

HANDEBOOK
of
CHEMISTRY
and
PHYSICS
FIVE
THIRTY-FIRST
EDITION

James M. McInerney

G. C. Henry III

HANDBOOK OF CHEMISTRY AND PHYSICS

A READY-REFERENCE BOOK OF
CHEMICAL AND PHYSICAL DATA

THIRTY-FIRST EDITION

EDITOR IN CHIEF

CHARLES D. HODGMAN, M.S.

Associate Professor of Physics at Case Institute of Technology

IN COLLABORATION WITH A LARGE NUMBER OF PROFESSIONAL
CHEMISTS AND PHYSICISTS WHOSE ASSISTANCE IS ACKNOWLEDGED
IN THE LIST OF GENERAL COLLABORATORS AND IN CONNECTION
WITH THE PARTICULAR TABLES OR SECTIONS INVOLVED.

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PREFACE

THE Handbook of Chemistry and Physics, continuing the policy of the past, is being revised at frequent intervals.

The general features and scheme of arrangement, which have received extensive endorsement in former editions have been retained. The aim throughout has been to present in condensed form as large an amount of accurate, reliable and up-to-date information in the fields of chemistry and physics as was consistent with convenience in form and the possibility of wide utility and distribution. A very large proportion of the tables have been compiled especially for the Handbook from various authoritative collections of data and from the current journals.

Since the beginning special consideration has been given to the requests and suggestions of those who have used former editions. In this way it has been hoped to develop the book along lines most acceptable to those interested in a volume of this type. Suggestions and contributions are received each year from many eminent chemists and physicists including members of the teaching profession and those engaged in industrial work. We believe this coöperation to have been of very great value in the growth and development of the work.

An attempt has been made to include material on all branches of chemistry and physics and the closely allied sciences, which would be likely to find any extended use. On the other hand, in order to retain the convenience of moderate dimensions and at the same time allow for natural growth due to the extension of knowledge in these sciences, and logical additions along lines already developed, it has seemed necessary to exclude types of material of use only in certain highly specialized lines of work.

Chemistry and physics, always closely related sciences, have been brought into much more intimate relations by the more recent developments of research. To an increasing extent the student of either science should have a knowledge of the other. It would seem that there should be a large field for a single volume containing the constants and formulæ of the two sciences together with mathematical and conversion tables adequate for

PREFACE TO THE THIRTY-FIRST EDITION

accurate computation. The generous response which the previous editions have met indicates that the volumes have been found useful and it is with the hope of even more completely meeting the needs of the chemists and physicists of the English-speaking world that succeeding editions are offered.

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PREFACE TO THE THIRTY-FIRST EDITION

The Thirty-first edition of the Handbook of Chemistry and Physics contains about 180 pages of completely revised and new material. Changes and additions have been made to one hundred additional pages and eighty-six worn plates have been remade, and one hundred and fifty-two plates repaired, to insure clearer printing.

Included in the more important new material added is a table of Isotopic Masses which will be useful for those dealing with atomic and nuclear problems.

To the mathematical section there has been added a twenty-three page table giving the values, to five significant figures, of $\sin^2 x \cos^2 x$ and the product of sine and cosine for each minute of angle. This will be an especial convenience in curve fitting.

The table "Wave Lengths of the Principal Lines in the Emission Spectra of the Elements" has been completely revised and rearranged. The extreme ultraviolet and infrared have been separated from the main table which latter now includes wave lengths from 2000 to 10,000 angstroms, the portion of the spectrum ordinarily recorded photographically and useful in qualitative and quantitative analysis.

Among the important tables added to recent editions is the very complete table of isotopes giving the percent abundance, type and energy of radiations and half-life for about 900 natural and artificial radioactive isotopes and stable isotopes.

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COLLABORATORS AND CONTRIBUTORS

to the

HANDBOOK OF CHEMISTRY AND PHYSICS

- ALBRIGHT, J. G., Ph.D. Professor and Head of Department of Physics, Rhode Island State College.
- ALLEN, S. J. M., Ph.D. Professor of Experimental Physics, University of Cincinnati.
- ASHLEY, R. H., Ph.D. Professor of Chemistry, The St. Lawrence University.
- BAXTER, ROBERT A., M.A. Associate Professor of Chemistry, Colorado School of Mines.
- BENFORD, FRANK, B.E.E. Research Laboratory, General Electric Company, Schenectady, New York.
- CORK, JAMES M., Ph.D. Associate Professor of Physics, University of Michigan.
- CURRIE, LAUCLIN M., Ph.D. Carbide and Carbon Chemicals Corporation, New York City.
- DEMING, H. G., Ph.D. Professor of Physical Chemistry, University of Hawaii.
- DE VRIES, THOMAS, Ph.D. Professor of Physical Chemistry, Purdue University.
- DUNN, MAX S., Ph.D. Associate Professor of Chemistry, University of California at Los Angeles.
- GASKILL, H. V., Ph.D. Dean of Division of Science, Iowa State College.
- HALE, HARRISON, Ph.D. Professor and Head of the Chemistry Department, University of Arkansas.
- HARKINS, WILLIAM D., Ph.D. Professor of Chemistry, University of Chicago.
- HARTMAN, W. W., Ph.D. Department of Synthetic Chemistry, Eastman Kodak Company, Rochester, New York.
- HAYNES, F. B., M.S. Applied Physics Laboratory, Johns Hopkins University.
- HOYT, CREIG S., Ph.D. Professor of Chemistry, Grove City College.
- JORDAN, CHARLES NEAL, Ph.D. Assistant Professor of Chemistry, St. Louis University School of Medicine.
- LEWIS, HOWARD BISHOP, Ph.D. Professor of Biological Chemistry, Director of the College of Pharmacy, Medical School, University of Michigan.
- LYONS, EDWARD, Ph.D. Chemistry Department, University of Florida.
- MARTIN, JOHN R., M.S. Associate Professor of Electrical Communication, Case Institute of Technology.

COLLABORATORS AND CONTRIBUTORS

- MARVEL, C. S., Ph.D. Professor of Organic Chemistry, University of Illinois.
- MASON, THOMAS W., M.S. Associate Professor of Analytical Chemistry, Penn. State College.
- PARKER, CHARLES B. U. S. Patent Office, Washington, D.C.
- PATTERSON, AUSTIN M., Ph.D. Professor Emeritus of Chemistry, Antioch College.
- PETERS, F. N., Ph.D. Director of Research, Quaker Oats Company, Chicago, Illinois.
- POST, HOWARD W., Ph.D. Assistant Professor of Chemistry, The University of Buffalo.
- PREBLUDA, H. J., Ph.D. Manager Special Products Sales, U. S. Industrial Chemicals, Inc., New York City.
- PRETTYMAN, IRVEN B., The Firestone Tire and Rubber Company, Akron, Ohio.
- PRUTTON, C. F., Ph.D. C. F. Prutton and Associates, Cleveland, Ohio.
- RANDALL, MERLE, Ph.D. Professor of Chemistry, University of California.
- RENNERFELT, IVAR. Electro-Metallurgist, Stockholm, Sweden.
- ROBERTS, ROBERT C., Ph.D. Professor of Chemistry, Colgate University.
- ROUSH, G. A., M.S. Former Editor of Mineral Industry, Arlington, Va.
- SHEELY, M. L. Assistant General Superintendent, Armour and Company, Chicago, Illinois.
- SHIPMAN, CHARLES H. The Dodd Company, Cleveland, Ohio.
- SWEENEY, ORLAND RUSSEL, Ph.D. Professor and Head of the Department of Chemical Engineering, Iowa State College.
- TURRILL, PARK L. Department of Chemistry, Glendale Junior College.
- WENIGER, W., Ph.D. Professor and Head of Department of Physics, Oregon State Agricultural College.
- YOE, JOHN H., Ph.D. Professor of Chemistry, University of Virginia.
- YOUNG, THOMAS F., Ph.D. Associate Professor of Chemistry, University of Chicago.

In addition to the above, assistance in special fields is acknowledged in connection with the various contributions, particularly the Physical Constants of Inorganic Compounds and the Physical Constants of Organic Compounds.

The Publishers and Editor will be grateful to readers of this Handbook who will call their attention to errors which may be discovered. Suggestions for improvement are also welcome.

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ANTIDOTES OF POISONS

Acetic Acid.—Emetics, magnesia, chalk, soap, oil.

Acetylene.—Same as for carbon monoxide.

Arsenic, Rat Poison, Paris Green.—Milk, raw egg, sweet oil, lime water, flour and water.

Carbolic Acid.—Any soluble non-toxic sulphate, after provoking vomiting with zinc sulphate; uncooked white of egg in abundance, milk of lime, saccharate of calcium, olive or castor oil with magnesia in suspension, ice, washing the stomach with equal parts water and vinegar; give alcohol or whiskey or about four fluid ounces camphorated oil at one dose.

Carbon Monoxide.—Remove to fresh air immediately and call for pulmotor; apply artificial respiration for at least one hour or until the pulmotor arrives. Administration of oxygen containing 5% of carbon dioxide is beneficial; inhalation of ammonia or amyl nitrite is often of value.

Chloroform, Chloral, Ether.—Dash cold water on head and chest, artificial respiration.

Ethylene.—Same as for carbon monoxide.

Gas (illuminating).—Same as for carbon monoxide.

Hydrochloric Acid.—Magnesia, alkali carbonates, albumen, ice.

Hydrocyanic or Prussic Acid.—Hydrogen peroxide internally, and artificial respiration, breathing ammonia or chlorine from chlorinated lime, ferrous sulphate followed by potassium carbonate, emetics, warmth.

Iodine.—Emetics, stomach siphon, starchy foods in abundance, sodium thiosulphate.

Lead Acetate.—Emetics, stomach siphon, sodium, potassium or magnesium sulphates, milk, albumen.

Mercuric Chloride or Corrosive Sublimate.—Zinc sulphate, emetics, stomach siphon, white of egg, milk, chalk, castor oil, table salt, reduced iron.

Nitrate of Silver.—Salt and water.

Nitric Acid.—Same as for hydrochloric acid.

Opium, Morphine, Laudanum, Paregoric, etc.—Strong coffee, hot bath. Keep awake and moving at any cost.

Phosphoric Acid.—Same as for hydrochloric.

ANTIDOTES OF POISONS (Continued)

Sodium Hydroxide or Potassium Hydroxide.—Vinegar, lemon juice, orange juice, oil, milk.

Sulfuric Acid.—Same as for hydrochloric acid with the addition of soap or oil.

Sulfurous Acid or Sulfur Dioxide.—Mustard plaster on chest; narcotics, expectorants.

Wood Alcohol (Methyl Alcohol or Methanol).—Emetic or wash out stomach (stomach tube) with a solution of 10 grains sodium citrate per ounce of water. Give milk, white of egg or flour in water; purgative of magnesium sulfate (15 grams); stimulate and combat collapse. In case of cardiac or pulmonary failure use artificial respiration. Physicians may administer atropine, digitalin or strychnine as stimulants; to cause perspiration and elimination of the poison use 0.1 grain of pilocarpine hydrochloride.

BURNS AND SCALDS

Exclude air by thin paste of starch, flour, or baking soda. Ordinary oils such as Vaseline petroleum jelly, olive or castor oil, lard or cream may also be used except for phosphorus burns. Lime water mixed with an equal part of raw linseed oil makes an excellent dressing. An especially valuable material for all burns is picric acid gauze which may be applied in the form of a compress.

After treatment with any of the above materials, cover with a cloth or with cotton and hold in place with a light bandage.

Apply a freshly prepared 5% tannic acid solution. Place several layers of sterile gauze over the burned area, saturate with the tannic acid solution and bandage loosely.

CHEMICAL BURNS

With either, wash off as quickly as possible with a large quantity of water. Water from a tap may be allowed to flow over burns.

Acids

While the injury is being washed, have procured lime water or lime water and raw linseed oil mixed together in equal proportions or a mixture of baking soda and water or soap suds and apply freely. For acid in the eye wash as quickly as possible with water and then with lime water.

Alkalis

Wash with a large quantity of water as for acid burns. Neutralize with weak vinegar, hard cider or lemon juice. For lime or other strong alkali burns in the eye wash with weak solution of vinegar or with olive oil or a saturated solution of boric acid.

Bromine.—Sponge immediately with a strong solution of sodium thiosulfate until all the bromine color is gone, then wash off the mildly poisonous sodium thiosulfate with plenty of water.

FIRE PRECAUTIONS AND CHEMICAL HAZARDS

Acetone.—Dilute with a spray of water to avoid spread of burning liquid. Use suitable gas mask.

Alcohol.—See under acetone.

Ammonia.—Use water and dilute acid. Use suitable gas mask.

Benzol or Benzene.—Use water to cool containers which are endangered; extinguish flame with sand, earth, fire-foam or carbon tetrachloride fire extinguishers. Use suitable gas mask.

Calcium Carbide.—Do not use water as this generates acetylene, an inflammable and explosive gas; cut off electric current to avoid ignition of gas. Remove containers to a dry place. Use gas mask.

Carbon Disulfide.—Use water to cool containers which are endangered; extinguish blaze with sand, earth, fire-foam or carbon tetrachloride fire extinguishers. Use suitable gas mask.

Carbon Tetrachloride.—Do not use a fire extinguisher filled with carbon tetrachloride (pyrene or carbona) on flames caused by an electrical short circuit in a confined space; the carbon tetrachloride may be decomposed into toxic gases.

Do not put carbon tetrachloride on a sodium fire, violent explosions may be caused.

Celluloid.—Use large volumes of water and sand. The smoke contains oxides of nitrogen which are injurious. Use suitable gas mask.

Chlorine.—Spray with water. The pungent nature of the gas makes the use of a gas mask imperative.

Collodion.—See under carbon disulfide.

Ether.—See under carbon disulfide.

Gasoline.—See under carbon disulfide.

Hydrochloric Acid.—Use large volumes of water also chalk or soda. Use gas mask.

Hydrocyanic or Prussic Acid.—Suitable gas mask is essential because of the extremely poisonous nature of the vapors. Provide ventilation.

FIRE PRECAUTIONS (Continued)

Lacquer Solvents.—See under carbon disulfide.

Magnesium.—Do not use water. Use sand or earth to extinguish flames. Remove containers to a dry place.

Nitric Acid and Oxides of Nitrogen.—Use large volumes of water. Do not use sand or earth. Use gas mask.

Potassium.—Do not use water. Remove containers to a dry place. Extinguish flames with sand or earth. For storage, potassium is kept immersed in petroleum.

Potassium Hydroxide.—Use large volumes of water or dilute acids.

Phosphorus.—Use water and wet sand. Use gas mask. For storage, white phosphorus must be kept immersed in water. Red phosphorus is less dangerous.

Sodium.—See under potassium.

Sodium Hydroxide.—See under potassium hydroxide.

Sulfur.—Extinguish with water or sand. Use gas mask.

Sulfuric Acid.—See under hydrochloric acid.

Turpentine.—See under acetone.

MATHEMATICAL TABLES

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USE OF MATHEMATICAL TABLES

For a complete discussion of the principles and use of mathematical tables, textbooks on the subject should be consulted. The following brief statements are intended to give only sufficient information to make possible the intelligent use of the tables, omitting for the most part any attempt at treating the theory and principles.

Exponential Method of Expressing Numbers—For convenience in writing and manipulation, numbers are often expressed as factors of appropriate powers of 10. The following examples will illustrate:

2,380,000,000.	may be written	2.38×10^9
238.	may be written	2.38×10^2
.238	may be written	2.38×10^{-1}
.000000238	may be written	2.38×10^{-7}

Logarithms—The logarithm of a number is the exponent of that power to which another number, the base, must be raised to give the number first named. Any positive number greater than 1 might serve as a base. Two have been selected, yielding two systems of logarithms. One base, 2.718 . . . usually indicated by the letter e , gives rise to a system of logarithms convenient in higher mathematics. These are called natural, Napierian, or hyperbolic logarithms. Reference will be made to their use in a subsequent paragraph.

The other base used is 10, giving logarithms particularly adapted to use in computation, called common or Briggian logarithms. Tables of logarithms given without designation are invariably of this latter type.

Since most numbers are incommensurable powers of ten, a common logarithm, in general, consists of an integer which is called the characteristic and an endless decimal, the mantissa.

It is to be observed that the common logarithms of all numbers expressed by the same figures in the same order with the decimal point in different positions have different characteristics but the same mantissa. To illustrate:—if the decimal point stand after the first figure of a number, counting from the left, the characteristic is 0; if after two figures, it is 1; if after three figures, it is 2, and so forth. If the decimal point stand before the first significant figure the characteristic is -1 , usually written $\bar{1}$; if there is one zero between the decimal point and the first significant figure it is 2 and so on. For example: $\log 256 = 2.40824$, $\log 2.56 = 0.40824$, $\log 0.256 = \bar{1}.40824$, $\log 0.00256 = \bar{3}.40824$. The two latter are often written $\log 0.256 = 9.40824 - 10$, $\log 0.00256 = 7.40824 - 10$.

USE OF MATHEMATICAL TABLES (Continued)

A method of determining characteristics of logarithms is to write the number with one figure to the left of the decimal point multiplied by the appropriate power of 10. The characteristic is then the exponent used. For example:

$$256,000,000 = 2.56 \times 10^8 \quad \log = 8.40824$$

$$0.000000256 = 2.56 \times 10^{-7} \quad \log = \bar{7}.40824 \text{ or } 3.40824 - 10$$

Inasmuch as the characteristic may be determined by inspection the mantissas only are given in tables of common logarithms.

To find the logarithm of a number:

For a number of four figures, take out the tabular mantissa on a line with the first three figures of the number and under its fourth figure. The characteristic is determined as previously explained.

For a number of less than four figures, supply zeros to make a four figure number and take the value of the mantissa from the tables as before. For example: $\log 2 = \log 2.000 = 0.30103$.

For a number of more than four figures, take the tabular value of the mantissa for the first four figures; find the difference between this mantissa and the next greater tabular mantissa and multiply the difference so found by the remaining figures of the number as a decimal and add the product to the mantissa of the first four figures. For example: to find $\log 46.762$.

$$\log 46.76 = 1.66987$$

Tabular difference between this mantissa and that for 4677 is .00010.

$$\begin{aligned} \therefore \log 46.762 &= 1.66987 + .2 \times .00010 \\ &= 1.66987 + .00002 \\ &= 1.66989 \end{aligned}$$

To find the number corresponding to a given logarithm:

If the mantissa is found exactly in the table, join the figure at the top which is directly above the given mantissa to the three figures on the line at the left and place the decimal point according to the characteristic of the logarithm. For example, $\log^{-1} (\text{antilogarithm}) \ 3.39967 = 2510$.

If the mantissa is not found exactly in the table it is necessary to interpolate. For example, $\log^{-1} 3.40028 = 2513. + \frac{9}{18} = 2513.5$.

The column of proportional parts at the right of each page of the table shows, under the heading of the various tabular differences, the parts of these differences which correspond to the digits from 1 to 9 in the fifth place. This makes it possible to take out a logarithm for a five figure number or to find an antilogarithm of the same number of significant figures with increased facility, usually by inspection.

USE OF MATHEMATICAL TABLES (Continued)

The following formulae express the relations on which the use of logarithms is based:

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

$$\log a^n = n \times \log a$$

$$\log \sqrt[n]{a} = \frac{\log a}{n}.$$

The following examples will serve as illustrations:

$$1. 52600 \times 0.00381 \times 2.74 = 549.1$$

$$\log 52600 = 4.72099$$

$$\log 0.00381 = \bar{3}.58092$$

$$\log 2.74 = 0.43775$$

$$\text{Sum:} = 2.73966$$

$$\text{Antilogarithm} = 549.1$$

The sum is the logarithm of the product, the mantissa of which is 73966. On looking up this mantissa in the logarithm tables we see that it corresponds to the digits 5491. The characteristic is 2, hence there are three figures before the decimal point. The number corresponding to the logarithm, called the antilogarithm, is 549.1.

$$2. 0.00123 \div 52.7 = 0.00002334 \quad \text{An Alternative method:}$$

$$\log 0.00123 = \bar{3}.08991$$

$$\log 0.00123 = 7.08991 - 10$$

$$\log 52.7 = 1.72181$$

$$\log 52.7 = 1.72181$$

$$\text{Subtracting} \quad \bar{5}.36810$$

$$5.36810 - 10$$

$$\text{Antilog} \quad 0.00002334$$

The characteristic $\bar{5}$ (5. -10) shows four zeros after the decimal point before the first significant figure.

$$3. \frac{273 \times 780}{292 \times 760} \times 15 \times 0.09 = 1.295$$

$$\log 273 = 2.43616$$

$$\log 292 = 2.46538$$

$$\log 780 = 2.89209$$

$$\log 760 = 2.88081$$

$$\log 15 = 1.17609$$

$$\log 0.09 = \bar{2}.95424$$

$$\log \text{denominator} = 5.34619$$

$$\log \text{sum} = 5.45858$$

$$\log \text{numerator} = 5.45858$$

$$\log \text{denominator} = 5.34619$$

$$\text{subtracting} = 0.11239$$

$$\text{antilogarithm} = 1.295$$

USE OF MATHEMATICAL TABLES (Continued)

As division may be accomplished by multiplying by the reciprocal of a number, the above may be considerably simplified. The logarithm of the reciprocal of a number, called the cologarithm, is readily obtained from the table by subtracting the logarithm of the number from zero. This may readily be read off from the table of mantissas. Change the sign of the characteristic algebraically adding to it -1 , then mentally subtract each figure of the mantissa from 9 proceeding from left to right, the last figure being subtracted from 10. The example then is:

$$\begin{array}{rcl} \log 273 & = & 2.43616 \\ \log 780 & = & 2.89209 \\ \log 15 & = & 1.17609 \\ \log 0.09 & = & \overline{2.95424} \\ \text{colog } 292 & = & \overline{3.53462} \\ \text{colog } 760 & = & \overline{3.11919} \end{array}$$

$$\hline 0.11239$$

$$4. (0.00098)^4 = 9.224 \times 10^{-13} \quad \text{An alternative method:}$$

$$\log 0.00098 = \overline{4.99123} \quad \log 0.00098 = 6.99123 - 10$$

4

4

$$\begin{array}{rcl} & 3.96492(a) & 27.96492 - 40 \\ \overline{4} \times 4 & \overline{16.} \quad (b) & \text{or } 7.96492 - 20 \\ & & \text{or } \overline{13.96492} \end{array}$$

$$\log (0.00098)^4 = \overline{13.96492(c)}$$

$$\text{antilog} = 9.224 \times 10^{-13}$$

$$\text{antilog} = 9.224 \times 10^{-13}$$

In the above it will be noted that the mantissa is always positive hence the multiplication of the mantissa shown at (a) while (b) shows the multiplication of the characteristic. (c) is the algebraic sum.

$$5. \sqrt[5]{492} = 3.455$$

$$\log 492 = 2.69197$$

Dividing the logarithm by 5 gives as the logarithm of the root 0.53839 the antilogarithm of which is 3.455 both characteristic and mantissa being positive. When the characteristic is negative and not evenly divisible by the root to be taken a modification of the logarithm is necessary.

$$6. \sqrt[3]{0.000372} =$$

$$\begin{array}{rcl} \log 3.72 \times 10^{-4} & = & \overline{4.57054} \quad (a) \\ & = & 26.57054 - 30 \quad (b) \end{array}$$

dividing (b) by 3 gives 8.85685-10 which may be written

USE OF MATHEMATICAL TABLES (Continued)

$\bar{2}.85685$ and is the logarithm of the root sought, the antilogarithm of which is 0.07192 .

$$7. \quad 0.000372^{1.2} = 0.000076674$$

$$\log 0.000372 = \bar{4}.57054$$

$$\text{or } 6.57054 - 10$$

$$1.2$$

$$7.88465 - 12$$

$$\text{antilogarithm } 0.000076674$$

Four-Place Logarithms—This short table on two facing pages makes possible logarithmic computation precise to four significant figures, (three without interpolation). The mantissa is given complete and the proportional parts indicated for each line.

Four-Place Antilogarithms—Some computers prefer to use separate tables for determining antilogarithms; the table being entered from the margins with the logarithm and the number being found in the body of the table. Such a table is given to accompany the four-place logarithms.

Five-Place Logarithms—For computation involving five significant figures, (four without interpolation) the five-place table will be adequate. Since the first two figures will be the same for several lines of the table they are given in the first line only. The point at which these first two figures change is indicated by an asterisk. While space does not permit the proportional parts for each line, tables will be found for each tabular difference.

The supplementary table following the five-place logarithms, giving seven-place logarithms for numbers of five significant figures from 10,000 to 12,000 will be found convenient to increase precision and avoid the inconvenience of interpolation where the differences are large.

Logarithms of the Trigonometric Functions—Logarithms of the functions are given for each minute from $0-360^\circ$.

The quantity -10 is to be appended to all logarithms of the sine and cosine, to logarithms of the tangent from $0-45^\circ$ and of the cotangent from $45-90^\circ$.

With degrees indicated at either side of the top of the page use the column headings at the top. With degrees stated at the bottom of the page use the column designations at the bottom.

With degrees at the left (top or bottom) use the minute column at the left, and with degrees on the right side of the page use the minute column at the right.

USE OF MATHEMATICAL TABLES (Continued)

To illustrate the proper employment of headings for angles in the four quadrants—

$\log \sin 6^\circ 24' = 9.04715 - 10$	$\log \sin 186^\circ 24' = 9.04715 - 10$
$\log \sin 83^\circ 15' = 9.99698 - 10$	$\log \sin 263^\circ 15' = 9.99698 - 10$
$\log \cos 96^\circ 41' = 9.06589 - 10$	$\log \cos 276^\circ 41' = 9.06589 - 10$
$\log \cos 173^\circ 49' = 9.99747 - 10$	$\log \cos 353^\circ 49' = 9.99747 - 10$

For the accurate determination of values where the tabular differences are large, the values of CS and CT are given. The following equations indicate their use.

To find the logarithm of the functions of an angle:

For angles $0-3^\circ$	For angles $87-90^\circ$
$\log \sin \theta = \log \theta'' - \text{CS}$	$\log \cos \theta = \log (90^\circ - \theta)'' - \text{CS}$
$\log \tan \theta = \log \theta'' - \text{CT}$	$\log \cot \theta = \log (90^\circ - \theta)'' - \text{CT}$
$\log \cot \theta = \text{colog } \tan \theta$	$\log \tan \theta = \text{colog } \cot \theta$

To find the angle:

For angles $0-3^\circ$	For angles $87-90^\circ$
$\log \theta'' = \log \sin \theta + \text{CS}$	$\log (90^\circ - \theta)'' = \log \cos \theta + \text{CS}$
$\log \theta'' = \log \tan \theta + \text{CT}$	$\log (90^\circ - \theta)'' = \log \cot \theta + \text{CT}$

In the above expressions, θ'' and $(90^\circ - \theta)''$ are used to indicate the value of the angles expressed in seconds. The values in the body of the table are the cologarithms and should be used as indicated above.

The values of the logarithms S and T are also given in a separate table. For these the following relations hold:

To find the functions of an angle.

$\log \sin \theta = \log \theta'' + \text{S}$	$\log \cos \theta = \log (90^\circ - \theta)'' + \text{S}$
$\log \tan \theta = \log \theta'' + \text{T}$	$\log \cot \theta = \log (90^\circ - \theta)'' + \text{T}$

To find the angle.

$\log \theta'' = \log \sin \theta - \text{S}$	$\log (90^\circ - \theta)'' = \log \cos \theta - \text{S}$
$\log \theta'' = \log \tan \theta - \text{T}$	$\log (90^\circ - \theta)'' = \log \cot \theta - \text{T}$

Where the values of CS and CT are given, the angles expressed in seconds are given in the supplementary column at the left.

The tabular differences are given under the headings "d" and "c.d.", the latter referring to the common difference for the tangent and cotangent. Tables of proportional parts ("P.P.") facilitate interpolation. At the bottom of each column will be found special proportional parts between the tabular differences for the tangent or cotangent and those for the sine or cosine. These are useful when one function is to be obtained directly from the other without determining the angle.

For example, suppose $\log \tan \theta$ is given as 9.67644 and $\log \cos \theta$ is required. The difference between the given logarithm and that given in the table, 9.67622 (opposite $25^\circ 23'$), is 22.

USE OF MATHEMATICAL TABLES (Continued)

The tabular differences of the two logarithmic functions at this place are 32 and 6. In the proportional table for $\frac{6}{32}$, 22 corresponds to 4; this, subtracted from the tabular logarithmic cosine 9.95591, gives the required $\log \cos \theta = 9.95587$.

The symbols $\bar{5}$ and $\dot{5}$ are used to indicate how the terminal 5 has been derived. For example, the logarithm 8.83075 is more fully given as 8.8307495 while the value 9.40825 is derived from 9.4082539.

Natural Trigonometric Functions—Values of the natural trigonometric functions of angles are given for each minute from $0-360^\circ$.

For degrees indicated at the top of the page use the column headings at the top. For degrees indicated at the bottom use the column indications at the bottom.

With degrees at the left of each block (top or bottom), use the minute column at the left and with degrees at the right of each block use the minute column at the right.

Natural Functions and their Logarithms are given for angles in degrees and tenths from 0 to 90 degrees.

Natural Functions and their Logarithms are given for angles in radians and hundredths, from 0 to 2 radians.

Haversines—Values of $(1 - \cos \theta)/2$ for angles between 0 and 180° are given to four significant figures. The four-place mantissas of the logarithms of the haversines are also given. The correct characteristic must be provided in each case.

The listed values of the haversines were derived from values which were computed to seven significant figures. The logarithms were independently derived from the more exact values of the haversines and are, therefore, in many cases not the exact value of the logarithm of the haversine as listed. This is notably true at the beginning of the table where the logarithm can be given with more exactness than the function.

Natural Logarithms—The natural logarithms of numbers from 0.000 to 999, are given in a group of four tables. The method of finding logarithms of numbers not included in the tables is indicated at the beginning of the third page. A convenient table of constants occurs at the top of the fourth page.

The first page gives the natural logarithms of numbers from 0.000 to 0.499. Since the characteristics change rapidly for the smaller numbers, they are indicated *above* the mantissa in the first line. In the second and following lines the characteristics are given at the left only. For example, $\log_e 0.004 = -5.52146$; $\log_e 0.014 = -4.26870$.

The succeeding pages give the natural logarithms of numbers up to 999.

USE OF MATHEMATICAL TABLES (Continued)

Exponential Functions—Values of e^x , $\log e^x$ and e^{-x} where e is the base of the natural system of logarithms 2.71828 . . . and x has values from 0 to 10. Facilitating the solution of exponential equations, these tables also serve as a table of natural or Napierian antilogarithms. For instance if the logarithm or exponent $x = 3.26$ the corresponding number or value of e^x is 26.050. Its reciprocal e^{-x} is .038388.

Hyperbolic Functions—The table gives the values and logarithms of the hyperbolic sine x , cosine x , tangent x and cotangent x for values of x from 0 to 5.

Degrees-Radians—This table gives the value in radians to five significant figures; for each 10 minutes from $0^\circ 0'$ to $90^\circ 0'$; for each degree from 90 to 180; for each 10 degrees from 180 to 480. Values are also given for each minute from $0-60'$ and for each second from $0-60''$.

Tables are also provided to facilitate changing from degrees and decimal fractions to radians, from decimal fractions of a degree to minutes and seconds and the reverse operations.

Numerical Tables—The first section gives the reciprocals of numbers from 0 to 1000 and circumferences and areas of circles with diameters having these values. Reciprocals and circumferences for values not listed can be obtained by an appropriate shift of the decimal point.

The second section is devoted to squares, cubes and roots. The squares and cubes from 1 to 1000 are given exactly. The roots are given to seven significant figures. Since the square roots of $10n$ are given, values of the square roots from 1 to 10,000 may be found directly. For the square roots of numbers below and above this range, use may be made of the following relations: $\sqrt{100n} = 10 \sqrt{n}$; $\sqrt{1000n} = 10 \sqrt{10n}$; $\sqrt{\frac{1}{10}n} = \frac{1}{10} \sqrt{10n}$; $\sqrt{\frac{1}{100}n} = \frac{1}{10} \sqrt{n}$; $\sqrt{\frac{1}{1000}n} = \frac{1}{100} \sqrt{10n}$. For example, the square root of 0.268 may be found by using the form, $\sqrt{0.268} = \frac{1}{100} \sqrt{10 \times 268}$. The tabular value for the square root of $10n$ for 268 is 51.76872. Hence, the desired root is 0.5176872.

Values of cube roots for all numbers from 1 to 100,000 will be found directly in the table. Cube roots for numbers above or below this range will be found from the following relations: $\sqrt[3]{1000n} = 10 \sqrt[3]{n}$; $\sqrt[3]{10,000n} = 10 \sqrt[3]{10n}$; $\sqrt[3]{100,000n} = 10 \sqrt[3]{100n}$; $\sqrt[3]{\frac{1}{10}n} = \frac{1}{10} \sqrt[3]{100n}$; $\sqrt[3]{\frac{1}{100}n} = \frac{1}{10} \sqrt[3]{10n}$; $\sqrt[3]{\frac{1}{1000}n} = \frac{1}{100} \sqrt[3]{n}$. For example, the cube root of 731,000 may be found

USE OF MATHEMATICAL TABLES (Continued)

by using the form, $\sqrt[3]{731,000} = 10\sqrt[3]{731}$. The tabular value of the root for 731 is 9.008223. The desired root is, therefore, 90.08223.

Powers of Numbers—This table is given to supplement the values of squares and cubes of numbers found in the preceding numerical table. The larger numbers are expressed exponentially to at least seven significant figures. The approximate value written as a whole number may be obtained by shifting the decimal point to the right by the number of places indicated in the exponent of 10 shown at the head of each group of values. For example: the approximate value of 33^8 is found in the table as 14.064086×10^{11} . Written as a whole number it is 1,406,408,600,000.

Factorials and their Logarithms—The product $n \times (n - 1) \times (n - 2) \times \cdots \times 1$ is called factorial n , expressed as $n!$ or \underline{n} . For example: factorial 5 = $5 \times 4 \times 3 \times 2 \times 1 = 120$. Factorials are very often met with in series. For purposes of computation in such cases the table giving the values of the factorials and of their logarithms for numbers from 1 to 100 is provided. The values of the factorials are expressed exponentially to 5 significant figures.

A brief table of exact values and reciprocals of factorials is to be found on page 186.

Factors for Computing Probable Errors—The probable error of a series of n measures $a_1, a_2, a_3 \dots a_n$, the mean of which is m , is given by the expression,

$$e = \frac{0.6745}{\sqrt{n-1}} \sqrt{(m - a_1)^2 + (m - a_2)^2 + \cdots (m - a_n)^2}$$

The probable error of the mean is,

$$E = \frac{0.6745}{\sqrt{n(n-1)}} \sqrt{(m - a_1)^2 + (m - a_2)^2 + \cdots (m - a_n)^2}$$

The following approximate equations are convenient forms for computation,

$$e = 0.8453 \frac{\Sigma d}{\sqrt{n(n-1)}}$$

$$E = 0.8453 \frac{\Sigma d}{n\sqrt{n-1}}$$

The symbol Σd represents the arithmetical sum of the deviations.

For convenience in computing the probable error the value of several of the factors involved is given for values of n from 2 to 100.

USE OF MATHEMATICAL TABLES (Continued)

Probability of Occurrence of Deviations—The significance of deviations is indicated by this table. The probability of occurrence of deviations as great as or greater than any specific value is given for various ratios of deviation to probable error and also with respect to the standard deviation σ . The probability of occurrence is stated in per cent or chances in 100. The odds against occurrence are also stated. The probable error is $0.6745 \times (\sigma)$.

Areas, Ordinates and Derivatives of the Normal Curve of Error—If, for a large number of observations, the frequency y , of the occurrence of an error of magnitude t be plotted, a curve results whose equation may be written,

$$y = \frac{1}{\sqrt{2\pi}} e^{-t^2/2}$$

The area, ordinates and derivatives for this curve given in the table are useful in the treatment of observational data. A text on statistical methods should be consulted for a complete explanation.

Factors and Primes—The table presents the prime factors of *all* factorable numbers and the logarithms of all prime numbers from 1 to 2000.

Conversion Table

Inches			Centimeters			Centimeters			Inches		
1	=		2.54001			1	=		0.39370		
2	=		5.08001			2	=		0.78740		
3	=		7.62002			3	=		1.1811		
4	=		10.16002			4	=		1.5748		
5	=		12.70003			5	=		1.9685		
6	=		15.24003			6	=		2.3622		
7	=		17.78004			7	=		2.7559		
8	=		20.32004			8	=		3.1496		
9	=		22.86005			9	=		3.5433		
Feet			Meters			Meters			Feet		
1	=		0.304801			1	=		3.28083		
2	=		0.609601			2	=		6.56167		
3	=		0.914402			3	=		9.84250		
4	=		1.219202			4	=		13.12333		
5	=		1.524003			5	=		16.40417		
6	=		1.828804			6	=		19.68500		
7	=		2.133604			7	=		22.96583		
8	=		2.438405			8	=		26.24666		
9	=		2.743205			9	=		29.52750		
Yards			Meters			Meters			Yards		
1	=		0.914402			1	=		1.093611		
2	=		1.828804			2	=		2.187222		
3	=		2.743205			3	=		3.280833		
4	=		3.657607			4	=		4.374444		
5	=		4.572009			5	=		5.468056		
6	=		5.486411			6	=		6.561667		
7	=		6.400813			7	=		7.655278		
8	=		7.315215			8	=		8.748889		
9	=		8.229616			9	=		9.842500		

USE OF MATHEMATICAL TABLES (Continued)

Conversion Tables (Continued)

Miles	Kilometers	Kilometers	Miles
1	1.60935	1	0.62137
2	3.21869	2	1.24274
3	4.82804	3	1.86411
4	6.43739	4	2.48548
5	8.04674	5	3.10685
6	9.65608	6	3.72822
7	11.26543	7	4.34959
8	12.87478	8	4.97096
9	14.48412	9	5.59233
Pounds Av.	Kilograms	Kilograms	Pounds Av.
1	0.45359	1	2.20462
2	0.90718	2	4.40924
3	1.36078	3	6.61387
4	1.81437	4	8.81849
5	2.26796	5	11.02311
6	2.72155	6	13.22773
7	3.17514	7	15.43236
8	3.62874	8	17.63698
9	4.08233	9	19.84160

Conversion Factors

U. S. AND METRIC UNITS

Each unit in bold face type is followed by its equivalent in one or other units of the same quantity.

Acre—0.0015625 square mile; 4.3560 $\times 10^4$ square feet; 0.4046873 hectare

Bushel—1.2444 cubic feet; 2150.42 cubic inches; 0.035239 cubic meter; 35.238 liters

Centimeter—0.032808 foot; 0.39370 inch.

Circular Mil.— 7.854×10^{-7} square inch; 5.0671×10^{-6} square centimeter

Cubic Centimeter—0.061023 cubic inch; 0.27051 dram; 16.231 minims; 0.99997 milliliter

Cubic Foot—0.80357 bushel; 7.481 gallon; 0.02831701 cubic meter; 28.316 liters

Cubic Inch—16.387162 cubic centimeters

Cubic Meter—35.314445 cubic feet; 264.173 gallons

Foot—0.3048006 meter

Gallon—0.13368 cubic foot; 0.83268 gallons (British); 231.00 cubic inches; 0.0037854 cubic meter; 3.7853 liters

Grain—0.064798918 gram

Gram—0.00220462 pound (avoirdupois); .0352740 ounce (avoirdupois); 15.4324 grains

Hectare—2.471044 acres; 1.0764 $\times 10^8$ square feet

Inch—2.540005 centimeter

Kilogram—2.2046223 pounds (avoirdupois)

Kilometer—0.62137 mile

Liter—0.26417762 gallon; 0.035316 cubic foot; 1.056710 quarts

Meter—1.093611 yards; 3.280833 feet; 39.3700 inches

Mile—1.60935 kilometers

Ounce (fluid)—1.80469 cubic inches; 29.5737 cubic centimeters

Ounce (avoirdupois)—28.349527 grams

Ounce (apothecary or troy)—31.103481 grams

Pint (liquid)—0.473167 liter; 473.179 cubic centimeters

Pound (avoirdupois)—0.453592 kilogram; 453.5924 grams

Pound (apothecary or troy)—0.3732418 kilogram; 373.2418 grams

Quart—1.10120 liters

Quart (liquid)—.946333 liter

Radian—57.29578 degrees

Rod—5.029210 meters

Square Centimeter—0.15500 square inches

Square Foot—0.09290341 square meter

Square Inch—645.16258 square millimeters

Square Meter—10.76387 square feet

Square Yard—0.83613 square meter

Ton (short)—907.185 kilograms

Yard—0.91440183 meter

NUMERICAL CONSTANTS

Numbers Containing π

$$\pi = 3.14159\ 26536 \quad \log_{10} \pi = 0.49714\ 98727 \quad \log_e \pi = 1.14472\ 98858$$

	Number	Logarithm		Number	Logarithm
π	3.1415 927	0.4971 499	π^2	9.8696 044	0.9942 997
2π	6.2831 853	0.7981 799	$2\pi^2$	19.7392 088	1.2953 297
3π	9.4247 780	0.9742 711	$4\pi^2$	39.4784 176	1.5963 597
4π	12.5663 706	1.0992 099	$1/\pi^2$	0.1013 212	9.0057 003-10
8π	25.1327 412	1.4002 399	$1/(2\pi^2)$	0.0506 606	8.7046 703-10
$\pi/2$	1.5707 963	0.1961 199	$1/(4\pi^2)$	0.0253 303	8.4036 403-10
$\pi/3$	1.0471 976	0.0200 286	$\sqrt{\pi}$	1.7724 539	0.2485 749
$\pi/4$	0.7853 982	9.8950 899-10	$\sqrt{\pi/4}$ or $\sqrt{\pi}/2$	0.8862 269	9.9475 449-10
$\pi/6$	0.5235 988	9.7189 986-10	$\sqrt{\pi/4}$	0.4431 135	9.6465 149-10
$\pi/8$	0.3926 991	9.5940 599-10	$\sqrt{\pi/2}$	1.2533 141	0.0980 599
$2\pi/3$	2.0943 951	0.3210 586	$\sqrt{2/\pi}$	0.7978 846	9.9019 401-10
$4\pi/3$	4.1887 902	0.6220 886	π^3	31.0062 767	1.4914 496
$1/\pi$	0.3183 099	9.5028 501-10	$\sqrt[3]{\pi}$	1.4645 919	0.1657 166
$2/\pi$	0.6366 198	9.8038 801-10	$1/\sqrt[3]{\pi}$	0.6827 841	9.8342 834-10
$4/\pi$	1.2732 395	0.1049 101	$\sqrt[3]{\pi^2}$	2.1450 294	0.3314 332
$1/(2\pi)$	0.1591 549	9.2018 201-10	$1/\sqrt{\pi}$	0.5641 896	9.7514 251-10
$1/(4\pi)$	0.0795 775	8.9007 901-10	$2/\sqrt{\pi}$ or $\sqrt{4/\pi}$	1.1283 792	0.0524 551
$1/(6\pi)$	0.0530 516	8.7246 989-10			
$1/(8\pi)$	0.0397 887	8.5997 601-10			

Logarithmic Constants

$$e = 2.71828\ 18285 \quad M = \log_{10} e = 0.43429\ 44819$$

$$1/M = \log_e 10 = 2.30258\ 50930 \quad \log_{10} M = \log_{10} \log_{10} e = 9.63778\ 43113 - 10$$

$$1/e = 0.36787\ 94412 \quad \log_e 2 = 0.69314\ 71806 \quad \log_{10} 2 = 0.30102\ 99957$$

Change of Base

$$\log_a x = \log_e x / \log_e a \quad \log_a x = \log_{10} x / \log_{10} a$$

$$\log_e x = 1/M \log_{10} x = 2.30258\ 50930 \log_{10} x$$

$$\log_{10} x = M \log_e x = 0.43429\ 44819 \log_e x$$

DECIMAL EQUIVALENTS OF COMMON FRACTIONS

	1/32	2/64 = 0.03125		17/32	34/64 = 0.53125
1/16	2/32	4/64 = .0625	9/16	18/32	36/64 = .5625
	3/32	6/64 = .09375		19/32	38/64 = .59375
1/8	4/32	8/64 = .125	5/8	20/32	40/64 = .625
	5/32	10/64 = .15625		21/32	42/64 = .65625
3/16	6/32	12/64 = .1875	11/16	22/32	44/64 = .6875
	7/32	14/64 = .21875		23/32	46/64 = .71875
1/4	8/32	16/64 = .25	3/4	24/32	48/64 = .75
	9/32	18/64 = .28125		25/32	50/64 = .78125
5/16	10/32	20/64 = .3125	13/16	26/32	52/64 = .8125
	11/32	22/64 = .34375		27/32	54/64 = .84375
3/8	12/32	24/64 = .375	7/8	28/32	56/64 = .875
	13/32	26/64 = .40625		29/32	58/64 = .90625
7/16	14/32	28/64 = .4375	15/16	30/32	60/64 = .9375
	15/32	30/64 = .46875		31/32	62/64 = .96875
1/2	16/32	32/64 = .50			

MISCELLANEOUS CONSTANTS

Mean radius of the earth, 3959 miles = 6371 kilometers.

1 degree of latitude at 40° = 69 miles.

1 nautical mile = 1' of arc on the earth's surface at the equator.

Mean density of the earth, 5.522 grams per cm^3 .

Constant of gravitation, $K = 6.670 \times 10^{-8}$ = the attraction in dynes between two gram masses one centimeter apart.

Acceleration due to gravity at sea level, lat. 45° = 980.616 cm. per sec. per sec. = 32.172 feet per sec. per sec.

Length of seconds pendulum at sea level, lat. 45° = 99.356 cm. = 39.116 in.

Density of mercury at 0°C. = 13.59509 g. per cm^3 .

Density of water, maximum at 3.98°C. = 0.999973 g. per cm^3

Density of dry air at 0°C. and 760 mm. = .001293 g. per cm^3 .

Velocity of sound in dry air at 0°C. , 33,136 cm. per sec. = 1089 feet per sec.

Velocity of light in a vacuum = 2.99776×10^{10} cm. per sec. = 9.83514×10^8 feet per sec. = 186,272 mi./sec.

Heat equivalent of fusion of water 79.63 cal. (15°C.) per gram.

Heat equivalent of vaporization of water, 539.55 cal. (15°C.) per gram.

Coefficient of expansion of gases, .003665.

Specific heat of air, at constant pressure, 0.238.

Electrochemical equivalent of silver, 0.001118 g. per sec. per int. ampere.

Mean wave length of sodium light, .00005893 cm. or 5893. ångström units.

Absolute wave length of red cadmium line in air, 760 mm. pressure, 15°C. ; 6438.4696 ångström units.

GREEK ALPHABET

Greek letter	Greek name	English equivalent	Greek letter	Greek name	English equivalent
A α	Alpha	a	N ν	Nu	n
B β	Beta	b	Ξ ξ	Xi	x
Γ γ	Gamma	g	Ο ο	Omicron	ö
Δ δ	Delta	d	Π π	Pi	p
E ε	Epsilon	ë	Ρ ρ	Rho	r
Z ζ	Zeta	z	Σ σ	Sigma	s
H η	Eta	ē	Τ τ	Tau	t
Θ θ	Theta	th	Υ υ	Upsilon	u
I ι	Iota	i	Φ φ	Phi	ph
K κ	Kappa	k	Χ χ	Chi	ch
Λ λ	Lambda	l	Ψ ψ	Psi	ps
M μ	Mu	m	Ω ω	Omega	ō

FOUR-PLACE

N											Proportional Parts									
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	*4	8	12	17	21	25	29	33	37	
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34	
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31	
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29	
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27	
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	*3	6	8	11	14	17	20	22	25	
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24	
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22	
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12	14	16	19	21	
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20	
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19	
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18	
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17	
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17	
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16	
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15	
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15	
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14	
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14	
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13	
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13	
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12	
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12	
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12	
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11	
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11	
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11	
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10	
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10	
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10	
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10	
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9	
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9	
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9	
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9	
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9	
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8	
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8	
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8	
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8	
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8	
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8	
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7	
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7	
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7	
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	

* Interpolation in this section of the table is inaccurate.

LOGARITHMS

N	0 1 2 3 4					5 6 7 8 9					Proportional Parts 1 2 3 4 5 6 7 8 9								
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	4	4
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

FOUR-PLACE COMMON LOGARITHMS

N	0	1	2	3	4	5	6	7	8	9
.10	-.1000	-.9957	-.9914	-.9872	-.9830	-.9788	-.9747	-.9706	-.9666	-.9626
.11	-.9586	-.9547	-.9508	-.9469	-.9431	-.9393	-.9355	-.9318	-.9281	-.9245
.12	-.9208	-.9172	-.9136	-.9101	-.9066	-.9031	-.8996	-.8962	-.8928	-.8894
.13	-.8861	-.8827	-.8794	-.8761	-.8729	-.8697	-.8665	-.8633	-.8601	-.8570
.14	-.8539	-.8508	-.8477	-.8447	-.8416	-.8386	-.8356	-.8327	-.8297	-.8268
.15	-.8239	-.8210	-.8182	-.8153	-.8125	-.8097	-.8069	-.8041	-.8013	-.7986
.16	-.7959	-.7932	-.7905	-.7878	-.7852	-.7825	-.7799	-.7773	-.7747	-.7721
.17	-.7696	-.7670	-.7645	-.7620	-.7595	-.7570	-.7545	-.7520	-.7496	-.7471
.18	-.7447	-.7423	-.7399	-.7375	-.7352	-.7328	-.7305	-.7282	-.7258	-.7235
.19	-.7212	-.7190	-.7167	-.7144	-.7122	-.7100	-.7077	-.7055	-.7033	-.7011
.20	-.6990	-.6968	-.6946	-.6925	-.6904	-.6882	-.6861	-.6840	-.6819	-.6799
.21	-.6778	-.6757	-.6737	-.6716	-.6696	-.6676	-.6655	-.6635	-.6615	-.6596
.22	-.6576	-.6556	-.6536	-.6517	-.6498	-.6478	-.6459	-.6440	-.6421	-.6402
.23	-.6383	-.6364	-.6345	-.6326	-.6308	-.6289	-.6271	-.6253	-.6234	-.6216
.24	-.6198	-.6180	-.6162	-.6144	-.6126	-.6108	-.6091	-.6073	-.6055	-.6038
.25	-.6021	-.6003	-.5986	-.5969	-.5952	-.5935	-.5918	-.5901	-.5884	-.5867
.26	-.5850	-.5834	-.5817	-.5800	-.5784	-.5768	-.5751	-.5735	-.5719	-.5702
.27	-.5686	-.5670	-.5654	-.5638	-.5622	-.5607	-.5591	-.5575	-.5560	-.5544
.28	-.5528	-.5513	-.5498	-.5482	-.5467	-.5452	-.5436	-.5421	-.5406	-.5391
.29	-.5376	-.5361	-.5346	-.5331	-.5317	-.5302	-.5287	-.5272	-.5258	-.5243
.30	-.5229	-.5214	-.5200	-.5186	-.5171	-.5157	-.5143	-.5129	-.5114	-.5100
.31	-.5086	-.5072	-.5058	-.5045	-.5031	-.5017	-.5003	-.4989	-.4976	-.4962
.32	-.4949	-.4935	-.4921	-.4908	-.4895	-.4881	-.4868	-.4855	-.4841	-.4828
.33	-.4815	-.4802	-.4789	-.4776	-.4763	-.4750	-.4737	-.4724	-.4711	-.4698
.34	-.4685	-.4672	-.4660	-.4647	-.4634	-.4622	-.4609	-.4597	-.4584	-.4572
.35	-.4559	-.4547	-.4535	-.4522	-.4510	-.4498	-.4486	-.4473	-.4461	-.4449
.36	-.4437	-.4425	-.4413	-.4401	-.4389	-.4377	-.4365	-.4353	-.4342	-.4330
.37	-.4318	-.4306	-.4295	-.4283	-.4271	-.4260	-.4248	-.4237	-.4225	-.4214
.38	-.4202	-.4191	-.4179	-.4168	-.4157	-.4145	-.4134	-.4123	-.4112	-.4101
.39	-.4089	-.4078	-.4067	-.4056	-.4045	-.4034	-.4023	-.4012	-.4001	-.3990
.40	-.3979	-.3969	-.3958	-.3947	-.3936	-.3925	-.3915	-.3904	-.3893	-.3883
.41	-.3872	-.3862	-.3851	-.3840	-.3830	-.3820	-.3809	-.3799	-.3788	-.3778
.42	-.3768	-.3757	-.3747	-.3737	-.3726	-.3716	-.3706	-.3696	-.3686	-.3675
.43	-.3665	-.3655	-.3645	-.3635	-.3625	-.3615	-.3605	-.3595	-.3585	-.3575
.44	-.3565	-.3556	-.3546	-.3536	-.3526	-.3516	-.3507	-.3497	-.3487	-.3478
.45	-.3468	-.3458	-.3449	-.3439	-.3429	-.3420	-.3410	-.3401	-.3391	-.3382
.46	-.3372	-.3363	-.3354	-.3344	-.3335	-.3325	-.3316	-.3307	-.3298	-.3288
.47	-.3279	-.3270	-.3261	-.3251	-.3242	-.3233	-.3224	-.3215	-.3206	-.3197
.48	-.3188	-.3179	-.3170	-.3161	-.3152	-.3143	-.3134	-.3125	-.3116	-.3107
.49	-.3098	-.3089	-.3080	-.3072	-.3063	-.3054	-.3045	-.3036	-.3028	-.3019
.50	-.3010	-.3002	-.2993	-.2984	-.2976	-.2967	-.2958	-.2950	-.2941	-.2933
.51	-.2924	-.2916	-.2907	-.2899	-.2890	-.2882	-.2874	-.2865	-.2857	-.2848
.52	-.2840	-.2832	-.2823	-.2815	-.2807	-.2798	-.2790	-.2782	-.2774	-.2765
.53	-.2757	-.2749	-.2741	-.2733	-.2725	-.2716	-.2708	-.2700	-.2692	-.2684
.54	-.2676	-.2668	-.2660	-.2652	-.2644	-.2636	-.2628	-.2620	-.2612	-.2604

OF DECIMAL FRACTIONS

N	0	1	2	3	4	5	6	7	8	9
.55	— .2596	— .2588	— .2581	— .2573	— .2565	— .2557	— .2549	— .2541	— .2534	— .2526
.56	— .2518	— .2510	— .2503	— .2495	— .2487	— .2480	— .2472	— .2464	— .2457	— .2449
.57	— .2441	— .2434	— .2426	— .2418	— .2411	— .2403	— .2396	— .2388	— .2381	— .2373
.58	— .2366	— .2358	— .2351	— .2343	— .2336	— .2328	— .2321	— .2314	— .2306	— .2299
.59	— .2291	— .2284	— .2277	— .2269	— .2262	— .2255	— .2248	— .2240	— .2233	— .2226
.60	— .2218	— .2211	— .2204	— .2197	— .2190	— .2182	— .2175	— .2168	— .2161	— .2154
.61	— .2147	— .2140	— .2132	— .2125	— .2118	— .2111	— .2104	— .2097	— .2090	— .2083
.62	— .2076	— .2069	— .2062	— .2055	— .2048	— .2041	— .2034	— .2027	— .2020	— .2013
.63	— .2007	— .2000	— .1993	— .1986	— .1979	— .1972	— .1965	— .1959	— .1952	— .1945
.64	— .1938	— .1931	— .1925	— .1918	— .1911	— .1904	— .1898	— .1891	— .1884	— .1878
.65	— .1871	— .1864	— .1858	— .1851	— .1844	— .1838	— .1831	— .1824	— .1818	— .1811
.66	— .1805	— .1798	— .1791	— .1785	— .1778	— .1772	— .1765	— .1759	— .1752	— .1746
.67	— .1739	— .1733	— .1726	— .1720	— .1713	— .1707	— .1701	— .1694	— .1688	— .1681
.68	— .1675	— .1669	— .1662	— .1656	— .1649	— .1643	— .1637	— .1630	— .1624	— .1618
.69	— .1612	— .1605	— .1599	— .1593	— .1586	— .1580	— .1574	— .1568	— .1561	— .1555
.70	— .1549	— .1543	— .1537	— .1530	— .1524	— .1518	— .1512	— .1506	— .1500	— .1494
.71	— .1487	— .1481	— .1475	— .1469	— .1463	— .1457	— .1451	— .1445	— .1439	— .1433
.72	— .1427	— .1421	— .1415	— .1409	— .1403	— .1397	— .1391	— .1385	— .1379	— .1373
.73	— .1367	— .1361	— .1355	— .1349	— .1343	— .1337	— .1331	— .1325	— .1319	— .1314
.74	— .1308	— .1302	— .1296	— .1290	— .1284	— .1278	— .1273	— .1267	— .1261	— .1255
.75	— .1249	— .1244	— .1238	— .1232	— .1226	— .1221	— .1215	— .1209	— .1203	— .1198
.76	— .1192	— .1186	— .1180	— .1175	— .1169	— .1163	— .1158	— .1152	— .1146	— .1141
.77	— .1135	— .1129	— .1124	— .1118	— .1113	— .1107	— .1101	— .1096	— .1090	— .1085
.78	— .1079	— .1073	— .1068	— .1062	— .1057	— .1051	— .1046	— .1040	— .1035	— .1029
.79	— .1024	— .1018	— .1013	— .1007	— .1002	— .0996	— .0991	— .0985	— .0980	— .0975
.80	— .0969	— .0964	— .0958	— .0953	— .0947	— .0942	— .0937	— .0931	— .0926	— .0921
.81	— .0915	— .0910	— .0904	— .0899	— .0894	— .0888	— .0883	— .0878	— .0872	— .0867
.82	— .0862	— .0857	— .0851	— .0846	— .0841	— .0835	— .0830	— .0825	— .0820	— .0814
.83	— .0809	— .0804	— .0799	— .0794	— .0788	— .0783	— .0778	— .0773	— .0768	— .0762
.84	— .0757	— .0752	— .0747	— .0742	— .0737	— .0731	— .0726	— .0721	— .0716	— .0711
.85	— .0706	— .0701	— .0696	— .0691	— .0685	— .0680	— .0675	— .0670	— .0665	— .0660
.86	— .0655	— .0650	— .0645	— .0640	— .0635	— .0630	— .0625	— .0620	— .0615	— .0610
.87	— .0605	— .0600	— .0595	— .0590	— .0585	— .0580	— .0575	— .0570	— .0565	— .0560
.88	— .0555	— .0550	— .0545	— .0540	— .0535	— .0531	— .0526	— .0521	— .0516	— .0511
.89	— .0506	— .0501	— .0496	— .0491	— .0487	— .0482	— .0477	— .0472	— .0467	— .0462
.90	— .0458	— .0453	— .0448	— .0443	— .0438	— .0434	— .0429	— .0424	— .0419	— .0414
.91	— .0410	— .0405	— .0400	— .0395	— .0391	— .0386	— .0381	— .0376	— .0372	— .0367
.92	— .0362	— .0357	— .0353	— .0348	— .0343	— .0339	— .0334	— .0329	— .0325	— .0320
.93	— .0315	— .0311	— .0306	— .0301	— .0297	— .0292	— .0287	— .0283	— .0278	— .0273
.94	— .0269	— .0264	— .0259	— .0255	— .0250	— .0246	— .0241	— .0237	— .0232	— .0227
.95	— .0223	— .0218	— .0214	— .0209	— .0205	— .0200	— .0195	— .0191	— .0186	— .0182
.96	— .0177	— .0173	— .0168	— .0164	— .0159	— .0155	— .0150	— .0146	— .0141	— .0137
.97	— .0132	— .0128	— .0123	— .0119	— .0114	— .0110	— .0106	— .0101	— .0097	— .0092
.98	— .0088	— .0083	— .0079	— .0074	— .0070	— .0066	— .0061	— .0057	— .0052	— .0048
.99	— .0044	— .0039	— .0035	— .0031	— .0026	— .0022	— .0017	— .0013	— .0009	— .0004

ANTILOGARITHMS

	0 1 2 3 4					5 6 7 8 9					Proportional Parts 1 2 3 4 5 6 7 8 9									
.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2	2
.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2	2
.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2	2
.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2	2
.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2	2
.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2	2
.06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1	2	2	2	2	2
.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	2	2
.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1	2	2	2	2	3
.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1	2	2	2	2	3
.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1	2	2	2	2	3
.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	1	2	2	2	2	3
.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	1	2	2	2	2	3
.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	1	2	2	2	2	3
.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	1	2	2	2	2	3
.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	1	2	2	2	2	3
.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	1	2	2	2	2	3
.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	1	2	2	2	2	3
.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	1	2	2	2	2	3
.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	1	2	2	2	2	3
.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	1	2	2	2	2	3
.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	1	1	2	2	2	2	3
.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	1	1	2	2	2	2	3
.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	1	1	2	2	2	2	3
.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	1	1	2	2	2	2	3
.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	1	1	2	2	2	2	3
.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	1	1	2	2	2	2	3
.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	1	1	2	2	2	2	3
.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	1	1	2	2	2	2	3
.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	1	1	2	2	2	2	3
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	1	1	2	2	2	2	3
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	1	1	2	2	2	2	3
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	1	1	2	2	2	2	3
.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	1	1	2	2	2	2	3
.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	2	2	2	2	2	3
.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	2	2	2	2	2	3
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	2	2	2	2	2	3
.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	2	2	2	2	2	3
.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	2	2	2	2	2	3
.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	2	2	2	2	2	3
.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	2	2	2	2	2	3
.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	2	2	2	2	2	3
.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	2	2	2	2	2	3
.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	2	2	2	2	2	2	3
.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	2	2	2	2	2	2	3
.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	2	2	2	2	2	2	3
.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	2	2	2	2	2	2	3
.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	2	2	2	2	2	2	3
.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	2	2	2	2	2	2	3
.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	2	2	2	2	2	2	3
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	

ANTILOGARITHMS

	0 1 2 3 4					5 6 7 8 9					Proportional Parts 1 2 3 4 5 6 7 8 9									
.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7	
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7	
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7	
.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7	
.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7	
.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7	
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8	
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8	
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8	
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8	
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8	
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9	
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9	
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9	
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9	
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9	
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10	
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10	
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10	
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10	
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11	
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11	
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11	
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11	
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12	
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12	
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12	
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12	
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13	
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13	
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13	
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14	
.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	12	14	
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14	
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15	
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15	
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15	
.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	3	5	7	9	10	12	14	16	
.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16	
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16	
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17	
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17	
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17	
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18	
.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18	
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19	
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19	
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20	
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20	
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20	
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	■	

FIVE-PLACE LOGARITHMS

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts				
100	00	000	043	087	130	173	217	260	303	346	389		44	43	42
101		432	475	518	561	604	647	689	732	775	817	1	4,4	4,3	4,2
102		860	903	945	988	*030	*072	*115	*157	*199	*242	2	8,8	8,6	8,4
103	01	284	326	368	410	452	494	536	578	620	662	3	13,2	12,9	12,6
104		703	745	787	828	870	912	953	995	*036	*078	4	17,6	17,2	16,8
105	02	119	160	202	243	284	325	366	407	449	490	5	22,0	21,5	21,0
106		531	572	612	653	694	735	776	816	857	898	6	26,4	25,8	25,2
107		938	979	*019	*060	*100	*141	*181	*222	*262	*302	7	30,8	30,1	29,4
108	03	342	383	423	463	503	543	583	623	663	703	8	35,2	34,4	33,6
109		743	782	822	862	902	941	981	*021	*060	*100	9	39,6	38,7	37,8
110	04	139	179	218	258	297	336	376	415	454	493		41	40	39
111		532	571	610	650	689	727	766	805	844	883	1	4,1	4,0	3,9
112		922	961	999	*038	*077	*115	*154	*192	*231	*269	2	8,2	8,0	7,8
113	05	308	346	385	423	461	500	538	576	614	652	3	12,3	12,0	11,7
114		690	729	767	805	843	881	918	956	994	*032	4	16,4	16,0	15,6
115	06	070	108	145	183	221	258	296	333	371	408	5	20,5	20,0	19,5
116		446	483	521	558	595	633	670	707	744	781	6	24,6	24,0	23,4
117		819	856	893	930	967	*004	*041	*078	*115	*151	7	28,7	28,0	27,3
118	07	188	225	262	298	335	372	408	445	482	518	8	32,8	32,0	31,2
119		555	591	628	664	700	737	773	809	846	882	9	36,9	36,0	35,1
120		918	954	990	*027	*063	*099	*135	*171	*207	*243		38	37	36
121	08	279	314	350	386	422	458	493	529	565	600	1	3,8	3,7	3,6
122		636	672	707	743	778	814	849	884	920	955	2	7,6	7,4	7,2
123		991	*026	*061	*096	*132	*167	*202	*237	*272	*307	3	11,4	11,1	10,8
124	09	342	377	412	447	482	517	552	587	621	656	4	15,2	14,8	14,4
125		691	726	760	795	830	864	899	934	968	*003	5	19,0	18,5	18,0
126	10	037	072	106	140	175	209	243	278	312	346	6	22,8	22,2	21,6
127		380	415	449	483	517	551	585	619	653	687	7	26,6	25,9	25,2
128		721	755	789	823	857	890	924	958	992	*025	8	30,4	29,6	28,8
129	11	059	093	126	160	193	227	261	294	327	361	9	34,2	33,3	32,4
130		394	428	461	494	528	561	594	628	661	694		35	34	33
131		727	760	793	826	860	893	926	959	992	*024	1	3,5	3,4	3,3
132	12	057	090	123	156	189	222	254	287	320	352	2	7,0	6,8	6,6
133		385	418	450	483	516	548	581	613	646	678	3	10,5	10,2	9,9
134		710	743	775	808	840	872	905	937	969	*001	4	14,0	13,6	13,2
135	13	033	066	098	130	162	194	226	258	290	322	5	17,5	17,0	16,5
136		354	386	418	450	481	513	545	577	609	640	6	21,0	20,4	19,8
137		672	704	735	767	799	830	862	893	925	956	7	24,5	23,8	23,1
138		988	*019	*051	*082	*114	*145	*176	*208	*239	*270	8	28,0	27,2	26,4
139	14	301	333	364	395	426	457	489	520	551	582	9	31,5	30,6	29,7
140		613	644	675	706	737	768	799	829	860	891		32	31	30
141		922	953	983	*014	*045	*076	*106	*137	*168	*198	1	3,2	3,1	3,0
142	15	229	259	290	320	351	381	412	442	473	503	2	6,4	6,2	6,0
143		534	564	594	625	655	685	715	746	776	806	3	9,6	9,3	9,0
144		836	866	897	927	957	987	*017	*047	*077	*107	4	12,8	12,4	12,0
145	16	137	167	197	227	256	286	316	346	376	406	5	16,0	15,5	15,0
146		435	465	495	524	554	584	613	643	673	702	6	19,2	18,6	18,0
147		732	761	791	820	850	879	909	938	967	997	7	22,4	21,7	21,0
148	17	026	056	085	114	143	173	202	231	260	289	8	25,6	24,8	24,0
149		319	348	377	406	435	464	493	522	551	580	9	28,8	27,9	27,0
150		609	638	667	696	725	754	782	811	840	869				
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts				

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		
150	17	609	638	667	696	725	754	782	811	840	869	29	28
151		898	926	955	984	*013	*041	*070	*099	*127	*156	1	2,9
152	18	184	213	241	270	298	327	355	384	412	441	2	5,8
153		469	498	526	554	583	611	639	667	696	724	3	8,7
154		752	780	808	837	865	893	921	949	977	*005	4	11,6
155	19	033	061	089	117	145	173	201	229	257	285	5	14,5
156		312	340	368	396	424	451	479	507	535	562	6	17,4
157		590	618	645	673	700	728	756	783	811	838	7	20,3
158		866	893	921	948	976	*003	*030	*058	*085	*112	8	23,2
159	20	140	167	194	222	249	276	303	330	358	385	9	26,1
160		412	439	466	493	520	548	575	602	629	656		27
161		683	710	737	763	790	817	844	871	898	925	1	2,7
162		952	978	*005	*032	*059	*085	*112	*139	*165	*192	2	5,4
163	21	219	245	272	299	325	352	378	405	431	458	3	8,1
164		484	511	537	564	590	617	643	669	696	722	4	10,8
165		748	775	801	827	854	880	906	932	958	985	5	13,5
166	22	011	037	063	089	115	141	167	194	220	246	6	16,2
167		272	298	324	350	376	401	427	453	479	505	7	18,9
168		531	557	583	608	634	660	686	712	737	763	8	21,6
169		789	814	840	866	891	917	943	968	994	*019	9	24,3
170	23	045	070	096	121	147	172	198	223	249	274		25
171		300	325	350	376	401	426	452	477	502	528	1	2,5
172		553	578	603	629	654	679	704	729	754	779	2	5,0
173		805	830	855	880	905	930	955	980	*005	*030	3	7,5
174	24	055	080	105	130	155	180	204	229	254	279	4	10,0
175		304	329	353	378	403	428	452	477	502	527	5	12,5
176		551	576	601	625	650	674	699	724	748	773	6	15,0
177		797	822	846	871	895	920	944	969	993	*018	7	17,5
178	25	042	066	091	115	139	164	188	212	237	261	8	20,0
179		285	310	334	358	382	406	431	455	479	503	9	22,5
180		527	551	575	600	624	648	672	696	720	744		24
181		768	792	816	840	864	888	912	935	959	983	1	2,4
182	26	007	031	055	079	102	126	150	174	198	221	2	4,8
183		245	269	293	316	340	364	387	411	435	458	3	7,2
184		482	505	529	553	576	600	623	647	670	694	4	9,6
185		717	741	764	788	811	834	858	881	905	928	5	12,0
186		951	975	998	*021	*045	*068	*091	*114	*138	*161	6	14,4
187	27	184	207	231	254	277	300	323	346	370	393	7	16,8
188		416	439	462	485	508	531	554	577	600	623	8	19,2
189		646	669	692	715	738	761	784	807	830	852	9	21,6
190		875	898	921	944	967	989	*012	*035	*058	*081		22
191	28	103	126	149	171	194	217	240	262	285	307	1	2,2
192		330	353	375	398	421	443	466	488	511	533	2	4,4
193		556	578	601	623	646	668	691	713	735	758	3	6,6
194		780	803	825	847	870	892	914	937	959	981	4	8,8
195	29	003	026	048	070	092	115	137	159	181	203	5	11,0
196		226	248	270	292	314	336	358	380	403	425	6	13,2
197		447	469	491	513	535	557	579	601	623	645	7	15,4
198		667	688	710	732	754	776	798	820	842	863	8	17,6
199		885	907	929	951	973	994	*016	*038	*060	*081	9	19,8
200	30	103	125	146	168	190	211	233	255	276	298		
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts			
200	30	103	125	146	168	190	211	233	255	276	298	22	21	
201		320	341	363	384	406	428	449	471	492	514	2	2,2	2,1
202		535	557	578	600	621	643	664	685	707	728	3	4,4	4,2
203		750	771	792	814	835	856	878	899	920	942	4	6,6	6,3
204		963	984	*006	*027	*048	*069	*091	*112	*133	*154	5	8,8	8,4
205	31	175	197	218	239	260	281	302	323	345	366	6	11,0	10,5
206		387	408	429	450	471	492	513	534	555	576	7	13,2	12,6
207		597	618	639	660	681	702	723	744	765	785	8	15,4	14,7
208		806	827	848	869	890	911	931	952	973	994	9	17,6	16,8
209	32	015	035	056	077	098	118	139	160	181	201		19,8	18,9
210		222	243	263	284	305	325	346	366	387	408	20		
211		428	449	469	490	510	531	552	572	593	613	1	2,0	
212		634	654	675	695	715	736	756	777	797	818	2	4,0	
213		838	858	879	899	919	940	960	980	*001	*021	3	6,0	
214	33	041	062	082	102	122	143	163	183	203	224	4	8,0	
215		244	264	284	304	325	345	365	385	405	425	5	10,0	
216		445	465	486	506	526	546	566	586	606	626	6	12,0	
217		646	666	686	706	726	746	766	786	806	826	7	14,0	
218		846	866	885	905	925	945	965	985	*005	*025	8	16,0	
219	34	044	064	084	104	124	143	163	183	203	223	9	18,0	
220		242	262	282	301	321	341	361	380	400	420	19		
221		439	459	479	498	518	537	557	577	596	616	1	1,9	
222		635	655	674	694	713	733	753	772	792	811	2	3,8	
223		830	850	869	889	908	928	947	967	986	*005	3	5,7	
224	35	025	044	064	083	102	122	141	160	180	199	4	7,6	
225		218	238	257	276	295	315	334	353	372	392	5	9,5	
226		411	430	449	468	488	507	526	545	564	583	6	11,4	
227		603	622	641	660	679	698	717	736	755	774	7	13,3	
228		793	813	832	851	870	889	908	927	946	965	8	15,2	
229		984	*003	*021	*040	*059	*078	*097	*116	*135	*154	9	17,1	
230	36	173	192	211	229	248	267	286	305	324	342	18		
231		361	380	399	418	436	455	474	493	511	530	1	1,8	
232		549	568	586	605	624	642	661	680	698	717	2	3,6	
233		736	754	773	791	810	829	847	866	884	903	3	5,4	
234		922	940	959	977	996	*014	*033	*051	*070	*088	4	7,2	
235	37	107	125	144	162	181	199	218	236	254	273	5	9,0	
236		291	310	328	346	365	383	401	420	438	457	6	10,8	
237		475	493	511	530	548	566	585	603	621	639	7	12,6	
238		658	676	694	712	731	749	767	785	803	822	8	14,4	
239		840	858	876	894	912	931	949	967	985	*003	9	16,2	
240	38	021	039	057	075	093	112	130	148	166	184	17		
241		202	220	238	256	274	292	310	328	346	364	1	1,7	
242		382	399	417	435	453	471	489	507	525	543	2	3,4	
243		561	578	596	614	632	650	668	686	703	721	3	5,1	
244		739	757	775	792	810	828	846	863	881	899	4	6,8	
245		917	934	952	970	987	*005	*023	*041	*058	*076	5	8,5	
246	39	094	111	129	146	164	182	199	217	235	252	6	10,2	
247		270	287	305	322	340	358	375	393	410	428	7	11,9	
248		445	463	480	498	515	533	550	568	585	602	8	13,6	
249		620	637	655	672	690	707	724	742	759	777	9	15,3	
250		794	811	829	846	863	881	898	915	933	950			
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts			

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		
250	39	794	811	829	846	863	881	898	915	933	950	18	
251		967	985	*002	*019	*037	*054	*071	*088	*106	*123	1	1,8
252	40	140	157	175	192	209	226	243	261	278	295	2	3,6
253		312	329	346	364	381	398	415	432	449	466	3	5,4
254		483	500	518	535	552	569	586	603	620	637	4	7,2
255		654	671	688	705	722	739	756	773	790	807	5	9,0
256		824	841	858	875	892	909	926	943	960	976	6	10,8
257		993	*010	*027	*044	*061	*078	*095	*111	*128	*145	7	12,6
258	41	162	179	196	212	229	246	263	280	296	313	8	14,4
259		330	347	363	380	397	414	430	447	464	481	9	16,2
260		497	514	531	547	564	581	597	614	631	647		17
261		664	681	697	714	731	747	764	780	797	814	1	1,7
262		830	847	863	880	896	913	929	946	963	979	2	3,4
263		996	*012	*029	*045	*062	*078	*095	*111	*127	*144	3	5,1
264	42	160	177	193	210	226	243	259	275	292	308	4	6,8
265		325	341	357	374	390	406	423	439	455	472	5	8,5
266		488	504	521	537	553	570	586	602	619	635	6	10,2
267		651	667	684	700	716	732	749	765	781	797	7	11,9
268		813	830	846	862	878	894	911	927	943	959	8	13,6
269		975	991	*008	*024	*040	*056	*072	*088	*104	*120	9	15,3
270	43	136	152	169	185	201	217	233	249	265	281		16
271		297	313	329	345	361	377	393	409	425	441	1	1,6
272		457	473	489	505	521	537	553	569	584	600	2	3,2
273		616	632	648	664	680	696	712	727	743	759	3	4,8
274		775	791	807	823	838	854	870	886	902	917	4	6,4
275		933	949	965	981	996	*012	*028	*044	*059	*075	5	8,0
276	44	091	107	122	138	154	170	185	201	217	232	6	9,6
277		248	264	279	295	311	326	342	358	373	389	7	11,2
278		404	420	436	451	467	483	498	514	529	545	8	12,8
279		560	576	592	607	623	638	654	669	685	700	9	14,4
280		716	731	747	762	778	793	809	824	840	855		15
281		871	886	902	917	932	948	963	979	994	*010	1	1,5
282	45	025	040	056	071	086	102	117	133	148	163	2	3,0
283		179	194	209	225	240	255	271	286	301	317	3	4,5
284		332	347	362	378	393	408	423	439	454	469	4	6,0
285		484	500	515	530	545	561	576	591	606	621	5	7,5
286		637	652	667	682	697	712	728	743	758	773	6	9,0
287		788	803	818	834	849	864	879	894	909	924	7	10,5
288		939	954	969	984	*000	*015	*030	*045	*060	*075	8	12,0
289	46	090	105	120	135	150	165	180	195	210	225	9	13,5
290		240	255	270	285	300	315	330	345	359	374		14
291		389	404	419	434	449	464	479	494	509	523	1	1,4
292		538	553	568	583	598	613	627	642	657	672	2	2,8
293		687	702	716	731	746	761	776	790	805	820	3	4,2
294		835	850	864	879	894	909	923	938	953	967	4	5,6
295		982	997	*012	*026	*041	*056	*070	*085	*100	*114	5	7,0
296	47	129	144	159	173	188	202	217	232	246	261	6	8,4
297		276	290	305	319	334	349	363	378	392	407	7	9,8
298		422	436	451	465	480	494	509	524	538	553	8	11,2
299		567	582	596	611	625	640	654	669	683	698	9	12,6
300		712	727	741	756	770	784	799	813	828	842		
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
300	47	712	727	741	756	770	784	799	813	828	842	
301		857	871	885	900	914	929	943	958	972	986	
302	48	001	015	029	044	058	073	087	101	116	130	
303		144	159	173	187	202	216	230	244	259	273	15
304		287	302	316	330	344	359	373	387	401	416	1,5
305		430	444	458	473	487	501	515	530	544	558	3,0
306		572	586	601	615	629	643	657	671	686	700	4,5
307		714	728	742	756	770	785	799	813	827	841	6,0
308		855	869	883	897	911	926	940	954	968	982	7,5
309		996	*010	*024	*038	*052	*066	*080	*094	*108	*122	9,0
310	49	136	150	164	178	192	206	220	234	248	262	10,5
311		276	290	304	318	332	346	360	374	388	402	12,0
312		415	429	443	457	471	485	499	513	527	541	13,5
313		554	568	582	596	610	624	638	651	665	679	
314		693	707	721	734	748	762	776	790	803	817	14
315		831	845	859	872	886	900	914	927	941	955	1,4
316		969	982	996	*010	*024	*037	*051	*065	*079	*092	2,8
317	50	106	120	133	147	161	174	188	202	215	229	4,2
318		243	256	270	284	297	311	325	338	352	365	5,6
319		379	393	406	420	433	447	461	474	488	501	7,0
320		515	529	542	556	569	583	596	610	623	637	8,4
321		651	664	678	691	705	718	732	745	759	772	9,8
322		786	799	813	826	840	853	866	880	893	907	11,2
323		920	934	947	961	974	987	*001	*014	*028	*041	12,6
324	51	055	068	081	095	108	121	135	148	162	175	
325		188	202	215	228	242	255	268	282	295	308	13
326		322	335	348	362	375	388	402	415	428	441	1,3
327		455	468	481	495	508	521	534	548	561	574	2,6
328		587	601	614	627	640	654	667	680	693	706	3,9
329		720	733	746	759	772	786	799	812	825	838	5,2
330		851	865	878	891	904	917	930	943	957	970	6,5
331		983	996	*009	*022	*035	*048	*061	*075	*088	*101	7,8
332	52	114	127	140	153	166	179	192	205	218	231	9,1
333		244	257	270	284	297	310	323	336	349	362	10,4
334		375	388	401	414	427	440	453	466	479	492	11,7
335		504	517	530	543	556	569	582	595	608	621	
336		634	647	660	673	686	699	711	724	737	750	12
337		763	776	789	802	815	827	840	853	866	879	1,2
338		892	905	917	930	943	956	969	982	994	*007	2,4
339	53	020	033	046	058	071	084	097	110	122	135	3,6
340		148	161	173	186	199	212	224	237	250	263	4,8
341		275	288	301	314	326	339	352	364	377	390	6,0
342		403	415	428	441	453	466	479	491	504	517	7,2
343		529	542	555	567	580	593	605	618	631	643	8,4
344		656	668	681	694	706	719	732	744	757	769	9,6
345		782	794	807	820	832	845	857	870	882	895	10,8
346		908	920	933	945	958	970	983	995	*008	*020	
347	54	033	045	058	070	083	095	108	120	133	145	
348		158	170	183	195	208	220	233	245	258	270	
349		283	295	307	320	332	345	357	370	382	394	
350		407	419	432	444	456	469	481	494	506	518	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.		0	1	2	3	4	5	6	7	8	9	Proportional parts
350	54	407	419	432	444	456	469	481	494	506	518	
351		531	543	555	568	580	593	605	617	630	642	
352		654	667	679	691	704	716	728	741	753	765	
353		777	790	802	814	827	839	851	864	876	888	13
354		900	913	925	937	949	962	974	986	998	*011	1 1,3
355	55	023	035	047	060	072	084	096	108	121	133	2 2,6
356		145	157	169	182	194	206	218	230	242	255	3 3,9
357		267	279	291	303	315	328	340	352	364	376	4 5,2
358		388	400	413	425	437	449	461	473	485	497	5 6,5
359		509	522	534	546	558	570	582	594	606	618	6 7,8
												7 9,1
360		630	642	654	666	678	691	703	715	727	739	8 10,4
361		751	763	775	787	799	811	823	835	847	859	9 11,7
362		871	883	895	907	919	931	943	955	967	979	
363		991	*003	*015	*027	*038	*050	*062	*074	*086	*098	
364	56	110	122	134	146	158	170	182	194	205	217	12
365		229	241	253	265	277	289	301	312	324	336	1 1,2
366		348	360	372	384	396	407	419	431	443	455	2 2,4
367		467	478	490	502	514	526	538	549	561	573	3 3,6
368		585	597	608	620	632	644	656	667	679	691	4 4,8
369		703	714	726	738	750	761	773	785	797	808	5 6,0
												6 7,2
370		820	832	844	855	867	879	891	902	914	926	7 8,4
371		937	949	961	972	984	996	*008	*019	*031	*043	8 9,6
372	57	054	066	078	089	101	113	124	136	148	159	9 10,8
373		171	183	194	206	217	229	241	252	264	276	
374		287	299	310	322	334	345	357	368	380	392	
375		403	415	426	438	449	461	473	484	496	507	
376		519	530	542	553	565	576	588	600	611	623	
377		634	646	657	669	680	692	703	715	726	738	11
378		749	761	772	784	795	807	818	830	841	852	1 1,1
379		864	875	887	898	910	921	933	944	955	967	2 2,2
												3 3,3
380		978	990	*001	*013	*024	*035	*047	*058	*070	*081	4 4,4
381	58	092	104	115	127	138	149	161	172	184	195	5 5,5
382		206	218	229	240	252	263	274	286	297	309	6 6,6
383		320	331	343	354	365	377	388	399	410	422	7 7,7
384		433	444	456	467	478	490	501	512	524	535	8 8,8
385		546	557	569	580	591	602	614	625	636	647	9 9,9
386		659	670	681	692	704	715	726	737	749	760	
387		771	782	794	805	816	827	838	850	861	872	
388		883	894	906	917	928	939	950	961	973	984	
389		995	*006	*017	*028	*040	*051	*062	*073	*084	*095	10
												1 1,0
390	59	106	118	129	140	151	162	173	184	195	207	2 2,0
391		218	229	240	251	262	273	284	295	306	318	3 3,0
392		329	340	351	362	373	384	395	406	417	428	4 4,0
393		439	450	461	472	483	494	506	517	528	539	5 5,0
394		550	561	572	583	594	605	616	627	638	649	6 6,0
395		660	671	682	693	704	715	726	737	748	759	7 7,0
396		770	780	791	802	813	824	835	846	857	868	8 8,0
397		879	890	901	912	923	934	945	956	966	977	9 9,0
398		988	999	*010	*021	*032	*043	*054	*065	*076	*086	
399	60	097	108	119	130	141	152	163	173	184	195	
400		206	217	228	239	249	260	271	282	293	304	
N.		0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
400	60	206	217	228	239	249	260	271	282	293	304	
401		314	325	336	347	358	369	379	390	401	412	
402		423	433	444	455	466	477	487	498	509	520	
403		531	541	552	563	574	584	595	606	617	627	
404		638	649	660	670	681	692	703	713	724	735	
405		746	756	767	778	788	799	810	821	831	842	
406		853	863	874	885	895	906	917	927	938	949	
407		959	970	981	991	*002	*013	*023	*034	*045	*055	11
408	61	066	077	087	098	109	119	130	140	151	162	1 1.1
409		172	183	194	204	215	225	236	247	257	268	2 2.2
												3 3.3
410		278	289	300	310	321	331	342	352	363	374	4 4.4
411		384	395	405	416	426	437	448	458	469	479	5 5.5
412		490	500	511	521	532	542	553	563	574	584	6 6.6
413		595	606	616	627	637	648	658	669	679	690	7 7.7
414		700	711	721	731	742	752	763	773	784	794	8 8.8
415		805	815	826	836	847	857	868	878	888	899	9 9.9
416		909	920	930	941	951	962	972	982	993	*003	
417	62	014	024	034	045	055	066	076	086	097	107	
418		118	128	138	149	159	170	180	190	201	211	
419		221	232	242	252	263	273	284	294	304	315	
420		325	335	346	356	366	377	387	397	408	418	10
421		428	439	449	459	469	480	490	500	511	521	1 1.0
422		531	542	552	562	572	583	593	603	613	624	2 2.0
423		634	644	655	665	675	685	696	706	716	726	3 3.0
424		737	747	757	767	778	788	798	808	818	829	4 4.0
425		839	849	859	870	880	890	900	910	921	931	5 5.0
426		941	951	961	972	982	992	*002	*012	*022	*033	6 6.0
427	63	043	053	063	073	083	094	104	114	124	134	7 7.0
428		144	155	165	175	185	195	205	215	225	236	8 8.0
429		246	256	266	276	286	296	306	317	327	337	9 9.0
430		347	357	367	377	387	397	407	417	428	438	
431		448	458	468	478	488	498	508	518	528	538	
432		548	558	568	579	589	599	609	619	629	639	
433		649	659	669	679	689	699	709	719	729	739	
434		749	759	769	779	789	799	809	819	829	839	
435		849	859	869	879	889	899	909	919	929	939	9
436		949	959	969	979	988	998	*008	*018	*028	*038	1 0.9
437	64	048	058	068	078	088	098	108	118	128	137	2 1.8
438		147	157	167	177	187	197	207	217	227	237	3 2.7
439		246	256	266	276	286	296	306	316	326	335	4 3.6
												5 4.5
440		345	355	365	375	385	395	404	414	424	434	6 5.4
441		444	454	464	473	483	493	503	513	523	532	7 6.3
442		542	552	562	572	582	591	601	611	621	631	8 7.2
443		640	650	660	670	680	689	699	709	719	729	9 8.1
444		738	748	758	768	777	787	797	807	816	826	
445		836	846	856	865	875	885	895	904	914	924	
446		933	943	953	963	972	982	992	*002	*011	*021	
447	65	031	040	050	060	070	079	089	099	108	118	
448		128	137	147	157	167	176	186	196	205	215	
449		225	234	244	254	263	273	283	292	302	312	
450		321	331	341	350	360	369	379	389	398	408	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
450	65	321	331	341	350	360	369	379	389	398	408	
451		418	427	437	447	456	466	475	485	495	504	
452		514	523	533	543	552	562	571	581	591	600	
453		610	619	629	639	648	658	667	677	686	696	
454		706	715	725	734	744	753	763	772	782	792	
455		801	811	820	830	839	849	858	868	877	887	
456		896	906	916	925	935	944	954	963	973	982	
457		992	*001	*011	*020	*030	*039	*049	*058	*068	*077	10
458	66	087	096	106	115	124	134	143	153	162	172	1 1.0
459		181	191	200	210	219	229	238	247	257	266	2 2.0
												3 3.0
460		276	285	295	304	314	323	332	342	351	361	4 4.0
461		370	380	389	398	408	417	427	436	445	455	5 5.0
462		464	474	483	492	502	511	521	530	539	549	6 6.0
463		558	567	577	586	596	605	614	624	633	642	7 7.0
464		652	661	671	680	689	699	708	717	727	736	8 8.0
465		745	755	764	773	783	792	801	811	820	829	9 9.0
466		839	848	857	867	876	885	894	904	913	922	
467		932	941	950	960	969	978	987	997	*006	*015	
468	67	025	034	043	052	062	071	080	089	099	108	
469		117	127	136	145	154	164	173	182	191	201	
470		210	219	228	237	247	256	265	274	284	293	9
471		302	311	321	330	339	348	357	367	376	385	1 0.9
472		394	403	413	422	431	440	449	459	468	477	2 1.8
473		486	495	504	514	523	532	541	550	560	569	3 2.7
474		578	587	596	605	614	624	633	642	651	660	4 3.6
475		669	679	688	697	706	715	724	733	742	752	5 4.5
476		761	770	779	788	797	806	815	825	834	843	6 5.4
477		852	861	870	879	888	897	906	916	925	934	7 6.3
478		943	952	961	970	979	988	997	*006	*015	*024	8 7.2
479	68	034	043	052	061	070	079	088	097	106	115	9 8.1
480		124	133	142	151	160	169	178	187	196	205	
481		215	224	233	242	251	260	269	278	287	296	
482		305	314	323	332	341	350	359	368	377	386	
483		395	404	413	422	431	440	449	458	467	476	
484		485	494	502	511	520	529	538	547	556	565	
485		574	583	592	601	610	619	628	637	646	655	8
486		664	673	681	690	699	708	717	726	735	744	1 0.8
487		753	762	771	780	789	797	806	815	824	833	2 1.6
488		842	851	860	869	878	886	895	904	913	922	3 2.4
489		931	940	949	958	966	975	984	993	*002	*011	4 3.2
												5 4.0
490	69	020	028	037	046	055	064	073	082	090	099	6 4.8
491		108	117	126	135	144	152	161	170	179	188	7 5.6
492		197	205	214	223	232	241	249	258	267	276	8 6.4
493		285	294	302	311	320	329	338	346	355	364	9 7.2
494		373	381	390	399	408	417	425	434	443	452	
495		461	469	478	487	496	504	513	522	531	539	
496		548	557	566	574	583	592	601	609	618	627	
497		636	644	653	662	671	679	688	697	705	714	
498		723	732	740	749	758	767	775	784	793	801	
499		810	819	827	836	845	854	862	871	880	888	
500		897	906	914	923	932	940	949	958	966	975	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
500	69	897	906	914	923	932	940	949	958	966	975	
501		984	992	*001	*010	*018	*027	*036	*044	*053	*062	
502	70	070	079	088	096	105	114	122	131	140	148	
503		157	165	174	183	191	200	209	217	226	234	
504		243	252	260	269	278	286	295	303	312	321	
505		329	338	346	355	364	372	381	389	398	406	
506		415	424	432	441	449	458	467	475	484	492	
507		501	509	518	526	535	544	552	561	569	578	9
508		586	595	603	612	621	629	638	646	655	663	1 0.9
509		672	680	689	697	706	714	723	731	740	749	2 1.8
												3 2.7
510		757	766	774	783	791	800	808	817	825	834	4 3.6
511		842	851	859	868	876	885	893	902	910	919	5 4.5
512		927	935	944	952	961	969	978	986	995	*003	6 5.4
513	71	012	020	029	037	046	054	063	071	079	088	7 6.3
514		096	105	113	122	130	139	147	155	164	172	8 7.2
515		181	189	198	206	214	223	231	240	248	257	9 8.1
516		265	273	282	290	299	307	315	324	332	341	
517		349	357	366	374	383	391	399	408	416	425	
518		433	441	450	458	466	475	483	492	500	508	
519		517	525	533	542	550	559	567	575	584	592	
												8
520		600	609	617	625	634	642	650	659	667	675	1 0.8
521		684	692	700	709	717	725	734	742	750	759	2 1.6
522		767	775	784	792	800	809	817	825	834	842	3 2.4
523		850	858	867	875	883	892	900	908	917	925	4 3.2
524		933	941	950	958	966	975	983	991	999	*008	5 4.0
525	72	016	024	032	041	049	057	066	074	082	090	6 4.8
526		099	107	115	123	132	140	148	156	165	173	7 5.6
527		181	189	198	206	214	222	230	239	247	255	8 6.4
528		263	272	280	288	296	304	313	321	329	337	9 7.2
529		346	354	362	370	378	387	395	403	411	419	
530		428	436	444	452	460	469	477	485	493	501	
531		509	518	526	534	542	550	558	567	575	583	
532		591	599	607	616	624	632	640	648	656	665	
533		673	681	689	697	705	713	722	730	738	746	
534		754	762	770	779	787	795	803	811	819	827	
535		835	843	852	860	868	876	884	892	900	908	7
536		916	925	933	941	949	957	965	973	981	989	1 0.7
537		997	*006	*014	*022	*030	*038	*046	*054	*062	*070	2 1.4
538	73	078	086	094	102	111	119	127	135	143	151	3 2.1
539		159	167	175	183	191	199	207	215	223	231	4 2.8
												5 3.5
540		239	247	255	263	272	280	288	296	304	312	6 4.2
541		320	328	336	344	352	360	368	376	384	392	7 4.9
542		400	408	416	424	432	440	448	456	464	472	8 5.6
543		480	488	496	504	512	520	528	536	544	552	9 6.3
544		560	568	576	584	592	600	608	616	624	632	
545		640	648	656	664	672	679	687	695	703	711	
546		719	727	735	743	751	759	767	775	783	791	
547		799	807	815	823	830	838	846	854	862	870	
548		878	886	894	902	910	918	926	933	941	949	
549		957	965	973	981	989	997	*005	*013	*020	*028	
550	74	036	044	052	060	068	076	084	092	099	107	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
550	74	036	044	052	060	068	076	084	092	107	
551		115	123	131	139	147	155	162	170	178	
552		194	202	210	218	225	233	241	249	257	
553		273	280	288	296	304	312	320	327	335	
554		351	359	367	374	382	390	398	406	414	
555		429	437	445	453	461	468	476	484	492	
556		507	515	523	531	539	547	554	562	570	
557		586	593	601	609	617	624	632	640	648	
558		663	671	679	687	695	702	710	718	726	
559		741	749	757	764	772	780	788	796	803	
560		819	827	834	842	850	858	865	873	881	8
561		896	904	912	920	927	935	943	950	958	1 | 0.8
562		974	981	989	997	*005	*012	*020	*028	*035	2 | 1.6
563	75	051	059	066	074	082	089	097	105	113	3 | 2.4
564		128	136	143	151	159	166	174	182	189	4 | 3.2
565		205	213	220	228	236	243	251	259	266	5 | 4.0
566		282	289	297	305	312	320	328	335	343	6 | 4.8
567		358	366	374	381	389	397	404	412	420	7 | 5.6
568		435	442	450	458	465	473	481	488	496	8 | 6.4
569		511	519	526	534	542	549	557	565	572	9 | 7.2
570		587	595	603	610	618	626	633	641	648	
571		664	671	679	686	694	702	709	717	724	
572		740	747	755	762	770	778	785	793	800	
573		815	823	831	838	846	853	861	868	876	
574		891	899	906	914	921	929	937	944	952	
575		967	974	982	989	997	*005	*012	*020	*027	*035
576	76	042	050	057	065	072	080	087	095	103	110
577		118	125	133	140	148	155	163	170	178	
578		193	200	208	215	223	230	238	245	253	
579		268	275	283	290	298	305	313	320	328	
580		343	350	358	365	373	380	388	395	403	7
581		418	425	433	440	448	455	462	470	477	1 | 0.7
582		492	500	507	515	522	530	537	545	552	2 | 1.4
583		567	574	582	589	597	604	612	619	626	3 | 2.1
584		641	649	656	664	671	678	686	693	701	4 | 2.8
585		716	723	730	738	745	753	760	768	775	5 | 3.5
586		790	797	805	812	819	827	834	842	849	6 | 4.2
587		864	871	879	886	893	901	908	916	923	7 | 4.9
588		938	945	953	960	967	975	982	989	997	*004
589	77	012	019	026	034	041	048	056	063	070	8 | 5.6
590		085	093	100	107	115	122	129	137	144	9 | 6.3
591		159	166	173	181	188	195	203	210	217	
592		232	240	247	254	262	269	276	283	291	
593		305	313	320	327	335	342	349	357	364	
594		379	386	393	401	408	415	422	430	437	
595		452	459	466	474	481	488	495	503	510	
596		525	532	539	546	554	561	568	576	583	
597		597	605	612	619	627	634	641	648	656	
598		670	677	685	692	699	706	714	721	728	
599		743	750	757	764	772	779	786	793	801	
600		815	822	830	837	844	851	859	866	873	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
600	77 815	822	830	837	844	851	859	366	873	880	
601	887	895	902	909	916	924	931	938	945	952	
602	960	967	974	981	988	996	*003	*010	*017	*025	
603	78 032	039	046	053	061	068	075	082	089	097	
604	104	111	118	125	132	140	147	154	161	168	
605	176	183	190	197	204	211	219	226	233	240	
606	247	254	262	269	276	283	290	297	305	312	
607	319	326	333	340	347	355	362	369	376	383	
608	390	398	405	412	419	426	433	440	447	455	8
609	462	469	476	483	490	497	504	512	519	526	1 0.8
610	533	540	547	554	561	569	576	583	590	597	2 1.6
611	604	611	618	625	633	640	647	654	661	668	3 2.4
612	675	682	689	696	704	711	718	725	732	739	4 3.2
613	746	753	760	767	774	781	789	796	803	810	5 4.0
614	817	824	831	838	845	852	859	866	873	880	6 4.8
615	888	895	902	909	916	923	930	937	944	951	7 5.6
616	958	965	972	979	986	993	*000	*007	*014	*021	8 6.4
617	79 029	036	043	050	057	064	071	078	085	092	9 7.2
618	099	106	113	120	127	134	141	148	155	162	
619	169	176	183	190	197	204	211	218	225	232	
620	239	246	253	260	267	274	281	288	295	302	7
621	309	316	323	330	337	344	351	358	365	372	1 0.7
622	379	386	393	400	407	414	421	428	435	442	2 1.4
623	449	456	463	470	477	484	491	498	505	511	3 2.1
624	518	525	532	539	546	553	560	567	574	581	4 2.8
625	588	595	602	609	616	623	630	637	644	650	5 3.5
626	657	664	671	678	685	692	699	706	713	720	6 4.2
627	727	734	741	748	754	761	768	775	782	789	7 4.9
628	796	803	810	817	824	831	837	844	851	858	8 5.6
629	865	872	879	886	893	900	906	913	920	927	9 6.3
630	934	941	948	955	962	969	975	982	989	996	
631	80 003	010	017	024	030	037	044	051	058	065	
632	072	079	085	092	099	106	113	120	127	134	
633	140	147	154	161	168	175	182	188	195	202	
634	209	216	223	229	236	243	250	257	264	271	
635	277	284	291	298	305	312	318	325	332	339	
636	346	353	359	366	373	380	387	393	400	407	1 0.6
637	414	421	428	434	441	448	455	462	468	475	2 1.2
638	482	489	496	502	509	516	523	530	536	543	3 1.8
639	550	557	564	570	577	584	591	598	604	611	4 2.4
640	618	625	632	638	645	652	659	665	672	679	5 3.0
641	686	693	699	706	713	720	726	733	740	747	6 3.6
642	754	760	767	774	781	787	794	801	808	814	7 4.2
643	821	828	835	841	848	855	862	868	875	882	8 4.8
644	889	895	902	909	916	922	929	936	943	949	9 5.4
645	956	963	969	976	983	990	996	*003	*010	*017	
646	81 023	030	037	043	050	057	064	070	077	084	
647	090	097	104	111	117	124	131	137	144	151	
648	158	164	171	178	184	191	198	204	211	218	
649	224	231	238	245	251	258	265	271	278	285	
650	291	298	305	311	318	325	331	338	345	351	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
650	81	291	298	305	311	318	325	331	338	345	351	
651		358	365	371	378	385	391	398	405	411	418	
652		425	431	438	445	451	458	465	471	478	485	
653		491	498	505	511	518	525	531	538	544	551	
654		558	564	571	578	584	591	598	604	611	617	
655		624	631	637	644	651	657	664	671	677	684	
656		690	697	704	710	717	723	730	737	743	750	
657		757	763	770	776	783	790	796	803	809	816	
658		823	829	836	842	849	856	862	869	875	882	
659		889	895	902	908	915	921	928	935	941	948	
660		954	961	968	974	981	987	994	*000	*007	*014	7
661	82	020	027	033	040	046	053	060	066	073	079	1 0.7
662		086	092	099	105	112	119	125	132	138	145	2 1.4
663		151	158	164	171	178	184	191	197	204	210	3 2.1
664		217	223	230	236	243	249	256	263	269	276	4 2.8
665		282	289	295	302	308	315	321	328	334	341	5 3.5
666		347	354	360	367	373	380	387	393	400	406	6 4.2
667		413	419	426	432	439	445	452	458	465	471	7 4.9
668		478	484	491	497	504	510	517	523	530	536	8 5.6
669		543	549	556	562	569	575	582	588	595	601	9 6.3
670		607	614	620	627	633	640	646	653	659	666	
671		672	679	685	692	698	705	711	718	724	730	
672		737	743	750	756	763	769	776	782	789	795	
673		802	808	814	821	827	834	840	847	853	860	
674		866	872	879	885	892	898	905	911	918	924	
675		930	937	943	950	956	963	969	975	982	988	
676		995	*001	*008	*014	*020	*027	*033	*040	*046	*052	
677	83	059	065	072	078	085	091	097	104	110	117	
678		123	129	136	142	149	155	161	168	174	181	
679		187	193	200	206	213	219	225	232	238	245	
680		251	257	264	270	276	283	289	296	302	308	
681		315	321	327	334	340	347	353	359	366	372	1 0.6
682		378	385	391	398	404	410	417	423	429	436	2 1.2
683		442	448	455	461	467	474	480	487	493	499	3 1.8
684		506	512	518	525	531	537	544	550	556	563	4 2.4
685		569	575	582	588	594	601	607	613	620	626	5 3.0
686		632	639	645	651	658	664	670	677	683	689	6 3.6
687		696	702	708	715	721	727	734	740	746	753	7 4.2
688		759	765	771	778	784	790	797	803	809	816	8 4.8
689		822	828	835	841	847	853	860	866	872	879	9 5.4
690		885	891	897	904	910	916	923	929	935	942	
691		948	954	960	967	973	979	985	992	998	*004	
692	84	011	017	023	029	036	042	048	055	061	067	
693		073	080	086	092	098	105	111	117	123	130	
694		136	142	148	155	161	167	173	180	186	192	
695		198	205	211	217	223	230	236	242	248	255	
696		261	267	273	280	286	292	298	305	311	317	
697		323	330	336	342	348	354	361	367	373	379	
698		386	392	398	404	410	417	423	429	435	442	
699		448	454	460	466	473	479	485	491	497	504	
700		510	516	522	528	535	541	547	553	559	566	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
700	84	510	516	522	528	535	541	547	553	559	566	
701		572	578	584	590	597	603	609	615	621	628	
702		634	640	646	652	658	665	671	677	683	689	
703		696	702	708	714	720	726	733	739	745	751	
704		757	763	770	776	782	788	794	800	807	813	
705		819	825	831	837	844	850	856	862	868	874	
706		880	887	893	899	905	911	917	924	930	936	
707		942	948	954	960	967	973	979	985	991	997	7
708	85	003	009	016	022	028	034	040	046	052	058	1 | 0.7
709		065	071	077	083	089	095	101	107	114	120	2 | 1.4
710		126	132	138	144	150	156	163	169	175	181	3 | 2.1
711		187	193	199	205	211	217	224	230	236	242	4 | 2.8
712		248	254	260	266	272	278	285	291	297	303	5 | 3.5
713		309	315	321	327	333	339	345	352	358	364	6 | 4.2
714		370	376	382	388	394	400	406	412	418	425	7 | 4.9
715		431	437	443	449	455	461	467	473	479	485	8 | 5.6
716		491	497	503	509	516	522	528	534	540	546	9 | 6.3
717		552	558	564	570	576	582	588	594	600	606	
718		612	618	625	631	637	643	649	655	661	667	
719		673	679	685	691	697	703	709	715	721	727	
720		733	739	745	751	757	763	769	775	781	788	E
721		794	800	806	812	818	824	830	836	842	848	1 | 0.6
722		854	860	866	872	878	884	890	896	902	908	2 | 1.2
723		914	920	926	932	938	944	950	956	962	968	3 | 1.8
724		974	980	986	992	998	*004	*010	*016	*022	*028	4 | 2.4
725	86	034	040	046	052	058	064	070	076	082	088	5 | 3.0
726		094	100	106	112	118	124	130	136	141	147	6 | 3.6
727		153	159	165	171	177	183	189	195	201	207	7 | 4.2
728		213	219	225	231	237	243	249	255	261	267	8 | 4.8
729		273	279	285	291	297	303	308	314	320	326	9 | 5.4
730		332	338	344	350	356	362	368	374	380	386	
731		392	398	404	410	415	421	427	433	439	445	
732		451	457	463	469	475	481	487	493	499	504	
733		510	516	522	528	534	540	546	552	558	564	
734		570	576	581	587	593	599	605	611	617	623	
735		629	635	641	646	652	658	664	670	676	682	F
736		688	694	700	705	711	717	723	729	735	741	1 | 0.5
737		747	753	759	764	770	776	782	788	794	800	2 | 1.0
738		806	812	817	823	829	835	841	847	853	859	3 | 1.5
739		864	870	876	882	888	894	900	906	911	917	4 | 2.0
740		923	929	935	941	947	953	958	964	970	976	5 | 2.5
741		982	988	994	999	*005	*011	*017	*023	*029	*035	6 | 3.0
742	87	040	046	052	058	064	070	075	081	087	093	7 | 3.5
743		099	105	111	116	122	128	134	140	146	151	8 | 4.0
744		157	163	169	175	181	186	192	198	204	210	9 | 4.5
745		216	221	227	233	239	245	251	256	262	268	
746		274	280	286	291	297	303	309	315	320	326	
747		332	338	344	349	355	361	367	373	379	384	
748		390	396	402	408	413	419	425	431	437	442	
749		448	454	460	466	471	477	483	489	495	500	
750		506	512	518	523	529	535	541	547	552	558	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
750	87	506	512	518	523	529	535	541	547	552	558	
751		564	570	576	581	587	593	599	604	610	616	
752		622	628	633	639	645	651	656	662	668	674	
753		679	685	691	697	703	708	714	720	726	731	
754		737	743	749	754	760	766	772	777	783	789	
755		795	800	806	812	818	823	829	835	841	846	
756		852	858	864	869	875	881	887	892	898	904	
757		910	915	921	927	933	938	944	950	955	961	
758		967	973	978	984	990	996	*001	*007	*013	*018	
759	88	024	030	036	041	047	053	058	064	070	076	
760		081	087	093	098	104	110	116	121	127	133	6
761		138	144	150	156	161	167	173	178	184	190	1 0.6
762		195	201	207	213	218	224	230	235	241	247	2 1.2
763		252	258	264	270	275	281	287	292	298	304	3 1.8
764		309	315	321	326	332	338	343	349	355	360	4 2.4
765		366	372	377	383	389	395	400	406	412	417	5 3.0
766		423	429	434	440	446	451	457	463	468	474	6 3.6
767		480	485	491	497	502	508	513	519	525	530	7 4.2
768		536	542	547	553	559	564	570	576	581	587	8 4.8
769		593	598	604	610	615	621	627	632	638	643	9 5.4
770		649	655	660	666	672	677	683	689	694	700	
771		705	711	717	722	728	734	739	745	750	756	
772		762	767	773	779	784	790	795	801	807	812	
773		818	824	829	835	840	846	852	857	863	868	
774		874	880	885	891	897	902	908	913	919	925	
775		930	936	941	947	953	958	964	969	975	981	
776		986	992	997	*003	*009	*014	*020	*025	*031	*037	
777	89	042	048	053	059	064	070	076	081	087	092	
778		098	104	109	115	120	126	131	137	143	148	
779		154	159	165	170	176	182	187	193	198	204	
780		209	215	221	226	232	237	243	248	254	260	5
781		265	271	276	282	287	293	298	304	310	315	1 0.5
782		321	326	332	337	343	348	354	360	365	371	2 1.0
783		376	382	387	393	398	404	409	415	421	426	3 1.5
784		432	437	443	448	454	459	465	470	476	481	4 2.0
785		487	492	498	504	509	515	520	526	531	537	5 2.5
786		542	548	553	559	564	570	575	581	586	592	6 3.0
787		597	603	609	614	620	625	631	636	642	647	7 3.5
788		653	658	664	669	675	680	686	691	697	702	8 4.0
789		708	713	719	724	730	735	741	746	752	757	9 4.5
790		763	768	774	779	785	790	796	801	807	812	
791		818	823	829	834	840	845	851	856	862	867	
792		873	878	883	889	894	900	905	911	916	922	
793		927	933	938	944	949	955	960	966	971	977	
794		982	988	993	998	*004	*009	*015	*020	*026	*031	
795	90	037	042	048	053	059	064	069	075	080	086	
796		091	097	102	108	113	119	124	129	135	140	
797		146	151	157	162	168	173	179	184	189	195	
798		200	206	211	217	222	227	233	238	244	249	
799		255	260	266	271	276	282	287	293	298	304	
800		309	314	320	325	331	336	342	347	352	358	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
800	90	309	314	320	325	331	336	342	347	352	358	
801		363	369	374	380	385	390	396	401	407	412	
802		417	423	428	434	439	445	450	455	461	466	
803		472	477	482	488	493	499	504	509	515	520	
804		526	531	536	542	547	553	558	563	569	574	
805		580	585	590	596	601	607	612	617	623	628	
806		634	639	644	650	655	660	666	671	677	682	
807		687	693	698	703	709	714	720	725	730	736	
808		741	747	752	757	763	768	773	779	784	789	
809		795	800	806	811	816	822	827	832	838	843	
810		849	854	859	865	870	875	881	886	891	897	6
811		902	907	913	918	924	929	934	940	945	950	1 0.6
812		956	961	966	972	977	982	988	993	998	*004	2 1.2
813	91	009	014	020	025	030	036	041	046	052	057	3 1.8
814		062	068	073	078	084	089	094	100	105	110	4 2.4
815		116	121	126	132	137	142	148	153	158	164	5 3.0
816		169	174	180	185	190	196	201	206	212	217	6 3.6
817		222	228	233	238	243	249	254	259	265	270	7 4.2
818		275	281	286	291	297	302	307	312	318	323	8 4.8
819		328	334	339	344	350	355	360	365	371	376	9 5.4
820		381	387	392	397	403	408	413	418	424	429	
821		434	440	445	450	455	461	466	471	477	482	
822		487	492	498	503	508	514	519	524	529	535	
823		540	545	551	556	561	566	572	577	582	587	
824		593	598	603	609	614	619	624	630	635	640	
825		645	651	656	661	666	672	677	682	687	693	
826		698	703	709	714	719	724	730	735	740	745	
827		751	756	761	766	772	777	782	787	793	798	
828		803	808	814	819	824	829	834	840	845	850	
829		855	861	866	871	876	882	887	892	897	903	
830		908	913	918	924	929	934	939	944	950	955	5
831		960	965	971	976	981	986	991	997	*002	*007	1 0.5
832	92	012	018	023	028	033	038	044	049	054	059	2 1.0
833		065	070	075	080	085	091	096	101	106	111	3 1.5
834		117	122	127	132	137	143	148	153	158	163	4 2.0
835		169	174	179	184	189	195	200	205	210	215	5 2.5
836		221	226	231	236	241	247	252	257	262	267	6 3.0
837		273	278	283	288	293	298	304	309	314	319	7 3.5
838		324	330	335	340	345	350	355	361	366	371	8 4.0
839		376	381	387	392	397	402	407	412	418	423	9 4.5
840		428	433	438	443	449	454	459	464	469	474	
841		480	485	490	495	500	505	511	516	521	526	
842		531	536	542	547	552	557	562	567	572	578	
843		583	588	593	598	603	609	614	619	624	629	
844		634	639	645	650	655	660	665	670	675	681	
845		686	691	696	701	706	711	716	722	727	732	
846		737	742	747	752	758	763	768	773	778	783	
847		788	793	799	804	809	814	819	824	829	834	
848		840	845	850	855	860	865	870	875	881	886	
849		891	896	901	906	911	916	921	927	932	937	
850		942	947	952	957	962	967	973	978	983	988	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
850	92	942	947	952	957	962	967	973	978	983	988	
851		993	998	*003	*008	*013	*018	*024	*029	*034	*039	
852	93	044	049	054	059	064	069	075	080	085	090	
853		095	100	105	110	115	120	125	131	136	141	
854		146	151	156	161	166	171	176	181	186	192	
855		197	202	207	212	217	222	227	232	237	242	
856		247	252	258	263	268	273	278	283	288	293	6
857		298	303	308	313	318	323	328	334	339	344	1 0.6
858		349	354	359	364	369	374	379	384	389	394	2 1.2
859		399	404	409	414	420	425	430	435	440	445	3 1.8
860		450	455	460	465	470	475	480	485	490	495	4 2.4
861		500	505	510	515	520	526	531	536	541	546	5 3.0
862		551	556	561	566	571	576	581	586	591	596	6 3.6
863		601	606	611	616	621	626	631	636	641	646	7 4.2
864		651	656	661	666	671	676	682	687	692	697	8 4.8
865		702	707	712	717	722	727	732	737	742	747	9 5.4
866		752	757	762	767	772	777	782	787	792	797	
867		802	807	812	817	822	827	832	837	842	847	
868		852	857	862	867	872	877	882	887	892	897	
869		902	907	912	917	922	927	932	937	942	947	
870		952	957	962	967	972	977	982	987	992	997	■
871	94	002	007	012	017	022	027	032	037	042	047	1 0.5
872		052	057	062	067	072	077	082	086	091	096	2 1.0
873		101	106	111	116	121	126	131	136	141	146	3 1.5
874		151	156	161	166	171	176	181	186	191	196	4 2.0
875		201	206	211	216	221	226	231	236	240	245	5 2.5
876		250	255	260	265	270	275	280	285	290	295	6 3.0
877		300	305	310	315	320	325	330	335	340	345	7 3.5
878		349	354	359	364	369	374	379	384	389	394	8 4.0
879		399	404	409	414	419	424	429	433	438	443	9 4.5
880		448	453	458	463	468	473	478	483	488	493	
881		498	503	507	512	517	522	527	532	537	542	
882		547	552	557	562	567	571	576	581	586	591	
883		596	601	606	611	616	621	626	630	635	640	
884		645	650	655	660	665	670	675	680	685	689	■
885		694	699	704	709	714	719	724	729	734	738	1 0.4
886		743	748	753	758	763	768	773	778	783	787	2 0.8
887		792	797	802	807	812	817	822	827	832	836	3 1.2
888		841	846	851	856	861	866	871	876	880	885	4 1.6
889		890	895	900	905	910	915	919	924	929	934	5 2.0
890		939	944	949	954	959	963	968	973	978	983	6 2.4
891		988	993	998	*002	*007	*012	*017	*022	*027	*032	7 2.8
892	95	036	041	046	051	056	061	066	071	075	080	8 3.2
893		085	090	095	100	105	109	114	119	124	129	9 3.6
894		134	139	143	148	153	158	163	168	173	177	
895		182	187	192	197	202	207	211	216	221	226	
896		231	236	240	245	250	255	260	265	270	274	
897		279	284	289	294	299	303	308	313	318	323	
898		328	332	337	342	347	352	357	361	366	371	
899		376	381	386	390	395	400	405	410	415	419	
900		424	429	434	439	444	448	453	458	463	468	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
900	95 424	429	434	439	444	448	453	458	463	468	
901	472	477	482	487	492	497	501	506	511	516	
902	521	525	530	535	540	545	550	554	559	564	
903	569	574	578	583	588	593	598	602	607	612	
904	617	622	626	631	636	641	646	650	655	660	
905	665	670	674	679	684	689	694	698	703	708	
906	713	718	722	727	732	737	742	746	751	756	
907	761	766	770	775	780	785	789	794	799	804	
908	809	813	818	823	828	832	837	842	847	852	
909	856	861	866	871	875	880	885	890	895	899	
910	904	909	914	918	923	928	933	938	942	947	5
911	952	957	961	966	971	976	980	985	990	995	1 | 0.5
912	999	*004	*009	*014	*019	*023	*028	*033	*038	*042	2 | 1.0
913	96 047	052	057	061	066	071	076	080	085	090	3 | 1.5
914	095	099	104	109	114	118	123	128	133	137	4 | 2.0
915	142	147	152	156	161	166	171	175	180	185	5 | 2.5
916	190	194	199	204	209	213	218	223	227	232	6 | 3.0
917	237	242	246	251	256	261	265	270	275	280	7 | 3.5
918	284	289	294	298	303	308	313	317	322	327	8 | 4.0
919	332	336	341	346	350	355	360	365	369	374	9 | 4.5
920	379	384	388	393	398	402	407	412	417	421	
921	426	431	435	440	445	450	454	459	464	468	
922	473	478	483	487	492	497	501	506	511	515	
923	520	525	530	534	539	544	548	553	558	562	
924	567	572	577	581	586	591	595	600	605	609	
925	614	619	624	628	633	638	642	647	652	656	
926	661	666	670	675	680	685	689	694	699	703	
927	708	713	717	722	727	731	736	741	745	750	
928	755	759	764	769	774	778	783	788	792	797	
929	802	806	811	816	820	825	830	834	839	844	
930	848	853	858	862	867	872	876	881	886	890	4
931	895	900	904	909	914	918	923	928	932	937	1 | 0.4
932	942	946	951	956	960	965	970	974	979	984	2 | 0.8
933	988	993	997	*002	*007	*011	*016	*021	*025	*030	3 | 1.2
934	97 035	039	044	049	053	058	063	067	072	077	4 | 1.6
935	081	086	090	095	100	104	109	114	118	123	5 | 2.0
936	128	132	137	142	146	151	155	160	165	169	6 | 2.4
937	174	179	183	188	192	197	202	206	211	216	7 | 2.8
938	220	225	230	234	239	243	248	253	257	262	8 | 3.2
939	267	271	276	280	285	290	294	299	304	308	9 | 3.6
940	313	317	322	327	331	336	340	345	350	354	
941	359	364	368	373	377	382	387	391	396	400	
942	405	410	414	419	424	428	433	437	442	447	
943	451	456	460	465	470	474	479	483	488	493	
944	497	502	506	511	516	520	525	529	534	539	
945	543	548	552	557	562	566	571	575	580	585	
946	589	594	598	603	607	612	617	621	626	630	
947	635	640	644	649	653	658	663	667	672	676	
948	681	685	690	695	699	704	708	713	717	722	
949	727	731	736	740	745	749	754	759	763	768	
950	772	777	782	786	791	795	800	804	809	813	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.		0	1	2	3	4	5	6	7	8	9	Proportional parts
950	97	772	777	782	786	791	795	800	804	809	813	
951		818	823	827	832	836	841	845	850	855	859	
952		864	868	873	877	882	886	891	896	900	905	
953		909	914	918	923	928	932	937	941	946	950	
954		955	959	964	968	973	978	982	987	991	996	
955	98	000	005	009	014	019	023	028	032	037	041	
956		046	050	055	059	064	068	073	078	082	087	
957		091	096	100	105	109	114	118	123	127	132	
958		137	141	146	150	155	159	164	168	173	177	
959		182	186	191	195	200	204	209	214	218	223	
960		227	232	236	241	245	250	254	259	263	268	5
961		272	277	281	286	290	295	299	304	308	313	1 0.5
962		318	322	327	331	336	340	345	349	354	358	2 1.0
963		363	367	372	376	381	385	390	394	399	403	3 1.5
964		408	412	417	421	426	430	435	439	444	448	4 2.0
965		453	457	462	466	471	475	480	484	489	493	5 2.5
966		498	502	507	511	516	520	525	529	534	538	6 3.0
967		543	547	552	556	561	565	570	574	579	583	7 3.5
968		588	592	597	601	605	610	614	619	623	628	8 4.0
969		632	637	641	646	650	655	659	664	668	673	9 4.5
970		677	682	686	691	695	700	704	709	713	717	
971		722	726	731	735	740	744	749	753	758	762	
972		767	771	776	780	784	789	793	798	802	807	
973		811	816	820	825	829	834	838	843	847	851	
974		856	860	865	869	874	878	883	887	892	896	
975		900	905	909	914	918	923	927	932	936	941	
976		945	949	954	958	963	967	972	976	981	985	
977		989	994	998	*003	*007	*012	*016	*021	*025	*029	
978	99	034	038	043	047	052	056	061	065	069	074	
979		078	083	087	092	096	100	105	109	114	118	
980		123	127	131	136	140	145	149	154	158	162	4
981		167	171	176	180	185	189	193	198	202	207	1 0.4
982		211	216	220	224	229	233	238	242	247	251	2 0.8
983		255	260	264	269	273	277	282	286	291	295	3 1.2
984		300	304	308	313	317	322	326	330	335	339	4 1.6
985		344	348	352	357	361	366	370	373	379	383	5 2.0
986		388	392	396	401	405	410	414	419	423	427	6 2.4
987		432	436	441	445	449	454	458	463	467	471	7 2.8
988		476	480	484	489	493	498	502	506	511	515	8 3.2
989		520	524	528	533	537	542	546	550	555	559	9 3.6
990		564	568	572	577	581	585	590	594	599	603	
991		607	612	616	621	625	629	634	638	642	647	
992		651	656	660	664	669	673	677	682	686	691	
993		695	699	704	708	712	717	721	726	730	734	
994		739	743	747	752	756	760	765	769	774	778	
995		782	787	791	795	800	804	808	813	817	822	
996		826	830	835	839	843	848	852	856	861	865	
997		870	874	878	883	887	891	896	900	904	909	
998		913	917	922	926	930	935	939	944	948	952	
999		957	961	965	970	974	978	983	987	991	996	
1000	00	000	004	009	013	017	022	026	030	035	039	
N.		0	1	2	3	4	5	6	7	8	9	Proportional parts

LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	d.	
1000	000	0000	0434	0869	1303	1737	2171	2605	3039	3473	3907	434
1001		4341	4775	5208	5642	6076	6510	6943	7377	7810	8244	434
1002		8677	9111	9544	9977	*0411	*0844	*1277	*1710	*2143	*2576	433
1003	001	3009	3442	3875	4308	4741	5174	5607	6039	6472	6905	433
1004		7337	7770	8202	8635	9067	9499	9932	*0364	*0796	*1228	432
1005	002	1661	2093	2525	2957	3389	3821	4253	4685	5116	5548	432
1006		5980	6411	6843	7275	7706	8138	8569	9001	9432	9863	431
1007	003	0295	0726	1157	1588	2019	2451	2882	3313	3744	4174	431
1008		4605	5036	5467	5898	6328	6759	7190	7620	8051	8481	431
1009		8912	9342	9772	*0203	*0633	*1063	*1493	*1924	*2354	*2784	430
1010	004	3214	3644	4074	4504	4933	5363	5793	6223	6652	7082	430
1011		7512	7941	8371	8800	9229	9659	*0088	*0517	*0947	*1376	429
1012	005	1805	2234	2663	3092	3521	3950	4379	4808	5237	5666	429
1013		6094	6523	6952	7380	7809	8238	8666	9094	9523	9951	429
1014	006	0380	0808	1236	1664	2092	2521	2949	3377	3805	4233	428
1015		4660	5088	5516	5944	6372	6799	7227	7655	8082	8510	428
1016		8937	9365	9792	*0219	*0647	*1074	*1501	*1923	*2355	*2782	427
1017	007	3210	3637	4064	4490	4917	5344	5771	6198	6624	7051	427
1018		7478	7904	8331	8757	9184	9610	*0037	*0463	*0889	*1316	426
1019	008	1742	2168	2594	3020	3446	3872	4298	4724	5150	5576	426
1020		6002	6427	6853	7279	7704	8130	8556	8981	9407	9832	426
1021	009	0257	0683	1108	1533	1959	2384	2809	3234	3659	4084	425
1022		4509	4934	5359	5784	6208	6633	7058	7483	7907	8332	425
1023		8756	9181	9605	*0030	*0454	*0878	*1303	*1727	*2151	*2575	424
1024	010	3000	3424	3848	4272	4696	5120	5544	5967	6391	6815	424
1025		7239	7662	8086	8510	8933	9357	9780	*0204	*0627	*1050	424
1026	011	1474	1897	2320	2743	3166	3590	4013	4436	4859	5282	423
1027		5704	6127	6550	6973	7396	7818	8241	8664	9086	9509	423
1028		9931	*0354	*0776	*1198	*1621	*2043	*2465	*2887	*3310	*3732	422
1029	012	4154	4576	4998	5420	5842	6264	6685	7107	7529	7951	422
1030		8372	8794	9215	9637	*0059	*0480	*0901	*1323	*1744	*2165	422
1031	013	2587	3008	3429	3850	4271	4692	5113	5534	5955	6376	421
1032		6797	7218	7639	8059	8480	8901	9321	9742	*0162	*0583	421
1033	014	1003	1424	1844	2264	2685	3105	3525	3945	4365	4785	420
1034		5265	5685	6105	6525	6945	7365	7785	8205	8624	9044	420
1035		9403	9823	*0243	*0662	*1082	*1501	*1920	*2340	*2759	*3178	420
1036	015	3598	4017	4436	4855	5274	5693	6112	6531	6950	7369	419
1037		7788	8206	8625	9044	9462	9881	*0300	*0718	*1137	*1555	419
1038	016	1974	2392	2810	3229	3647	4065	4483	4901	5319	5737	418
1039		6155	6573	6991	7409	7827	8245	8663	9080	9498	9916	418
1040	017	0333	0751	1168	1586	2003	2421	2838	3256	3673	4090	417
1041		4507	4924	5342	5759	6176	6593	7010	7427	7844	8260	417
1042		8677	9094	9511	9927	*0344	*0761	*1177	*1594	*2010	*2427	417
1043	018	2843	3259	3676	4092	4508	4925	5341	5757	6173	6589	416
1044		7005	7421	7837	8253	8669	9084	9500	9916	*0332	*0747	416
1045	019	1163	1578	1994	2410	2825	3240	3656	4071	4486	4902	415
1046		5317	5732	6147	6562	6977	7392	7807	8222	8637	9052	415
1047		9467	9882	*0296	*0711	*1126	*1540	*1955	*2369	*2784	*3198	415
1048	020	3613	4027	4442	4856	5270	5684	6099	6513	6927	7341	414
1049		7755	8169	8583	8997	9411	9824	*0238	*0652	*1066	*1479	414
1050	021	1893	2307	2720	3134	3547	3961	4374	4787	5201	5614	413
N.	0	1	2	3	4	5	6	7	8	9	d.	

LOGARITHMS (Continued)

N.		0	1	2	3	4	5	6	7	8	9	d.
1050	021	1893	2307	2720	3134	3547	3961	4374	4787	5201	5614	413
1051		6027	6440	6854	7267	7680	8093	8506	8919	9332	9745	413
1052	022	0157	0570	0983	1396	1808	2221	2634	3046	3459	3871	413
1053		4284	4696	5109	5521	5933	6345	6758	7170	7582	7994	412
1054		8406	8818	9230	9642	*0054	*0466	*0878	*1289	*1701	*2113	412
1055	023	2525	2936	3348	3759	4171	4582	4994	5405	5817	6228	411
1056		6639	7050	7462	7873	8284	8695	9106	9517	9928	*0339	411
1057	024	0750	1161	1572	1982	2393	2804	3214	3625	4036	4446	411
1058		4857	5267	5678	6088	6498	6909	7319	7729	8139	8549	410
1059		8960	9370	9780	*0190	*0600	*1010	*1419	*1829	*2239	*2649	410
1060	025	3059	3468	3878	4288	4697	5107	5516	5926	6335	6744	410
1061		7154	7563	7972	8382	8791	9200	9609	*0018	*0427	*0836	409
1062	026	1245	1654	2063	2472	2881	3289	3698	4107	4515	4924	409
1063		5333	5741	6150	6558	6967	7375	7783	8192	8600	9008	408
1064		9416	9824	*0233	*0641	*1049	*1457	*1865	*2273	*2680	*3088	408
1065	027	3496	3904	4312	4719	5127	5535	5942	6350	6757	7165	408
1066		7572	7979	8387	8794	9201	9609	*0016	*0423	*0830	*1237	407
1067	028	1644	2051	2458	2865	3272	3679	4086	4492	4899	5306	407
1068		5713	6119	6526	6932	7339	7745	8152	8558	8964	9371	406
1069		9777	*0183	*0590	*0996	*1402	*1808	*2214	*2620	*3026	*3432	406
1070	029	3838	4244	4649	5055	5461	5867	6272	6678	7084	7489	406
1071		7895	8300	8706	9111	9516	9922	*0327	*0732	*1138	*1543	405
1072	030	1948	2353	2758	3163	3568	3973	4378	4783	5188	5592	405
1073		5997	6402	6807	7211	7616	8020	8425	8830	9234	9638	405
1074	031	0043	0447	0851	1256	1660	2064	2468	2872	3277	3681	404
1075		4085	4489	4893	5296	5700	6104	6508	6912	7315	7719	404
1076		8123	8526	8930	9333	9737	*0140	*0544	*0947	*1350	*1754	403
1077	032	2157	2560	2963	3367	3770	4173	4576	4979	5382	5785	403
1078		6188	6590	6993	7396	7799	8201	8604	9007	9409	9812	403
1079	033	0214	0617	1019	1422	1824	2226	2629	3031	3433	3835	402
1080		4238	4640	5042	5444	5846	6248	6650	7052	7453	7855	402
1081		8257	8659	9060	9462	9864	*0265	*0667	*1068	*1470	*1871	402
1082	034	2273	2674	3075	3477	3878	4279	4680	5081	5482	5884	401
1083		6285	6686	7087	7487	7888	8289	8690	9091	9491	9892	401
1084	035	0293	0693	1094	1495	1895	2296	2696	3096	3497	3897	400
1085		4297	4698	5098	5498	5898	6298	6698	7098	7498	7898	400
1086		8298	8698	9098	9498	9898	*0297	*0697	*1097	*1496	*1896	400
1087	036	2295	2695	3094	3494	3893	4293	4692	5091	5491	5890	399
1088		6289	6688	7087	7486	7885	8284	8683	9082	9481	9880	399
1089	037	0279	0678	1076	1475	1874	2272	2671	3070	3468	3867	399
1090		4265	4663	5062	5460	5858	6257	6655	7053	7451	7849	398
1091		8248	8646	9044	9442	9839	*0237	*0635	*1033	*1431	*1829	398
1092	038	2226	2624	3022	3419	3817	4214	4612	5009	5407	5804	398
1093		6202	6599	6996	7393	7791	8188	8585	8982	9379	9776	397
1094	039	0173	0570	0967	1364	1761	2158	2554	2951	3348	3745	397
1095		4141	4538	4934	5331	5727	6124	6520	6917	7313	7709	397
1096		8106	8502	8898	9294	9690	*0086	*0482	*0878	*1274	*1670	396
1097	040	2066	2462	2858	3254	3650	4045	4441	4837	5232	5628	396
1098		6023	6419	6814	7210	7605	8001	8396	8791	9187	9582	395
1099		9977	*0372	*0767	*1162	*1557	*1952	*2347	*2742	*3137	*3532	395
1100	041	3927	4322	4716	5111	5506	5900	6295	6690	7084	7479	395
N.		0	1	2	3	4	5	6	7	8	9	d.

LOGARITHMS—(Continued)

N	0	1	2	3	4	5	6	7	8	9	d.	
1100	041	3927	4322	4716	5111	5506	5900	6295	6690	7084	7479	395
1101		7873	8268	8662	9056	9451	9845	*0239	*0633	*1028	*1422	394
1102	042	1816	2210	2604	2998	3392	3786	4180	4574	4968	5361	394
1103		5755	6149	6543	6936	7330	7723	8117	8510	8904	9297	394
1104		9691	*0084	*0477	*0871	*1264	*1657	*2050	*2444	*2837	*3230	393
1105	043	3623	4016	4409	4802	5195	5587	5980	6373	6766	7159	393
1106		7551	7944	8337	8729	9122	9514	9907	*0299	*0692	*1084	393
1107	044	1476	1869	2261	2653	3045	3437	3829	4222	4614	5006	392
1108		5398	5790	6181	6573	6965	7357	7749	8140	8532	8924	392
1109		9315	9707	*0099	*0490	*0882	*1273	*1664	*2056	*2447	*2839	392
1110	045	3230	3621	4012	4403	4795	5186	5577	5968	6359	6750	391
1111		7141	7531	7922	8313	8704	9095	9485	9876	*0267	*0657	391
1112	046	1048	1438	1829	2219	2610	3000	3391	3781	4171	4561	390
1113		4952	5342	5732	6122	6512	6902	7292	7682	8072	8462	390
1114		8852	9242	9632	*0021	*0411	*0801	*1190	*1580	*1970	*2359	390
1115	047	2749	3138	3528	3917	4306	4696	5085	5474	5864	6253	389
1116		6642	7031	7420	7809	8198	8587	8976	9365	9754	*0143	389
1117	048	0532	0921	1309	1698	2087	2475	2864	3253	3641	4030	389
1118		4418	4806	5195	5583	5972	6360	6748	7136	7525	7913	388
1119		8301	8689	9077	9465	9853	*0241	*0629	*1017	*1405	*1792	388
1120	049	2180	2568	2956	3343	3731	4119	4506	4894	5281	5669	388
1121		6056	6444	6831	7218	7606	7993	8380	8767	9154	9541	387
1122		9929	*0316	*0703	*1090	*1477	*1863	*2250	*2637	*3024	*3411	387
1123	050	3798	4184	4571	4958	5344	5731	6117	6504	6890	7277	387
1124		7663	8049	8436	8822	9208	9595	9981	*0367	*0753	*1139	386
1125	051	1525	1911	2297	2683	3069	3455	3841	4227	4612	4998	386
1126		5384	5770	6155	6541	6926	7312	7697	8083	8468	8854	386
1127		9239	9624	*0010	*0395	*0780	*1166	*1551	*1936	*2321	*2706	385
1128	052	3091	3476	3861	4246	4631	5016	5400	5785	6170	6555	385
1129		6939	7324	7709	8093	8478	8862	9247	9631	*0016	*0400	385
1130	053	0784	1169	1553	1937	2321	2706	3090	3474	3858	4242	384
1131		4626	5010	5394	5778	6162	6546	6929	7313	7697	8081	384
1132		8464	8848	9232	9615	9999	*0382	*0766	*1149	*1532	*1916	384
1133	054	2299	2682	3066	3449	3832	4215	4598	4981	5365	5748	383
1134		6131	6514	6896	7279	7662	8045	8428	8811	9193	9576	383
1135		9959	*0341	*0724	*1106	*1489	*1871	*2254	*2636	*3019	*3401	382
1136	055	3783	4166	4548	4930	5312	5694	6077	6459	6841	7223	382
1137		7605	7987	8369	8750	9132	9514	9896	*0278	*0659	*1041	382
1138	056	1423	1804	2186	2567	2949	3330	3712	4093	4475	4856	381
1139		5237	5619	6000	6381	6762	7143	7524	7905	8287	8668	381
1140		9049	9429	9810	*0191	*0572	*0953	*1334	*1714	*2095	*2476	381
1141	057	2856	3237	3618	3998	4379	4759	5140	5520	5900	6281	381
1142		6661	7041	7422	7802	8182	8562	8942	9322	9702	*0082	380
1143	058	0462	0842	1222	1602	1982	2362	2741	3121	3501	3881	380
1144		4260	4640	5019	5399	5778	6158	6537	6917	7296	7676	380
1145		8055	8434	8813	9193	9572	9951	*0330	*0709	*1088	*1467	379
1146	059	1846	2225	2604	2983	3362	3741	4119	4498	4877	5256	379
1147		5634	6013	6391	6770	7148	7527	7905	8284	8662	9041	379
1148		9419	9797	*0175	*0554	*0932	*1310	*1688	*2066	*2444	*2822	378
1149	060	3200	3578	3956	4334	4712	5090	5468	5845	6223	6601	378
1150		6978	7356	7734	8111	8489	8866	9244	9621	9999	*0376	378
N	0	1	2	3	4	5	6	7	8	9	d.	

LOGARITHMS—(Continued)

N	0	1	2	3	4	5	6	7	8	9	d.	
1150	060	6978	7356	7734	8111	8489	8866	9244	9621	9999	*0376	378
1151	061	0753	1131	1508	1885	2262	2639	3017	3394	3771	4148	377
1152		4525	4902	5279	5656	6032	6409	6786	7163	7540	7916	377
1153		8293	8670	9046	9423	9799	*0176	*0552	*0929	*1305	*1682	377
1154	062	2058	2434	2811	3187	3563	3939	4316	4692	5068	5444	376
1155		5820	6196	6572	6948	7324	7699	8075	8451	8827	9203	376
1156		9578	9954	*0330	*0705	*1081	*1456	*1832	*2207	*2583	*2958	376
1157	063	3334	3709	4084	4460	4835	5210	5585	5960	6335	6711	375
1158		7086	7461	7836	8211	8585	8960	9335	9710	*0085	*0460	375
1159	064	0834	1209	1584	1958	2333	2708	3082	3457	3831	4205	375
1160		4580	4954	5329	5703	6077	6451	6826	7200	7574	7948	374
1161		8322	8696	9070	9444	9818	*0192	*0566	*0940	*1314	*1688	374
1162	065	2061	2435	2809	3182	3556	3930	4303	4677	5050	5424	374
1163		5797	6171	6544	6917	7291	7664	8037	8410	8784	9157	373
1164		9530	9903	*0276	*0649	*1022	*1395	*1768	*2141	*2514	*2886	373
1165	066	3259	3632	4005	4377	4750	5123	5495	5868	6241	6613	373
1166		6986	7358	7730	8103	8475	8847	9220	9592	9964	*0336	372
1167	067	0709	1081	1453	1825	2197	2569	2941	3313	3685	4057	372
1168		4428	4800	5172	5544	5915	6287	6659	7030	7402	7774	372
1169		8145	8517	8888	9259	9631	*0002	*0374	*0745	*1116	*1487	371
1170	068	1859	2230	2601	2972	3343	3714	4085	4456	4827	5198	371
1171		5569	5940	6311	6681	7052	7423	7794	8164	8535	8906	371
1172		9276	9647	*0017	*0388	*0758	*1129	*1499	*1869	*2240	*2610	370
1173	069	2980	3350	3721	4091	4461	4831	5201	5571	5941	6311	370
1174		6681	7051	7421	7791	8160	8530	8900	9270	9639	*0009	370
1175	070	0379	0748	1118	1487	1857	2226	2596	2965	3335	3704	369
1176		4073	4442	4812	5181	5550	5919	6288	6658	7027	7396	369
1177		7765	8134	8503	8871	9240	9609	9978	*0347	*0715	*1084	369
1178	071	1453	1822	2190	2559	2927	3296	3664	4033	4401	4770	369
1179		5138	5506	5875	6243	6611	6979	7348	7716	8084	8452	368
1180		8820	9188	9556	9924	*0292	*0660	*1028	*1396	*1763	*2131	368
1181	072	2499	2867	3234	3602	3970	4337	4705	5072	5440	5807	368
1182		6175	6542	6910	7277	7644	8011	8379	8746	9113	9480	367
1183		9847	*0215	*0582	*0949	*1316	*1683	*2050	*2416	*2783	*3150	367
1184	073	3517	3884	4251	4617	4984	5351	5717	6084	6450	6817	367
1185		7184	7550	7916	8283	8649	9016	9382	9748	*0114	*0481	366
1186	074	0847	1213	1579	1945	2311	2677	3043	3409	3775	4141	366
1187		4507	4873	5239	5605	5970	6336	6702	7068	7433	7799	366
1188		8164	8530	8895	9261	9626	9992	*0357	*0723	*1088	*1453	365
1189	075	1819	2184	2549	2914	3279	3644	4010	4375	4740	5105	365
1190		5470	5835	6199	6564	6929	7294	7659	8024	8388	8753	365
1191		9118	9482	9847	*0211	*0576	*0940	*1305	*1669	*2034	*2398	364
1192	076	2763	3127	3491	3855	4220	4584	4948	5312	5676	6040	364
1193		6404	6768	7132	7496	7860	8224	8588	8952	9316	9680	364
1194	077	0043	0407	0771	1134	1498	1862	2225	2589	2952	3316	364
1195		3679	4042	4406	4769	5133	5496	5859	6222	6585	6949	363
1196		7312	7675	8038	8401	8764	9127	9490	9853	*0216	*0579	363
1197	078	0942	1304	1667	2030	2393	2755	3118	3480	3843	4206	363
1198		4568	4931	5293	5656	6018	6380	6743	7105	7467	7830	362
1199		8192	8554	8916	9278	9640	*0003	*0365	*0727	*1089	*1451	362
1200	079	1812	2174	2536	2898	3260	3622	3983	4345	4707	5068	362
N	0	1	2	3	4	5	6	7	8	9	d.	

LOGARITHMS OF THE TRIGONOMETRIC FUNCTIONS

Logarithms of the functions are given for each minute from $0-360^{\circ}$.

The quantity -10 is to be appended to all logarithms of the sine and cosine, to logarithms of the tangent from $0-45^{\circ}$ and of the cotangent from $45-90^{\circ}$.

With degrees indicated at either side of the top of the page use the column headings at the top. With degrees stated at the bottom of the page use the column designations at the bottom.

With degrees at the left (top or bottom) use the minute column at the left, and with degrees on the right side of the page use the minute column at the right.

The method of determining the functions of small angles by the auxiliary quantities S and T is given in the section explaining the use of the mathematical tables at the front of the volume.

LOGARITHMS OF TRIGONOMETRIC FUNCTIONS

Min .	Values of S, — 10 to be appended						Values of T, — 10 to be appended						Sec.
	0°	1°	2°	3°	4°	0°	1°	2°	3°	4°			
0'	4.68	557	555	549	538	522	4.68	557	562	575	597	628	0'
1		557	555	549	537	522		557	562	575	598	629	60
2		557	555	548	537	522		557	562	576	598	629	120
3		557	555	548	537	521		557	562	578	599	630	180
4		557	555	548	537	521		558	563	576	599	631	240
5		557	555	548	537	521		558	563	577	599	631	300
6		557	555	548	536	520		558	563	577	600	632	360
7		557	555	548	536	520		558	563	577	600	632	420
8		557	555	548	536	520		558	563	578	601	633	480
9		557	555	547	536	520		558	563	578	601	634	540
10	4.68	557	555	547	535	519	4.68	558	564	578	602	634	600
11		557	554	547	535	519		558	564	579	602	635	660
12		557	554	547	535	519		558	564	579	603	635	720
13		557	554	547	535	518		558	564	579	603	636	780
14		557	554	547	534	518		558	564	580	604	637	840
15		557	554	546	534	518		558	564	580	604	637	900
16		557	554	546	534	517		558	565	580	605	638	960
17		557	554	546	534	517		558	565	581	605	639	1020
18		557	554	546	534	517		558	565	581	606	639	1080
19		557	554	546	533	516		558	565	581	606	640	1140
20	4.68	557	554	546	533	516	4.68	558	565	582	607	640	1200
21		557	554	545	533	516		558	566	582	607	641	1260
22		557	553	545	533	515		558	566	582	608	642	1320
23		557	553	545	532	515		558	566	583	608	642	1380
24		557	553	545	532	515		558	566	583	609	643	1440
25		557	553	545	532	515		558	566	583	609	644	1500
26		557	553	544	532	514		558	567	584	610	644	1560
27		557	553	544	531	514		558	567	584	610	645	1620
28		557	553	544	531	514		558	567	584	611	646	1680
29		557	553	544	531	513		559	567	585	611	646	1740
30	4.68	557	553	544	531	513	4.68	559	567	585	612	647	1800
31		557	552	544	530	513		559	568	585	612	648	1860
32		557	552	543	530	512		559	568	586	613	648	1920
33		557	552	543	530	512		559	568	586	613	649	1980
34		557	552	543	529	512		559	568	587	614	650	2040
35		557	552	543	529	511		559	569	587	614	650	2100
36		557	552	543	529	511		559	569	587	615	651	2160
37		557	552	542	529	511		559	569	588	615	652	2220
38		557	552	542	528	510		559	569	588	616	652	2280
39		557	552	542	528	510		559	570	589	616	653	2340
40	4.68	557	551	542	528	510	4.68	559	570	589	617	654	2400
41		556	551	542	528	509		560	570	589	617	654	2460
42		556	551	541	527	509		560	570	590	618	655	2520
43		556	551	541	527	508		560	571	590	619	656	2580
44		556	551	541	527	508		560	571	591	619	656	2640
45		556	551	541	527	508		560	571	591	620	657	2700
46		556	551	541	526	507		560	571	591	620	658	2760
47		556	551	540	526	507		560	572	592	621	659	2820
48		556	550	540	526	507		560	572	592	621	659	2880
49		556	550	540	525	506		560	572	593	622	660	2940
50	4.68	556	550	540	525	506	4.68	561	572	593	622	661	3000
51		556	550	540	525	506		561	573	593	623	661	3060
52		556	550	539	525	505		561	573	594	624	662	3120
53		556	550	539	524	505		561	573	594	624	663	3180
54		556	550	539	524	505		561	573	595	625	664	3240
55		556	549	539	524	504		561	574	595	625	664	3300
56		556	549	539	523	504		561	574	596	626	665	3360
57		556	549	538	523	503		562	574	596	626	666	3420
58		555	549	538	523	503		562	575	596	627	667	3480
59		555	549	538	523	503		562	575	597	628	667	3540
60	4.68	555	549	538	522	502	4.68	562	575	597	628	668	3600

LOGARITHMS OF THE FUNCTIONS (Continued)

0° (180°)										(359°) 179°			
"	'	L. Sin.	d.	C. S.	C. T.	L. Tan.	c.d.	L. Cot.	L. Cos.	"	'	L. Cos.	"
0	0									0	0	0.00 000	60
60	1	6.46 373	30103	5.31 443	5.31 443	6.46 373	30103	3.53 627	0.00 000	59	1	0.00 000	59
120	2	6.76 476	17609	5.31 443	5.31 443	6.76 476	17609	3.23 524	0.00 000	58	2	0.00 000	58
180	3	6.94 085	12494	5.31 443	5.31 443	6.94 085	12494	3.05 915	0.00 000	57	3	0.00 000	57
240	4	7.06 579	9691	5.31 443	5.31 442	7.06 579	9691	2.93 421	0.00 000	56	4	0.00 000	56
300	5	7.16 270	7918	5.31 443	5.31 442	7.16 270	7918	2.83 730	0.00 000	55	5	0.00 000	55
360	6	7.24 188	6694	5.31 443	5.31 442	7.24 188	6694	2.75 812	0.00 000	54	6	0.00 000	54
420	7	7.30 882	5800	5.31 443	5.31 442	7.30 882	5800	2.69 118	0.00 000	53	7	0.00 000	53
480	8	7.36 682	5115	5.31 443	5.31 442	7.36 682	5115	2.63 318	0.00 000	52	8	0.00 000	52
540	9	7.41 797	4576	5.31 443	5.31 442	7.41 797	4576	2.58 203	0.00 000	51	9	0.00 000	51
600	10	7.46 373	4139	5.31 443	5.31 442	7.46 373	4139	2.53 627	0.00 000	50	10	0.00 000	50
660	11	7.50 512	3779	5.31 443	5.31 442	7.50 512	3779	2.49 488	0.00 000	49	11	0.00 000	49
720	12	7.54 291	3476	5.31 443	5.31 442	7.54 291	3476	2.45 709	0.00 000	48	12	0.00 000	48
780	13	7.57 767	3218	5.31 443	5.31 442	7.57 767	3219	2.42 233	0.00 000	47	13	0.00 000	47
840	14	7.60 985	2997	5.31 443	5.31 442	7.60 986	2996	2.39 014	0.00 000	46	14	0.00 000	46
900	15	7.63 982	2802	5.31 443	5.31 442	7.63 982	2803	2.36 018	0.00 000	45	15	0.00 000	45
960	16	7.66 784	2633	5.31 443	5.31 442	7.66 785	2633	2.33 215	0.00 000	44	16	0.00 000	44
1020	17	7.69 417	2483	5.31 443	5.31 442	7.69 418	2482	2.30 582	9.99 999	43	17	9.99 999	43
1080	18	7.71 900	2348	5.31 443	5.31 442	7.71 900	2348	2.28 100	9.99 999	42	18	9.99 999	42
1140	19	7.74 248	2227	5.31 443	5.31 442	7.74 248	2226	2.25 752	9.99 999	41	19	9.99 999	41
1200	20	7.76 475	2119	5.31 443	5.31 442	7.76 476	2119	2.23 524	9.99 999	40	20	9.99 999	40
1260	21	7.78 594	2021	5.31 443	5.31 442	7.78 595	2020	2.21 405	9.99 999	39	21	9.99 999	39
1320	22	7.80 615	1930	5.31 443	5.31 442	7.80 615	1931	2.19 385	9.99 999	38	22	9.99 999	38
1380	23	7.82 545	1848	5.31 443	5.31 442	7.82 546	1848	2.17 454	9.99 999	37	23	9.99 999	37
1440	24	7.84 393	1773	5.31 443	5.31 442	7.84 394	1773	2.15 606	9.99 999	36	24	9.99 999	36
1500	25	7.86 166	1704	5.31 443	5.31 442	7.86 167	1704	2.13 833	9.99 999	35	25	9.99 999	35
1560	26	7.87 870	1639	5.31 443	5.31 442	7.87 871	1639	2.12 129	9.99 999	34	26	9.99 999	34
1620	27	7.89 509	1579	5.31 443	5.31 442	7.89 510	1579	2.10 490	9.99 999	33	27	9.99 999	33
1680	28	7.91 088	1524	5.31 443	5.31 442	7.91 089	1524	2.08 911	9.99 999	32	28	9.99 999	32
1740	29	7.92 612	1472	5.31 443	5.31 441	7.92 613	1473	2.07 387	9.99 998	31	29	9.99 998	31
1800	30	7.94 084	1424	5.31 443	5.31 441	7.94 086	1424	2.05 914	9.99 998	30	30	9.99 998	30
1860	31	7.95 508	1379	5.31 443	5.31 441	7.95 510	1379	2.04 490	9.99 998	29	31	9.99 998	29
1920	32	7.96 887	1336	5.31 443	5.31 441	7.96 889	1336	2.03 111	9.99 998	28	32	9.99 998	28
1980	33	7.98 223	1297	5.31 443	5.31 441	7.98 225	1297	2.01 775	9.99 998	27	33	9.99 998	27
2040	34	7.99 520	1259	5.31 443	5.31 441	7.99 522	1259	2.00 478	9.99 998	26	34	9.99 998	26
2100	35	8.00 779	1223	5.31 443	5.31 441	8.00 781	1223	1.99 219	9.99 998	25	35	9.99 998	25
2160	36	8.02 002	1190	5.31 443	5.31 441	8.02 004	1190	1.97 996	9.99 998	24	36	9.99 998	24
2220	37	8.03 192	1158	5.31 443	5.31 441	8.03 194	1159	1.96 806	9.99 997	23	37	9.99 997	23
2280	38	8.04 350	1128	5.31 443	5.31 441	8.04 353	1128	1.95 647	9.99 997	22	38	9.99 997	22
2340	39	8.05 478	1100	5.31 443	5.31 441	8.05 481	1100	1.94 519	9.99 997	21	39	9.99 997	21
2400	40	8.06 578	1072	5.31 443	5.31 441	8.06 581	1072	1.93 419	9.99 997	20	40	9.99 997	20
2460	41	8.07 650	1046	5.31 444	5.31 440	8.07 653	1047	1.92 347	9.99 997	19	41	9.99 997	19
2520	42	8.08 696	1022	5.31 444	5.31 440	8.08 700	1022	1.91 300	9.99 997	18	42	9.99 997	18
2580	43	8.09 718	999	5.31 444	5.31 440	8.09 722	998	1.90 278	9.99 997	17	43	9.99 997	17
2640	44	8.10 717	976	5.31 444	5.31 440	8.10 720	976	1.89 280	9.99 996	16	44	9.99 996	16
2700	45	8.11 693	954	5.31 444	5.31 440	8.11 696	955	1.88 304	9.99 996	15	45	9.99 996	15
2760	46	8.12 647	934	5.31 444	5.31 440	8.12 651	934	1.87 349	9.99 996	14	46	9.99 996	14
2820	47	8.13 581	914	5.31 444	5.31 440	8.13 585	915	1.86 415	9.99 996	13	47	9.99 996	13
2880	48	8.14 495	896	5.31 444	5.31 440	8.14 500	895	1.85 500	9.99 996	12	48	9.99 996	12
2940	49	8.15 391	877	5.31 444	5.31 440	8.15 395	878	1.84 605	9.99 996	11	49	9.99 996	11
3000	50	8.16 268	860	5.31 444	5.31 439	8.16 273	860	1.83 727	9.99 995	10	50	9.99 995	10
3060	51	8.17 128	843	5.31 444	5.31 439	8.17 133	843	1.82 867	9.99 995	9	51	9.99 995	9
3120	52	8.17 971	827	5.31 444	5.31 439	8.17 976	828	1.82 024	9.99 995	8	52	9.99 995	8
3180	53	8.18 798	812	5.31 444	5.31 439	8.18 804	812	1.81 196	9.99 995	7	53	9.99 995	7
3240	54	8.19 610	797	5.31 444	5.31 439	8.19 616	797	1.80 384	9.99 995	6	54	9.99 995	6
3300	55	8.20 407	782	5.31 444	5.31 439	8.20 413	782	1.79 587	9.99 994	5	55	9.99 994	5
3360	56	8.21 189	769	5.31 444	5.31 439	8.21 195	769	1.78 805	9.99 994	4	56	9.99 994	4
3420	57	8.21 958	755	5.31 445	5.31 439	8.21 964	756	1.78 036	9.99 994	3	57	9.99 994	3
3480	58	8.22 713	743	5.31 445	5.31 438	8.22 720	742	1.77 280	9.99 994	2	58	9.99 994	2
3540	59	8.23 456	730	5.31 445	5.31 438	8.23 462	730	1.76 538	9.99 994	1	59	9.99 994	1
3600	60	8.24 186		5.31 445	5.31 438	8.24 192		1.75 808	9.99 993	0	60	9.99 993	0
"	'	L. Cos.	d.			L. Cot.	c.d.	L. Tan.	L. Sin.	"	'		"

90° (270°)

(269°) 89°

LOGARITHMS OF THE FUNCTIONS (Continued)

1° (181°)

(358°) 178°

"		L. Sin.	d.	C. S.	C. T.	L. Tan.	c.d.	L. Cot.	L. Cos.	"
3600	0	8.24 186	717	5.31 445	5.31 438	8.24 192	718	1.75 808	9.99 993	60
3660	1	8.24 903	706	5.31 445	5.31 438	8.24 910	706	1.75 090	9.99 993	59
3720	2	8.25 609	695	5.31 445	5.31 438	8.25 616	696	1.74 384	9.99 993	58
3780	3	8.26 304	684	5.31 445	5.31 438	8.26 312	684	1.73 688	9.99 993	57
3840	4	8.26 988	673	5.31 445	5.31 437	8.26 996	673	1.73 004	9.99 992	56
3900	5	8.27 661	663	5.31 445	5.31 437	8.27 669	663	1.72 331	9.99 992	55
3960	6	8.28 324	653	5.31 445	5.31 437	8.28 332	654	1.71 668	9.99 992	54
4020	7	8.28 977	644	5.31 445	5.31 437	8.28 986	643	1.71 014	9.99 992	53
4080	8	8.29 621	634	5.31 445	5.31 437	8.29 629	634	1.70 371	9.99 992	52
4140	9	8.30 255	624	5.31 445	5.31 437	8.30 263	625	1.69 737	9.99 991	51
4200	10	8.30 879	616	5.31 446	5.31 437	8.30 888	617	1.69 112	9.99 991	50
4260	11	8.31 495	608	5.31 446	5.31 436	8.31 505	607	1.68 495	9.99 991	49
4320	12	8.32 103	599	5.31 446	5.31 436	8.32 112	599	1.67 888	9.99 990	48
4380	13	8.32 702	590	5.31 446	5.31 436	8.32 711	591	1.67 289	9.99 990	47
4440	14	8.33 292	583	5.31 446	5.31 436	8.33 302	584	1.66 698	9.99 990	46
4500	15	8.33 875	575	5.31 446	5.31 436	8.33 886	575	1.66 114	9.99 990	45
4560	16	8.34 450	568	5.31 446	5.31 435	8.34 461	568	1.65 539	9.99 989	44
4620	17	8.35 018	560	5.31 446	5.31 435	8.35 029	561	1.64 971	9.99 989	43
4680	18	8.35 578	553	5.31 446	5.31 435	8.35 590	553	1.64 410	9.99 989	42
4740	19	8.36 131	547	5.31 446	5.31 435	8.36 143	546	1.63 857	9.99 989	41
4800	20	8.36 678	539	5.31 446	5.31 435	8.36 689	540	1.63 311	9.99 988	40
4860	21	8.37 217	533	5.31 447	5.31 434	8.37 229	533	1.62 771	9.99 988	39
4920	22	8.37 750	526	5.31 447	5.31 434	8.37 762	527	1.62 238	9.99 988	38
4980	23	8.38 276	520	5.31 447	5.31 434	8.38 289	520	1.61 711	9.99 987	37
5040	24	8.38 796	514	5.31 447	5.31 434	8.38 809	514	1.61 191	9.99 987	36
5100	25	8.39 310	508	5.31 447	5.31 434	8.39 323	509	1.60 677	9.99 987	35
5160	26	8.39 818	502	5.31 447	5.31 433	8.39 832	502	1.60 168	9.99 986	34
5220	27	8.40 320	496	5.31 447	5.31 433	8.40 334	496	1.59 666	9.99 986	33
5280	28	8.40 816	491	5.31 447	5.31 433	8.40 830	491	1.59 170	9.99 986	32
5340	29	8.41 307	485	5.31 447	5.31 433	8.41 321	486	1.58 679	9.99 985	31
5400	30	8.41 792	480	5.31 447	5.31 433	8.41 807	480	1.58 193	9.99 985	30
5460	31	8.42 272	474	5.31 448	5.31 432	8.42 287	475	1.57 713	9.99 985	29
5520	32	8.42 746	470	5.31 448	5.31 432	8.42 762	470	1.57 238	9.99 984	28
5580	33	8.43 216	464	5.31 448	5.31 432	8.43 232	464	1.56 768	9.99 984	27
5640	34	8.43 680	459	5.31 448	5.31 432	8.43 696	460	1.56 304	9.99 984	26
5700	35	8.44 139	455	5.31 448	5.31 431	8.44 156	455	1.55 844	9.99 983	25
5760	36	8.44 594	450	5.31 448	5.31 431	8.44 611	450	1.55 389	9.99 983	24
5820	37	8.45 044	445	5.31 448	5.31 431	8.45 061	446	1.54 939	9.99 983	23
5880	38	8.45 489	441	5.31 448	5.31 431	8.45 507	441	1.54 493	9.99 982	22
5940	39	8.45 930	436	5.31 449	5.31 431	8.45 948	437	1.54 052	9.99 982	21
6000	40	8.46 366	433	5.31 449	5.31 430	8.46 385	432	1.53 615	9.99 982	20
6060	41	8.46 799	427	5.31 449	5.31 430	8.46 817	428	1.53 183	9.99 981	19
6120	42	8.47 226	424	5.31 449	5.31 430	8.47 245	424	1.52 755	9.99 981	18
6180	43	8.47 650	419	5.31 449	5.31 430	8.47 669	420	1.52 331	9.99 981	17
6240	44	8.48 069	416	5.31 449	5.31 429	8.48 089	416	1.51 911	9.99 980	16
6300	45	8.48 485	411	5.31 449	5.31 429	8.48 505	412	1.51 495	9.99 980	15
6360	46	8.48 896	408	5.31 449	5.31 429	8.48 917	408	1.51 083	9.99 979	14
6420	47	8.49 304	404	5.31 450	5.31 428	8.49 325	404	1.50 675	9.99 979	13
6480	48	8.49 708	400	5.31 450	5.31 428	8.49 729	401	1.50 271	9.99 979	12
6540	49	8.50 108	396	5.31 450	5.31 428	8.50 130	397	1.49 870	9.99 978	11
6600	50	8.50 504	393	5.31 450	5.31 427	8.50 527	393	1.49 473	9.99 978	10
6660	51	8.50 897	390	5.31 450	5.31 427	8.50 920	390	1.49 080	9.99 977	9
6720	52	8.51 287	386	5.31 450	5.31 427	8.51 310	386	1.48 690	9.99 977	8
6780	53	8.51 673	382	5.31 450	5.31 427	8.51 696	383	1.48 304	9.99 977	7
6840	54	8.52 055	379	5.31 450	5.31 427	8.52 079	380	1.47 921	9.99 976	6
6900	55	8.52 434	376	5.31 451	5.31 426	8.52 459	376	1.47 541	9.99 976	5
6960	56	8.52 810	373	5.31 451	5.31 426	8.52 835	373	1.47 165	9.99 975	4
7020	57	8.53 183	369	5.31 451	5.31 426	8.53 208	370	1.46 792	9.99 975	3
7080	58	8.53 552	367	5.31 451	5.31 425	8.53 578	367	1.46 422	9.99 974	2
7140	59	8.53 919	363	5.31 451	5.31 425	8.53 945	363	1.46 055	9.99 974	1
7200	60	8.54 282		5.31 451	5.31 425	8.54 308		1.45 692	9.99 974	0
		L. Cos.	d.			L. Cot.	c.d.	L. Tan.	L. Sin.	

91° (271°)

(268°) 88°

LOGARITHMS OF THE FUNCTIONS (Continued)

2° (182°)

(357°) 177°

		L. Sin.	d.	C. S.	C. T.	L. Tan.	c.d.	L. Cot.	L. Cos.	
7200	0	8.54 282	360	5.31 451	5.31 425	8.54 308	361	1.45 692	9.99 974	60
7260	1	8.54 642	357	5.31 451	5.31 425	8.54 669	358	1.45 331	9.99 973	59
7320	2	8.54 999	355	5.31 452	5.31 424	8.55 027	355	1.44 973	9.99 973	58
7380	3	8.55 354	351	5.31 452	5.31 424	8.55 382	352	1.44 618	9.99 972	57
7440	4	8.55 705	349	5.31 452	5.31 424	8.55 734	349	1.44 266	9.99 972	56
7500	5	8.56 054	346	5.31 452	5.31 423	8.56 083	346	1.43 917	9.99 971	55
7560	6	8.56 400	343	5.31 452	5.31 423	8.56 429	344	1.43 571	9.99 971	54
7620	7	8.56 743	341	5.31 452	5.31 423	8.56 773	341	1.43 227	9.99 970	53
7680	8	8.57 084	337	5.31 453	5.31 422	8.57 114	338	1.42 886	9.99 970	52
7740	9	8.57 421	336	5.31 453	5.31 422	8.57 452	336	1.42 548	9.99 969	51
7800	10	8.57 757	332	5.31 453	5.31 422	8.57 788	333	1.42 212	9.99 969	50
7860	11	8.58 089	330	5.31 453	5.31 421	8.58 121	330	1.41 879	9.99 968	49
7920	12	8.58 419	328	5.31 453	5.31 421	8.58 451	328	1.41 549	9.99 968	48
7980	13	8.58 747	325	5.31 453	5.31 421	8.58 779	326	1.41 221	9.99 967	47
8040	14	8.59 072	323	5.31 454	5.31 421	8.59 105	323	1.40 895	9.99 967	46
8100	15	8.59 395	320	5.31 454	5.31 420	8.59 428	321	1.40 572	9.99 967	45
8160	16	8.59 715	318	5.31 454	5.31 420	8.59 749	319	1.40 251	9.99 966	44
8220	17	8.60 033	316	5.31 454	5.31 420	8.60 068	316	1.39 932	9.99 966	43
8280	18	8.60 349	313	5.31 454	5.31 419	8.60 384	314	1.39 616	9.99 965	42
8340	19	8.60 662	311	5.31 454	5.31 419	8.60 698	311	1.39 302	9.99 964	41
8400	20	8.60 973	309	5.31 455	5.31 418	8.61 009	310	1.38 991	9.99 964	40
8460	21	8.61 282	307	5.31 455	5.31 418	8.61 319	307	1.38 681	9.99 963	39
8520	22	8.61 589	305	5.31 455	5.31 418	8.61 626	305	1.38 374	9.99 963	38
8580	23	8.61 894	302	5.31 455	5.31 417	8.61 931	303	1.38 069	9.99 962	37
8640	24	8.62 196	301	5.31 455	5.31 417	8.62 234	301	1.37 766	9.99 962	36
8700	25	8.62 497	298	5.31 455	5.31 417	8.62 535	299	1.37 465	9.99 961	35
8760	26	8.62 795	296	5.31 456	5.31 416	8.62 834	297	1.37 166	9.99 961	34
8820	27	8.63 091	294	5.31 456	5.31 416	8.63 131	295	1.36 869	9.99 960	33
8880	28	8.63 385	293	5.31 456	5.31 416	8.63 426	292	1.36 574	9.99 960	32
8940	29	8.63 678	290	5.31 456	5.31 415	8.63 718	291	1.36 282	9.99 959	31
9000	30	8.63 968	288	5.31 456	5.31 415	8.64 009	289	1.35 991	9.99 959	30
9060	31	8.64 256	287	5.31 456	5.31 415	8.64 298	287	1.35 702	9.99 958	29
9120	32	8.64 543	284	5.31 457	5.31 414	8.64 585	285	1.35 415	9.99 958	28
9180	33	8.64 827	283	5.31 457	5.31 414	8.64 870	284	1.35 130	9.99 957	27
9240	34	8.65 110	281	5.31 457	5.31 413	8.65 154	281	1.34 846	9.99 956	26
9300	35	8.65 391	279	5.31 457	5.31 413	8.65 435	280	1.34 565	9.99 956	25
9360	36	8.65 670	277	5.31 457	5.31 413	8.65 715	278	1.34 285	9.99 955	24
9420	37	8.65 947	276	5.31 458	5.31 412	8.65 993	276	1.34 007	9.99 955	23
9480	38	8.66 223	274	5.31 458	5.31 412	8.66 269	274	1.33 731	9.99 954	22
9540	39	8.66 497	272	5.31 458	5.31 412	8.66 543	273	1.33 457	9.99 954	21
9600	40	8.66 769	270	5.31 458	5.31 411	8.66 816	271	1.33 184	9.99 953	20
9660	41	8.67 039	269	5.31 458	5.31 411	8.67 087	269	1.32 913	9.99 952	19
9720	42	8.67 308	267	5.31 459	5.31 410	8.67 356	268	1.32 644	9.99 952	18
9780	43	8.67 575	266	5.31 459	5.31 410	8.67 624	266	1.32 376	9.99 951	17
9840	44	8.67 841	263	5.31 459	5.31 410	8.67 890	264	1.32 110	9.99 951	16
9900	45	8.68 104	263	5.31 459	5.31 409	8.68 154	263	1.31 846	9.99 950	15
9960	46	8.68 367	260	5.31 459	5.31 409	8.68 417	261	1.31 583	9.99 949	14
10020	47	8.68 627	259	5.31 460	5.31 408	8.68 678	260	1.31 322	9.99 949	13
10080	48	8.68 886	258	5.31 460	5.31 408	8.68 938	258	1.31 062	9.99 948	12
10140	49	8.69 144	256	5.31 460	5.31 408	8.69 199	257	1.30 804	9.99 948	11
10200	50	8.69 400	254	5.31 460	5.31 407	8.69 453	255	1.30 547	9.99 947	10
10260	51	8.69 654	253	5.31 461	5.31 407	8.69 708	254	1.30 292	9.99 946	9
10320	52	8.69 907	252	5.31 461	5.31 406	8.69 962	252	1.30 038	9.99 946	8
10380	53	8.70 159	250	5.31 461	5.31 406	8.70 214	251	1.29 786	9.99 945	7
10440	54	8.70 409	249	5.31 461	5.31 405	8.70 465	249	1.29 535	9.99 944	6
10500	55	8.70 658	247	5.31 461	5.31 405	8.70 714	248	1.29 286	9.99 944	5
10560	56	8.70 905	246	5.31 461	5.31 405	8.70 962	246	1.29 038	9.99 943	4
10620	57	8.71 151	244	5.31 462	5.31 404	8.71 208	245	1.28 792	9.99 942	3
10680	58	8.71 395	243	5.31 462	5.31 404	8.71 453	244	1.28 547	9.99 942	2
10740	59	8.71 638	242	5.31 462	5.31 403	8.71 697	243	1.28 303	9.99 941	1
10800	60	8.71 880		5.31 462	5.31 403	8.71 940		1.28 060	9.99 940	0
		L. Cos.	d.			L. Cot.	c.d.	L. Tan.	L. Sin.	

92° (272°)

(267°) 87°

LOGARITHMS OF THE FUNCTIONS (Continued)

8° (183°)

(356°) 176°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.		P. P.
0	8.71 880		8.71 940		1.28 060	9.99 940	60	" 241 239 237 235 234
1	8.72 120	240	8.72 181	241	1.27 819	9.99 940	59	1 4.0 4.0 4.0 3.9 3.9
2	8.72 359	239	8.72 420	239	1.27 580	9.99 939	58	2 8.0 8.0 7.9 7.8 7.8
3	8.72 597	238	8.72 659	239	1.27 341	9.99 938	57	3 12.0 12.0 11.8 11.8 11.7
4	8.72 834	237	8.72 896	237	1.27 104	9.99 938	56	4 16.1 15.9 15.8 15.7 15.6
5	8.73 069	235	8.73 132	236	1.26 868	9.99 937	55	5 20.1 19.9 19.8 19.6 19.5
6	8.73 303	234	8.73 366	234	1.26 634	9.99 936	54	6 24.1 23.9 23.7 23.5 23.4
7	8.73 535	232	8.73 600	234	1.26 400	9.99 936	53	7 28.1 27.9 27.6 27.4 27.3
8	8.73 767	232	8.73 832	232	1.26 168	9.99 935	52	8 32.1 31.9 31.6 31.3 31.2
9	8.73 997	230	8.74 063	231	1.25 937	9.99 934	51	9 36.2 35.8 35.6 35.2 35.1
10	8.74 226	229	8.74 292	229	1.25 708	9.99 934	50	" 232 229 227 225 223
11	8.74 454	228	8.74 521	229	1.25 479	9.99 933	49	1 3.9 3.8 3.8 3.8 3.7
12	8.74 680	226	8.74 748	227	1.25 252	9.99 932	48	2 7.7 7.6 7.6 7.5 7.4
13	8.74 906	226	8.74 974	226	1.25 026	9.99 932	47	3 11.6 11.4 11.4 11.2 11.2
14	8.75 130	224	8.75 199	225	1.24 801	9.99 931	46	4 15.5 15.3 15.1 15.0 14.9
15	8.75 353	223	8.75 423	224	1.24 577	9.99 930	45	5 19.3 19.1 18.9 18.8 18.6
16	8.75 575	222	8.75 645	222	1.24 355	9.99 929	44	6 23.2 22.9 22.7 22.5 22.3
17	8.75 795	220	8.75 867	222	1.24 133	9.99 929	43	7 27.1 26.7 26.5 26.2 26.0
18	8.76 015	219	8.76 087	220	1.23 913	9.99 928	42	8 30.9 30.5 30.3 30.0 29.7
19	8.76 234	217	8.76 306	219	1.23 694	9.99 927	41	9 34.8 34.4 34.0 33.8 33.4
20	8.76 451	216	8.76 525	219	1.23 475	9.99 926	40	" 222 220 217 215 213
21	8.76 667	216	8.76 742	217	1.23 258	9.99 926	39	1 3.7 3.7 3.6 3.6 3.6
22	8.76 883	214	8.76 958	216	1.23 042	9.99 925	38	2 7.4 7.3 7.2 7.2 7.1
23	8.77 097	213	8.77 173	215	1.22 827	9.99 924	37	3 11.1 11.0 10.8 10.8 10.6
24	8.77 310	212	8.77 387	214	1.22 613	9.99 923	36	4 14.8 14.7 14.5 14.3 14.2
25	8.77 522	211	8.77 600	213	1.22 400	9.99 923	35	5 18.5 18.3 18.1 17.9 17.8
26	8.77 733	210	8.77 811	211	1.22 189	9.99 922	34	6 22.2 22.0 21.7 21.5 21.3
27	8.77 943	209	8.78 022	210	1.21 978	9.99 921	33	7 25.9 25.7 25.3 25.1 24.8
28	8.78 152	208	8.78 232	209	1.21 768	9.99 920	32	8 29.6 29.3 28.9 28.7 28.4
29	8.78 360	208	8.78 441	208	1.21 559	9.99 920	31	9 33.3 33.0 32.6 32.2 32.0
30	8.78 568	206	8.78 649	206	1.21 351	9.99 919	30	" 211 208 206 203 201
31	8.78 774	205	8.78 855	206	1.21 145	9.99 918	29	1 3.5 3.5 3.4 3.4 3.4
32	8.78 979	204	8.79 061	205	1.20 939	9.99 917	28	2 7.0 6.9 6.9 6.8 6.7
33	8.79 183	203	8.79 266	204	1.20 734	9.99 917	27	3 10.6 10.4 10.3 10.2 10.0
34	8.79 386	202	8.79 470	203	1.20 530	9.99 916	26	4 14.1 13.9 13.7 13.5 13.4
35	8.79 588	201	8.79 673	202	1.20 327	9.99 915	25	5 17.6 17.3 17.2 16.9 16.8
36	8.79 789	201	8.79 875	201	1.20 125	9.99 914	24	6 21.1 20.8 20.6 20.3 20.1
37	8.79 990	199	8.80 076	201	1.19 924	9.99 913	23	7 24.6 24.3 24.0 23.7 23.4
38	8.80 189	199	8.80 277	199	1.19 723	9.99 913	22	8 28.1 27.7 27.5 27.1 26.8
39	8.80 388	197	8.80 476	198	1.19 524	9.99 912	21	9 31.6 31.2 30.9 30.4 30.2
40	8.80 585	197	8.80 674	198	1.19 326	9.99 911	20	" 199 197 195 193 192
41	8.80 782	196	8.80 872	196	1.19 128	9.99 910	19	1 3.3 3.3 3.2 3.2 3.2
42	8.80 978	195	8.81 068	196	1.18 932	9.99 909	18	2 6.6 6.6 6.5 6.4 6.4
43	8.81 173	194	8.81 264	195	1.18 736	9.99 909	17	3 10.0 9.8 9.8 9.6 9.6
44	8.81 367	193	8.81 459	194	1.18 541	9.99 908	16	4 13.3 13.1 13.0 12.9 12.8
45	8.81 560	192	8.81 653	193	1.18 347	9.99 907	15	5 16.6 16.4 16.2 16.1 16.0
46	8.81 752	192	8.81 846	192	1.18 154	9.99 906	14	6 19.9 19.7 19.5 19.3 19.2
47	8.81 944	190	8.82 038	192	1.17 962	9.99 905	13	7 23.2 23.0 22.8 22.5 22.4
48	8.82 134	190	8.82 230	190	1.17 770	9.99 904	12	8 26.5 26.3 26.0 25.7 25.6
49	8.82 324	189	8.82 420	190	1.17 580	9.99 904	11	9 29.8 29.6 29.2 29.0 28.8
50	8.82 513	188	8.82 610	189	1.17 390	9.99 903	10	" 189 187 185 183 181
51	8.82 701	187	8.82 799	188	1.17 201	9.99 902	9	1 3.2 3.1 3.1 3.0 3.0
52	8.82 888	187	8.82 987	188	1.17 013	9.99 901	8	2 6.3 6.2 6.2 6.1 6.0
53	8.83 075	186	8.83 175	186	1.16 825	9.99 900	7	3 9.4 9.4 9.2 9.2 9.0
54	8.83 261	185	8.83 361	186	1.16 639	9.99 899	6	4 12.6 12.5 12.3 12.2 12.1
55	8.83 446	184	8.83 547	185	1.16 453	9.99 898	5	5 15.8 15.6 15.4 15.2 15.1
56	8.83 630	183	8.83 732	184	1.16 268	9.99 898	4	6 18.9 18.7 18.5 18.3 18.1
57	8.83 813	183	8.83 916	184	1.16 084	9.99 897	3	7 22.0 21.8 21.6 21.4 21.1
58	8.83 996	181	8.84 100	182	1.15 900	9.99 896	2	8 25.2 24.9 24.7 24.4 24.1
59	8.84 177	181	8.84 282	182	1.15 718	9.99 895	1	9 28.4 28.0 27.8 27.4 27.2
60	8.84 358		8.84 464		1.15 536	9.99 894	0	10 31.5 31.2 30.8 30.5 30.2
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.		P. P.

93° (273°)

(266°) 86°

LOGARITHMS OF THE FUNCTIONS (Continued)

4° (184°)

(355°) 175°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	'	P. P.					
0	8.84 358	181	8.84 464	182	1.15 536	9.99 894	60	"	182	181	179	178	177
1	8.84 539	179	8.84 646	180	1.15 354	9.99 893	59	1	3.0	3.0	3.0	3.0	3.0
2	8.84 718	179	8.84 826	180	1.15 174	9.99 892	58	2	6.1	6.0	6.0	5.9	5.9
3	8.84 897	178	8.85 006	179	1.14 994	9.99 891	57	3	9.1	9.0	9.0	8.9	8.8
4	8.85 075	177	8.85 185	178	1.14 815	9.99 891	56	4	12.1	12.1	11.9	11.9	11.8
5	8.85 252	177	8.85 363	177	1.14 637	9.99 890	55	5	15.2	15.1	14.9	14.8	14.8
6	8.85 429	176	8.85 540	177	1.14 460	9.99 889	54	6	18.2	18.1	17.9	17.8	17.7
7	8.85 605	175	8.85 717	176	1.14 283	9.99 888	53	7	21.2	21.1	20.9	20.8	20.6
8	8.85 780	175	8.85 893	176	1.14 107	9.99 887	52	8	24.3	24.1	23.9	23.7	23.6
9	8.85 955	173	8.86 069	176	1.13 931	9.99 886	51	9	27.3	27.2	26.8	26.7	26.6
10	8.86 128	173	8.86 243	174	1.13 757	9.99 885	50	"	176	175	174	173	172
11	8.86 301	173	8.86 417	174	1.13 583	9.99 884	49	1	2.9	2.9	2.9	2.9	2.9
12	8.86 474	171	8.86 591	172	1.13 409	9.99 883	48	2	5.9	5.8	5.8	5.8	5.7
13	8.86 645	171	8.86 763	172	1.13 237	9.99 882	47	3	8.8	8.8	8.7	8.6	8.6
14	8.86 816	171	8.86 935	171	1.13 065	9.99 881	46	4	11.7	11.7	11.6	11.5	11.5
15	8.86 987	169	8.87 106	171	1.12 894	9.99 880	45	5	14.7	14.6	14.5	14.4	14.3
16	8.87 156	169	8.87 277	170	1.12 723	9.99 879	44	6	17.6	17.5	17.4	17.3	17.2
17	8.87 325	169	8.87 447	169	1.12 553	9.99 879	43	7	20.5	20.4	20.3	20.2	20.1
18	8.87 494	167	8.87 616	169	1.12 384	9.99 878	42	8	23.5	23.3	23.2	23.1	22.9
19	8.87 661	168	8.87 785	169	1.12 215	9.99 877	41	9	26.4	26.2	26.1	26.0	25.8
20	8.87 829	166	8.87 953	167	1.12 047	9.99 876	40	"	171	170	169	168	167
21	8.87 995	166	8.88 120	167	1.11 880	9.99 875	39	1	2.8	2.8	2.8	2.8	2.8
22	8.88 161	165	8.88 287	166	1.11 713	9.99 874	38	2	5.7	5.7	5.6	5.6	5.6
23	8.88 326	164	8.88 453	165	1.11 547	9.99 873	37	3	8.6	8.5	8.4	8.4	8.4
24	8.88 490	164	8.88 618	165	1.11 382	9.99 872	36	4	11.4	11.3	11.3	11.2	11.1
25	8.88 654	163	8.88 783	165	1.11 217	9.99 871	35	5	14.2	14.2	14.1	14.0	13.9
26	8.88 817	163	8.88 948	163	1.11 052	9.99 870	34	6	17.1	17.0	16.9	16.8	16.7
27	8.88 980	162	8.89 111	163	1.10 889	9.99 869	33	7	20.0	19.8	19.7	19.6	19.5
28	8.89 142	162	8.89 274	163	1.10 726	9.99 868	32	8	22.8	22.7	22.5	22.4	22.3
29	8.89 304	160	8.89 437	161	1.10 563	9.99 867	31	9	25.6	25.5	25.4	25.2	25.0
30	8.89 464	161	8.89 598	162	1.10 402	9.99 866	30	"	166	165	164	163	162
31	8.89 625	159	8.89 760	160	1.10 240	9.99 865	29	1	2.8	2.8	2.7	2.7	2.7
32	8.89 784	159	8.89 920	160	1.10 080	9.99 864	28	2	5.5	5.5	5.5	5.4	5.4
33	8.89 943	159	8.90 080	160	1.09 920	9.99 863	27	3	8.3	8.2	8.2	8.2	8.1
34	8.90 102	158	8.90 240	159	1.09 760	9.99 862	26	4	11.1	11.0	10.9	10.9	10.8
35	8.90 260	157	8.90 399	158	1.09 601	9.99 861	25	5	13.8	13.8	13.7	13.6	13.5
36	8.90 417	157	8.90 557	158	1.09 443	9.99 860	24	6	16.6	16.5	16.4	16.3	16.2
37	8.90 574	156	8.90 715	157	1.09 285	9.99 859	23	7	19.4	19.2	19.1	19.0	18.9
38	8.90 730	155	8.90 872	157	1.09 128	9.99 858	22	8	22.1	22.0	21.9	21.7	21.6
39	8.90 885	155	8.91 029	156	1.08 971	9.99 857	21	9	24.9	24.8	24.6	24.4	24.3
40	8.91 040	155	8.91 185	155	1.08 815	9.99 856	20	"	161	160	159	158	157
41	8.91 195	154	8.91 340	155	1.08 660	9.99 855	19	1	2.7	2.7	2.6	2.6	2.6
42	8.91 349	154	8.91 495	155	1.08 505	9.99 854	18	2	5.4	5.3	5.3	5.3	5.2
43	8.91 502	153	8.91 650	153	1.08 350	9.99 853	17	3	8.0	8.0	8.0	7.9	7.8
44	8.91 655	152	8.91 803	154	1.08 197	9.99 852	16	4	10.7	10.7	10.6	10.5	10.5
45	8.91 807	152	8.91 957	153	1.08 043	9.99 851	15	5	13.4	13.3	13.2	13.2	13.1
46	8.91 959	151	8.92 110	152	1.07 890	9.99 850	14	6	16.1	16.0	15.9	15.8	15.7
47	8.92 110	151	8.92 262	152	1.07 738	9.99 849	13	7	18.8	18.7	18.6	18.4	18.3
48	8.92 261	150	8.92 414	151	1.07 586	9.99 847	12	8	21.5	21.3	21.2	21.1	20.9
49	8.92 411	150	8.92 565	151	1.07 435	9.99 846	11	9	24.2	24.0	23.8	23.7	23.6
50	8.92 561	149	8.92 716	150	1.07 284	9.99 845	10	"	156	155	154	153	152
51	8.92 710	149	8.92 866	150	1.07 134	9.99 844	9	1	2.6	2.6	2.6	2.6	2.5
52	8.92 859	148	8.93 016	149	1.06 984	9.99 843	8	2	5.2	5.2	5.1	5.1	5.1
53	8.93 007	147	8.93 165	148	1.06 835	9.99 842	7	3	7.8	7.8	7.7	7.6	7.6
54	8.93 154	147	8.93 313	149	1.06 687	9.99 841	6	4	10.4	10.3	10.3	10.2	10.1
55	8.93 301	147	8.93 462	147	1.06 538	9.99 840	5	5	13.0	12.9	12.8	12.8	12.7
56	8.93 448	146	8.93 609	147	1.06 391	9.99 839	4	6	15.6	15.5	15.4	15.3	15.2
57	8.93 594	146	8.93 756	147	1.06 244	9.99 838	3	7	18.2	18.1	18.0	17.8	17.7
58	8.93 740	145	8.93 903	146	1.06 097	9.99 837	2	8	20.8	20.7	20.5	20.4	20.3
59	8.93 885	145	8.94 049	146	1.05 951	9.99 836	1	9	23.4	23.2	23.1	23.0	22.8
60	8.94 030		8.94 195		1.05 805	9.99 834	0	10	26.0	25.8	25.7	25.5	25.3
7	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	'	P. P.					

94° (274°)

(265°) 85°

LOGARITHMS OF THE FUNCTIONS (Continued)

5° (185°)

(354°) 174°

'	L. Sin.	d.	L.Tan.	c.d.	L. Cot.	L. Cos.	'	P.P.					
0	8.94 030		8.94 195		1.05 805	9.99 834	60	"	151	149	148	147	146
1	8.94 174	144	8.94 340	145	1.05 660	9.99 833	59	1	2.5	2.5	2.5	2.4	2.4
2	8.94 317	143	8.94 485	145	1.05 515	9.99 832	58	2	5.0	5.0	4.9	4.9	4.9
3	8.94 461	144	8.94 630	145	1.05 370	9.99 831	57	3	7.6	7.4	7.4	7.4	7.3
4	8.94 603	142	8.94 773	143	1.05 227	9.99 830	56	4	10.1	9.9	9.9	9.8	9.7
5	8.94 746	143	8.94 917	144	1.05 083	9.99 829	55	5	12.6	12.4	12.3	12.2	12.2
6	8.94 887	141	8.95 060	143	1.04 940	9.99 828	54	6	15.1	14.9	14.8	14.7	14.6
7	8.95 029	142	8.95 202	142	1.04 798	9.99 827	53	7	17.6	17.4	17.3	17.2	17.0
8	8.95 170	141	8.95 344	142	1.04 656	9.99 826	52	8	20.1	19.9	19.7	19.6	19.5
9	8.95 310	140	8.95 486	142	1.04 514	9.99 824	51	9	22.6	22.4	22.2	22.0	21.9
10	8.95 450	140	8.95 627	141	1.04 373	9.99 823	50	"	145	144	143	142	141
11	8.95 589	139	8.95 767	140	1.04 233	9.99 822	49	1	2.4	2.4	2.4	2.4	2.4
12	8.95 728	139	8.95 908	141	1.04 092	9.99 821	48	2	4.8	4.8	4.8	4.7	4.7
13	8.95 867	139	8.96 047	139	1.03 953	9.99 820	47	3	7.2	7.2	7.2	7.1	7.0
14	8.96 005	138	8.96 187	140	1.03 813	9.99 819	46	4	9.7	9.6	9.5	9.5	9.4
15	8.96 143	138	8.96 325	138	1.03 675	9.99 817	45	5	12.1	12.0	11.9	11.8	11.8
16	8.96 280	137	8.96 464	139	1.03 536	9.99 816	44	6	14.5	14.4	14.3	14.2	14.1
17	8.96 417	137	8.96 602	138	1.03 398	9.99 815	43	7	16.9	16.8	16.7	16.6	16.4
18	8.96 553	136	8.96 739	137	1.03 261	9.99 814	42	8	19.3	19.2	19.1	18.9	18.8
19	8.96 689	136	8.96 877	138	1.03 123	9.99 813	41	9	21.8	21.6	21.4	21.3	21.2
20	8.96 825	136	8.97 013	136	1.02 987	9.99 812	40	"	140	139	138	137	136
21	8.96 960	135	8.97 150	137	1.02 850	9.99 810	39	1	2.3	2.3	2.3	2.3	2.3
22	8.97 095	135	8.97 285	135	1.02 715	9.99 809	38	2	4.7	4.6	4.6	4.6	4.5
23	8.97 229	134	8.97 421	136	1.02 579	9.99 808	37	3	7.0	7.0	6.9	6.8	6.8
24	8.97 363	134	8.97 556	135	1.02 444	9.99 807	36	4	9.3	9.3	9.2	9.1	9.1
25	8.97 496	133	8.97 691	135	1.02 309	9.99 806	35	5	11.7	11.6	11.5	11.4	11.3
26	8.97 629	133	8.97 825	134	1.02 175	9.99 804	34	6	14.0	13.9	13.8	13.7	13.6
27	8.97 762	133	8.97 959	134	1.02 041	9.99 803	33	7	16.3	16.2	16.1	16.0	15.9
28	8.97 894	132	8.98 092	133	1.01 908	9.99 802	32	8	18.7	18.6	18.4	18.3	18.1
29	8.98 026	132	8.98 225	133	1.01 775	9.99 801	31	9	21.0	20.8	20.7	20.6	20.4
30	8.98 157	131	8.98 358	133	1.01 642	9.99 800	30	"	135	134	133	132	131
31	8.98 288	131	8.98 490	132	1.01 510	9.99 798	29	1	2.2	2.2	2.2	2.2	2.2
32	8.98 419	131	8.98 622	132	1.01 378	9.99 797	28	2	4.5	4.5	4.4	4.4	4.4
33	8.98 549	130	8.98 753	131	1.01 247	9.99 796	27	3	6.8	6.7	6.6	6.6	6.6
34	8.98 679	130	8.98 884	131	1.01 116	9.99 795	26	4	9.0	8.9	8.9	8.8	8.7
35	8.98 808	129	8.99 015	130	1.00 985	9.99 793	25	5	11.2	11.2	11.1	11.0	10.9
36	8.98 937	129	8.99 145	130	1.00 855	9.99 792	24	6	13.5	13.4	13.3	13.2	13.1
37	8.99 066	129	8.99 275	130	1.00 725	9.99 791	23	7	15.8	15.6	15.5	15.4	15.3
38	8.99 194	128	8.99 405	129	1.00 595	9.99 790	22	8	18.0	17.9	17.7	17.6	17.5
39	8.99 322	128	8.99 534	129	1.00 466	9.99 788	21	9	20.2	20.1	20.0	19.8	19.6
40	8.99 450	128	8.99 662	128	1.00 338	9.99 787	20	"	130	129	128	127	126
41	8.99 577	127	8.99 791	129	1.00 209	9.99 786	19	1	2.2	2.2	2.1	2.1	2.1
42	8.99 704	127	8.99 919	128	1.00 081	9.99 785	18	2	4.3	4.3	4.3	4.2	4.2
43	8.99 830	126	9.00 046	127	0.99 954	9.99 783	17	3	6.5	6.4	6.4	6.4	6.3
44	8.99 956	126	9.00 174	128	0.99 826	9.99 782	16	4	8.7	8.6	8.6	8.5	8.4
45	9.00 082	126	9.00 301	127	0.99 699	9.99 781	15	5	10.8	10.8	10.7	10.6	10.5
46	9.00 207	125	9.00 427	126	0.99 573	9.99 780	14	6	13.0	12.9	12.8	12.7	12.6
47	9.00 332	125	9.00 553	126	0.99 447	9.99 778	13	7	15.2	15.0	14.9	14.8	14.7
48	9.00 456	124	9.00 679	126	0.99 321	9.99 777	12	8	17.3	17.2	17.1	16.9	16.8
49	9.00 581	125	9.00 805	125	0.99 195	9.99 776	11	9	19.5	19.4	19.2	19.0	18.9
50	9.00 704	123	9.00 930	125	0.99 070	9.99 775	10	"	125	124	123	122	121
51	9.00 828	124	9.01 055	124	0.98 945	9.99 773	9	1	2.1	2.1	2.0	2.0	2.0
52	9.00 951	123	9.01 179	124	0.98 821	9.99 772	8	2	4.2	4.1	4.1	4.1	4.0
53	9.01 074	123	9.01 303	124	0.98 697	9.99 771	7	3	6.2	6.2	6.2	6.1	6.0
54	9.01 196	122	9.01 427	123	0.98 573	9.99 769	6	4	8.3	8.3	8.2	8.1	8.1
55	9.01 318	122	9.01 550	123	0.98 450	9.99 768	5	5	10.4	10.3	10.2	10.2	10.1
56	9.01 440	122	9.01 673	123	0.98 327	9.99 767	4	6	12.5	12.4	12.3	12.2	12.1
57	9.01 561	121	9.01 796	123	0.98 204	9.99 765	3	7	14.6	14.5	14.4	14.2	14.1
58	9.01 682	121	9.01 918	122	0.98 082	9.99 764	2	8	16.7	16.5	16.4	16.3	16.1
59	9.01 803	121	9.02 040	122	0.97 960	9.99 763	1	9	18.8	18.6	18.4	18.3	18.2
60	9.01 923	120	9.02 162	122	0.97 838	9.99 761	0	10	20.8	20.7	20.5	20.3	20.2
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	'	P.P.					

95° (275°)

(264°) 114°

LOGARITHMS OF THE FUNCTIONS (Continued)

6° (186°)

(353°) 173°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	'	P. P.				
0	9.01 923		9.02 162		0.97 838	9.99 761	60	"	121	100	119	118
1	9.02 043	120	9.02 283	121	0.97 717	9.99 760	59	1	2.0	2.0	2.0	2.0
2	9.02 163	120	9.02 404	121	0.97 596	9.99 759	58	2	4.0	4.0	4.0	3.9
3	9.02 283	120	9.02 525	121	0.97 475	9.99 757	57	3	6.0	6.0	6.0	5.9
4	9.02 402	119	9.02 645	120	0.97 355	9.99 756	56	4	8.1	8.0	7.9	7.9
5	9.02 520	118	9.02 766	121	0.97 234	9.99 755	55	5	10.1	10.0	9.9	9.8
6	9.02 639	119	9.02 885	119	0.97 115	9.99 753	54	6	12.1	12.0	11.9	11.8
7	9.02 757	118	9.03 005	120	0.96 995	9.99 752	53	7	14.1	14.0	13.9	13.8
8	9.02 874	117	9.03 124	119	0.96 876	9.99 751	52	8	16.1	16.0	15.9	15.7
9	9.02 992	118	9.03 242	118	0.96 758	9.99 749	51	9	18.2	18.0	17.8	17.7
10	9.03 109	117	9.03 361	119	0.96 639	9.99 748	50	10	20.2	20.0	19.8	19.7
11	9.03 226	117	9.03 479	118	0.96 521	9.99 747	49	20	40.3	40.0	39.7	39.3
12	9.03 342	116	9.03 597	118	0.96 403	9.99 745	48	30	60.5	60.0	59.5	59.0
13	9.03 458	116	9.03 714	117	0.96 286	9.99 744	47	40	80.7	80.0	79.3	78.7
14	9.03 574	116	9.03 832	118	0.96 168	9.99 742	46	50	100.8	100.0	99.2	98.3
15	9.03 690	115	9.03 948	116	0.96 052	9.99 741	45	"	117	116	115	114
16	9.03 805	115	9.04 065	117	0.95 935	9.99 740	44	1	2.0	1.9	1.9	1.9
17	9.03 920	115	9.04 181	116	0.95 819	9.99 738	43	2	3.9	3.9	3.8	3.8
18	9.04 034	114	9.04 297	116	0.95 703	9.99 737	42	3	5.8	5.8	5.8	5.7
19	9.04 149	115	9.04 413	116	0.95 587	9.99 736	41	4	7.8	7.7	7.7	7.6
20	9.04 262	113	9.04 528	115	0.95 472	9.99 734	40	5	9.8	9.7	9.6	9.5
21	9.04 376	114	9.04 643	115	0.95 357	9.99 733	39	6	11.7	11.6	11.5	11.4
22	9.04 490	114	9.04 758	115	0.95 242	9.99 731	38	7	13.6	13.5	13.4	13.3
23	9.04 603	113	9.04 873	115	0.95 127	9.99 730	37	8	15.6	15.5	15.3	15.2
24	9.04 715	112	9.04 987	114	0.95 013	9.99 728	36	9	17.6	17.4	17.2	17.1
25	9.04 828	113	9.05 101	114	0.94 899	9.99 727	35	10	19.5	19.3	19.2	19.0
26	9.04 940	112	9.05 214	113	0.94 786	9.99 726	34	20	39.0	38.7	38.3	38.0
27	9.05 052	112	9.05 328	114	0.94 672	9.99 724	33	30	58.5	58.0	57.5	57.0
28	9.05 164	112	9.05 441	113	0.94 559	9.99 723	32	40	78.0	77.3	76.7	76.0
29	9.05 275	111	9.05 553	112	0.94 447	9.99 721	31	50	97.5	96.7	95.8	95.0
30	9.05 386	111	9.05 666	113	0.94 334	9.99 720	30	"	113	112	111	110
31	9.05 497	111	9.05 778	112	0.94 222	9.99 718	29	1	1.9	1.9	1.8	1.8
32	9.05 607	110	9.05 890	112	0.94 110	9.99 717	28	2	3.8	3.7	3.7	3.7
33	9.05 717	110	9.06 002	112	0.93 998	9.99 716	27	3	5.6	5.6	5.6	5.5
34	9.05 827	110	9.06 113	111	0.93 887	9.99 714	26	4	7.5	7.5	7.4	7.3
35	9.05 937	110	9.06 224	111	0.93 776	9.99 713	25	5	9.4	9.3	9.2	9.2
36	9.06 046	109	9.06 335	111	0.93 665	9.99 711	24	6	11.3	11.2	11.1	11.0
37	9.06 155	109	9.06 445	110	0.93 555	9.99 710	23	7	13.2	13.1	13.0	12.8
38	9.06 264	109	9.06 556	111	0.93 444	9.99 708	22	8	15.1	14.9	14.8	14.7
39	9.06 372	109	9.06 666	110	0.93 334	9.99 707	21	9	17.0	16.8	16.6	16.5
40	9.06 481	108	9.06 775	109	0.93 225	9.99 705	20	10	18.8	18.7	18.5	18.3
41	9.06 589	108	9.06 885	110	0.93 115	9.99 704	19	20	37.7	37.3	37.0	36.7
42	9.06 696	107	9.06 994	109	0.93 006	9.99 702	18	30	56.5	56.0	55.5	55.0
43	9.06 804	108	9.07 103	109	0.92 897	9.99 701	17	40	75.3	74.7	74.0	73.3
44	9.06 911	107	9.07 211	108	0.92 789	9.99 699	16	50	94.2	93.3	92.5	91.7
45	9.07 018	107	9.07 320	109	0.92 680	9.99 698	15	"	109	108	107	106
46	9.07 124	106	9.07 428	108	0.92 572	9.99 696	14	1	1.8	1.8	1.8	1.8
47	9.07 231	107	9.07 536	108	0.92 464	9.99 695	13	2	3.6	3.6	3.6	3.6
48	9.07 337	106	9.07 643	107	0.92 357	9.99 693	12	3	5.4	5.4	5.4	5.3
49	9.07 442	106	9.07 751	108	0.92 249	9.99 692	11	4	7.3	7.2	7.1	7.1
50	9.07 548	105	9.07 858	107	0.92 142	9.99 690	10	5	9.1	9.0	8.9	8.8
51	9.07 653	105	9.07 964	106	0.92 036	9.99 689	9	6	10.9	10.8	10.7	10.6
52	9.07 758	105	9.08 071	107	0.91 929	9.99 687	8	7	12.7	12.6	12.5	12.4
53	9.07 863	105	9.08 177	106	0.91 823	9.99 686	7	8	14.5	14.4	14.3	14.1
54	9.07 968	105	9.08 283	106	0.91 717	9.99 684	6	9	16.4	16.2	16.0	15.9
55	9.08 072	104	9.08 389	106	0.91 611	9.99 683	5	10	18.2	18.0	17.8	17.7
56	9.08 176	104	9.08 495	105	0.91 505	9.99 681	4	20	36.3	36.0	35.7	35.3
57	9.08 280	104	9.08 600	105	0.91 400	9.99 680	3	30	54.5	54.0	53.5	53.0
58	9.08 383	103	9.08 705	105	0.91 295	9.99 678	2	40	72.7	72.0	71.3	70.7
59	9.08 486	103	9.08 810	105	0.91 190	9.99 677	1	50	90.8	90.0	89.2	88.3
60	9.08 589	103	9.08 914	104	0.91 086	9.99 675	0	"				
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	'	P. P.				

95° (276°)

(263°) 83°

LOGARITHMS OF THE FUNCTIONS (Continued)

7° (187°)

(352°) 172°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	'	P. P.
0	9.08 589		9.08 914		0.91 086	9.99 675	60	" 105 101 103 103
1	9.08 692	103	9.09 019	105	0.90 981	9.99 674	59	1 1.8 1.7 1.7 1.7
2	9.08 795	103	9.09 123	104	0.90 877	9.99 672	58	2 3.5 3.5 3.4 3.4
3	9.08 897	102	9.09 227	104	0.90 773	9.99 670	57	3 5.2 5.2 5.2 5.1
4	9.08 999	102	9.09 330	103	0.90 670	9.99 669	56	4 7.0 6.9 6.9 6.8
5	9.09 101	102	9.09 434	104	0.90 566	9.99 667	55	5 8.8 8.7 8.6 8.5
6	9.09 202	101	9.09 537	103	0.90 463	9.99 666	54	6 10.5 10.4 10.3 10.2
7	9.09 304	102	9.09 640	103	0.90 360	9.99 664	53	7 12.2 12.1 12.0 11.9
8	9.09 405	101	9.09 742	102	0.90 258	9.99 663	52	8 14.0 13.9 13.7 13.6
9	9.09 506	101	9.09 845	103	0.90 155	9.99 661	51	9 15.8 15.6 15.4 15.3
10	9.09 606	100	9.09 947	102	0.90 053	9.99 659	50	10 17.5 17.3 17.2 17.0
11	9.09 707	101	9.10 049	102	0.89 951	9.99 658	49	20 35.0 34.7 34.3 34.0
12	9.09 807	100	9.10 150	101	0.89 850	9.99 656	48	30 52.5 52.0 51.5 51.0
13	9.09 907	100	9.10 252	102	0.89 748	9.99 655	47	40 70.0 69.3 68.7 68.0
14	9.10 006	99	9.10 353	101	0.89 647	9.99 653	46	50 87.5 86.7 85.8 85.0
15	9.10 106	100	9.10 454	101	0.89 546	9.99 651	45	" 101 100 99 99
16	9.10 205	99	9.10 555	101	0.89 445	9.99 650	44	1 1.7 1.7 1.6 1.6
17	9.10 304	99	9.10 656	101	0.89 344	9.99 648	43	2 3.4 3.3 3.3 3.3
18	9.10 402	98	9.10 756	100	0.89 244	9.99 647	42	3 6.0 5.0 5.0 4.9
19	9.10 501	99	9.10 856	100	0.89 144	9.99 645	41	4 6.7 6.7 6.6 6.6
20	9.10 599	98	9.10 956	100	0.89 044	9.99 643	40	5 8.4 8.3 8.2 8.2
21	9.10 697	98	9.11 056	99	0.88 944	9.99 642	39	6 10.1 10.0 9.9 9.8
22	9.10 795	98	9.11 155	99	0.88 845	9.99 640	38	7 11.8 11.7 11.6 11.4
23	9.10 893	98	9.11 254	99	0.88 746	9.99 638	37	8 13.5 13.3 13.2 13.1
24	9.10 990	97	9.11 353	99	0.88 647	9.99 637	36	9 15.2 15.0 14.8 14.7
25	9.11 087	97	9.11 452	99	0.88 548	9.99 635	35	10 16.8 16.7 16.5 16.3
26	9.11 184	97	9.11 551	99	0.88 449	9.99 633	34	20 33.7 33.3 33.0 32.7
27	9.11 281	96	9.11 649	98	0.88 351	9.99 632	33	30 50.5 50.0 49.5 49.0
28	9.11 377	96	9.11 747	98	0.88 253	9.99 630	32	40 67.3 66.7 66.0 65.3
29	9.11 474	96	9.11 845	98	0.88 155	9.99 629	31	50 84.2 83.3 82.5 81.7
30	9.11 570	96	9.11 943	98	0.88 057	9.99 627	30	" 97 96 95 94
31	9.11 666	95	9.12 040	97	0.87 960	9.99 625	29	1 1.6 1.6 1.6 1.6
32	9.11 761	95	9.12 138	98	0.87 862	9.99 624	28	2 3.2 3.2 3.2 3.1
33	9.11 857	95	9.12 235	97	0.87 765	9.99 622	27	3 4.8 4.8 4.8 4.7
34	9.11 952	95	9.12 332	97	0.87 668	9.99 620	26	4 6.5 6.4 6.3 6.3
35	9.12 047	95	9.12 428	96	0.87 572	9.99 618	25	5 8.1 8.0 7.9 7.8
36	9.12 142	94	9.12 525	97	0.87 475	9.99 617	24	6 9.7 9.6 9.5 9.4
37	9.12 236	94	9.12 621	96	0.87 379	9.99 615	23	7 11.3 11.2 11.1 11.0
38	9.12 331	95	9.12 717	96	0.87 283	9.99 613	22	8 12.9 12.8 12.7 12.6
39	9.12 425	94	9.12 813	96	0.87 187	9.99 612	21	9 14.6 14.4 14.2 14.1
40	9.12 519	93	9.12 909	96	0.87 091	9.99 610	20	10 16.2 16.0 15.8 15.7
41	9.12 612	93	9.13 004	95	0.86 996	9.99 608	19	20 32.3 32.0 31.7 31.3
42	9.12 706	94	9.13 099	95	0.86 901	9.99 607	18	30 48.5 48.0 47.5 47.0
43	9.12 799	93	9.13 194	95	0.86 806	9.99 605	17	40 64.7 64.0 63.3 62.7
44	9.12 892	93	9.13 289	95	0.86 711	9.99 603	16	50 80.8 80.0 79.2 78.3
45	9.12 985	93	9.13 384	95	0.86 616	9.99 601	15	" 91 90 89 88
46	9.13 078	93	9.13 478	94	0.86 522	9.99 600	14	1 1.6 1.5 1.5 1.5
47	9.13 171	93	9.13 573	95	0.86 427	9.99 598	13	2 3.1 3.1 3.0 3.0
48	9.13 263	92	9.13 667	94	0.86 333	9.99 596	12	3 4.6 4.6 4.6 4.5
49	9.13 355	92	9.13 761	94	0.86 239	9.99 595	11	4 6.2 6.1 6.1 6.0
50	9.13 447	92	9.13 854	93	0.86 146	9.99 593	10	5 7.8 7.7 7.6 7.5
51	9.13 539	91	9.13 948	94	0.86 052	9.99 591	9	6 9.3 9.2 9.1 9.0
52	9.13 630	92	9.14 041	93	0.85 959	9.99 589	8	7 10.8 10.7 10.6 10.5
53	9.13 722	91	9.14 134	93	0.85 866	9.99 588	7	8 12.4 12.3 12.1 12.0
54	9.13 813	91	9.14 227	93	0.85 773	9.99 586	6	9 14.0 13.8 13.6 13.5
55	9.13 904	90	9.14 320	92	0.85 680	9.99 584	5	10 15.5 15.3 15.2 15.0
56	9.13 994	91	9.14 412	92	0.85 588	9.99 582	4	20 31.0 30.7 30.3 30.0
57	9.14 085	90	9.14 504	92	0.85 496	9.99 581	3	30 46.5 46.0 45.5 45.0
58	9.14 175	91	9.14 597	93	0.85 403	9.99 579	2	40 62.0 61.3 60.7 60.0
59	9.14 266	90	9.14 688	91	0.85 312	9.99 577	1	50 77.5 76.7 75.8 75.0
60	9.14 356	90	9.14 780	92	0.85 220	9.99 575	0	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	'	P. P.

97° (277°)

(262°) 82°

LOGARITHMS OF THE FUNCTIONS (Continued)

8° (188°)

(351°) 171°

	L. Sin	d.	L. Tan.	c. d.	L. Cot.	L. Cos.		P. P.			
0	9.14 356	89	9.14 780	92	0.85 220	9.99 575	60	"	92	91	90
1	9.14 445	89	9.14 872	92	0.85 128	9.99 574	59	1	1.5	1.5	1.5
2	9.14 535	90	9.14 963	91	0.85 037	9.99 572	58	2	3.1	3.0	3.0
3	9.14 624	89	9.15 054	91	0.84 946	9.99 570	57	3	4.6	4.6	4.5
4	9.14 714	89	9.15 145	91	0.84 855	9.99 568	56	4	6.1	6.1	6.0
5	9.14 803	88	9.15 236	91	0.84 764	9.99 566	55	5	7.7	7.6	7.5
6	9.14 891	89	9.15 327	90	0.84 673	9.99 565	54	6	9.2	9.1	9.0
7	9.14 980	89	9.15 417	90	0.84 583	9.99 563	53	7	10.7	10.6	10.5
8	9.15 069	89	9.15 508	91	0.84 492	9.99 561	52	8	12.3	12.1	12.0
9	9.15 157	88	9.15 598	90	0.84 402	9.99 559	51	9	13.8	13.6	13.5
		88		90							
10	9.15 245	88	9.15 688	89	0.84 312	9.99 557	50	10	15.3	15.2	15.0
11	9.15 333	88	9.15 777	90	0.84 223	9.99 556	49	20	30.7	30.3	30.0
12	9.15 421	88	9.15 867	90	0.84 133	9.99 554	48	30	46.0	45.5	45.0
13	9.15 508	87	9.15 956	89	0.84 044	9.99 552	47	40	61.3	60.7	60.0
14	9.15 596	88	9.16 046	90	0.83 954	9.99 550	46	50	76.7	75.8	75.0
		87		89							
15	9.15 683	87	9.16 135	89	0.83 865	9.99 548	45	"	89	88	87
16	9.15 770	87	9.16 224	89	0.83 776	9.99 546	44	1	1.5	1.5	1.4
17	9.15 857	87	9.16 312	88	0.83 688	9.99 545	43	2	3.0	2.9	2.9
18	9.15 944	87	9.16 401	88	0.83 599	9.99 543	42	3	4.4	4.4	4.4
19	9.16 030	86	9.16 489	88	0.83 511	9.99 541	41	4	5.9	5.9	5.8
		86		88							
20	9.16 116	87	9.16 577	88	0.83 423	9.99 539	40	5	7.4	7.3	7.2
21	9.16 203	86	9.16 665	88	0.83 335	9.99 537	39	6	8.9	8.8	8.7
22	9.16 289	86	9.16 753	88	0.83 247	9.99 535	38	7	10.4	10.3	10.2
23	9.16 374	85	9.16 841	88	0.83 159	9.99 533	37	8	11.9	11.7	11.6
24	9.16 460	86	9.16 928	87	0.83 072	9.99 532	36	9	13.4	13.2	13.0
		85		88							
25	9.16 545	86	9.17 016	87	0.82 984	9.99 530	35	10	14.8	14.7	14.5
26	9.16 631	85	9.17 103	87	0.82 897	9.99 528	34	20	29.7	29.3	29.0
27	9.16 716	85	9.17 190	87	0.82 810	9.99 526	33	30	44.5	44.0	43.5
28	9.16 801	85	9.17 277	87	0.82 723	9.99 524	32	40	59.3	58.7	58.0
29	9.16 886	84	9.17 363	86	0.82 637	9.99 522	31	50	74.2	73.3	72.5
		84		87							
30	9.16 970	85	9.17 450	86	0.82 550	9.99 520	30	"	86	85	84
31	9.17 055	84	9.17 536	86	0.82 464	9.99 518	29	1	1.4	1.4	1.4
32	9.17 139	84	9.17 622	86	0.82 378	9.99 517	28	2	2.9	2.8	2.8
33	9.17 223	84	9.17 708	86	0.82 292	9.99 515	27	3	4.3	4.2	4.2
34	9.17 307	84	9.17 794	86	0.82 206	9.99 513	26	4	5.7	5.7	5.6
		84		86							
35	9.17 391	83	9.17 880	85	0.82 120	9.99 511	25	5	7.2	7.1	7.0
36	9.17 474	84	9.17 965	86	0.82 035	9.99 509	24	6	8.6	8.5	8.4
37	9.17 558	83	9.18 051	85	0.81 949	9.99 507	23	7	10.0	9.9	9.8
38	9.17 641	83	9.18 136	85	0.81 864	9.99 505	22	8	11.5	11.3	11.2
39	9.17 724	83	9.18 221	85	0.81 779	9.99 503	21	9	12.9	12.8	12.6
		83		85							
40	9.17 807	83	9.18 306	85	0.81 694	9.99 501	20	10	14.3	14.2	14.0
41	9.17 890	83	9.18 391	84	0.81 609	9.99 499	19	20	28.7	28.3	28.0
42	9.17 973	83	9.18 475	85	0.81 525	9.99 497	18	30	43.0	42.5	42.0
43	9.18 055	82	9.18 560	84	0.81 440	9.99 495	17	40	57.3	56.7	56.0
44	9.18 137	83	9.18 644	84	0.81 356	9.99 494	16	50	71.7	70.8	70.0
		83		84							
45	9.18 220	82	9.18 728	84	0.81 272	9.99 492	15	"	83	82	81
46	9.18 302	81	9.18 812	84	0.81 188	9.99 490	14	1	1.4	1.4	1.4
47	9.18 383	82	9.18 896	84	0.81 104	9.99 488	13	2	2.8	2.7	2.7
48	9.18 465	82	9.18 979	83	0.81 021	9.99 486	12	3	4.2	4.1	4.0
49	9.18 547	82	9.19 063	84	0.80 937	9.99 484	11	4	5.5	5.5	5.4
		81		83							
50	9.18 628	81	9.19 146	83	0.80 854	9.99 482	10	5	6.9	6.8	6.8
51	9.18 709	81	9.19 229	83	0.80 771	9.99 480	9	6	8.3	8.2	8.1
52	9.18 790	81	9.19 312	83	0.80 688	9.99 478	8	7	9.7	9.6	9.4
53	9.18 871	81	9.19 395	83	0.80 605	9.99 476	7	8	11.1	10.9	10.8
54	9.18 952	81	9.19 478	83	0.80 522	9.99 474	6	9	12.4	12.3	12.2
		81		83							
55	9.19 033	80	9.19 561	82	0.80 439	9.99 472	5	10	13.8	13.7	13.5
56	9.19 113	80	9.19 643	82	0.80 357	9.99 470	4	20	27.7	27.3	27.0
57	9.19 193	80	9.19 725	82	0.80 275	9.99 468	3	30	41.5	41.0	40.5
58	9.19 273	80	9.19 807	82	0.80 193	9.99 466	2	40	55.3	54.7	54.0
59	9.19 353	80	9.19 889	82	0.80 111	9.99 464	1	50	69.2	68.3	67.5
60	9.19 433	80	9.19 971		0.80 029	9.99 462	0				
	L. Cos.	d.	L. Cot.	c. d.	L. Tan.	L. Sin.		P. P.			

98° (278°)

(261°) 81°

LOGARITHMS OF THE FUNCTIONS (Continued)

9° (189°)

(350°) 170°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.		P. P.
0	9.19 433		9.19 971	82	0.80 029	9.99 462	60	
1	9.19 513	80	9.20 053	81	0.79 947	9.99 460	59	
2	9.19 592	79	9.20 134	81	0.79 866	9.99 458	58	
3	9.19 672	80	9.20 216	82	0.79 784	9.99 456	57	
4	9.19 751	79	9.20 297	81	0.79 703	9.99 454	56	
5	9.19 830	79	9.20 378	81	0.79 622	9.99 452	55	
6	9.19 909	79	9.20 459	81	0.79 541	9.99 450	54	
7	9.19 988	79	9.20 540	81	0.79 460	9.99 448	53	
8	9.20 067	79	9.20 621	81	0.79 379	9.99 446	52	
9	9.20 145	78	9.20 701	80	0.79 299	9.99 444	51	
10	9.20 223	78	9.20 782	81	0.79 218	9.99 442	50	
11	9.20 302	78	9.20 862	80	0.79 138	9.99 440	49	
12	9.20 380	78	9.20 942	80	0.79 058	9.99 438	48	
13	9.20 458	77	9.21 022	80	0.78 978	9.99 436	47	
14	9.20 535	77	9.21 102	80	0.78 898	9.99 434	46	
15	9.20 613	78	9.21 182	80	0.78 818	9.99 432	45	
16	9.20 691	77	9.21 261	79	0.78 739	9.99 429	44	
17	9.20 768	77	9.21 341	80	0.78 659	9.99 427	43	
18	9.20 845	77	9.21 420	79	0.78 580	9.99 425	42	
19	9.20 922	77	9.21 499	79	0.78 501	9.99 423	41	
20	9.20 999	77	9.21 578	79	0.78 422	9.99 421	40	
21	9.21 076	77	9.21 657	79	0.78 343	9.99 419	39	
22	9.21 153	77	9.21 736	79	0.78 264	9.99 417	38	
23	9.21 229	76	9.21 814	78	0.78 186	9.99 415	37	
24	9.21 306	77	9.21 893	79	0.78 107	9.99 413	36	
25	9.21 382	76	9.21 971	78	0.78 029	9.99 411	35	
26	9.21 458	76	9.22 049	78	0.77 951	9.99 409	34	
27	9.21 534	76	9.22 127	78	0.77 873	9.99 407	33	
28	9.21 610	75	9.22 205	78	0.77 795	9.99 404	32	
29	9.21 685	75	9.22 283	78	0.77 717	9.99 402	31	
30	9.21 761	76	9.22 361	78	0.77 639	9.99 400	30	
31	9.21 836	75	9.22 438	77	0.77 562	9.99 398	29	
32	9.21 912	76	9.22 516	77	0.77 484	9.99 396	28	
33	9.21 987	75	9.22 593	77	0.77 407	9.99 394	27	
34	9.22 062	75	9.22 670	77	0.77 330	9.99 392	26	
35	9.22 137	75	9.22 747	77	0.77 253	9.99 390	25	
36	9.22 211	74	9.22 824	77	0.77 176	9.99 388	24	
37	9.22 286	75	9.22 901	77	0.77 099	9.99 385	23	
38	9.22 361	75	9.22 977	77	0.77 023	9.99 383	22	
39	9.22 435	74	9.23 054	76	0.76 946	9.99 381	21	
40	9.22 509	74	9.23 130	76	0.76 870	9.99 379	20	
41	9.22 583	74	9.23 206	77	0.76 794	9.99 377	19	
42	9.22 657	74	9.23 283	76	0.76 717	9.99 375	18	
43	9.22 731	74	9.23 359	76	0.76 641	9.99 372	17	
44	9.22 805	73	9.23 435	75	0.76 565	9.99 370	16	
45	9.22 878	74	9.23 510	76	0.76 490	9.99 368	15	
46	9.22 952	74	9.23 586	76	0.76 414	9.99 366	14	
47	9.23 025	73	9.23 661	75	0.76 339	9.99 364	13	
48	9.23 098	73	9.23 737	75	0.76 263	9.99 362	12	
49	9.23 171	73	9.23 812	75	0.76 188	9.99 359	11	
50	9.23 244	73	9.23 887	75	0.76 113	9.99 357	10	
51	9.23 317	73	9.23 962	75	0.76 038	9.99 355	9	
52	9.23 390	72	9.24 037	75	0.75 963	9.99 353	8	
53	9.23 462	72	9.24 112	75	0.75 888	9.99 351	7	
54	9.23 535	73	9.24 186	74	0.75 814	9.99 348	6	
55	9.23 607	72	9.24 261	75	0.75 739	9.99 346	5	
56	9.23 679	72	9.24 335	74	0.75 665	9.99 344	4	
57	9.23 752	73	9.24 410	75	0.75 590	9.99 342	3	
58	9.23 823	71	9.24 484	74	0.75 516	9.99 340	2	
59	9.23 895	72	9.24 558	74	0.75 442	9.99 337	1	
60	9.23 967	72	9.24 632	74	0.75 368	9.99 335	0	
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.		P. P.

99° (279°)

(260°) 80°

	80	79	78	77
1	1.3	1.3	1.3	1.3
2	2.7	2.6	2.6	2.6
3	4.0	4.0	3.9	3.8
4	5.3	5.3	5.2	5.1
5	6.7	6.6	6.5	6.4
6	8.0	7.9	7.8	7.7
7	9.3	9.2	9.1	9.0
8	10.7	10.5	10.4	10.3
9	12.0	11.8	11.7	11.6
10	13.3	13.2	13.0	12.8
20	26.7	26.3	26.0	25.7
30	40.0	39.5	39.0	38.5
40	53.3	52.7	52.0	51.3
50	66.7	65.8	65.0	64.2
	76	75	74	73
1	1.3	1.2	1.2	1.2
2	2.5	2.5	2.5	2.4
3	3.8	3.8	3.7	3.6
4	5.1	5.0	4.9	4.9
5	6.3	6.2	6.2	6.1
6	7.6	7.5	7.4	7.3
7	8.9	8.8	8.6	8.5
8	10.1	10.0	9.9	9.7
9	11.4	11.2	11.1	11.0
10	12.7	12.5	12.3	12.2
20	25.3	25.0	24.7	24.3
30	38.0	37.5	37.0	36.5
40	50.7	50.0	49.3	48.7
50	63.3	62.5	61.7	60.8
	71	70	69	68
1	1.2	1.2	0.0	0.0
2	2.4	2.4	0.1	0.1
3	3.6	3.6	0.2	0.1
4	4.8	4.7	0.2	0.1
5	6.0	5.9	0.2	0.2
6	7.2	7.1	0.3	0.2
7	8.4	8.3	0.4	0.2
8	9.6	9.5	0.4	0.3
9	10.8	10.6	0.4	0.3
10	12.0	11.8	0.5	0.3
20	24.0	23.7	1.0	0.7
30	36.0	35.5	1.5	1.0
40	48.0	47.3	2.0	1.3
50	60.0	59.2	2.5	1.7
	3	3	3	
	79	78	77	
0	13.2	13.0	12.8	
1	39.5	39.0	38.5	
2	65.8	65.0	64.2	
3				
	3	3	3	
	76	75	74	
0	12.7	12.5	12.3	
1	38.0	37.5	37.0	
2	63.3	62.5	61.7	
3				
	P. P.			

LOGARITHMS OF THE FUNCTIONS (Continued)

 10° (190°)

(349°) 169°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	P. P.
0	9.23 967	72	9.24 632	74	0.75 368	9.99 335	60	
1	9.24 039	71	9.24 706	73	0.75 294	9.99 333	59	" 74 73 72
2	9.24 110	71	9.24 779	74	0.75 221	9.99 331	58	1 1.2 1.2 1.2
3	9.24 181	72	9.24 853	73	0.75 147	9.99 328	57	2 2.5 2.4 2.4
4	9.24 253	71	9.24 926	74	0.75 074	9.99 326	56	3 3 7 3 6 3.6
5	9.24 324	71	9.25 000	73	0.75 000	9.99 324	55	4 4.9 4.9 4.8
6	9.24 395	71	9.25 073	73	0.74 927	9.99 322	54	5 6.2 6.1 6.0
7	9.24 466	70	9.25 146	73	0.74 854	9.99 319	53	6 7.4 7.3 7.2
8	9.24 536	71	9.25 219	73	0.74 781	9.99 317	52	7 8.6 8.5 8.4
9	9.24 607	70	9.25 292	73	0.74 708	9.99 315	51	8 9.9 9.7 9.6
10	9.24 677	71	9.25 365	72	0.74 635	9.99 313	50	9 11.1 11.0 10.8
11	9.24 748	70	9.25 437	73	0.74 563	9.99 310	49	10 12.3 12.2 12.0
12	9.24 818	70	9.25 510	72	0.74 490	9.99 308	48	20 24.7 24.3 24.0
13	9.24 888	70	9.25 582	73	0.74 418	9.99 306	47	30 37.0 36.5 36.0
14	9.24 958	70	9.25 655	72	0.74 345	9.99 304	46	40 49.3 48.7 48.0
15	9.25 028	70	9.25 727	72	0.74 273	9.99 301	45	50 61.7 60.8 60.0
16	9.25 098	70	9.25 799	72	0.74 201	9.99 299	44	" 71 70 69
17	9.25 168	69	9.25 871	72	0.74 129	9.99 297	43	1 1.2 1.2 1.2
18	9.25 237	69	9.25 943	72	0.74 057	9.99 294	42	2 2.4 2.3 2.3
19	9.25 307	69	9.26 015	71	0.73 985	9.99 292	41	3 3 6 3.5 3.4
20	9.25 376	69	9.26 086	72	0.73 914	9.99 290	40	4 4.7 4.7 4.6
21	9.25 445	69	9.26 158	71	0.73 842	9.99 288	39	5 5.9 5.8 5.8
22	9.25 514	69	9.26 229	72	0.73 771	9.99 285	38	6 7.1 7.0 6.9
23	9.25 583	69	9.26 301	71	0.73 699	9.99 283	37	7 8.3 8.2 8.0
24	9.25 652	69	9.26 372	71	0.73 628	9.99 281	36	8 9.5 9.3 9.2
25	9.25 721	69	9.26 443	71	0.73 557	9.99 278	35	9 10.6 10.5 10.4
26	9.25 790	68	9.26 514	71	0.73 486	9.99 276	34	10 11.8 11.7 11.5
27	9.25 858	68	9.26 585	70	0.73 415	9.99 274	33	20 23.7 23.3 23.0
28	9.25 927	68	9.26 656	71	0.73 345	9.99 271	32	30 35.5 35.0 34.5
29	9.25 995	68	9.26 726	71	0.73 274	9.99 269	31	40 47.3 46.7 46.0
30	9.26 063	68	9.26 797	70	0.73 203	9.99 267	30	50 59.2 58.3 57.5
31	9.26 131	68	9.26 867	70	0.73 133	9.99 264	29	" 68 67 66
32	9.26 199	68	9.26 937	71	0.73 063	9.99 262	28	1 1.1 1.1 1.1
33	9.26 267	68	9.27 008	70	0.72 992	9.99 260	27	2 2.3 2.2 2.2
34	9.26 335	68	9.27 078	70	0.72 922	9.99 257	26	3 3.4 3.4 3.3
35	9.26 403	67	9.27 148	70	0.72 852	9.99 255	25	4 4.5 4.5 4.4
36	9.26 470	68	9.27 218	70	0.72 782	9.99 252	24	5 5.7 5.6 5.5
37	9.26 538	67	9.27 288	69	0.72 712	9.99 250	23	6 6.8 6.7 6.6
38	9.26 605	67	9.27 357	70	0.72 643	9.99 248	22	7 7.9 7.8 7

100° (280°)

(259°) 79°

LOGARITHMS OF THE FUNCTIONS (Continued)

11° (191°)

(348°) **168°**

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	P. P.
0	9.28 060	65	9.28 865	68	0.71 135	9.99 195	3	60
1	9.28 125	65	9.28 933	67	0.71 067	9.99 192	3	59
2	9.28 190	65	9.29 000	67	0.71 000	9.99 190	3	58
3	9.28 254	64	9.29 067	67	0.70 933	9.99 187	3	57
4	9.28 319	65	9.29 134	67	0.70 866	9.99 185	3	56
		65		67			3	55
5	9.28 384	64	9.29 201	67	0.70 799	9.99 182	3	54
6	9.28 448	64	9.29 268	67	0.70 732	9.99 180	3	53
7	9.28 512	64	9.29 335	67	0.70 665	9.99 177	3	52
8	9.28 577	65	9.29 402	67	0.70 598	9.99 175	3	51
9	9.28 641	64	9.29 468	66	0.70 532	9.99 172	3	50
		64		67			2	49
10	9.28 705	64	9.29 535	66	0.70 465	9.99 170	3	48
11	9.28 769	64	9.29 601	66	0.70 399	9.99 167	3	47
12	9.28 833	64	9.29 668	67	0.70 332	9.99 165	3	46
13	9.28 896	63	9.29 734	66	0.70 266	9.99 162	3	45
14	9.28 960	64	9.29 800	66	0.70 200	9.99 160	3	44
		64		66			2	43
15	9.29 024	63	9.29 866	66	0.70 134	9.99 157	2	42
16	9.29 087	63	9.29 932	66	0.70 068	9.99 155	3	41
17	9.29 150	63	9.29 998	66	0.70 002	9.99 152	3	40
18	9.29 214	64	9.30 064	66	0.69 936	9.99 150	3	39
19	9.29 277	63	9.30 130	66	0.69 870	9.99 147	2	38
		63		65			2	37
20	9.29 340	63	9.30 195	66	0.69 805	9.99 145	3	36
21	9.29 403	63	9.30 261	65	0.69 739	9.99 142	3	35
22	9.29 466	63	9.30 326	65	0.69 674	9.99 140	3	34
23	9.29 529	63	9.30 391	65	0.69 609	9.99 137	3	33
24	9.29 591	62	9.30 457	66	0.69 543	9.99 135	3	32
		63		65			2	31
25	9.29 654	62	9.30 522	65	0.69 478	9.99 132	2	30
26	9.29 716	63	9.30 587	65	0.69 413	9.99 130	3	29
27	9.29 779	63	9.30 652	65	0.69 348	9.99 127	3	28
28	9.29 841	62	9.30 717	65	0.69 283	9.99 124	3	27
29	9.29 903	62	9.30 782	65	0.69 218	9.99 122	2	26
		63		64			3	25
30	9.29 966	62	9.30 846	65	0.69 154	9.99 119	2	24
31	9.30 028	62	9.30 911	65	0.69 089	9.99 117	2	23
32	9.30 090	62	9.30 976	64	0.69 025	9.99 114	2	22
33	9.30 151	61	9.31 040	65	0.68 960	9.99 112	3	21
34	9.30 213	62	9.31 104	64	0.68 896	9.99 109	3	20
		62		64			2	19
35	9.30 275	61	9.31 168	65	0.68 832	9.99 106	2	18
36	9.30 336	62	9.31 233	64	0.68 767	9.99 104	2	17
37	9.30 398	62	9.31 297	64	0.68 703	9.99 101	2	16
38	9.30 459	61	9.31 361	64	0.68 639	9.99 099	3	15
39	9.30 521	62	9.31 425	64	0.68 575	9.99 096	3	14
		61		64			3	13
40	9.30 582	61	9.31 489	63	0.68 511	9.99 093	2	12
41	9.30 643	61	9.31 552	63	0.68 448	9.99 091	2	11
42	9.30 704	61	9.31 616	64	0.68 384	9.99 088	2	10
43	9.30 766	61	9.31 679	63	0.68 321	9.99 086	2	9
44	9.30 826	61	9.31 743	64	0.68 257	9.99 083	3	8
		61		63			3	7
45	9.30 887	60	9.31 806	64	0.68 194	9.99 080	2	6
46	9.30 947	61	9.31 870	64	0.68 130	9.99 078	2	5
47	9.31 008	61	9.31 933	63	0.68 067	9.99 075	3	4
48	9.31 068	60	9.31 996	63	0.68 004	9.99 072	3	3
49	9.31 129	61	9.32 059	63	0.67 941	9.99 070	2	2
		60		63			3	1
50	9.31 189	61	9.32 122	63	0.67 878	9.99 067	2	0
51	9.31 250	60	9.32 185	63	0.67 815	9.99 064	3	9
52	9.31 310	60	9.32 248	63	0.67 752	9.99 062	3	8
53	9.31 370	60	9.32 311	63	0.67 689	9.99 059	3	7
54	9.31 430	60	9.32 373	62	0.67 627	9.99 056	3	6
		60		63			2	5
55	9.31 490	59	9.32 436	62	0.67 564	9.99 054	3	4
56	9.31 549	60	9.32 498	62	0.67 502	9.99 051	3	3
57	9.31 609	60	9.32 561	63	0.67 439	9.99 048	3	2
58	9.31 669	59	9.32 623	62	0.67 377	9.99 046	3	1
59	9.31 728	60	9.32 685	62	0.67 315	9.99 043	3	0
		60		62			3	9
60	9.31 788		9.32 747		0.67 253	9.99 040		8
								7
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	P. P.

101° (281°)

(258°) 78°

LOGARITHMS OF THE FUNCTIONS (Continued)

12° (192°)

(347°) 167°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P. P.
0	9.31 788		9.32 747		0.67 253	9.99 040		60	
1	9.31 847	59	9.32 810	63	0.67 190	9.99 038	2	59	" 62 61
2	9.31 907	60	9.32 872	62	0.67 128	9.99 035	3	58	1 1.0 1.0 1.0
3	9.31 966	59	9.32 933	61	0.67 067	9.99 032	3	57	2 2.1 2.1 2.0
4	9.32 025	59	9.32 995	62	0.67 005	9.99 030	2	56	3 3.2 3.1 3.0
5	9.32 084	59	9.33 057	62	0.66 943	9.99 027	3	55	4 4.2 4.1 4.1
6	9.32 143	59	9.33 119	62	0.66 881	9.99 024	3	54	5 5.2 5.2 5.1
7	9.32 202	59	9.33 180	61	0.66 820	9.99 022	2	53	6 6.3 6.2 6.1
8	9.32 261	59	9.33 242	62	0.66 758	9.99 019	3	52	7 7.4 7.2 7.1
9	9.32 319	58	9.33 303	61	0.66 697	9.99 016	3	51	8 8.4 8.3 8.1
10	9.32 378	59	9.33 365	62	0.66 605	9.99 013	3	50	9 9.4 9.3 9.2
11	9.32 437	59	9.33 426	61	0.66 574	9.99 011	2	49	10 10.5 10.3 10.2
12	9.32 495	58	9.33 487	61	0.66 513	9.99 008	3	48	20 21.0 20.7 20.3
13	9.32 553	58	9.33 548	61	0.66 452	9.99 005	3	47	30 31.5 31.0 30.5
14	9.32 612	59	9.33 609	61	0.66 391	9.99 002	3	46	40 42.0 41.3 40.7
15	9.32 670	58	9.33 670	61	0.66 330	9.99 000	2	45	50 52.5 51.7 50.8
16	9.32 728	58	9.33 731	61	0.66 269	9.98 997	3	44	" 60 59 58
17	9.32 786	58	9.33 792	61	0.66 208	9.98 994	3	43	1 1.0 1.0 1.0
18	9.32 844	58	9.33 853	61	0.66 147	9.98 991	3	42	2 2.0 2.0 1.9
19	9.32 902	58	9.33 913	60	0.66 087	9.98 989	2	41	3 3.0 3.0 2.9
20	9.32 960	58	9.33 974	61	0.66 026	9.98 986	3	40	4 4.0 3.9 3.9
21	9.33 018	58	9.34 034	60	0.65 966	9.98 983	3	39	5 5.0 4.9 4.8
22	9.33 075	57	9.34 095	61	0.65 905	9.98 980	3	38	6 6.0 5.9 5.8
23	9.33 133	58	9.34 155	60	0.65 845	9.98 978	3	37	7 7.0 6.9 6.8
24	9.33 190	58	9.34 215	60	0.65 785	9.98 975	3	36	8 8.0 7.9 7.7
25	9.33 248	57	9.34 276	61	0.65 724	9.98 972	3	35	9 9.0 8.8 8.7
26	9.33 305	57	9.34 336	60	0.65 664	9.98 969	3	34	10 10.0 9.8 9.7
27	9.33 362	57	9.34 396	60	0.65 604	9.98 967	2	33	20 20.0 19.7 19.3
28	9.33 420	58	9.34 456	60	0.65 544	9.98 964	3	32	30 30.0 29.5 29.0
29	9.33 477	57	9.34 516	60	0.65 484	9.98 961	3	31	40 40.0 39.3 38.7
30	9.33 534	57	9.34 576	59	0.65 424	9.98 958	3	30	50 50.0 49.2 48.3
31	9.33 591	56	9.34 635	59	0.65 365	9.98 955	3	29	" 57 56 55
32	9.33 647	56	9.34 695	60	0.65 305	9.98 953	2	28	1 1.0 0.9 0.9
33	9.33 704	57	9.34 755	60	0.65 245	9.98 950	3	27	2 1.9 1.9 1.8
34	9.33 761	57	9.34 814	59	0.65 186	9.98 947	3	26	3 2.8 2.8 2.8
35	9.33 818	57	9.34 874	59	0.65 126	9.98 944	3	25	4 3.8 3.7 3.7
36	9.33 874	56	9.34 933	59	0.65 067	9.98 941	3	24	5 4.8 4.7 4.6
37	9.33 931	57	9.34 992	59	0.65 008	9.98 938	3	23	6 5.7 5.6 5.5
38	9.33 987	56	9.35 051	59	0.64 949	9.98 936	2	22	7 6.6 6.5 6.4
39	9.34 043	56	9.35 111	60	0.64 889	9.98 933	3	21	8 7.6 7.5 7.3
40	9.34 100	57	9.35 170	59	0.64 830	9.98 930	3	20	9 8.6 8.4 8.2
41	9.34 156	56	9.35 229	59	0.64 771	9.98 927	3	19	10 9.5 9.3 9.2
42	9.34 212	56	9.35 288	59	0.64 712	9.98 924	3	18	20 19.0 18.7 18.3
43	9.34 268	56	9.35 347	59	0.64 653	9.98 921	3	17	30 28.5 28.0 27.5
44	9.34 324	56	9.35 045	58	0.64 595	9.98 919	2	16	40 38.0 37.3 36.7
45	9.34 380	56	9.35 464	59	0.64 536	9.98 916	3	15	50 47.5 46.7 45.8
46	9.34 436	56	9.35 523	59	0.64 477	9.98 913	3	14	
47	9.34 491	55	9.35 581	58	0.64 419	9.98 910	3	13	
48	9.34 547	56	9.35 640	59	0.64 360	9.98 907	3	12	
49	9.34 602	55	9.35 698	58	0.64 302	9.98 904	3	11	
50	9.34 658	55	9.35 757	58	0.64 243	9.98 901	3	10	0 10.3 10.2 10.0
51	9.34 713	55	9.35 815	58	0.64 185	9.98 898	3	9	1 31.0 30.5 30.0
52	9.34 769	56	9.35 873	58	0.64 127	9.98 896	2	8	2 51.7 50.8 50.0
53	9.34 824	55	9.35 931	58	0.64 069	9.98 893	3	7	
54	9.34 879	55	9.35 989	58	0.64 011	9.98 890	3	6	
55	9.34 934	55	9.36 047	58	0.63 953	9.98 887	3	5	
56	9.34 989	55	9.36 105	58	0.63 895	9.98 884	3	4	
57	9.35 044	55	9.36 163	58	0.63 837	9.98 881	3	3	
58	9.35 099	55	9.36 221	58	0.63 779	9.98 878	3	2	0 9.8 9.7 9.5
59	9.35 154	55	9.36 279	58	0.63 721	9.98 875	3	1	1 29.5 29.0 28.5
60	9.35 209	55	9.36 336	57	0.63 664	9.98 872	3	0	2 49.2 48.3 47.5
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P. P.

102° (282°)

(257°) 77°

LOGARITHMS OF THE FUNCTIONS (Continued)

13° (193°)

(346°) 166°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	P. P.
0	9.35 209		9.36 336		0.63 664	9.98 872		
1	9.35 263	54	9.36 394	58	0.63 606	9.98 869	3	
2	9.35 318	55	9.36 452	58	0.63 548	9.98 867	2	
3	9.35 373	55	9.36 509	57	0.63 491	9.98 864	3	
4	9.35 427	54	9.36 566	57	0.63 434	9.98 861	3	
5	9.35 481	55	9.36 624	57	0.63 376	9.98 858	3	
6	9.35 536	54	9.36 681	57	0.63 319	9.98 855	3	
7	9.35 590	54	9.36 738	57	0.63 262	9.98 852	3	
8	9.35 644	54	9.36 795	57	0.63 205	9.98 849	3	
9	9.35 698	54	9.36 852	57	0.63 148	9.98 846	3	
10	9.35 752	54	9.36 909	57	0.63 091	9.98 843	3	
11	9.35 806	54	9.36 966	57	0.63 034	9.98 840	3	
12	9.35 860	54	9.37 023	57	0.62 977	9.98 837	3	
13	9.35 914	54	9.37 080	57	0.62 920	9.98 834	3	
14	9.35 968	54	9.37 137	57	0.62 863	9.98 831	3	
15	9.36 022	53	9.37 193	57	0.62 807	9.98 828	3	
16	9.36 075	53	9.37 250	57	0.62 750	9.98 825	3	
17	9.36 129	54	9.37 306	56	0.62 694	9.98 822	3	
18	9.36 182	53	9.37 363	57	0.62 637	9.98 819	3	
19	9.36 236	54	9.37 419	56	0.62 581	9.98 816	3	
20	9.36 289	53	9.37 476	57	0.62 524	9.98 813	3	
21	9.36 342	53	9.37 532	56	0.62 468	9.98 810	3	
22	9.36 395	53	9.37 588	56	0.62 412	9.98 807	3	
23	9.36 449	54	9.37 644	56	0.62 356	9.98 804	3	
24	9.36 502	53	9.37 700	56	0.62 300	9.98 801	3	
25	9.36 555	53	9.37 756	56	0.62 244	9.98 798	3	
26	9.36 608	52	9.37 812	56	0.62 188	9.98 795	3	
27	9.36 660	53	9.37 868	56	0.62 132	9.98 792	3	
28	9.36 713	53	9.37 924	56	0.62 076	9.98 789	3	
29	9.36 766	53	9.37 980	56	0.62 020	9.98 786	3	
30	9.36 819	52	9.38 035	55	0.61 965	9.98 783	3	
31	9.36 871	53	9.38 091	56	0.61 909	9.98 780	3	
32	9.36 924	52	9.38 147	55	0.61 853	9.98 777	3	
33	9.36 976	52	9.38 202	55	0.61 798	9.98 774	3	
34	9.37 028	53	9.38 257	56	0.61 743	9.98 771	3	
35	9.37 081	52	9.38 313	55	0.61 687	9.98 768	3	
36	9.37 133	52	9.38 368	55	0.61 632	9.98 765	3	
37	9.37 185	52	9.38 423	55	0.61 577	9.98 762	3	
38	9.37 237	52	9.38 479	56	0.61 521	9.98 759	3	
39	9.37 289	52	9.38 534	55	0.61 466	9.98 756	3	
40	9.37 341	52	9.38 589	55	0.61 411	9.98 753	3	
41	9.37 393	52	9.38 644	55	0.61 356	9.98 750	3	
42	9.37 445	52	9.38 699	55	0.61 301	9.98 746	3	
43	9.37 497	52	9.38 754	55	0.61 246	9.98 743	3	
44	9.37 549	51	9.38 808	54	0.61 192	9.98 740	3	
45	9.37 600	52	9.38 863	55	0.61 137	9.98 737	3	
46	9.37 652	51	9.38 918	54	0.61 082	9.98 734	3	
47	9.37 703	52	9.38 972	54	0.61 028	9.98 731	3	
48	9.37 755	51	9.39 027	55	0.60 973	9.98 728	3	
49	9.37 806	52	9.39 082	54	0.60 918	9.98 725	3	
50	9.37 858	51	9.39 136	54	0.60 864	9.98 722	3	
51	9.37 909	51	9.39 190	54	0.60 810	9.98 719	3	
52	9.37 960	51	9.39 245	55	0.60 755	9.98 715	3	
53	9.38 011	51	9.39 299	54	0.60 701	9.98 712	3	
54	9.38 062	51	9.39 353	54	0.60 647	9.98 709	3	
55	9.38 113	51	9.39 407	54	0.60 593	9.98 706	3	
56	9.38 164	51	9.39 461	54	0.60 539	9.98 703	3	
57	9.38 215	51	9.39 515	54	0.60 485	9.98 700	3	
58	9.38 266	51	9.39 569	54	0.60 431	9.98 697	3	
59	9.38 317	51	9.39 623	54	0.60 377	9.98 694	3	
60	9.38 368	51	9.39 677	54	0.60 323	9.98 690	3	
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	P. P.

103° (283°)

(256°) 76°

LOGARITHMS OF THE FUNCTIONS (Continued)

14° (194°)

(345°) 165°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.			
0	9.38 368	50	9.39 677	54	0.60 323	9.98 690	3	60	"	54	53	52
1	9.38 418	51	9.39 731	54	0.60 269	9.98 687	3	59	1	0.9	0.9	0.9
2	9.38 469	50	9.39 785	53	0.60 215	9.98 684	3	58	2	1.8	1.8	1.7
3	9.38 519	51	9.39 838	54	0.60 162	9.98 681	3	57	3	2.7	2.6	2.6
4	9.38 570	50	9.39 892	53	0.60 108	9.98 678	3	56	4	3.6	3.5	3.5
5	9.38 620	50	9.39 945	54	0.60 055	9.98 675	4	55	5	4.5	4.4	4.3
6	9.38 670	51	9.39 999	53	0.60 001	9.98 671	4	54	6	5.4	5.3	5.2
7	9.38 721	50	9.40 052	54	0.59 948	9.98 668	3	53	7	6.3	6.2	6.1
8	9.38 771	50	9.40 106	53	0.59 894	9.98 665	3	52	8	7.2	7.1	6.9
9	9.38 821	50	9.40 159	53	0.59 841	9.98 662	3	51	9	8.1	8.0	7.8
10	9.38 871	50	9.40 212	54	0.59 788	9.98 659	3	50	10	9.0	8.8	8.7
11	9.38 921	50	9.40 266	53	0.59 734	9.98 656	4	49	20	18.0	17.7	17.3
12	9.38 971	50	9.40 319	53	0.59 681	9.98 652	4	48	30	27.0	26.5	26.0
13	9.39 021	50	9.40 372	53	0.59 628	9.98 649	3	47	40	36.0	35.3	34.7
14	9.39 071	50	9.40 425	53	0.59 575	9.98 646	3	46	50	45.0	44.2	43.3
15	9.39 121	49	9.40 478	53	0.59 522	9.98 643	4	45	"	51	50	49
16	9.39 170	50	9.40 531	53	0.59 469	9.98 640	4	44	1	0.8	0.8	0.8
17	9.39 220	50	9.40 584	52	0.59 416	9.98 636	4	43	2	1.7	1.7	1.6
18	9.39 270	50	9.40 636	53	0.59 364	9.98 633	3	42	3	2.6	2.5	2.4
19	9.39 319	49	9.40 689	53	0.59 311	9.98 630	3	41	4	3.4	3.3	3.3
20	9.39 369	49	9.40 742	53	0.59 258	9.98 627	4	40	5	4.2	4.2	4.1
21	9.39 418	49	9.40 795	52	0.59 205	9.98 623	3	39	6	5.1	5.0	4.9
22	9.39 467	50	9.40 847	53	0.59 153	9.98 620	3	38	7	6.0	5.8	5.7
23	9.39 517	49	9.40 900	52	0.59 100	9.98 617	3	37	8	6.8	6.7	6.5
24	9.39 566	49	9.40 952	53	0.59 048	9.98 614	4	36	9	7.6	7.5	7.4
25	9.39 615	49	9.41 005	52	0.58 995	9.98 610	3	35	10	8.5	8.3	8.2
26	9.39 664	49	9.41 057	52	0.58 943	9.98 607	3	34	20	17.0	16.7	16.3
27	9.39 713	49	9.41 109	52	0.58 891	9.98 604	3	33	30	25.5	25.0	24.5
28	9.39 762	49	9.41 161	53	0.58 839	9.98 601	3	32	40	34.0	33.3	32.7
29	9.39 811	49	9.41 214	52	0.58 786	9.98 597	4	31	50	42.5	41.7	40.8
30	9.39 860	49	9.41 266	52	0.58 734	9.98 594	3	30	"	48	47	46
31	9.39 909	49	9.41 318	52	0.58 682	9.98 591	3	29	1	0.8	0.8	0.1
32	9.39 958	49	9.41 370	52	0.58 630	9.98 588	4	28	2	1.6	1.6	0.1
33	9.40 006	48	9.41 422	52	0.58 578	9.98 584	3	27	3	2.4	2.4	0.2
34	9.40 055	48	9.41 474	52	0.58 526	9.98 581	3	26	4	3.2	3.1	0.3
35	9.40 103	49	9.41 526	52	0.58 474	9.98 578	4	25	5	4.0	3.9	0.3
36	9.40 152	48	9.41 578	51	0.58 422	9.98 574	3	24	6	4.8	4.7	0.4
37	9.40 200	49	9.41 629	52	0.58 371	9.98 571	3	23	7	5.6	5.5	0.5
38	9.40 249	48	9.41 681	52	0.58 319	9.98 568	3	22	8	6.4	6.3	0.5
39	9.40 297	49	9.41 733	51	0.58 267	9.98 565	4	21	9	7.2	7.0	0.6
40	9.40 346	48	9.41 784	52	0.58 216	9.98 561	3	20	10	8.0	7.8	0.7
41	9.40 394	48	9.41 836	51	0.58 164	9.98 558	3	19	20	16.0	15.7	1.3
42	9.40 442	48	9.41 887	52	0.58 113	9.98 555	4	18	30	24.0	23.5	2.0
43	9.40 490	48	9.41 939	51	0.58 061	9.98 551	3	17	40	32.0	31.3	2.7
44	9.40 538	48	9.41 990	51	0.58 010	9.98 548	3	16	50	40.0	39.2	3.3
45	9.40 586	48	9.42 041	52	0.57 959	9.98 545	4	15				
46	9.40 634	48	9.42 093	51	0.57 907	9.98 541	3	14				
47	9.40 682	48	9.42 144	51	0.57 856	9.98 538	3	13				
48	9.40 730	48	9.42 195	51	0.57 805	9.98 535	4	12				
49	9.40 778	47	9.42 246	51	0.57 754	9.98 531	3	11				
50	9.40 825	48	9.42 297	51	0.57 703	9.98 528	3	10	0	6.8	6.6	6.5
51	9.40 873	48	9.42 348	51	0.57 652	9.98 525	4	9	1	20.2	19.9	19.5
52	9.40 921	47	9.42 399	51	0.57 601	9.98 521	3	8	2	33.8	33.1	32.5
53	9.40 968	47	9.42 450	51	0.57 550	9.98 518	3	7	3	47.2	46.4	45.5
54	9.41 016	48	9.42 501	51	0.57 499	9.98 515	4	6	4	45.5	44.6	
55	9.41 063	48	9.42 552	51	0.57 448	9.98 511	3	5				
56	9.41 111	47	9.42 603	50	0.57 397	9.98 508	3	4	0			
57	9.41 158	47	9.42 653	51	0.57 347	9.98 505	4	3	1	9.0	8.8	8.7
58	9.41 205	47	9.42 704	51	0.57 296	9.98 501	3	2	2	27.0	26.5	26.0
59	9.41 252	48	9.42 755	50	0.57 245	9.98 498	4	1	3	45.0	44.2	43.3
60	9.41 300		9.42 805		0.57 195	9.98 494		0		42.5		
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.			

104° (284°)

(255°) 75°

LOGARITHMS OF THE FUNCTIONS (Continued)

15° (195°)

(344°) 164°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P. P.
0	9.41 300	47	9.42 805	51	0.57 195	9.98 494	3	60	" 51 50 49
1	9.41 347	47	9.42 856	50	0.57 144	9.98 491	3	59	1 0.8 0.8 0.8
2	9.41 394	47	9.42 906	50	0.57 094	9.98 488	3	58	2 1.7 1.7 1.6
3	9.41 441	47	9.42 957	51	0.57 043	9.98 484	4	57	3 2.6 2.5 2.4
4	9.41 488	47	9.43 007	50	0.56 993	9.98 481	3	56	4 3.4 3.3 3.3
5	9.41 535	47	9.43 057	50	0.56 943	9.98 477	4	55	5 4.2 4.2 4.1
6	9.41 582	47	9.43 108	51	0.56 892	9.98 474	3	54	6 5.1 5.0 4.9
7	9.41 628	46	9.43 158	50	0.56 842	9.98 471	3	53	7 6.0 5.8 5.7
8	9.41 675	47	9.43 208	50	0.56 792	9.98 467	4	52	8 6.8 6.7 6.5
9	9.41 722	47	9.43 258	50	0.56 742	9.98 464	3	51	9 7.6 7.5 7.4
10	9.41 768	46	9.43 308	50	0.56 692	9.98 460	4	50	10 8.5 8.3 8.2
11	9.41 815	47	9.43 358	50	0.56 642	9.98 457	3	49	20 17.0 16.7 16.3
12	9.41 861	46	9.43 408	50	0.56 592	9.98 453	4	48	30 25.5 25.0 24.5
13	9.41 908	47	9.43 458	50	0.56 542	9.98 450	3	47	40 34.0 33.3 32.7
14	9.41 954	46	9.43 508	50	0.56 492	9.98 447	4	46	50 42.5 41.7 40.8
15	9.42 001	47	9.43 558	50	0.56 442	9.98 443	3	45	" 48 47 46
16	9.42 047	46	9.43 607	49	0.56 393	9.98 440	4	44	1 0.8 0.8 0.8
17	9.42 093	46	9.43 657	50	0.56 343	9.98 436	4	43	2 1.6 1.6 1.5
18	9.42 140	47	9.43 707	50	0.56 293	9.98 433	3	42	3 2.4 2.4 2.3
19	9.42 186	46	9.43 756	49	0.56 244	9.98 429	4	41	4 3.2 3.1 3.1
20	9.42 232	46	9.43 806	50	0.56 194	9.98 426	3	40	5 4.0 3.9 3.8
21	9.42 278	46	9.43 855	49	0.56 145	9.98 422	3	39	6 4.8 4.7 4.6
22	9.42 324	46	9.43 905	50	0.56 095	9.98 419	3	38	7 5.6 5.5 5.4
23	9.42 370	46	9.43 954	49	0.56 046	9.98 415	4	37	8 6.4 6.3 6.1
24	9.42 416	46	9.44 004	50	0.55 996	9.98 412	3	36	9 7.2 7.0 6.9
25	9.42 461	45	9.44 053	49	0.55 947	9.98 409	3	35	10 8.0 7.8 7.7
26	9.42 507	46	9.44 102	49	0.55 898	9.98 405	4	34	20 16.0 15.7 15.3
27	9.42 553	46	9.44 151	49	0.55 849	9.98 402	3	33	30 24.0 23.5 23.0
28	9.42 599	46	9.44 201	50	0.55 799	9.98 398	4	32	40 32.0 31.3 30.7
29	9.42 644	45	9.44 250	49	0.55 750	9.98 395	3	31	50 40.0 39.2 38.3
30	9.42 690	46	9.44 299	49	0.55 701	9.98 391	3	30	" 45 44 4 3
31	9.42 735	45	9.44 348	49	0.55 652	9.98 388	4	29	1 0.8 0.7 0.1 0.0
32	9.42 781	46	9.44 397	49	0.55 603	9.98 384	4	28	2 1.5 1.5 0.1 0.1
33	9.42 826	46	9.44 446	49	0.55 554	9.98 381	3	27	3 2.2 2.2 0.2 0.2
34	9.42 872	46	9.44 495	49	0.55 505	9.98 377	4	26	4 3.0 2.9 0.3 0.2
35	9.42 917	45	9.44 544	48	0.55 456	9.98 373	3	25	5 3.8 3.7 0.3 0.2
36	9.42 962	45	9.44 592	48	0.55 408	9.98 370	4	24	6 4.5 4.4 0.4 0.3
37	9.43 008	46	9.44 641	49	0.55 359	9.98 366	3	23	7 5.2 5.1 0.5 0.4
38	9.43 053	45	9.44 690	49	0.55 310	9.98 363	4	22	8 6.0 5.9 0.5 0.4
39	9.43 098	45	9.44 738	48	0.55 262	9.98 359	3	21	9 6.8 6.6 0.6 0.4
40	9.43 143	45	9.44 787	49	0.55 213	9.98 356	4	20	10 7.5 7.3 0.7 0.5
41	9.43 188	45	9.44 836	49	0.55 164	9.98 352	3	19	20 15.0 14.7 1.3 1.0
42	9.43 233	45	9.44 884	48	0.55 116	9.98 349	4	18	30 22.5 22.0 2.0 1.5
43	9.43 278	45	9.44 933	49	0.55 067	9.98 345	3	17	40 30.0 29.3 2.7 2.0
44	9.43 323	45	9.44 981	48	0.55 019	9.98 342	4	16	50 37.5 36.7 3.3 2.5
45	9.43 367	45	9.45 029	49	0.54 971	9.98 338	3	15	
46	9.43 412	45	9.45 078	49	0.54 922	9.98 334	4	14	
47	9.43 457	45	9.45 126	48	0.54 874	9.98 331	3	13	
48	9.43 502	45	9.45 174	48	0.54 826	9.98 327	4	12	
49	9.43 546	44	9.45 222	48	0.54 778	9.98 324	3	11	
50	9.43 591	45	9.45 271	49	0.54 729	9.98 320	4	10	
51	9.43 635	44	9.45 319	48	0.54 681	9.98 317	3	9	
52	9.43 680	45	9.45 367	48	0.54 633	9.98 313	4	8	
53	9.43 724	44	9.45 415	48	0.54 585	9.98 309	3	7	
54	9.43 769	45	9.45 463	48	0.54 537	9.98 306	4	6	
55	9.43 813	44	9.45 511	48	0.54 489	9.98 302	3	5	
56	9.43 857	44	9.45 559	47	0.54 441	9.98 299	4	4	
57	9.43 901	44	9.45 606	48	0.54 394	9.98 295	3	3	
58	9.43 946	45	9.45 654	48	0.54 346	9.98 291	4	2	
59	9.43 990	44	9.45 702	48	0.54 298	9.98 288	3	1	
60	9.44 034	44	9.45 750	48	0.54 250	9.98 284	4	0	
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P. P.

105° (285°)

(254°) 74°

LOGARITHMS OF THE FUNCTIONS (Continued)

16° (196°)

(343°) 163°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P.P.
0	9.44 034		9.45 750		0.54 250	9.98 284		60	" 43 47 41
1	9.44 078	44	9.45 797	47	0.54 203	9.98 281	3	59	1 0.8 0.8 0.8
2	9.44 122	44	9.45 845	48	0.54 155	9.98 277	4	58	2 1.6 1.6 1.6
3	9.44 166	44	9.45 892	47	0.54 108	9.98 273	4	57	3 2.4 2.4 2.3
4	9.44 210	44	9.45 940	48	0.54 060	9.98 270	3	56	4 3.2 3.1 3.1
5	9.44 253	43	9.45 987	47	0.54 013	9.98 266	4	55	5 4.0 3.9 3.8
6	9.44 297	44	9.46 035	48	0.53 965	9.98 262	4	54	6 4.8 4.7 4.6
7	9.44 341	44	9.46 082	47	0.53 918	9.98 259	3	53	7 5.6 5.5 5.4
8	9.44 385	44	9.46 130	48	0.53 870	9.98 255	4	52	8 6.4 6.3 6.1
9	9.44 428	43	9.46 177	47	0.53 823	9.98 251	4	51	9 7.2 7.0 6.9
10	9.44 472	44	9.46 224	47	0.53 776	9.98 248	3	50	10 8.0 7.8 7.7
11	9.44 516	44	9.46 271	47	0.53 729	9.98 244	4	49	20 16.0 15.7 15.3
12	9.44 559	43	9.46 319	48	0.53 681	9.98 240	4	48	30 24.0 23.5 23.0
13	9.44 602	43	9.46 366	47	0.53 634	9.98 237	3	47	40 32.0 31.3 30.7
14	9.44 646	44	9.46 413	47	0.53 587	9.98 233	4	46	50 40.0 39.2 38.3
15	9.44 689	43	9.46 460	47	0.53 540	9.98 229	4	45	" 45 44 43
16	9.44 733	44	9.46 507	47	0.53 493	9.98 226	3	44	1 0.8 0.7 0.7
17	9.44 776	43	9.46 554	47	0.53 446	9.98 222	4	43	2 1.5 1.5 1.4
18	9.44 819	43	9.46 601	47	0.53 399	9.98 218	4	42	3 2.2 2.2 2.2
19	9.44 862	43	9.46 648	46	0.53 352	9.98 215	3	41	4 3.0 2.9 2.9
20	9.44 905	43	9.46 694	47	0.53 306	9.98 211	4	40	5 3.8 3.7 3.6
21	9.44 948	43	9.46 741	47	0.53 259	9.98 207	4	39	6 4.5 4.4 4.3
22	9.44 992	44	9.46 788	47	0.53 212	9.98 204	3	38	7 5.2 5.1 5.0
23	9.45 035	43	9.46 835	47	0.53 165	9.98 200	4	37	8 6.0 5.9 5.7
24	9.45 077	42	9.46 881	46	0.53 119	9.98 196	4	36	9 6.8 6.6 6.4
25	9.45 120	43	9.46 928	47	0.53 072	9.98 192	3	35	10 7.5 7.3 7.2
26	9.45 163	43	9.46 975	47	0.53 025	9.98 189	3	34	20 15.0 14.7 14.3
27	9.45 206	43	9.47 021	46	0.52 979	9.98 185	4	33	30 22.5 22.0 21.5
28	9.45 249	43	9.47 068	47	0.52 932	9.98 181	4	32	40 30.0 29.3 28.7
29	9.45 292	42	9.47 114	46	0.52 886	9.98 177	4	31	50 37.5 36.7 35.8
30	9.45 334	43	9.47 160	47	0.52 840	9.98 174	4	30	" 42 41 4 3
31	9.45 377	43	9.47 207	47	0.52 793	9.98 170	4	29	1 0.7 0.7 0.1 0.0
32	9.45 419	42	9.47 253	46	0.52 747	9.98 166	4	28	2 1.4 1.4 0.1 0.1
33	9.45 462	43	9.47 299	46	0.52 701	9.98 162	4	27	3 2.1 2.0 0.2 0.2
34	9.45 504	43	9.47 346	46	0.52 654	9.98 159	3	26	4 2.8 2.7 0.3 0.2
35	9.45 547	42	9.47 392	46	0.52 608	9.98 155	4	25	5 3.5 3.4 0.3 0.2
36	9.45 589	42	9.47 438	46	0.52 562	9.98 151	4	24	6 4.2 4.1 0.4 0.3
37	9.45 632	43	9.47 484	46	0.52 516	9.98 147	4	23	7 4.9 4.8 0.5 0.4
38	9.45 674	42	9.47 530	46	0.52 470	9.98 144	3	22	8 5.6 5.5 0.5 0.4
39	9.45 716	42	9.47 576	46	0.52 424	9.98 140	4	21	9 6.3 6.2 0.6 0.4
40	9.45 758	43	9.47 622	46	0.52 378	9.98 136	4	20	10 7.0 6.8 0.7 0.5
41	9.45 801	42	9.47 668	46	0.52 332	9.98 132	4	19	20 14.0 13.7 1.3 1.0
42	9.45 843	42	9.47 714	46	0.52 286	9.98 129	4	18	30 21.0 20.5 2.0 1.5
43	9.45 885	42	9.47 760	46	0.52 240	9.98 125	4	17	40 28.0 27.3 2.7 2.0
44	9.45 927	42	9.47 806	46	0.52 194	9.98 121	4	16	50 35.0 34.2 3.3 2.5
45	9.45 969	42	9.47 852	45	0.52 148	9.98 117	4	15	
46	9.46 011	42	9.47 897	45	0.52 103	9.98 113	4	14	
47	9.46 053	42	9.47 943	46	0.52 057	9.98 110	3	13	
48	9.46 095	42	9.47 989	46	0.52 011	9.98 106	4	12	4 4 4 4
49	9.46 136	41	9.48 035	45	0.51 965	9.98 102	4	11	0 48 47 46 45
50	9.46 178	42	9.48 080	46	0.51 920	9.98 098	4	10	1 6.0 5.9 5.8 5.6
51	9.46 220	42	9.48 126	46	0.51 874	9.98 094	4	9	2 18.0 17.6 17.2 16.9
52	9.46 262	42	9.48 171	45	0.51 829	9.98 090	4	8	3 30.0 29.4 28.8 28.1
53	9.46 303	41	9.48 217	46	0.51 783	9.98 087	3	7	4 42.0 41.1 40.2 39.4
54	9.46 345	41	9.48 262	45	0.51 738	9.98 083	4	6	
55	9.46 386	42	9.48 307	45	0.51 693	9.98 079	4	5	3 3 3 3
56	9.46 428	41	9.48 353	46	0.51 647	9.98 075	4	4	4 47 46 45
57	9.46 469	41	9.48 398	45	0.51 602	9.98 071	4	3	0 8.0 7.8 7.7 7.5
58	9.46 511	42	9.48 443	45	0.51 557	9.98 067	4	2	1 24.0 23.5 23.0 22.5
59	9.46 552	41	9.48 489	46	0.51 511	9.98 063	4	1	2 40.0 39.2 38.3 37.5
60	9.46 594	42	9.48 534	45	0.51 466	9.98 060	3	0	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P.P.

106° (286°)

(253°) 73°

LOGARITHMS OF THE FUNCTIONS (Continued)

17° (197°)

(342°) 162°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	P.P.				
0	9.46 594		9.48 534		0.51 466	9.98 060		60	"	45	44	41
1	9.46 635	41	9.48 579	45	0.51 421	9.98 056	4	59	1	0.8	0.7	0.7
2	9.46 676	41	9.48 624	45	0.51 376	9.98 052	4	58	2	1.5	1.5	1.4
3	9.46 717	41	9.48 669	45	0.51 331	9.98 048	4	57	3	2.2	2.2	2.2
4	9.46 758	42	9.48 714	45	0.51 286	9.98 044	4	56	4	3.0	2.9	2.9
5	9.46 800		9.48 759		0.51 241	9.98 040		55	5	3.8	3.7	3.6
6	9.46 841	41	9.48 804	45	0.51 196	9.98 036	4	54	6	4.5	4.4	4.3
7	9.46 882	41	9.48 849	45	0.51 151	9.98 032	4	53	7	5.2	5.1	5.0
8	9.46 923	41	9.48 894	45	0.51 106	9.98 029	3	52	8	6.0	5.9	5.7
9	9.46 964	41	9.48 939	45	0.51 061	9.98 025	4	51	9	6.8	6.6	6.4
10	9.47 005		9.48 984		0.51 016	9.98 021		50	10	7.5	7.3	7.2
11	9.47 045	40	9.49 029	45	0.50 971	9.98 017	4	49	20	15.0	14.7	14.3
12	9.47 086	41	9.49 073	44	0.50 927	9.98 013	4	48	30	22.5	22.0	21.5
13	9.47 127	41	9.49 118	45	0.50 882	9.98 009	4	47	40	30.0	29.3	28.7
14	9.47 168	41	9.49 163	45	0.50 837	9.98 005	4	46	50	37.5	36.7	35.8
15	9.47 209		9.49 207		0.50 793	9.98 001		45	"	41	41	40
16	9.47 249	40	9.49 252	45	0.50 748	9.97 997	4	44	1	0.7	0.7	0.7
17	9.47 290	41	9.49 296	44	0.50 704	9.97 993	4	43	2	1.4	1.4	1.3
18	9.47 330	40	9.49 341	45	0.50 659	9.97 989	4	42	3	2.1	2.0	2.0
19	9.47 371	40	9.49 385	44	0.50 615	9.97 986	3	41	4	2.8	2.7	2.7
20	9.47 411		9.49 430		0.50 570	9.97 982		40	5	3.5	3.4	3.3
21	9.47 452	41	9.49 474	44	0.50 526	9.97 978	4	39	6	4.2	4.1	4.0
22	9.47 493	40	9.49 519	45	0.50 481	9.97 974	4	38	7	4.9	4.8	4.7
23	9.47 533	41	9.49 563	44	0.50 437	9.97 970	4	37	8	5.6	5.5	5.3
24	9.47 573	40	9.49 607	44	0.50 393	9.97 966	4	36	9	6.3	6.2	6.0
25	9.47 613		9.49 652		0.50 348	9.97 962		35	10	7.0	6.8	6.7
26	9.47 654	41	9.49 696	44	0.50 304	9.97 958	4	34	20	14.0	13.7	13.3
27	9.47 694	40	9.49 740	44	0.50 260	9.97 954	4	33	30	21.0	20.5	20.0
28	9.47 734	40	9.49 784	44	0.50 216	9.97 950	4	32	40	28.0	27.3	26.7
29	9.47 774	40	9.49 828	44	0.50 172	9.97 946	4	31	50	35.0	34.2	33.3
30	9.47 814		9.49 872		0.50 128	9.97 942		30	"	39	5	4
31	9.47 854	40	9.49 916	44	0.50 084	9.97 938	4	29	1	0.6	0.1	0.1
32	9.47 894	40	9.49 960	44	0.50 040	9.97 934	4	28	2	1.3	0.2	0.1
33	9.47 934	40	9.50 004	44	0.49 996	9.97 930	4	27	3	2.0	0.2	0.2
34	9.47 974	40	9.50 048	44	0.49 952	9.97 926	4	26	4	2.6	0.3	0.3
35	9.48 014		9.50 092		0.49 908	9.97 922		25	5	3.2	0.4	0.3
36	9.48 054	40	9.50 136	44	0.49 864	9.97 918	4	24	6	3.9	0.5	0.4
37	9.48 094	40	9.50 180	44	0.49 820	9.97 914	4	23	7	4.6	0.6	0.5
38	9.48 133	39	9.50 223	43	0.49 777	9.97 910	4	22	8	5.2	0.7	0.6
39	9.48 173	40	9.50 267	44	0.49 733	9.97 906	4	21	9	5.8	0.8	0.6
40	9.48 213		9.50 311		0.49 689	9.97 902		20	10	6.5	0.8	0.7
41	9.48 252	39	9.50 355	44	0.49 645	9.97 898	4	19	20	13.0	1.7	1.3
42	9.48 292	40	9.50 398	43	0.49 602	9.97 894	4	18	30	19.5	2.5	2.0
43	9.48 332	40	9.50 442	44	0.49 558	9.97 890	4	17	40	26.0	3.3	2.7
44	9.48 371	39	9.50 485	43	0.49 515	9.97 886	4	16	50	32.5	4.2	3.3
45	9.48 411		9.50 529		0.49 471	9.97 882		15				
46	9.48 450	39	9.50 572	43	0.49 428	9.97 878	4	14				
47	9.48 490	40	9.50 616	44	0.49 384	9.97 874	4	13				
48	9.48 529	39	9.50 659	43	0.49 341	9.97 870	4	12				
49	9.48 568	39	9.50 703	43	0.49 297	9.97 866	4	11				
50	9.48 607		9.50 746		0.49 254	9.97 861		10				
51	9.48 647	40	9.50 789	43	0.49 211	9.97 857	4	9				
52	9.48 686	39	9.50 833	44	0.49 167	9.97 853	4	8				
53	9.48 725	39	9.50 876	43	0.49 124	9.97 849	4	7				
54	9.48 764	39	9.50 919	43	0.49 081	9.97 845	4	6				
55	9.48 803		9.50 962		0.49 038	9.97 841		5				
56	9.48 842	39	9.51 005	43	0.48 995	9.97 837	4	4				
57	9.48 881	39	9.51 048	43	0.48 952	9.97 833	4	3				
58	9.48 920	39	9.51 092	44	0.48 908	9.97 829	4	2				
59	9.48 959	39	9.51 135	43	0.48 865	9.97 825	4	1				
60	9.48 998	39	9.51 178	43	0.48 822	9.97 821	4	0				
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	P.P.				

107° (287°)

(252°) 72°

LOGARITHMS OF THE FUNCTIONS (Continued)

18° (198°)

(341°) 161°

"	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d	'	P. P.		
0	9.48 998		9.51 178		0.48 822	9.97 821	60	"	43	41	41
1	9.49 037	39	9.51 221	43	0.48 779	9.97 817	59	1	0.7	0.7	0.7
2	9.49 076	39	9.51 264	43	0.48 736	9.97 812	58	2	1.4	1.4	1.4
3	9.49 115	39	9.51 306	42	0.48 694	9.97 808	57	3	2.2	2.1	2.0
4	9.49 153	38	9.51 349	43	0.48 651	9.97 804	56	4	2.9	2.8	2.7
5	9.49 192	39	9.51 392	43	0.48 608	9.97 800	55	5	3.6	3.5	3.4
6	9.49 231	39	9.51 435	43	0.48 566	9.97 796	54	6	4.3	4.2	4.1
7	9.49 269	38	9.51 478	42	0.48 522	9.97 792	53	7	5.0	4.9	4.8
8	9.49 308	39	9.51 520	42	0.48 480	9.97 788	52	8	5.7	5.6	5.5
9	9.49 347	38	9.51 563	43	0.48 437	9.97 784	51	9	6.4	6.3	6.2
10	9.49 385	39	9.51 606	42	0.48 394	9.97 779	50	10	7.2	7.0	6.8
11	9.49 424	39	9.51 648	42	0.48 352	9.97 775	39	20	14.3	14.0	13.7
12	9.49 462	38	9.51 691	43	0.48 309	9.97 771	48	30	21.5	21.0	20.5
13	9.49 500	38	9.51 734	42	0.48 266	9.97 767	47	40	28.7	28.0	27.3
14	9.49 539	39	9.51 776	43	0.48 224	9.97 763	46	50	35.8	35.0	34.2
15	9.49 577	38	9.51 819	42	0.48 181	9.97 759	45	"	39	28	27
16	9.49 615	39	9.51 861	42	0.48 139	9.97 754	44	1	0.6	0.6	0.6
17	9.49 654	39	9.51 903	42	0.48 097	9.97 750	43	2	1.3	1.3	1.2
18	9.49 692	38	9.51 946	43	0.48 054	9.97 746	42	3	2.0	1.9	1.8
19	9.49 730	38	9.51 988	43	0.48 012	9.97 742	41	4	2.6	2.5	2.5
20	9.49 768	38	9.52 031	42	0.47 969	9.97 738	40	5	3.2	3.2	3.1
21	9.49 806	38	9.52 073	42	0.47 927	9.97 734	39	6	3.9	3.8	3.7
22	9.49 844	38	9.52 115	42	0.47 885	9.97 729	38	7	4.6	4.4	4.3
23	9.49 882	38	9.52 157	42	0.47 843	9.97 725	37	8	5.2	5.1	4.9
24	9.49 920	38	9.52 200	42	0.47 800	9.97 721	36	9	5.8	5.7	5.6
25	9.49 958	38	9.52 242	42	0.47 758	9.97 717	35	10	6.5	6.3	6.2
26	9.49 996	38	9.52 284	42	0.47 716	9.97 713	34	20	13.0	12.7	12.3
27	9.50 034	38	9.52 326	42	0.47 674	9.97 708	33	30	19.5	19.0	18.5
28	9.50 072	38	9.52 368	42	0.47 632	9.97 704	32	40	26.0	25.3	24.7
29	9.50 110	38	9.52 410	42	0.47 590	9.97 700	31	50	32.5	31.7	30.8
30	9.50 148	37	9.52 452	42	0.47 548	9.97 696	30	"	36	28	27
31	9.50 186	38	9.52 494	42	0.47 506	9.97 691	29	1	0.6	0.1	0.1
32	9.50 223	38	9.52 536	42	0.47 464	9.97 687	28	2	1.2	0.2	0.1
33	9.50 261	38	9.52 578	42	0.47 422	9.97 683	27	3	1.8	0.2	0.2
34	9.50 298	37	9.52 620	42	0.47 380	9.97 679	26	4	2.4	0.3	0.3
35	9.50 336	38	9.52 661	42	0.47 339	9.97 674	25	5	3.0	0.4	0.3
36	9.50 374	38	9.52 703	42	0.47 297	9.97 670	24	6	3.6	0.5	0.4
37	9.50 411	37	9.52 745	42	0.47 255	9.97 666	23	7	4.2	0.6	0.5
38	9.50 449	38	9.52 787	42	0.47 213	9.97 662	22	8	4.8	0.7	0.5
39	9.50 486	37	9.52 829	41	0.47 171	9.97 657	21	9	5.4	0.8	0.6
40	9.50 523	38	9.52 870	42	0.47 130	9.97 653	20	10	6.0	0.8	0.7
41	9.50 561	37	9.52 912	42	0.47 088	9.97 649	19	20	12.0	1.7	1.3
42	9.50 598	37	9.52 953	41	0.47 047	9.97 645	18	30	18.0	2.5	2.0
43	9.50 635	37	9.52 995	42	0.47 005	9.97 640	17	40	24.0	3.3	2.7
44	9.50 673	38	9.53 037	41	0.46 963	9.97 636	16	50	30.0	4.2	3.3
45	9.50 710	37	9.53 078	42	0.46 922	9.97 632	15	"	5	5	5
46	9.50 747	37	9.53 120	41	0.46 880	9.97 628	14	1	43	42	41
47	9.50 784	37	9.53 161	41	0.46 839	9.97 623	13	2	4.3	4.2	4.1
48	9.50 821	37	9.53 202	41	0.46 798	9.97 619	12	3	12.9	12.6	12.3
49	9.50 858	38	9.53 244	41	0.46 756	9.97 615	11	4	21.5	21.0	20.5
50	9.50 896	37	9.53 285	42	0.46 715	9.97 610	10	5	30.1	29.4	28.7
51	9.50 933	37	9.53 327	42	0.46 673	9.97 606	9	6	38.7	37.8	36.9
52	9.50 970	37	9.53 368	41	0.46 632	9.97 602	8	7	4	4	4
53	9.51 007	36	9.53 409	41	0.46 591	9.97 597	7	8	43	42	41
54	9.51 043	37	9.53 450	42	0.46 550	9.97 593	6	9	5.4	5.2	5.1
55	9.51 080	37	9.53 492	41	0.46 508	9.97 589	5	10	16.1	15.8	15.4
56	9.51 117	37	9.53 533	41	0.46 467	9.97 584	4	11	26.9	26.2	25.6
57	9.51 154	37	9.53 574	41	0.46 426	9.97 580	3	12	37.6	36.8	35.9
58	9.51 191	36	9.53 615	41	0.46 385	9.97 576	2	13			
59	9.51 227	37	9.53 656	41	0.46 344	9.97 571	1	14			
60	9.51 264	37	9.53 697	41	0.46 303	9.97 567	0	15			
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d	'	P. P.		

108° (288°)

(251°) 71°

LOGARITHMS OF THE FUNCTIONS (Continued)

19° (199°)

(340°) 160°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.			
0	9.51 264		9.53 697		0.46 303	9.97 567		60	"	41	40	39
1	9.51 301	37	9.53 738	41	0.46 262	9.97 563	4	59	1	0.7	0.7	0.6
2	9.51 338	37	9.53 779	41	0.46 221	9.97 558	5	58	2	1.4	1.3	1.3
3	9.51 374	36	9.53 820	41	0.46 180	9.97 554	4	57	3	2.0	2.0	2.0
4	9.51 411	37	9.53 861	41	0.46 139	9.97 550	4	56	4	2.7	2.7	2.6
5	9.51 447	36	9.53 902	41	0.46 098	9.97 545	5	55	5	3.4	3.3	3.2
6	9.51 484	37	9.53 943	41	0.46 057	9.97 541	4	54	6	4.1	4.0	3.9
7	9.51 520	36	9.53 984	41	0.46 016	9.97 536	5	53	7	4.8	4.7	4.6
8	9.51 557	37	9.54 025	41	0.45 975	9.97 532	4	52	8	5.5	5.3	5.2
9	9.51 593	36	9.54 065	40	0.45 935	9.97 528	5	51	9	6.2	6.0	5.8
10	9.51 629	36	9.54 106	41	0.45 894	9.97 523	4	50	10	6.8	6.7	6.5
11	9.51 666	37	9.54 147	41	0.45 853	9.97 519	4	49	20	13.7	13.3	13.0
12	9.51 702	36	9.54 187	40	0.45 813	9.97 515	4	48	30	20.5	20.0	19.5
13	9.51 738	36	9.54 228	41	0.45 772	9.97 510	4	47	40	27.3	26.7	26.0
14	9.51 774	36	9.54 269	41	0.45 731	9.97 506	5	46	50	34.2	33.3	32.5
15	9.51 811	37	9.54 309	40	0.45 691	9.97 501	4	45	"	37	36	35
16	9.51 847	36	9.54 350	41	0.45 650	9.97 497	5	44	1	0.6	0.6	0.6
17	9.51 883	36	9.54 390	40	0.45 610	9.97 492	4	43	2	1.2	1.2	1.2
18	9.51 919	36	9.54 431	41	0.45 569	9.97 488	5	42	3	1.8	1.8	1.8
19	9.51 955	36	9.54 471	40	0.45 529	9.97 484	4	41	4	2.5	2.4	2.3
20	9.51 991	36	9.54 512	41	0.45 488	9.97 479	5	40	5	3.1	3.0	2.9
21	9.52 027	36	9.54 552	40	0.45 448	9.97 475	4	39	6	3.7	3.6	3.5
22	9.52 063	36	9.54 593	41	0.45 407	9.97 470	5	38	7	4.3	4.2	4.1
23	9.52 099	36	9.54 633	40	0.45 367	9.97 466	4	37	8	4.9	4.8	4.7
24	9.52 135	36	9.54 673	40	0.45 327	9.97 461	5	36	9	5.6	5.4	5.2
25	9.52 171	36	9.54 714	41	0.45 286	9.97 457	4	35	10	6.2	6.0	5.8
26	9.52 207	36	9.54 754	40	0.45 246	9.97 453	5	34	20	12.3	12.0	11.7
27	9.52 242	35	9.54 794	40	0.45 206	9.97 448	4	33	30	18.5	18.0	17.5
28	9.52 278	36	9.54 835	41	0.45 165	9.97 444	5	32	40	24.7	24.0	23.3
29	9.52 314	36	9.54 875	40	0.45 125	9.97 439	4	31	50	30.8	30.0	29.2
30	9.52 350	35	9.54 915	40	0.45 085	9.97 435	5	30	"	34	33	32
31	9.52 385	36	9.54 955	40	0.45 045	9.97 430	4	29	1	0.6	0.1	0.1
32	9.52 421	35	9.54 995	40	0.45 005	9.97 426	5	28	2	1.1	0.2	0.1
33	9.52 456	35	9.55 035	40	0.44 965	9.97 421	4	27	3	1.7	0.2	0.2
34	9.52 492	36	9.55 075	40	0.44 925	9.97 417	5	26	4	2.3	0.3	0.3
35	9.52 527	36	9.55 115	40	0.44 885	9.97 412	4	25	5	2.8	0.4	0.3
36	9.52 563	35	9.55 155	40	0.44 845	9.97 408	5	24	6	3.4	0.5	0.4
37	9.52 598	35	9.55 195	40	0.44 805	9.97 403	4	23	7	4.0	0.6	0.5
38	9.52 634	36	9.55 235	40	0.44 765	9.97 399	5	22	8	4.6	0.7	0.5
39	9.52 669	36	9.55 275	40	0.44 725	9.97 394	4	21	9	5.1	0.8	0.6
40	9.52 705	35	9.55 315	40	0.44 685	9.97 390	5	20	10	5.7	0.8	0.7
41	9.52 740	35	9.55 355	40	0.44 645	9.97 385	4	19	20	11.3	1.7	1.3
42	9.52 775	36	9.55 395	40	0.44 605	9.97 381	5	18	30	17.0	2.5	2.0
43	9.52 811	35	9.55 434	39	0.44 566	9.97 376	4	17	40	22.7	3.3	2.7
44	9.52 846	35	9.55 474	40	0.44 526	9.97 372	5	16	50	28.3	4.2	3.3
45	9.52 881	35	9.55 514	40	0.44 486	9.97 367	4	15				
46	9.52 916	35	9.55 554	40	0.44 446	9.97 363	5	14		5	5	5
47	9.52 951	35	9.55 593	39	0.44 407	9.97 358	4	13		41	40	39
48	9.52 986	35	9.55 633	40	0.44 367	9.97 353	5	12	0	4.1	4.0	3.9
49	9.53 021	35	9.55 673	40	0.44 327	9.97 349	4	11	1	12.3	12.0	11.7
50	9.53 056	36	9.55 712	39	0.44 288	9.97 344	5	10	2	20.5	20.0	19.5
51	9.53 092	34	9.55 752	40	0.44 248	9.97 340	4	9	3	28.7	28.0	27.3
52	9.53 126	35	9.55 791	39	0.44 209	9.97 335	5	8	4	36.9	36.0	35.1
53	9.53 161	35	9.55 831	40	0.44 169	9.97 331	4	7	5			
54	9.53 196	35	9.55 870	39	0.44 130	9.97 326	5	6		4	4	4
55	9.53 231	35	9.55 910	40	0.44 090	9.97 322	4	5		41	40	39
56	9.53 266	35	9.55 949	39	0.44 051	9.97 317	5	4	0	5.1	5.0	4.9
57	9.53 301	35	9.55 989	40	0.44 011	9.97 312	4	3	1	15.4	15.0	14.6
58	9.53 336	35	9.56 028	39	0.43 972	9.97 308	5	2	2	25.6	25.0	24.4
59	9.53 370	34	9.56 067	39	0.43 933	9.97 303	4	1	3	35.9	35.0	34.1
60	9.53 405	35	9.56 107	40	0.43 893	9.97 299	5	0	4			
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.			

109° (289°)

(250°) 70°

LOGARITHMS OF THE FUNCTIONS (Continued)

20° (200°)

(339°) 159°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P.P.
0	9.53 405		9.56 197		0.43 893	9.97 299		60	40 39
1	9.53 440	35	9.56 146	39	0.43 854	9.97 294	5	59	1 0.7 0.6 0.6
2	9.53 475	35	9.56 185	39	0.43 815	9.97 289	5	58	2 1.3 1.3 1.3
3	9.53 509	34	9.56 224	39	0.43 776	9.97 285	4	57	3 2.0 2.0 1.9
4	9.53 544	34	9.56 264	40	0.43 736	9.97 280	5	56	4 2.7 2.6 2.6
5	9.53 578	34	9.56 303	39	0.43 697	9.97 276	5	55	5 3.3 3.2 3.2
6	9.53 613	35	9.56 342	39	0.43 658	9.97 271	5	54	6 4.0 3.9 3.8
7	9.53 647	34	9.56 381	39	0.43 619	9.97 266	5	53	7 4.7 4.6 4.4
8	9.53 682	35	9.56 420	39	0.43 580	9.97 262	4	52	8 5.3 5.2 5.1
9	9.53 716	34	9.56 459	39	0.43 541	9.97 257	5	51	9 6.0 5.8 5.7
10	9.53 751	35	9.56 498	39	0.43 502	9.97 252	4	50	10 6.7 6.5 6.3
11	9.53 785	34	9.56 537	39	0.43 463	9.97 248	49	20	13.3 13.0 12.7
12	9.53 819	35	9.56 576	39	0.43 424	9.97 243	48	30	20.0 19.5 19.0
13	9.53 854	35	9.56 615	39	0.43 385	9.97 238	5	40	26.7 26.0 25.3
14	9.53 888	34	9.56 654	39	0.43 346	9.97 234	4	50	33.3 32.5 31.7
15	9.53 922	34	9.56 693	39	0.43 307	9.97 229	5	45	40 33 35 34
16	9.53 957	35	9.56 732	39	0.43 268	9.97 224	4	44	1 0.6 0.6 0.6
17	9.53 991	34	9.56 771	39	0.43 229	9.97 220	4	43	2 1.2 1.2 1.1
18	9.54 025	34	9.56 810	39	0.43 190	9.97 215	5	42	3 1.8 1.8 1.7
19	9.54 059	34	9.56 849	39	0.43 151	9.97 210	5	41	4 2.5 2.3 2.3
20	9.54 093	34	9.56 887	38	0.43 113	9.97 206	4	40	5 3.1 2.9 2.8
21	9.54 127	34	9.56 926	39	0.43 074	9.97 201	5	39	6 3.7 3.5 3.4
22	9.54 161	34	9.56 965	39	0.43 035	9.97 196	4	38	7 4.3 4.1 4.0
23	9.54 195	34	9.57 004	39	0.42 996	9.97 192	5	37	8 4.9 4.7 4.6
24	9.54 229	34	9.57 042	38	0.42 958	9.97 187	5	36	9 5.6 5.2 5.1
25	9.54 263	34	9.57 081	39	0.42 919	9.97 182	5	35	10 6.2 5.8 5.7
26	9.54 297	34	9.57 120	39	0.42 880	9.97 178	4	34	20 12.3 11.7 11.3
27	9.54 331	34	9.57 158	38	0.42 842	9.97 173	5	33	30 18.5 17.5 17.0
28	9.54 365	34	9.57 197	39	0.42 803	9.97 168	5	32	40 24.7 23.3 22.7
29	9.54 399	34	9.57 235	38	0.42 765	9.97 163	5	31	50 30.8 29.2 28.3
30	9.54 433	34	9.57 274	39	0.42 726	9.97 159	4	30	32 33 34 35
31	9.54 466	33	9.57 312	38	0.42 688	9.97 154	5	29	1 0.6 0.1 0.1
32	9.54 500	34	9.57 351	39	0.42 649	9.97 149	5	28	2 1.1 0.2 0.1
33	9.54 534	34	9.57 389	38	0.42 611	9.97 145	4	27	3 1.6 0.2 0.2
34	9.54 567	33	9.57 428	39	0.42 572	9.97 140	5	26	4 2.2 0.3 0.3
35	9.54 601	34	9.57 466	38	0.42 534	9.97 135	5	25	5 2.8 0.4 0.3
36	9.54 635	34	9.57 504	39	0.42 496	9.97 130	4	24	6 3.3 0.5 0.4
37	9.54 668	33	9.57 543	38	0.42 457	9.97 126	5	23	7 3.8 0.6 0.5
38	9.54 702	34	9.57 581	39	0.42 419	9.97 121	5	22	8 4.4 0.7 0.6
39	9.54 735	34	9.57 619	38	0.42 381	9.97 116	5	21	9 5.0 0.8 0.6
40	9.54 769	33	9.57 658	39	0.42 342	9.97 111	5	20	10 5.5 0.8 0.7
41	9.54 802	33	9.57 696	38	0.42 304	9.97 107	4	19	20 11.0 1.7 1.3
42	9.54 836	34	9.57 734	38	0.42 266	9.97 102	5	18	30 16.5 2.5 2.0
43	9.54 869	33	9.57 772	38	0.42 228	9.97 097	5	17	40 22.0 3.3 2.7
44	9.54 903	34	9.57 810	39	0.42 190	9.97 092	5	16	50 27.5 4.2 3.3
45	9.54 936	33	9.57 849	38	0.42 151	9.97 087	5	15	5 5 5
46	9.54 969	33	9.57 887	38	0.42 113	9.97 083	4	14	10 11 11
47	9.55 003	34	9.57 925	38	0.42 075	9.97 078	5	13	15 16 16
48	9.55 036	33	9.57 963	38	0.42 037	9.97 073	5	12	20 21 21
49	9.55 069	33	9.58 001	38	0.41 999	9.97 068	5	11	25 26 26
50	9.55 102	34	9.58 039	38	0.41 961	9.97 063	5	10	30 31 31
51	9.55 136	33	9.58 077	38	0.41 923	9.97 059	4	9	35 36 36
52	9.55 169	33	9.58 115	38	0.41 885	9.97 054	5	8	40 41 41
53	9.55 202	33	9.58 153	38	0.41 847	9.97 049	5	7	45 46 46
54	9.55 235	33	9.58 191	38	0.41 809	9.97 044	5	6	50 51 51
55	9.55 268	33	9.58 229	38	0.41 771	9.97 039	5	5	55 56 56
56	9.55 301	33	9.58 267	38	0.41 733	9.97 035	4	4	60 61 61
57	9.55 334	33	9.58 304	37	0.41 696	9.97 030	5	3	65 66 66
58	9.55 367	33	9.58 342	38	0.41 658	9.97 025	5	2	70 71 71
59	9.55 400	33	9.58 380	38	0.41 620	9.97 020	5	1	75 76 76
60	9.55 433	33	9.58 418	38	0.41 582	9.97 015	5	0	80 81 81
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P.P.

110° (290°)

(249°) 69°

LOGARITHMS OF THE FUNCTIONS (Continued)

 21° (201°)

(338°) 158°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	P. P.
0	9.55 433	33	9.58 418	37	0.41 582	9.97 015	5 60	" 38 37 36
1	9.55 466	33	9.58 455	37	0.41 545	9.97 010	5 59	1 0.6 0.6 0.6
2	9.55 499	33	9.58 493	38	0.41 507	9.97 005	5 58	2 1.3 1.2 1.2
3	9.55 532	33	9.58 531	38	0.41 469	9.97 001	5 4 57	3 1.9 1.8 1.8
4	9.55 564	32	9.58 569	38	0.41 431	9.96 996	5 56	4 2.5 2.5 2.4
5	9.55 597	33	9.58 606	37	0.41 394	9.96 991	5 55	5 3.2 3.1 3.0
6	9.55 630	33	9.58 644	38	0.41 356	9.96 986	5 54	6 3.8 3.7 3.6
7	9.55 663	33	9.58 681	37	0.41 319	9.96 981	5 53	7 4.4 4.3 4.2
8	9.55 695	32	9.58 719	38	0.41 281	9.96 976	5 52	8 5.1 4.9 4.8
9	9.55 728	33	9.58 757	38	0.41 243	9.96 971	5 51	9 5.7 5.6 5.4
10	9.55 761	33	9.58 794	37	0.41 206	9.96 966	5 50	10 6.3 6.2 6.0
11	9.55 793	32	9.58 832	38	0.41 168	9.96 962	4 49	20 12.7 12.3 12.0
12	9.55 826	33	9.58 869	37	0.41 131	9.96 957	4 30	19.0 18.5 18.0
13	9.55 858	32	9.58 907	38	0.41 093	9.96 952	4 50	25.3 24.7 24.0
14	9.55 891	33	9.58 944	37	0.41 056	9.96 947	5 46	50 31.7 30.8 30.0
15	9.55 923	32	9.58 981	37	0.41 019	9.96 942	5 45	" 33 32 31
16	9.55 956	33	9.59 019	38	0.40 981	9.96 937	5 44	1 0.6 0.5 0.5
17	9.55 988	32	9.59 056	37	0.40 944	9.96 932	5 43	2 1.1 1.1 1.0
18	9.56 021	33	9.59 094	38	0.40 906	9.96 927	5 42	3 1.6 1.6 1.6
19	9.56 053	32	9.59 131	37	0.40 869	9.96 922	5 41	4 2.2 2.1 2.1
20	9.56 085	33	9.59 168	37	0.40 832	9.96 917	5 40	5 2.8 2.7 2.6
21	9.56 118	32	9.59 205	38	0.40 795	9.96 912	5 39	6 3.3 3.2 3.1
22	9.56 150	33	9.59 243	37	0.40 757	9.96 907	5 38	7 3.8 3.7 3.6
23	9.56 182	32	9.59 280	37	0.40 720	9.96 903	4 37	8 4.4 4.3 4.1
24	9.56 215	33	9.59 317	38	0.40 683	9.96 898	5 36	9 5.0 4.8 4.6
25	9.56 247	32	9.59 354	37	0.40 646	9.96 893	5 35	10 5.5 5.3 5.2
26	9.56 279	33	9.59 391	38	0.40 609	9.96 888	5 34	20 11.0 10.7 10.3
27	9.56 311	32	9.59 429	37	0.40 571	9.96 883	5 33	30 16.5 16.0 15.5
28	9.56 343	33	9.59 466	38	0.40 534	9.96 878	5 32	40 22.0 21.3 20.7
29	9.56 375	32	9.59 503	37	0.40 497	9.96 873	5 31	50 27.5 26.7 25.8
30	9.56 408	33	9.59 540	37	0.40 460	9.96 868	5 30	" 6 5 4
31	9.56 440	32	9.59 577	38	0.40 423	9.96 863	5 29	1 0.1 0.1 0.1
32	9.56 472	33	9.59 614	37	0.40 386	9.96 858	5 28	2 0.2 0.2 0.1
33	9.56 504	32	9.59 651	38	0.40 349	9.96 853	5 27	3 0.3 0.2 0.2
34	9.56 536	33	9.59 688	37	0.40 312	9.96 848	5 26	4 0.4 0.3 0.3
35	9.56 568	32	9.59 725	38	0.40 275	9.96 843	5 25	5 0.5 0.4 0.3
36	9.56 599	33	9.59 762	37	0.40 238	9.96 838	5 24	6 0.6 0.5 0.4
37	9.56 631	32	9.59 799	38	0.40 201	9.96 833	5 23	7 0.7 0.6 0.5
38	9.56 663	33	9.59 835	36	0.40 165	9.96 828	5 22	8 0.8 0.7 0.5
39	9.56 695	32	9.59 872	37	0.40 128	9.96 823	5 21	9 0.9 0.8 0.6
40	9.56 727	33	9.59 909	37	0.40 091	9.96 818	5 20	10 1.0 0.8 0.7
41	9.56 759	32	9.59 946	38	0.40 054	9.96 813	5 19	20 2.0 1.7 1.3
42	9.56 790	33	9.59 983	37	0.40 017	9.96 808	5 18	30 3.0 2.5 2.0
43	9.56 822	32	9.60 019	36	0.39 981	9.96 803	5 17	40 4.0 3.3 2.7
44	9.56 854	33	9.60 056	37	0.39 944	9.96 798	5 16	50 5.0 4.2 3.3
45	9.56 886	32	9.60 093	38	0.39 907	9.96 793	5 15	" 6 5 5
46	9.56 917	33	9.60 130	37	0.39 870	9.96 788	5 14	37 38 37
47	9.56 949	32	9.60 166	36	0.39 834	9.96 783	5 13	0 3.1 3.8 3.7
48	9.56 980	33	9.60 203	37	0.39 797	9.96 778	5 12	1 9.2 11.4 11.1
49	9.57 012	32	9.60 240	38	0.39 760	9.96 772	5 11	2 15.4 19.0 18.5
50	9.57 044	33	9.60 276	36	0.39 724	9.96 767	5 10	3 21.6 26.6 25.9
51	9.57 075	32	9.60 313	37	0.39 687	9.96 762	5 9	4 27.8 34.2 33.3
52	9.57 107	33	9.60 349	36	0.39 651	9.96 757	5 8	5 33.9 — —
53	9.57 138	32	9.60 386	37	0.39 614	9.96 752	5 7	6 5 4 4
54	9.57 169	33	9.60 422	36	0.39 578	9.96 747	5 6	36 38 37
55	9.57 201	32	9.60 459	37	0.39 541	9.96 742	5 5	0 3.6 4.8 4.6
56	9.57 232	33	9.60 495	36	0.39 505	9.96 737	5 4	1 10.8 14.2 13.9
57	9.57 264	32	9.60 532	37	0.39 468	9.96 732	5 3	2 18.0 23.8 23.1
58	9.57 295	33	9.60 568	36	0.39 432	9.96 727	5 2	3 25.2 33.2 32.4
59	9.57 326	32	9.60 605	37	0.39 395	9.96 722	5 1	4 32.4 — —
60	9.57 358	33	9.60 641	36	0.39 359	9.96 717	5 0	5 — — —
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	P. P.

111° (291°)

(248°) 68°

LOGARITHMS OF THE FUNCTIONS (Continued)

22° (202°)

(337°) 157°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P. P.
0	9.57 358		9.60 641		0.39 359	9.96 717		60	37 36 35
1	9.57 389	31	9.60 677	36	0.39 323	9.96 711	6	59 1	0.6 0.6 0.6
2	9.57 420	31	9.60 714	37	0.39 286	9.96 706	5	58 2	1.2 1.2 1.2
3	9.57 451	31	9.60 750	36	0.39 250	9.96 701	5	57 3	1.8 1.8 1.8
4	9.57 482	31	9.60 786	36	0.39 214	9.96 696	5	56 4	2.5 2.4 2.3
5	9.57 514	32	9.60 823	37	0.39 177	9.96 691	5	55 5	3.1 3.0 2.9
6	9.57 545	31	9.60 859	36	0.39 141	9.97 686	5	54 6	3.7 3.6 3.5
7	9.57 576	31	9.60 895	36	0.39 105	9.96 681	5	53 7	4.3 4.2 4.1
8	9.57 607	31	9.60 931	36	0.39 069	9.96 676	5	52 8	4.9 4.8 4.7
9	9.57 638	31	9.60 967	36	0.39 033	9.96 670	6	51 9	5.6 5.4 5.2
10	9.57 669	31	9.61 004	37	0.38 996	9.96 665	5	50 10	6.2 6.0 5.8
11	9.57 700	31	9.61 040	36	0.38 960	9.96 660	5	49 20	12.3 12.0 11.7
12	9.57 731	31	9.61 076	36	0.38 924	9.96 655	5	48 30	18.5 18.0 17.5
13	9.57 762	31	9.61 112	36	0.38 888	9.96 650	5	47 40	24.7 24.0 23.3
14	9.57 793	31	9.61 148	36	0.38 852	9.96 645	5	46 50	30.8 30.0 29.2
15	9.57 824	31	9.61 184	36	0.38 816	9.96 640	5	45 "	32 31 30
16	9.57 855	31	9.61 220	36	0.38 780	9.96 634	6	44 1	0.5 0.5 0.5
17	9.57 885	30	9.61 256	36	0.38 744	9.96 629	6	43 2	1.1 1.0 1.0
18	9.57 916	31	9.61 292	36	0.38 708	9.96 624	5	42 3	1.6 1.6 1.5
19	9.57 947	31	9.61 328	36	0.38 672	9.96 619	5	41 4	2.1 2.1 2.0
20	9.57 978	31	9.61 364	36	0.38 636	9.96 614	5	40 5	2.7 2.6 2.5
21	9.58 008	30	9.61 400	36	0.38 600	9.96 608	6	39 6	3.2 3.1 3.0
22	9.58 039	31	9.61 436	36	0.38 564	9.96 603	5	38 7	3.7 3.6 3.5
23	9.58 070	31	9.61 472	36	0.38 528	9.96 598	5	37 8	4.3 4.1 4.0
24	9.58 101	31	9.61 508	36	0.38 492	9.96 593	5	36 9	4.8 4.6 4.5
25	9.58 131	30	9.61 544	36	0.38 456	9.96 588	5	35 10	5.3 5.2 5.0
26	9.58 162	31	9.61 579	35	0.38 421	9.96 582	6	34 20	10.7 10.3 10.0
27	9.58 192	30	9.61 615	36	0.38 385	9.96 577	6	33 30	16.0 15.5 15.0
28	9.58 223	31	9.61 651	36	0.38 349	9.96 572	5	32 40	21.3 20.7 20.0
29	9.58 253	30	9.61 687	36	0.38 313	9.96 567	5	31 50	26.7 25.8 25.0
30	9.58 284	31	9.61 722	35	0.38 278	9.96 562	5	30 "	29 6 5
31	9.58 314	30	9.61 758	36	0.38 242	9.96 556	6	29 1	0.5 0.1 0.1
32	9.58 345	31	9.61 794	36	0.38 206	9.96 551	5	28 2	1.0 0.2 0.2
33	9.58 375	30	9.61 830	36	0.38 170	9.96 546	5	27 3	1.4 0.3 0.2
34	9.58 406	31	9.61 865	35	0.38 135	9.96 541	5	26 4	1.9 0.4 0.3
35	9.58 436	30	9.61 901	36	0.38 099	9.96 535	6	25 5	2.4 0.5 0.4
36	9.58 467	31	9.61 936	35	0.38 064	9.96 530	5	24 6	2.9 0.6 0.5
37	9.58 497	30	9.61 972	36	0.38 028	9.96 525	5	23 7	3.4 0.7 0.6
38	9.58 527	30	9.62 008	36	0.37 992	9.96 520	5	22 8	3.9 0.8 0.7
39	9.58 557	30	9.62 043	35	0.37 957	9.96 514	5	21 9	4.4 0.9 0.8
40	9.58 588	31	9.62 079	36	0.37 921	9.96 509	5	20 10	4.8 1.0 0.8
41	9.58 618	30	9.62 114	35	0.37 886	9.96 504	5	19 20	9.7 2.0 1.7
42	9.58 648	30	9.62 150	36	0.37 850	9.96 498	6	18 30	14.5 3.0 2.5
43	9.58 678	30	9.62 185	35	0.37 815	9.96 493	5	17 40	19.3 4.0 3.3
44	9.58 709	31	9.62 221	36	0.37 779	9.96 488	5	16 50	24.2 5.0 4.2
45	9.58 739	30	9.62 256	35	0.37 744	9.96 483	5	15	6 6
46	9.58 769	30	9.62 292	36	0.37 708	9.96 477	6	14	36 35
47	9.58 799	30	9.62 327	35	0.37 673	9.96 472	5	13	0 3.0 2.9
48	9.58 829	30	9.62 362	35	0.37 638	9.96 467	5	12	1 9.0 8.8
49	9.58 859	30	9.62 398	36	0.37 602	9.96 461	6	11	2 15.0 14.6
50	9.58 889	30	9.62 433	35	0.37 567	9.96 456	5	10	3 21.0 20.4
51	9.58 919	30	9.62 468	35	0.37 532	9.96 451	5	9	4 27.0 26.2
52	9.58 949	30	9.62 504	36	0.37 496	9.96 445	6	8	5 33.0 32.1
53	9.58 979	30	9.62 539	35	0.37 461	9.96 440	5	7	5 5 5
54	9.59 009	30	9.62 574	35	0.37 426	9.96 435	5	6	37 36 35
55	9.59 039	30	9.62 609	35	0.37 391	9.96 429	6	5	0 3.7 3.6 3.5
56	9.59 069	30	9.62 645	36	0.38 355	9.96 424	5	4	1 11.1 10.8 10.5
57	9.59 098	29	9.62 680	35	0.37 320	9.96 419	5	3	2 18.5 18.0 17.5
58	9.59 128	30	9.62 715	35	0.37 285	9.96 413	6	2	3 25.9 25.2 24.5
59	9.59 158	30	9.62 750	35	0.37 250	9.96 408	5	1	4 33.3 32.4 31.5
60	9.59 188	30	9.62 785	35	0.37 215	9.96 403	5	0	5
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P. P.

112° (292°)

(247°) 67°

LOGARITHMS OF THE FUNCTIONS (Continued)

23° (203°)

(336°) 156°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.			
0	9.59 188		9.62 785		0.37 215	9.96 403		60	"	36	34	
1	9.59 218	30	9.62 820	35	0.37 180	9.96 397	6	59	1	0.6	0.6	0.6
2	9.59 247	29	9.62 855	35	0.37 145	9.96 392	5	58	2	1.2	1.2	1.1
3	9.59 277	30	9.62 890	35	0.37 110	9.96 387	5	57	3	1.8	1.8	1.
4	9.59 307	29	9.62 926	36	0.37 074	9.96 381	6	56	4	2.4	2.3	2.3
5	9.59 336	30	9.62 961	35	0.37 039	9.96 376	5	55	5	3.0	2.9	2.8
6	9.59 366	30	9.62 996	35	0.37 004	9.96 370	6	54	6	3.6	3.5	3.4
7	9.59 396	30	9.63 031	35	0.36 969	9.96 365	5	53	7	4.2	4.1	4.0
8	9.59 425	29	9.63 066	35	0.36 934	9.96 360	5	52	8	4.8	4.7	4.6
9	9.59 455	30	9.63 101	35	0.36 899	9.96 354	6	51	9	5.4	5.2	5.1
10	9.59 484	29	9.63 135	34	0.36 865	9.96 349	5	50	10	6.0	5.8	5.7
11	9.59 514	30	9.63 170	35	0.36 830	9.96 343	6	49	20	12.0	11.7	11.3
12	9.59 543	29	9.63 205	35	0.36 795	9.96 338	5	48	30	18.0	17.5	17.0
13	9.59 573	30	9.63 240	35	0.36 760	9.96 333	5	47	40	24.0	23.3	22.7
14	9.59 602	29	9.63 275	35	0.36 725	9.96 327	6	46	50	30.0	29.2	28.3
15	9.59 632	30	9.63 310	35	0.36 690	9.96 322	5	45	"	30	29	28
16	9.59 661	29	9.63 345	35	0.36 655	9.96 316	6	44	1	0.5	0.5	0.5
17	9.59 690	30	9.63 379	34	0.36 621	9.96 311	5	43	2	1.0	1.0	0.9
18	9.59 720	29	9.63 414	35	0.36 586	9.96 305	6	42	3	1.5	1.4	1.4
19	9.59 749	30	9.63 449	35	0.36 551	9.96 300	5	41	4	2.0	1.9	1.9
20	9.59 778	29	9.63 484	35	0.36 516	9.96 294	6	40	5	2.5	2.4	2.3
21	9.59 808	30	9.63 519	35	0.36 481	9.96 289	5	39	6	3.0	2.9	2.8
22	9.59 837	29	9.63 553	34	0.36 447	9.96 284	5	38	7	3.5	3.4	3.3
23	9.59 866	30	9.63 588	35	0.36 412	9.96 278	6	37	8	4.0	3.9	3.7
24	9.59 895	29	9.63 623	35	0.36 377	9.96 273	5	36	9	4.5	4.4	4.2
25	9.59 924	30	9.63 657	34	0.36 343	9.96 267	6	35	10	5.0	4.8	4.7
26	9.59 954	29	9.63 692	35	0.36 308	9.96 262	5	34	20	10.0	9.7	9.3
27	9.59 983	30	9.63 726	34	0.36 274	9.96 256	6	33	30	15.0	14.5	14.0
28	9.60 012	29	9.63 761	35	0.36 239	9.96 251	5	32	40	20.0	19.3	18.7
29	9.60 041	30	9.63 796	35	0.36 204	9.96 245	6	31	50	25.0	24.2	23.3
30	9.60 070	29	9.63 830	34	0.36 170	9.96 240	5	30	"	6		
31	9.60 099	30	9.63 865	35	0.36 135	9.96 234	6	29	1	0.1	0.1	
32	9.60 128	29	9.63 899	34	0.36 101	9.96 229	5	28	2	0.2	0.2	
33	9.60 157	30	9.63 934	35	0.36 066	9.96 223	6	27	3	0.3	0.2	
34	9.60 186	29	9.63 968	34	0.36 032	9.96 218	5	26	4	0.4	0.3	
35	9.60 215	30	9.64 003	35	0.35 997	9.96 212	6	25	5	0.5	0.4	
36	9.60 244	29	9.64 037	34	0.35 963	9.96 207	5	24	6	0.6	0.5	
37	9.60 273	30	9.64 072	35	0.35 928	9.96 201	6	23	7	0.7	0.6	
38	9.60 302	29	9.64 106	34	0.35 894	9.96 196	5	22	8	0.8	0.7	
39	9.60 331	30	9.64 140	35	0.35 860	9.96 190	6	21	9	0.9	0.8	
40	9.60 359	28	9.64 175	34	0.35 825	9.96 185	5	20	10	1.0	0.8	
41	9.60 388	29	9.64 209	35	0.35 791	9.96 179	6	19	20	2.0	1.7	
42	9.60 417	30	9.64 243	34	0.35 757	9.96 174	5	18	30	3.0	2.5	
43	9.60 446	29	9.64 278	35	0.35 722	9.96 168	6	17	40	4.0	3.3	
44	9.60 474	30	9.64 312	34	0.35 688	9.96 162	5	16	50	5.0	4.2	
45	9.60 503	29	9.64 346	34	0.35 654	9.96 157	6	15	"	6		
46	9.60 532	30	9.64 381	35	0.35 619	9.96 151	5	14	"	35	34	
47	9.60 561	29	9.64 415	34	0.35 585	9.96 146	6	13	0	3.0	2.9	2.8
48	9.60 589	30	9.64 449	35	0.35 551	9.96 140	5	12	1	9.0	8.8	8.5
49	9.60 618	29	9.64 483	34	0.35 517	9.96 135	6	11	2	15.0	14.6	14.2
50	9.60 646	30	9.64 517	35	0.35 483	9.96 129	5	10	3	21.0	20.4	19.8
51	9.60 675	29	9.64 552	34	0.35 448	9.96 123	6	9	4	27.0	26.2	25.5
52	9.60 704	30	9.64 586	35	0.35 414	9.96 118	5	8	5	33.0	32.1	31.2
53	9.60 732	29	9.64 620	34	0.35 380	9.96 112	6	7	6			
54	9.60 761	30	9.64 654	35	0.35 346	9.96 107	5	6	"	5		
55	9.60 789	29	9.64 688	34	0.35 312	9.96 101	6	5	"	34		
56	9.60 818	30	9.64 722	35	0.35 278	9.96 095	5	4	0	3.5	3.4	
57	9.60 846	29	9.64 756	34	0.35 244	9.96 090	6	3	1	10.5	10.2	
58	9.60 875	30	9.64 790	35	0.35 210	9.96 084	5	2	2	17.5	17.0	
59	9.60 903	29	9.64 824	34	0.35 176	9.96 079	6	1	3	24.5	23.8	
60	9.60 931	30	9.64 858	35	0.35 142	9.96 073	5	0	4	31.5	30.6	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.			

113° (293°)

(246°) 66°

LOGARITHMS OF THE FUNCTIONS (Continued)

24° (204°)

(335°) 155°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P. P.
0	9.60 931		9.64 858		0.35 142	9.96 073	60		
1	9.60 960	29	9.64 892	34	0.35 108	9.96 067	59		
2	9.60 988	28	9.64 926	34	0.35 074	9.96 062	58	"	34 33
3	9.61 016	28	9.64 960	34	0.35 040	9.96 056	57	1	0.6 0.6
4	9.61 045	29	9.64 994	34	0.35 006	9.96 050	56	2	1.1 1.1
5	9.61 073	28	9.65 028	34	0.34 972	9.96 045	55	3	1.7 1.6
6	9.61 101	28	9.65 062	34	0.34 938	9.96 039	54	4	2.3 2.2
7	9.61 129	28	9.65 096	34	0.34 904	9.96 034	53	5	2.8 2.8
8	9.61 158	29	9.65 130	34	0.34 870	9.96 028	52	6	3.4 3.3
9	9.61 186	28	9.65 164	34	0.34 836	9.96 022	51	7	4.0 3.8
10	9.61 214	28	9.65 197	33	0.34 803	9.96 017	50	8	4.5 4.4
11	9.61 242	28	9.65 231	34	0.34 769	9.96 011	49	9	5.1 5.0
12	9.61 270	28	9.65 265	34	0.34 735	9.96 005	48	10	5.7 5.5
13	9.61 298	28	9.65 299	34	0.34 701	9.96 000	47	20	11.3 11.0
14	9.61 326	28	9.65 333	34	0.34 667	9.95 994	46	30	17.0 16.5
15	9.61 354	28	9.65 366	33	0.34 634	9.95 988	45	40	22.7 22.0
16	9.61 382	28	9.65 400	34	0.34 600	9.95 982	44	50	28.3 27.5
17	9.61 411	29	9.65 434	34	0.34 566	9.95 977	43	"	29 28 27
18	9.61 438	27	9.65 467	33	0.34 533	9.95 971	42	1	0.5 0.5
19	9.61 466	28	9.65 501	34	0.34 499	9.95 965	41	2	1.0 0.9
20	9.61 494	28	9.65 535	34	0.34 465	9.95 960	40	3	1.4 1.4
21	9.61 522	28	9.65 568	33	0.34 432	9.95 954	39	4	1.9 1.9
22	9.61 550	28	9.65 602	34	0.34 398	9.95 948	38	5	2.4 2.3
23	9.61 578	28	9.65 636	34	0.34 364	9.95 942	37	6	2.9 2.8
24	9.61 606	28	9.65 669	33	0.34 331	9.95 937	36	7	3.4 3.3
25	9.61 634	28	9.65 703	34	0.34 297	9.95 931	35	8	3.9 3.7
26	9.61 662	28	9.65 736	33	0.34 264	9.95 925	34	9	4.4 4.2
27	9.61 689	27	9.65 770	34	0.34 230	9.95 920	33	10	4.8 4.7
28	9.61 717	28	9.65 803	33	0.34 197	9.95 914	32	20	9.7 9.3
29	9.61 745	28	9.65 837	34	0.34 163	9.95 908	31	30	14.5 14.0
30	9.61 773	28	9.65 870	33	0.34 130	9.95 902	30	40	19.3 18.7
31	9.61 800	27	9.65 904	34	0.34 096	9.95 897	29	50	24.2 23.3
32	9.61 828	28	9.65 937	33	0.34 063	9.95 891	28	"	6 5
33	9.61 856	28	9.65 971	34	0.34 029	9.95 885	27	1	0.1 0.1
34	9.61 883	27	9.66 004	33	0.33 996	9.95 879	26	2	0.2 0.2
35	9.61 911	28	9.66 038	34	0.33 962	9.95 873	25	3	0.3 0.2
36	9.61 939	28	9.66 071	33	0.33 929	9.95 868	24	4	0.4 0.3
37	9.61 966	27	9.66 104	33	0.33 896	9.95 862	23	5	0.5 0.4
38	9.61 994	28	9.66 138	34	0.33 862	9.95 856	22	6	0.6 0.5
39	9.62 021	27	9.66 171	33	0.33 829	9.95 850	21	7	0.7 0.6
40	9.62 049	28	9.66 204	33	0.33 796	9.95 844	20	8	0.8 0.7
41	9.62 076	27	9.66 238	34	0.33 762	9.95 839	19	9	0.9 0.8
42	9.62 104	28	9.66 271	33	0.33 729	9.95 833	18	10	1.0 0.8
43	9.62 131	27	9.66 304	33	0.33 696	9.95 827	17	20	2.0 1.7
44	9.62 159	28	9.66 337	33	0.33 663	9.95 821	16	30	3.0 2.5
45	9.62 186	27	9.66 371	34	0.33 629	9.95 815	15	40	4.0 3.3
46	9.62 214	28	9.66 404	33	0.33 596	9.95 810	14	50	5.0 4.2
47	9.62 241	27	9.66 437	33	0.33 563	9.95 804	13		
48	9.62 268	27	9.66 470	33	0.33 530	9.95 798	12		
49	9.62 296	28	9.66 503	33	0.33 497	9.95 792	11		
50	9.62 323	27	9.66 537	34	0.33 463	9.95 786	10		
51	9.62 350	27	9.66 570	33	0.33 430	9.95 780	9		
52	9.62 377	27	9.66 603	33	0.33 397	9.95 775	8		
53	9.62 405	28	9.66 636	33	0.33 364	9.95 769	7	0	2.8 2.8 3.4
54	9.62 432	27	9.66 669	33	0.33 331	9.95 763	6	1	8.5 8.2 10.2
55	9.62 459	27	9.66 702	33	0.33 298	9.95 757	5	2	14.2 13.8 17.0
56	9.62 486	27	9.66 735	33	0.33 265	9.95 751	4	3	19.8 19.2 23.8
57	9.62 513	27	9.66 768	33	0.33 232	9.95 745	3	4	25.5 24.8 30.6
58	9.62 541	28	9.66 801	33	0.33 199	9.95 739	2	5	31.2 30.2 —
59	9.62 568	27	9.66 834	33	0.33 166	9.95 733	1	6	
60	9.62 595	27	9.66 867	33	0.33 133	9.95 728	0		
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P. P.

114° (294°)

(245°) 65°

LOGARITHMS OF THE FUNCTIONS (Continued)

25° (205°)

(334°) 154°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P.P.
0	9.62 595	27	9.66 867	33	0.33 133	9.95 728	6	60	
1	9.62 622	27	9.66 900	33	0.33 100	9.95 722	6	59	
2	9.62 649	27	9.66 933	33	0.33 067	9.95 716	6	58	
3	9.62 676	27	9.66 966	33	0.33 034	9.95 710	6	57	33
4	9.62 703	27	9.66 999	33	0.33 001	9.95 704	6	56	1 0.6 0.6
5	9.62 730	27	9.67 032	33	0.32 968	9.95 698	6	55	2 1.1 1.1
6	9.62 757	27	9.67 065	33	0.32 935	9.95 692	6	54	3 1.6 1.6
7	9.62 784	27	9.67 098	33	0.32 902	9.95 686	6	53	4 2.2 2.1
8	9.62 811	27	9.67 131	33	0.32 869	9.95 680	6	52	5 2.8 2.7
9	9.62 838	27	9.67 163	33	0.32 837	9.95 674	6	51	6 3.3 3.2
10	9.62 865	27	9.67 196	33	0.32 804	9.95 668	6	50	7 3.8 3.7
11	9.62 892	27	9.67 229	33	0.32 771	9.95 663	5	49	8 4.4 4.3
12	9.62 918	26	9.67 262	33	0.32 738	9.95 657	6	48	9 5.0 4.8
13	9.62 945	27	9.67 295	33	0.32 705	9.95 651	6	47	10 5.5 5.3
14	9.62 972	27	9.67 327	33	0.32 673	9.95 645	6	46	20 11.0 10.7
15	9.62 999	27	9.67 360	33	0.32 640	9.95 639	6	45	30 16.5 16.0
16	9.63 026	27	9.67 393	33	0.32 607	9.95 633	6	44	40 22.0 21.3
17	9.63 052	26	9.67 426	33	0.32 574	9.95 627	6	43	50 27.5 26.7
18	9.63 079	27	9.67 458	33	0.32 542	9.95 621	6	42	
19	9.63 106	27	9.67 491	33	0.32 509	9.95 615	6	41	27 26
20	9.63 133	26	9.67 524	32	0.32 476	9.95 609	6	40	1 0.4 0.4
21	9.63 159	27	9.67 556	32	0.32 444	9.95 603	6	39	2 0.9 0.9
22	9.63 186	27	9.67 589	33	0.32 411	9.95 597	6	38	3 1.4 1.3
23	9.63 213	27	9.67 622	33	0.32 378	9.95 591	6	37	4 1.8 1.7
24	9.63 239	26	9.67 654	33	0.32 346	9.95 585	6	36	5 2.2 2.2
25	9.63 266	26	9.67 687	32	0.32 313	9.95 579	6	35	6 2.7 2.6
26	9.63 292	27	9.67 719	32	0.32 281	9.95 573	6	34	7 3.2 3.0
27	9.63 319	27	9.67 752	33	0.32 248	9.95 567	6	33	8 3.6 3.5
28	9.63 345	26	9.67 785	33	0.32 215	9.95 561	6	32	9 4.0 3.9
29	9.63 372	27	9.67 817	32	0.32 183	9.95 555	6	31	10 4.5 4.3
30	9.63 398	26	9.67 850	33	0.32 150	9.95 549	6	30	20 9.0 8.7
31	9.63 425	27	9.67 882	32	0.32 118	9.95 543	6	29	30 13.5 13.0
32	9.63 451	26	9.67 915	33	0.32 085	9.95 537	6	28	40 18.0 17.3
33	9.63 478	27	9.67 947	32	0.32 053	9.95 531	6	27	50 22.5 21.7
34	9.63 504	26	9.67 980	32	0.32 020	9.95 525	6	26	
35	9.63 531	27	9.68 012	32	0.31 988	9.95 519	6	25	7 6 5
36	9.63 557	26	9.68 044	32	0.31 956	9.95 513	6	24	1 0.1 0.1
37	9.63 583	27	9.68 077	33	0.31 923	9.95 507	6	23	2 0.2 0.2
38	9.63 610	26	9.68 109	32	0.31 891	9.95 500	6	22	3 0.4 0.3
39	9.63 636	26	9.68 142	33	0.31 858	9.95 494	6	21	4 0.5 0.4
40	9.63 662	27	9.68 174	32	0.31 826	9.95 488	6	20	5 0.6 0.5
41	9.63 689	26	9.68 206	32	0.31 794	9.95 482	6	19	6 0.7 0.6
42	9.63 715	27	9.68 239	33	0.31 761	9.95 476	6	18	7 0.8 0.7
43	9.63 741	26	9.68 271	32	0.31 729	9.95 470	6	17	8 0.9 0.8
44	9.63 767	27	9.68 303	32	0.31 697	9.95 464	6	16	9 1.0 0.9
45	9.63 794	26	9.68 336	32	0.31 664	9.95 458	6	15	10 1.2 1.0
46	9.63 820	27	9.68 368	32	0.31 632	9.95 452	6	14	11 2.3 2.0
47	9.63 846	26	9.68 400	32	0.31 600	9.95 446	6	13	12 3.0 2.7
48	9.63 872	27	9.68 432	33	0.31 568	9.95 440	6	12	13 3.5 3.0
49	9.63 898	26	9.68 465	32	0.31 535	9.95 434	6	11	14 4.0 3.3
50	9.63 924	27	9.68 497	32	0.31 503	9.95 427	6	10	15 4.7 4.0
51	9.63 950	26	9.68 529	32	0.31 471	9.95 421	6	9	16 5.8 5.0
52	9.63 976	27	9.68 561	32	0.31 439	9.95 415	6	8	
53	9.64 002	26	9.68 593	32	0.31 407	9.95 409	6	7	7 32 33
54	9.64 028	27	9.68 626	33	0.31 374	9.95 403	6	6	1 2.3 2.7
55	9.64 054	26	9.68 658	32	0.31 342	9.95 397	6	5	2 6.9 8.0
56	9.64 080	27	9.68 690	32	0.31 310	9.95 391	6	4	3 11.4 13.3
57	9.64 106	26	9.68 722	32	0.31 278	9.95 384	6	3	4 16.0 18.7
58	9.64 132	27	9.68 754	32	0.31 246	9.95 378	6	2	5 20.6 24.0
59	9.64 158	26	9.68 786	32	0.31 214	9.95 372	6	1	6 25.1 29.3
60	9.64 184	27	9.68 818	32	0.31 182	9.95 366	6	0	7 29.7 — —
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P.P.

115° (295°)

(244°) 64°

LOGARITHMS OF THE FUNCTIONS (Continued)

26° (206°)

(333°) 153°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P.P.		
0	9.64 184		9.68 818		0.31 182	9.95 366		60			
1	9.64 210	26	9.68 850	32	0.31 150	9.95 360	6	59	"	31	
2	9.64 236	26	9.68 882	32	0.31 118	9.95 354	6	58	1	0.5	0.5
3	9.64 262	26	9.68 914	32	0.31 086	9.95 348	6	57	2	1.1	1.0
4	9.64 288	26	9.68 946	32	0.31 054	9.95 341	7	56	3	1.6	1.6
5	9.64 313	25	9.68 978	32	0.31 022	9.95 335	6	55	4	2.1	2.1
6	9.64 339	26	9.69 010	32	0.30 990	9.95 329	6	54	5	2.7	2.6
7	9.64 365	26	9.69 042	32	0.30 958	9.95 323	6	53	6	3.2	3.1
8	9.64 391	26	9.69 074	32	0.30 926	9.95 317	6	52	7	3.7	3.6
9	9.64 417	25	9.69 106	32	0.30 894	9.95 310	7	51	8	4.3	4.1
10	9.64 442	26	9.69 138	32	0.30 862	9.95 304	6	50	9	4.8	4.6
11	9.64 468	26	9.69 170	32	0.30 830	9.95 298	6	49	10	5.3	5.2
12	9.64 494	26	9.69 202	32	0.30 798	9.95 292	6	48	20	10.7	10.3
13	9.64 519	25	9.69 234	32	0.30 766	9.95 286	6	47	30	16.0	15.5
14	9.64 545	26	9.69 266	32	0.30 734	9.95 279	7	46	40	21.3	20.7
15	9.64 571	25	9.69 298	32	0.30 702	9.95 273	6	45	50	26.7	25.8
16	9.64 596	26	9.69 329	31	0.30 671	9.95 267	6	44			
17	9.64 622	26	9.69 361	32	0.30 639	9.95 261	6	43	"	26	25
18	9.64 647	25	9.69 393	32	0.30 607	9.95 254	7	42	1	0.4	0.4
19	9.64 673	26	9.69 425	32	0.30 575	9.95 248	6	41	2	0.9	0.8
20	9.64 698	25	9.69 457	32	0.30 543	9.95 242	6	40	3	1.3	1.2
21	9.64 724	26	9.69 488	31	0.30 512	9.95 236	6	39	4	1.7	1.7
22	9.64 749	25	9.69 520	32	0.30 480	9.95 229	7	38	5	2.2	2.1
23	9.64 775	26	9.69 552	32	0.30 448	9.95 223	6	37	6	2.6	2.5
24	9.64 800	25	9.69 584	32	0.30 416	9.95 217	6	36	7	3.0	2.9
25	9.64 826	26	9.69 616	31	0.30 385	9.95 211	6	35	8	3.5	3.3
26	9.64 851	25	9.69 647	32	0.30 353	9.95 204	7	34	9	3.9	3.8
27	9.64 877	26	9.69 679	32	0.30 321	9.95 198	6	33	10	4.3	4.2
28	9.64 902	25	9.69 710	31	0.30 290	9.95 192	6	32	20	8.7	8.3
29	9.64 927	26	9.69 742	32	0.30 258	9.95 185	7	31	30	13.0	12.5
30	9.64 953	25	9.69 774	32	0.30 226	9.95 179	6	30	40	17.3	16.7
31	9.64 978	26	9.69 805	31	0.30 195	9.95 173	6	29	50	21.7	20.8
32	9.65 003	25	9.69 837	32	0.30 163	9.95 167	6	28			
33	9.65 029	26	9.69 868	31	0.30 132	9.95 160	6	27	"	7	6
34	9.65 054	25	9.69 900	32	0.30 100	9.95 154	6	26	1	0.1	0.1
35	9.65 079	26	9.69 932	32	0.30 068	9.95 148	6	25	2	0.2	0.2
36	9.65 104	25	9.69 963	31	0.30 037	9.95 141	7	24	3	0.4	0.3
37	9.65 130	26	9.69 995	32	0.30 005	9.95 135	6	23	4	0.5	0.4
38	9.65 155	25	9.70 026	31	0.29 974	9.95 129	6	22	5	0.6	0.5
39	9.65 180	26	9.70 058	32	0.29 942	9.95 122	7	21	6	0.7	0.6
40	9.65 205	25	9.70 089	31	0.29 911	9.95 116	6	20	7	0.8	0.7
41	9.65 230	26	9.70 121	32	0.29 879	9.95 110	6	19	8	0.9	0.8
42	9.65 255	25	9.70 152	31	0.29 848	9.95 103	7	18	9	1.0	0.9
43	9.65 281	26	9.70 184	32	0.29 816	9.95 097	6	17	10	1.2	1.0
44	9.65 306	25	9.70 215	31	0.29 785	9.95 090	7	16	20	2.3	2.0
45	9.65 331	26	9.70 247	32	0.29 753	9.95 084	6	15	30	3.5	3.0
46	9.65 356	25	9.70 278	31	0.29 722	9.95 078	6	14	40	4.7	4.0
47	9.65 381	26	9.70 309	32	0.29 691	9.95 071	7	13	50	5.8	5.0
48	9.65 406	25	9.70 341	31	0.29 659	9.95 065	6	12			
49	9.65 431	26	9.70 372	32	0.29 628	9.95 059	7	11			
50	9.65 456	25	9.70 404	31	0.29 596	9.95 052	6	10			
51	9.65 481	26	9.70 435	32	0.29 565	9.95 046	7	9	7	32	31
52	9.65 506	25	9.70 466	31	0.29 534	9.95 039	6	8	0	2.3	2.2
53	9.65 531	26	9.70 498	32	0.29 502	9.95 033	7	7	1	6.9	6.6
54	9.65 556	25	9.70 529	31	0.29 471	9.95 027	6	6	2	11.4	11.1
55	9.65 580	26	9.70 560	32	0.29 440	9.95 020	7	5	3	16.0	15.5
56	9.65 605	25	9.70 592	31	0.29 408	9.95 014	6	4	4	20.6	19.9
57	9.65 630	26	9.70 623	32	0.29 377	9.95 007	7	3	5	25.1	24.4
58	9.65 655	25	9.70 654	31	0.29 346	9.95 001	6	2	6	29.7	28.8
59	9.65 680	26	9.70 685	32	0.29 315	9.94 995	7	1	7		
60	9.65 705	25	9.70 717	31	0.29 283	9.94 988	6	0			
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P.P.		

116° (296°)

(243°) 63°

LOGARITHMS OF THE FUNCTIONS (Continued)

27° (207°)

(332°) 152°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P. P.
0	9.65 705		9.70 717	31	0.29 283	9.94 988	6	60	
1	9.65 729	24	9.70 748	31	0.29 252	9.94 982	7	59	" 32 31 30
2	9.65 754	25	9.70 779	31	0.29 221	9.94 975	7	58	1 0.5 0.5 0.5
3	9.65 779	25	9.70 810	31	0.29 190	9.94 969	6	57	2 1.1 1.0 1.0
4	9.65 804	25	9.70 841	31	0.29 159	9.94 962	7	56	3 1.6 1.6 1.5
5	9.65 828	24	9.70 873	32	0.29 127	9.94 956	6	55	4 2.1 2.1 2.0
6	9.65 853	25	9.70 904	31	0.29 096	9.94 949	7	54	5 2.7 2.6 2.5
7	9.65 878	25	9.70 935	31	0.29 065	9.94 943	6	53	6 3.2 3.1 3.0
8	9.65 902	24	9.70 966	31	0.29 034	9.94 936	7	52	7 3.7 3.6 3.5
9	9.65 927	25	9.70 997	31	0.29 003	9.94 930	6	51	8 4.3 4.1 4.0
10	9.65 952	25	9.71 028	31	0.28 972	9.94 923	7	50	9 4.8 4.6 4.5
11	9.65 976	24	9.71 059	31	0.28 941	9.94 917	6	49	10 5.3 5.2 5.0
12	9.66 001	25	9.71 090	31	0.28 910	9.94 911	6	48	20 10.7 10.3 10.0
13	9.66 025	24	9.71 121	31	0.28 879	9.94 904	7	47	30 16.0 15.5 15.0
14	9.66 050	25	9.71 153	32	0.28 847	9.94 898	6	46	40 21.3 20.7 20.0
15	9.66 075	24	9.71 184	31	0.28 816	9.94 891	7	45	50 26.7 25.8 25.0
16	9.66 099	25	9.71 215	31	0.28 785	9.94 885	6	44	
17	9.66 124	24	9.71 246	31	0.28 754	9.94 878	7	43	" 25 24 23
18	9.66 148	25	9.71 277	31	0.28 723	9.94 871	7	42	1 0.4 0.4 0.4
19	9.66 173	24	9.71 308	31	0.28 692	9.94 865	6	41	2 0.8 0.8 0.8
20	9.66 197	25	9.71 339	31	0.28 661	9.94 858	7	40	3 1.2 1.2 1.2
21	9.66 221	24	9.71 370	31	0.28 630	9.94 852	6	39	4 1.7 1.6 1.5
22	9.66 246	25	9.71 401	31	0.28 599	9.94 845	7	38	5 2.1 2.0 1.9
23	9.66 270	24	9.71 431	30	0.28 569	9.94 839	6	37	6 2.5 2.4 2.3
24	9.66 295	25	9.71 462	31	0.28 538	9.94 832	7	36	7 2.9 2.8 2.7
25	9.66 319	24	9.71 493	31	0.28 507	9.94 826	6	35	8 3.3 3.2 3.1
26	9.66 343	25	9.71 524	31	0.28 476	9.94 819	7	34	9 3.8 3.6 3.4
27	9.66 368	24	9.71 555	31	0.28 445	9.94 813	6	33	10 4.2 4.0 3.8
28	9.66 392	25	9.71 586	31	0.28 414	9.94 806	7	32	20 8.3 8.0 7.7
29	9.66 416	24	9.71 617	31	0.28 383	9.94 799	6	31	30 12.5 12.0 11.5
30	9.66 441	25	9.71 648	31	0.28 352	9.94 793	7	30	40 16.7 16.0 15.3
31	9.66 465	24	9.71 679	30	0.28 321	9.94 786	6	29	50 20.8 20.0 19.2
32	9.66 489	25	9.71 709	31	0.28 291	9.94 780	7	28	
33	9.66 513	24	9.71 740	31	0.28 260	9.94 773	6	27	" 7 6
34	9.66 537	25	9.71 771	31	0.28 229	9.94 767	7	26	1 0.1 0.1
35	9.66 562	24	9.71 802	31	0.28 198	9.94 760	6	25	2 0.2 0.2
36	9.66 586	25	9.71 833	31	0.28 167	9.94 753	7	24	3 0.4 0.3
37	9.66 610	24	9.71 863	30	0.28 137	9.94 747	6	23	4 0.5 0.4
38	9.66 634	25	9.71 894	31	0.28 106	9.94 740	7	22	5 0.6 0.5
39	9.66 658	24	9.71 925	31	0.28 075	9.94 734	6	21	6 0.7 0.6
40	9.66 682	25	9.71 955	30	0.28 045	9.94 727	7	20	7 0.8 0.7
41	9.66 706	24	9.71 986	31	0.28 014	9.94 720	6	19	8 0.9 0.8
42	9.66 731	25	9.72 017	31	0.27 983	9.94 714	7	18	9 1.0 0.9
43	9.66 755	24	9.72 048	30	0.27 952	9.94 707	6	17	10 1.2 1.0
44	9.66 779	25	9.72 078	31	0.27 922	9.94 700	7	16	20 2.3 2.0
45	9.66 803	24	9.72 109	31	0.27 891	9.94 694	6	15	30 3.5 3.0
46	9.66 827	25	9.72 140	31	0.27 860	9.94 687	7	14	40 4.7 4.0
47	9.66 851	24	9.72 170	30	0.27 830	9.94 680	6	13	50 5.8 5.0
48	9.66 875	25	9.72 201	31	0.27 799	9.94 674	7	12	
49	9.66 899	24	9.72 231	30	0.27 769	9.94 667	6	11	
50	9.66 922	25	9.72 262	31	0.27 738	9.94 660	7	10	7 6 6
51	9.66 946	24	9.72 293	31	0.27 707	9.94 654	6	9	30 31 30
52	9.66 970	25	9.72 323	30	0.27 677	9.94 647	7	8	
53	9.66 994	24	9.72 354	31	0.27 646	9.94 640	6	7	0 2.1 2.6 2.5
54	9.67 018	25	9.72 384	31	0.27 616	9.94 634	7	6	1 6.4 7.8 7.5
55	9.67 042	24	9.72 415	30	0.27 585	9.94 627	6	5	2 10.7 12.9 12.5
56	9.67 066	25	9.72 445	31	0.27 555	9.94 620	7	4	3 15.0 18.1 17.5
57	9.67 090	24	9.72 476	30	0.27 524	9.94 614	6	3	4 19.3 23.2 22.5
58	9.67 113	25	9.72 506	31	0.27 494	9.94 607	7	2	5 23.6 28.4 27.5
59	9.67 137	24	9.72 537	30	0.27 463	9.94 600	6	1	6 27.9 — —
60	9.67 161	25	9.72 567	31	0.27 433	9.94 593	7	0	
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P. P.

117° (297°)

(242°) 62°

LOGARITHMS OF THE FUNCTIONS (Continued)

28° (208°)

(331°) 151°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.
0	9.67 161		9.72 567	31	0.27 433	9.94 593	6	50	
1	9.67 185	24	9.72 598	30	0.27 402	9.94 587	7	59	" 31 11 29
2	9.67 208	23	9.72 628	30	0.27 372	9.94 580	7	58	1 0.5 0.5 0.5
3	9.67 232	24	9.72 659	31	0.27 341	9.94 573	7	57	2 1.0 1.0 1.0
4	9.67 256	24	9.72 689	30	0.27 311	9.94 567	7	56	3 1.6 1.5 1.4
5	9.67 280	24	9.72 720	31	0.27 280	9.94 560	7	55	4 2.1 2.0 1.9
6	9.67 303	23	9.72 750	30	0.27 250	9.94 553	7	54	5 2.6 2.5 2.4
7	9.67 327	24	9.72 780	30	0.27 220	9.94 546	7	53	6 3.1 3.0 2.9
8	9.67 350	23	9.72 811	31	0.27 189	9.94 540	6	52	7 3.6 3.5 3.4
9	9.67 374	24	9.72 841	31	0.27 159	9.94 533	7	51	8 4.1 4.0 3.9
10	9.67 398	24	9.72 872	30	0.27 128	9.94 526	7	50	9 4.6 4.5 4.4
11	9.67 421	23	9.72 902	30	0.27 098	9.94 519	6	49	10 5.2 5.0 4.8
12	9.67 445	24	9.72 932	30	0.27 068	9.94 513	6	48	20 10.3 10.0 9.7
13	9.67 468	23	9.72 963	31	0.27 037	9.94 506	7	47	30 15.5 15.0 14.5
14	9.67 492	24	9.72 993	30	0.27 007	9.94 499	7	46	40 20.7 20.0 19.3
15	9.67 515	23	9.73 023	30	0.26 977	9.94 492	7	45	50 25.8 25.0 24.2
16	9.67 539	24	9.73 054	31	0.26 946	9.94 486	7	44	" 24 23 22
17	9.67 562	23	9.73 084	30	0.26 916	9.94 479	7	43	1 0.4 0.4 0.4
18	9.67 586	24	9.73 114	30	0.26 886	9.94 472	7	42	2 0.8 0.8 0.7
19	9.67 609	23	9.73 144	31	0.26 856	9.94 465	7	41	3 1.2 1.2 1.1
20	9.67 633	24	9.73 175	30	0.26 825	9.94 458	7	40	4 1.6 1.6 1.5
21	9.67 656	23	9.73 205	30	0.26 795	9.94 451	6	39	5 2.0 1.9 1.8
22	9.67 680	24	9.73 236	30	0.26 765	9.94 445	6	38	6 2.4 2.3 2.2
23	9.67 703	23	9.73 266	30	0.26 735	9.94 438	7	37	7 2.8 2.7 2.6
24	9.67 726	24	9.73 296	31	0.26 705	9.94 431	7	36	8 3.2 3.1 2.9
25	9.67 750	23	9.73 326	30	0.26 674	9.94 424	7	35	9 3.6 3.4 3.3
26	9.67 773	24	9.73 356	30	0.26 644	9.94 417	7	34	10 4.0 3.8 3.7
27	9.67 796	23	9.73 386	30	0.26 614	9.94 410	6	33	20 8.0 7.7 7.3
28	9.67 820	24	9.73 416	30	0.26 584	9.94 404	6	32	30 12.0 11.5 11.0
29	9.67 843	23	9.73 446	30	0.26 554	9.94 397	7	31	40 16.0 15.3 14.7
30	9.67 866	24	9.73 476	31	0.26 524	9.94 390	7	30	50 20.0 19.2 18.3
31	9.67 890	23	9.73 507	30	0.26 493	9.94 383	7	29	
32	9.67 913	24	9.73 537	30	0.26 463	9.94 376	7	28	
33	9.67 936	23	9.73 567	30	0.26 433	9.94 369	7	27	" 7 1 1
34	9.67 959	24	9.73 597	30	0.26 403	9.94 362	7	26	1 0.1 0.1
35	9.67 982	23	9.73 627	30	0.26 373	9.94 355	7	25	2 0.2 0.2
36	9.68 006	24	9.73 657	30	0.26 343	9.94 349	6	24	3 0.4 0.3
37	9.68 029	23	9.73 687	30	0.26 313	9.94 342	7	23	4 0.5 0.4
38	9.68 052	24	9.73 717	30	0.26 283	9.94 335	7	22	5 0.6 0.5
39	9.68 075	23	9.73 747	30	0.26 253	9.94 328	7	21	6 0.7 0.6
40	9.68 098	24	9.73 777	30	0.26 223	9.94 321	7	20	7 0.8 0.7
41	9.68 121	23	9.73 807	30	0.26 193	9.94 314	7	19	8 0.9 0.8
42	9.68 144	24	9.73 837	30	0.26 163	9.94 307	7	18	9 1.0 0.9
43	9.68 167	23	9.73 867	30	0.26 133	9.94 300	7	17	10 1.2 1.0
44	9.68 190	24	9.73 897	30	0.26 103	9.94 293	7	16	20 2.3 2.0
45	9.68 213	23	9.73 927	30	0.26 073	9.94 286	7	15	30 3.5 3.0
46	9.68 237	24	9.73 957	30	0.26 043	9.94 279	7	14	40 4.7 4.0
47	9.68 260	23	9.73 987	30	0.26 013	9.94 273	6	13	50 5.8 5.0
48	9.68 283	24	9.74 017	30	0.25 983	9.94 266	7	12	
49	9.68 306	23	9.74 047	30	0.25 953	9.94 259	7	11	
50	9.68 328	24	9.74 077	30	0.25 923	9.94 252	7	10	" 7 6 6
51	9.68 351	23	9.74 107	30	0.25 893	9.94 245	7	9	1 2.2 2.6 2.5
52	9.68 374	24	9.74 137	30	0.25 863	9.94 238	7	8	2 6.6 7.8 7.5
53	9.68 397	23	9.74 166	29	0.25 834	9.94 231	7	7	3 11.1 12.9 12.5
54	9.68 420	24	9.74 196	30	0.25 804	9.94 224	7	6	4 15.5 18.1 17.5
55	9.68 443	23	9.74 226	30	0.25 774	9.94 217	7	5	5 19.9 23.2 22.5
56	9.68 466	24	9.74 256	30	0.25 744	9.94 210	7	4	6 24.4 28.4 27.5
57	9.68 489	23	9.74 286	30	0.25 714	9.94 203	7	3	7 28.8 — —
58	9.68 512	24	9.74 316	29	0.25 684	9.94 196	7	2	
59	9.68 534	23	9.74 346	30	0.25 655	9.94 189	7	1	
60	9.68 557	24	9.74 376	30	0.25 625	9.94 182	7	0	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.

118° (208°)

(241°) 61°

LOGARITHMS OF THE FUNCTIONS (Continued)

29° (209°)

(330°) 150°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.		
0	9.68 557	23	9.74 375	30	0.25 625	9.94 182	7	60			
1	9.68 580	23	9.74 405	30	0.25 595	9.94 175	7	59			
2	9.68 603	23	9.74 435	30	0.25 565	9.94 168	7	58			
3	9.68 625	23	9.74 465	30	0.25 535	9.94 161	7	57			
4	9.68 648	23	9.74 494	30	0.25 506	9.94 154	7	56			
5	9.68 671	23	9.74 524	30	0.25 476	9.94 147	7	55			
6	9.68 694	23	9.74 554	30	0.25 446	9.94 140	7	54			
7	9.68 716	22	9.74 583	29	0.25 417	9.94 133	7	53			
8	9.68 739	23	9.74 613	30	0.25 387	9.94 126	7	52			
9	9.68 762	23	9.74 643	30	0.25 357	9.94 119	7	51			
10	9.68 784	22	9.74 673	30	0.25 327	9.94 112	7	50			
11	9.68 807	23	9.74 702	29	0.25 298	9.94 105	7	49			
12	9.68 829	22	9.74 732	30	0.25 268	9.94 098	7	48			
13	9.68 852	23	9.74 762	30	0.25 238	9.94 090	8	47			
14	9.68 875	23	9.74 791	29	0.25 209	9.94 083	7	46			
15	9.68 897	22	9.74 821	30	0.25 179	9.94 076	7	45			
16	9.68 920	23	9.74 851	30	0.25 149	9.94 069	7	44			
17	9.68 942	22	9.74 880	29	0.25 120	9.94 062	7	43			
18	9.68 965	23	9.74 910	30	0.25 090	9.94 055	7	42			
19	9.68 987	22	9.74 939	29	0.25 061	9.94 048	7	41			
20	9.69 010	23	9.74 969	30	0.25 031	9.94 041	7	40			
21	9.69 032	22	9.74 998	29	0.25 002	9.94 034	7	39			
22	9.69 055	23	9.75 028	30	0.24 972	9.94 027	7	38			
23	9.69 077	22	9.75 058	30	0.24 942	9.94 020	7	37			
24	9.69 100	23	9.75 087	29	0.24 913	9.94 012	8	36			
25	9.69 122	22	9.75 117	30	0.24 883	9.94 005	7	35			
26	9.69 144	23	9.75 146	29	0.24 854	9.93 998	7	34			
27	9.69 167	22	9.75 176	30	0.24 824	9.93 991	7	33			
28	9.69 189	23	9.75 205	29	0.24 795	9.93 984	7	32			
29	9.69 212	22	9.75 235	30	0.24 765	9.93 977	7	31			
30	9.69 234	23	9.75 264	29	0.24 736	9.93 970	7	30			
31	9.69 256	22	9.75 294	30	0.24 706	9.93 963	7	29			
32	9.69 279	23	9.75 323	29	0.24 677	9.93 956	8	28			
33	9.69 301	22	9.75 353	30	0.24 647	9.93 948	7	27			
34	9.69 323	23	9.75 382	29	0.24 618	9.93 941	7	26			
35	9.69 345	22	9.75 411	30	0.24 589	9.93 934	7	25			
36	9.69 368	23	9.75 441	29	0.24 559	9.93 927	7	24			
37	9.69 390	22	9.75 470	30	0.24 530	9.93 920	8	23			
38	9.69 412	23	9.75 500	29	0.24 500	9.93 912	8	22			
39	9.69 434	22	9.75 529	30	0.24 471	9.93 905	7	21			
40	9.69 456	23	9.75 558	29	0.24 442	9.93 898	7	20			
41	9.69 479	22	9.75 588	30	0.24 412	9.93 891	7	19			
42	9.69 501	23	9.75 617	29	0.24 383	9.93 884	8	18			
43	9.69 523	22	9.75 647	30	0.24 353	9.93 876	7	17			
44	9.69 545	23	9.75 676	29	0.24 324	9.93 869	7	16			
45	9.69 567	22	9.75 705	30	0.24 295	9.93 862	7	15			
46	9.69 589	23	9.75 735	29	0.24 265	9.93 855	7	14			
47	9.69 611	22	9.75 764	30	0.24 236	9.93 847	8	13			
48	9.69 633	23	9.75 793	29	0.24 207	9.93 840	7	12			
49	9.69 655	22	9.75 822	30	0.24 178	9.93 833	7	11			
50	9.69 677	23	9.75 852	29	0.24 148	9.93 826	7	10			
51	9.69 699	22	9.75 881	30	0.24 119	9.93 819	8	9			
52	9.69 721	23	9.75 910	29	0.24 090	9.93 811	7	8			
53	9.69 743	22	9.75 939	30	0.24 061	9.93 804	7	7			
54	9.69 765	23	9.75 969	29	0.24 031	9.93 797	8	6			
55	9.69 787	22	9.75 998	30	0.24 002	9.93 789	7	5			
56	9.69 809	23	9.76 027	29	0.23 973	9.93 782	7	4			
57	9.69 831	22	9.76 056	30	0.23 944	9.93 775	7	3			
58	9.69 853	23	9.76 086	29	0.23 914	9.93 768	8	2			
59	9.69 875	22	9.76 115	30	0.23 885	9.93 760	7	1			
60	9.69 897	23	9.76 144	29	0.23 856	9.93 753	7	0			
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.		

119° (299°)

(240°) 60°

LOGARITHMS OF THE FUNCTIONS (Continued)

33° (210°)

(329°) 149°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P.P.
0	9.69 897	22	9.76 144	29	0.23 856	9.93 753	7	60	
1	9.69 919	22	9.76 173	29	0.23 827	9.93 746	8	59	" 30 29 28
2	9.69 941	22	9.76 202	29	0.23 798	9.93 738	9	58	1 0.5 0.5 0.5
3	9.69 963	22	9.76 231	30	0.23 769	9.93 731	7	57	2 1.0 1.0 0.9
4	9.69 984	22	9.76 261	29	0.23 739	9.93 724	7	56	3 1.5 1.4 1.4
5	9.70 006	22	9.76 290	29	0.23 710	9.93 717	8	55	4 2.0 1.9 1.9
6	9.70 028	22	9.76 319	29	0.23 681	9.93 709	8	54	5 2.5 2.4 2.3
7	9.70 050	22	9.76 348	29	0.23 652	9.93 702	7	53	6 3.0 2.9 2.8
8	9.70 072	22	9.76 377	29	0.23 623	9.93 695	7	52	7 3.5 3.4 3.3
9	9.70 093	22	9.76 406	29	0.23 594	9.93 687	8	51	8 4.0 3.9 3.7
10	9.70 115	22	9.76 435	29	0.23 565	9.93 680	7	50	9 4.5 4.4 4.2
11	9.70 137	22	9.76 464	29	0.23 536	9.93 673	8	49	10 5.0 4.8 4.7
12	9.70 159	22	9.76 493	29	0.23 507	9.93 665	8	48	20 10.0 9.7 9.3
13	9.70 180	22	9.76 522	29	0.23 478	9.93 658	7	47	30 15.0 14.5 14.0
14	9.70 202	22	9.76 551	29	0.23 449	9.93 650	8	46	40 20.0 19.3 18.7
15	9.70 224	21	9.76 580	29	0.23 420	9.93 643	7	45	50 25.0 24.2 23.3
16	9.70 246	22	9.76 609	30	0.23 391	9.93 636	7	44	
17	9.70 267	22	9.76 639	30	0.23 361	9.93 628	8	43	" 33 31
18	9.70 288	22	9.76 668	29	0.23 332	9.93 621	7	42	1 0.4 0.4
19	9.70 310	22	9.76 697	28	0.23 303	9.93 614	7	41	2 0.7 0.7
20	9.70 332	21	9.76 726	29	0.23 275	9.93 606	8	40	3 1.1 1.0
21	9.70 353	21	9.76 754	29	0.23 246	9.93 599	7	39	4 1.5 1.4
22	9.70 375	22	9.76 783	29	0.23 217	9.93 591	8	38	5 1.8 1.8
23	9.70 396	21	9.76 812	29	0.23 188	9.93 584	7	37	6 2.2 2.1
24	9.70 418	22	9.76 841	29	0.23 159	9.93 577	7	36	7 2.6 2.4
25	9.70 439	22	9.76 870	29	0.23 130	9.93 569	8	35	8 2.9 2.8
26	9.70 461	21	9.76 899	29	0.23 101	9.93 562	7	34	9 3.3 3.2
27	9.70 482	22	9.76 928	29	0.23 072	9.93 554	8	33	10 3.7 3.5
28	9.70 504	22	9.76 957	29	0.23 043	9.93 547	7	32	20 7.3 7.0
29	9.70 525	21	9.76 986	29	0.23 014	9.93 539	8	31	30 11.0 10.5
30	9.70 547	22	9.77 015	29	0.22 985	9.93 532	7	30	40 14.7 14.0
31	9.70 568	21	9.77 044	29	0.22 956	9.93 525	7	29	50 18.3 17.5
32	9.70 590	22	9.77 073	28	0.22 927	9.93 517	8	28	" 8 7
33	9.70 611	22	9.77 101	29	0.22 899	9.93 510	7	27	1 0.1 0.1
34	9.70 633	21	9.77 130	29	0.22 870	9.93 502	8	26	2 0.3 0.2
35	9.70 654	21	9.77 159	29	0.22 841	9.93 495	7	25	3 0.4 0.4
36	9.70 675	22	9.77 188	29	0.22 812	9.93 487	8	24	4 0.5 0.5
37	9.70 697	21	9.77 217	29	0.22 783	9.93 480	7	23	5 0.7 0.6
38	9.70 718	21	9.77 246	28	0.22 754	9.93 472	8	22	6 0.8 0.7
39	9.70 739	22	9.77 274	29	0.22 726	9.93 465	7	21	7 0.9 0.8
40	9.70 761	21	9.77 303	29	0.22 697	9.93 457	8	20	8 1.1 0.9
41	9.70 782	21	9.77 332	29	0.22 668	9.93 450	7	19	9 1.2 1.0
42	9.70 803	21	9.77 361	29	0.22 639	9.93 442	8	18	10 1.3 1.2
43	9.70 824	22	9.77 390	28	0.22 610	9.93 435	7	17	20 2.7 2.3
44	9.70 846	21	9.77 418	29	0.22 582	9.93 427	8	16	30 4.0 3.5
45	9.70 867	21	9.77 447	29	0.22 553	9.93 420	7	15	40 5.3 4.7
46	9.70 888	21	9.77 476	29	0.22 524	9.93 412	8	14	50 6.7 5.8
47	9.70 909	22	9.77 505	28	0.22 495	9.93 405	7	13	
48	9.70 931	21	9.77 533	29	0.22 467	9.93 397	8	12	
49	9.70 952	21	9.77 562	29	0.22 438	9.93 390	7	11	
50	9.70 973	21	9.77 591	28	0.22 409	9.93 382	8	10	7 7 7
51	9.70 994	21	9.77 619	29	0.22 381	9.93 375	7	9	30 29 28
52	9.71 015	22	9.77 648	29	0.22 352	9.93 367	8	8	1 2.1 2.1 2.0
53	9.71 036	22	9.77 677	29	0.22 323	9.93 360	7	7	2 6.4 6.2 6.0
54	9.71 058	21	9.77 706	28	0.22 294	9.93 352	8	6	3 10.7 10.4 10.0
55	9.71 079	21	9.77 734	29	0.22 266	9.93 344	7	5	4 15.0 14.5 14.0
56	9.71 100	21	9.77 763	28	0.22 237	9.93 337	8	4	5 19.3 18.6 18.0
57	9.71 121	21	9.77 791	29	0.22 209	9.93 329	7	3	6 23.6 22.8 22.0
58	9.71 142	21	9.77 820	29	0.22 180	9.93 322	8	2	7 27.9 26.9 26.0
59	9.71 163	21	9.77 849	28	0.22 151	9.93 314	7	1	
60	9.71 184	21	9.77 877	28	0.22 123	9.93 307	7	0	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P.P.

120° (300°)

(239°) 59°

LOGARITHMS OF THE FUNCTIONS (Continued)

31° (211°)

(328°) 148°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P.P.
0	9.71 184		9.77 877		0.22 123	9.93 307		60	
1	9.71 205	21	9.77 906	29	0.22 094	9.93 299	8	59	■ ■ ■
2	9.71 226	21	9.77 935	29	0.22 065	9.93 291	8	58	1 0.5 0.8
3	9.71 247	21	9.77 963	28	0.22 037	9.93 284	7	57	2 1.0 0.9
4	9.71 268	21	9.77 992	29	0.22 008	9.93 276	8	56	3 1.4 1.4
5	9.71 289	21	9.78 020	28	0.21 980	9.93 269	7	55	4 1.9 1.9
6	9.71 310	21	9.78 049	29	0.21 951	9.93 261	8	54	5 2.4 2.3
7	9.71 331	21	9.78 077	28	0.21 923	9.93 253	8	53	6 2.9 2.8
8	9.71 352	21	9.78 106	29	0.21 894	9.93 246	7	52	7 3.4 3.3
9	9.71 373	21	9.78 135	29	0.21 865	9.93 238	8	51	8 3.9 3.7
		20		28			8		9 4.4 4.2
10	9.71 393	21	9.78 163	29	0.21 837	9.93 230	7	50	10 4.8 4.7
11	9.71 414	21	9.78 192	28	0.21 808	9.93 223	8	49	20 9.7 9.3
12	9.71 435	21	9.78 220	29	0.21 780	9.93 215	8	48	30 14.5 14.0
13	9.71 456	21	9.78 249	29	0.21 751	9.93 207	7	47	40 19.3 18.7
14	9.71 477	21	9.78 277	28	0.21 723	9.93 200	8	46	50 24.2 23.3
15	9.71 498	21	9.78 306	28	0.21 694	9.93 192	8	45	
16	9.71 519	21	9.78 334	28	0.21 666	9.93 184	8	44	■ 21 20
17	9.71 539	20	9.78 363	29	0.21 637	9.93 177	7	43	1 0.4 0.3
18	9.71 560	21	9.78 391	28	0.21 609	9.93 169	8	42	2 0.7 0.7
19	9.71 581	21	9.78 419	28	0.21 581	9.93 161	8	41	3 1.0 1.0
		21		29			7		4 1.4 1.3
20	9.71 602	20	9.78 448	28	0.21 552	9.93 154	8	40	5 1.8 1.7
21	9.71 622	21	9.78 476	29	0.21 524	9.93 146	8	39	6 2.1 2.0
22	9.71 643	21	9.78 505	29	0.21 495	9.93 138	8	38	7 2.4 2.3
23	9.71 664	21	9.78 533	28	0.21 467	9.93 131	7	37	8 2.8 2.7
24	9.71 685	21	9.78 562	29	0.21 438	9.93 123	8	36	9 3.2 3.0
		20		28			7		10 3.5 3.3
25	9.71 706	21	9.78 590	28	0.21 410	9.93 115	8	35	20 7.0 6.7
26	9.71 726	21	9.78 618	28	0.21 382	9.93 108	8	34	30 10.5 10.0
27	9.71 747	21	9.78 647	29	0.21 353	9.93 100	8	33	40 14.0 13.3
28	9.71 767	20	9.78 675	28	0.21 325	9.93 092	8	32	50 17.5 16.7
29	9.71 788	21	9.78 704	29	0.21 296	9.93 084	7	31	
		21		28			8		■ 8 7
30	9.71 809	20	9.78 732	28	0.21 268	9.93 077	8	30	1 0.1 0.1
31	9.71 829	21	9.78 760	29	0.21 240	9.93 069	8	29	2 0.3 0.2
32	9.71 850	21	9.78 789	29	0.21 211	9.93 061	8	28	3 0.4 0.4
33	9.71 870	20	9.78 817	28	0.21 183	9.93 053	8	27	4 0.5 0.5
34	9.71 891	21	9.78 845	28	0.21 155	9.93 046	7	26	5 0.7 0.6
		20		29			8		6 0.8 0.7
35	9.71 911	21	9.78 874	28	0.21 126	9.93 038	8	25	7 0.9 0.8
36	9.71 932	21	9.78 902	28	0.21 098	9.93 030	8	24	8 1.1 0.9
37	9.71 952	20	9.78 930	28	0.21 070	9.93 022	8	23	9 1.2 1.0
38	9.71 973	21	9.78 959	29	0.21 041	9.93 014	8	22	10 1.3 1.2
39	9.71 994	21	9.78 987	28	0.21 013	9.93 007	7	21	20 2.7 2.3
		20		29			8		30 4.0 3.5
40	9.72 014	20	9.79 015	28	0.20 985	9.92 999	8	20	40 5.3 4.7
41	9.72 034	21	9.79 043	28	0.20 957	9.92 991	8	19	50 6.7 5.8
42	9.72 055	21	9.79 072	29	0.20 928	9.92 983	8	18	
43	9.72 075	20	9.79 100	28	0.20 900	9.92 976	7	17	
44	9.72 096	21	9.79 128	28	0.20 872	9.92 968	8	16	
		20		29			8		
45	9.72 116	21	9.79 156	29	0.20 844	9.92 960	8	15	
46	9.72 137	20	9.79 185	28	0.20 815	9.92 952	8	14	
47	9.72 157	21	9.79 213	28	0.20 787	9.92 944	8	13	
48	9.72 177	20	9.79 241	28	0.20 759	9.92 936	8	12	
49	9.72 198	21	9.79 269	28	0.20 731	9.92 929	7	11	
		20		29			8		■ 8 8
50	9.72 218	20	9.79 297	28	0.20 703	9.92 921	8	10	1 1.9 1.8
51	9.72 238	21	9.79 326	28	0.20 674	9.92 913	8	9	2 5.6 5.4
52	9.72 259	21	9.79 354	28	0.20 646	9.92 905	8	8	3 9.4 9.1
53	9.72 279	20	9.79 382	28	0.20 618	9.92 897	7	7	4 13.1 12.7
54	9.72 299	21	9.79 410	28	0.20 590	9.92 889	8	6	5 16.9 16.3
		20		29			8		6 20.6 19.9
55	9.72 320	20	9.79 438	28	0.20 562	9.92 881	7	5	7 24.4 23.6
56	9.72 340	21	9.79 466	28	0.20 534	9.92 874	8	4	8 28.1 27.2
57	9.72 360	21	9.79 495	29	0.20 505	9.92 866	8	3	
58	9.72 381	20	9.79 523	28	0.20 477	9.92 858	8	2	
59	9.72 401	20	9.79 551	28	0.20 449	9.92 850	8	1	
		20		29			8		■ 0
60	9.72 421		9.79 579		0.20 421	9.92 842		0	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P.P.

121° (301°)

(238°) 58°

LOGARITHMS OF THE FUNCTIONS (Continued)

32° (212°)

(327°) 147°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P. P.
0	9.72 421	20	9.79 579	28	0.20 421	9.92 842	8	60	" 29 28 27
1	9.72 441	20	9.79 607	28	0.20 393	9.92 834	8	59	1 0.5 0.5 0.4
2	9.72 461	20	9.79 635	28	0.20 365	9.92 826	8	58	2 1.0 0.9 0.9
3	9.72 482	21	9.79 663	28	0.20 337	9.92 818	8	57	3 1.4 1.4 1.4
4	9.72 502	20	9.79 691	28	0.20 309	9.92 810	8	56	4 1.9 1.9 1.8
5	9.72 522	20	9.79 719	28	0.20 281	9.92 803	8	55	5 2.4 2.3 2.2
6	9.72 542	20	9.79 747	28	0.20 253	9.92 795	8	54	6 2.9 2.8 2.7
7	9.72 562	20	9.79 776	28	0.20 224	9.92 787	8	53	7 3.4 3.3 3.2
8	9.72 582	20	9.79 804	28	0.20 196	9.92 779	8	52	8 3.9 3.7 3.6
9	9.72 602	20	9.79 832	28	0.20 168	9.92 771	8	51	9 4.4 4.2 4.0
10	9.72 622	20	9.79 860	28	0.20 140	9.92 763	8	50	10 4.8 4.7 4.5
11	9.72 643	21	9.79 888	28	0.20 112	9.92 755	8	49	20 9.7 9.3 9.0
12	9.72 663	20	9.79 916	28	0.20 084	9.92 747	8	48	30 14.5 14.0 13.5
13	9.72 683	20	9.79 944	28	0.20 056	9.92 739	8	47	40 19.3 18.7 18.0
14	9.72 703	20	9.79 972	28	0.20 028	9.92 731	8	46	50 24.2 23.3 22.5
15	9.72 723	20	9.80 000	28	0.20 000	9.92 723	8	45	" 21 20 19
16	9.72 743	20	9.80 028	28	0.19 972	9.92 715	8	44	1 0.4 0.3 0.3
17	9.72 763	20	9.80 056	28	0.19 944	9.92 707	8	43	2 0.7 0.7 0.6
18	9.72 783	20	9.80 084	28	0.19 916	9.92 699	8	42	3 1.0 1.0 1.0
19	9.72 803	20	9.80 112	28	0.19 888	9.92 691	8	41	4 1.4 1.3 1.3
20	9.72 823	20	9.80 140	28	0.19 860	9.92 683	8	40	5 1.8 1.7 1.6
21	9.72 843	20	9.80 168	28	0.19 832	9.92 675	8	39	6 2.1 2.0 1.9
22	9.72 863	20	9.80 195	27	0.19 805	9.92 667	8	38	7 2.4 2.3 2.2
23	9.72 883	20	9.80 223	28	0.19 777	9.92 659	8	37	8 2.8 2.7 2.5
24	9.72 902	19	9.80 251	28	0.19 749	9.92 651	8	36	9 3.2 3.0 2.8
25	9.72 922	20	9.80 279	28	0.19 721	9.92 643	8	35	10 3.5 3.3 3.2
26	9.72 942	20	9.80 307	28	0.19 693	9.92 635	8	34	20 7.0 6.7 6.3
27	9.72 962	20	9.80 335	28	0.19 665	9.92 627	8	33	30 10.5 10.0 9.5
28	9.72 982	20	9.80 363	28	0.19 637	9.92 619	8	32	40 14.0 13.3 12.7
29	9.73 002	20	9.80 391	28	0.19 609	9.92 611	8	31	50 17.5 16.7 15.8
30	9.73 022	20	9.80 419	28	0.19 581	9.92 603	8	30	" 9 8 7
31	9.73 041	19	9.80 447	28	0.19 553	9.92 595	8	29	1 0.2 0.1 0.1
32	9.73 061	20	9.80 474	27	0.19 526	9.92 587	8	28	2 0.3 0.3 0.2
33	9.73 081	20	9.80 502	28	0.19 498	9.92 579	8	27	3 0.4 0.4 0.4
34	9.73 101	20	9.80 530	28	0.19 470	9.92 571	8	26	4 0.6 0.5 0.5
35	9.73 121	19	9.80 558	28	0.19 442	9.92 563	8	25	5 0.8 0.7 0.6
36	9.73 140	20	9.80 586	28	0.19 414	9.92 555	8	24	6 0.9 0.8 0.7
37	9.73 160	20	9.80 614	28	0.19 386	9.92 546	9	23	7 1.0 0.9 0.8
38	9.73 180	20	9.80 642	28	0.19 358	9.92 538	8	22	8 1.2 1.1 0.9
39	9.73 200	20	9.80 669	27	0.19 331	9.92 530	8	21	9 1.4 1.2 1.0
40	9.73 219	19	9.80 697	28	0.19 303	9.92 522	8	20	10 1.5 1.3 1.2
41	9.73 239	20	9.80 725	28	0.19 275	9.92 514	8	19	20 3.0 2.7 2.3
42	9.73 259	20	9.80 753	28	0.19 247	9.92 506	8	18	30 4.5 4.0 3.5
43	9.73 278	19	9.80 781	28	0.19 219	9.92 498	8	17	40 6.0 5.3 4.7
44	9.73 298	20	9.80 808	27	0.19 192	9.92 490	8	16	50 7.5 6.7 5.8
45	9.73 318	20	9.80 836	28	0.19 164	9.92 482	8	15	
46	9.73 337	19	9.80 864	28	0.19 136	9.92 473	9	14	
47	9.73 357	20	9.80 892	28	0.19 108	9.92 465	8	13	
48	9.73 377	20	9.80 919	27	0.19 081	9.92 457	8	12	
49	9.73 396	19	9.80 947	28	0.19 053	9.92 449	8	11	
50	9.73 416	20	9.80 975	28	0.19 025	9.92 441	8	10	0 1.8 1.8 2.0
51	9.73 435	19	9.81 003	28	0.18 997	9.92 433	8	9	1 5.4 5.2 6.0
52	9.73 455	20	9.81 030	27	0.18 970	9.92 425	8	8	2 9.1 8.8 10.0
53	9.73 474	19	9.81 058	28	0.18 942	9.92 416	9	7	3 12.7 12.2 14.0
54	9.73 494	20	9.81 086	28	0.18 914	9.92 408	8	6	4 16.3 15.8 18.0
55	9.73 513	19	9.81 113	27	0.18 887	9.92 400	8	5	5 19.9 19.2 22.0
56	9.73 533	20	9.81 141	28	0.18 859	9.92 392	8	4	6 23.6 22.8 26.0
57	9.73 552	19	9.81 169	28	0.18 831	9.92 384	8	3	7 27.2 26.2 —
58	9.73 572	20	9.81 196	27	0.18 804	9.92 376	8	2	
59	9.73 591	19	9.81 224	28	0.18 776	9.92 367	9	1	
60	9.73 611	20	9.81 252	28	0.18 748	9.92 359	8	0	
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P. P.

122° (302°)

(237°) 57°

LOGARITHMS OF THE FUNCTIONS (Continued)

33° (213°)

(326°) 146°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	P. P.
0	9.73 611		9.81 252		0.18 748	9.92 359	60	" 28 27
1	9.73 630	19	9.81 279	27	0.18 721	9.92 351	59	1 0.5 0.4
2	9.73 650	20	9.81 307	28	0.18 693	9.92 343	58	2 0.9 0.9
3	9.73 669	19	9.81 335	28	0.18 665	9.92 335	57	3 1.4 1.4
4	9.73 689	20	9.81 362	27	0.18 638	9.92 326	56	4 1.9 1.8
5	9.73 708	19	9.81 390	28	0.18 610	9.92 318	55	5 2.3 2.2
6	9.73 727	19	9.81 418	28	0.18 582	9.92 310	54	6 2.8 2.7
7	9.73 747	20	9.81 445	27	0.18 555	9.92 302	53	7 3.3 3.2
8	9.73 766	19	9.81 473	28	0.18 527	9.92 293	52	8 3.7 3.6
9	9.73 785	19	9.81 500	27	0.18 500	9.92 285	51	9 4.2 4.0
10	9.73 805	20	9.81 528	28	0.18 472	9.92 277	50	10 4.7 4.5
11	9.73 824	19	9.81 556	28	0.18 444	9.92 269	49	20 9.3 9.0
12	9.73 843	19	9.81 583	27	0.18 417	9.92 260	48	30 14.0 13.5
13	9.73 863	20	9.81 611	28	0.18 389	9.92 252	47	40 18.7 18.0
14	9.73 882	19	9.81 638	27	0.18 362	9.92 244	46	50 23.3 22.5
15	9.73 901	19	9.81 666	28	0.18 334	9.92 235	45	" 20 19 18
16	9.73 921	20	9.81 693	27	0.18 307	9.92 227	44	1 0.3 0.3 0.3
17	9.73 940	19	9.81 721	28	0.18 279	9.92 219	43	2 0.7 0.6 0.6
18	9.73 959	19	9.81 748	27	0.18 252	9.92 211	42	3 1.0 1.0 0.9
19	9.73 978	19	9.81 776	28	0.18 224	9.92 202	41	4 1.3 1.3 1.2
20	9.73 997	20	9.81 803	27	0.18 197	9.92 194	40	5 1.7 1.6 1.5
21	9.74 017	19	9.81 831	28	0.18 169	9.92 186	39	6 2.0 1.9 1.8
22	9.74 036	19	9.81 858	27	0.18 142	9.92 177	38	7 2.3 2.2 2.1
23	9.74 055	19	9.81 886	28	0.18 114	9.92 169	37	8 2.7 2.5 2.4
24	9.74 074	20	9.81 913	27	0.18 087	9.92 161	36	9 3.0 2.8 2.7
25	9.74 093	19	9.81 941	28	0.18 059	9.92 152	35	10 3.3 3.2 3.0
26	9.74 113	20	9.81 968	27	0.18 032	9.92 144	34	20 6.7 6.3 6.0
27	9.74 132	19	9.81 996	28	0.18 004	9.92 136	33	30 10.0 9.5 9.0
28	9.74 151	19	9.82 023	27	0.17 977	9.92 127	32	40 13.3 12.7 12.0
29	9.74 170	19	9.82 051	28	0.17 949	9.92 119	31	50 16.7 15.8 15.0
30	9.74 189	20	9.82 078	27	0.17 922	9.92 111	30	" 9 8
31	9.74 208	19	9.82 106	28	0.17 894	9.92 102	29	1 0.2 0.1
32	9.74 227	19	9.82 133	27	0.17 867	9.92 094	28	2 0.3 0.3
33	9.74 246	19	9.82 161	28	0.17 839	9.92 086	27	3 0.4 0.4
34	9.74 265	20	9.82 188	27	0.17 812	9.92 077	26	4 0.6 0.5
35	9.74 284	19	9.82 215	28	0.17 785	9.92 069	25	5 0.8 0.7
36	9.74 303	19	9.82 243	27	0.17 757	9.92 060	24	6 0.9 0.8
37	9.74 322	19	9.82 270	28	0.17 730	9.92 052	23	7 1.0 0.9
38	9.74 341	20	9.82 298	27	0.17 702	9.92 044	22	8 1.2 1.1
39	9.74 360	19	9.82 325	28	0.17 675	9.92 035	21	9 1.4 1.2
40	9.74 379	19	9.82 352	27	0.17 648	9.92 027	20	10 1.5 1.3
41	9.74 398	20	9.82 380	28	0.17 620	9.92 018	19	20 3.0 2.7
42	9.74 417	19	9.82 407	27	0.17 593	9.92 010	18	30 4.5 4.0
43	9.74 436	19	9.82 435	28	0.17 565	9.92 002	17	40 6.0 5.3
44	9.74 455	20	9.82 462	27	0.17 538	9.91 993	16	50 7.5 6.7
45	9.74 474	19	9.82 489	28	0.17 511	9.91 985	15	
46	9.74 493	19	9.82 517	27	0.17 483	9.91 976	14	
47	9.74 512	20	9.82 544	28	0.17 456	9.91 968	13	
48	9.74 531	19	9.82 571	27	0.17 429	9.91 959	12	
49	9.74 549	18	9.82 599	28	0.17 401	9.91 951	11	
50	9.74 568	19	9.82 626	27	0.17 374	9.91 942	10	0 1.6 1.5 1.7
51	9.74 587	20	9.82 653	28	0.17 347	9.91 934	9	1 4.7 4.5 5.1
52	9.74 606	19	9.82 681	27	0.17 319	9.91 925	8	2 7.8 7.5 8.4
53	9.74 625	19	9.82 708	28	0.17 292	9.91 917	7	3 10.9 10.5 11.8
54	9.74 644	20	9.82 735	27	0.17 265	9.91 908	6	4 14.0 13.5 15.2
55	9.74 662	18	9.82 762	28	0.17 238	9.91 900	5	5 17.1 16.5 18.6
56	9.74 681	19	9.82 790	27	0.17 210	9.91 891	4	6 20.2 19.5 21.9
57	9.74 700	20	9.82 817	28	0.17 183	9.91 883	3	7 23.3 22.5 25.3
58	9.74 719	19	9.82 844	27	0.17 156	9.91 874	2	8 26.4 25.5
59	9.74 737	18	9.82 871	28	0.17 129	9.91 866	1	
60	9.74 756	19	9.82 899	27	0.17 101	9.91 857	0	
	L. Cos.	d.	L. Cot.	c.d.	L. Tan	L. Sin.	d.	P. P.

123° (303°)

(236°) 56°

LOGARITHMS OF THE FUNCTIONS (Continued)

34° (214°)

(325°) 145°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P.P.
0	9.74 756	19	9.82 899	27	0.17 101	9.91 857	8	60	28 27 26
1	9.74 775	19	9.82 926	27	0.17 074	9.91 849	8	59	1 0.5 0.4 0.4
2	9.74 794	19	9.82 953	27	0.17 047	9.91 840	8	58	2 0.9 0.9 0.9
3	9.74 812	18	9.82 980	27	0.17 020	9.91 832	8	57	3 1.4 1.4 1.3
4	9.74 831	19	9.83 008	28	0.16 992	9.91 823	8	56	4 1.9 1.8 1.7
5	9.74 850	19	9.83 035	27	0.16 965	9.91 815	8	55	5 2.3 2.2 2.2
6	9.74 868	18	9.83 062	27	0.16 938	9.91 806	8	54	6 2.8 2.7 2.6
7	9.74 887	19	9.83 089	27	0.16 911	9.91 798	8	53	7 3.3 3.2 3.0
8	9.74 906	19	9.83 117	28	0.16 883	9.91 789	8	52	8 3.7 3.6 3.5
9	9.74 924	18	9.83 144	27	0.16 856	9.91 781	8	51	9 4.2 4.0 3.9
10	9.74 943	19	9.83 171	27	0.16 829	9.91 772	8	50	10 4.7 4.5 4.3
11	9.74 961	18	9.83 198	27	0.16 802	9.91 763	8	49	20 9.3 9.0 8.7
12	9.74 980	19	9.83 225	27	0.16 775	9.91 755	8	48	30 14.0 13.5 13.0
13	9.74 999	19	9.83 252	27	0.16 748	9.91 746	8	47	40 18.7 18.0 17.3
14	9.75 017	18	9.83 280	28	0.16 720	9.91 738	8	46	50 23.3 22.5 21.7
15	9.75 036	19	9.83 307	27	0.16 693	9.91 729	8	45	" 19 18
16	9.75 054	18	9.83 334	27	0.16 666	9.91 720	8	44	1 0.3 0.3
17	9.75 073	19	9.83 361	27	0.16 639	9.91 712	8	43	2 0.6 0.6
18	9.75 091	18	9.83 388	27	0.16 612	9.91 703	8	42	3 1.0 0.9
19	9.75 110	19	9.83 415	27	0.16 585	9.91 695	8	41	4 1.3 1.2
20	9.75 128	18	9.83 442	28	0.16 558	9.91 686	8	40	5 1.6 1.5
21	9.75 147	19	9.83 470	27	0.16 530	9.91 677	8	39	6 1.9 1.8
22	9.75 165	18	9.83 497	27	0.16 503	9.91 669	8	38	7 2.2 2.1
23	9.75 184	19	9.83 524	27	0.16 476	9.91 660	8	37	8 2.5 2.4
24	9.75 202	18	9.83 551	27	0.16 449	9.91 651	8	36	9 2.8 2.7
25	9.75 221	19	9.83 578	27	0.16 422	9.91 643	8	35	10 3.2 3.0
26	9.75 239	18	9.83 605	27	0.16 395	9.91 634	8	34	20 6.3 6.0
27	9.75 258	19	9.83 632	27	0.16 368	9.91 625	8	33	30 9.5 9.0
28	9.75 276	18	9.83 659	27	0.16 341	9.91 617	8	32	40 12.7 12.0
29	9.75 294	19	9.83 686	27	0.16 314	9.91 608	8	31	50 15.8 15.0
30	9.75 313	18	9.83 713	27	0.16 287	9.91 599	8	30	" 9 8
31	9.75 331	19	9.83 740	27	0.16 260	9.91 591	8	29	1 0.2 0.1
32	9.75 350	18	9.83 768	28	0.16 232	9.91 582	8	28	2 0.3 0.3
33	9.75 368	19	9.83 795	27	0.16 205	9.91 573	8	27	3 0.4 0.4
34	9.75 386	18	9.83 822	27	0.16 178	9.91 565	8	26	4 0.6 0.5
35	9.75 405	19	9.83 849	27	0.16 151	9.91 556	8	25	5 0.8 0.7
36	9.75 423	18	9.83 876	27	0.16 124	9.91 547	8	24	6 0.9 0.8
37	9.75 441	19	9.83 903	27	0.16 097	9.91 538	8	23	7 1.0 0.9
38	9.75 459	18	9.83 930	27	0.16 070	9.91 530	8	22	8 1.2 1.1
39	9.75 478	19	9.83 957	27	0.16 043	9.91 521	8	21	9 1.4 1.2
40	9.75 496	18	9.83 984	27	0.16 016	9.91 512	8	20	10 1.5 1.3
41	9.75 514	19	9.84 011	27	0.15 989	9.91 504	8	19	20 3.0 2.7
42	9.75 533	18	9.84 038	27	0.15 962	9.91 495	8	18	30 4.5 4.0
43	9.75 551	19	9.84 065	27	0.15 935	9.91 486	8	17	40 6.0 5.3
44	9.75 569	18	9.84 092	27	0.15 908	9.91 477	8	16	50 7.5 6.7
45	9.75 587	19	9.84 119	27	0.15 881	9.91 469	8	15	
46	9.75 605	18	9.84 146	27	0.15 854	9.91 460	8	14	
47	9.75 624	19	9.84 173	27	0.15 827	9.91 451	8	13	
48	9.75 642	18	9.84 200	27	0.15 800	9.91 442	8	12	
49	9.75 660	19	9.84 227	27	0.15 773	9.91 433	8	11	
50	9.75 678	18	9.84 254	27	0.15 746	9.91 425	8	10	9 28 8 8
51	9.75 696	19	9.84 280	26	0.15 720	9.91 416	8	9	0 1.6 1.8 1.7
52	9.75 714	18	9.84 307	27	0.15 693	9.91 407	8	8	1 4.7 5.2 5.1
53	9.75 733	19	9.84 334	27	0.15 666	9.91 398	8	7	2 7.8 8.8 8.4
54	9.75 751	18	9.84 361	27	0.15 639	9.91 389	8	6	3 10.9 12.2 11.8
55	9.75 769	19	9.84 388	27	0.15 612	9.91 381	8	5	4 14.0 15.8 15.2
56	9.75 787	18	9.84 415	27	0.15 585	9.91 372	8	4	5 17.1 19.2 18.6
57	9.75 805	19	9.84 442	27	0.15 558	9.91 363	8	3	6 20.2 22.8 21.9
58	9.75 823	18	9.84 469	27	0.15 531	9.91 354	8	2	7 23.3 26.2 25.3
59	9.75 841	19	9.84 496	27	0.15 504	9.91 345	8	1	8 26.4 — —
60	9.75 859	18	9.84 523	27	0.15 477	9.91 336	8	0	9
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P.P.

124° (304°)

(235°) 55°

LOGARITHMS OF THE FUNCTIONS (Continued)

35° (215°)

(324°) 144°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P.P.
0	9.75 859		9.84 523		0.15 477	9.91 336		60	
1	9.75 877	18	9.84 550	26	0.15 450	9.91 328	8	59	" 27 26 18
2	9.75 895	18	9.84 576	26	0.15 424	9.91 319	9	58	1 0.4 0.4 0.3
3	9.75 913	18	9.84 603	27	0.15 397	9.91 310	9	57	2 0.9 0.9 0.6
4	9.75 931	18	9.84 630	27	0.15 370	9.91 301	9	56	3 1.4 1.3 0.9
5	9.75 949	18	9.84 657	27	0.15 343	9.91 292	9	55	4 1.8 1.7 1.2
6	9.75 967	18	9.84 684	27	0.15 316	9.91 283	9	54	5 2.2 2.2 1.5
7	9.75 985	18	9.84 711	27	0.15 289	9.91 274	9	53	6 2.7 2.6 1.8
8	9.76 003	18	9.84 738	27	0.15 262	9.91 266	8	52	7 3.2 3.0 2.1
9	9.76 021	18	9.84 764	26	0.15 236	9.91 257	9	51	8 3.6 3.5 2.4
10	9.76 039	18	9.84 791	27	0.15 209	9.91 248	9	50	9 4.0 3.9 2.7
11	9.76 057	18	9.84 818	27	0.15 182	9.91 239	9	49	10 4.5 4.3 3.0
12	9.76 075	18	9.84 845	27	0.15 155	9.91 230	9	48	20 9.0 8.7 6.0
13	9.76 093	18	9.84 872	27	0.15 128	9.91 221	9	47	30 13.5 13.0 9.0
14	9.76 111	18	9.84 899	27	0.15 101	9.91 212	9	46	40 18.0 17.3 12.0
15	9.76 129	18	9.84 925	26	0.15 075	9.91 203	9	45	50 22.5 21.7 15.0
16	9.76 146	17	9.84 952	27	0.15 048	9.91 194	9	44	" 17 10 5 5
17	9.76 164	18	9.84 979	27	0.15 021	9.91 185	9	43	1 0.3 0.2 0.2 0.1
18	9.76 182	18	9.85 006	27	0.14 994	9.91 176	9	42	2 0.6 0.3 0.3 0.3
19	9.76 200	18	9.85 033	26	0.14 967	9.91 167	9	41	3 0.8 0.5 0.4 0.4
20	9.76 218	18	9.85 059	27	0.14 941	9.91 158	9	40	4 1.1 0.7 0.6 0.6
21	9.76 236	18	9.85 086	27	0.14 914	9.91 149	9	39	5 1.4 0.8 0.8 0.7
22	9.76 253	17	9.85 113	27	0.14 887	9.91 141	9	38	6 1.7 1.0 0.9 0.8
23	9.76 271	18	9.85 140	27	0.14 860	9.91 132	9	37	7 2.0 1.2 1.0 0.9
24	9.76 289	18	9.85 166	26	0.14 834	9.91 123	9	36	8 2.3 1.3 1.2 1.1
25	9.76 307	18	9.85 193	27	0.14 807	9.91 114	9	35	9 2.6 1.5 1.4 1.2
26	9.76 324	17	9.85 220	27	0.14 780	9.91 105	9	34	10 2.8 1.7 1.5 1.3
27	9.76 342	18	9.85 247	27	0.14 753	9.91 096	9	33	20 5.7 3.3 3.0 2.7
28	9.76 360	18	9.85 273	26	0.14 727	9.91 087	9	32	30 8.5 5.0 4.5 4.0
29	9.76 378	18	9.85 300	27	0.14 700	9.91 078	9	31	40 11.3 6.7 6.0 5.3
30	9.76 395	17	9.85 327	27	0.14 673	9.91 069	9	30	50 14.2 8.3 7.5 6.7
31	9.76 413	18	9.85 354	27	0.14 646	9.91 060	9	29	
32	9.76 431	18	9.85 380	26	0.14 620	9.91 051	9	28	
33	9.76 448	17	9.85 407	27	0.14 593	9.91 042	9	27	
34	9.76 466	18	9.85 434	27	0.14 566	9.91 033	9	26	
35	9.76 484	18	9.85 460	26	0.14 540	9.91 023	10	25	10 10
36	9.76 501	17	9.85 487	27	0.14 513	9.91 014	9	24	27 15
37	9.76 519	18	9.85 514	27	0.14 486	9.91 005	9	23	0 1.4 1.3
38	9.76 537	18	9.85 540	26	0.14 460	9.90 996	9	22	1 4.1 3.9
39	9.76 554	17	9.85 567	27	0.14 433	9.90 987	9	21	2 6.8 6.5
40	9.76 572	18	9.85 594	27	0.14 406	9.90 978	9	20	3 9.4 9.1
41	9.76 590	18	9.85 620	26	0.14 380	9.90 969	9	19	4 12.2 11.7
42	9.76 607	17	9.85 647	27	0.14 353	9.90 960	9	18	5 14.8 14.3
43	9.76 625	18	9.85 674	27	0.14 326	9.90 951	9	17	6 17.6 16.9
44	9.76 642	17	9.85 700	26	0.14 300	9.90 942	9	16	7 20.2 19.5
45	9.76 660	18	9.85 727	27	0.14 273	9.90 933	9	15	8 22.9 22.1
46	9.76 677	17	9.85 754	27	0.14 246	9.90 924	9	14	9 25.6 24.7
47	9.76 695	18	9.85 780	26	0.14 220	9.90 915	9	13	
48	9.76 712	17	9.85 807	27	0.14 193	9.90 906	9	12	9 9
49	9.76 730	18	9.85 834	26	0.14 166	9.90 896	10	11	27 26
50	9.76 747	17	9.85 860	27	0.14 140	9.90 887	9	10	0 1.5 1.4
51	9.76 765	18	9.85 887	27	0.14 113	9.90 878	9	9	1 4.5 4.3
52	9.76 782	17	9.85 913	26	0.14 087	9.90 869	9	8	2 7.5 7.2
53	9.76 800	18	9.85 940	27	0.14 060	9.90 860	9	7	3 10.5 10.1
54	9.76 817	17	9.85 967	27	0.14 033	9.90 851	9	6	4 13.5 13.0
55	9.76 835	18	9.85 993	26	0.14 007	9.90 842	9	5	5 16.5 15.9
56	9.76 852	17	9.86 020	27	0.13 980	9.90 832	10	4	6 19.5 18.8
57	9.76 870	18	9.86 046	26	0.13 954	9.90 823	9	3	7 22.5 21.7
58	9.76 887	17	9.86 073	27	0.13 927	9.90 814	9	2	8 25.5 24.6
59	9.76 904	18	9.86 100	27	0.13 900	9.90 805	9	1	
60	9.76 922	18	9.86 126	26	0.13 874	9.90 796	9	0	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P.P.

125° (305°)

(234°) 54°

(323°) 143°

(233°) 53°

LOGARITHMS OF THE FUNCTIONS (Continued)

37° (217°)

(322°) 142°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.
0	9.77 946		9.87 711	27	0.12 289	9.90 235	10	60	
1	9.77 963	17	9.87 738	26	0.12 262	9.90 225	9	59	" 27 26
2	9.77 980	17	9.87 764	26	0.12 236	9.90 216	9	58	1 0.4 0.4
3	9.77 997	17	9.87 790	26	0.12 210	9.90 206	10	57	2 0.9 0.9
4	9.78 013	16	9.87 817	27	0.12 183	9.90 197	9	56	3 1.4 1.3
5	9.78 030	17	9.87 843	26	0.12 157	9.90 187	10	55	4 1.8 1.7
6	9.78 047	17	9.87 869	26	0.12 131	9.90 178	9	54	5 2.2 2.2
7	9.78 063	16	9.87 895	26	0.12 105	9.90 168	10	53	6 2.7 2.6
8	9.78 080	17	9.87 922	27	0.12 078	9.90 159	9	52	7 3.2 3.0
9	9.78 097	17	9.87 948	26	0.12 052	9.90 149	10	51	8 3.6 3.5
10	9.78 113	16	9.87 974	26	0.12 026	9.90 139	10	50	9 4.0 3.9
11	9.78 130	17	9.88 000	26	0.12 000	9.90 130	9	49	10 4.5 4.3
12	9.78 147	17	9.88 027	27	0.11 973	9.90 120	10	48	20 9.0 8.7
13	9.78 163	16	9.88 053	26	0.11 947	9.90 111	9	47	30 13.5 13.0
14	9.78 180	17	9.88 079	26	0.11 921	9.90 101	10	46	40 18.0 17.3
15	9.78 197	16	9.88 105	26	0.11 895	9.90 091	10	45	50 22.5 21.7
16	9.78 213	16	9.88 131	26	0.11 869	9.90 082	9	44	" 17 16
17	9.78 230	17	9.88 158	27	0.11 842	9.90 072	10	43	1 0.3 0.3
18	9.78 246	16	9.88 184	26	0.11 816	9.90 063	9	42	2 0.6 0.5
19	9.78 263	17	9.88 210	26	0.11 790	9.90 053	10	41	3 0.8 0.8
20	9.78 280	16	9.88 236	26	0.11 764	9.90 043	10	40	4 1.1 1.1
21	9.78 296	16	9.88 262	26	0.11 738	9.90 034	9	39	5 1.4 1.3
22	9.78 313	17	9.88 289	27	0.11 711	9.90 024	10	38	6 1.7 1.6
23	9.78 329	16	9.88 315	26	0.11 685	9.90 014	10	37	7 2.0 1.9
24	9.78 346	17	9.88 341	26	0.11 659	9.90 005	9	36	8 2.3 2.1
25	9.78 362	16	9.88 367	26	0.11 633	9.89 995	10	35	9 2.6 2.4
26	9.78 379	17	9.88 393	26	0.11 607	9.89 985	9	34	10 2.8 2.7
27	9.78 395	16	9.88 420	27	0.11 580	9.89 976	9	33	20 5.7 5.3
28	9.78 412	17	9.88 446	26	0.11 554	9.89 966	10	32	30 8.5 8.0
29	9.78 428	16	9.88 472	26	0.11 528	9.89 956	10	31	40 11.3 10.7
30	9.78 445	17	9.88 498	26	0.11 502	9.89 947	9	30	50 14.2 13.3
31	9.78 461	16	9.88 524	26	0.11 476	9.89 937	10	29	" 10 9
32	9.78 478	17	9.88 550	26	0.11 450	9.89 927	10	28	1 0.2 0.2
33	9.78 494	16	9.88 577	27	0.11 423	9.89 918	9	27	2 0.3 0.3
34	9.78 510	16	9.88 603	26	0.11 397	9.89 908	10	26	3 0.5 0.4
35	9.78 527	17	9.88 629	26	0.11 371	9.89 898	10	25	4 0.7 0.6
36	9.78 543	16	9.88 655	26	0.11 345	9.89 888	10	24	5 0.8 0.8
37	9.78 560	17	9.88 681	26	0.11 319	9.89 879	9	23	6 1.0 0.9
38	9.78 576	16	9.88 707	26	0.11 293	9.89 869	10	22	7 1.2 1.0
39	9.78 592	16	9.88 733	26	0.11 267	9.89 859	10	21	8 1.3 1.2
40	9.78 609	17	9.88 759	26	0.11 241	9.89 849	9	20	9 1.5 1.4
41	9.78 625	16	9.88 786	27	0.11 214	9.89 840	9	19	10 1.7 1.5
42	9.78 642	17	9.88 812	26	0.11 188	9.89 830	10	18	20 3.3 3.0
43	9.78 658	16	9.88 838	26	0.11 162	9.89 820	10	17	30 5.0 4.5
44	9.78 674	16	9.88 864	26	0.11 136	9.89 810	10	16	40 6.7 6.0
45	9.78 691	17	9.88 890	26	0.11 110	9.89 801	9	15	50 8.3 7.5
46	9.78 707	16	9.88 916	26	0.11 084	9.89 791	10	14	
47	9.78 723	16	9.88 942	26	0.11 058	9.89 781	10	13	
48	9.78 739	16	9.88 968	26	0.11 032	9.89 771	10	12	
49	9.78 756	17	9.88 994	26	0.11 006	9.89 761	10	11	
50	9.78 772	16	9.89 020	26	0.10 980	9.89 752	10	10	10 10 10
51	9.78 788	16	9.89 046	26	0.10 954	9.89 742	10	9	0 1.4 1.3
52	9.78 805	17	9.89 073	27	0.10 927	9.89 732	10	8	1 4.1 3.9
53	9.78 821	16	9.89 099	26	0.10 901	9.89 722	10	7	2 6.8 6.5
54	9.78 837	16	9.89 125	26	0.10 875	9.89 712	10	6	3 9.4 9.1
55	9.78 853	16	9.89 151	26	0.10 849	9.89 702	10	5	4 12.2 11.7
56	9.78 869	16	9.89 177	26	0.10 823	9.89 693	9	4	5 14.8 14.3
57	9.78 886	17	9.89 203	26	0.10 797	9.89 683	10	3	6 17.6 16.9
58	9.78 902	16	9.89 229	26	0.10 771	9.89 673	10	2	7 20.2 19.5
59	9.78 918	16	9.89 255	26	0.10 745	9.89 663	10	1	8 22.9 22.1
60	9.78 934	16	9.89 281	26	0.10 719	9.89 653	10	0	9 25.6 24.7
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.

127° (307°)

(232°) 11°

LOGARITHMS OF THE FUNCTIONS (Continued)

38° (218°)

(321°) 141°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.
0	9.78 934		9.89 281		0.10 719	9.89 653		60	" 30 0.4
1	9.78 960	16	9.89 307	26	0.10 693	9.89 643	10	59	1 0.4 0.4
2	9.78 967	17	9.89 333	26	0.10 667	9.89 633	10	58	2 0.9 0.8
3	9.78 983	16	9.89 359	26	0.10 641	9.89 624	9	57	3 1.3 1.2
4	9.78 999	16	9.89 385	26	0.10 615	9.89 614	10	56	4 1.7 1.7
5	9.79 015	16	9.89 411	26	0.10 589	9.89 604	10	55	5 2.2 2.1
6	9.79 031	16	9.89 437	26	0.10 563	9.89 594	10	54	6 2.6 2.5
7	9.79 047	16	9.89 463	26	0.10 537	9.89 584	10	53	7 3.0 2.9
8	9.79 063	16	9.89 489	26	0.10 511	9.89 574	10	52	8 3.5 3.3
9	9.79 079	16	9.89 515	26	0.10 485	9.89 564	10	51	9 3.9 3.8
10	9.79 095	16	9.89 541	26	0.10 459	9.89 554	10	50	10 4.3 4.2
11	9.79 111	16	9.89 567	26	0.10 433	9.89 544	10	49	20 8.7 8.3
12	9.79 128	17	9.89 593	26	0.10 407	9.89 534	10	48	30 13.0 12.5
13	9.79 144	16	9.89 619	26	0.10 381	9.89 524	10	47	40 17.3 16.7
14	9.79 160	16	9.89 645	26	0.10 355	9.89 514	10	46	50 21.7 20.8
15	9.79 176	16	9.89 671	26	0.10 329	9.89 504	10	45	" 17 16 15
16	9.79 192	16	9.89 697	26	0.10 303	9.89 495	9	44	1 0.3 0.3 0.2
17	9.79 208	16	9.89 723	26	0.10 277	9.89 485	10	43	2 0.6 0.6 0.5
18	9.79 224	16	9.89 749	26	0.10 251	9.89 475	10	42	3 0.8 0.8 0.8
19	9.79 240	16	9.89 775	26	0.10 225	9.89 465	10	41	4 1.1 1.1 1.0
20	9.79 256	16	9.89 801	26	0.10 199	9.89 455	10	40	5 1.4 1.3 1.2
21	9.79 272	16	9.89 827	26	0.10 173	9.89 445	10	39	6 1.7 1.6 1.5
22	9.79 288	16	9.89 853	26	0.10 147	9.89 435	10	38	7 2.0 1.9 1.8
23	9.79 304	16	9.89 879	26	0.10 121	9.89 425	10	37	8 2.3 2.1 2.0
24	9.79 319	15	9.89 905	26	0.10 095	9.89 415	10	36	9 2.6 2.4 2.2
25	9.79 335	16	9.89 931	26	0.10 069	9.89 405	10	35	10 2.8 2.7 2.5
26	9.79 351	16	9.89 957	26	0.10 043	9.89 395	10	34	20 5.7 5.3 5.0
27	9.79 367	16	9.89 983	26	0.10 017	9.89 385	10	33	30 8.5 8.0 7.5
28	9.79 383	16	9.90 009	26	0.09 991	9.89 375	10	32	40 11.3 10.7 10.0
29	9.79 399	16	9.90 035	26	0.09 965	9.89 364	10	31	50 14.2 13.3 12.5
30	9.79 415	16	9.90 061	25	0.09 939	9.89 354	10	30	" 11 10 "
31	9.79 431	16	9.90 086	26	0.09 914	9.89 344	10	29	1 0.2 0.2 0.2
32	9.79 447	16	9.90 112	26	0.09 888	9.89 334	10	28	2 0.4 0.3 0.3
33	9.79 463	16	9.90 138	26	0.09 862	9.89 324	10	27	3 0.6 0.5 0.4
34	9.79 478	15	9.90 164	26	0.09 836	9.89 314	10	26	4 0.7 0.7 0.6
35	9.79 494	16	9.90 190	26	0.09 810	9.89 304	10	25	5 0.9 0.8 0.8
36	9.79 510	16	9.90 216	26	0.09 784	9.89 294	10	24	6 1.1 1.0 0.9
37	9.79 526	16	9.90 242	26	0.09 758	9.89 284	10	23	7 1.3 1.2 1.0
38	9.79 542	16	9.90 268	26	0.09 732	9.89 274	10	22	8 1.5 1.3 1.2
39	9.79 558	15	9.90 294	26	0.09 706	9.89 264	10	21	9 1.6 1.5 1.4
40	9.79 573	16	9.90 320	26	0.09 680	9.89 254	10	20	10 1.8 1.7 1.5
41	9.79 589	16	9.90 346	25	0.09 654	9.89 244	10	19	20 3.7 3.3 3.0
42	9.79 605	16	9.90 371	26	0.09 629	9.89 233	10	18	30 5.5 5.0 4.5
43	9.79 621	16	9.90 397	26	0.09 603	9.89 223	10	17	40 7.3 6.7 6.0
44	9.79 636	16	9.90 423	26	0.09 577	9.89 213	10	16	50 9.2 8.3 7.5
45	9.79 652	16	9.90 449	26	0.09 551	9.89 203	10	15	
46	9.79 668	16	9.90 475	26	0.09 525	9.89 193	10	14	
47	9.79 684	16	9.90 501	26	0.09 499	9.89 183	10	13	
48	9.79 699	15	9.90 527	26	0.09 473	9.89 173	10	12	
49	9.79 715	16	9.90 553	25	0.09 447	9.89 162	11	11	
50	9.79 731	15	9.90 578	26	0.09 422	9.89 152	10	10	
51	9.79 746	16	9.90 604	26	0.09 396	9.89 142	10	9	
52	9.79 762	16	9.90 630	26	0.09 370	9.89 132	10	8	
53	9.79 778	15	9.90 656	26	0.09 344	9.89 122	10	7	
54	9.79 793	16	9.90 682	26	0.09 318	9.89 112	10	6	
55	9.79 809	16	9.90 708	26	0.09 292	9.89 101	11	5	
56	9.79 825	16	9.90 734	25	0.09 266	9.89 091	10	4	
57	9.79 840	15	9.90 759	26	0.09 241	9.89 081	10	3	
58	9.79 856	16	9.90 785	26	0.09 215	9.89 071	10	2	
59	9.79 872	15	9.90 811	26	0.09 189	9.89 060	11	1	
60	9.79 887	15	9.90 837	26	0.09 163	9.89 050	10	0	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.

128° (308°)

82

(231°) 51°

LOGARITHMS OF THE FUNCTIONS (Continued)

39° (219°)

(320°) **140°**

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P. P.
0	9.79 887	16	9.90 837	26	0.09 163	9.89 050	60	"	26
1	9.79 903	15	9.90 863	26	0.09 137	9.89 040	59	1	0.4 0.4
2	9.79 918	15	9.90 889	26	0.09 111	9.89 030	58	2	0.9 0.8
3	9.79 934	16	9.90 914	25	0.09 086	9.89 020	57	3	1.3 1.2
4	9.79 950	16	9.90 940	26	0.09 060	9.89 009	56	4	1.7 1.7
5	9.79 965	15	9.90 966	26	0.09 034	9.88 999	55	5	2.2 2.1
6	9.79 981	16	9.90 992	26	0.09 008	9.88 989	54	6	2.6 2.5
7	9.79 996	15	9.91 018	26	0.08 982	9.88 978	53	7	3.0 2.9
8	9.80 012	16	9.91 043	25	0.08 957	9.88 968	52	8	3.5 3.3
9	9.80 027	15	9.91 069	26	0.08 931	9.88 958	51	9	3.9 3.8
10	9.80 043	16	9.91 095	26	0.08 905	9.88 948	50	10	4.3 4.2
11	9.80 058	15	9.91 121	26	0.08 879	9.88 937	49	20	8.7 8.3
12	9.80 074	16	9.91 147	26	0.08 853	9.88 927	48	30	13.0 12.5
13	9.80 089	15	9.91 172	25	0.08 828	9.88 917	47	40	17.3 16.7
14	9.80 105	16	9.91 198	26	0.08 802	9.88 906	46	50	21.7 20.8
15	9.80 120	15	9.91 224	26	0.08 776	9.88 896	45	"	11 11
16	9.80 136	16	9.91 250	26	0.08 750	9.88 886	44	1	0.3 0.2
17	9.80 151	15	9.91 276	26	0.08 724	9.88 875	43	2	0.6 0.5
18	9.80 166	15	9.91 301	25	0.08 699	9.88 865	42	3	0.8 0.8
19	9.80 182	16	9.91 327	26	0.08 673	9.88 855	41	4	1.1 1.0
20	9.80 197	15	9.91 353	26	0.08 647	9.88 844	40	5	1.3 1.2
21	9.80 213	16	9.91 379	26	0.08 621	9.88 834	39	6	1.6 1.5
22	9.80 228	15	9.91 404	25	0.08 596	9.88 824	38	7	1.9 1.8
23	9.80 244	16	9.91 430	26	0.08 570	9.88 813	37	8	2.1 2.0
24	9.80 259	15	9.91 456	26	0.08 544	9.88 803	36	9	2.4 2.2
25	9.80 274	16	9.91 482	26	0.08 518	9.88 793	35	10	2.7 2.5
26	9.80 290	15	9.91 507	25	0.08 493	9.88 782	34	20	5.3 5.0
27	9.80 305	16	9.91 533	26	0.08 467	9.88 772	33	30	8.0 7.5
28	9.80 320	15	9.91 559	26	0.08 441	9.88 761	32	40	10.7 10.0
29	9.80 336	16	9.91 585	25	0.08 415	9.88 751	31	50	13.2 12.5
30	9.80 351	15	9.91 610	26	0.08 390	9.88 741	30	"	11 10
31	9.80 366	16	9.91 636	26	0.08 364	9.88 730	29	1	0.2 0.2
32	9.80 382	15	9.91 662	26	0.08 338	9.88 720	28	2	0.4 0.3
33	9.80 397	16	9.91 688	26	0.08 312	9.88 709	27	3	0.6 0.5
34	9.80 412	15	9.91 713	25	0.08 287	9.88 699	26	4	0.7 0.7
35	9.80 428	16	9.91 739	26	0.08 261	9.88 688	25	5	0.9 0.8
36	9.80 443	15	9.91 765	26	0.08 235	9.88 678	24	6	1.1 1.0
37	9.80 458	16	9.91 791	26	0.08 209	9.88 668	23	7	1.3 1.2
38	9.80 473	15	9.91 816	25	0.08 184	9.88 657	22	8	1.5 1.3
39	9.80 489	16	9.91 842	26	0.08 158	9.88 647	21	9	1.6 1.5
40	9.80 504	15	9.91 868	26	0.08 132	9.88 636	20	10	1.8 1.7
41	9.80 519	16	9.91 893	25	0.08 107	9.88 626	19	20	3.7 3.3
42	9.80 534	15	9.91 919	26	0.08 081	9.88 616	18	30	5.5 5.0
43	9.80 550	16	9.91 945	26	0.08 055	9.88 605	17	40	7.3 6.7
44	9.80 565	15	9.91 971	25	0.08 029	9.88 594	16	50	9.2 8.3
45	9.80 580	16	9.91 996	26	0.08 004	9.88 584	15		
46	9.80 595	15	9.92 022	26	0.07 978	9.88 573	14		
47	9.80 610	16	9.92 048	26	0.07 952	9.88 563	13	11	11
48	9.80 625	15	9.92 073	25	0.07 927	9.88 552	12	11	11
49	9.80 641	16	9.92 099	26	0.07 901	9.88 542	11		
50	9.80 656	15	9.92 125	26	0.07 875	9.88 531	10	1	1.2 1.1
51	9.80 671	16	9.92 150	25	0.07 850	9.88 521	9	2	3.5 3.4
52	9.80 686	15	9.92 176	26	0.07 824	9.88 510	8	3	5.9 5.7
53	9.80 701	16	9.92 202	26	0.07 798	9.88 499	7	4	8.3 7.9
54	9.80 716	15	9.92 227	25	0.07 773	9.88 489	6	5	10.6 10.2
55	9.80 731	16	9.92 253	26	0.07 747	9.88 478	5	6	13.0 12.5
56	9.80 746	15	9.92 279	26	0.07 721	9.88 468	4	7	15.4 14.8
57	9.80 762	16	9.92 304	25	0.07 696	9.88 457	3	8	17.7 17.1
58	9.80 777	15	9.92 330	26	0.07 670	9.88 447	2	9	20.1 19.3
59	9.80 792	16	9.92 356	26	0.07 644	9.88 436	1	10	22.5 21.6
60	9.80 807	15	9.92 381	25	0.07 619	9.88 425	0	11	24.8 23.9
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P. P.

129° (309°)

(230°) 50°

LOGARITHMS OF THE FUNCTIONS (Continued)

40° (220°)

(319°) 139°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	P. P.		
0	9.80 807		9.92 381		0.07 619	9.88 425		"	26	25
1	9.80 822	15	9.92 407	26	0.07 593	9.88 415	10	59	1	0.4 0.4
2	9.80 837	15	9.92 433	26	0.07 567	9.88 404	11	58	2	0.9 0.8
3	9.80 852	15	9.92 458	25	0.07 542	9.88 394	10	57	3	1.3 1.2
4	9.80 867	15	9.92 484	26	0.07 516	9.88 383	11	56	4	1.7 1.7
5	9.80 882	15	9.92 510	26	0.07 490	9.88 372	11	55	5	2.2 2.1
6	9.80 897	15	9.92 535	25	0.07 465	9.88 362	10	54	6	2.6 2.5
7	9.80 912	15	9.92 561	26	0.07 439	9.88 351	11	53	7	3.0 2.9
8	9.80 927	15	9.92 587	26	0.07 413	9.88 340	11	52	8	3.5 3.3
9	9.80 942	15	9.92 612	25	0.07 388	9.88 330	10	51	9	3.9 3.8
10	9.80 957	15	9.92 638	26	0.07 362	9.88 319	11	50	10	4.3 4.2
11	9.80 972	15	9.92 663	25	0.07 337	9.88 308	11	49	20	8.7 8.3
12	9.80 987	15	9.92 689	26	0.07 311	9.88 298	10	48	30	13.0 12.5
13	9.81 002	15	9.92 715	26	0.07 285	9.88 287	11	47	40	17.3 16.7
14	9.81 017	15	9.92 740	25	0.07 260	9.88 276	11	46	50	21.7 20.8
15	9.81 032	15	9.92 766	26	0.07 234	9.88 266	10	45	"	15 14
16	9.81 047	15	9.92 792	26	0.07 208	9.88 255	11	44	1	0.2 0.2
17	9.81 061	14	9.92 817	25	0.07 183	9.88 244	11	43	2	0.5 0.5
18	9.81 076	15	9.92 843	26	0.07 157	9.88 234	10	42	3	0.8 0.7
19	9.81 091	15	9.92 868	25	0.07 132	9.88 223	11	41	4	1.0 0.9
20	9.81 106	15	9.92 894	26	0.07 106	9.88 212	11	40	5	1.2 1.2
21	9.81 121	15	9.92 920	26	0.07 080	9.88 201	11	39	6	1.5 1.4
22	9.81 136	15	9.92 945	25	0.07 055	9.88 191	10	38	7	1.8 1.6
23	9.81 151	15	9.92 971	26	0.07 029	9.88 180	11	37	8	2.0 1.9
24	9.81 166	15	9.92 996	25	0.07 004	9.88 169	11	36	9	2.2 2.1
25	9.81 180	14	9.93 022	26	0.06 978	9.88 158	10	35	10	2.5 2.3
26	9.81 195	15	9.93 048	26	0.06 952	9.88 148	10	34	20	5.0 4.7
27	9.81 210	15	9.93 073	25	0.06 927	9.88 137	11	33	30	7.5 7.0
28	9.81 225	15	9.93 099	26	0.06 901	9.88 126	11	32	40	10.0 9.3
29	9.81 240	15	9.93 124	25	0.06 876	9.88 115	11	31	50	12.5 11.7
30	9.81 254	14	9.93 150	26	0.06 850	9.88 105	10	30	"	11 10
31	9.81 269	15	9.93 175	25	0.06 825	9.88 094	11	29	1	0.2 0.2
32	9.81 284	15	9.93 201	26	0.06 799	9.88 083	11	28	2	0.4 0.3
33	9.81 299	15	9.93 227	26	0.06 773	9.88 072	11	27	3	0.6 0.5
34	9.81 314	15	9.93 252	25	0.06 748	9.88 061	10	26	4	0.7 0.7
35	9.81 328	14	9.93 278	26	0.06 722	9.88 051	11	25	5	0.9 0.8
36	9.81 343	15	9.93 303	25	0.06 697	9.88 040	11	24	6	1.1 1.0
37	9.81 358	15	9.93 329	26	0.06 671	9.88 029	11	23	7	1.3 1.2
38	9.81 372	14	9.93 354	25	0.06 646	9.88 018	11	22	8	1.5 1.3
39	9.81 387	15	9.93 380	26	0.06 620	9.88 007	11	21	9	1.6 1.5
40	9.81 402	15	9.93 406	26	0.06 594	9.87 996	11	20	10	1.8 1.7
41	9.81 417	15	9.93 431	25	0.06 569	9.87 985	10	19	20	3.7 3.3
42	9.81 431	14	9.93 457	26	0.06 543	9.87 975	10	18	30	5.5 5.0
43	9.81 446	15	9.93 482	25	0.06 518	9.87 964	11	17	40	7.3 6.7
44	9.81 461	15	9.93 508	26	0.06 492	9.87 953	11	16	50	9.2 8.3
45	9.81 475	14	9.93 533	25	0.06 467	9.87 942	11	15		
46	9.81 490	15	9.93 559	26	0.06 441	9.87 931	11	14		
47	9.81 505	15	9.93 584	25	0.06 416	9.87 920	11	13		
48	9.81 519	14	9.93 610	26	0.06 390	9.87 909	11	12		
49	9.81 534	15	9.93 636	26	0.06 364	9.87 898	11	11		
50	9.81 549	15	9.93 661	25	0.06 339	9.87 887	10	10		
51	9.81 563	14	9.93 687	26	0.06 313	9.87 877	10	9		
52	9.81 578	15	9.93 712	25	0.06 288	9.87 866	11	8		
53	9.81 592	14	9.93 738	26	0.06 262	9.87 855	11	7		
54	9.81 607	15	9.93 763	25	0.06 237	9.87 844	11	6		
55	9.81 622	15	9.93 789	26	0.06 211	9.87 833	11	5		
56	9.81 636	14	9.93 814	25	0.06 186	9.87 822	11	4		
57	9.81 651	15	9.93 840	26	0.06 160	9.87 811	11	3		
58	9.81 665	14	9.93 865	25	0.06 135	9.87 800	11	2		
59	9.81 680	15	9.93 891	26	0.06 109	9.87 789	11	1		
60	9.81 694	14	9.93 916	25	0.06 084	9.87 778	11	0		
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	P. P.		

130° (310°)

(229°) 49°

LOGARITHMS OF THE FUNCTIONS (Continued)

41° (221°)

(318°) 138°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.		P. P.
0	9.81 694		9.93 916		0.06 084	9.87 778		60	" 26 25
1	9.81 709	15	9.93 942	26	0.06 058	9.87 767	11 59	1	0.4 0.4
2	9.81 723	14	9.93 967	25	0.06 033	9.87 756	11 58	2	0.9 0.8
3	9.81 738	15	9.93 993	26	0.06 007	9.87 745	11 57	3	1.3 1.2
4	9.81 752	14	9.94 018	25	0.05 982	9.87 734	11 56	4	1.7 1.7
		15		26			11		
5	9.81 767		9.94 044		0.05 956	9.87 723	11 55	5	2.2 2.1
6	9.81 781	14	9.94 069	25	0.05 931	9.87 712	11 54	6	2.6 2.5
7	9.81 796	15	9.94 095	26	0.05 905	9.87 701	11 53	7	3.0 2.9
8	9.81 810	14	9.94 120	25	0.05 880	9.87 690	11 52	8	3.5 3.3
9	9.81 825	15	9.94 146	26	0.05 854	9.87 679	11 51	9	3.9 3.8
		14		25			11		
10	9.81 839		9.94 171		0.05 829	9.87 668	11 50	10	4.3 4.2
11	9.81 854	15	9.94 197	26	0.05 803	9.87 657	11 49	20	8.7 8.3
12	9.81 868	14	9.94 222	25	0.05 778	9.87 646	11 48	30	13.0 12.5
13	9.81 882	14	9.94 248	26	0.05 752	9.87 635	11 47	40	17.3 16.7
14	9.81 897	15	9.94 273	25	0.05 727	9.87 624	11 46	50	21.7 20.8
		14		26			11		
15	9.81 911		9.94 299		0.05 701	9.87 613	11 45	"	15 14
16	9.81 926	15	9.94 324	25	0.05 676	9.87 601	11 44	1	0.2 0.2
17	9.81 940	14	9.94 350	26	0.05 650	9.87 590	11 43	2	0.5 0.5
18	9.81 955	15	9.94 375	25	0.05 625	9.87 579	11 42	3	0.8 0.7
19	9.81 969	14	9.94 401	26	0.05 599	9.87 568	11 41	4	1.0 0.9
		14		25			11		
20	9.81 983		9.94 426		0.05 574	9.87 557	11 40	5	1.2 1.2
21	9.81 998	15	9.94 452	26	0.05 548	9.87 546	11 39	6	1.5 1.4
22	9.82 012	14	9.94 477	25	0.05 523	9.87 535	11 38	7	1.8 1.6
23	9.82 026	14	9.94 503	26	0.05 497	9.87 524	11 37	8	2.0 1.9
24	9.82 041	15	9.94 528	25	0.05 472	9.87 513	11 36	9	2.2 2.1
		14		26			12		
25	9.82 055		9.94 554		0.05 446	9.87 501	11 35	10	2.5 2.3
26	9.82 069	14	9.94 579	25	0.05 421	9.87 490	11 34	20	5.0 4.7
27	9.82 084	15	9.94 604	26	0.05 396	9.87 479	11 33	30	7.5 7.0
28	9.82 098	14	9.94 630	25	0.05 370	9.87 468	11 32	40	10.0 9.3
29	9.82 112	14	9.94 655	26	0.05 345	9.87 457	11 31	50	12.5 11.7
		14		25			11		
30	9.82 126		9.94 681		0.05 319	9.87 446	11 30	"	12 11
31	9.82 141	15	9.94 706	25	0.05 294	9.87 434	11 29	1	0.2 0.2
32	9.82 155	14	9.94 732	26	0.05 268	9.87 423	11 28	2	0.4 0.4
33	9.82 169	14	9.94 757	25	0.05 243	9.87 412	11 27	3	0.6 0.6
34	9.82 184	15	9.94 783	26	0.05 217	9.87 401	11 26	4	0.8 0.7
		14		25			11		
35	9.82 198		9.94 808		0.05 192	9.87 390	11 25	5	1.0 0.9
36	9.82 212	14	9.94 834	26	0.05 166	9.87 378	11 24	6	1.2 1.1
37	9.82 226	14	9.94 859	25	0.05 141	9.87 367	11 23	7	1.4 1.3
38	9.82 240	14	9.94 884	25	0.05 116	9.87 356	11 22	8	1.6 1.5
39	9.82 255	15	9.94 910	26	0.05 090	9.87 345	11 21	9	1.8 1.6
		14		25			11		
40	9.82 269		9.94 935		0.05 065	9.87 334	11 20	10	2.0 1.8
41	9.82 283	14	9.94 961	26	0.05 039	9.87 322	11 19	20	4.0 3.7
42	9.82 297	14	9.94 986	25	0.05 014	9.87 311	11 18	30	6.0 5.5
43	9.82 311	14	9.95 012	26	0.04 988	9.87 300	11 17	40	8.0 7.3
44	9.82 326	15	9.95 037	25	0.04 963	9.87 288	11 16	50	10.0 9.2
		14		26			11		
45	9.82 340		9.95 062		0.04 938	9.87 277	11 15		
46	9.82 354	14	9.95 088	26	0.04 912	9.87 266	11 14	12	12 11
47	9.82 368	14	9.95 113	25	0.04 887	9.87 255	11 13	26	25 25
48	9.82 382	14	9.95 139	26	0.04 861	9.87 243	11 12		
49	9.82 396	14	9.95 164	25	0.04 836	9.87 232	11 11	0	1.1 1.1 1.1
		14		26			11	1	
50	9.82 410		9.95 190		0.04 810	9.87 221	11 10	2	3.2 3.1 3.4
51	9.82 424	14	9.95 215	25	0.04 785	9.87 209	11 9	3	5.4 5.2 5.7
52	9.82 439	15	9.95 240	26	0.04 760	9.87 198	11 8	4	7.6 7.3 7.9
53	9.82 453	14	9.95 266	25	0.04 734	9.87 187	11 7	5	9.8 9.4 10.2
54	9.82 467	14	9.95 291	26	0.04 709	9.87 175	11 6	6	11.9 11.5 12.5
		14		25			11	7	14.1 13.5 14.8
55	9.82 481		9.95 317		0.04 683	9.87 164	11 5	8	16.2 15.6 17.1
56	9.82 495	14	9.95 342	25	0.04 658	9.87 153	11 4	9	18.4 17.7 19.3
57	9.82 509	14	9.95 368	26	0.04 632	9.87 141	11 3	10	20.6 19.8 21.6
58	9.82 523	14	9.95 393	25	0.04 607	9.87 130	11 2	11	22.8 21.9 23.9
59	9.82 537	14	9.95 418	26	0.04 582	9.87 119	11 1	12	24.9 23.9 —
		14		25			12	0	
60	9.82 551		9.95 444		0.04 556	9.87 107	12		
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.		P. P.

131° (311°)

(228°) 48°

LOGARITHMS OF THE FUNCTIONS (Continued)

42° (222°)

(317°) 137°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.
0	9.82 551		9.95 444		0.04 556	9.87 107		60	" 26 25
1	9.82 565	14	9.95 469	25	0.04 531	9.87 096	11	59	1 0.4 0.4
2	9.82 579	14	9.95 495	26	0.04 505	9.87 085	11	58	2 0.9 0.8
3	9.82 593	14	9.95 520	25	0.04 480	9.87 073	12	57	3 1.3 1.2
4	9.82 607	14	9.95 545	25	0.04 455	9.87 062	11	56	4 1.7 1.7
5	9.82 621	14	9.95 571	26	0.04 429	9.87 050	12	55	5 2.2 2.1
6	9.82 635	14	9.95 596	25	0.04 404	9.87 039	11	54	6 2.6 2.5
7	9.82 649	14	9.95 622	26	0.04 378	9.87 028	11	53	7 3.0 2.9
8	9.82 663	14	9.95 647	25	0.04 353	9.87 016	12	52	8 3.5 3.3
9	9.82 677	14	9.95 672	25	0.04 328	9.87 005	11	51	9 3.9 3.8
10	9.82 691	14	9.95 698	26	0.04 302	9.86 993	12	50	10 4.3 4.2
11	9.82 705	14	9.95 723	25	0.04 277	9.86 982	11	49	20 8.7 8.3
12	9.82 719	14	9.95 748	25	0.04 252	9.86 970	12	48	30 13.0 12.5
13	9.82 733	14	9.95 774	26	0.04 226	9.86 959	11	47	40 17.3 16.7
14	9.82 747	14	9.95 799	25	0.04 201	9.86 947	12	46	50 21.7 20.8
15	9.82 761	14	9.95 825	26	0.04 175	9.86 936	11	45	" 14 13
16	9.82 775	14	9.95 850	25	0.04 150	9.86 924	12	44	1 0.2 0.2
17	9.82 788	13	9.95 875	25	0.04 125	9.86 913	11	43	2 0.5 0.4
18	9.82 802	14	9.95 901	26	0.04 099	9.86 902	11	42	3 0.7 0.6
19	9.82 816	14	9.95 926	25	0.04 074	9.86 890	12	41	4 0.9 0.9
20	9.82 830	14	9.95 952	26	0.04 048	9.86 879	11	40	5 1.2 1.1
21	9.82 844	14	9.95 977	25	0.04 023	9.86 867	12	39	6 1.4 1.3
22	9.82 858	14	9.96 002	25	0.03 998	9.86 855	12	38	7 1.6 1.5
23	9.82 872	14	9.96 028	26	0.03 972	9.86 844	11	37	8 1.9 1.7
24	9.82 885	13	9.96 053	25	0.03 947	9.86 832	12	36	9 2.1 2.0
25	9.82 899	14	9.96 078	25	0.03 922	9.86 821	11	35	10 2.3 2.2
26	9.82 913	14	9.96 104	26	0.03 896	9.86 809	12	34	20 4.7 4.3
27	9.82 927	14	9.96 129	25	0.03 871	9.86 798	11	33	30 7.0 6.5
28	9.82 941	14	9.96 155	26	0.03 845	9.86 786	12	32	40 9.3 8.7
29	9.82 955	14	9.96 180	25	0.03 820	9.86 775	11	31	50 11.7 10.8
30	9.82 968	13	9.96 205	25	0.03 795	9.86 763	12	30	" 12 11
31	9.82 982	14	9.96 231	26	0.03 769	9.86 752	11	29	1 0.2 0.2
32	9.82 996	14	9.96 256	25	0.03 744	9.86 740	12	28	2 0.4 0.4
33	9.83 010	14	9.96 281	25	0.03 719	9.86 728	12	27	3 0.6 0.6
34	9.83 023	13	9.96 307	26	0.03 693	9.86 717	11	26	4 0.8 0.7
35	9.83 037	14	9.96 332	25	0.03 668	9.86 705	12	25	5 1.0 0.9
36	9.83 051	14	9.96 357	25	0.03 643	9.86 694	11	24	6 1.2 1.1
37	9.83 065	14	9.96 383	26	0.03 617	9.86 682	12	23	7 1.4 1.3
38	9.83 078	13	9.96 408	25	0.03 592	9.86 670	12	22	8 1.6 1.5
39	9.83 092	14	9.96 433	25	0.03 567	9.86 659	11	21	9 1.8 1.6
40	9.83 106	14	9.96 459	26	0.03 541	9.86 647	12	20	10 2.0 1.8
41	9.83 120	14	9.96 484	25	0.03 516	9.86 635	12	19	20 4.0 3.7
42	9.83 133	13	9.96 510	26	0.03 490	9.86 624	11	18	30 6.0 5.5
43	9.83 147	14	9.96 535	25	0.03 465	9.86 612	12	17	40 8.0 7.3
44	9.83 161	14	9.96 560	25	0.03 440	9.86 600	12	16	50 10.0 9.2
45	9.83 174	13	9.96 586	26	0.03 414	9.86 589	11	15	
46	9.83 188	14	9.96 611	25	0.03 389	9.86 577	12	14	12 11 11
47	9.83 202	14	9.96 636	25	0.03 364	9.86 565	12	13	26 26 26
48	9.83 215	13	9.96 662	26	0.03 338	9.86 554	11	12	
49	9.83 229	14	9.96 687	25	0.03 313	9.86 542	12	11	
50	9.83 242	13	9.96 712	25	0.03 288	9.86 530	12	10	0 1.1 1.2 1.1
51	9.83 256	14	9.96 738	26	0.03 262	9.86 518	12	9	2 3.2 3.5 3.4
52	9.83 270	14	9.96 763	25	0.03 237	9.86 507	11	8	3 5.4 5.9 5.7
53	9.83 283	13	9.96 788	25	0.03 212	9.86 495	12	7	4 7.6 8.3 7.9
54	9.83 297	14	9.96 814	26	0.03 186	9.86 483	12	6	5 9.8 10.6 10.2
55	9.83 310	13	9.96 839	25	0.03 161	9.86 472	11	5	6 11.9 13.0 12.5
56	9.83 324	14	9.96 864	25	0.03 136	9.86 460	12	4	6 14.1 15.4 14.8
57	9.83 338	14	9.96 890	26	0.03 110	9.86 448	12	3	5 16.2 17.7 17.1
58	9.83 351	13	9.96 915	25	0.03 085	9.86 436	12	2	4 18.4 20.1 19.3
59	9.83 365	14	9.96 940	25	0.03 060	9.86 425	11	1	9 20.6 22.5 21.6
60	9.83 378	13	9.96 966	26	0.03 034	9.86 413	12	0	10 22.8 24.8 23.9
								11	24.9 — —
								12	
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.

132° (312°)

(227°) 47°

LOGARITHMS OF THE FUNCTIONS (Continued)

43° (223°)

(316°) 136°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'	P. P.
0	9.83 378		9.96 966	25	0.03 034	9.86 413	12	60	" 26 ■■
1	9.83 392	14	9.96 991	25	0.03 009	9.86 401	12	59	1 0.4 0.4
2	9.83 405	13	9.97 016	25	0.02 984	9.86 389	12	58	2 0.9 0.8
3	9.83 419	14	9.97 042	26	0.02 958	9.86 377	12	57	3 1.3 1.2
4	9.83 432	13	9.97 067	25	0.02 933	9.86 366	11	56	4 1.7 1.7
		14		25			12		
5	9.83 446		9.97 092	26	0.02 908	9.86 354	12	55	5 2.2 2.1
6	9.83 459	13	9.97 118	26	0.02 882	9.86 342	12	54	6 2.6 2.5
7	9.83 473	14	9.97 143	25	0.02 857	9.86 330	12	53	7 3.0 2.9
8	9.83 486	13	9.97 168	25	0.02 832	9.86 318	12	52	8 3.5 3.3
9	9.83 500	14	9.97 193	25	0.02 807	9.86 306	12	51	9 3.9 3.8
		13		26			11		
10	9.83 513		9.97 219	26	0.02 781	9.86 295	12	50	10 4.3 4.2
11	9.83 527	14	9.97 244	25	0.02 756	9.86 283	12	49	20 8.7 8.3
12	9.83 540	13	9.97 269	25	0.02 731	9.86 271	12	48	30 13.0 12.5
13	9.83 554	14	9.97 295	26	0.02 705	9.86 259	12	47	40 17.3 16.7
14	9.83 567	13	9.97 320	25	0.02 680	9.86 247	12	46	50 21.7 20.8
		14		25			12		
15	9.83 581		9.97 345	26	0.02 655	9.86 235	12	45	" 14 13
16	9.83 594	13	9.97 371	26	0.02 629	9.86 223	12	44	1 0.2 0.2
17	9.83 608	14	9.97 396	25	0.02 604	9.86 211	12	43	2 0.5 0.4
18	9.83 621	13	9.97 421	25	0.02 579	9.86 200	12	42	3 0.7 0.6
19	9.83 634	14	9.97 447	26	0.02 553	9.86 188	12	41	4 0.9 0.9
		13		25			12		
20	9.83 648		9.97 472	25	0.02 528	9.86 176	12	40	5 1.2 1.1
21	9.83 661	13	9.97 497	25	0.02 503	9.86 164	12	39	6 1.4 1.3
22	9.83 674	13	9.97 523	26	0.02 477	9.86 152	12	38	7 1.6 1.5
23	9.83 688	14	9.97 548	25	0.02 452	9.86 140	12	37	8 1.9 1.7
24	9.83 701	13	9.97 573	25	0.02 427	9.86 128	12	36	9 2.1 2.0
		14		25			12		
25	9.83 715		9.97 598	26	0.02 402	9.86 116	12	35	10 2.3 2.2
26	9.83 728	13	9.97 624	26	0.02 376	9.86 104	12	34	20 4.7 4.3
27	9.83 741	13	9.97 649	25	0.02 351	9.86 092	12	33	30 7.0 6.5
28	9.83 755	14	9.97 674	25	0.02 326	9.86 080	12	32	40 9.3 8.7
29	9.83 768	13	9.97 700	26	0.02 300	9.86 068	12	31	50 11.7 10.8
		13		25			12		
30	9.83 781		9.97 725	25	0.02 275	9.86 056	12	30	" 12 11
31	9.83 795	14	9.97 750	25	0.02 250	9.86 044	12	29	1 0.2 0.2
32	9.83 808	13	9.97 776	26	0.02 224	9.86 032	12	28	2 0.4 0.4
33	9.83 821	13	9.97 801	25	0.02 199	9.86 020	12	27	3 0.6 0.6
34	9.83 834	13	9.97 826	25	0.02 174	9.86 008	12	26	4 0.8 0.7
		14		25			12		
35	9.83 848		9.97 851	26	0.02 149	9.85 996	12	25	5 1.0 0.9
36	9.83 861	13	9.97 877	26	0.02 123	9.85 984	12	24	6 1.2 1.1
37	9.83 874	13	9.97 902	25	0.02 098	9.85 972	12	23	7 1.4 1.3
38	9.83 887	13	9.97 927	25	0.02 073	9.85 960	12	22	8 1.6 1.5
39	9.83 901	14	9.97 953	26	0.02 047	9.85 948	12	21	9 1.8 1.6
		13		25			12		
40	9.83 914		9.97 978	25	0.02 022	9.85 936	12	20	10 2.0 1.8
41	9.83 927	13	9.98 003	25	0.01 997	9.85 924	12	19	20 4.0 3.7
42	9.83 940	13	9.98 029	26	0.01 971	9.85 912	12	18	30 6.0 5.5
43	9.83 954	14	9.98 054	25	0.01 946	9.85 900	12	17	40 8.0 7.3
44	9.83 967	13	9.98 079	25	0.01 921	9.85 888	12	16	50 10.0 9.2
		13		25			12		
45	9.83 980		9.98 104	26	0.01 896	9.85 876	12	15	13 13 12
46	9.83 993	13	9.98 130	26	0.01 870	9.85 864	12	14	14 14 14
47	9.84 006	13	9.98 155	25	0.01 845	9.85 851	13	13	15 15 15
48	9.84 020	14	9.98 180	25	0.01 820	9.85 839	12	12	16 16 16
49	9.84 033	13	9.98 206	26	0.01 794	9.85 827	12	11	17 17 17
		13		25			12		
50	9.84 046		9.98 231	25	0.01 769	9.85 815	12	10	18 18 18
51	9.84 059	13	9.98 256	25	0.01 744	9.85 803	12	9	19 19 19
52	9.84 072	13	9.98 281	25	0.01 719	9.85 791	12	8	20 20 20
53	9.84 085	13	9.98 307	26	0.01 693	9.85 779	12	7	21 21 21
54	9.84 098	13	9.98 332	25	0.01 668	9.85 766	13	6	22 22 22
		14		25			12		
55	9.84 112		9.98 357	25	0.01 643	9.85 754	12	5	23 23 23
56	9.84 125	13	9.98 383	26	0.01 617	9.85 742	12	4	24 24 24
57	9.84 138	13	9.98 408	25	0.01 592	9.85 730	12	3	25 25 25
58	9.84 151	13	9.98 433	25	0.01 567	9.85 718	12	2	26 26 26
59	9.84 164	13	9.98 458	25	0.01 542	9.85 706	12	1	27 27 27
		13		26			13		
60	9.84 177		9.98 484	26	0.01 516	9.85 693	13	0	28 28 28
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'	P. P.

133° (313°)

(226°) 46°

LOGARITHMS OF THE FUNCTIONS (Continued)

44° (224°)

(315°) 135°

	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	P. P.		
0	9.84 177	13	9.98 484	25	0.01 516	9.85 693	12	60	"	26 25
1	9.84 190	13	9.98 509	25	0.01 491	9.85 681	12	59	1	0.4 0.4
2	9.84 203	13	9.98 534	25	0.01 466	9.85 669	12	58	2	0.9 0.8
3	9.84 216	13	9.98 560	26	0.01 440	9.85 657	12	57	3	1.3 1.2
4	9.84 229	13	9.98 585	25	0.01 415	9.85 645	12	56	4	1.7 1.7
5	9.84 242	13	9.98 610	25	0.01 390	9.85 632	12	55	5	2.2 2.1
6	9.84 255	13	9.98 635	25	0.01 365	9.85 620	12	54	6	2.6 2.5
7	9.84 269	14	9.98 661	26	0.01 339	9.85 608	12	53	7	3.0 2.9
8	9.84 282	13	9.98 686	25	0.01 314	9.85 596	12	52	8	3.5 3.3
9	9.84 295	13	9.98 711	25	0.01 289	9.85 583	12	51	9	3.9 3.8
10	9.84 308	13	9.98 737	26	0.01 263	9.85 571	12	50	10	4.3 4.2
11	9.84 321	13	9.98 762	25	0.01 238	9.85 559	12	49	20	8.7 8.3
12	9.84 334	13	9.98 787	25	0.01 213	9.85 547	12	48	30	13.0 12.5
13	9.84 347	13	9.98 812	25	0.01 188	9.85 534	12	47	40	17.3 16.7
14	9.84 360	13	9.98 838	26	0.01 162	9.85 522	12	46	50	21.7 20.8
15	9.84 373	13	9.98 863	25	0.01 137	9.85 510	12	45	"	14 13 12
16	9.84 385	12	9.98 888	25	0.01 112	9.85 497	12	44	1	0.2 0.2 0.2
17	9.84 398	13	9.98 913	25	0.01 087	9.85 485	12	43	2	0.5 0.4 0.4
18	9.84 411	13	9.98 939	26	0.01 061	9.85 473	12	42	3	0.7 0.6 0.6
19	9.84 424	13	9.98 964	25	0.01 036	9.85 460	12	41	4	0.9 0.9 0.8
20	9.84 437	13	9.98 989	26	0.01 011	9.85 448	12	40	5	1.2 1.1 1.0
21	9.84 450	13	9.99 015	25	0.00 985	9.85 436	12	39	6	1.4 1.3 1.2
22	9.84 463	13	9.99 040	25	0.00 960	9.85 423	12	38	7	1.6 1.5 1.4
23	9.84 476	13	9.99 065	25	0.00 935	9.85 411	12	37	8	1.9 1.7 1.6
24	9.84 489	13	9.99 090	26	0.00 910	9.85 399	12	36	9	2.1 2.0 1.8
25	9.84 502	13	9.99 116	25	0.00 884	9.85 386	12	35	10	2.3 2.2 2.0
26	9.84 515	13	9.99 141	25	0.00 859	9.85 374	12	34	20	4.7 4.3 4.0
27	9.84 528	13	9.99 166	25	0.00 834	9.85 361	12	33	30	7.0 6.5 6.0
28	9.84 540	12	9.99 191	25	0.00 809	9.85 349	12	32	40	9.3 8.7 8.0
29	9.84 553	13	9.99 217	26	0.00 783	9.85 337	12	31	50	11.7 10.8 10.0
30	9.84 566	13	9.99 242	25	0.00 758	9.85 324	12	30		13 13
31	9.84 579	13	9.99 267	25	0.00 733	9.85 312	12	29		26 25
32	9.84 592	13	9.99 293	26	0.00 707	9.85 299	12	28		
33	9.84 605	13	9.99 318	25	0.00 682	9.85 287	12	27	0	1.0 0.9
34	9.84 618	13	9.99 343	25	0.00 657	9.85 274	12	26	1	3.0 2.9
35	9.84 630	12	9.99 368	25	0.00 632	9.85 262	12	25	2	5.0 4.8
36	9.84 643	13	9.99 394	26	0.00 606	9.85 250	12	24	3	7.0 6.7
37	9.84 656	13	9.99 419	25	0.00 581	9.85 237	12	23	4	9.0 8.7
38	9.84 669	13	9.99 444	25	0.00 556	9.85 225	12	22	5	11.0 10.6
39	9.84 682	13	9.99 469	26	0.00 531	9.85 212	12	21	6	13.0 12.5
40	9.84 694	12	9.99 495	25	0.00 505	9.85 200	12	20	7	15.0 14.4
41	9.84 707	13	9.99 520	25	0.00 480	9.85 187	12	19	8	17.0 16.3
42	9.84 720	13	9.99 545	25	0.00 455	9.85 175	12	18	9	19.0 18.3
43	9.84 733	13	9.99 570	25	0.00 430	9.85 162	12	17	10	21.0 20.2
44	9.84 745	12	9.99 596	26	0.00 404	9.85 150	12	16	11	23.0 22.1
45	9.84 758	13	9.99 621	25	0.00 379	9.85 137	12	15	12	25.0 24.1
46	9.84 771	13	9.99 646	25	0.00 354	9.85 125	12	14	13	
47	9.84 784	13	9.99 672	26	0.00 328	9.85 112	12	13		12 12
48	9.84 796	12	9.99 697	25	0.00 303	9.85 100	12	12		26 25
49	9.84 809	13	9.99 722	25	0.00 278	9.85 087	12	11	0	
50	9.84 822	13	9.99 747	25	0.00 253	9.85 074	12	10	1	1.1 1.1
51	9.84 835	13	9.99 773	26	0.00 227	9.85 062	12	9	2	3.2 3.1
52	9.84 847	12	9.99 798	25	0.00 202	9.85 049	12	8	3	5.4 5.2
53	9.84 860	13	9.99 823	25	0.00 177	9.85 037	12	7	4	7.6 7.3
54	9.84 873	13	9.99 848	25	0.00 152	9.85 024	12	6	5	9.8 9.4
55	9.84 885	12	9.99 874	26	0.00 126	9.85 012	12	5	6	11.9 11.5
56	9.84 898	13	9.99 899	25	0.00 101	9.84 999	12	4	7	14.1 13.5
57	9.84 911	13	9.99 924	25	0.00 076	9.84 986	12	3	8	16.2 15.6
58	9.84 923	12	9.99 949	25	0.00 051	9.84 974	12	2	9	18.4 17.7
59	9.84 936	13	9.99 975	26	0.00 025	9.84 961	12	1	10	20.6 19.8
60	9.84 949	13	0.00 000	25	0.00 000	9.84 949	12	0	11	22.8 21.9
									12	24.9 23.9
	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	P. P.		

134° (314°)

(225°) 45°

NATURAL TRIGONOMETRIC FUNCTIONS

Values of the trigonometric functions of angles for each minute from 0-360°.

For degrees indicated at the top of the page use the column headings at the top. For degrees indicated at the bottom use the column indications at the bottom.

With degrees at the left of each block (top or bottom), use the minute column at the left and with degrees at the right of each block use the minute column at the right.

NATURAL FUNCTIONS

0° (180°)

(359°) 179°

1° (181°)

(358°) 178°

'	Sin	Tan	Cot	Cos	'
0	.00000	.00000	—	1.0000	60
1	.00029	.00029	3437.7	1.0000	59
2	.00058	.00058	1718.9	1.0000	58
3	.00087	.00087	1145.9	1.0000	57
4	.00116	.00116	859.44	1.0000	56
5	.00145	.00145	687.55	1.0000	55
6	.00175	.00175	572.96	1.0000	54
7	.00204	.00204	491.11	1.0000	53
8	.00233	.00233	429.72	1.0000	52
9	.00262	.00262	381.97	1.0000	51
10	.00291	.00291	343.77	1.0000	50
11	.00320	.00320	312.52	.99999	49
12	.00349	.00349	286.48	.99999	48
13	.00378	.00378	264.44	.99999	47
14	.00407	.00407	245.55	.99999	46
15	.00436	.00436	229.18	.99999	45
16	.00465	.00465	214.86	.99999	44
17	.00495	.00495	202.22	.99999	43
18	.00524	.00524	190.98	.99999	42
19	.00553	.00553	180.93	.99998	41
20	.00582	.00582	171.89	.99998	40
21	.00611	.00611	163.70	.99998	39
22	.00640	.00640	156.26	.99998	38
23	.00669	.00669	149.47	.99998	37
24	.00698	.00698	143.24	.99998	36
25	.00727	.00727	137.51	.99997	35
26	.00756	.00756	132.22	.99997	34
27	.00785	.00785	127.32	.99997	33
28	.00814	.00815	122.77	.99997	32
29	.00844	.00844	118.54	.99996	31
30	.00873	.00873	114.59	.99996	30
31	.00902	.00902	110.89	.99996	29
32	.00931	.00931	107.43	.99996	28
33	.00960	.00960	104.17	.99995	27
34	.00989	.00989	101.11	.99995	26
35	.01018	.01018	98.218	.99995	25
36	.01047	.01047	95.489	.99995	24
37	.01076	.01076	92.908	.99994	23
38	.01105	.01105	90.463	.99994	22
39	.01134	.01135	88.144	.99994	21
40	.01164	.01164	85.940	.99993	20
41	.01193	.01193	83.844	.99993	19
42	.01222	.01222	81.847	.99993	18
43	.01251	.01251	79.943	.99992	17
44	.01280	.01280	78.126	.99992	16
45	.01309	.01309	76.390	.99991	15
46	.01338	.01338	74.729	.99991	14
47	.01367	.01367	73.139	.99991	13
48	.01396	.01396	71.615	.99990	12
49	.01425	.01425	70.153	.99990	11
50	.01454	.01455	68.750	.99989	10
51	.01483	.01484	67.402	.99989	9
52	.01513	.01513	66.105	.99989	8
53	.01542	.01542	64.858	.99988	7
54	.01571	.01571	63.657	.99988	6
55	.01600	.01600	62.499	.99987	5
56	.01629	.01629	61.383	.99987	4
57	.01658	.01658	60.306	.99986	3
58	.01687	.01687	59.266	.99986	2
59	.01716	.01716	58.261	.99985	1
60	.01745	.01746	57.290	.99985	0
'	Cos	Cot	Tan	Sin	'

90° (270°)

(269°) 89°

91° (271°)

(268°) 88°

'	Sin	Tan	Cot	Cos	'
0	.01745	.01746	57.290	.99985	60
1	.01774	.01775	56.351	.99984	59
2	.01803	.01804	55.442	.99984	58
3	.01832	.01833	54.561	.99983	57
4	.01862	.01862	53.709	.99983	56
5	.01891	.01891	52.882	.99982	55
6	.01920	.01920	52.081	.99982	54
7	.01949	.01949	51.303	.99981	53
8	.01978	.01978	50.549	.99980	52
9	.02007	.02007	49.816	.99980	51
10	.02036	.02036	49.104	.99979	50
11	.02065	.02066	48.312	.99979	49
12	.02094	.02095	47.740	.99978	48
13	.02123	.02124	47.085	.99977	47
14	.02152	.02153	46.449	.99977	46
15	.02181	.02182	45.829	.99976	45
16	.02211	.02211	45.226	.99976	44
17	.02240	.02240	44.639	.99975	43
18	.02269	.02269	44.066	.99974	42
19	.02298	.02298	43.508	.99974	41
20	.02327	.02328	42.964	.99973	40
21	.02356	.02357	42.433	.99972	39
22	.02385	.02386	41.916	.99972	38
23	.02414	.02415	41.411	.99971	37
24	.02443	.02444	40.917	.99970	36
25	.02472	.02473	40.436	.99969	35
26	.02501	.02502	39.965	.99969	34
27	.02530	.02531	39.506	.99968	33
28	.02560	.02560	39.057	.99967	32
29	.02589	.02589	38.618	.99966	31
30	.02618	.02619	38.188	.99966	30
31	.02647	.02648	37.769	.99965	29
32	.02676	.02677	37.358	.99964	28
33	.02705	.02706	36.956	.99963	27
34	.02734	.02735	36.563	.99963	26
35	.02763	.02764	36.178	.99962	25
36	.02792	.02793	35.801	.99961	24
37	.02821	.02822	35.431	.99960	23
38	.02850	.02851	35.070	.99959	22
39	.02879	.02881	34.715	.99959	21
40	.02908	.02910	34.368	.99958	20
41	.02938	.02939	34.027	.99957	19
42	.02967	.02968	33.694	.99956	18
43	.02996	.02997	33.366	.99955	17
44	.03025	.03026	33.045	.99954	16
45	.03054	.03055	32.730	.99953	15
46	.03083	.03084	32.421	.99952	14
47	.03112	.03114	32.118	.99952	13
48	.03141	.03143	31.821	.99951	12
49	.03170	.03172	31.528	.99950	11
50	.03199	.03201	31.242	.99949	10
51	.03228	.03230	30.960	.99948	9
52	.03257	.03259	30.683	.99947	8
53	.03286	.03288	30.412	.99946	7
54	.03316	.03317	30.145	.99945	6
55	.03345	.03346	29.882	.99944	5
56	.03374	.03376	29.624	.99943	4
57	.03403	.03405	29.371	.99942	3
58	.03432	.03434	29.122	.99941	2
59	.03461	.03463	28.877	.99940	1
60	.03490	.03492	28.636	.99939	0
'	Cos	Cot	Tan	Sin	'

NATURAL FUNCTIONS (Continued)

2° (182°)

(357°) 177°

3° (183°)

(356°) 176°

'	Sin	Tan	Cot	Cos	'
0	.03490	.03492	28.636	.99939	60
1	.03519	.03521	28.399	.99938	59
2	.03548	.03550	28.166	.99937	58
3	.03577	.03579	27.937	.99936	57
4	.03606	.03609	27.712	.99935	56
5	.03635	.03638	27.490	.99934	55
6	.03664	.03667	27.271	.99933	54
7	.03693	.03696	27.057	.99932	53
8	.03723	.03725	26.845	.99931	52
9	.03752	.03754	26.637	.99930	51
10	.03781	.03783	26.432	.99929	50
11	.03810	.03812	26.230	.99927	49
12	.03839	.03842	26.031	.99926	48
13	.03868	.03871	25.835	.99925	47
14	.03897	.03900	25.642	.99924	46
15	.03926	.03929	25.452	.99923	45
16	.03955	.03958	25.264	.99922	44
17	.03984	.03987	25.080	.99921	43
18	.04013	.04016	24.898	.99919	42
19	.04042	.04046	24.719	.99918	41
20	.04071	.04075	24.542	.99917	40
21	.04100	.04104	24.368	.99916	39
22	.04129	.04133	24.196	.99915	38
23	.04159	.04162	24.026	.99913	37
24	.04188	.04191	23.859	.99912	36
25	.04217	.04220	23.695	.99911	35
26	.04246	.04250	23.532	.99910	34
27	.04275	.04279	23.372	.99909	33
28	.04304	.04308	23.214	.99907	32
29	.04333	.04337	23.058	.99906	31
30	.04362	.04366	22.904	.99905	30
31	.04391	.04395	22.752	.99904	29
32	.04420	.04424	22.602	.99902	28
33	.04449	.04454	22.454	.99901	27
34	.04478	.04483	22.308	.99900	26
35	.04507	.04512	22.164	.99898	25
36	.04536	.04541	22.022	.99897	24
37	.04565	.04570	21.881	.99896	23
38	.04594	.04599	21.743	.99894	22
39	.04623	.04628	21.606	.99893	21
40	.04653	.04658	21.470	.99892	20
41	.04682	.04687	21.337	.99890	19
42	.04711	.04716	21.205	.99889	18
43	.04740	.04745	21.075	.99888	17
44	.04769	.04774	20.946	.99886	16
45	.04798	.04803	20.819	.99885	15
46	.04827	.04833	20.693	.99883	14
47	.04856	.04862	20.569	.99882	13
48	.04885	.04891	20.446	.99881	12
49	.04914	.04920	20.325	.99879	11
50	.04943	.04949	20.206	.99876	10
51	.04972	.04978	20.087	.99876	9
52	.05001	.05007	19.970	.99875	8
53	.05030	.05037	19.855	.99873	7
54	.05059	.05066	19.740	.99872	6
55	.05088	.05095	19.627	.99870	5
56	.05117	.05124	19.516	.99869	4
57	.05146	.05153	19.405	.99867	3
58	.05175	.05182	19.296	.99866	2
59	.05205	.05212	19.188	.99864	1
60	.05234	.05241	19.081	.99863	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.05234	.05421	19.081	.99863	60
1	.05263	.05270	18.976	.99861	59
2	.05292	.05299	18.871	.99860	58
3	.05321	.05328	18.768	.99858	57
4	.05350	.05357	18.666	.99857	56
5	.05379	.05387	18.564	.99855	55
6	.05408	.05416	18.464	.99854	54
7	.05437	.05445	18.366	.99852	53
8	.05466	.05474	18.268	.99851	52
9	.05495	.05503	18.171	.99849	51
10	.05524	.05533	18.075	.99847	50
11	.05553	.05562	17.980	.99846	49
12	.05582	.05591	17.886	.99844	48
13	.05611	.05620	17.793	.99842	47
14	.05640	.05649	17.702	.99841	46
15	.05669	.05678	17.611	.99839	45
16	.05698	.05708	17.521	.99838	44
17	.05727	.05737	17.431	.99836	43
18	.05756	.05766	17.343	.99834	42
19	.05785	.05795	17.256	.99833	41
20	.05814	.05824	17.169	.99831	40
21	.05844	.05854	17.084	.99829	39
22	.05873	.05883	16.999	.99827	38
23	.05902	.05912	16.915	.99826	37
24	.05931	.05941	16.832	.99824	36
25	.05960	.05970	16.750	.99822	35
26	.05989	.05999	16.668	.99821	34
27	.06018	.06029	16.587	.99819	33
28	.06047	.06058	16.507	.99817	32
29	.06076	.06087	16.428	.99815	31
30	.06105	.06116	16.350	.99813	30
31	.06134	.06145	16.272	.99812	29
32	.06163	.06175	16.195	.99810	28
33	.06192	.06204	16.119	.99808	27
34	.06221	.06233	16.043	.99806	26
35	.06250	.06262	15.969	.99804	25
36	.06279	.06291	15.895	.99803	24
37	.06308	.06321	15.821	.99801	23
38	.06337	.06350	15.748	.99799	22
39	.06366	.06379	15.676	.99797	21
40	.06395	.06408	15.605	.99795	20
41	.06424	.06438	15.534	.99793	19
42	.06453	.06467	15.464	.99792	18
43	.06482	.06496	15.394	.99790	17
44	.06511	.06525	15.325	.99788	16
45	.06540	.06554	15.257	.99786	15
46	.06569	.06584	15.189	.99784	14
47	.06598	.06613	15.122	.99782	13
48	.06627	.06642	15.056	.99780	12
49	.06656	.06671	14.990	.99778	11
50	.06685	.06700	14.924	.99776	10
51	.06714	.06730	14.860	.99774	9
52	.06743	.06759	14.795	.99772	8
53	.06773	.06788	14.732	.99770	7
54	.06802	.06817	14.669	.99768	6
55	.06831	.06847	14.606	.99766	5
56	.06860	.06876	14.544	.99764	4
57	.06889	.06905	14.482	.99762	3
58	.06918	.06934	14.421	.99760	2
59	.06947	.06963	14.361	.99758	1
60	.06976	.06993	14.301	.99756	0
'	Cos	Cot	Tan	Sin	'

92° (272°)

(267°) 87°

93° (273°)

(266°) 86°

NATURAL FUNCTIONS (Continued)

4° (184°)

(355°) 175°

5° (185°)

(354°) 174°

'	Sin	Tan	Cot	Cos	'
0	.06976	.06993	14.301	.99756	60
1	.07005	.07022	14.241	.99754	59
2	.07034	.07051	14.182	.99752	58
3	.07063	.07080	14.124	.99750	57
4	.07092	.07110	14.065	.99748	56
5	.07121	.07139	14.008	.99746	55
6	.07150	.07168	13.951	.99744	54
7	.07179	.07197	13.894	.99742	53
8	.07208	.07227	13.838	.99740	52
9	.07237	.07256	13.782	.99738	51
10	.07266	.07285	13.727	.99736	50
11	.07295	.07314	13.672	.99734	49
12	.07324	.07344	13.617	.99731	48
13	.07353	.07373	13.563	.99729	47
14	.07382	.07402	13.510	.99727	46
15	.07411	.07431	13.457	.99725	45
16	.07440	.07461	13.404	.99723	44
17	.07469	.07490	13.352	.99721	43
18	.07498	.07519	13.300	.99719	42
19	.07527	.07548	13.248	.99716	41
20	.07556	.07578	13.197	.99714	40
21	.07585	.07607	13.146	.99712	39
22	.07614	.07636	13.096	.99710	38
23	.07643	.07665	13.046	.99708	37
24	.07672	.07695	12.996	.99705	36
25	.07701	.07724	12.947	.99703	35
26	.07730	.07753	12.898	.99701	34
27	.07759	.07782	12.850	.99699	33
28	.07788	.07812	12.801	.99696	32
29	.07817	.07841	12.754	.99694	31
30	.07846	.07870	12.706	.99692	30
31	.07875	.07899	12.659	.99689	29
32	.07904	.07929	12.612	.99687	28
33	.07933	.07958	12.566	.99685	27
34	.07962	.07987	12.520	.99683	26
35	.07991	.08017	12.474	.99680	25
36	.08020	.08046	12.429	.99678	24
37	.08049	.08075	12.384	.99676	23
38	.08078	.08104	12.339	.99673	22
39	.08107	.08134	12.295	.99671	21
40	.08136	.08163	12.251	.99668	20
41	.08165	.08192	12.207	.99666	19
42	.08194	.08221	12.163	.99664	18
43	.08223	.08251	12.120	.99661	17
44	.08252	.08280	12.077	.99659	16
45	.08281	.08309	12.035	.99657	15
46	.08310	.08339	11.992	.99654	14
47	.08339	.08368	11.950	.99652	13
48	.08368	.08397	11.909	.99649	12
49	.08397	.08427	11.867	.99647	11
50	.08426	.08456	11.826	.99644	10
51	.08455	.08485	11.785	.99642	9
52	.08484	.08514	11.745	.99639	8
53	.08513	.08544	11.705	.99637	7
54	.08542	.08573	11.664	.99635	6
55	.08571	.08602	11.625	.99632	5
56	.08600	.08632	11.585	.99630	4
57	.08629	.08661	11.546	.99627	3
58	.08658	.08690	11.507	.99625	2
59	.08687	.08720	11.468	.99622	1
60	.08716	.08749	11.430	.99619	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.08716	.08749	11.430	.99619	60
1	.08745	.08778	11.392	.99617	59
2	.08774	.08807	11.354	.99614	58
3	.08803	.08837	11.316	.99612	57
4	.08831	.08866	11.279	.99609	56
5	.08860	.08895	11.242	.99607	55
6	.08889	.08925	11.205	.99604	54
7	.08918	.08954	11.168	.99602	53
8	.08947	.08983	11.132	.99599	52
9	.08976	.09013	11.095	.99596	51
10	.09005	.09042	11.059	.99594	50
11	.09034	.09071	11.024	.99591	49
12	.09063	.09101	10.988	.99588	48
13	.09092	.09130	10.953	.99586	47
14	.09121	.09159	10.918	.99583	46
15	.09150	.09189	10.883	.99580	45
16	.09179	.09218	10.848	.99578	44
17	.09208	.09247	10.814	.99575	43
18	.09237	.09277	10.780	.99572	42
19	.09266	.09306	10.746	.99570	41
20	.09295	.09335	10.712	.99567	40
21	.09324	.09365	10.678	.99564	39
22	.09353	.09394	10.645	.99562	38
23	.09382	.09423	10.612	.99559	37
24	.09411	.09453	10.579	.99556	36
25	.09440	.09482	10.546	.99553	35
26	.09469	.09511	10.514	.99551	34
27	.09498	.09541	10.481	.99548	33
28	.09527	.09570	10.449	.99545	32
29	.09556	.09600	10.417	.99542	31
30	.09585	.09629	10.385	.99540	30
31	.09614	.09658	10.354	.99537	29
32	.09642	.09688	10.322	.99534	28
33	.09671	.09717	10.291	.99531	27
34	.09700	.09746	10.260	.99528	26
35	.09729	.09776	10.229	.99526	25
36	.09758	.09805	10.199	.99523	24
37	.09787	.09834	10.168	.99520	23
38	.09816	.09864	10.138	.99517	22
39	.09845	.09893	10.108	.99514	21
40	.09874	.09923	10.078	.99511	20
41	.09903	.09952	10.048	.99508	19
42	.09932	.09981	10.019	.99506	18
43	.09961	.10011	9.9893	.99503	17
44	.09990	.10040	9.9601	.99500	16
45	.10019	.10069	9.9310	.99497	15
46	.10048	.10099	9.9021	.99494	14
47	.10077	.10128	9.8734	.99491	13
48	.10106	.10158	9.8448	.99488	12
49	.10135	.10187	9.8164	.99485	11
50	.10164	.10216	9.7882	.99482	10
51	.10192	.10246	9.7601	.99479	9
52	.10221	.10275	9.7322	.99476	8
53	.10250	.10305	9.7044	.99473	7
54	.10279	.10334	9.6768	.99470	6
55	.10308	.10363	9.6493	.99467	5
56	.10337	.10393	9.6220	.99464	4
57	.10366	.10422	9.5949	.99461	3
58	.10395	.10452	9.5679	.99458	2
59	.10424	.10481	9.5411	.99455	1
60	.10453	.10510	9.5144	.99452	0
'	Cos	Cot	Tan	Sin	'

94° (274°)

(265°) 85°

95° (275°)

(264°) 84°

NATURAL FUNCTIONS (Continued)

6° (186°)

(353°) 173°

7° (187°)

(352°) 172°

'	Sin	Tan	Cot	Cos	'
0	10453	10510	9.5144	.99452	60
1	10482	10540	9.4878	.99449	59
2	10511	10569	9.4614	.99446	58
3	10540	10599	9.4352	.99443	57
4	10569	10628	9.4090	.99440	56
5	10597	10657	9.3831	.99437	55
6	10626	10687	9.3572	.99434	54
7	10655	10716	9.3315	.99431	53
8	10684	10746	9.3060	.99428	52
9	10713	10775	9.2806	.99424	51
10	10742	10805	9.2553	.99421	50
11	10771	10834	9.2302	.99418	49
12	10800	10863	9.2052	.99415	48
13	10829	10893	9.1803	.99412	47
14	10858	10922	9.1555	.99409	46
15	10887	10952	9.1309	.99406	45
16	10916	10981	9.1065	.99402	44
17	10945	11011	9.0821	.99399	43
18	10973	11040	9.0579	.99396	42
19	11002	11070	9.0338	.99393	41
20	11031	11099	9.0098	.99390	40
21	11060	11128	8.9860	.99386	39
22	11089	11158	8.9623	.99383	38
23	11118	11187	8.9387	.99380	37
24	11147	11217	8.9152	.99377	36
25	11176	11246	8.8919	.99374	35
26	11205	11276	8.8686	.99370	34
27	11234	11305	8.8455	.99367	33
28	11263	11335	8.8225	.99364	32
29	11291	11364	8.7996	.99360	31
30	11320	11394	8.7769	.99357	30
31	11349	11423	8.7542	.99354	29
32	11378	11452	8.7317	.99351	28
33	11407	11482	8.7093	.99347	27
34	11436	11511	8.6870	.99344	26
35	11465	11541	8.6648	.99341	25
36	11494	11570	8.6427	.99337	24
37	11523	11600	8.6208	.99334	23
38	11552	11629	8.5989	.99331	22
39	11580	11659	8.5772	.99327	21
40	11609	11688	8.5555	.99324	20
41	11638	11718	8.5340	.99320	19
42	11667	11747	8.5126	.99317	18
43	11696	11777	8.4913	.99314	17
44	11725	11806	8.4701	.99310	16
45	11754	11836	8.4490	.99307	15
46	11783	11865	8.4280	.99303	14
47	11812	11895	8.4071	.99300	13
48	11840	11924	8.3863	.99297	12
49	11869	11954	8.3656	.99293	11
50	11898	11983	8.3450	.99290	10
51	11927	12013	8.3245	.99286	9
52	11956	12042	8.3041	.99283	8
53	11985	12072	8.2838	.99279	7
54	12014	12101	8.2636	.99276	6
55	12043	12131	8.2434	.99272	5
56	12071	12160	8.2234	.99269	4
57	12100	12190	8.2035	.99265	3
58	12129	12219	8.1837	.99262	2
59	12158	12249	8.1640	.99258	1
60	12187	12278	8.1443	.99255	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	12187	12278	8.1443	.99255	60
1	12216	12308	8.1248	.99251	59
2	12245	12338	8.1054	.99248	58
3	12274	12367	8.0860	.99244	57
4	12302	12397	8.0667	.99240	56
5	12331	12426	8.0476	.99237	55
6	12360	12456	8.0285	.99233	54
7	12389	12485	8.0095	.99230	53
8	12418	12515	7.9906	.99226	52
9	12447	12544	7.9718	.99222	51
10	12476	12574	7.9530	.99219	50
11	12504	12603	7.9344	.99215	49
12	12533	12633	7.9158	.99211	48
13	12562	12662	7.8973	.99208	47
14	12591	12692	7.8789	.99204	46
15	12620	12722	7.8606	.99200	45
16	12649	12751	7.8424	.99197	44
17	12678	12781	7.8243	.99193	43
18	12706	12810	7.8062	.99189	42
19	12735	12840	7.7882	.99186	41
20	12764	12869	7.7704	.99182	40
21	12793	12899	7.7525	.99178	39
22	12822	12929	7.7348	.99175	38
23	12851	12958	7.7171	.99171	37
24	12880	12988	7.6996	.99167	36
25	12908	13017	7.6821	.99163	35
26	12937	13047	7.6647	.99160	34
27	12966	13076	7.6473	.99156	33
28	12995	13106	7.6301	.99152	32
29	13024	13136	7.6129	.99148	31
30	13053	13165	7.5958	.99144	30
31	13081	13195	7.5787	.99141	29
32	13110	13224	7.5618	.99137	28
33	13139	13254	7.5449	.99133	27
34	13168	13284	7.5281	.99129	26
35	13197	13313	7.5113	.99125	25
36	13226	13343	7.4947	.99122	24
37	13254	13372	7.4781	.99118	23
38	13283	13402	7.4615	.99114	22
39	13312	13432	7.4451	.99110	21
40	13341	13461	7.4287	.99106	20
41	13370	13491	7.4124	.99102	19
42	13399	13521	7.3962	.99098	18
43	13427	13550	7.3800	.99094	17
44	13456	13580	7.3639	.99091	16
45	13485	13609	7.3479	.99087	15
46	13514	13639	7.3319	.99083	14
47	13543	13669	7.3160	.99079	13
48	13572	13698	7.3002	.99075	12
49	13600	13728	7.2844	.99071	11
50	13629	13758	7.2687	.99067	10
51	13658	13787	7.2531	.99063	9
52	13687	13817	7.2375	.99059	8
53	13716	13846	7.2220	.99055	7
54	13744	13876	7.2066	.99051	6
55	13773	13906	7.1912	.99047	5
56	13802	13935	7.1759	.99043	4
57	13831	13965	7.1607	.99039	3
58	13860	13995	7.1455	.99035	2
59	13889	14024	7.1304	.99031	1
60	13917	14054	7.1154	.99027	0
'	Cos	Cot	Tan	Sin	'

96° (276°)

(263°) 83°

97° (277°)

(262°) 82°

NATURAL FUNCTIONS (Continued)

8° (188°)

(351°) 171°

9° (189°)

(350°) 170°

'	Sin	Tan	Cot	Cos	'
0	.13917	.14054	7.1154	.99027	60
1	.13946	.14084	7.1004	.99023	59
2	.13975	.14113	7.0855	.99019	58
3	.14004	.14143	7.0706	.99015	57
4	.14033	.14173	7.0558	.99011	56
5	.14061	.14202	7.0410	.99006	55
6	.14090	.14232	7.0264	.99002	54
7	.14119	.14262	7.0117	.98998	53
8	.14148	.14291	6.9972	.98994	52
9	.14177	.14321	6.9827	.98990	51
10	.14205	.14351	6.9682	.98986	50
11	.14234	.14381	6.9538	.98982	49
12	.14263	.14410	6.9395	.98978	48
13	.14292	.14440	6.9252	.98973	47
14	.14320	.14470	6.9110	.98969	46
15	.14349	.14499	6.8969	.98965	45
16	.14378	.14529	6.8828	.98961	44
17	.14407	.14559	6.8687	.98957	43
18	.14436	.14588	6.8548	.98953	42
19	.14464	.14618	6.8408	.98948	41
20	.14493	.14648	6.8269	.98944	40
21	.14522	.14678	6.8131	.98940	39
22	.14551	.14707	6.7994	.98936	38
23	.14580	.14737	6.7856	.98931	37
24	.14608	.14767	6.7720	.98927	36
25	.14637	.14796	6.7584	.98923	35
26	.14666	.14826	6.7448	.98919	34
27	.14695	.14856	6.7313	.98914	33
28	.14723	.14886	6.7179	.98910	32
29	.14752	.14915	6.7045	.98906	31
30	.14781	.14945	6.6912	.98902	30
31	.14810	.14975	6.6779	.98897	29
32	.14838	.15005	6.6646	.98893	28
33	.14867	.15034	6.6514	.98889	27
34	.14896	.15064	6.6383	.98884	26
35	.14925	.15094	6.6252	.98880	25
36	.14954	.15124	6.6122	.98876	24
37	.14982	.15153	6.5992	.98871	23
38	.15011	.15183	6.5863	.98867	22
39	.15040	.15213	6.5734	.98863	21
40	.15069	.15243	6.5606	.98858	20
41	.15097	.15272	6.5478	.98854	19
42	.15126	.15302	6.5350	.98849	18
43	.15155	.15332	6.5223	.98845	17
44	.15184	.15362	6.5097	.98841	16
45	.15212	.15391	6.4971	.98836	15
46	.15241	.15421	6.4846	.98832	14
47	.15270	.15451	6.4721	.98827	13
48	.15299	.15481	6.4596	.98823	12
49	.15327	.15511	6.4472	.98818	11
50	.15356	.15540	6.4348	.98814	10
51	.15385	.15570	6.4225	.98809	9
52	.15414	.15600	6.4103	.98805	8
53	.15442	.15630	6.3980	.98800	7
54	.15471	.15660	6.3859	.98796	6
55	.15500	.15689	6.3737	.98791	5
56	.15529	.15719	6.3617	.98787	4
57	.15557	.15749	6.3496	.98782	3
58	.15586	.15779	6.3376	.98778	2
59	.15615	.15809	6.3257	.98773	1
60	.15643	.15838	6.3138	.98769	0
'	Cos	Cot	Tan	Sin	'

98° (278°)

(261°) 81°

99° (279°)

(260°) 80°

'	Sin	Tan	Cot	Cos	'
0	.15643	.15838	6.3138	.98769	60
1	.15672	.15868	6.3019	.98764	59
2	.15701	.15898	6.2901	.98760	58
3	.15730	.15928	6.2783	.98755	57
4	.15758	.15958	6.2666	.98751	56
5	.15787	.15988	6.2549	.98746	55
6	.15816	.16017	6.2432	.98741	54
7	.15845	.16047	6.2316	.98737	53
8	.15873	.16077	6.2200	.98732	52
9	.15902	.16107	6.2085	.98728	51
10	.15931	.16137	6.1970	.98723	50
11	.15959	.16167	6.1856	.98718	49
12	.15988	.16196	6.1742	.98714	48
13	.16017	.16226	6.1628	.98709	47
14	.16046	.16256	6.1515	.98704	46
15	.16074	.16286	6.1402	.98700	45
16	.16103	.16316	6.1290	.98695	44
17	.16132	.16346	6.1178	.98690	43
18	.16160	.16376	6.1066	.98686	42
19	.16189	.16405	6.0955	.98681	41
20	.16218	.16435	6.0844	.98676	40
21	.16246	.16465	6.0734	.98671	39
22	.16275	.16495	6.0624	.98667	38
23	.16304	.16525	6.0514	.98662	37
24	.16333	.16555	6.0405	.98657	36
25	.16361	.16585	6.0296	.98652	35
26	.16390	.16615	6.0188	.98648	34
27	.16419	.16645	6.0080	.98643	33
28	.16447	.16674	5.9972	.98638	32
29	.16476	.16704	5.9865	.98633	31
30	.16505	.16734	5.9758	.98629	30
31	.16533	.16764	5.9651	.98624	29
32	.16562	.16794	5.9545	.98619	28
33	.16591	.16824	5.9439	.98614	27
34	.16620	.16854	5.9333	.98609	26
35	.16648	.16884	5.9228	.98604	25
36	.16677	.16914	5.9124	.98600	24
37	.16706	.16944	5.9019	.98595	23
38	.16734	.16974	5.8915	.98590	22
39	.16763	.17004	5.8811	.98585	21
40	.16792	.17033	5.8708	.98580	20
41	.16820	.17063	5.8605	.98575	19
42	.16849	.17093	5.8502	.98570	18
43	.16878	.17123	5.8400	.98565	17
44	.16906	.17153	5.8298	.98561	16
45	.16935	.17183	5.8197	.98556	15
46	.16964	.17213	5.8095	.98551	14
47	.16992	.17243	5.7994	.98546	13
48	.17021	.17273	5.7894	.98541	12
49	.17050	.17303	5.7794	.98536	11
50	.17078	.17333	5.7694	.98531	10
51	.17107	.17363	5.7594	.98526	9
52	.17136	.17393	5.7495	.98521	8
53	.17164	.17423	5.7396	.98516	7
54	.17193	.17453	5.7297	.98511	6
55	.17222	.17483	5.7199	.98506	5
56	.17250	.17513	5.7101	.98501	4
57	.17279	.17543	5.7004	.98496	3
58	.17308	.17573	5.6906	.98491	2
59	.17336	.17603	5.6809	.98486	1
60	.17365	.17633	5.6713	.98481	0
'	Cos	Cot	Tan	Sin	'

NATURAL FUNCTIONS (Continued)

10° (190°)

(349°) 169°

11° (191°)

(348°) 168°

'	Sin	Tan	Cot	Cos	'
0	.17365	.17633	5.6713	.98481	60
1	.17393	.17663	5.6617	.98476	59
2	.17422	.17693	5.6521	.98471	58
3	.17451	.17723	5.6425	.98466	57
4	.17479	.17753	5.6329	.98461	56
5	.17508	.17783	5.6234	.98455	55
6	.17537	.17813	5.6140	.98450	54
7	.17565	.17843	5.6045	.98445	53
8	.17594	.17873	5.5951	.98440	52
9	.17623	.17903	5.5857	.98435	51
10	.17651	.17933	5.5764	.98430	50
11	.17680	.17963	5.5671	.98425	49
12	.17708	.17993	5.5578	.98420	48
13	.17737	.18023	5.5485	.98414	47
14	.17766	.18053	5.5393	.98409	46
15	.17794	.18083	5.5301	.98404	45
16	.17823	.18113	5.5209	.98399	44
17	.17852	.18143	5.5118	.98394	43
18	.17880	.18173	5.5026	.98389	42
19	.17909	.18203	5.4936	.98383	41
20	.17937	.18233	5.4845	.98378	40
21	.17966	.18263	5.4755	.98373	39
22	.17995	.18293	5.4665	.98368	38
23	.18023	.18323	5.4575	.98362	37
24	.18052	.18353	5.4486	.98357	36
25	.18081	.18384	5.4397	.98352	35
26	.18109	.18414	5.4308	.98347	34
27	.18138	.18444	5.4219	.98341	33
28	.18166	.18474	5.4131	.98336	32
29	.18195	.18504	5.4043	.98331	31
30	.18224	.18534	5.3955	.98325	30
31	.18252	.18564	5.3868	.98320	29
32	.18281	.18594	5.3781	.98315	28
33	.18309	.18624	5.3694	.98310	27
34	.18338	.18654	5.3607	.98304	26
35	.18367	.18684	5.3521	.98299	25
36	.18395	.18714	5.3435	.98294	24
37	.18424	.18745	5.3349	.98288	23
38	.18452	.18775	5.3263	.98283	22
39	.18481	.18805	5.3178	.98277	21
40	.18509	.18835	5.3093	.98272	20
41	.18538	.18865	5.3008	.98267	19
42	.18567	.18895	5.2924	.98261	18
43	.18595	.18925	5.2839	.98256	17
44	.18624	.18955	5.2755	.98250	16
45	.18652	.18986	5.2672	.98245	15
46	.18681	.19016	5.2588	.98240	14
47	.18710	.19046	5.2505	.98234	13
48	.18738	.19076	5.2422	.98229	12
49	.18767	.19106	5.2339	.98223	11
50	.18795	.19136	5.2257	.98218	10
51	.18824	.19166	5.2174	.98212	9
52	.18852	.19197	5.2092	.98207	8
53	.18881	.19227	5.2011	.98201	7
54	.18910	.19257	5.1929	.98196	6
55	.18938	.19287	5.1848	.98190	5
56	.18967	.19317	5.1767	.98185	4
57	.18995	.19347	5.1686	.98179	3
58	.19024	.19378	5.1606	.98174	2
59	.19052	.19408	5.1526	.98168	1
60	.19081	.19438	5.1446	.98163	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.19081	.19438	5.1446	.98163	60
1	.19109	.19468	5.1366	.98157	59
2	.19138	.19498	5.1286	.98152	58
3	.19167	.19529	5.1207	.98146	57
4	.19195	.19559	5.1128	.98140	56
5	.19224	.19589	5.1049	.98135	55
6	.19252	.19619	5.0970	.98129	54
7	.19281	.19649	5.0892	.98124	53
8	.19309	.19680	5.0814	.98118	52
9	.19338	.19710	5.0736	.98112	51
10	.19366	.19740	5.0658	.98107	50
11	.19395	.19770	5.0581	.98101	49
12	.19423	.19801	5.0504	.98096	48
13	.19452	.19831	5.0427	.98090	47
14	.19481	.19861	5.0350	.98084	46
15	.19509	.19891	5.0273	.98079	45
16	.19538	.19921	5.0197	.98073	44
17	.19566	.19952	5.0121	.98067	43
18	.19595	.19982	5.0045	.98061	42
19	.19623	.20012	4.9969	.98056	41
20	.19652	.20042	4.9894	.98050	40
21	.19680	.20073	4.9819	.98044	39
22	.19709	.20103	4.9744	.98039	38
23	.19737	.20133	4.9669	.98033	37
24	.19766	.20164	4.9594	.98027	36
25	.19794	.20194	4.9520	.98021	35
26	.19823	.20224	4.9446	.98016	34
27	.19851	.20254	4.9372	.98010	33
28	.19880	.20285	4.9298	.98004	32
29	.19908	.20315	4.9225	.97998	31
30	.19937	.20345	4.9152	.97992	30
31	.19965	.20376	4.9078	.97987	29
32	.19994	.20406	4.9006	.97981	28
33	.20022	.20436	4.8933	.97975	27
34	.20051	.20466	4.8860	.97969	26
35	.20079	.20497	4.8788	.97963	25
36	.20108	.20527	4.8716	.97958	24
37	.20136	.20557	4.8644	.97952	23
38	.20165	.20588	4.8573	.97946	22
39	.20193	.20618	4.8501	.97940	21
40	.20222	.20648	4.8430	.97934	20
41	.20250	.20679	4.8359	.97938	19
42	.20279	.20709	4.8288	.97932	18
43	.20307	.20739	4.8218	.97926	17
44	.20336	.20770	4.8147	.97920	16
45	.20364	.20800	4.8077	.97915	15
46	.20393	.20830	4.8007	.97909	14
47	.20421	.20861	4.7937	.97903	13
48	.20450	.20891	4.7867	.97897	12
49	.20478	.20921	4.7798	.97891	11
50	.20507	.20952	4.7729	.97885	10
51	.20535	.20982	4.7659	.97879	9
52	.20563	.21013	4.7591	.97873	8
53	.20592	.21043	4.7522	.97867	7
54	.20620	.21073	4.7453	.97861	6
55	.20649	.21104	4.7385	.97855	5
56	.20677	.21134	4.7317	.97849	4
57	.20706	.21164	4.7249	.97843	3
58	.20734	.21195	4.7181	.97837	2
59	.20763	.21225	4.7114	.97831	1
60	.20791	.21256	4.7046	.97825	0
'	Cos	Cot	Tan	Sin	'

100° (280°)

(259°) 79°

101° (281°)

(258°) 78°

NATURAL FUNCTIONS (Continued)

12° (192°)

(347°) 167°

13° (193°)

(346°) 166°

'	Sin	Tan	Cot	Cos	'
0	.20791	.21256	4.7046	.97815	60
1	.20820	.21286	4.6979	.97809	59
2	.20848	.21316	4.6912	.97803	58
3	.20877	.21347	4.6845	.97797	57
4	.20905	.21377	4.6779	.97791	56
5	.20933	.21408	4.6712	.97784	55
6	.20962	.21438	4.6646	.97778	54
7	.20990	.21469	4.6580	.97772	53
8	.21019	.21499	4.6514	.97766	52
9	.21047	.21529	4.6448	.97760	51
10	.21076	.21560	4.6382	.97754	50
11	.21104	.21590	4.6317	.97748	49
12	.21132	.21621	4.6252	.97742	48
13	.21161	.21651	4.6187	.97735	47
14	.21189	.21682	4.6122	.97729	46
15	.21218	.21712	4.6057	.97723	45
16	.21246	.21743	4.5993	.97717	44
17	.21275	.21773	4.5928	.97711	43
18	.21303	.21804	4.5864	.97705	42
19	.21331	.21834	4.5800	.97698	41
20	.21360	.21864	4.5736	.97692	40
21	.21388	.21895	4.5673	.97686	39
22	.21417	.21925	4.5609	.97680	38
23	.21445	.21956	4.5546	.97673	37
24	.21474	.21986	4.5483	.97667	36
25	.21502	.22017	4.5420	.97661	35
26	.21530	.22047	4.5357	.97655	34
27	.21559	.22078	4.5294	.97648	33
28	.21587	.22108	4.5232	.97642	32
29	.21616	.22139	4.5169	.97636	31
30	.21644	.22169	4.5107	.97630	30
31	.21672	.22200	4.5045	.97623	29
32	.21701	.22231	4.4983	.97617	28
33	.21729	.22261	4.4922	.97611	27
34	.21758	.22292	4.4860	.97604	26
35	.21786	.22322	4.4799	.97598	25
36	.21814	.22353	4.4737	.97592	24
37	.21843	.22383	4.4676	.97585	23
38	.21871	.22414	4.4615	.97579	22
39	.21899	.22444	4.4555	.97573	21
40	.21928	.22475	4.4494	.97566	20
41	.21956	.22505	4.4434	.97560	19
42	.21985	.22536	4.4373	.97553	18
43	.22013	.22567	4.4313	.97547	17
44	.22041	.22597	4.4253	.97541	16
45	.22070	.22628	4.4194	.97534	15
46	.22098	.22658	4.4134	.97528	14
47	.22126	.22689	4.4075	.97521	13
48	.22155	.22719	4.4015	.97515	12
49	.22183	.22750	4.3956	.97508	11
50	.22212	.22781	4.3897	.97502	10
51	.22240	.22811	4.3838	.97496	9
52	.22268	.22842	4.3779	.97489	8
53	.22297	.22872	4.3721	.97483	7
54	.22325	.22903	4.3662	.97476	6
55	.22353	.22934	4.3604	.97470	5
56	.22382	.22964	4.3546	.97463	4
57	.22410	.22995	4.3488	.97457	3
58	.22438	.23026	4.3430	.97450	2
59	.22467	.23056	4.3372	.97444	1
60	.22495	.23087	4.3315	.97437	0
'	Cos	Cot	Tan	Sin	'

102° (282°)

(257°) 77°

103° (283°)

(256°) 76°

'	Sin	Tan	Cot	Cos	'
0	.22495	.23087	4.3315	.97437	60
1	.22523	.23117	4.3257	.97430	59
2	.22552	.23148	4.3200	.97424	58
3	.22580	.23179	4.3143	.97417	57
4	.22608	.23209	4.3086	.97411	56
5	.22637	.23240	4.3029	.97404	55
6	.22665	.23271	4.2972	.97398	54
7	.22693	.23301	4.2916	.97391	53
8	.22722	.23332	4.2859	.97384	52
9	.22750	.23363	4.2803	.97378	51
10	.22778	.23393	4.2747	.97371	50
11	.22807	.23424	4.2691	.97365	49
12	.22835	.23455	4.2635	.97358	48
13	.22863	.23485	4.2580	.97351	47
14	.22892	.23516	4.2524	.97345	46
15	.22920	.23547	4.2468	.97338	45
16	.22948	.23578	4.2413	.97331	44
17	.22977	.23608	4.2358	.97325	43
18	.23005	.23639	4.2303	.97318	42
19	.23033	.23670	4.2248	.97311	41
20	.23062	.23700	4.2193	.97304	40
21	.23090	.23731	4.2139	.97298	39
22	.23118	.23762	4.2084	.97291	38
23	.23146	.23793	4.2030	.97284	37
24	.23175	.23823	4.1976	.97278	36
25	.23203	.23854	4.1922	.97271	35
26	.23231	.23885	4.1868	.97264	34
27	.23260	.23916	4.1814	.97257	33
28	.23288	.23946	4.1760	.97251	32
29	.23316	.23977	4.1706	.97244	31
30	.23345	.24008	4.1653	.97237	30
31	.23373	.24039	4.1600	.97230	29
32	.23401	.24069	4.1547	.97223	28
33	.23429	.24100	4.1493	.97217	27
34	.23458	.24131	4.1441	.97210	26
35	.23486	.24162	4.1388	.97203	25
36	.23514	.24193	4.1335	.97196	24
37	.23542	.24223	4.1282	.97189	23
38	.23571	.24254	4.1230	.97182	22
39	.23599	.24285	4.1178	.97176	21
40	.23627	.24316	4.1126	.97169	20
41	.23656	.24347	4.1074	.97162	19
42	.23684	.24377	4.1022	.97155	18
43	.23712	.24408	4.0970	.97148	17
44	.23740	.24439	4.0918	.97141	16
45	.23769	.24470	4.0867	.97134	15
46	.23797	.24501	4.0815	.97127	14
47	.23825	.24532	4.0764	.97120	13
48	.23853	.24562	4.0713	.97113	12
49	.23882	.24593	4.0662	.97106	11
50	.23910	.24624	4.0611	.97100	10
51	.23938	.24655	4.0560	.97093	9
52	.23966	.24686	4.0509	.97086	8
53	.23995	.24717	4.0459	.97079	7
54	.24023	.24747	4.0408	.97072	6
55	.24051	.24778	4.0358	.97065	5
56	.24079	.24809	4.0308	.97058	4
57	.24108	.24840	4.0257	.97051	3
58	.24136	.24871	4.0207	.97044	2
59	.24164	.24902	4.0158	.97037	1
60	.24192	.24933	4.0108	.97030	0
'	Cos	Cot	Tan	Sin	'

NATURAL FUNCTIONS (Continued)

14° (194°)

(345°) 165°

15° (195°)

(344°) 164°

'	Sin	Tan	Cot	Cos	'
0	24192	24933	4.0108	.97030	60
1	24220	24964	4.0058	.97023	59
2	24249	24995	4.0009	.97015	58
3	24277	25026	3.9959	.97008	57
4	24305	25056	3.9910	.97001	56
5	24333	25087	3.9861	.96994	55
6	24362	25118	3.9812	.96987	54
7	24390	25149	3.9763	.96980	53
8	24418	25180	3.9714	.96973	52
9	24446	25211	3.9665	.96966	51
10	24474	25242	3.9617	.96959	50
11	24503	25273	3.9568	.96952	49
12	24531	25304	3.9520	.96945	48
13	24559	25335	3.9471	.96937	47
14	24587	25366	3.9423	.96930	46
15	24615	25397	3.9375	.96923	45
16	24644	25428	3.9327	.96916	44
17	24672	25459	3.9279	.96909	43
18	24700	25490	3.9232	.96902	42
19	24728	25521	3.9184	.96894	41
20	24756	25552	3.9136	.96887	40
21	24784	25583	3.9089	.96880	39
22	24813	25614	3.9042	.96873	38
23	24841	25645	3.8995	.96866	37
24	24869	25676	3.8947	.96858	36
25	24897	25707	3.8900	.96851	35
26	24925	25738	3.8854	.96844	34
27	24954	25769	3.8807	.96837	33
28	24982	25800	3.8760	.96829	32
29	25010	25831	3.8714	.96822	31
30	25038	25862	3.8667	.96815	30
31	25066	25893	3.8621	.96807	29
32	25094	25924	3.8575	.96800	28
33	25122	25955	3.8528	.96793	27
34	25151	25986	3.8482	.96786	26
35	25179	26017	3.8436	.96778	25
36	25207	26048	3.8391	.96771	24
37	25235	26079	3.8345	.96764	23
38	25263	26110	3.8299	.96756	22
39	25291	26141	3.8254	.96749	21
40	25320	26172	3.8208	.96742	20
41	25348	26203	3.8163	.96734	19
42	25376	26235	3.8118	.96727	18
43	25404	26266	3.8073	.96719	17
44	25432	26297	3.8028	.96712	16
45	25460	26328	3.7983	.96705	15
46	25488	26359	3.7938	.96697	14
47	25516	26390	3.7893	.96690	13
48	25545	26421	3.7848	.96682	12
49	25573	26452	3.7804	.96675	11
50	25601	26483	3.7760	.96667	10
51	25629	26515	3.7715	.96660	9
52	25657	26546	3.7671	.96653	8
53	25685	26577	3.7627	.96645	7
54	25713	26608	3.7583	.96638	6
55	25741	26639	3.7539	.96630	5
56	25769	26670	3.7495	.96623	4
57	25798	26701	3.7451	.96615	3
58	25826	26733	3.7408	.96608	2
59	25854	26764	3.7364	.96600	1
60	25882	26795	3.7321	.96593	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	25882	26795	3.7321	.96593	60
1	25910	26826	3.7277	.96585	59
2	25938	26857	3.7234	.96578	58
3	25966	26888	3.7191	.96570	57
4	25994	26920	3.7148	.96562	56
5	26022	26951	3.7105	.96555	55
6	26050	26982	3.7062	.96547	54
7	26079	27013	3.7019	.96540	53
8	26107	27044	3.6976	.96532	52
9	26135	27076	3.6933	.96524	51
10	26163	27107	3.6891	.96517	50
11	26191	27138	3.6848	.96509	49
12	26219	27169	3.6806	.96502	48
13	26247	27201	3.6764	.96494	47
14	26275	27232	3.6722	.96486	46
15	26303	27263	3.6680	.96479	45
16	26331	27294	3.6638	.96471	44
17	26359	27326	3.6596	.96463	43
18	26387	27357	3.6554	.96456	42
19	26415	27388	3.6512	.96448	41
20	26443	27419	3.6470	.96440	40
21	26471	27451	3.6429	.96433	39
22	26500	27482	3.6387	.96425	38
23	26528	27513	3.6346	.96417	37
24	26556	27545	3.6305	.96410	36
25	26584	27576	3.6264	.96402	35
26	26612	27607	3.6222	.96394	34
27	26640	27638	3.6181	.96386	33
28	26668	27670	3.6140	.96379	32
29	26696	27701	3.6100	.96371	31
30	26724	27732	3.6059	.96363	30
31	26752	27764	3.6018	.96355	29
32	26780	27795	3.5978	.96347	28
33	26808	27826	3.5937	.96340	27
34	26836	27858	3.5897	.96332	26
35	26864	27889	3.5856	.96324	25
36	26892	27921	3.5816	.96316	24
37	26920	27952	3.5776	.96308	23
38	26948	27983	3.5736	.96301	22
39	26976	28015	3.5696	.96293	21
40	27004	28046	3.5656	.96285	20
41	27032	28077	3.5616	.96277	19
42	27060	28109	3.5576	.96269	18
43	27088	28140	3.5536	.96261	17
44	27116	28172	3.5497	.96253	16
45	27144	28203	3.5457	.96246	15
46	27172	28234	3.5418	.96238	14
47	27200	28266	3.5379	.96230	13
48	27228	28297	3.5339	.96222	12
49	27256	28329	3.5300	.96214	11
50	27284	28360	3.5261	.96206	10
51	27312	28391	3.5222	.96198	9
52	27340	28423	3.5183	.96190	8
53	27368	28454	3.5144	.96182	7
54	27396	28486	3.5105	.96174	6
55	27424	28517	3.5067	.96166	5
56	27452	28549	3.5028	.96158	4
57	27480	28580	3.4989	.96150	3
58	27508	28612	3.4951	.96142	2
59	27536	28643	3.4912	.96134	1
60	27564	28675	3.4874	.96126	0
'	Cos	Cot	Tan	Sin	'

104° (284°)

(255°) 75°

105° (285°)

(254°) 74°

NATURAL FUNCTIONS (Continued)

16° (196°)

(343°) 163°

17° (197°)

(342°) 162°

'	Sin	Tan	Cot	Cos	'
0	.27564	.28675	3.4874	.96126	60
1	.27592	.28706	3.4836	.96118	59
2	.27620	.28738	3.4798	.96110	58
3	.27648	.28769	3.4760	.96102	57
4	.27676	.28801	3.4722	.96094	56
5	.27704	.28832	3.4684	.96086	55
6	.27731	.28864	3.4646	.96078	54
7	.27759	.28895	3.4608	.96070	53
8	.27787	.28927	3.4570	.96062	52
9	.27815	.28958	3.4533	.96054	51
10	.27843	.28990	3.4495	.96046	50
11	.27871	.29021	3.4458	.96037	49
12	.27899	.29053	3.4420	.96029	48
13	.27927	.29084	3.4383	.96021	47
14	.27955	.29116	3.4346	.96013	46
15	.27983	.29147	3.4308	.96005	45
16	.28011	.29179	3.4271	.95997	44
17	.28039	.29210	3.4234	.95989	43
18	.28067	.29242	3.4197	.95981	42
19	.28095	.29274	3.4160	.95972	41
20	.28123	.29305	3.4124	.95964	40
21	.28150	.29337	3.4087	.95956	39
22	.28178	.29368	3.4050	.95948	38
23	.28206	.29400	3.4014	.95940	37
24	.28234	.29432	3.3977	.95931	36
25	.28262	.29463	3.3941	.95923	35
26	.28290	.29495	3.3904	.95915	34
27	.28318	.29526	3.3868	.95907	33
28	.28346	.29558	3.3832	.95898	32
29	.28374	.29590	3.3796	.95890	31
30	.28402	.29621	3.3759	.95882	30
31	.28429	.29653	3.3723	.95874	29
32	.28457	.29685	3.3687	.95865	28
33	.28485	.29716	3.3652	.95857	27
34	.28513	.29748	3.3616	.95849	26
35	.28541	.29780	3.3580	.95841	25
36	.28569	.29811	3.3544	.95832	24
37	.28597	.29843	3.3509	.95824	23
38	.28625	.29875	3.3473	.95816	22
39	.28652	.29906	3.3438	.95807	21
40	.28680	.29938	3.3402	.95799	20
41	.28708	.29970	3.3367	.95791	19
42	.28736	.30001	3.3332	.95782	18
43	.28764	.30033	3.3297	.95774	17
44	.28792	.30065	3.3261	.95766	16
45	.28820	.30097	3.3226	.95757	15
46	.28847	.30128	3.3191	.95749	14
47	.28875	.30160	3.3156	.95740	13
48	.28903	.30192	3.3122	.95732	12
49	.28931	.30224	3.3087	.95724	11
50	.28959	.30255	3.3052	.95715	10
51	.28987	.30287	3.3017	.95707	9
52	.29015	.30319	3.2983	.95698	8
53	.29042	.30351	3.2948	.95690	7
54	.29070	.30382	3.2914	.95681	6
55	.29098	.30414	3.2879	.95673	5
56	.29126	.30446	3.2845	.95664	4
57	.29154	.30478	3.2811	.95656	3
58	.29182	.30509	3.2777	.95647	2
59	.29209	.30541	3.2743	.95639	1
60	.29237	.30573	3.2709	.95630	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.29237	.30573	3.2709	.95630	60
1	.29265	.30605	3.2675	.95622	59
2	.29293	.30637	3.2641	.95613	58
3	.29321	.30669	3.2607	.95605	57
4	.29348	.30700	3.2573	.95596	56
5	.29376	.30732	3.2539	.95588	55
6	.29404	.30764	3.2506	.95579	54
7	.29432	.30796	3.2472	.95571	53
8	.29460	.30828	3.2438	.95562	52
9	.29487	.30860	3.2405	.95554	51
10	.29515	.30891	3.2371	.95545	50
11	.29543	.30923	3.2338	.95536	49
12	.29571	.30955	3.2305	.95528	48
13	.29599	.30987	3.2272	.95519	47
14	.29626	.31019	3.2238	.95511	46
15	.29654	.31051	3.2205	.95502	45
16	.29682	.31083	3.2172	.95493	44
17	.29710	.31115	3.2139	.95485	43
18	.29737	.31147	3.2106	.95476	42
19	.29765	.31178	3.2073	.95467	41
20	.29793	.31210	3.2041	.95459	40
21	.29821	.31242	3.2008	.95450	39
22	.29849	.31274	3.1975	.95441	38
23	.29876	.31306	3.1943	.95433	37
24	.29904	.31338	3.1910	.95424	36
25	.29932	.31370	3.1878	.95415	35
26	.29960	.31402	3.1845	.95407	34
27	.29987	.31434	3.1813	.95398	33
28	.30015	.31466	3.1780	.95389	32
29	.30043	.31498	3.1748	.95380	31
30	.30071	.31530	3.1716	.95372	30
31	.30098	.31562	3.1684	.95363	29
32	.30126	.31594	3.1652	.95354	28
33	.30154	.31626	3.1620	.95345	27
34	.30182	.31658	3.1588	.95337	26
35	.30209	.31690	3.1556	.95328	25
36	.30237	.31722	3.1524	.95319	24
37	.30265	.31754	3.1492	.95310	23
38	.30292	.31786	3.1460	.95301	22
39	.30320	.31818	3.1429	.95293	21
40	.30348	.31850	3.1397	.95284	20
41	.30376	.31882	3.1366	.95275	19
42	.30403	.31914	3.1334	.95266	18
43	.30431	.31946	3.1303	.95257	17
44	.30459	.31978	3.1271	.95248	16
45	.30486	.32010	3.1240	.95240	15
46	.30514	.32042	3.1209	.95231	14
47	.30542	.32074	3.1178	.95222	13
48	.30570	.32106	3.1146	.95213	12
49	.30597	.32139	3.1115	.95204	11
50	.30625	.32171	3.1084	.95195	10
51	.30653	.32203	3.1053	.95186	9
52	.30680	.32235	3.1022	.95177	8
53	.30708	.32267	3.0991	.95168	7
54	.30736	.32299	3.0961	.95159	6
55	.30763	.32331	3.0930	.95150	5
56	.30791	.32363	3.0899	.95142	4
57	.30819	.32396	3.0868	.95133	3
58	.30846	.32428	3.0838	.95124	2
59	.30874	.32460	3.0807	.95115	1
60	.30902	.32492	3.0777	.95106	0
'	Cos	Cot	Tan	Sin	'

106° (286°)

(253°) 73°

107° (287°)

(252°) 72°

NATURAL FUNCTIONS (Continued)

18° (198°)

(341°) 161°

19° (199°)

(340°) 160°

'	Sin	Tan	Cot	Cos	'
0	.30902	.32492	3.0777	.95106	60
1	.30929	.32524	3.0746	.95097	59
2	.30957	.32556	3.0716	.95088	58
3	.30985	.32588	3.0686	.95079	57
4	.31012	.32621	3.0655	.95070	56
5	.31040	.32653	3.0625	.95061	55
6	.31068	.32685	3.0595	.95052	54
7	.31095	.32717	3.0565	.95043	53
8	.31123	.32749	3.0535	.95033	52
9	.31151	.32782	3.0505	.95024	51
10	.31178	.32814	3.0475	.95015	50
11	.31206	.32846	3.0445	.95006	49
12	.31233	.32878	3.0415	.94997	48
13	.31261	.32911	3.0385	.94988	47
14	.31289	.32943	3.0356	.94979	46
15	.31316	.32975	3.0326	.94970	45
16	.31344	.33007	3.0296	.94961	44
17	.31372	.33040	3.0267	.94952	43
18	.31399	.33072	3.0237	.94943	42
19	.31427	.33104	3.0208	.94933	41
20	.31454	.33136	3.0178	.94924	40
21	.31482	.33169	3.0149	.94915	39
22	.31510	.33201	3.0120	.94906	38
23	.31537	.33233	3.0090	.94897	37
24	.31565	.33266	3.0061	.94888	36
25	.31593	.33298	3.0032	.94878	35
26	.31620	.33330	3.0003	.94869	34
27	.31648	.33363	2.9974	.94860	33
28	.31675	.33395	2.9945	.94851	32
29	.31703	.33427	2.9916	.94842	31
30	.31730	.33460	2.9887	.94833	30
31	.31758	.33492	2.9858	.94823	29
32	.31786	.33524	2.9829	.94814	28
33	.31813	.33557	2.9800	.94805	27
34	.31841	.33589	2.9772	.94795	26
35	.31868	.33621	2.9743	.94786	25
36	.31896	.33654	2.9714	.94777	24
37	.31923	.33686	2.9686	.94768	23
38	.31951	.33718	2.9657	.94758	22
39	.31979	.33751	2.9629	.94749	21
40	.32006	.33783	2.9600	.94740	20
41	.32034	.33816	2.9572	.94730	19
42	.32061	.33848	2.9544	.94721	18
43	.32089	.33881	2.9515	.94712	17
44	.32116	.33913	2.9487	.94702	16
45	.32144	.33945	2.9459	.94693	15
46	.32171	.33978	2.9431	.94684	14
47	.32199	.34010	2.9403	.94674	13
48	.32227	.34043	2.9375	.94665	12
49	.32254	.34075	2.9347	.94656	11
50	.32282	.34108	2.9319	.94646	10
51	.32309	.34140	2.9291	.94637	9
52	.32337	.34173	2.9263	.94627	8
53	.32364	.34205	2.9235	.94618	7
54	.32392	.34238	2.9208	.94609	6
55	.32419	.34270	2.9180	.94599	5
56	.32447	.34303	2.9152	.94590	4
57	.32474	.34335	2.9125	.94580	3
58	.32502	.34368	2.9097	.94571	2
59	.32529	.34400	2.9070	.94561	1
60	.32557	.34433	2.9042	.94552	0
'	Cos	Cot	Tan	Sin	'

108° (288°)

(251°) 71°

109° (289°)

(250°) 70°

'	Sin	Tan	Cot	Cos	'
0	.32557	.34433	2.9042	.94552	60
1	.32584	.34465	2.9015	.94542	59
2	.32612	.34498	2.8987	.94533	58
3	.32639	.34530	2.8960	.94523	57
4	.32667	.34563	2.8933	.94514	56
5	.32694	.34596	2.8905	.94504	55
6	.32722	.34628	2.8878	.94495	54
7	.32749	.34661	2.8851	.94485	53
8	.32777	.34693	2.8824	.94476	52
9	.32804	.34726	2.8797	.94466	51
10	.32832	.34758	2.8770	.94457	50
11	.32859	.34791	2.8743	.94447	49
12	.32887	.34824	2.8716	.94438	48
13	.32914	.34856	2.8689	.94428	47
14	.32942	.34889	2.8662	.94418	46
15	.32969	.34922	2.8636	.94409	45
16	.32997	.34954	2.8609	.94399	44
17	.33024	.34987	2.8582	.94390	43
18	.33051	.35020	2.8556	.94380	42
19	.33079	.35052	2.8529	.94370	41
20	.33106	.35085	2.8502	.94361	40
21	.33134	.35118	2.8476	.94351	39
22	.33161	.35150	2.8449	.94342	38
23	.33189	.35183	2.8423	.94332	37
24	.33216	.35216	2.8397	.94322	36
25	.33244	.35248	2.8370	.94313	35
26	.33271	.35281	2.8344	.94303	24
27	.33298	.35314	2.8318	.94293	33
28	.33326	.35346	2.8291	.94284	32
29	.33353	.35379	2.8265	.94274	31
30	.33381	.35412	2.8239	.94264	30
31	.33408	.35445	2.8213	.94254	29
32	.33436	.35477	2.8187	.94245	28
33	.33463	.35510	2.8161	.94235	27
34	.33490	.35543	2.8135	.94225	26
35	.33518	.35576	2.8109	.94215	25
36	.33545	.35608	2.8083	.94206	24
37	.33573	.35641	2.8057	.94196	23
38	.33600	.35674	2.8032	.94186	22
39	.33627	.35707	2.8006	.94176	21
40	.33655	.35740	2.7980	.94167	20
41	.33682	.35772	2.7955	.94157	19
42	.33710	.35805	2.7929	.94147	18
43	.33737	.35838	2.7903	.94137	17
44	.33764	.35871	2.7878	.94127	16
45	.33792	.35904	2.7852	.94118	15
46	.33819	.35937	2.7827	.94108	14
47	.33846	.35969	2.7801	.94098	13
48	.33874	.36002	2.7776	.94088	12
49	.33901	.36035	2.7751	.94078	11
50	.33929	.36068	2.7725	.94068	10
51	.33956	.36101	2.7700	.94058	9
52	.33983	.36134	2.7675	.94049	8
53	.34011	.36167	2.7650	.94039	7
54	.34038	.36199	2.7625	.94029	6
55	.34065	.36232	2.7600	.94019	5
56	.34093	.36265	2.7575	.94009	4
57	.34120	.36298	2.7550	.93999	3
58	.34147	.36331	2.7525	.93989	2
59	.34175	.36364	2.7500	.93979	1
60	.34202	.36397	2.7475	.93969	0
'	Cos	Cot	Tan	Sin	'

NATURAL FUNCTIONS (Continued)

20° (200°)

(339°) 159°

21° (201°)

(338°) 158°

'	Sin	Tan	Cot	Cos	'
0	.34202	.36397	2.7475	.93969	60
1	.34229	.36430	2.7450	.93959	59
2	.34257	.36463	2.7425	.93949	58
3	.34284	.36496	2.7400	.93939	57
4	.34311	.36529	2.7376	.93929	56
5	.34339	.36562	2.7351	.93919	55
6	.34366	.36595	2.7326	.93909	54
7	.34393	.36628	2.7302	.93899	53
8	.34421	.36661	2.7277	.93889	52
9	.34448	.36694	2.7253	.93879	51
10	.34475	.36727	2.7228	.93869	50
11	.34503	.36760	2.7204	.93859	49
12	.34530	.36793	2.7179	.93849	48
13	.34557	.36826	2.7155	.93839	47
14	.34584	.36859	2.7130	.93829	46
15	.34612	.36892	2.7106	.93819	45
16	.34639	.36925	2.7082	.93809	44
17	.34666	.36958	2.7058	.93799	43
18	.34694	.36991	2.7034	.93789	42
19	.34721	.37024	2.7009	.93779	41
20	.34748	.37057	2.6985	.93769	40
21	.34775	.37090	2.6961	.93759	39
22	.34803	.37123	2.6937	.93748	38
23	.34830	.37157	2.6913	.93738	37
24	.34857	.37190	2.6889	.93728	36
25	.34884	.37223	2.6865	.93718	35
26	.34912	.37256	2.6841	.93708	34
27	.34939	.37289	2.6818	.93698	33
28	.34966	.37322	2.6794	.93688	32
29	.34993	.37355	2.6770	.93677	31
30	.35021	.37388	2.6746	.93667	30
31	.35048	.37422	2.6723	.93657	29
32	.35075	.37455	2.6699	.93647	28
33	.35102	.37488	2.6675	.93637	27
34	.35130	.37521	2.6652	.93626	26
35	.35157	.37554	2.6628	.93616	25
36	.35184	.37588	2.6605	.93606	24
37	.35211	.37621	2.6581	.93596	23
38	.35239	.37654	2.6558	.93585	22
39	.35266	.37687	2.6534	.93575	21
40	.35293	.37720	2.6511	.93565	20
41	.35320	.37754	2.6488	.93555	19
42	.35347	.37787	2.6464	.93544	18
43	.35375	.37820	2.6441	.93534	17
44	.35402	.37853	2.6418	.93524	16
45	.35429	.37887	2.6395	.93514	15
46	.35456	.37920	2.6371	.93503	14
47	.35484	.37953	2.6348	.93493	13
48	.35511	.37986	2.6325	.93483	12
49	.35538	.38020	2.6302	.93472	11
50	.35565	.38053	2.6279	.93462	10
51	.35592	.38086	2.6256	.93452	9
52	.35619	.38120	2.6233	.93441	8
53	.35647	.38153	2.6210	.93431	7
54	.35674	.38186	2.6187	.93420	6
55	.35701	.38220	2.6165	.93410	5
56	.35728	.38253	2.6142	.93400	4
57	.35755	.38286	2.6119	.93389	3
58	.35782	.38320	2.6096	.93379	2
59	.35810	.38353	2.6074	.93368	1
60	.35837	.38386	2.6051	.93358	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.35837	.38386	2.6051	.93358	60
1	.35864	.38420	2.6028	.93348	59
2	.35891	.38453	2.6006	.93337	58
3	.35918	.38487	2.5983	.93327	57
4	.35945	.38520	2.5961	.93316	56
5	.35973	.38553	2.5938	.93306	55
6	.36000	.38587	2.5916	.93295	54
7	.36027	.38620	2.5893	.93285	53
8	.36054	.38654	2.5871	.93274	52
9	.36081	.38687	2.5848	.93264	51
10	.36108	.38721	2.5826	.93253	50
11	.36135	.38754	2.5804	.93243	49
12	.36162	.38787	2.5782	.93232	48
13	.36190	.38821	2.5759	.93222	47
14	.36217	.38854	2.5737	.93211	46
15	.36244	.38888	2.5715	.93201	45
16	.36271	.38921	2.5693	.93190	44
17	.36298	.38955	2.5671	.93180	43
18	.36325	.38988	2.5649	.93169	42
19	.36352	.39022	2.5627	.93159	41
20	.36379	.39055	2.5605	.93148	40
21	.36406	.39089	2.5583	.93137	39
22	.36434	.39122	2.5561	.93127	38
23	.36461	.39156	2.5539	.93116	37
24	.36488	.39190	2.5517	.93106	36
25	.36515	.39223	2.5495	.93095	35
26	.36542	.39257	2.5473	.93084	34
27	.36569	.39290	2.5452	.93074	33
28	.36596	.39324	2.5430	.93063	32
29	.36623	.39357	2.5408	.93052	31
30	.36650	.39391	2.5386	.93042	30
31	.36677	.39425	2.5365	.93031	29
32	.36704	.39458	2.5343	.93020	28
33	.36731	.39492	2.5322	.93010	27
34	.36758	.39526	2.5300	.92999	26
35	.36785	.39559	2.5279	.92988	25
36	.36812	.39593	2.5257	.92978	24
37	.36839	.39626	2.5236	.92967	23
38	.36867	.39660	2.5214	.92956	22
39	.36894	.39694	2.5193	.92945	21
40	.36921	.39727	2.5172	.92935	20
41	.36948	.39761	2.5150	.92924	19
42	.36975	.39795	2.5129	.92913	18
43	.37002	.39829	2.5108	.92902	17
44	.37029	.39862	2.5086	.92892	16
45	.37056	.39896	2.5065	.92881	15
46	.37083	.39930	2.5044	.92870	14
47	.37110	.39963	2.5023	.92859	13
48	.37137	.39997	2.5002	.92849	12
49	.37164	.40031	2.4981	.92838	11
50	.37191	.40065	2.4960	.92827	10
51	.37218	.40098	2.4939	.92816	9
52	.37245	.40132	2.4918	.92805	8
53	.37272	.40166	2.4897	.92794	7
54	.37299	.40200	2.4876	.92784	6
55	.37326	.40234	2.4855	.92773	5
56	.37353	.40267	2.4834	.92762	4
57	.37380	.40301	2.4813	.92751	3
58	.37407	.40335	2.4792	.92740	2
59	.37434	.40369	2.4772	.92729	1
60	.37461	.40403	2.4751	.92718	0
'	Cos	Cot	Tan	Sin	'

110° (290°)

(249°) 69°

111° (291°)

(248°) 68°

NATURAL FUNCTIONS (Continued)

22° (202°)

(337°) 157°

23° (203°)

(336°) 156°

	Sin	Tan	Cot	Cos	
0	.37461	.40403	2.4751	.92718	60
1	.37488	.40436	2.4730	.92707	59
2	.37515	.40470	2.4709	.92697	58
3	.37542	.40504	2.4689	.92686	57
4	.37569	.40538	2.4668	.92675	56
5	.37595	.40572	2.4648	.92664	55
6	.37622	.40606	2.4627	.92653	54
7	.37649	.40640	2.4606	.92642	53
8	.37676	.40674	2.4586	.92631	52
9	.37703	.40707	2.4566	.92620	51
10	.37730	.40741	2.4545	.92609	50
11	.37757	.40775	2.4525	.92598	49
12	.37784	.40809	2.4504	.92587	48
13	.37811	.40843	2.4484	.92576	47
14	.37838	.40877	2.4464	.92565	46
15	.37865	.40911	2.4443	.92554	45
16	.37892	.40945	2.4423	.92543	44
17	.37919	.40979	2.4403	.92532	43
18	.37946	.41013	2.4383	.92521	42
19	.37973	.41047	2.4362	.92510	41
20	.37999	.41081	2.4342	.92499	40
21	.38026	.41115	2.4322	.92488	39
22	.38053	.41149	2.4302	.92477	38
23	.38080	.41183	2.4282	.92466	37
24	.38107	.41217	2.4262	.92455	36
25	.38134	.41251	2.4242	.92444	35
26	.38161	.41285	2.4222	.92432	34
27	.38188	.41319	2.4202	.92421	33
28	.38215	.41353	2.4182	.92410	32
29	.38241	.41387	2.4162	.92399	31
30	.38268	.41421	2.4142	.92388	30
31	.38295	.41455	2.4122	.92377	29
32	.38322	.41490	2.4102	.92366	28
33	.38349	.41524	2.4083	.92355	27
34	.38376	.41558	2.4063	.92343	26
35	.38403	.41592	2.4043	.92332	25
36	.38430	.41626	2.4023	.92321	24
37	.38456	.41660	2.4004	.92310	23
38	.38483	.41694	2.3984	.92299	22
39	.38510	.41728	2.3964	.92287	21
40	.38537	.41763	2.3945	.92276	20
41	.38564	.41797	2.3925	.92265	19
42	.38591	.41831	2.3906	.92254	18
43	.38617	.41865	2.3886	.92243	17
44	.38644	.41899	2.3867	.92231	16
45	.38671	.41933	2.3847	.92220	15
46	.38698	.41968	2.3828	.92209	14
47	.38725	.42002	2.3808	.92198	13
48	.38752	.42036	2.3789	.92186	12
49	.38778	.42070	2.3770	.92175	11
50	.38805	.42105	2.3750	.92164	10
51	.38832	.42139	2.3731	.92152	9
52	.38859	.42173	2.3712	.92141	8
53	.38886	.42207	2.3693	.92130	7
54	.38912	.42242	2.3673	.92119	6
55	.38939	.42276	2.3654	.92107	5
56	.38966	.42310	2.3635	.92096	4
57	.38993	.42345	2.3616	.92085	3
58	.39020	.42379	2.3597	.92073	2
59	.39046	.42413	2.3578	.92062	1
60	.39073	.42447	2.3559	.92050	0
	Cos	Cot	Tan	Sin	

112° (292°)

(247°) 67°

113° (293°)

(246°) 66°

	Sin	Tan	Cot	Cos	
0	.39073	.42447	2.3559	.92050	60
1	.39100	.42482	2.3539	.92039	59
2	.39127	.42516	2.3520	.92028	58
3	.39153	.42551	2.3501	.92016	57
4	.39180	.42585	2.3483	.92005	56
5	.39207	.42619	2.3464	.91994	55
6	.39234	.42654	2.3445	.91982	54
7	.39260	.42688	2.3426	.91971	53
8	.39287	.42722	2.3407	.91959	52
9	.39314	.42757	2.3388	.91948	51
10	.39341	.42791	2.3369	.91936	50
11	.39367	.42826	2.3351	.91925	49
12	.39394	.42860	2.3332	.91914	48
13	.39421	.42894	2.3313	.91902	47
14	.39448	.42929	2.3294	.91891	46
15	.39474	.42963	2.3276	.91879	45
16	.39501	.42998	2.3257	.91868	44
17	.39528	.43032	2.3238	.91856	43
18	.39555	.43067	2.3220	.91845	42
19	.39581	.43101	2.3201	.91833	41
20	.39608	.43136	2.3183	.91822	40
21	.39635	.43170	2.3164	.91810	39
22	.39661	.43205	2.3146	.91799	38
23	.39688	.43239	2.3127	.91787	37
24	.39715	.43274	2.3109	.91775	36
25	.39741	.43308	2.3090	.91764	35
26	.39768	.43343	2.3072	.91752	34
27	.39795	.43378	2.3053	.91741	33
28	.39822	.43412	2.3035	.91729	32
29	.39848	.43447	2.3017	.91718	31
30	.39875	.43481	2.2998	.91706	30
31	.39902	.43516	2.2980	.91694	29
32	.39928	.43550	2.2962	.91683	28
33	.39955	.43585	2.2944	.91671	27
34	.39982	.43620	2.2925	.91660	26
35	.40008	.43654	2.2907	.91648	25
36	.40035	.43689	2.2889	.91636	24
37	.40062	.43724	2.2871	.91625	23
38	.40088	.43758	2.2853	.91613	22
39	.40115	.43793	2.2835	.91601	21
40	.40141	.43828	2.2817	.91590	20
41	.40168	.43862	2.2799	.91578	19
42	.40195	.43897	2.2781	.91566	18
43	.40221	.43932	2.2763	.91555	17
44	.40248	.43966	2.2745	.91543	16
45	.40275	.44001	2.2727	.91531	15
46	.40301	.44036	2.2709	.91519	14
47	.40328	.44071	2.2691	.91508	13
48	.40355	.44105	2.2673	.91496	12
49	.40381	.44140	2.2655	.91484	11
50	.40408	.44175	2.2637	.91472	10
51	.40434	.44210	2.2620	.91461	9
52	.40461	.44244	2.2602	.91449	8
53	.40488	.44279	2.2584	.91437	7
54	.40514	.44314	2.2566	.91425	6
55	.40541	.44349	2.2549	.91414	5
56	.40567	.44384	2.2531	.91402	4
57	.40594	.44418	2.2513	.91390	3
58	.40621	.44453	2.2496	.91378	2
59	.40647	.44488	2.2478	.91366	1
60	.40674	.44523	2.2460	.91355	0
	Cos	Cot	Tan	Sin	

NATURAL FUNCTIONS (Continued)

24° (204°)

(335°) 155°

25° (205°)

(334°) 154°

'	Sin	Tan	Cot	Cos	'
0	.40674	.44523	2.2460	.91355	60
1	.40700	.44558	2.2443	.91343	59
2	.40727	.44593	2.2425	.91331	58
3	.40753	.44627	2.2408	.91319	57
4	.40780	.44662	2.2390	.91307	56
5	.40806	.44697	2.2373	.91295	55
6	.40833	.44732	2.2355	.91283	54
7	.40860	.44767	2.2338	.91272	53
8	.40886	.44802	2.2320	.91260	52
9	.40913	.44837	2.2303	.91248	51
10	.40939	.44872	2.2286	.91236	50
11	.40966	.44907	2.2268	.91224	49
12	.40992	.44942	2.2251	.91212	48
13	.41019	.44977	2.2234	.91200	47
14	.41045	.45012	2.2216	.91188	46
15	.41072	.45047	2.2199	.91176	45
16	.41098	.45082	2.2182	.91164	44
17	.41125	.45117	2.2165	.91152	43
18	.41151	.45152	2.2148	.91140	42
19	.41178	.45187	2.2130	.91128	41
20	.41204	.45222	2.2113	.91116	40
21	.41231	.45257	2.2096	.91104	39
22	.41257	.45292	2.2079	.91092	38
23	.41284	.45327	2.2062	.91080	37
24	.41310	.45362	2.2045	.91068	36
25	.41337	.45397	2.2028	.91056	35
26	.41363	.45432	2.2011	.91044	34
27	.41390	.45467	2.1994	.91032	33
28	.41416	.45502	2.1977	.91020	32
29	.41443	.45538	2.1960	.91008	31
30	.41469	.45573	2.1943	.90996	30
31	.41496	.45608	2.1926	.90984	29
32	.41522	.45643	2.1909	.90972	28
33	.41549	.45678	2.1892	.90960	27
34	.41575	.45713	2.1876	.90948	26
35	.41602	.45748	2.1859	.90936	25
36	.41628	.45784	2.1842	.90924	24
37	.41655	.45819	2.1825	.90911	23
38	.41681	.45854	2.1808	.90899	22
39	.41707	.45889	2.1792	.90887	21
40	.41734	.45924	2.1775	.90875	20
41	.41760	.45960	2.1758	.90863	19
42	.41787	.45995	2.1742	.90851	18
43	.41813	.46030	2.1725	.90839	17
44	.41840	.46065	2.1708	.90826	16
45	.41866	.46101	2.1692	.90814	15
46	.41892	.46136	2.1675	.90802	14
47	.41919	.46171	2.1659	.90790	13
48	.41945	.46206	2.1642	.90778	12
49	.41972	.46242	2.1625	.90766	11
50	.41998	.46277	2.1609	.90753	10
51	.42024	.46312	2.1592	.90741	9
52	.42051	.46348	2.1576	.90729	8
53	.42077	.46383	2.1560	.90717	7
54	.42104	.46418	2.1543	.90704	6
55	.42130	.46454	2.1527	.90692	5
56	.42156	.46489	2.1510	.90680	4
57	.42183	.46525	2.1494	.90668	3
58	.42209	.46560	2.1478	.90655	2
59	.42235	.46595	2.1461	.90643	1
60	.42262	.46631	2.1445	.90631	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.42262	.46631	2.1445	.90631	60
1	.42288	.46666	2.1429	.90618	59
2	.42315	.46702	2.1413	.90606	58
3	.42341	.46737	2.1396	.90594	57
4	.42367	.46772	2.1380	.90582	56
5	.42394	.46808	2.1364	.90569	55
6	.42420	.46843	2.1348	.90557	54
7	.42446	.46879	2.1332	.90545	53
8	.42473	.46914	2.1315	.90532	52
9	.42499	.46950	2.1299	.90520	51
10	.42525	.46985	2.1283	.90507	50
11	.42552	.47021	2.1267	.90495	49
12	.42578	.47056	2.1251	.90483	48
13	.42604	.47092	2.1235	.90470	47
14	.42631	.47128	2.1219	.90458	46
15	.42657	.47163	2.1203	.90446	45
16	.42683	.47199	2.1187	.90433	44
17	.42709	.47234	2.1171	.90421	43
18	.42736	.47270	2.1155	.90408	42
19	.42762	.47305	2.1139	.90396	41
20	.42788	.47341	2.1123	.90383	40
21	.42815	.47377	2.1107	.90371	39
22	.42841	.47412	2.1092	.90358	38
23	.42867	.47448	2.1076	.90346	37
24	.42894	.47483	2.1060	.90334	36
25	.42920	.47519	2.1044	.90321	35
26	.42946	.47555	2.1028	.90309	34
27	.42972	.47590	2.1013	.90296	33
28	.42999	.47626	2.0997	.90284	32
29	.43025	.47662	2.0981	.90271	31
30	.43051	.47698	2.0965	.90259	30
31	.43077	.47733	2.0950	.90246	29
32	.43104	.47769	2.0934	.90233	28
33	.43130	.47805	2.0918	.90221	27
34	.43156	.47840	2.0903	.90208	26
35	.43182	.47876	2.0887	.90196	25
36	.43209	.47912	2.0872	.90183	24
37	.43235	.47948	2.0856	.90171	23
38	.43261	.47984	2.0840	.90158	22
39	.43287	.48019	2.0825	.90146	21
40	.43313	.48055	2.0809	.90133	20
41	.43340	.48091	2.0794	.90120	19
42	.43366	.48127	2.0778	.90108	18
43	.43392	.48163	2.0763	.90095	17
44	.43418	.48198	2.0748	.90082	16
45	.43445	.48234	2.0732	.90070	15
46	.43471	.48270	2.0717	.90057	14
47	.43497	.48306	2.0701	.90045	13
48	.43523	.48342	2.0686	.90032	12
49	.43549	.48378	2.0671	.90019	11
50	.43575	.48414	2.0655	.90007	10
51	.43602	.48450	2.0640	.89994	9
52	.43628	.48486	2.0625	.89981	8
53	.43654	.48521	2.0609	.89968	7
54	.43680	.48557	2.0594	.89956	6
55	.43706	.48593	2.0579	.89943	5
56	.43733	.48629	2.0564	.89930	4
57	.43759	.48665	2.0549	.89918	3
58	.43785	.48701	2.0533	.89905	2
59	.43811	.48737	2.0518	.89892	1
60	.43837	.48773	2.0503	.89879	0
'	Cos	Cot	Tan	Sin	'

114° (294°)

(245°) 65°

115° (295°)

(244°) 64°

NATURAL FUNCTIONS (Continued)

26° (206°)

(333°) 153°

27° (207°)

(332°) 152°

'	Sin	Tan	Cot	Cos	'
0	.43837	.48773	2.0503	.89879	60
1	.43863	.48809	2.0488	.89867	59
2	.43889	.48845	2.0473	.89854	58
3	.43916	.48881	2.0458	.89841	57
4	.43942	.48917	2.0443	.89828	56
5	.43968	.48953	2.0428	.89816	55
6	.43994	.48989	2.0413	.89803	54
7	.44020	.49026	2.0398	.89790	53
8	.44046	.49062	2.0383	.89777	52
9	.44072	.49098	2.0368	.89764	51
10	.44098	.49134	2.0353	.89752	50
11	.44124	.49170	2.0338	.89739	49
12	.44151	.49206	2.0323	.89726	48
13	.44177	.49242	2.0308	.89713	47
14	.44203	.49278	2.0293	.89700	46
15	.44229	.49315	2.0278	.89687	45
16	.44255	.49351	2.0263	.89674	44
17	.44281	.49387	2.0248	.89662	43
18	.44307	.49423	2.0233	.89649	42
19	.44333	.49459	2.0219	.89636	41
20	.44359	.49495	2.0204	.89623	40
21	.44385	.49532	2.0189	.89610	39
22	.44411	.49568	2.0174	.89597	38
23	.44437	.49604	2.0160	.89584	37
24	.44464	.49640	2.0145	.89571	36
25	.44490	.49677	2.0130	.89558	35
26	.44516	.49713	2.0115	.89545	34
27	.44542	.49749	2.0101	.89532	33
28	.44568	.49786	2.0086	.89519	32
29	.44594	.49822	2.0072	.89506	31
30	.44620	.49858	2.0057	.89493	30
31	.44646	.49894	2.0042	.89480	29
32	.44672	.49931	2.0028	.89467	28
33	.44698	.49967	2.0013	.89454	27
34	.44724	.50004	1.9999	.89441	26
35	.44750	.50040	1.9984	.89428	25
36	.44776	.50076	1.9970	.89415	24
37	.44802	.50113	1.9955	.89402	23
38	.44828	.50149	1.9941	.89389	22
39	.44854	.50185	1.9926	.89376	21
40	.44880	.50222	1.9912	.89363	20
41	.44906	.50258	1.9897	.89350	19
42	.44932	.50295	1.9883	.89337	18
43	.44958	.50331	1.9868	.89324	17
44	.44984	.50368	1.9854	.89311	16
45	.45010	.50404	1.9840	.89298	15
46	.45036	.50441	1.9825	.89285	14
47	.45062	.50477	1.9811	.89272	13
48	.45088	.50514	1.9797	.89259	12
49	.45114	.50550	1.9782	.89245	11
50	.45140	.50587	1.9768	.89232	10
51	.45166	.50623	1.9754	.89219	9
52	.45192	.50660	1.9740	.89206	8
53	.45218	.50696	1.9725	.89193	7
54	.45243	.50733	1.9711	.89180	6
55	.45269	.50769	1.9697	.89167	5
56	.45295	.50806	1.9683	.89153	4
57	.45321	.50843	1.9669	.89140	3
58	.45347	.50879	1.9654	.89127	2
59	.45373	.50916	1.9640	.89114	1
60	.45399	.50953	1.9626	.89101	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.45399	.50953	1.9626	.89101	60
1	.45425	.50989	1.9612	.89087	59
2	.45451	.51026	1.9598	.89074	58
3	.45477	.51063	1.9584	.89061	57
4	.45503	.51099	1.9570	.89048	56
5	.45529	.51136	1.9556	.89035	55
6	.45554	.51173	1.9542	.89021	54
7	.45580	.51209	1.9528	.89008	53
8	.45606	.51246	1.9514	.88995	52
9	.45632	.51283	1.9500	.88981	51
10	.45658	.51319	1.9486	.88968	50
11	.45684	.51356	1.9472	.88955	49
12	.45710	.51393	1.9458	.88942	48
13	.45736	.51430	1.9444	.88928	47
14	.45762	.51467	1.9430	.88915	46
15	.45787	.51503	1.9416	.88902	45
16	.45813	.51540	1.9402	.88888	44
17	.45839	.51577	1.9388	.88875	43
18	.45865	.51614	1.9375	.88862	42
19	.45891	.51651	1.9361	.88848	41
20	.45917	.51688	1.9347	.88835	40
21	.45942	.51724	1.9333	.88822	39
22	.45968	.51761	1.9319	.88808	38
23	.45994	.51798	1.9306	.88795	37
24	.46020	.51835	1.9292	.88782	36
25	.46046	.51872	1.9278	.88768	35
26	.46072	.51909	1.9265	.88755	34
27	.46097	.51946	1.9251	.88741	33
28	.46123	.51983	1.9237	.88728	32
29	.46149	.52020	1.9223	.88715	31
30	.46175	.52057	1.9210	.88701	30
31	.46201	.52094	1.9196	.88688	29
32	.46226	.52131	1.9183	.88674	28
33	.46252	.52168	1.9169	.88661	27
34	.46278	.52205	1.9155	.88647	26
35	.46304	.52242	1.9142	.88634	25
36	.46330	.52279	1.9128	.88620	24
37	.46355	.52316	1.9115	.88607	23
38	.46381	.52353	1.9101	.88593	22
39	.46407	.52390	1.9088	.88580	21
40	.46433	.52427	1.9074	.88566	20
41	.46458	.52464	1.9061	.88553	19
42	.46484	.52501	1.9047	.88539	18
43	.46510	.52538	1.9034	.88526	17
44	.46536	.52575	1.9020	.88512	16
45	.46561	.52613	1.9007	.88499	15
46	.46587	.52650	1.8993	.88485	14
47	.46613	.52687	1.8980	.88472	13
48	.46639	.52724	1.8967	.88458	12
49	.46664	.52761	1.8953	.88445	11
50	.46690	.52798	1.8940	.88431	10
51	.46716	.52836	1.8927	.88417	9
52	.46742	.52873	1.8913	.88404	8
53	.46767	.52910	1.8900	.88390	7
54	.46793	.52947	1.8887	.88377	6
55	.46819	.52985	1.8873	.88363	5
56	.46844	.53022	1.8860	.88349	4
57	.46870	.53059	1.8847	.88336	3
58	.46896	.53096	1.8834	.88322	2
59	.46921	.53134	1.8820	.88308	1
60	.46947	.53171	1.8807	.88295	0
'	Cos	Cot	Tan	Sin	'

116° (296°)

(243°) 63°

117° (297°)

(242°) 62°

NATURAL FUNCTIONS (Continued)

28° (208°)

(331°) 151°

29° (209°)

(330°) 150°

	Sin	Tan	Cot	Cos	
0	.46947	.53171	1.8807	.88295	60
1	.46973	.53208	1.8794	.88281	59
2	.46999	.53246	1.8781	.88267	58
3	.47024	.53283	1.8768	.88254	57
4	.47050	.53320	1.8755	.88240	56
5	.47076	.53358	1.8741	.88226	55
6	.47101	.53395	1.8728	.88213	54
7	.47127	.53432	1.8715	.88199	53
8	.47153	.53470	1.8702	.88185	52
9	.47178	.53507	1.8689	.88172	51
10	.47204	.53545	1.8676	.88158	50
11	.47229	.53582	1.8663	.88144	49
12	.47255	.53620	1.8650	.88130	48
13	.47281	.53657	1.8637	.88117	47
14	.47306	.53694	1.8624	.88103	46
15	.47332	.53732	1.8611	.88089	45
16	.47358	.53769	1.8598	.88075	44
17	.47383	.53807	1.8585	.88062	43
18	.47409	.53844	1.8572	.88048	42
19	.47434	.53882	1.8559	.88034	41
20	.47460	.53920	1.8546	.88020	40
21	.47486	.53957	1.8533	.88006	39
22	.47511	.53995	1.8520	.87993	38
23	.47537	.54032	1.8507	.87979	37
24	.47562	.54070	1.8495	.87965	36
25	.47588	.54107	1.8482	.87951	35
26	.47614	.54145	1.8469	.87937	34
27	.47639	.54183	1.8456	.87923	33
28	.47665	.54220	1.8443	.87909	32
29	.47690	.54258	1.8430	.87896	31
30	.47716	.54296	1.8418	.87882	30
31	.47741	.54333	1.8405	.87868	29
32	.47767	.54371	1.8392	.87854	28
33	.47793	.54409	1.8379	.87840	27
34	.47818	.54446	1.8367	.87826	26
35	.47844	.54484	1.8354	.87812	25
36	.47869	.54522	1.8341	.87798	24
37	.47895	.54560	1.8329	.87784	23
38	.47920	.54597	1.8316	.87770	22
39	.47946	.54635	1.8303	.87756	21
40	.47971	.54673	1.8291	.87743	20
41	.47997	.54711	1.8278	.87729	19
42	.48022	.54748	1.8265	.87715	18
43	.48048	.54786	1.8253	.87701	17
44	.48073	.54824	1.8240	.87687	16
45	.48099	.54862	1.8228	.87673	15
46	.48124	.54900	1.8215	.87659	14
47	.48150	.54938	1.8202	.87645	13
48	.48175	.54975	1.8190	.87631	12
49	.48201	.55013	1.8177	.87617	11
50	.48226	.55051	1.8165	.87603	10
51	.48252	.55089	1.8152	.87589	9
52	.48277	.55127	1.8140	.87575	8
53	.48303	.55165	1.8127	.87561	7
54	.48328	.55203	1.8115	.87546	6
55	.48354	.55241	1.8103	.87532	5
56	.48379	.55279	1.8090	.87518	4
57	.48405	.55317	1.8078	.87504	3
58	.48430	.55355	1.8065	.87490	2
59	.48456	.55393	1.8053	.87476	1
60	.48481	.55431	1.8040	.87462	0
	Cos	Cot	Tan	Sin	

118° (298°)

(241°) 61°

119° (299°)

(240°) 60°

	Sin	Tan	Cot	Cos	
0	.48481	.55431	1.8040	.87462	60
1	.48506	.55469	1.8028	.87448	59
2	.48532	.55507	1.8016	.87434	58
3	.48557	.55545	1.8003	.87420	57
4	.48583	.55583	1.7991	.87406	56
5	.48608	.55621	1.7979	.87391	55
6	.48634	.55659	1.7966	.87377	54
7	.48659	.55697	1.7954	.87363	53
8	.48684	.55736	1.7942	.87349	52
9	.48710	.55774	1.7930	.87335	51
10	.48735	.55812	1.7917	.87321	50
11	.48761	.55850	1.7905	.87306	49
12	.48786	.55888	1.7893	.87292	48
13	.48811	.55926	1.7881	.87278	47
14	.48837	.55964	1.7868	.87264	46
15	.48862	.56003	1.7856	.87250	45
16	.48888	.56041	1.7844	.87235	44
17	.48913	.56079	1.7832	.87221	43
18	.48938	.56117	1.7820	.87207	42
19	.48964	.56156	1.7808	.87193	41
20	.48989	.56194	1.7796	.87178	40
21	.49014	.56232	1.7783	.87164	39
22	.49040	.56270	1.7771	.87150	38
23	.49065	.56309	1.7759	.87136	37
24	.49090	.56347	1.7747	.87121	36
25	.49116	.56385	1.7735	.87107	35
26	.49141	.56424	1.7723	.87093	34
27	.49166	.56462	1.7711	.87079	33
28	.49192	.56501	1.7699	.87064	32
29	.49217	.56539	1.7687	.87050	31
30	.49242	.56577	1.7675	.87036	30
31	.49268	.56616	1.7663	.87021	29
32	.49293	.56654	1.7651	.87007	28
33	.49318	.56693	1.7639	.86993	27
34	.49344	.56731	1.7627	.86978	26
35	.49369	.56769	1.7615	.86964	25
36	.49394	.56808	1.7603	.86949	24
37	.49419	.56846	1.7591	.86935	23
38	.49445	.56885	1.7579	.86921	22
39	.49470	.56923	1.7567	.86906	21
40	.49495	.56962	1.7556	.86892	20
41	.49521	.57000	1.7544	.86878	19
42	.49546	.57039	1.7532	.86863	18
43	.49571	.57078	1.7520	.86849	17
44	.49596	.57116	1.7508	.86834	16
45	.49622	.57155	1.7496	.86820	15
46	.49647	.57193	1.7485	.86805	14
47	.49672	.57232	1.7473	.86791	13
48	.49697	.57271	1.7461	.86777	12
49	.49723	.57309	1.7449	.86762	11
50	.49748	.57348	1.7437	.86748	10
51	.49773	.57386	1.7426	.86733	9
52	.49798	.57425	1.7414	.86719	8
53	.49824	.57464	1.7402	.86704	7
54	.49849	.57503	1.7391	.86690	6
55	.49874	.57541	1.7379	.86675	5
56	.49899	.57580	1.7367	.86661	4
57	.49924	.57619	1.7355	.86646	3
58	.49950	.57657	1.7344	.86632	2
59	.49975	.57696	1.7332	.86617	1
60	.50000	.57735	1.7321	.86603	0
	Cos	Cot	Tan	Sin	

NATURAL FUNCTIONS (Continued)

30° (210°)

(329°) 149°

31° (211°)

(328°) 148°

'	Sin	Tan	Cot	Cos	'
0	.50000	.57735	1.7321	.86603	60
1	.50025	.57774	1.7309	.86588	59
2	.50050	.57813	1.7297	.86573	58
3	.50076	.57851	1.7286	.86559	57
4	.50101	.57890	1.7274	.86544	56
5	.50126	.57929	1.7262	.86530	55
6	.50151	.57968	1.7251	.86515	54
7	.50176	.58007	1.7239	.86501	53
8	.50201	.58046	1.7228	.86486	52
9	.50227	.58085	1.7216	.86471	51
10	.50252	.58124	1.7205	.86457	50
11	.50277	.58162	1.7193	.86442	49
12	.50302	.58201	1.7182	.86427	48
13	.50327	.58240	1.7170	.86413	47
14	.50352	.58279	1.7159	.86398	46
15	.50377	.58318	1.7147	.86384	45
16	.50403	.58357	1.7136	.86369	44
17	.50428	.58396	1.7124	.86354	43
18	.50453	.58435	1.7113	.86340	42
19	.50478	.58474	1.7102	.86325	41
20	.50503	.58513	1.7090	.86310	40
21	.50528	.58552	1.7079	.86295	39
22	.50553	.58591	1.7067	.86281	38
23	.50578	.58631	1.7056	.86266	37
24	.50603	.58670	1.7045	.86251	36
25	.50628	.58709	1.7033	.86237	35
26	.50654	.58748	1.7022	.86222	34
27	.50679	.58787	1.7011	.86207	33
28	.50704	.58826	1.6999	.86192	32
29	.50729	.58865	1.6988	.86178	31
30	.50754	.58905	1.6977	.86163	30
31	.50779	.58944	1.6965	.86148	29
32	.50804	.58983	1.6954	.86133	28
33	.50829	.59022	1.6943	.86119	27
34	.50854	.59061	1.6932	.86104	26
35	.50879	.59101	1.6920	.86089	25
36	.50904	.59140	1.6909	.86074	24
37	.50929	.59179	1.6898	.86059	23
38	.50954	.59218	1.6887	.86045	22
39	.50979	.59258	1.6875	.86030	21
40	.51004	.59297	1.6864	.86015	20
41	.51029	.59336	1.6853	.86000	19
42	.51054	.59376	1.6842	.85985	18
43	.51079	.59415	1.6831	.85970	17
44	.51104	.59454	1.6820	.85956	16
45	.51129	.59494	1.6808	.85941	15
46	.51154	.59533	1.6797	.85926	14
47	.51179	.59573	1.6786	.85911	13
48	.51204	.59612	1.6775	.85896	12
49	.51229	.59651	1.6764	.85881	11
50	.51254	.59691	1.6753	.85866	10
51	.51279	.59730	1.6742	.85851	9
52	.51304	.59770	1.6731	.85836	8
53	.51329	.59809	1.6720	.85821	7
54	.51354	.59849	1.6709	.85806	6
55	.51379	.59888	1.6698	.85792	5
56	.51404	.59928	1.6687	.85777	4
57	.51429	.59967	1.6676	.85762	3
58	.51454	.60007	1.6665	.85747	2
59	.51479	.60046	1.6654	.85732	1
60	.51504	.60086	1.6643	.85717	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.51504	.60086	1.6643	.85717	60
1	.51529	.60126	1.6632	.85702	59
2	.51554	.60165	1.6621	.85687	58
3	.51579	.60205	1.6610	.85672	57
4	.51604	.60245	1.6599	.85657	56
5	.51628	.60284	1.6588	.85642	55
6	.51653	.60324	1.6577	.85627	54
7	.51678	.60364	1.6566	.85612	53
8	.51703	.60403	1.6555	.85597	52
9	.51728	.60443	1.6545	.85582	51
10	.51753	.60483	1.6534	.85567	50
11	.51778	.60522	1.6523	.85551	49
12	.51803	.60562	1.6512	.85536	48
13	.51828	.60602	1.6501	.85521	47
14	.51852	.60642	1.6490	.85506	46
15	.51877	.60681	1.6479	.85491	45
16	.51902	.60721	1.6469	.85476	44
17	.51927	.60761	1.6458	.85461	43
18	.51952	.60801	1.6447	.85446	42
19	.51977	.60841	1.6436	.85431	41
20	.52002	.60881	1.6426	.85416	40
21	.52026	.60921	1.6415	.85401	39
22	.52051	.60960	1.6404	.85385	38
23	.52076	.61000	1.6393	.85370	37
24	.52101	.61040	1.6383	.85355	36
25	.52126	.61080	1.6372	.85340	35
26	.52151	.61120	1.6361	.85325	34
27	.52175	.61160	1.6351	.85310	33
28	.52200	.61200	1.6340	.85294	32
29	.52225	.61240	1.6329	.85279	31
30	.52250	.61280	1.6319	.85264	30
31	.52275	.61320	1.6308	.85249	29
32	.52299	.61360	1.6297	.85234	28
33	.52324	.61400	1.6287	.85218	27
34	.52349	.61440	1.6276	.85203	26
35	.52374	.61480	1.6265	.85188	25
36	.52399	.61520	1.6255	.85173	24
37	.52423	.61561	1.6244	.85157	23
38	.52448	.61601	1.6234	.85142	22
39	.52473	.61641	1.6223	.85127	21
40	.52498	.61681	1.6212	.85112	20
41	.52522	.61721	1.6202	.85096	19
42	.52547	.61761	1.6191	.85081	18
43	.52572	.61801	1.6181	.85066	17
44	.52597	.61842	1.6170	.85051	16
45	.52621	.61882	1.6160	.85035	15
46	.52646	.61922	1.6149	.85020	14
47	.52671	.61962	1.6139	.85005	13
48	.52696	.62003	1.6128	.84989	12
49	.52720	.62043	1.6118	.84974	11
50	.52745	.62083	1.6107	.84959	10
51	.52770	.62124	1.6097	.84943	9
52	.52794	.62164	1.6087	.84928	8
53	.52819	.62204	1.6076	.84913	7
54	.52844	.62245	1.6066	.84897	6
55	.52869	.62285	1.6055	.84882	5
56	.52893	.62325	1.6045	.84866	4
57	.52918	.62366	1.6034	.84851	3
58	.52943	.62406	1.6024	.84836	2
59	.52967	.62446	1.6014	.84820	1
60	.52992	.62487	1.6003	.84805	0
'	Cos	Cot	Tan	Sin	'

120° (300°)

(239°) 59°

121° (301°)

(238°) 58°

NATURAL FUNCTIONS (Continued)

32° (212°)

(327°) 147°

33° (213°)

(326°) 146°

'	Sin	Tan	Cot	Cos	'
0	.52992	.62487	1.6003	.84805	60
1	.53017	.62527	1.5993	.84789	59
2	.53041	.62568	1.5983	.84774	58
3	.53066	.62608	1.5972	.84759	57
4	.53091	.62649	1.5962	.84743	56
5	.53115	.62689	1.5952	.84728	55
6	.53140	.62730	1.5941	.84712	54
7	.53164	.62770	1.5931	.84697	53
8	.53189	.62811	1.5921	.84681	52
9	.53214	.62852	1.5911	.84666	51
10	.53238	.62892	1.5900	.84650	50
11	.53263	.62933	1.5890	.84635	49
12	.53288	.62973	1.5880	.84619	48
13	.53312	.63014	1.5869	.84604	47
14	.53337	.63055	1.5859	.84588	46
15	.53361	.63095	1.5849	.84573	45
16	.53386	.63136	1.5839	.84557	44
17	.53411	.63177	1.5829	.84542	43
18	.53435	.63217	1.5818	.84526	42
19	.53460	.63258	1.5808	.84511	41
20	.53484	.63299	1.5798	.84495	40
21	.53509	.63340	1.5788	.84480	39
22	.53534	.63380	1.5778	.84464	38
23	.53558	.63421	1.5768	.84448	37
24	.53583	.63462	1.5757	.84433	36
25	.53607	.63503	1.5747	.84417	35
26	.53632	.63544	1.5737	.84402	34
27	.53656	.63584	1.5727	.84386	33
28	.53681	.63625	1.5717	.84370	32
29	.53705	.63666	1.5707	.84355	31
30	.53730	.63707	1.5697	.84339	30
31	.53754	.63748	1.5687	.84324	29
32	.53779	.63789	1.5677	.84308	28
33	.53804	.63830	1.5667	.84292	27
34	.53828	.63871	1.5657	.84277	26
35	.53853	.63912	1.5647	.84261	25
36	.53877	.63953	1.5637	.84245	24
37	.53902	.63994	1.5627	.84230	23
38	.53926	.64035	1.5617	.84214	22
39	.53951	.64076	1.5607	.84198	21
40	.53975	.64117	1.5597	.84182	20
41	.54000	.64158	1.5587	.84167	19
42	.54024	.64199	1.5577	.84151	18
43	.54049	.64240	1.5567	.84135	17
44	.54073	.64281	1.5557	.84120	16
45	.54097	.64322	1.5547	.84104	15
46	.54122	.64363	1.5537	.84088	14
47	.54146	.64404	1.5527	.84072	13
48	.54171	.64446	1.5517	.84057	12
49	.54195	.64487	1.5507	.84041	11
50	.54220	.64528	1.5497	.84025	10
51	.54244	.64569	1.5487	.84009	9
52	.54269	.64610	1.5477	.83994	8
53	.54293	.64652	1.5468	.83978	7
54	.54317	.64693	1.5458	.83962	6
55	.54342	.64734	1.5448	.83946	5
56	.54366	.64775	1.5438	.83930	4
57	.54391	.64817	1.5428	.83915	3
58	.54415	.64858	1.5418	.83899	2
59	.54440	.64899	1.5408	.83883	1
60	.54464	.64941	1.5399	.83867	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.54464	.64941	1.5399	.83867	60
1	.54488	.64982	1.5389	.83851	59
2	.54513	.65024	1.5379	.83835	58
3	.54537	.65065	1.5369	.83819	57
4	.54561	.65106	1.5359	.83804	56
5	.54586	.65148	1.5350	.83788	55
6	.54610	.65189	1.5340	.83772	54
7	.54635	.65231	1.5330	.83756	53
8	.54659	.65272	1.5320	.83740	52
9	.54683	.65314	1.5311	.83724	51
10	.54708	.65355	1.5301	.83708	50
11	.54732	.65397	1.5291	.83692	49
12	.54756	.65438	1.5282	.83676	48
13	.54781	.65480	1.5272	.83660	47
14	.54805	.65521	1.5262	.83645	46
15	.54829	.65563	1.5253	.83629	45
16	.54854	.65604	1.5243	.83613	44
17	.54878	.65646	1.5233	.83597	43
18	.54902	.65688	1.5224	.83581	42
19	.54927	.65729	1.5214	.83565	41
20	.54951	.65771	1.5204	.83549	40
21	.54975	.65813	1.5195	.83533	39
22	.54999	.65854	1.5185	.83517	38
23	.55024	.65896	1.5175	.83501	37
24	.55048	.65938	1.5166	.83485	36
25	.55072	.65980	1.5156	.83469	35
26	.55097	.66021	1.5147	.83453	34
27	.55121	.66063	1.5137	.83437	33
28	.55145	.66105	1.5127	.83421	32
29	.55169	.66147	1.5118	.83405	31
30	.55194	.66189	1.5108	.83389	30
31	.55218	.66230	1.5099	.83373	29
32	.55242	.66272	1.5089	.83356	28
33	.55266	.66314	1.5080	.83340	27
34	.55291	.66356	1.5070	.83324	26
35	.55315	.66398	1.5061	.83308	25
36	.55339	.66440	1.5051	.83292	24
37	.55363	.66482	1.5042	.83276	23
38	.55388	.66524	1.5032	.83260	22
39	.55412	.66566	1.5023	.83244	21
40	.55436	.66608	1.5013	.83228	20
41	.55460	.66650	1.5004	.83212	19
42	.55484	.66692	1.4994	.83195	18
43	.55509	.66734	1.4985	.83179	17
44	.55533	.66776	1.4975	.83163	16
45	.55557	.66818	1.4966	.83147	15
46	.55581	.66860	1.4957	.83131	14
47	.55605	.66902	1.4947	.83115	13
48	.55630	.66944	1.4938	.83098	12
49	.55654	.66986	1.4928	.83082	11
50	.55678	.67028	1.4919	.83066	10
51	.55702	.67071	1.4910	.83050	9
52	.55726	.67113	1.4900	.83034	8
53	.55750	.67155	1.4891	.83017	7
54	.55775	.67197	1.4882	.83001	6
55	.55799	.67239	1.4872	.82985	5
56	.55823	.67282	1.4863	.82969	4
57	.55847	.67324	1.4854	.82953	3
58	.55871	.67366	1.4844	.82936	2
59	.55895	.67409	1.4835	.82920	1
60	.55919	.67451	1.4826	.82904	0
'	Cos	Cot	Tan	Sin	'

122° (302°)

(237°) 57°

123° (303°)

(236°) 56°

NATURAL FUNCTIONS (Continued)

34° (214°)

(325°) 145°

35° (215°)

(324°) 144°

'	Sin	Tan	Cot	Cos	'
0	.55919	.67451	1.4826	.82904	60
1	.55943	.67493	1.4816	.82887	59
2	.55968	.67536	1.4807	.82871	58
3	.55992	.67578	1.4798	.82855	57
4	.56016	.67620	1.4788	.82839	56
5	.56040	.67663	1.4779	.82822	55
6	.56064	.67705	1.4770	.82806	54
7	.56088	.67748	1.4761	.82790	53
8	.56112	.67790	1.4751	.82773	52
9	.56136	.67832	1.4742	.82757	51
10	.56160	.67875	1.4733	.82741	50
11	.56184	.67917	1.4724	.82724	49
12	.56208	.67960	1.4715	.82708	48
13	.56232	.68002	1.4705	.82692	47
14	.56256	.68045	1.4696	.82675	46
15	.56280	.68088	1.4687	.82659	45
16	.56305	.68130	1.4678	.82643	44
17	.56329	.68173	1.4669	.82626	43
18	.56353	.68215	1.4659	.82610	42
19	.56377	.68258	1.4650	.82593	41
20	.56401	.68301	1.4641	.82577	40
21	.56425	.68343	1.4632	.82561	39
22	.56449	.68386	1.4623	.82544	38
23	.56473	.68429	1.4614	.82528	37
24	.56497	.68471	1.4605	.82511	36
25	.56521	.68514	1.4596	.82495	35
26	.56545	.68557	1.4586	.82478	34
27	.56569	.68600	1.4577	.82462	33
28	.56593	.68642	1.4568	.82446	32
29	.56617	.68685	1.4559	.82429	31
30	.56641	.68728	1.4550	.82413	30
31	.56665	.68771	1.4541	.82396	29
32	.56689	.68814	1.4532	.82380	28
33	.56713	.68857	1.4523	.82363	27
34	.56736	.68900	1.4514	.82347	26
35	.56760	.68942	1.4505	.82330	25
36	.56784	.68985	1.4496	.82314	24
37	.56808	.69028	1.4487	.82297	23
38	.56832	.69071	1.4478	.82281	22
39	.56856	.69114	1.4469	.82264	21
40	.56880	.69157	1.4460	.82248	20
41	.56904	.69200	1.4451	.82231	19
42	.56928	.69243	1.4442	.82214	18
43	.56952	.69286	1.4433	.82198	17
44	.56976	.69329	1.4424	.82181	16
45	.57000	.69372	1.4415	.82165	15
46	.57024	.69416	1.4406	.82148	14
47	.57047	.69459	1.4397	.82132	13
48	.57071	.69502	1.4388	.82115	12
49	.57095	.69545	1.4379	.82098	11
50	.57119	.69588	1.4370	.82082	10
51	.57143	.69631	1.4361	.82065	9
52	.57167	.69675	1.4352	.82048	8
53	.57191	.69718	1.4344	.82032	7
54	.57215	.69761	1.4335	.82015	6
55	.57238	.69804	1.4326	.81999	5
56	.57262	.69847	1.4317	.81982	4
57	.57286	.69891	1.4308	.81965	3
58	.57310	.69934	1.4299	.81949	2
59	.57334	.69977	1.4290	.81932	1
60	.57358	.70021	1.4281	.81915	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.57358	.70021	1.4281	.81915	60
1	.57381	.70064	1.4273	.81899	59
2	.57405	.70107	1.4264	.81882	58
3	.57429	.70151	1.4255	.81865	57
4	.57453	.70194	1.4246	.81848	56
5	.57477	.70238	1.4237	.81832	55
6	.57501	.70281	1.4229	.81815	54
7	.57524	.70325	1.4220	.81798	53
8	.57548	.70368	1.4211	.81782	52
9	.57572	.70412	1.4202	.81765	51
10	.57596	.70455	1.4193	.81748	50
11	.57619	.70499	1.4185	.81731	49
12	.57643	.70542	1.4176	.81714	48
13	.57667	.70586	1.4167	.81698	47
14	.57691	.70629	1.4158	.81681	46
15	.57715	.70673	1.4150	.81664	45
16	.57738	.70717	1.4141	.81647	44
17	.57762	.70760	1.4132	.81631	43
18	.57786	.70804	1.4124	.81614	42
19	.57810	.70848	1.4115	.81597	41
20	.57833	.70891	1.4106	.81580	40
21	.57857	.70935	1.4097	.81563	39
22	.57881	.70979	1.4089	.81546	38
23	.57904	.71023	1.4080	.81530	37
24	.57928	.71066	1.4071	.81513	36
25	.57952	.71110	1.4063	.81496	35
26	.57976	.71154	1.4054	.81479	34
27	.57999	.71198	1.4045	.81462	33
28	.58023	.71242	1.4037	.81445	32
29	.58047	.71285	1.4028	.81428	31
30	.58070	.71329	1.4019	.81412	30
31	.58094	.71373	1.4011	.81395	29
32	.58118	.71417	1.4002	.81378	28
33	.58141	.71461	1.3994	.81361	27
34	.58165	.71505	1.3985	.81344	26
35	.58189	.71549	1.3976	.81327	25
36	.58212	.71593	1.3968	.81310	24
37	.58236	.71637	1.3959	.81293	23
38	.58260	.71681	1.3951	.81276	22
39	.58283	.71725	1.3942	.81259	21
40	.58307	.71769	1.3934	.81242	20
41	.58330	.71813	1.3925	.81225	19
42	.58354	.71857	1.3916	.81208	18
43	.58378	.71901	1.3908	.81191	17
44	.58401	.71946	1.3899	.81174	16
45	.58425	.71990	1.3891	.81157	15
46	.58449	.72034	1.3882	.81140	14
47	.58472	.72078	1.3874	.81123	13
48	.58496	.72122	1.3865	.81106	12
49	.58519	.72167	1.3857	.81089	11
50	.58543	.72211	1.3848	.81072	10
51	.58567	.72255	1.3840	.81055	9
52	.58590	.72299	1.3831	.81038	8
53	.58614	.72344	1.3823	.81021	7
54	.58637	.72388	1.3814	.81004	6
55	.58661	.72432	1.3806	.80987	5
56	.58684	.72477	1.3798	.80970	4
57	.58708	.72521	1.3789	.80953	3
58	.58731	.72565	1.3781	.80936	2
59	.58755	.72610	1.3772	.80919	1
60	.58779	.72654	1.3764	.80902	0
'	Cos	Cot	Tan	Sin	'

124° (304°)

(235°) 55°

125° (305°)

(234°) 54°

NATURAL FUNCTIONS (Continued)

36° (216°)

(323°) 143°

37° (217°)

(322°) 142°

'	Sin	Tan	Cot	Cos	'
0	.58779	.72654	1.3764	.80902	60
1	.58802	.72699	1.3755	.80885	59
2	.58826	.72743	1.3747	.80867	58
3	.58849	.72788	1.3739	.80850	57
4	.58873	.72832	1.3730	.80833	56
5	.58896	.72877	1.3722	.80816	55
6	.58920	.72921	1.3713	.80799	54
7	.58943	.72966	1.3705	.80782	53
8	.58967	.73010	1.3697	.80765	52
9	.58990	.73055	1.3688	.80748	51
10	.59014	.73100	1.3680	.80730	50
11	.59037	.73144	1.3672	.80713	49
12	.59061	.73189	1.3663	.80696	48
13	.59084	.73234	1.3655	.80679	47
14	.59108	.73278	1.3647	.80662	46
15	.59131	.73323	1.3638	.80644	45
16	.59154	.73368	1.3630	.80627	44
17	.59178	.73413	1.3622	.80610	43
18	.59201	.73457	1.3613	.80593	42
19	.59225	.73502	1.3605	.80576	41
20	.59248	.73547	1.3597	.80558	40
21	.59272	.73592	1.3588	.80541	39
22	.59295	.73637	1.3580	.80524	38
23	.59318	.73681	1.3572	.80507	37
24	.59342	.73726	1.3564	.80489	36
25	.59365	.73771	1.3555	.80472	35
26	.59389	.73816	1.3547	.80455	34
27	.59412	.73861	1.3539	.80438	33
28	.59436	.73906	1.3531	.80420	32
29	.59459	.73951	1.3522	.80403	31
30	.59482	.73996	1.3514	.80386	30
31	.59506	.74041	1.3506	.80368	29
32	.59529	.74086	1.3498	.80351	28
33	.59552	.74131	1.3490	.80334	27
34	.59576	.74176	1.3481	.80316	26
35	.59599	.74221	1.3473	.80299	25
36	.59622	.74267	1.3465	.80282	24
37	.59646	.74312	1.3457	.80264	23
38	.59669	.74357	1.3449	.80247	22
39	.59693	.74402	1.3440	.80230	21
40	.59716	.74447	1.3432	.80212	20
41	.59739	.74492	1.3424	.80195	19
42	.59763	.74538	1.3416	.80178	18
43	.59786	.74583	1.3408	.80160	17
44	.59809	.74628	1.3400	.80143	16
45	.59832	.74674	1.3392	.80125	15
46	.59856	.74719	1.3384	.80108	14
47	.59879	.74764	1.3375	.80091	13
48	.59902	.74810	1.3367	.80073	12
49	.59926	.74855	1.3359	.80056	11
50	.59949	.74900	1.3351	.80038	10
51	.59972	.74946	1.3343	.80021	9
52	.59995	.74991	1.3335	.80003	8
53	.60019	.75037	1.3327	.79986	7
54	.60042	.75082	1.3319	.79968	6
55	.60065	.75128	1.3311	.79951	5
56	.60089	.75173	1.3303	.79934	4
57	.60112	.75219	1.3295	.79916	3
58	.60135	.75264	1.3287	.79899	2
59	.60158	.75310	1.3278	.79881	1
60	.60182	.75355	1.3270	.79864	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.60182	.75355	1.3270	.79864	60
1	.60205	.75401	1.3262	.79846	59
2	.60228	.75447	1.3254	.79829	58
3	.60251	.75492	1.3246	.79811	57
4	.60274	.75538	1.3238	.79793	56
5	.60298	.75584	1.3230	.79776	55
6	.60321	.75629	1.3222	.79758	54
7	.60344	.75675	1.3214	.79741	53
8	.60367	.75721	1.3206	.79723	52
9	.60390	.75767	1.3198	.79706	51
10	.60414	.75812	1.3190	.79688	50
11	.60437	.75858	1.3182	.79671	49
12	.60460	.75904	1.3175	.79653	48
13	.60483	.75950	1.3167	.79635	47
14	.60506	.75996	1.3159	.79618	46
15	.60529	.76042	1.3151	.79600	45
16	.60553	.76088	1.3143	.79583	44
17	.60576	.76134	1.3135	.79565	43
18	.60599	.76180	1.3127	.79547	42
19	.60622	.76226	1.3119	.79530	41
20	.60645	.76272	1.3111	.79512	40
21	.60668	.76318	1.3103	.79494	39
22	.60691	.76364	1.3095	.79477	38
23	.60714	.76410	1.3087	.79459	37
24	.60738	.76456	1.3079	.79441	36
25	.60761	.76502	1.3072	.79424	35
26	.60784	.76548	1.3064	.79406	34
27	.60807	.76594	1.3056	.79388	33
28	.60830	.76640	1.3048	.79371	32
29	.60853	.76686	1.3040	.79353	31
30	.60876	.76733	1.3032	.79335	30
31	.60899	.76779	1.3024	.79318	29
32	.60922	.76825	1.3017	.79300	28
33	.60945	.76871	1.3009	.79282	27
34	.60968	.76918	1.3001	.79264	26
35	.60991	.76964	1.2993	.79247	25
36	.61015	.77010	1.2985	.79229	24
37	.61038	.77057	1.2977	.79213	23
38	.61061	.77103	1.2970	.79195	22
39	.61084	.77149	1.2962	.79176	21
40	.61107	.77196	1.2954	.79158	20
41	.61130	.77242	1.2946	.79140	19
42	.61153	.77289	1.2938	.79122	18
43	.61176	.77335	1.2931	.79105	17
44	.61199	.77382	1.2923	.79087	16
45	.61222	.77428	1.2915	.79069	15
46	.61245	.77475	1.2907	.79051	14
47	.61268	.77521	1.2900	.79033	13
48	.61291	.77568	1.2892	.79016	12
49	.61314	.77615	1.2884	.78998	11
50	.61337	.77661	1.2876	.78980	10
51	.61360	.77708	1.2869	.78962	9
52	.61383	.77754	1.2861	.78944	8
53	.61406	.77801	1.2853	.78926	7
54	.61429	.77848	1.2846	.78908	6
55	.61451	.77895	1.2838	.78891	5
56	.61474	.77941	1.2830	.78873	4
57	.61497	.77988	1.2822	.78855	3
58	.61520	.78035	1.2815	.78837	2
59	.61543	.78082	1.2807	.78819	1
60	.61566	.78129	1.2799	.78801	0
'	Cos	Cot	Tan	Sin	'

126° (306°)

(233°) 53°

127° (307°)

(232°) 52°

NATURAL FUNCTIONS (Continued)

38° (218°)

(321°) 141°

39° (219°)

(320°) 140°

'	Sin	Tan	Cot	Cos	'
0	.61566	.78129	1.2799	.78801	60
1	.61589	.78175	1.2792	.78783	59
2	.61612	.78222	1.2784	.78765	58
3	.61635	.78269	1.2776	.78747	57
4	.61658	.78316	1.2769	.78729	56
5	.61681	.78363	1.2761	.78711	55
6	.61704	.78410	1.2753	.78694	54
7	.61726	.78457	1.2746	.78676	53
8	.61749	.78504	1.2738	.78658	52
9	.61772	.78551	1.2731	.78640	51
10	.61795	.78598	1.2723	.78622	50
11	.61818	.78645	1.2715	.78604	49
12	.61841	.78692	1.2708	.78586	48
13	.61864	.78739	1.2700	.78568	47
14	.61887	.78786	1.2693	.78550	46
15	.61909	.78834	1.2685	.78532	45
16	.61932	.78881	1.2677	.78514	44
17	.61955	.78928	1.2670	.78496	43
18	.61978	.78975	1.2662	.78478	42
19	.62001	.79022	1.2655	.78460	41
20	.62024	.79070	1.2647	.78442	40
21	.62046	.79117	1.2640	.78424	39
22	.62069	.79164	1.2632	.78405	38
23	.62092	.79212	1.2624	.78387	37
24	.62115	.79259	1.2617	.78369	36
25	.62138	.79306	1.2609	.78351	35
26	.62160	.79354	1.2602	.78333	34
27	.62183	.79401	1.2594	.78315	33
28	.62206	.79449	1.2587	.78297	32
29	.62229	.79496	1.2579	.78279	31
30	.62251	.79544	1.2572	.78261	30
31	.62274	.79591	1.2564	.78243	29
32	.62297	.79639	1.2557	.78225	28
33	.62320	.79686	1.2549	.78206	27
34	.62342	.79734	1.2542	.78188	26
35	.62365	.79781	1.2534	.78170	25
36	.62388	.79829	1.2527	.78152	24
37	.62411	.79877	1.2519	.78134	23
38	.62433	.79924	1.2512	.78116	22
39	.62456	.79972	1.2504	.78098	21
40	.62479	.80020	1.2497	.78079	20
41	.62502	.80067	1.2489	.78061	19
42	.62524	.80115	1.2482	.78043	18
43	.62547	.80163	1.2475	.78025	17
44	.62570	.80211	1.2467	.78007	16
45	.62592	.80258	1.2460	.77988	15
46	.62615	.80306	1.2452	.77970	14
47	.62638	.80354	1.2445	.77952	13
48	.62660	.80402	1.2437	.77934	12
49	.62683	.80450	1.2430	.77916	11
50	.62706	.80498	1.2423	.77897	10
51	.62728	.80546	1.2415	.77879	9
52	.62751	.80594	1.2408	.77861	8
53	.62774	.80642	1.2401	.77843	7
54	.62796	.80690	1.2393	.77824	6
55	.62819	.80738	1.2386	.77806	5
56	.62842	.80786	1.2378	.77788	4
57	.62864	.80834	1.2371	.77769	3
58	.62887	.80882	1.2364	.77751	2
59	.62909	.80930	1.2356	.77733	1
60	.62932	.80978	1.2349	.77715	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.62932	.80978	1.2349	.77715	60
1	.62955	.81027	1.2342	.77696	59
2	.62977	.81075	1.2334	.77678	58
3	.63000	.81123	1.2327	.77660	57
4	.63022	.81171	1.2320	.77641	56
5	.63045	.81220	1.2312	.77623	55
6	.63068	.81268	1.2305	.77605	54
7	.63090	.81316	1.2298	.77586	53
8	.63113	.81364	1.2290	.77568	52
9	.63135	.81413	1.2283	.77550	51
10	.63158	.81461	1.2276	.77531	50
11	.63180	.81510	1.2268	.77513	49
12	.63203	.81558	1.2261	.77494	48
13	.63225	.81606	1.2254	.77476	47
14	.63248	.81655	1.2247	.77458	46
15	.63271	.81703	1.2239	.77439	45
16	.63293	.81752	1.2232	.77421	44
17	.63316	.81800	1.2225	.77402	43
18	.63338	.81849	1.2218	.77384	42
19	.63361	.81898	1.2210	.77366	41
20	.63383	.81946	1.2203	.77347	40
21	.63406	.81995	1.2196	.77329	39
22	.63428	.82044	1.2189	.77310	38
23	.63451	.82092	1.2181	.77292	37
24	.63473	.82141	1.2174	.77273	36
25	.63496	.82190	1.2167	.77255	35
26	.63518	.82238	1.2160	.77236	34
27	.63540	.82287	1.2153	.77218	33
28	.63563	.82336	1.2145	.77199	32
29	.63585	.82385	1.2138	.77181	31
30	.63608	.82434	1.2131	.77162	30
31	.63630	.82483	1.2124	.77144	29
32	.63653	.82531	1.2117	.77125	28
33	.63675	.82580	1.2109	.77107	27
34	.63698	.82629	1.2102	.77088	26
35	.63720	.82678	1.2095	.77070	25
36	.63742	.82727	1.2088	.77051	24
37	.63765	.82776	1.2081	.77033	23
38	.63787	.82825	1.2074	.77014	22
39	.63810	.82874	1.2066	.76996	21
40	.63832	.82923	1.2059	.76977	20
41	.63854	.82972	1.2052	.76959	19
42	.63877	.83022	1.2045	.76940	18
43	.63899	.83071	1.2038	.76921	17
44	.63922	.83120	1.2031	.76903	16
45	.63944	.83169	1.2024	.76884	15
46	.63966	.83218	1.2017	.76866	14
47	.63989	.83268	1.2009	.76847	13
48	.64011	.83317	1.2002	.76828	12
49	.64033	.83366	1.1995	.76810	11
50	.64056	.83415	1.1988	.76791	10
51	.64078	.83465	1.1981	.76772	9
52	.64100	.83514	1.1974	.76754	8
53	.64123	.83564	1.1967	.76735	7
54	.64145	.83613	1.1960	.76717	6
55	.64167	.83662	1.1953	.76698	5
56	.64190	.83712	1.1946	.76679	4
57	.64212	.83761	1.1939	.76661	3
58	.64234	.83811	1.1932	.76642	2
59	.64256	.83860	1.1925	.76623	1
60	.64279	.83910	1.1918	.76604	0
'	Cos	Cot	Tan	Sin	'

128° (308°)

(231°) 51°

129° (309°)

(230°) 50°

NATURAL FUNCTIONS (Continued)

40° (220°)

(319°) 139°

41° (221°)

(318°) 138°

'	Sin	Tan	Cot	Cos	'
0	.64279	.83910	1.1918	.76604	60
1	.64301	.83960	1.1910	.76586	59
2	.64323	.84009	1.1903	.76567	58
3	.64346	.84059	1.1896	.76548	57
4	.64368	.84108	1.1889	.76530	56
5	.64390	.84158	1.1882	.76511	55
6	.64412	.84208	1.1875	.76492	54
7	.64435	.84258	1.1868	.76473	53
8	.64457	.84307	1.1861	.76455	52
9	.64479	.84357	1.1854	.76436	51
10	.64501	.84407	1.1847	.76417	50
11	.64524	.84457	1.1840	.76398	49
12	.64546	.84507	1.1833	.76380	48
13	.64568	.84556	1.1826	.76361	47
14	.64590	.84606	1.1819	.76342	46
15	.64612	.84656	1.1812	.76323	45
16	.64635	.84706	1.1806	.76304	44
17	.64657	.84756	1.1799	.76286	43
18	.64679	.84806	1.1792	.76267	42
19	.64701	.84856	1.1785	.76248	41
20	.64723	.84906	1.1778	.76229	40
21	.64746	.84956	1.1771	.76210	39
22	.64768	.85006	1.1764	.76192	38
23	.64790	.85057	1.1757	.76173	37
24	.64812	.85107	1.1750	.76154	36
25	.64834	.85157	1.1743	.76135	35
26	.64856	.85207	1.1736	.76116	34
27	.64878	.85257	1.1729	.76097	33
28	.64901	.85308	1.1722	.76078	32
29	.64923	.85358	1.1715	.76059	31
30	.64945	.85408	1.1708	.76041	30
31	.64967	.85458	1.1702	.76022	29
32	.64989	.85509	1.1695	.76003	28
33	.65011	.85559	1.1688	.75984	27
34	.65033	.85609	1.1681	.75965	26
35	.65055	.85660	1.1674	.75946	25
36	.65077	.85710	1.1667	.75927	24
37	.65100	.85761	1.1660	.75908	23
38	.65122	.85811	1.1653	.75889	22
39	.65144	.85862	1.1647	.75870	21
40	.65166	.85912	1.1640	.75851	20
41	.65188	.85963	1.1633	.75832	19
42	.65210	.86014	1.1626	.75813	18
43	.65232	.86064	1.1619	.75794	17
44	.65254	.86115	1.1612	.75775	16
45	.65276	.86166	1.1606	.75756	15
46	.65298	.86216	1.1599	.75738	14
47	.65320	.86267	1.1592	.75719	13
48	.65342	.86318	1.1585	.75700	12
49	.65364	.86368	1.1578	.75680	11
50	.65386	.86419	1.1571	.75661	10
51	.65408	.86470	1.1565	.75642	9
52	.65430	.86521	1.1558	.75623	8
53	.65452	.86572	1.1551	.75604	7
54	.65474	.86623	1.1544	.75585	6
55	.65496	.86674	1.1538	.75566	5
56	.65518	.86725	1.1531	.75547	4
57	.65540	.86776	1.1524	.75528	3
58	.65562	.86827	1.1517	.75509	2
59	.65584	.86878	1.1510	.75490	1
60	.65606	.86929	1.1504	.75471	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.65606	.86929	1.1504	.75471	60
1	.65628	.86980	1.1497	.75452	59
2	.65650	.87031	1.1490	.75433	58
3	.65672	.87082	1.1483	.75414	57
4	.65694	.87133	1.1477	.75395	56
5	.65716	.87184	1.1470	.75375	55
6	.65738	.87236	1.1463	.75356	54
7	.65759	.87287	1.1456	.75337	53
8	.65781	.87338	1.1450	.75318	52
9	.65803	.87389	1.1443	.75299	51
10	.65825	.87441	1.1436	.75280	50
11	.65847	.87492	1.1430	.75261	49
12	.65869	.87543	1.1423	.75241	48
13	.65891	.87595	1.1416	.75222	47
14	.65913	.87646	1.1410	.75203	46
15	.65935	.87698	1.1403	.75184	45
16	.65956	.87749	1.1396	.75165	44
17	.65978	.87801	1.1389	.75146	43
18	.66000	.87852	1.1383	.75126	42
19	.66022	.87904	1.1376	.75107	41
20	.66044	.87955	1.1369	.75088	40
21	.66066	.88007	1.1363	.75069	39
22	.66088	.88059	1.1356	.75050	38
23	.66109	.88110	1.1349	.75030	37
24	.66131	.88162	1.1343	.75011	36
25	.66153	.88214	1.1336	.74992	35
26	.66175	.88265	1.1329	.74973	34
27	.66197	.88317	1.1323	.74953	33
28	.66218	.88369	1.1316	.74934	32
29	.66240	.88421	1.1310	.74915	31
30	.66262	.88473	1.1303	.74896	30
31	.66284	.88524	1.1296	.74876	29
32	.66306	.88576	1.1290	.74857	28
33	.66327	.88628	1.1283	.74838	27
34	.66349	.88680	1.1276	.74818	26
35	.66371	.88732	1.1270	.74799	25
36	.66393	.88784	1.1263	.74780	24
37	.66414	.88836	1.1257	.74760	23
38	.66436	.88888	1.1250	.74741	22
39	.66458	.88940	1.1243	.74722	21
40	.66480	.88992	1.1237	.74703	20
41	.66501	.89045	1.1230	.74683	19
42	.66523	.89097	1.1224	.74664	18
43	.66545	.89149	1.1217	.74644	17
44	.66566	.89201	1.1211	.74625	16
45	.66588	.89253	1.1204	.74606	15
46	.66610	.89306	1.1197	.74586	14
47	.66632	.89358	1.1191	.74567	13
48	.66653	.89410	1.1184	.74548	12
49	.66675	.89463	1.1178	.74528	11
50	.66697	.89515	1.1171	.74509	10
51	.66718	.89567	1.1165	.74489	9
52	.66740	.89620	1.1158	.74470	8
53	.66762	.89672	1.1152	.74451	7
54	.66783	.89725	1.1145	.74431	6
55	.66805	.89777	1.1139	.74412	5
56	.66827	.89830	1.1132	.74392	4
57	.66848	.89883	1.1126	.74373	3
58	.66870	.89935	1.1119	.74353	2
59	.66891	.89988	1.1113	.74334	1
60	.66913	.90040	1.1106	.74314	0
'	Cos	Cot	Tan	Sin	'

130° (310°)

(229°) 49°

131° (311°)

(228°) 48°

NATURAL FUNCTIONS (Continued)

42° (222°)

(317°) 137°

43° (223°)

(316°) 136°

'	Sin	Tan	Cot	Cos	'
0	.66913	.90040	1.1106	.74314	60
1	.66935	.90093	1.1100	.74295	59
2	.66956	.90146	1.1093	.74276	58
3	.66978	.90199	1.1087	.74256	57
4	.66999	.90251	1.1080	.74237	56
5	.67021	.90304	1.1074	.74217	55
6	.67043	.90357	1.1067	.74198	54
7	.67064	.90410	1.1061	.74178	53
8	.67086	.90463	1.1054	.74159	52
9	.67107	.90516	1.1048	.74139	51
10	.67129	.90569	1.1041	.74120	50
11	.67151	.90621	1.1035	.74100	49
12	.67172	.90674	1.1028	.74080	48
13	.67194	.90727	1.1022	.74061	47
14	.67215	.90781	1.1016	.74041	46
15	.67237	.90834	1.1009	.74022	45
16	.67258	.90887	1.1003	.74002	44
17	.67280	.90940	1.0996	.73983	43
18	.67301	.90993	1.0990	.73963	42
19	.67323	.91046	1.0983	.73944	41
20	.67344	.91099	1.0977	.73924	40
21	.67366	.91153	1.0971	.73904	39
22	.67387	.91206	1.0964	.73885	38
23	.67409	.91259	1.0958	.73865	37
24	.67430	.91313	1.0951	.73846	36
25	.67452	.91366	1.0945	.73826	35
26	.67473	.91419	1.0939	.73806	34
27	.67495	.91473	1.0932	.73787	33
28	.67516	.91526	1.0926	.73767	32
29	.67538	.91580	1.0919	.73747	31
30	.67559	.91633	1.0913	.73728	30
31	.67580	.91687	1.0907	.73708	29
32	.67602	.91740	1.0900	.73688	28
33	.67623	.91794	1.0894	.73669	27
34	.67645	.91847	1.0888	.73649	26
35	.67666	.91901	1.0881	.73629	25
36	.67688	.91955	1.0875	.73610	24
37	.67709	.92008	1.0869	.73590	23
38	.67730	.92062	1.0862	.73570	22
39	.67752	.92116	1.0856	.73551	21
40	.67773	.92170	1.0850	.73531	20
41	.67795	.92224	1.0843	.73511	19
42	.67816	.92277	1.0837	.73491	18
43	.67837	.92331	1.0831	.73472	17
44	.67859	.92385	1.0824	.73452	16
45	.67880	.92439	1.0818	.73432	15
46	.67901	.92493	1.0812	.73413	14
47	.67923	.92547	1.0805	.73393	13
48	.67944	.92601	1.0799	.73373	12
49	.67965	.92655	1.0793	.73353	11
50	.67987	.92709	1.0786	.73333	10
51	.68008	.92763	1.0780	.73314	9
52	.68029	.92817	1.0774	.73294	8
53	.68051	.92872	1.0768	.73274	7
54	.68072	.92926	1.0761	.73254	6
55	.68093	.92980	1.0755	.73234	5
56	.68115	.93034	1.0749	.73215	4
57	.68136	.93088	1.0742	.73195	3
58	.68157	.93143	1.0736	.73175	2
59	.68179	.93197	1.0730	.73155	1
60	.68200	.93252	1.0724	.73135	0
'	Cos	Cot	Tan	Sin	'

'	Sin	Tan	Cot	Cos	'
0	.68200	.93252	1.0724	.73135	60
1	.68221	.93306	1.0717	.73116	59
2	.68242	.93360	1.0711	.73096	58
3	.68264	.93415	1.0705	.73076	57
4	.68285	.93469	1.0699	.73056	56
5	.68306	.93524	1.0692	.73036	55
6	.68327	.93578	1.0686	.73016	54
7	.68349	.93633	1.0680	.72996	53
8	.68370	.93688	1.0674	.72976	52
9	.68391	.93742	1.0668	.72957	51
10	.68412	.93796	1.0661	.72937	50
11	.68434	.93852	1.0655	.72917	49
12	.68455	.93906	1.0649	.72897	48
13	.68476	.93961	1.0643	.72877	47
14	.68497	.94016	1.0637	.72857	46
15	.68518	.94071	1.0630	.72837	45
16	.68539	.94125	1.0624	.72817	44
17	.68561	.94180	1.0618	.72797	43
18	.68582	.94235	1.0612	.72777	42
19	.68603	.94290	1.0606	.72757	41
20	.68624	.94345	1.0599	.72737	40
21	.68645	.94400	1.0593	.72717	39
22	.68666	.94455	1.0587	.72697	38
23	.68688	.94510	1.0581	.72677	37
24	.68709	.94565	1.0575	.72657	36
25	.68730	.94620	1.0569	.72637	35
26	.68751	.94676	1.0562	.72617	34
27	.68772	.94731	1.0556	.72597	33
28	.68793	.94786	1.0550	.72577	32
29	.68814	.94841	1.0544	.72557	31
30	.68835	.94896	1.0538	.72537	30
31	.68857	.94952	1.0532	.72517	29
32	.68878	.95007	1.0526	.72497	28
33	.68899	.95062	1.0519	.72477	27
34	.68920	.95118	1.0513	.72457	26
35	.68941	.95173	1.0507	.72437	25
36	.68962	.95229	1.0501	.72417	24
37	.68983	.95284	1.0495	.72397	23
38	.69004	.95340	1.0489	.72377	22
39	.69025	.95395	1.0483	.72357	21
40	.69046	.95451	1.0477	.72337	20
41	.69067	.95506	1.0470	.72317	19
42	.69088	.95562	1.0464	.72297	18
43	.69109	.95618	1.0458	.72277	17
44	.69130	.95673	1.0452	.72257	16
45	.69151	.95729	1.0446	.72236	15
46	.69172	.95785	1.0440	.72216	14
47	.69193	.95841	1.0434	.72196	13
48	.69214	.95897	1.0428	.72176	12
49	.69235	.95952	1.0422	.72156	11
50	.69256	.96008	1.0416	.72136	10
51	.69277	.96064	1.0410	.72116	9
52	.69298	.96120	1.0404	.72095	8
53	.69319	.96176	1.0398	.72075	7
54	.69340	.96232	1.0392	.72055	6
55	.69361	.96288	1.0385	.72035	5
56	.69382	.96344	1.0379	.72015	4
57	.69403	.96400	1.0373	.71995	3
58	.69424	.96457	1.0367	.71974	2
59	.69445	.96513	1.0361	.71954	1
60	.69466	.96569	1.0355	.71934	0
'	Cos	Cot	Tan	Sin	'

132° (312°)

(227°) 47°

133° (313°)

(226°) 46°

NATURAL FUNCTIONS (Continued)

44° (224°)

(315°) 135°

'	Sin	Tan	Cot	Cos	'
0	.69466	.96569	1.0355	.71934	60
1	.69487	.96625	1.0349	.71914	59
2	.69508	.96681	1.0343	.71894	58
3	.69529	.96738	1.0337	.71873	57
4	.69549	.96794	1.0331	.71853	56
5	.69570	.96850	1.0325	.71833	55
6	.69591	.96907	1.0319	.71813	54
7	.69612	.96963	1.0313	.71792	53
8	.69633	.97020	1.0307	.71772	52
9	.69654	.97076	1.0301	.71752	51
10	.69675	.97133	1.0295	.71732	50
11	.69696	.97189	1.0289	.71711	49
12	.69717	.97246	1.0283	.71691	48
13	.69737	.97302	1.0277	.71671	47
14	.69758	.97359	1.0271	.71650	46
15	.69779	.97416	1.0265	.71630	45
16	.69800	.97472	1.0259	.71610	44
17	.69821	.97529	1.0253	.71590	43
18	.69842	.97586	1.0247	.71569	42
19	.69862	.97643	1.0241	.71549	41
20	.69883	.97700	1.0235	.71529	40
21	.69904	.97756	1.0230	.71508	39
22	.69925	.97813	1.0224	.71488	38
23	.69946	.97870	1.0218	.71468	37
24	.69966	.97927	1.0212	.71447	36
25	.69987	.97984	1.0206	.71427	35
26	.70008	.98041	1.0200	.71407	34
27	.70029	.98098	1.0194	.71386	33
28	.70049	.98155	1.0188	.71366	32
29	.70070	.98213	1.0182	.71345	31
30	.70091	.98270	1.0176	.71325	30
31	.70112	.98327	1.0170	.71305	29
32	.70132	.98384	1.0164	.71284	28
33	.70153	.98441	1.0158	.71264	27
34	.70174	.98499	1.0152	.71243	26
35	.70195	.98556	1.0147	.71223	25
36	.70215	.98613	1.0141	.71203	24
37	.70236	.98671	1.0135	.71182	23
38	.70257	.98728	1.0129	.71162	22
39	.70277	.98786	1.0123	.71141	21
40	.70298	.98843	1.0117	.71121	20
41	.70319	.98901	1.0111	.71100	19
42	.70339	.98958	1.0105	.71080	18
43	.70360	.99016	1.0099	.71059	17
44	.70381	.99073	1.0094	.71039	16
45	.70401	.99131	1.0088	.71019	15
46	.70422	.99189	1.0082	.70998	14
47	.70443	.99247	1.0076	.70978	13
48	.70463	.99304	1.0070	.70957	12
49	.70484	.99362	1.0064	.70937	11
50	.70505	.99420	1.0058	.70916	10
51	.70525	.99478	1.0052	.70896	9
52	.70546	.99536	1.0047	.70875	8
53	.70567	.99594	1.0041	.70855	7
54	.70587	.99652	1.0035	.70834	6
55	.70608	.99710	1.0029	.70813	5
56	.70628	.99768	1.0023	.70793	4
57	.70649	.99826	1.0017	.70772	3
58	.70670	.99884	1.0012	.70752	2
59	.70690	.99942	1.0006	.70731	1
60	.70711	1.0000	1.0000	.70711	0
'	Cos	Cot	Tan	Sin	'

134° (314°)

(225°) 45°

NATURAL FUNCTIONS—SECANT'S AND COSECANTS

0° (180°)

(359°) 179°

1° (181°)

(358°) 178°

2° (182°)

(357°) 177°

'	Sec	Csc	'
0	1.0000		60
1	1.0000	3437.7	59
2	1.0000	1718.9	58
3	1.0000	1145.9	57
4	1.0000	859.44	56
5	1.0000	687.55	55
6	1.0000	572.96	54
7	1.0000	491.11	53
8	1.0000	429.72	52
9	1.0000	381.97	51
10	1.0000	343.78	50
11	1.0000	312.52	49
12	1.0000	286.48	48
13	1.0000	264.44	47
14	1.0000	245.55	46
15	1.0000	229.18	45
16	1.0000	214.86	44
17	1.0000	202.22	43
18	1.0000	190.99	42
19	1.0000	180.93	41
20	1.0000	171.89	40
21	1.0000	163.70	39
22	1.0000	156.26	38
23	1.0000	149.47	37
24	1.0000	143.24	36
25	1.0000	137.51	35
26	1.0000	132.22	34
27	1.0000	127.33	33
28	1.0000	122.78	32
29	1.0000	118.54	31
30	1.0000	114.59	30
31	1.0000	110.90	29
32	1.0000	107.43	28
33	1.0000	104.18	27
34	1.0000	101.11	26
35	1.0001	98.223	25
36	1.0001	95.495	24
37	1.0001	92.914	23
38	1.0001	90.469	22
39	1.0001	88.149	21
40	1.0001	85.946	20
41	1.0001	83.849	19
42	1.0001	81.853	18
43	1.0001	79.950	17
44	1.0001	78.133	16
45	1.0001	76.397	15
46	1.0001	74.736	14
47	1.0001	73.146	13
48	1.0001	71.622	12
49	1.0001	70.160	11
50	1.0001	68.757	10
51	1.0001	67.409	9
52	1.0001	66.113	8
53	1.0001	64.866	7
54	1.0001	63.665	6
55	1.0001	62.507	5
56	1.0001	61.391	4
57	1.0001	60.314	3
58	1.0001	59.274	2
59	1.0001	58.270	1
60	1.0002	57.299	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0002	57.299	60
1	1.0002	56.359	59
2	1.0002	55.451	58
3	1.0002	54.570	57
4	1.0002	53.718	56
5	1.0002	52.892	55
6	1.0002	52.090	54
7	1.0002	51.313	53
8	1.0002	50.558	52
9	1.0002	49.826	51
10	1.0002	49.114	50
11	1.0002	48.422	49
12	1.0002	47.750	48
13	1.0002	47.096	47
14	1.0002	46.460	46
15	1.0002	45.840	45
16	1.0002	45.237	44
17	1.0003	44.650	43
18	1.0003	44.077	42
19	1.0003	43.520	41
20	1.0003	42.976	40
21	1.0003	42.445	39
22	1.0003	41.928	38
23	1.0003	41.423	37
24	1.0003	40.930	36
25	1.0003	40.448	35
26	1.0003	39.978	34
27	1.0003	39.519	33
28	1.0003	39.070	32
29	1.0003	38.631	31
30	1.0003	38.202	30
31	1.0004	37.782	29
32	1.0004	37.371	28
33	1.0004	36.970	27
34	1.0004	36.576	26
35	1.0004	36.191	25
36	1.0004	35.815	24
37	1.0004	35.445	23
38	1.0004	35.084	22
39	1.0004	34.730	21
40	1.0004	34.382	20
41	1.0004	34.042	19
42	1.0004	33.708	18
43	1.0004	33.381	17
44	1.0005	33.060	16
45	1.0005	32.746	15
46	1.0005	32.437	14
47	1.0005	32.134	13
48	1.0005	31.836	12
49	1.0005	31.544	11
50	1.0005	31.258	10
51	1.0005	30.976	9
52	1.0005	30.700	8
53	1.0005	30.428	7
54	1.0006	30.161	6
55	1.0006	29.899	5
56	1.0006	29.641	4
57	1.0006	29.388	3
58	1.0006	29.139	2
59	1.0006	28.894	1
60	1.0006	28.654	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0006	28.654	60
1	1.0006	28.417	59
2	1.0006	28.184	58
3	1.0006	27.955	57
4	1.0007	27.730	56
5	1.0007	27.508	55
6	1.0007	27.290	54
7	1.0007	27.075	53
8	1.0007	26.864	52
9	1.0007	26.655	51
10	1.0007	26.451	50
11	1.0007	26.249	49
12	1.0007	26.050	48
13	1.0007	25.854	47
14	1.0008	25.661	46
15	1.0008	25.471	45
16	1.0008	25.284	44
17	1.0008	25.100	43
18	1.0008	24.918	42
19	1.0008	24.739	41
20	1.0008	24.562	40
21	1.0008	24.388	39
22	1.0009	24.216	38
23	1.0009	24.047	37
24	1.0009	23.880	36
25	1.0009	23.716	35
26	1.0009	23.553	34
27	1.0009	23.393	33
28	1.0009	23.235	32
29	1.0009	23.079	31
30	1.0010	22.926	30
31	1.0010	22.774	29
32	1.0010	22.624	28
33	1.0010	22.476	27
34	1.0010	22.330	26
35	1.0010	22.187	25
36	1.0010	22.044	24
37	1.0010	21.904	23
38	1.0011	21.766	22
39	1.0011	21.629	21
40	1.0011	21.494	20
41	1.0011	21.360	19
42	1.0011	21.229	18
43	1.0011	21.098	17
44	1.0011	20.970	16
45	1.0012	20.843	15
46	1.0012	20.717	14
47	1.0012	20.593	13
48	1.0012	20.471	12
49	1.0012	20.350	11
50	1.0012	20.230	10
51	1.0012	20.112	9
52	1.0013	19.995	8
53	1.0013	19.880	7
54	1.0013	19.766	6
55	1.0013	19.653	5
56	1.0013	19.541	4
57	1.0013	19.431	3
58	1.0013	19.322	2
59	1.0014	19.214	1
60	1.0014	19.107	0
'	Csc	Sec	'

90° (270°)

(269°) 89°

91° (271°)

(268°) 88°

92° (272°)

(267°) 87°

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

3° (183°)

(356°) 176°

4° (184°)

(355°) 175°

5° (185°)

(354°) 174°

'	Sec	Csc	'
0	1.0014	19.107	60
1	1.0014	19.002	59
2	1.0014	18.898	58
3	1.0014	18.794	57
4	1.0014	18.692	56
5	1.0014	18.591	55
6	1.0015	18.492	54
7	1.0015	18.393	53
8	1.0015	18.295	52
9	1.0015	18.198	51
10	1.0015	18.103	50
11	1.0015	18.008	49
12	1.0016	17.914	48
13	1.0016	17.822	47
14	1.0016	17.730	46
15	1.0016	17.639	45
16	1.0016	17.549	44
17	1.0016	17.460	43
18	1.0017	17.372	42
19	1.0017	17.285	41
20	1.0017	17.198	40
21	1.0017	17.113	39
22	1.0017	17.028	38
23	1.0017	16.945	37
24	1.0018	16.862	36
25	1.0018	16.779	35
26	1.0018	16.698	34
27	1.0018	16.618	33
28	1.0018	16.538	32
29	1.0019	16.459	31
30	1.0019	16.380	30
31	1.0019	16.303	29
32	1.0019	16.226	28
33	1.0019	16.150	27
34	1.0019	16.075	26
35	1.0020	16.000	25
36	1.0020	15.926	24
37	1.0020	15.853	23
38	1.0020	15.780	22
39	1.0020	15.708	21
40	1.0021	15.637	20
41	1.0021	15.566	19
42	1.0021	15.496	18
43	1.0021	15.427	17
44	1.0021	15.358	16
45	1.0021	15.290	15
46	1.0022	15.222	14
47	1.0022	15.155	13
48	1.0022	15.089	12
49	1.0022	15.023	11
50	1.0022	14.958	10
51	1.0023	14.893	9
52	1.0023	14.829	8
53	1.0023	14.766	7
54	1.0023	14.703	6
55	1.0023	14.640	5
56	1.0024	14.578	4
57	1.0024	14.517	3
58	1.0024	14.456	2
59	1.0024	14.395	1
60	1.0024	14.336	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0024	14.336	60
1	1.0025	14.276	59
2	1.0025	14.217	58
3	1.0025	14.159	57
4	1.0025	14.101	56
5	1.0025	14.044	55
6	1.0026	13.987	54
7	1.0026	13.930	53
8	1.0026	13.874	52
9	1.0026	13.818	51
10	1.0027	13.763	50
11	1.0027	13.708	49
12	1.0027	13.654	48
13	1.0027	13.600	47
14	1.0027	13.547	46
15	1.0028	13.494	45
16	1.0028	13.441	44
17	1.0028	13.389	43
18	1.0028	13.337	42
19	1.0028	13.286	41
20	1.0029	13.235	40
21	1.0029	13.184	39
22	1.0029	13.134	38
23	1.0029	13.084	37
24	1.0030	13.035	36
25	1.0030	12.985	35
26	1.0030	12.937	34
27	1.0030	12.888	33
28	1.0030	12.840	32
29	1.0031	12.793	31
30	1.0031	12.745	30
31	1.0031	12.699	29
32	1.0031	12.652	28
33	1.0032	12.606	27
34	1.0032	12.560	26
35	1.0032	12.514	25
36	1.0032	12.469	24
37	1.0033	12.424	23
38	1.0033	12.379	22
39	1.0033	12.335	21
40	1.0033	12.291	20
41	1.0034	12.248	19
42	1.0034	12.204	18
43	1.0034	12.161	17
44	1.0034	12.119	16
45	1.0034	12.076	15
46	1.0035	12.034	14
47	1.0035	11.992	13
48	1.0035	11.951	12
49	1.0035	11.909	11
50	1.0036	11.868	10
51	1.0036	11.828	9
52	1.0036	11.787	8
53	1.0036	11.747	7
54	1.0037	11.707	6
55	1.0037	11.668	5
56	1.0037	11.628	4
57	1.0037	11.589	3
58	1.0038	11.551	2
59	1.0038	11.512	1
60	1.0038	11.474	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0038	11.474	60
1	1.0038	11.436	59
2	1.0039	11.398	58
3	1.0039	11.360	57
4	1.0039	11.323	56
5	1.0039	11.286	55
6	1.0040	11.249	54
7	1.0040	11.213	53
8	1.0040	11.176	52
9	1.0041	11.140	51
10	1.0041	11.105	50
11	1.0041	11.069	49
12	1.0041	11.034	48
13	1.0042	10.998	47
14	1.0042	10.963	46
15	1.0042	10.929	45
16	1.0042	10.894	44
17	1.0043	10.860	43
18	1.0043	10.826	42
19	1.0043	10.792	41
20	1.0043	10.758	40
21	1.0044	10.725	39
22	1.0044	10.692	38
23	1.0044	10.659	37
24	1.0045	10.626	36
25	1.0045	10.593	35
26	1.0045	10.561	34
27	1.0045	10.529	33
28	1.0046	10.497	32
29	1.0046	10.465	31
30	1.0046	10.433	30
31	1.0047	10.402	29
32	1.0047	10.371	28
33	1.0047	10.340	27
34	1.0047	10.309	26
35	1.0048	10.278	25
36	1.0048	10.248	24
37	1.0048	10.217	23
38	1.0049	10.187	22
39	1.0049	10.157	21
40	1.0049	10.128	20
41	1.0049	10.098	19
42	1.0050	10.068	18
43	1.0050	10.039	17
44	1.0050	10.010	16
45	1.0051	9.9812	15
46	1.0051	9.9525	14
47	1.0051	9.9239	13
48	1.0051	9.8955	12
49	1.0052	9.8672	11
50	1.0052	9.8391	10
51	1.0052	9.8112	9
52	1.0053	9.7834	8
53	1.0053	9.7558	7
54	1.0053	9.7283	6
55	1.0054	9.7010	5
56	1.0054	9.6739	4
57	1.0054	9.6469	3
58	1.0054	9.6200	2
59	1.0055	9.5933	1
60	1.0055	9.5668	0
'	Csc	Sec	'

93° (273°)

(266°) 86°

94° (274°)

(265°) 85°

95° (275°)

(264°) 84°

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

6° (186°)				7° (187°)				8° (188°)				9° (189°)			
(353°) 173°				(352°) 172°				(351°) 171°				(350°) 170°			
'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'
0	1.0055	9.5668	60	0	1.0075	8.2055	60	0	1.0098	7.1853	60	0	1.0125	6.3925	0
1	1.0055	9.5404	59	1	1.0075	8.1861	59	1	1.0099	7.1705	59	1	1.0125	6.4042	1
2	1.0056	9.5141	58	2	1.0076	8.1668	58	2	1.0099	7.1557	58	2	1.0124	6.4160	2
3	1.0056	9.4880	57	3	1.0076	8.1476	57	3	1.0100	7.1410	57	3	1.0124	6.4279	3
4	1.0056	9.4620	56	4	1.0077	8.1285	56	4	1.0100	7.1263	56	4	1.0122	6.4398	4
5	1.0057	9.4362	55	5	1.0077	8.1095	55	5	1.0100	7.1117	55	5	1.0122	6.4517	5
6	1.0057	9.4105	54	6	1.0077	8.0905	54	6	1.0101	7.0972	54	6	1.0123	6.4637	6
7	1.0057	9.3850	53	7	1.0078	8.0717	53	7	1.0101	7.0827	53	7	1.0123	6.4757	7
8	1.0058	9.3596	52	8	1.0078	8.0529	52	8	1.0102	7.0683	52	8	1.0122	6.4878	8
9	1.0058	9.3343	51	9	1.0078	8.0342	51	9	1.0102	7.0539	51	9	1.0122	6.4999	9
10	1.0058	9.3092	50	10	1.0079	8.0156	50	10	1.0102	7.0396	50	10	1.0120	6.5121	10
11	1.0059	9.2842	49	11	1.0079	7.9971	49	11	1.0103	7.0254	49	11	1.0120	6.5243	11
12	1.0059	9.2593	48	12	1.0079	7.9787	48	12	1.0103	7.0112	48	12	1.0120	6.5366	12
13	1.0059	9.2346	47	13	1.0080	7.9604	47	13	1.0104	6.9971	47	13	1.0120	6.5489	13
14	1.0059	9.2100	46	14	1.0080	7.9422	46	14	1.0104	6.9830	46	14	1.0120	6.5612	14
15	1.0060	9.1855	45	15	1.0081	7.9240	45	15	1.0105	6.9690	45	15	1.0118	6.5736	15
16	1.0060	9.1612	44	16	1.0081	7.9059	44	16	1.0105	6.9550	44	16	1.0118	6.5861	16
17	1.0060	9.1370	43	17	1.0081	7.8879	43	17	1.0105	6.9411	43	17	1.0118	6.5986	17
18	1.0061	9.1129	42	18	1.0082	7.8700	42	18	1.0106	6.9273	42	18	1.0117	6.6111	18
19	1.0061	9.0890	41	19	1.0082	7.8522	41	19	1.0106	6.9135	41	19	1.0117	6.6237	19
20	1.0061	9.0652	40	20	1.0082	7.8344	40	20	1.0107	6.8998	40	20	1.0116	6.6363	20
21	1.0062	9.0415	39	21	1.0083	7.8168	39	21	1.0107	6.8861	39	21	1.0116	6.6490	21
22	1.0062	9.0179	38	22	1.0083	7.7992	38	22	1.0108	6.8725	38	22	1.0115	6.6618	22
23	1.0062	8.9944	37	23	1.0084	7.7817	37	23	1.0108	6.8589	37	23	1.0115	6.6745	23
24	1.0063	8.9711	36	24	1.0084	7.7642	36	24	1.0108	6.8454	36	24	1.0115	6.6872	24
25	1.0063	8.9479	35	25	1.0084	7.7469	35	25	1.0109	6.8320	35	25	1.0114	6.6999	25
26	1.0063	8.9248	34	26	1.0085	7.7296	34	26	1.0109	6.8186	34	26	1.0114	6.7126	26
27	1.0064	8.9019	33	27	1.0085	7.7124	33	27	1.0110	6.8052	33	27	1.0114	6.7253	27
28	1.0064	8.8790	32	28	1.0086	7.6953	32	28	1.0110	6.7919	32	28	1.0113	6.7380	28
29	1.0064	8.8563	31	29	1.0086	7.6783	31	29	1.0111	6.7787	31	29	1.0113	6.7507	29
30	1.0065	8.8337	30	30	1.0086	7.6613	30	30	1.0111	6.7655	30	30	1.0113	6.7634	30
31	1.0065	8.8112	29	31	1.0087	7.6444	29	31	1.0112	6.7523	29	31	1.0112	6.7761	31
32	1.0065	8.7888	28	32	1.0087	7.6276	28	32	1.0112	6.7392	28	32	1.0112	6.7888	32
33	1.0066	8.7665	27	33	1.0087	7.6109	27	33	1.0112	6.7262	27	33	1.0112	6.8015	33
34	1.0066	8.7444	26	34	1.0088	7.5942	26	34	1.0113	6.7132	26	34	1.0111	6.8142	34
35	1.0066	8.7223	25	35	1.0088	7.5776	25	35	1.0113	6.7003	25	35	1.0111	6.8269	35
36	1.0067	8.7004	24	36	1.0089	7.5611	24	36	1.0114	6.6874	24	36	1.0111	6.8396	36
37	1.0067	8.6786	23	37	1.0089	7.5446	23	37	1.0114	6.6745	23	37	1.0111	6.8523	37
38	1.0067	8.6569	22	38	1.0089	7.5282	22	38	1.0115	6.6618	22	38	1.0110	6.8650	38
39	1.0068	8.6353	21	39	1.0090	7.5119	21	39	1.0115	6.6490	21	39	1.0110	6.8777	39
40	1.0068	8.6138	20	40	1.0090	7.4957	20	40	1.0116	6.6363	20	40	1.0110	6.8904	40
41	1.0068	8.5924	19	41	1.0091	7.4795	19	41	1.0116	6.6237	19	41	1.0110	6.9031	41
42	1.0069	8.5711	18	42	1.0091	7.4635	18	42	1.0116	6.6111	18	42	1.0110	6.9158	42
43	1.0069	8.5500	17	43	1.0091	7.4474	17	43	1.0117	6.5986	17	43	1.0110	6.9285	43
44	1.0069	8.5289	16	44	1.0092	7.4315	16	44	1.0117	6.5861	16	44	1.0110	6.9412	44
45	1.0070	8.5079	15	45	1.0092	7.4156	15	45	1.0118	6.5736	15	45	1.0110	6.9539	45
46	1.0070	8.4871	14	46	1.0093	7.3998	14	46	1.0118	6.5612	14	46	1.0110	6.9666	46
47	1.0070	8.4663	13	47	1.0093	7.3840	13	47	1.0119	6.5489	13	47	1.0110	6.9793	47
48	1.0071	8.4457	12	48	1.0093	7.3684	12	48	1.0119	6.5366	12	48	1.0110	6.9920	48
49	1.0071	8.4251	11	49	1.0094	7.3527	11	49	1.0120	6.5243	11	49	1.0110	7.0047	49
50	1.0072	8.4047	10	50	1.0094	7.3372	10	50	1.0120	6.5121	10	50	1.0110	7.0174	50
51	1.0072	8.3843	9	51	1.0095	7.3217	9	51	1.0120	6.4999	9	51	1.0110	7.0301	51
52	1.0072	8.3641	8	52	1.0095	7.3063	8	52	1.0121	6.4878	8	52	1.0110	7.0428	52
53	1.0073	8.3439	7	53	1.0095	7.2909	7	53	1.0121	6.4757	7	53	1.0110	7.0555	53
54	1.0073	8.3238	6	54	1.0096	7.2757	6	54	1.0122	6.4637	6	54	1.0110	7.0682	54
55	1.0073	8.3039	5	55	1.0096	7.2604	5	55	1.0122	6.4517	5	55	1.0110	7.0809	55
56	1.0074	8.2840	4	56	1.0097	7.2453	4	56	1.0123	6.4398	4	56	1.0110	7.0936	56
57	1.0074	8.2642	3	57	1.0097	7.2302	3	57	1.0123	6.4279	3	57	1.0110	7.1063	57
58	1.0074	8.2446	2	58	1.0097	7.2152	2	58	1.0124	6.4160	2	58	1.0110	7.1190	58
59	1.0075	8.2250	1	59	1.0098	7.2002	1	59	1.0124	6.4042	1	59	1.0110	7.1317	59
60	1.0075	8.2055	0	60	1.0098	7.1853	0	60	1.0125	6.3925	0	60	1.0110	7.1444	60
'	Csc	Sec	'	'	Csc	Sec	'	'	Csc	Sec	'	'	Csc	Sec	'

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

9° (189°)				(350°) 170°				10° (190°)				(349°) 169°				11° (191°)				(348°) 168°			
'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'
0	1.0125	6.3925	60	0	1.0154	5.7588	60	0	1.0187	5.2408	60	0	1.0187	5.2408	60	0	1.0187	5.2408	60	0	1.0187	5.2408	60
1	1.0125	6.3807	59	1	1.0155	5.7493	59	1	1.0188	5.2330	59	1	1.0188	5.2330	59	1	1.0188	5.2330	59	1	1.0188	5.2330	59
2	1.0126	6.3691	58	2	1.0155	5.7398	58	2	1.0188	5.2252	58	2	1.0188	5.2252	58	2	1.0188	5.2252	58	2	1.0188	5.2252	58
3	1.0126	6.3574	57	3	1.0156	5.7304	57	3	1.0189	5.2174	57	3	1.0189	5.2174	57	3	1.0189	5.2174	57	3	1.0189	5.2174	57
4	1.0127	6.3458	56	4	1.0156	5.7210	56	4	1.0189	5.2097	56	4	1.0189	5.2097	56	4	1.0189	5.2097	56	4	1.0189	5.2097	56
5	1.0127	6.3343	55	5	1.0157	5.7117	55	5	1.0190	5.2019	55	5	1.0190	5.2019	55	5	1.0190	5.2019	55	5	1.0190	5.2019	55
6	1.0127	6.3228	54	6	1.0157	5.7023	54	6	1.0191	5.1942	54	6	1.0191	5.1942	54	6	1.0191	5.1942	54	6	1.0191	5.1942	54
7	1.0128	6.3113	53	7	1.0158	5.6930	53	7	1.0191	5.1865	53	7	1.0191	5.1865	53	7	1.0191	5.1865	53	7	1.0191	5.1865	53
8	1.0128	6.2999	52	8	1.0158	5.6838	52	8	1.0192	5.1789	52	8	1.0192	5.1789	52	8	1.0192	5.1789	52	8	1.0192	5.1789	52
9	1.0129	6.2885	51	9	1.0159	5.6745	51	9	1.0192	5.1712	51	9	1.0192	5.1712	51	9	1.0192	5.1712	51	9	1.0192	5.1712	51
10	1.0129	6.2772	50	10	1.0160	5.6653	50	10	1.0193	5.1636	50	10	1.0193	5.1636	50	10	1.0193	5.1636	50	10	1.0193	5.1636	50
11	1.0130	6.2659	49	11	1.0160	5.6562	49	11	1.0194	5.1560	49	11	1.0194	5.1560	49	11	1.0194	5.1560	49	11	1.0194	5.1560	49
12	1.0130	6.2546	48	12	1.0161	5.6470	48	12	1.0194	5.1484	48	12	1.0194	5.1484	48	12	1.0194	5.1484	48	12	1.0194	5.1484	48
13	1.0131	6.2434	47	13	1.0161	5.6379	47	13	1.0195	5.1409	47	13	1.0195	5.1409	47	13	1.0195	5.1409	47	13	1.0195	5.1409	47
14	1.0131	6.2323	46	14	1.0162	5.6288	46	14	1.0195	5.1333	46	14	1.0195	5.1333	46	14	1.0195	5.1333	46	14	1.0195	5.1333	46
15	1.0132	6.2211	45	15	1.0162	5.6198	45	15	1.0196	5.1258	45	15	1.0196	5.1258	45	15	1.0196	5.1258	45	15	1.0196	5.1258	45
16	1.0132	6.2100	44	16	1.0163	5.6107	44	16	1.0197	5.1183	44	16	1.0197	5.1183	44	16	1.0197	5.1183	44	16	1.0197	5.1183	44
17	1.0133	6.1990	43	17	1.0163	5.6017	43	17	1.0197	5.1109	43	17	1.0197	5.1109	43	17	1.0197	5.1109	43	17	1.0197	5.1109	43
18	1.0133	6.1880	42	18	1.0164	5.5928	42	18	1.0198	5.1034	42	18	1.0198	5.1034	42	18	1.0198	5.1034	42	18	1.0198	5.1034	42
19	1.0134	6.1770	41	19	1.0164	5.5838	41	19	1.0198	5.0960	41	19	1.0198	5.0960	41	19	1.0198	5.0960	41	19	1.0198	5.0960	41
20	1.0134	6.1661	40	20	1.0165	5.5749	40	20	1.0199	5.0886	40	20	1.0199	5.0886	40	20	1.0199	5.0886	40	20	1.0199	5.0886	40
21	1.0135	6.1552	39	21	1.0165	5.5660	39	21	1.0199	5.0813	39	21	1.0199	5.0813	39	21	1.0199	5.0813	39	21	1.0199	5.0813	39
22	1.0135	6.1443	38	22	1.0166	5.5572	38	22	1.0200	5.0739	38	22	1.0200	5.0739	38	22	1.0200	5.0739	38	22	1.0200	5.0739	38
23	1.0136	6.1335	37	23	1.0166	5.5484	37	23	1.0201	5.0666	37	23	1.0201	5.0666	37	23	1.0201	5.0666	37	23	1.0201	5.0666	37
24	1.0136	6.1227	36	24	1.0167	5.5396	36	24	1.0201	5.0593	36	24	1.0201	5.0593	36	24	1.0201	5.0593	36	24	1.0201	5.0593	36
25	1.0137	6.1120	35	25	1.0168	5.5308	35	25	1.0202	5.0520	35	25	1.0202	5.0520	35	25	1.0202	5.0520	35	25	1.0202	5.0520	35
26	1.0137	6.1013	34	26	1.0168	5.5221	34	26	1.0202	5.0447	34	26	1.0202	5.0447	34	26	1.0202	5.0447	34	26	1.0202	5.0447	34
27	1.0138	6.0906	33	27	1.0169	5.5134	33	27	1.0203	5.0375	33	27	1.0203	5.0375	33	27	1.0203	5.0375	33	27	1.0203	5.0375	33
28	1.0138	6.0800	32	28	1.0169	5.5047	32	28	1.0204	5.0302	32	28	1.0204	5.0302	32	28	1.0204	5.0302	32	28	1.0204	5.0302	32
29	1.0139	6.0694	31	29	1.0170	5.4960	31	29	1.0204	5.0230	31	29	1.0204	5.0230	31	29	1.0204	5.0230	31	29	1.0204	5.0230	31
30	1.0139	6.0589	30	30	1.0170	5.4874	30	30	1.0205	5.0159	30	30	1.0205	5.0159	30	30	1.0205	5.0159	30	30	1.0205	5.0159	30
31	1.0140	6.0483	29	31	1.0171	5.4788	29	31	1.0205	5.0087	29	31	1.0205	5.0087	29	31	1.0205	5.0087	29	31	1.0205	5.0087	29
32	1.0140	6.0379	28	32	1.0171	5.4702	28	32	1.0206	5.0016	28	32	1.0206	5.0016	28	32	1.0206	5.0016	28	32	1.0206	5.0016	28
33	1.0141	6.0274	27	33	1.0172	5.4617	27	33	1.0207	4.9944	27	33	1.0207	4.9944	27	33	1.0207	4.9944	27	33	1.0207	4.9944	27
34	1.0141	6.0170	26	34	1.0173	5.4532	26	34	1.0207	4.9873	26	34	1.0207	4.9873	26	34	1.0207	4.9873	26	34	1.0207	4.9873	26
35	1.0142	6.0067	25	35	1.0173	5.4447	25	35	1.0208	4.9803	25	35	1.0208	4.9803	25	35	1.0208	4.9803	25	35	1.0208	4.9803	25
36	1.0142	5.9963	24	36	1.0174	5.4362	24	36	1.0209	4.9732	24	36	1.0209	4.9732	24	36	1.0209	4.9732	24	36	1.0209	4.9732	24
37	1.0143	5.9860	23	37	1.0174	5.4278	23	37	1.0209	4.9662	23	37	1.0209	4.9662	23	37	1.0209	4.9662	23	37	1.0209	4.9662	23
38	1.0143	5.9758	22	38	1.0175	5.4194	22	38	1.0210	4.9591	22	38	1.0210	4.9591	22	38	1.0210	4.9591	22	38	1.0210	4.9591	22
39	1.0144	5.9656	21	39	1.0175	5.4110	21	39	1.0210	4.9521	21	39	1.0210	4.9521	21	39	1.0210	4.9521	21	39	1.0210	4.9521	21
40	1.0144	5.9554	20	40	1.0176	5.4026	20	40	1.0211	4.9452	20	40	1.0211	4.9452	20	40	1.0211	4.9452	20	40	1.0211	4.9452	20
41	1.0145	5.9452	19	41	1.0176	5.3943	19	41	1.0212	4.9382	19	41	1.0212	4.9382	19	41	1.0212	4.9382	19	41	1.0212	4.9382	19
42	1.0145	5.9351	18	42	1.0177	5.3860	18	42	1.0212	4.9313	18	42	1.0212	4.9313	18	42	1.0212	4.9313	18	42	1.0212	4.9313	18
43	1.0146	5.9250	17	43	1.0178	5.3777	17	43	1.0213	4.9244	17	43	1.0213	4.9244	17	43	1.0213	4.9244	17	43	1.0213	4.9244	17
44	1.0146	5.9150	16	44	1.0178	5.3695	16	44	1.0213	4.9175	16	44	1.0213	4.9175	16	44	1.0213	4.9175	16	44	1.0213	4.9175	16
45	1.0147	5.9049	15	45	1.0179	5.3612	15	45	1.0214	4.9106	15	45	1.0214	4.9106	15	45	1.0214	4.9106	15	45	1.0214	4.9106	15
46	1.0147	5.8950	14	46	1.0179	5.3530	14	46	1.0215	4.9037	14	46	1.0215	4.9037	14	46	1.0215	4.9037	14	46	1.0215	4.9037	14
47	1.0148	5.8850	13	47	1.0180	5.3449	13	47	1.0215	4.8969	13	47	1.0215	4.8969	13	47	1.0215	4.8969	13	47	1.0215	4.8969	13
48	1.0148	5.8751	12	48	1.0180	5.3367	12	48	1.0216	4.8901	12	48	1.0216	4.8901	12	48	1.0216	4.8901	12	48	1.0216	4.8901	12
49	1.0149	5.8652	11	49	1.0181	5.3286	11	49	1.0217	4.8833	11	49	1.0217	4.8833	11	49	1.0217	4.8833	11	49	1.0217	4.8833	11
50	1.0149	5.8554	10	50	1.0181	5.3205	10	50	1.0217	4.8765	10	50	1.0217	4.8765	10	50	1.0217	4.8765	10	50	1.0217	4.8765	10
51	1.0150	5.8456	9	51	1.0182	5.3124	9	51	1.0218	4.8697	9	51	1.0218	4.8697	9	51	1.0218	4.8697	9	51	1.0218	4.8697	9
52	1.0150	5.8358	8	52	1.0183	5.3044	8	52	1.0218	4.8630	8	52	1.0218	4.8630	8	52	1.0218	4.8630	8	52	1.0218	4.8630	8
53	1.0151	5.8261	7	53	1.0183	5.2963	7	53	1.0219	4.8563	7	53	1.0219	4.8563	7	53	1.0219	4.8563	7	53	1.0219	4.8563	7
54																							

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

12° (192°) (347°) 167° 13° (193°) (346°) 166° 14° (194°) (345°) 165°

'	Sec	Csc	'
0	1.0223	4.8097	60
1	1.0224	4.8032	59
2	1.0225	4.7966	58
3	1.0225	4.7901	57
4	1.0226	4.7836	56
5	1.0227	4.7771	55
6	1.0227	4.7706	54
7	1.0228	4.7641	53
8	1.0228	4.7577	52
9	1.0229	4.7512	51
10	1.0230	4.7448	50
11	1.0230	4.7384	49
12	1.0231	4.7321	48
13	1.0232	4.7257	47
14	1.0232	4.7194	46
15	1.0233	4.7130	45
16	1.0234	4.7067	44
17	1.0234	4.7004	43
18	1.0235	4.6942	42
19	1.0236	4.6879	41
20	1.0236	4.6817	40
21	1.0237	4.6755	39
22	1.0238	4.6693	38
23	1.0238	4.6631	37
24	1.0239	4.6569	36
25	1.0240	4.6507	35
26	1.0240	4.6446	34
27	1.0241	4.6385	33
28	1.0241	4.6324	32
29	1.0242	4.6263	31
30	1.0243	4.6202	30
31	1.0243	4.6142	29
32	1.0244	4.6081	28
33	1.0245	4.6021	27
34	1.0245	4.5961	26
35	1.0246	4.5901	25
36	1.0247	4.5841	24
37	1.0247	4.5782	23
38	1.0248	4.5722	22
39	1.0249	4.5663	21
40	1.0249	4.5604	20
41	1.0250	4.5545	19
42	1.0251	4.5486	18
43	1.0251	4.5428	17
44	1.0252	4.5369	16
45	1.0253	4.5311	15
46	1.0253	4.5253	14
47	1.0254	4.5195	13
48	1.0255	4.5137	12
49	1.0256	4.5079	11
50	1.0256	4.5022	10
51	1.0257	4.4964	9
52	1.0258	4.4907	8
53	1.0258	4.4850	7
54	1.0259	4.4793	6
55	1.0260	4.4736	5
56	1.0260	4.4679	4
57	1.0261	4.4623	3
58	1.0262	4.4566	2
59	1.0262	4.4510	1
60	1.0263	4.4454	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0263	4.4454	60
1	1.0264	4.4398	59
2	1.0264	4.4342	58
3	1.0265	4.4287	57
4	1.0266	4.4231	56
5	1.0266	4.4176	55
6	1.0267	4.4121	54
7	1.0268	4.4066	53
8	1.0269	4.4011	52
9	1.0269	4.3956	51
10	1.0270	4.3901	50
11	1.0271	4.3847	49
12	1.0271	4.3792	48
13	1.0272	4.3738	47
14	1.0273	4.3684	46
15	1.0273	4.3630	45
16	1.0274	4.3576	44
17	1.0275	4.3522	43
18	1.0276	4.3469	42
19	1.0276	4.3415	41
20	1.0277	4.3362	40
21	1.0278	4.3309	39
22	1.0278	4.3256	38
23	1.0279	4.3203	37
24	1.0280	4.3150	36
25	1.0281	4.3098	35
26	1.0281	4.3045	34
27	1.0282	4.2993	33
28	1.0283	4.2941	32
29	1.0283	4.2889	31
30	1.0284	4.2837	30
31	1.0285	4.2785	29
32	1.0286	4.2733	28
33	1.0286	4.2681	27
34	1.0287	4.2630	26
35	1.0288	4.2579	25
36	1.0288	4.2527	24
37	1.0289	4.2476	23
38	1.0290	4.2425	22
39	1.0291	4.2375	21
40	1.0291	4.2324	20
41	1.0292	4.2273	19
42	1.0293	4.2223	18
43	1.0294	4.2173	17
44	1.0294	4.2122	16
45	1.0295	4.2072	15
46	1.0296	4.2022	14
47	1.0297	4.1973	13
48	1.0297	4.1923	12
49	1.0298	4.1873	11
50	1.0299	4.1824	10
51	1.0299	4.1774	9
52	1.0300	4.1725	8
53	1.0301	4.1676	7
54	1.0302	4.1627	6
55	1.0302	4.1578	5
56	1.0303	4.1529	4
57	1.0304	4.1481	3
58	1.0305	4.1432	2
59	1.0305	4.1384	1
60	1.0306	4.1336	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0306	4.1336	60
1	1.0307	4.1287	59
2	1.0308	4.1239	58
3	1.0308	4.1191	57
4	1.0309	4.1144	56
5	1.0310	4.1096	55
6	1.0311	4.1048	54
7	1.0311	4.1001	53
8	1.0312	4.0954	52
9	1.0313	4.0906	51
10	1.0314	4.0859	50
11	1.0314	4.0812	49
12	1.0315	4.0765	48
13	1.0316	4.0718	47
14	1.0317	4.0672	46
15	1.0317	4.0625	45
16	1.0318	4.0579	44
17	1.0319	4.0532	43
18	1.0320	4.0486	42
19	1.0321	4.0440	41
20	1.0321	4.0394	40
21	1.0322	4.0348	39
22	1.0323	4.0302	38
23	1.0324	4.0256	37
24	1.0324	4.0211	36
25	1.0325	4.0165	35
26	1.0326	4.0120	34
27	1.0327	4.0075	33
28	1.0327	4.0029	32
29	1.0328	3.9984	31
30	1.0329	3.9939	30
31	1.0330	3.9894	29
32	1.0331	3.9850	28
33	1.0331	3.9805	27
34	1.0332	3.9760	26
35	1.0333	3.9716	25
36	1.0334	3.9672	24
37	1.0334	3.9627	23
38	1.0335	3.9583	22
39	1.0336	3.9539	21
40	1.0337	3.9495	20
41	1.0338	3.9451	19
42	1.0338	3.9408	18
43	1.0339	3.9364	17
44	1.0340	3.9320	16
45	1.0341	3.9277	15
46	1.0342	3.9234	14
47	1.0342	3.9190	13
48	1.0343	3.9147	12
49	1.0344	3.9104	11
50	1.0345	3.9061	10
51	1.0346	3.9018	9
52	1.0346	3.8976	8
53	1.0347	3.8933	7
54	1.0348	3.8890	6
55	1.0349	3.8848	5
56	1.0350	3.8806	4
57	1.0350	3.8763	3
58	1.0351	3.8721	2
59	1.0352	3.8679	1
60	1.0353	3.8637	0
'	Csc	Sec	'

102° (282°) (257°) 77° 103° (283°) (256°) 76° 104° (284°) (255°) 75°

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

15° (195°)

(344°) 164°

16° (196°)

(343°) 163°

17° (197°)

(342°) 162°

'	Sec	Csc	'
0	1.0353	3.8637	60
1	1.0354	3.8595	59
2	1.0354	3.8553	58
3	1.0355	3.8512	57
4	1.0356	3.8470	56
5	1.0357	3.8428	55
6	1.0358	3.8387	54
7	1.0358	3.8346	53
8	1.0359	3.8304	52
9	1.0360	3.8263	51
10	1.0361	3.8222	50
11	1.0362	3.8181	49
12	1.0363	3.8140	48
13	1.0363	3.8100	47
14	1.0364	3.8059	46
15	1.0365	3.8018	45
16	1.0366	3.7978	44
17	1.0367	3.7937	43
18	1.0367	3.7897	42
19	1.0368	3.7857	41
20	1.0369	3.7817	40
21	1.0370	3.7777	39
22	1.0371	3.7737	38
23	1.0372	3.7697	37
24	1.0372	3.7657	36
25	1.0373	3.7617	35
26	1.0374	3.7577	34
27	1.0375	3.7538	33
28	1.0376	3.7498	32
29	1.0377	3.7459	31
30	1.0377	3.7420	30
31	1.0378	3.7381	29
32	1.0379	3.7341	28
33	1.0380	3.7302	27
34	1.0381	3.7263	26
35	1.0382	3.7225	25
36	1.0382	3.7186	24
37	1.0383	3.7147	23
38	1.0384	3.7108	22
39	1.0385	3.7070	21
40	1.0386	3.7032	20
41	1.0387	3.6993	19
42	1.0388	3.6955	18
43	1.0388	3.6917	17
44	1.0389	3.6879	16
45	1.0390	3.6840	15
46	1.0391	3.6803	14
47	1.0392	3.6765	13
48	1.0393	3.6727	12
49	1.0394	3.6689	11
50	1.0394	3.6652	10
51	1.0395	3.6614	9
52	1.0396	3.6576	8
53	1.0397	3.6539	7
54	1.0398	3.6502	6
55	1.0399	3.6465	5
56	1.0400	3.6427	4
57	1.0400	3.6390	3
58	1.0401	3.6353	2
59	1.0402	3.6316	1
60	1.0403	3.6280	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0403	3.6280	60
1	1.0404	3.6243	59
2	1.0405	3.6206	58
3	1.0406	3.6169	57
4	1.0406	3.6133	56
5	1.0407	3.6097	55
6	1.0408	3.6060	54
7	1.0409	3.6024	53
8	1.0410	3.5988	52
9	1.0411	3.5951	51
10	1.0412	3.5915	50
11	1.0413	3.5879	49
12	1.0413	3.5843	48
13	1.0414	3.5808	47
14	1.0415	3.5772	46
15	1.0416	3.5736	45
16	1.0417	3.5700	44
17	1.0418	3.5665	43
18	1.0419	3.5629	42
19	1.0420	3.5594	41
20	1.0421	3.5559	40
21	1.0421	3.5523	39
22	1.0422	3.5488	38
23	1.0423	3.5453	37
24	1.0424	3.5418	36
25	1.0425	3.5383	35
26	1.0426	3.5348	34
27	1.0427	3.5313	33
28	1.0428	3.5279	32
29	1.0429	3.5244	31
30	1.0429	3.5209	30
31	1.0430	3.5175	29
32	1.0431	3.5140	28
33	1.0432	3.5106	27
34	1.0433	3.5072	26
35	1.0434	3.5037	25
36	1.0435	3.5003	24
37	1.0436	3.4969	23
38	1.0437	3.4935	22
39	1.0438	3.4901	21
40	1.0439	3.4867	20
41	1.0439	3.4833	19
42	1.0440	3.4799	18
43	1.0441	3.4766	17
44	1.0442	3.4732	16
45	1.0443	3.4699	15
46	1.0444	3.4665	14
47	1.0445	3.4632	13
48	1.0446	3.4598	12
49	1.0447	3.4565	11
50	1.0448	3.4532	10
51	1.0449	3.4499	9
52	1.0450	3.4465	8
53	1.0450	3.4432	7
54	1.0451	3.4399	6
55	1.0452	3.4367	5
56	1.0453	3.4334	4
57	1.0454	3.4301	3
58	1.0455	3.4268	2
59	1.0456	3.4236	1
60	1.0457	3.4203	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0457	3.4203	60
1	1.0458	3.4171	59
2	1.0459	3.4138	58
3	1.0460	3.4106	57
4	1.0461	3.4073	56
5	1.0462	3.4041	55
6	1.0463	3.4009	54
7	1.0463	3.3977	53
8	1.0464	3.3945	52
9	1.0465	3.3913	51
10	1.0466	3.3881	50
11	1.0467	3.3849	49
12	1.0468	3.3817	48
13	1.0469	3.3785	47
14	1.0470	3.3754	46
15	1.0471	3.3722	45
16	1.0472	3.3691	44
17	1.0473	3.3659	43
18	1.0474	3.3628	42
19	1.0475	3.3596	41
20	1.0476	3.3565	40
21	1.0477	3.3534	39
22	1.0478	3.3502	38
23	1.0479	3.3471	37
24	1.0480	3.3440	36
25	1.0480	3.3409	35
26	1.0481	3.3378	34
27	1.0482	3.3347	33
28	1.0483	3.3317	32
29	1.0484	3.3286	31
30	1.0485	3.3255	30
31	1.0486	3.3224	29
32	1.0487	3.3194	28
33	1.0488	3.3163	27
34	1.0489	3.3133	26
35	1.0490	3.3102	25
36	1.0491	3.3072	24
37	1.0492	3.3042	23
38	1.0493	3.3012	22
39	1.0494	3.2981	21
40	1.0495	3.2951	20
41	1.0496	3.2921	19
42	1.0497	3.2891	18
43	1.0498	3.2861	17
44	1.0499	3.2831	16
45	1.0500	3.2801	15
46	1.0501	3.2772	14
47	1.0502	3.2742	13
48	1.0503	3.2712	12
49	1.0504	3.2683	11
50	1.0505	3.2653	10
51	1.0506	3.2624	9
52	1.0507	3.2594	8
53	1.0508	3.2565	7
54	1.0509	3.2535	6
55	1.0510	3.2506	5
56	1.0511	3.2477	4
57	1.0512	3.2448	3
58	1.0513	3.2419	2
59	1.0514	3.2390	1
60	1.0515	3.2361	0
'	Csc	Sec	'

105° (285°)

(254°) 74°

106° (286°)

(253°) 73°

107° (287°)

(252°) 72°

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

18° (198°)

(341°) 161°

19° (199°)

(340°) 160°

20° (200°)

(339°) 159°

'	Sec	Csc	'
0	1.0515	3.2361	60
1	1.0516	3.2332	59
2	1.0517	3.2303	58
3	1.0518	3.2274	57
4	1.0519	3.2245	56
5	1.0520	3.2217	55
6	1.0521	3.2188	54
7	1.0522	3.2159	53
8	1.0523	3.2131	52
9	1.0524	3.2102	51
10	1.0525	3.2074	50
11	1.0526	3.2045	49
12	1.0527	3.2017	48
13	1.0528	3.1989	47
14	1.0529	3.1960	46
15	1.0530	3.1932	45
16	1.0531	3.1904	44
17	1.0532	3.1876	43
18	1.0533	3.1848	42
19	1.0534	3.1820	41
20	1.0535	3.1792	40
21	1.0536	3.1764	39
22	1.0537	3.1736	38
23	1.0538	3.1708	37
24	1.0539	3.1681	36
25	1.0540	3.1653	35
26	1.0541	3.1625	34
27	1.0542	3.1598	33
28	1.0543	3.1570	32
29	1.0544	3.1543	31
30	1.0545	3.1515	30
31	1.0546	3.1488	29
32	1.0547	3.1461	28
33	1.0548	3.1433	27
34	1.0549	3.1406	26
35	1.0550	3.1379	25
36	1.0551	3.1352	24
37	1.0552	3.1325	23
38	1.0553	3.1298	22
39	1.0554	3.1271	21
40	1.0555	3.1244	20
41	1.0556	3.1217	19
42	1.0557	3.1190	18
43	1.0558	3.1163	17
44	1.0559	3.1137	16
45	1.0560	3.1110	15
46	1.0561	3.1083	14
47	1.0563	3.1057	13
48	1.0564	3.1030	12
49	1.0565	3.1004	11
50	1.0566	3.0977	10
51	1.0567	3.0951	9
52	1.0568	3.0925	8
53	1.0569	3.0898	7
54	1.0570	3.0872	6
55	1.0571	3.0846	5
56	1.0572	3.0820	4
57	1.0573	3.0794	3
58	1.0574	3.0768	2
59	1.0575	3.0742	1
60	1.0576	3.0716	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0576	3.0716	60
1	1.0577	3.0690	59
2	1.0578	3.0664	58
3	1.0579	3.0638	57
4	1.0580	3.0612	56
5	1.0582	3.0586	55
6	1.0583	3.0561	54
7	1.0584	3.0535	53
8	1.0585	3.0509	52
9	1.0586	3.0484	51
10	1.0587	3.0458	50
11	1.0588	3.0433	49
12	1.0589	3.0407	48
13	1.0590	3.0382	47
14	1.0591	3.0357	46
15	1.0592	3.0331	45
16	1.0593	3.0306	44
17	1.0594	3.0281	43
18	1.0595	3.0256	42
19	1.0597	3.0231	41
20	1.0598	3.0206	40
21	1.0599	3.0181	39
22	1.0600	3.0156	38
23	1.0601	3.0131	37
24	1.0602	3.0106	36
25	1.0603	3.0081	35
26	1.0604	3.0056	34
27	1.0605	3.0031	33
28	1.0606	3.0007	32
29	1.0607	2.9982	31
30	1.0608	2.9957	30
31	1.0610	2.9933	29
32	1.0611	2.9908	28
33	1.0612	2.9884	27
34	1.0613	2.9859	26
35	1.0614	2.9835	25
36	1.0615	2.9811	24
37	1.0616	2.9786	23
38	1.0617	2.9762	22
39	1.0618	2.9738	21
40	1.0619	2.9713	20
41	1.0621	2.9689	19
42	1.0622	2.9665	18
43	1.0623	2.9641	17
44	1.0624	2.9617	16
45	1.0625	2.9593	15
46	1.0626	2.9569	14
47	1.0627	2.9545	13
48	1.0628	2.9521	12
49	1.0629	2.9498	11
50	1.0631	2.9474	10
51	1.0632	2.9450	9
52	1.0633	2.9426	8
53	1.0634	2.9403	7
54	1.0635	2.9379	6
55	1.0636	2.9355	5
56	1.0637	2.9332	4
57	1.0638	2.9308	3
58	1.0640	2.9285	2
59	1.0641	2.9261	1
60	1.0642	2.9238	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0642	2.9238	60
1	1.0643	2.9215	59
2	1.0644	2.9191	58
3	1.0645	2.9168	57
4	1.0646	2.9145	56
5	1.0647	2.9122	55
6	1.0649	2.9099	54
7	1.0650	2.9075	53
8	1.0651	2.9052	52
9	1.0652	2.9029	51
10	1.0653	2.9006	50
11	1.0654	2.8983	49
12	1.0655	2.8960	48
13	1.0657	2.8938	47
14	1.0658	2.8915	46
15	1.0659	2.8892	45
16	1.0660	2.8869	44
17	1.0661	2.8846	43
18	1.0662	2.8824	42
19	1.0663	2.8801	41
20	1.0665	2.8779	40
21	1.0666	2.8756	39
22	1.0667	2.8733	38
23	1.0668	2.8711	37
24	1.0669	2.8688	36
25	1.0670	2.8666	35
26	1.0671	2.8644	34
27	1.0673	2.8621	33
28	1.0674	2.8599	32
29	1.0675	2.8577	31
30	1.0676	2.8555	30
31	1.0677	2.8532	29
32	1.0678	2.8510	28
33	1.0680	2.8488	27
34	1.0681	2.8466	26
35	1.0682	2.8444	25
36	1.0683	2.8422	24
37	1.0684	2.8400	23
38	1.0685	2.8378	22
39	1.0687	2.8356	21
40	1.0688	2.8334	20
41	1.0689	2.8312	19
42	1.0690	2.8291	18
43	1.0691	2.8269	17
44	1.0692	2.8247	16
45	1.0694	2.8225	15
46	1.0695	2.8204	14
47	1.0696	2.8182	13
48	1.0697	2.8161	12
49	1.0698	2.8139	11
50	1.0700	2.8117	10
51	1.0701	2.8096	9
52	1.0702	2.8075	8
53	1.0703	2.8053	7
54	1.0704	2.8032	6
55	1.0705	2.8010	5
56	1.0707	2.7989	4
57	1.0708	2.7968	3
58	1.0709	2.7947	2
59	1.0710	2.7925	1
60	1.0711	2.7904	0
'	Csc	Sec	'

108° (288°)

(251°) 71°

109° (289°)

(250°) 70°

110° (290°)

(249°) 69°

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

21° (201°)

(338°) 158°

22° (202°)

(337°) 157°

23° (203°)

(336°) 156°

'	Sec	Csc	'
0	1.0711	2.7904	60
1	1.0713	2.7883	59
2	1.0714	2.7862	58
3	1.0715	2.7841	57
4	1.0716	2.7820	56
5	1.0717	2.7799	55
6	1.0719	2.7778	54
7	1.0720	2.7757	53
8	1.0721	2.7736	52
9	1.0722	2.7715	51
10	1.0723	2.7695	50
11	1.0725	2.7674	49
12	1.0726	2.7653	48
13	1.0727	2.7632	47
14	1.0728	2.7612	46
15	1.0730	2.7591	45
16	1.0731	2.7570	44
17	1.0732	2.7550	43
18	1.0733	2.7529	42
19	1.0734	2.7509	41
20	1.0736	2.7488	40
21	1.0737	2.7468	39
22	1.0738	2.7447	38
23	1.0739	2.7427	37
24	1.0740	2.7407	36
25	1.0742	2.7386	35
26	1.0743	2.7366	34
27	1.0744	2.7346	33
28	1.0745	2.7325	32
29	1.0747	2.7305	31
30	1.0748	2.7285	30
31	1.0749	2.7265	29
32	1.0750	2.7245	28
33	1.0752	2.7225	27
34	1.0753	2.7205	26
35	1.0754	2.7185	25
36	1.0755	2.7165	24
37	1.0757	2.7145	23
38	1.0758	2.7125	22
39	1.0759	2.7105	21
40	1.0760	2.7085	20
41	1.0761	2.7065	19
42	1.0763	2.7046	18
43	1.0764	2.7026	17
44	1.0765	2.7006	16
45	1.0766	2.6986	15
46	1.0768	2.6967	14
47	1.0769	2.6947	13
48	1.0770	2.6927	12
49	1.0771	2.6908	11
50	1.0773	2.6888	10
51	1.0774	2.6869	9
52	1.0775	2.6849	8
53	1.0777	2.6830	7
54	1.0778	2.6811	6
55	1.0779	2.6791	5
56	1.0780	2.6772	4
57	1.0782	2.6752	3
58	1.0783	2.6733	2
59	1.0784	2.6714	1
60	1.0785	2.6695	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0785	2.6695	60
1	1.0787	2.6675	59
2	1.0788	2.6656	58
3	1.0789	2.6637	57
4	1.0790	2.6618	56
5	1.0792	2.6599	55
6	1.0793	2.6580	54
7	1.0794	2.6561	53
8	1.0796	2.6542	52
9	1.0797	2.6523	51
10	1.0798	2.6504	50
11	1.0799	2.6485	49
12	1.0801	2.6466	48
13	1.0802	2.6447	47
14	1.0803	2.6429	46
15	1.0804	2.6410	45
16	1.0806	2.6391	44
17	1.0807	2.6372	43
18	1.0808	2.6354	42
19	1.0810	2.6335	41
20	1.0811	2.6316	40
21	1.0812	2.6298	39
22	1.0814	2.6279	38
23	1.0815	2.6260	37
24	1.0816	2.6242	36
25	1.0817	2.6223	35
26	1.0819	2.6205	34
27	1.0820	2.6186	33
28	1.0821	2.6168	32
29	1.0823	2.6150	31
30	1.0824	2.6131	30
31	1.0825	2.6113	29
32	1.0827	2.6095	28
33	1.0828	2.6076	27
34	1.0829	2.6058	26
35	1.0830	2.6040	25
36	1.0832	2.6022	24
37	1.0833	2.6003	23
38	1.0834	2.5985	22
39	1.0836	2.5967	21
40	1.0837	2.5949	20
41	1.0838	2.5931	19
42	1.0840	2.5913	18
43	1.0841	2.5895	17
44	1.0842	2.5877	16
45	1.0844	2.5859	15
46	1.0845	2.5841	14
47	1.0846	2.5823	13
48	1.0848	2.5805	12
49	1.0849	2.5788	11
50	1.0850	2.5770	10
51	1.0852	2.5752	9
52	1.0853	2.5734	8
53	1.0854	2.5716	7
54	1.0856	2.5699	6
55	1.0857	2.5681	5
56	1.0858	2.5663	4
57	1.0860	2.5646	3
58	1.0861	2.5628	2
59	1.0862	2.5611	1
60	1.0864	2.5593	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.0864	2.5593	60
1	1.0865	2.5576	59
2	1.0866	2.5558	58
3	1.0868	2.5541	57
4	1.0869	2.5523	56
5	1.0870	2.5506	55
6	1.0872	2.5488	54
7	1.0873	2.5471	53
8	1.0874	2.5454	52
9	1.0876	2.5436	51
10	1.0877	2.5419	50
11	1.0878	2.5402	49
12	1.0880	2.5384	48
13	1.0881	2.5367	47
14	1.0883	2.5350	46
15	1.0884	2.5333	45
16	1.0885	2.5316	44
17	1.0887	2.5299	43
18	1.0888	2.5282	42
19	1.0889	2.5264	41
20	1.0891	2.5247	40
21	1.0892	2.5230	39
22	1.0893	2.5213	38
23	1.0895	2.5196	37
24	1.0896	2.5180	36
25	1.0898	2.5163	35
26	1.0899	2.5146	34
27	1.0900	2.5129	33
28	1.0902	2.5112	32
29	1.0903	2.5095	31
30	1.0904	2.5078	30
31	1.0906	2.5062	29
32	1.0907	2.5045	28
33	1.0909	2.5028	27
34	1.0910	2.5012	26
35	1.0911	2.4995	25
36	1.0913	2.4978	24
37	1.0914	2.4962	23
38	1.0915	2.4945	22
39	1.0917	2.4928	21
40	1.0918	2.4912	20
41	1.0920	2.4895	19
42	1.0921	2.4879	18
43	1.0922	2.4862	17
44	1.0924	2.4846	16
45	1.0925	2.4830	15
46	1.0927	2.4813	14
47	1.0928	2.4797	13
48	1.0929	2.4780	12
49	1.0931	2.4764	11
50	1.0932	2.4748	10
51	1.0934	2.4731	9
52	1.0935	2.4715	8
53	1.0936	2.4699	7
54	1.0938	2.4683	6
55	1.0939	2.4667	5
56	1.0941	2.4650	4
57	1.0942	2.4634	3
58	1.0944	2.4618	2
59	1.0945	2.4602	1
60	1.0946	2.4586	0
'	Csc	Sec	'

111° (291°)

(248°) 68°

112° (292°)

(247°) 67°

113° (293°)

(246°) 66°

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

24° (204°)				(335°) 155°				25° (205°)				(334°) 154°				26° (206°)				(333°) 153°			
'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'
0	1.0946	2.4586	60	0	1.1034	2.3662	60	0	1.1126	2.2812	60	0	1.1126	2.2812	60	0	1.1126	2.2812	60	0	1.1126	2.2812	60
1	1.0948	2.4570	59	1	1.1035	2.3647	59	1	1.1128	2.2798	59	1	1.1128	2.2798	59	1	1.1128	2.2798	59	1	1.1128	2.2798	59
2	1.0949	2.4554	58	2	1.1037	2.3633	58	2	1.1129	2.2785	58	2	1.1129	2.2785	58	2	1.1129	2.2785	58	2	1.1129	2.2785	58
3	1.0951	2.4538	57	3	1.1038	2.3618	57	3	1.1131	2.2771	57	3	1.1131	2.2771	57	3	1.1131	2.2771	57	3	1.1131	2.2771	57
4	1.0952	2.4522	56	4	1.1040	2.3603	56	4	1.1132	2.2757	56	4	1.1132	2.2757	56	4	1.1132	2.2757	56	4	1.1132	2.2757	56
5	1.0953	2.4506	55	5	1.1041	2.3588	55	5	1.1134	2.2744	55	5	1.1134	2.2744	55	5	1.1134	2.2744	55	5	1.1134	2.2744	55
6	1.0955	2.4490	54	6	1.1043	2.3574	54	6	1.1136	2.2730	54	6	1.1136	2.2730	54	6	1.1136	2.2730	54	6	1.1136	2.2730	54
7	1.0956	2.4474	53	7	1.1044	2.3559	53	7	1.1137	2.2717	53	7	1.1137	2.2717	53	7	1.1137	2.2717	53	7	1.1137	2.2717	53
8	1.0958	2.4458	52	8	1.1046	2.3545	52	8	1.1139	2.2703	52	8	1.1139	2.2703	52	8	1.1139	2.2703	52	8	1.1139	2.2703	52
9	1.0959	2.4442	51	9	1.1047	2.3530	51	9	1.1140	2.2690	51	9	1.1140	2.2690	51	9	1.1140	2.2690	51	9	1.1140	2.2690	51
10	1.0961	2.4426	50	10	1.1049	2.3515	50	10	1.1142	2.2677	50	10	1.1142	2.2677	50	10	1.1142	2.2677	50	10	1.1142	2.2677	50
11	1.0962	2.4411	49	11	1.1050	2.3501	49	11	1.1143	2.2663	49	11	1.1143	2.2663	49	11	1.1143	2.2663	49	11	1.1143	2.2663	49
12	1.0963	2.4395	48	12	1.1052	2.3486	48	12	1.1145	2.2650	48	12	1.1145	2.2650	48	12	1.1145	2.2650	48	12	1.1145	2.2650	48
13	1.0965	2.4379	47	13	1.1053	2.3472	47	13	1.1147	2.2636	47	13	1.1147	2.2636	47	13	1.1147	2.2636	47	13	1.1147	2.2636	47
14	1.0966	2.4363	46	14	1.1055	2.3457	46	14	1.1148	2.2623	46	14	1.1148	2.2623	46	14	1.1148	2.2623	46	14	1.1148	2.2623	46
15	1.0968	2.4348	45	15	1.1056	2.3443	45	15	1.1150	2.2610	45	15	1.1150	2.2610	45	15	1.1150	2.2610	45	15	1.1150	2.2610	45
16	1.0969	2.4332	44	16	1.1058	2.3428	44	16	1.1151	2.2596	44	16	1.1151	2.2596	44	16	1.1151	2.2596	44	16	1.1151	2.2596	44
17	1.0971	2.4316	43	17	1.1059	2.3414	43	17	1.1153	2.2583	43	17	1.1153	2.2583	43	17	1.1153	2.2583	43	17	1.1153	2.2583	43
18	1.0972	2.4300	42	18	1.1061	2.3400	42	18	1.1155	2.2570	42	18	1.1155	2.2570	42	18	1.1155	2.2570	42	18	1.1155	2.2570	42
19	1.0974	2.4285	41	19	1.1062	2.3385	41	19	1.1156	2.2556	41	19	1.1156	2.2556	41	19	1.1156	2.2556	41	19	1.1156	2.2556	41
20	1.0975	2.4269	40	20	1.1064	2.3371	40	20	1.1158	2.2543	40	20	1.1158	2.2543	40	20	1.1158	2.2543	40	20	1.1158	2.2543	40
21	1.0976	2.4254	39	21	1.1066	2.3356	39	21	1.1159	2.2530	39	21	1.1159	2.2530	39	21	1.1159	2.2530	39	21	1.1159	2.2530	39
22	1.0978	2.4238	38	22	1.1067	2.3342	38	22	1.1161	2.2517	38	22	1.1161	2.2517	38	22	1.1161	2.2517	38	22	1.1161	2.2517	38
23	1.0979	2.4222	37	23	1.1069	2.3328	37	23	1.1163	2.2504	37	23	1.1163	2.2504	37	23	1.1163	2.2504	37	23	1.1163	2.2504	37
24	1.0981	2.4207	36	24	1.1070	2.3314	36	24	1.1164	2.2490	36	24	1.1164	2.2490	36	24	1.1164	2.2490	36	24	1.1164	2.2490	36
25	1.0982	2.4191	35	25	1.1072	2.3299	35	25	1.1166	2.2477	35	25	1.1166	2.2477	35	25	1.1166	2.2477	35	25	1.1166	2.2477	35
26	1.0984	2.4176	34	26	1.1073	2.3285	34	26	1.1168	2.2464	34	26	1.1168	2.2464	34	26	1.1168	2.2464	34	26	1.1168	2.2464	34
27	1.0985	2.4160	33	27	1.1075	2.3271	33	27	1.1169	2.2451	33	27	1.1169	2.2451	33	27	1.1169	2.2451	33	27	1.1169	2.2451	33
28	1.0987	2.4145	32	28	1.1076	2.3257	32	28	1.1171	2.2438	32	28	1.1171	2.2438	32	28	1.1171	2.2438	32	28	1.1171	2.2438	32
29	1.0988	2.4130	31	29	1.1078	2.3242	31	29	1.1172	2.2425	31	29	1.1172	2.2425	31	29	1.1172	2.2425	31	29	1.1172	2.2425	31
30	1.0989	2.4114	30	30	1.1079	2.3228	30	30	1.1174	2.2412	30	30	1.1174	2.2412	30	30	1.1174	2.2412	30	30	1.1174	2.2412	30
31	1.0991	2.4099	29	31	1.1081	2.3214	29	31	1.1176	2.2399	29	31	1.1176	2.2399	29	31	1.1176	2.2399	29	31	1.1176	2.2399	29
32	1.0992	2.4083	28	32	1.1082	2.3200	28	32	1.1177	2.2385	28	32	1.1177	2.2385	28	32	1.1177	2.2385	28	32	1.1177	2.2385	28
33	1.0994	2.4068	27	33	1.1084	2.3186	27	33	1.1179	2.2372	27	33	1.1179	2.2372	27	33	1.1179	2.2372	27	33	1.1179	2.2372	27
34	1.0995	2.4053	26	34	1.1085	2.3172	26	34	1.1180	2.2359	26	34	1.1180	2.2359	26	34	1.1180	2.2359	26	34	1.1180	2.2359	26
35	1.0997	2.4038	25	35	1.1087	2.3158	25	35	1.1182	2.2346	25	35	1.1182	2.2346	25	35	1.1182	2.2346	25	35	1.1182	2.2346	25
36	1.0998	2.4022	24	36	1.1089	2.3144	24	36	1.1184	2.2333	24	36	1.1184	2.2333	24	36	1.1184	2.2333	24	36	1.1184	2.2333	24
37	1.1000	2.4007	23	37	1.1090	2.3130	23	37	1.1185	2.2320	23	37	1.1185	2.2320	23	37	1.1185	2.2320	23	37	1.1185	2.2320	23
38	1.1001	2.3992	22	38	1.1092	2.3115	22	38	1.1187	2.2308	22	38	1.1187	2.2308	22	38	1.1187	2.2308	22	38	1.1187	2.2308	22
39	1.1003	2.3977	21	39	1.1093	2.3101	21	39	1.1189	2.2295	21	39	1.1189	2.2295	21	39	1.1189	2.2295	21	39	1.1189	2.2295	21
40	1.1004	2.3961	20	40	1.1095	2.3088	20	40	1.1190	2.2282	20	40	1.1190	2.2282	20	40	1.1190	2.2282	20	40	1.1190	2.2282	20
41	1.1006	2.3946	19	41	1.1096	2.3074	19	41	1.1192	2.2269	19	41	1.1192	2.2269	19	41	1.1192	2.2269	19	41	1.1192	2.2269	19
42	1.1007	2.3931	18	42	1.1098	2.3060	18	42	1.1194	2.2256	18	42	1.1194	2.2256	18	42	1.1194	2.2256	18	42	1.1194	2.2256	18
43	1.1009	2.3916	17	43	1.1099	2.3046	17	43	1.1195	2.2243	17	43	1.1195	2.2243	17	43	1.1195	2.2243	17	43	1.1195	2.2243	17
44	1.1010	2.3901	16	44	1.1101	2.3032	16	44	1.1197	2.2230	16	44	1.1197	2.2230	16	44	1.1197	2.2230	16	44	1.1197	2.2230	16
45	1.1011	2.3886	15	45	1.1102	2.3018	15	45	1.1198	2.2217	15	45	1.1198	2.2217	15	45	1.1198	2.2217	15	45	1.1198	2.2217	15
46	1.1013	2.3871	14	46	1.1104	2.3004	14	46	1.1200	2.2205	14	46	1.1200	2.2205	14	46	1.1200	2.2205	14	46	1.1200	2.2205	14
47	1.1014	2.3856	13	47	1.1106	2.2990	13	47	1.1202	2.2192	13	47	1.1202	2.2192	13	47	1.1202	2.2192	13	47	1.1202	2.2192	13
48	1.1016	2.3841	12	48	1.1107	2.2976	12	48	1.1203	2.2179	12	48	1.1203	2.2179	12	48	1.1203	2.2179	12	48	1.1203	2.2179	12
49	1.1017	2.3826	11	49	1.1109	2.2962	11	49	1.1205	2.2166	11	49	1.1205	2.2166	11	49	1.1205	2.2166	11	49	1.1205	2.2166	11
50	1.1019	2.3811	10	50	1.1110	2.2949	10	50	1.1207	2.2153	10	50	1.1207	2.2153	10	50	1.1207	2.2153	10	50	1.1207	2.2153	10
51	1.1020	2.3796	9	51	1.1112	2.2935	9	51	1.1208	2.2141	9	51	1.1208	2.2141	9	51	1.1208	2.2141	9	51	1.1208	2.2141	9
52	1.1022	2.3781	8	52	1.1113	2.2921	8	52	1.1210	2.2128	8	52	1.1210	2.2128	8	52	1.1210	2.2128	8	52	1.1210	2.2128	8
53	1.1023	2.3766	7	53	1.1115	2.2907	7	53	1.1212	2.2115	7	53	1.1212	2.2115	7	53	1.1212	2.2115	7	53	1.1212	2.2115	7
54	1.1025</																						

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

27° (207°)				(332°) 152°				28° (208°)				(331°) 151°				29° (209°)				(330°) 150°						
'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	Sec	Csc	'	'	'	Sec	Csc	'	'	'	Sec	Csc	'	
0	1.1223	2.2027	60	0	1.1326	2.1301	60	0	1.1434	2.0627	60	0	1.1434	2.0627	60	0	1.1434	2.0627	60	0	1.1434	2.0627	60	0	1.1434	2.0627
1	1.1225	2.2014	59	1	1.1327	2.1289	59	1	1.1435	2.0616	59	1	1.1435	2.0616	59	1	1.1435	2.0616	59	1	1.1435	2.0616	59	1	1.1435	2.0616
2	1.1227	2.2002	58	2	1.1329	2.1277	58	2	1.1437	2.0605	58	2	1.1437	2.0605	58	2	1.1437	2.0605	58	2	1.1437	2.0605	58	2	1.1437	2.0605
3	1.1228	2.1989	57	3	1.1331	2.1266	57	3	1.1439	2.0594	57	3	1.1439	2.0594	57	3	1.1439	2.0594	57	3	1.1439	2.0594	57	3	1.1439	2.0594
4	1.1230	2.1977	56	4	1.1333	2.1254	56	4	1.1441	2.0583	56	4	1.1441	2.0583	56	4	1.1441	2.0583	56	4	1.1441	2.0583	56	4	1.1441	2.0583
5	1.1232	2.1964	55	5	1.1334	2.1242	55	5	1.1443	2.0573	55	5	1.1443	2.0573	55	5	1.1443	2.0573	55	5	1.1443	2.0573	55	5	1.1443	2.0573
6	1.1233	2.1952	54	6	1.1336	2.1231	54	6	1.1445	2.0562	54	6	1.1445	2.0562	54	6	1.1445	2.0562	54	6	1.1445	2.0562	54	6	1.1445	2.0562
7	1.1235	2.1939	53	7	1.1338	2.1219	53	7	1.1446	2.0551	53	7	1.1446	2.0551	53	7	1.1446	2.0551	53	7	1.1446	2.0551	53	7	1.1446	2.0551
8	1.1237	2.1927	52	8	1.1340	2.1208	52	8	1.1448	2.0540	52	8	1.1448	2.0540	52	8	1.1448	2.0540	52	8	1.1448	2.0540	52	8	1.1448	2.0540
9	1.1238	2.1914	51	9	1.1342	2.1196	51	9	1.1450	2.0530	51	9	1.1450	2.0530	51	9	1.1450	2.0530	51	9	1.1450	2.0530	51	9	1.1450	2.0530
10	1.1240	2.1902	50	10	1.1343	2.1185	50	10	1.1452	2.0519	50	10	1.1452	2.0519	50	10	1.1452	2.0519	50	10	1.1452	2.0519	50	10	1.1452	2.0519
11	1.1242	2.1890	49	11	1.1345	2.1173	49	11	1.1454	2.0508	49	11	1.1454	2.0508	49	11	1.1454	2.0508	49	11	1.1454	2.0508	49	11	1.1454	2.0508
12	1.1243	2.1877	48	12	1.1347	2.1162	48	12	1.1456	2.0498	48	12	1.1456	2.0498	48	12	1.1456	2.0498	48	12	1.1456	2.0498	48	12	1.1456	2.0498
13	1.1245	2.1865	47	13	1.1349	2.1150	47	13	1.1458	2.0487	47	13	1.1458	2.0487	47	13	1.1458	2.0487	47	13	1.1458	2.0487	47	13	1.1458	2.0487
14	1.1247	2.1852	46	14	1.1350	2.1139	46	14	1.1460	2.0476	46	14	1.1460	2.0476	46	14	1.1460	2.0476	46	14	1.1460	2.0476	46	14	1.1460	2.0476
15	1.1248	2.1840	45	15	1.1352	2.1127	45	15	1.1461	2.0466	45	15	1.1461	2.0466	45	15	1.1461	2.0466	45	15	1.1461	2.0466	45	15	1.1461	2.0466
16	1.1250	2.1828	44	16	1.1354	2.1116	44	16	1.1463	2.0455	44	16	1.1463	2.0455	44	16	1.1463	2.0455	44	16	1.1463	2.0455	44	16	1.1463	2.0455
17	1.1252	2.1815	43	17	1.1356	2.1105	43	17	1.1465	2.0445	43	17	1.1465	2.0445	43	17	1.1465	2.0445	43	17	1.1465	2.0445	43	17	1.1465	2.0445
18	1.1253	2.1803	42	18	1.1357	2.1093	42	18	1.1467	2.0434	42	18	1.1467	2.0434	42	18	1.1467	2.0434	42	18	1.1467	2.0434	42	18	1.1467	2.0434
19	1.1255	2.1791	41	19	1.1359	2.1082	41	19	1.1469	2.0423	41	19	1.1469	2.0423	41	19	1.1469	2.0423	41	19	1.1469	2.0423	41	19	1.1469	2.0423
20	1.1257	2.1779	40	20	1.1361	2.1070	40	20	1.1471	2.0413	40	20	1.1471	2.0413	40	20	1.1471	2.0413	40	20	1.1471	2.0413	40	20	1.1471	2.0413
21	1.1259	2.1766	39	21	1.1363	2.1059	39	21	1.1473	2.0402	39	21	1.1473	2.0402	39	21	1.1473	2.0402	39	21	1.1473	2.0402	39	21	1.1473	2.0402
22	1.1260	2.1754	38	22	1.1365	2.1048	38	22	1.1474	2.0392	38	22	1.1474	2.0392	38	22	1.1474	2.0392	38	22	1.1474	2.0392	38	22	1.1474	2.0392
23	1.1262	2.1742	37	23	1.1366	2.1036	37	23	1.1476	2.0381	37	23	1.1476	2.0381	37	23	1.1476	2.0381	37	23	1.1476	2.0381	37	23	1.1476	2.0381
24	1.1264	2.1730	36	24	1.1368	2.1025	36	24	1.1478	2.0371	36	24	1.1478	2.0371	36	24	1.1478	2.0371	36	24	1.1478	2.0371	36	24	1.1478	2.0371
25	1.1265	2.1718	35	25	1.1370	2.1014	35	25	1.1480	2.0360	35	25	1.1480	2.0360	35	25	1.1480	2.0360	35	25	1.1480	2.0360	35	25	1.1480	2.0360
26	1.1267	2.1705	34	26	1.1372	2.1002	34	26	1.1482	2.0350	34	26	1.1482	2.0350	34	26	1.1482	2.0350	34	26	1.1482	2.0350	34	26	1.1482	2.0350
27	1.1269	2.1693	33	27	1.1374	2.0991	33	27	1.1484	2.0339	33	27	1.1484	2.0339	33	27	1.1484	2.0339	33	27	1.1484	2.0339	33	27	1.1484	2.0339
28	1.1270	2.1681	32	28	1.1375	2.0980	32	28	1.1486	2.0329	32	28	1.1486	2.0329	32	28	1.1486	2.0329	32	28	1.1486	2.0329	32	28	1.1486	2.0329
29	1.1272	2.1669	31	29	1.1377	2.0969	31	29	1.1488	2.0318	31	29	1.1488	2.0318	31	29	1.1488	2.0318	31	29	1.1488	2.0318	31	29	1.1488	2.0318
30	1.1274	2.1657	30	30	1.1379	2.0957	30	30	1.1490	2.0308	30	30	1.1490	2.0308	30	30	1.1490	2.0308	30	30	1.1490	2.0308	30	30	1.1490	2.0308
31	1.1276	2.1645	29	31	1.1381	2.0946	29	31	1.1491	2.0297	29	31	1.1491	2.0297	29	31	1.1491	2.0297	29	31	1.1491	2.0297	29	31	1.1491	2.0297
32	1.1277	2.1633	28	32	1.1383	2.0935	28	32	1.1493	2.0287	28	32	1.1493	2.0287	28	32	1.1493	2.0287	28	32	1.1493	2.0287	28	32	1.1493	2.0287
33	1.1279	2.1621	27	33	1.1384	2.0924	27	33	1.1495	2.0276	27	33	1.1495	2.0276	27	33	1.1495	2.0276	27	33	1.1495	2.0276	27	33	1.1495	2.0276
34	1.1281	2.1609	26	34	1.1386	2.0913	26	34	1.1497	2.0266	26	34	1.1497	2.0266	26	34	1.1497	2.0266	26	34	1.1497	2.0266	26	34	1.1497	2.0266
35	1.1282	2.1596	25	35	1.1388	2.0901	25	35	1.1499	2.0256	25	35	1.1499	2.0256	25	35	1.1499	2.0256	25	35	1.1499	2.0256	25	35	1.1499	2.0256
36	1.1284	2.1584	24	36	1.1390	2.0890	24	36	1.1501	2.0245	24	36	1.1501	2.0245	24	36	1.1501	2.0245	24	36	1.1501	2.0245	24	36	1.1501	2.0245
37	1.1286	2.1572	23	37	1.1392	2.0879	23	37	1.1503	2.0235	23	37	1.1503	2.0235	23	37	1.1503	2.0235	23	37	1.1503	2.0235	23	37	1.1503	2.0235
38	1.1288	2.1560	22	38	1.1393	2.0868	22	38	1.1505	2.0225	22	38	1.1505	2.0225	22	38	1.1505	2.0225	22	38	1.1505	2.0225	22	38	1.1505	2.0225
39	1.1289	2.1549	21	39	1.1395	2.0857	21	39	1.1507	2.0214	21	39	1.1507	2.0214	21	39	1.1507	2.0214	21	39	1.1507	2.0214	21	39	1.1507	2.0214
40	1.1291	2.1537	20	40	1.1397	2.0846	20	40	1.1509	2.0204	20	40	1.1509	2.0204	20	40	1.1509	2.0204	20	40	1.1509	2.0204	20	40	1.1509	2.0204
41	1.1293	2.1525	19	41	1.1399	2.0835	19	41	1.1510	2.0194	19	41	1.1510	2.0194	19	41	1.1510	2.0194	19	41	1.1510	2.0194	19	41	1.1510	2.0194
42	1.1294	2.1513	18	42	1.1401	2.0824	18	42	1.1512	2.0183	18	42	1.1512	2.0183	18	42	1.1512	2.0183	18	42	1.1512	2.0183	18	42	1.1512	2.0183
43	1.1296	2.1501	17	43	1.1402	2.0813	17	43	1.1514	2.0173	17	43	1.1514	2.0173	17	43	1.1514	2.0173	17	43	1.1514	2.0173	17	43	1.1514	2.0173
44	1.1298	2.1489	16	44	1.1404	2.0802	16	44	1.1516	2.0163	16	44	1.1516	2.0163	16	44	1.1516	2.0163	16	44	1.1516	2.0163	16	44	1.1516	2.0163
45	1.1300	2.1477	15	45	1.1406	2.0791	15	45	1.1518	2.0152	15	45	1.1518	2.0152	15	45	1.1518	2.0152	15	45	1.1518	2.0152	15	45	1.1518	2.0152
46	1.1301	2.1465	14	46	1.1408	2.0779	14	46	1.1520	2.0142	14	46	1.1520	2.0142	14	46	1.1520	2.0142	14	46	1.1520	2.0142	14	46	1.1520	2.0142
47	1.1303	2.1453	13	47	1.1410	2.0768	13	47	1.1522	2.0132	13	47	1.1522	2.0132	13	47	1.1522	2.0132								

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

30° (210°)

(329°) 149°

31° (211°)

(328°) 148°

32° (212°)

(327°) 147°

'	Sec	Csc	'
0	1.1547	2.0000	60
1	1.1549	1.9990	59
2	1.1551	1.9980	58
3	1.1553	1.9970	57
4	1.1555	1.9960	56
5	1.1557	1.9950	55
6	1.1559	1.9940	54
7	1.1561	1.9930	53
8	1.1563	1.9920	52
9	1.1565	1.9910	51
10	1.1566	1.9900	50
11	1.1568	1.9890	49
12	1.1570	1.9880	48
13	1.1572	1.9870	47
14	1.1574	1.9860	46
15	1.1576	1.9850	45
16	1.1578	1.9840	44
17	1.1580	1.9830	43
18	1.1582	1.9821	42
19	1.1584	1.9811	41
20	1.1586	1.9801	40
21	1.1588	1.9791	39
22	1.1590	1.9781	38
23	1.1592	1.9771	37
24	1.1594	1.9762	36
25	1.1596	1.9752	35
26	1.1598	1.9742	34
27	1.1600	1.9732	33
28	1.1602	1.9722	32
29	1.1604	1.9713	31
30	1.1606	1.9703	30
31	1.1608	1.9693	29
32	1.1610	1.9684	28
33	1.1612	1.9674	27
34	1.1614	1.9664	26
35	1.1616	1.9654	25
36	1.1618	1.9645	24
37	1.1620	1.9635	23
38	1.1622	1.9625	22
39	1.1624	1.9616	21
40	1.1626	1.9606	20
41	1.1628	1.9597	19
42	1.1630	1.9587	18
43	1.1632	1.9577	17
44	1.1634	1.9568	16
45	1.1636	1.9558	15
46	1.1638	1.9549	14
47	1.1640	1.9539	13
48	1.1642	1.9530	12
49	1.1644	1.9520	11
50	1.1646	1.9511	10
51	1.1648	1.9501	9
52	1.1650	1.9492	8
53	1.1652	1.9482	7
54	1.1654	1.9473	6
55	1.1656	1.9463	5
56	1.1658	1.9454	4
57	1.1660	1.9444	3
58	1.1662	1.9435	2
59	1.1664	1.9425	1
60	1.1666	1.9416	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.1666	1.9416	60
1	1.1668	1.9407	59
2	1.1670	1.9397	58
3	1.1672	1.9388	57
4	1.1675	1.9379	56
5	1.1677	1.9369	55
6	1.1679	1.9360	54
7	1.1681	1.9351	53
8	1.1683	1.9341	52
9	1.1685	1.9332	51
10	1.1687	1.9323	50
11	1.1689	1.9313	49
12	1.1691	1.9304	48
13	1.1693	1.9295	47
14	1.1695	1.9285	46
15	1.1697	1.9276	45
16	1.1699	1.9267	44
17	1.1701	1.9258	43
18	1.1703	1.9249	42
19	1.1705	1.9239	41
20	1.1707	1.9230	40
21	1.1710	1.9221	39
22	1.1712	1.9212	38
23	1.1714	1.9203	37
24	1.1716	1.9194	36
25	1.1718	1.9184	35
26	1.1720	1.9175	34
27	1.1722	1.9166	33
28	1.1724	1.9157	32
29	1.1726	1.9148	31
30	1.1728	1.9139	30
31	1.1730	1.9130	29
32	1.1732	1.9121	28
33	1.1735	1.9112	27
34	1.1737	1.9103	26
35	1.1739	1.9094	25
36	1.1741	1.9084	24
37	1.1743	1.9075	23
38	1.1745	1.9066	22
39	1.1747	1.9057	21
40	1.1749	1.9048	20
41	1.1751	1.9039	19
42	1.1753	1.9031	18
43	1.1756	1.9022	17
44	1.1758	1.9013	16
45	1.1760	1.9004	15
46	1.1762	1.8995	14
47	1.1764	1.8986	13
48	1.1766	1.8977	12
49	1.1768	1.8968	11
50	1.1770	1.8959	10
51	1.1773	1.8950	9
52	1.1775	1.8941	8
53	1.1777	1.8933	7
54	1.1779	1.8924	6
55	1.1781	1.8915	5
56	1.1783	1.8906	4
57	1.1785	1.8897	3
58	1.1788	1.8888	2
59	1.1790	1.8880	1
60	1.1792	1.8871	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.1792	1.8871	60
1	1.1794	1.8862	59
2	1.1796	1.8853	58
3	1.1798	1.8844	57
4	1.1800	1.8836	56
5	1.1803	1.8827	55
6	1.1805	1.8818	54
7	1.1807	1.8810	53
8	1.1809	1.8801	52
9	1.1811	1.8792	51
10	1.1813	1.8783	50
11	1.1815	1.8775	49
12	1.1818	1.8766	48
13	1.1820	1.8757	47
14	1.1822	1.8749	46
15	1.1824	1.8740	45
16	1.1826	1.8731	44
17	1.1828	1.8723	43
18	1.1831	1.8714	42
19	1.1833	1.8706	41
20	1.1835	1.8697	40
21	1.1837	1.8688	39
22	1.1839	1.8680	38
23	1.1842	1.8671	37
24	1.1844	1.8663	36
25	1.1846	1.8654	35
26	1.1848	1.8646	34
27	1.1850	1.8637	33
28	1.1852	1.8629	32
29	1.1855	1.8620	31
30	1.1857	1.8612	30
31	1.1859	1.8603	29
32	1.1861	1.8595	28
33	1.1863	1.8586	27
34	1.1866	1.8578	26
35	1.1868	1.8569	25
36	1.1870	1.8561	24
37	1.1872	1.8552	23
38	1.1875	1.8544	22
39	1.1877	1.8535	21
40	1.1879	1.8527	20
41	1.1881	1.8519	19
42	1.1883	1.8510	18
43	1.1886	1.8502	17
44	1.1888	1.8494	16
45	1.1890	1.8485	15
46	1.1892	1.8477	14
47	1.1895	1.8468	13
48	1.1897	1.8460	12
49	1.1899	1.8452	11
50	1.1901	1.8443	10
51	1.1903	1.8435	9
52	1.1906	1.8427	8
53	1.1908	1.8419	7
54	1.1910	1.8410	6
55	1.1912	1.8402	5
56	1.1915	1.8394	4
57	1.1917	1.8385	3
58	1.1919	1.8377	2
59	1.1921	1.8369	1
60	1.1924	1.8361	0
'	Csc	Sec	'

120° (300°)

(239°) 59°

121° (301°)

(238°) 58°

122° (302°)

(237°) 57°

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

33° (213°)
(329°) 146°
34° (214°)
(325°) 145°
35° (215°)
(324°) 144°

'	Sec	Csc	'
0	1.1924	1.8361	60
1	1.1926	1.8353	59
2	1.1928	1.8344	58
3	1.1930	1.8336	57
4	1.1933	1.8328	56
5	1.1935	1.8320	55
6	1.1937	1.8312	54
7	1.1939	1.8303	53
8	1.1942	1.8295	52
9	1.1944	1.8287	51
10	1.1946	1.8279	50
11	1.1949	1.8271	49
12	1.1951	1.8263	48
13	1.1953	1.8255	47
14	1.1955	1.8247	46
15	1.1958	1.8238	45
16	1.1960	1.8230	44
17	1.1962	1.8222	43
18	1.1964	1.8214	42
19	1.1967	1.8206	41
20	1.1969	1.8198	40
21	1.1971	1.8190	39
22	1.1974	1.8182	38
23	1.1976	1.8174	37
24	1.1978	1.8166	36
25	1.1981	1.8158	35
26	1.1983	1.8150	34
27	1.1985	1.8142	33
28	1.1987	1.8134	32
29	1.1990	1.8126	31
30	1.1992	1.8118	30
31	1.1994	1.8110	29
32	1.1997	1.8102	28
33	1.1999	1.8094	27
34	1.2001	1.8086	26
35	1.2004	1.8078	25
36	1.2006	1.8070	24
37	1.2008	1.8062	23
38	1.2011	1.8055	22
39	1.2013	1.8047	21
40	1.2015	1.8039	20
41	1.2018	1.8031	19
42	1.2020	1.8023	18
43	1.2022	1.8015	17
44	1.2025	1.8007	16
45	1.2027	1.8000	15
46	1.2029	1.7992	14
47	1.2032	1.7984	13
48	1.2034	1.7976	12
49	1.2036	1.7968	11
50	1.2039	1.7960	10
51	1.2041	1.7953	9
52	1.2043	1.7945	8
53	1.2046	1.7937	7
54	1.2048	1.7929	6
55	1.2050	1.7922	5
56	1.2053	1.7914	4
57	1.2055	1.7906	3
58	1.2057	1.7898	2
59	1.2060	1.7891	1
60	1.2062	1.7883	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.2062	1.7883	60
1	1.2065	1.7875	59
2	1.2067	1.7868	58
3	1.2069	1.7860	57
4	1.2072	1.7852	56
5	1.2074	1.7844	55
6	1.2076	1.7837	54
7	1.2079	1.7829	53
8	1.2081	1.7821	52
9	1.2084	1.7814	51
10	1.2086	1.7806	50
11	1.2088	1.7799	49
12	1.2091	1.7791	48
13	1.2093	1.7783	47
14	1.2096	1.7776	46
15	1.2098	1.7768	45
16	1.2100	1.7761	44
17	1.2103	1.7753	43
18	1.2105	1.7745	42
19	1.2108	1.7738	41
20	1.2110	1.7730	40
21	1.2112	1.7723	39
22	1.2115	1.7715	38
23	1.2117	1.7708	37
24	1.2120	1.7700	36
25	1.2122	1.7693	35
26	1.2124	1.7685	34
27	1.2127	1.7678	33
28	1.2129	1.7670	32
29	1.2132	1.7663	31
30	1.2134	1.7655	30
31	1.2136	1.7648	29
32	1.2139	1.7640	28
33	1.2141	1.7633	27
34	1.2144	1.7625	26
35	1.2146	1.7618	25
36	1.2149	1.7610	24
37	1.2151	1.7603	23
38	1.2154	1.7596	22
39	1.2156	1.7588	21
40	1.2158	1.7581	20
41	1.2161	1.7573	19
42	1.2163	1.7566	18
43	1.2166	1.7559	17
44	1.2168	1.7551	16
45	1.2171	1.7544	15
46	1.2173	1.7537	14
47	1.2176	1.7530	13
48	1.2178	1.7522	12
49	1.2181	1.7515	11
50	1.2183	1.7507	10
51	1.2185	1.7500	9
52	1.2188	1.7493	8
53	1.2190	1.7485	7
54	1.2193	1.7478	6
55	1.2195	1.7471	5
56	1.2198	1.7463	4
57	1.2200	1.7456	3
58	1.2203	1.7449	2
59	1.2205	1.7442	1
60	1.2208	1.7434	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.2208	1.7434	60
1	1.2210	1.7427	59
2	1.2213	1.7420	58
3	1.2215	1.7413	57
4	1.2218	1.7406	56
5	1.2220	1.7398	55
6	1.2223	1.7391	54
7	1.2225	1.7384	53
8	1.2228	1.7377	52
9	1.2230	1.7370	51
10	1.2233	1.7362	50
11	1.2235	1.7355	49
12	1.2238	1.7348	48
13	1.2240	1.7341	47
14	1.2243	1.7334	46
15	1.2245	1.7327	45
16	1.2248	1.7320	44
17	1.2250	1.7312	43
18	1.2253	1.7305	42
19	1.2255	1.7298	41
20	1.2258	1.7291	40
21	1.2260	1.7284	39
22	1.2263	1.7277	38
23	1.2265	1.7270	37
24	1.2268	1.7263	36
25	1.2271	1.7256	35
26	1.2273	1.7249	34
27	1.2276	1.7242	33
28	1.2278	1.7235	32
29	1.2281	1.7228	31
30	1.2283	1.7221	30
31	1.2286	1.7213	29
32	1.2288	1.7206	28
33	1.2291	1.7199	27
34	1.2293	1.7192	26
35	1.2296	1.7185	25
36	1.2299	1.7179	24
37	1.2301	1.7172	23
38	1.2304	1.7165	22
39	1.2306	1.7158	21
40	1.2309	1.7151	20
41	1.2311	1.7144	19
42	1.2314	1.7137	18
43	1.2317	1.7130	17
44	1.2319	1.7123	16
45	1.2322	1.7116	15
46	1.2324	1.7109	14
47	1.2327	1.7102	13
48	1.2329	1.7095	12
49	1.2332	1.7088	11
50	1.2335	1.7081	10
51	1.2337	1.7075	9
52	1.2340	1.7068	8
53	1.2342	1.7061	7
54	1.2345	1.7054	6
55	1.2348	1.7047	5
56	1.2350	1.7040	4
57	1.2353	1.7033	3
58	1.2355	1.7027	2
59	1.2358	1.7020	1
60	1.2361	1.7013	0
'	Csc	Sec	'

123° (303°)
(236°) 56°
124° (304°)
(235°) 55°
125° (305°)
(234°) 54°

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

36° (216°)				(328°) 143°				37° (217°)				(322°) 142°				38° (218°)				(321°) 141°				
	Sec	Csc			Sec	Csc			Sec	Csc			Sec	Csc				Sec	Csc			Sec	Csc	
0	1.2361	1.7013	60	0	1.2521	1.6616	60	0	1.2690	1.6243	60	0	1.2719	1.6183	50	0	1.2734	1.6153	45	0	1.2745	1.6129	40	
1	1.2363	1.7006	59	1	1.2524	1.6610	59	1	1.2693	1.6237	59	1	1.2722	1.6177	49	1	1.2737	1.6147	44	1	1.2748	1.6123	39	
2	1.2366	1.6999	58	2	1.2527	1.6604	58	2	1.2696	1.6231	58	2	1.2715	1.6171	48	2	1.2740	1.6117	38	2	1.2751	1.6117	39	
3	1.2369	1.6993	57	3	1.2530	1.6597	57	3	1.2699	1.6225	57	3	1.2713	1.6165	47	3	1.2742	1.6135	42	3	1.2753	1.6129	41	
4	1.2371	1.6986	56	4	1.2532	1.6591	56	4	1.2702	1.6213	55	4	1.2710	1.6189	51	4	1.2743	1.6129	41	4	1.2754	1.6109	36	
5	1.2374	1.6979	55	5	1.2535	1.6584	55	5	1.2705	1.6207	54	5	1.2713	1.6183	50	5	1.2746	1.6123	40	5	1.2756	1.6103	35	
6	1.2376	1.6972	54	6	1.2538	1.6578	54	6	1.2708	1.6201	53	6	1.2716	1.6179	49	6	1.2749	1.6117	39	6	1.2759	1.6101	34	
7	1.2379	1.6966	53	7	1.2541	1.6572	53	7	1.2711	1.6195	52	7	1.2719	1.6175	48	7	1.2752	1.6111	38	7	1.2762	1.6099	33	
8	1.2382	1.6959	52	8	1.2543	1.6565	52	8	1.2714	1.6189	51	8	1.2722	1.6173	47	8	1.2755	1.6105	37	8	1.2765	1.6093	32	
9	1.2384	1.6952	51	9	1.2546	1.6559	51	9	1.2717	1.6183	50	9	1.2725	1.6167	46	9	1.2758	1.6101	36	9	1.2768	1.6087	31	
10	1.2387	1.6945	50	10	1.2549	1.6553	50	10	1.2720	1.6177	49	10	1.2728	1.6161	45	10	1.2761	1.6095	30	10	1.2771	1.6081	30	
11	1.2390	1.6939	49	11	1.2552	1.6546	49	11	1.2723	1.6171	48	11	1.2731	1.6155	44	11	1.2764	1.6089	29	11	1.2774	1.6077	29	
12	1.2392	1.6932	48	12	1.2554	1.6540	48	12	1.2726	1.6165	47	12	1.2734	1.6149	43	12	1.2767	1.6087	28	12	1.2777	1.6075	28	
13	1.2395	1.6925	47	13	1.2557	1.6534	47	13	1.2729	1.6159	46	13	1.2737	1.6143	42	13	1.2770	1.6085	27	13	1.2780	1.6073	27	
14	1.2397	1.6918	46	14	1.2560	1.6527	46	14	1.2732	1.6153	45	14	1.2740	1.6137	41	14	1.2773	1.6083	26	14	1.2783	1.6071	26	
15	1.2400	1.6912	45	15	1.2563	1.6521	45	15	1.2735	1.6147	44	15	1.2743	1.6131	40	15	1.2776	1.6081	25	15	1.2786	1.6069	25	
16	1.2403	1.6905	44	16	1.2566	1.6515	44	16	1.2738	1.6141	43	16	1.2746	1.6125	39	16	1.2779	1.6081	24	16	1.2789	1.6067	24	
17	1.2405	1.6898	43	17	1.2568	1.6508	43	17	1.2741	1.6135	42	17	1.2749	1.6119	38	17	1.2782	1.6081	23	17	1.2792	1.6065	23	
18	1.2408	1.6892	42	18	1.2571	1.6502	42	18	1.2744	1.6129	41	18	1.2752	1.6113	37	18	1.2785	1.6081	22	18	1.2795	1.6063	22	
19	1.2411	1.6885	41	19	1.2574	1.6496	41	19	1.2747	1.6123	40	19	1.2755	1.6107	36	19	1.2788	1.6081	21	19	1.2798	1.6061	21	
20	1.2413	1.6878	40	20	1.2577	1.6489	40	20	1.2750	1.6117	39	20	1.2758	1.6101	35	20	1.2791	1.6081	20	20	1.2801	1.6059	20	
21	1.2416	1.6871	39	21	1.2579	1.6483	39	21	1.2753	1.6111	38	21	1.2761	1.6095	34	21	1.2794	1.6081	19	21	1.2804	1.6057	19	
22	1.2419	1.6865	38	22	1.2582	1.6477	38	22	1.2756	1.6105	37	22	1.2764	1.6079	33	22	1.2797	1.6081	18	22	1.2807	1.6055	18	
23	1.2421	1.6858	37	23	1.2585	1.6471	37	23	1.2759	1.6101	36	23	1.2767	1.6073	32	23	1.2800	1.6081	17	23	1.2810	1.6053	17	
24	1.2424	1.6852	36	24	1.2588	1.6464	36	24	1.2762	1.6095	35	24	1.2770	1.6067	31	24	1.2803	1.6081	16	24	1.2813	1.6051	16	
25	1.2427	1.6845	35	25	1.2591	1.6458	35	25	1.2765	1.6089	34	25	1.2773	1.6061	30	25	1.2806	1.6081	15	25	1.2816	1.6049	15	
26	1.2429	1.6838	34	26	1.2593	1.6452	34	26	1.2768	1.6083	33	26	1.2776	1.6055	29	26	1.2809	1.6081	14	26	1.2819	1.6047	14	
27	1.2432	1.6832	33	27	1.2596	1.6446	33	27	1.2771	1.6077	32	27	1.2780	1.6049	28	27	1.2812	1.6081	13	27	1.2822	1.6045	13	
28	1.2435	1.6825	32	28	1.2599	1.6440	32	28	1.2774	1.6073	31	28	1.2783	1.6041	27	28	1.2815	1.6081	12	28	1.2825	1.6041	12	
29	1.2437	1.6818	31	29	1.2602	1.6433	31	29	1.2777	1.6069	30	29	1.2786	1.6039	26	29	1.2818	1.6081	11	29	1.2828	1.6039	11	
30	1.2440	1.6812	30	30	1.2605	1.6427	30	30	1.2780	1.6067	29	30	1.2790	1.6037	25	30	1.2821	1.6081	10	30	1.2831	1.6037	10	
31	1.2443	1.6805	29	31	1.2608	1.6421	29	31	1.2783	1.6065	28	31	1.2793	1.6035	24	31	1.2824	1.6081	9	31	1.2834	1.6035	9	
32	1.2445	1.6799	28	32	1.2610	1.6414	28	32	1.2786	1.6063	27	32	1.2796	1.6033	23	32	1.2827	1.6081	8	32	1.2837	1.6035	8	
33	1.2448	1.6792	27	33	1.2613	1.6408	27	33	1.2789	1.6061	26	33	1.2800	1.6031	22	33	1.2830	1.6081	7	33	1.2840	1.6035	7	
34	1.2451	1.6785	26	34	1.2616	1.6402	26	34	1.2792	1.6059	25	34	1.2803	1.6029	21	34	1.2833	1.6081	6	34	1.2843	1.6035	6	
35	1.2453	1.6779	25	35	1.2619	1.6396	25	35	1.2795	1.6057	24	35	1.2806	1.6027	20	35	1.2836	1.6081	5	35	1.2846	1.6035	5	
36	1.2456	1.6772	24	36	1.2622	1.6390	24	36	1.2798	1.6055	23	36	1.2809	1.6025	19	36	1.2839	1.6081	4	36	1.2849	1.6035	4	
37	1.2459	1.6766	23	37	1.2624	1.6383	23	37	1.2801	1.6053	22	37	1.2812	1.6023	18	37	1.2842	1.6081	3	37	1.2852	1.6035	3	
38	1.2462	1.6759	22	38	1.2627	1.6377	22	38	1.2804	1.6051	21	38	1.2815	1.6021	17	38	1.2845	1.6081	2	38	1.2855	1.6035	2	
39	1.2464	1.6753	21	39	1.2630	1.6371	21	39	1.2807	1.6049	20	39	1.2818	1.6019	16	39	1.2848	1.6081	1	39	1.2858	1.6035	1	
40	1.2467	1.6746	20	40	1.2633	1.6365	20	40	1.2810	1.6047	19	40	1.2820	1.6017	15	40	1.2851	1.6081	0	40	1.2861	1.6035	0	
41	1.2470	1.6739	19	41	1.2636	1.6359	19	41	1.2813	1.6045	18	41	1.2823	1.6015	14	41	1.2854	1.6081	0	41	1.2864	1.6035	0	
42	1.2472	1.6733	18	42	1.2639	1.6353	18	42	1.2816	1.6043	17	42	1.2826	1.6013	13	42	1.2857	1.6081	0	42	1.2867	1.6035	0	
43	1.2475	1.6726	17	43	1.2641	1.6346	17	43	1.2819	1.6041	16	43	1.2829	1.6011	12	43	1.2860	1.6081	0	43	1.2870	1.6035	0	
44	1.2478	1.6720	16	44	1.2644	1.6340	16	44	1.2822	1.6039	15	44	1.2832	1.6009	11	44	1.2863	1.6081	0	44	1.2873	1.6035	0	
45	1.2480	1.6713	15	45	1.2647	1.6334	15	45	1.2825	1.6037	14	45	1.2835	1.6007	10	45	1.2866	1.6081	0	45	1.2876	1.6035	0	
46	1.2483	1.6707	14	46	1.2650	1.6328	14	46	1.2828	1.6035	13	46	1.2838	1.6005	9	46	1.2869	1.6081	0	46	1.2879	1.6035	0	
47	1.2486	1.6700	13	47	1.2653	1.6322	13	47	1.2831	1.6033	12	47	1.2841	1.6003	8	47	1.2872	1.6081	0	47	1.2882	1.6035	0	
48	1.2489	1.6694	12	48	1.2656	1.6316	12	48	1.2834	1.6031	11	48	1.2844	1.6001	7	48	1.2875	1.6081	0	48	1.2885	1.6035	0	
49	1.2491	1.6687	11	49	1.2659	1.6310	11	49	1.2837	1.6029	10	49	1.2847	1.6001	6	49	1.2878	1.6081	0	49	1.2888	1.6035	0	
50	1.2494	1.6681	10	50	1.2661	1.6303	10	50	1.2840	1.6027	9	50	1.2850	1.6001	5	50	1.2881	1.6081	0	50	1.2891	1.6035	0	
51	1.2497	1.6674	9	51	1.2664	1.6297	9	51	1.2843	1.6025	8	51	1.2853	1.6001	4	51	1.2884	1.6081	0	51	1.2894	1.6035	0	
52	1.2499	1.6668	8	52	1.2667	1.6291	8	52	1.2846	1.6023	7	52	1.2856	1.6001	3	52	1.2887	1.6081	0	52	1.2897	1.6035	0	
53	1.2502	1.6661	7	53	1.2670	1.6285	7	53	1.2849	1.6021	6	53	1.2859	1.6001	2	53	1.2890	1.6081	0	53	1.2900	1.6035	0	
54	1.2505	1.6655	6	54	1.2673	1.6279	6																	

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

39° (219°) **(320°) 140°** **40° (220°)** **(319°) 139°** **41° (221°)** **(318°) 138°**

'	Sec	Csc	'
0	1.2868	1.5890	60
1	1.2871	1.5884	59
2	1.2874	1.5879	58
3	1.2877	1.5873	57
4	1.2880	1.5867	56
5	1.2883	1.5862	55
6	1.2886	1.5856	54
7	1.2889	1.5850	53
8	1.2892	1.5845	52
9	1.2895	1.5839	51
10	1.2898	1.5833	50
11	1.2901	1.5828	49
12	1.2904	1.5822	48
13	1.2907	1.5816	47
14	1.2910	1.5811	46
15	1.2913	1.5805	45
16	1.2916	1.5800	44
17	1.2919	1.5794	43
18	1.2923	1.5788	42
19	1.2926	1.5783	41
20	1.2929	1.5777	40
21	1.2932	1.5771	39
22	1.2935	1.5766	38
23	1.2938	1.5760	37
24	1.2941	1.5755	36
25	1.2944	1.5749	35
26	1.2947	1.5744	34
27	1.2950	1.5738	33
28	1.2953	1.5732	32
29	1.2957	1.5727	31
30	1.2960	1.5721	30
31	1.2963	1.5716	29
32	1.2966	1.5710	28
33	1.2969	1.5705	27
34	1.2972	1.5699	26
35	1.2975	1.5694	25
36	1.2978	1.5688	24
37	1.2981	1.5683	23
38	1.2985	1.5677	22
39	1.2988	1.5672	21
40	1.2991	1.5666	20
41	1.2994	1.5661	19
42	1.2997	1.5655	18
43	1.3000	1.5650	17
44	1.3003	1.5644	16
45	1.3007	1.5639	15
46	1.3010	1.5633	14
47	1.3013	1.5628	13
48	1.3016	1.5622	12
49	1.3019	1.5617	11
50	1.3022	1.5611	10
51	1.3026	1.5606	9
52	1.3029	1.5601	8
53	1.3032	1.5595	7
54	1.3035	1.5590	6
55	1.3038	1.5584	5
56	1.3041	1.5579	4
57	1.3045	1.5573	3
58	1.3048	1.5568	2
59	1.3051	1.5563	1
60	1.3054	1.5557	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.3054	1.5557	60
1	1.3057	1.5552	59
2	1.3060	1.5546	58
3	1.3064	1.5541	57
4	1.3067	1.5536	56
5	1.3070	1.5530	55
6	1.3078	1.5525	54
7	1.3076	1.5520	53
8	1.3080	1.5514	52
9	1.3083	1.5509	51
10	1.3086	1.5504	50
11	1.3089	1.5498	49
12	1.3093	1.5493	48
13	1.3096	1.5488	47
14	1.3099	1.5482	46
15	1.3102	1.5477	45
16	1.3105	1.5472	44
17	1.3109	1.5466	43
18	1.3112	1.5461	42
19	1.3115	1.5456	41
20	1.3118	1.5450	40
21	1.3122	1.5445	39
22	1.3125	1.5440	38
23	1.3128	1.5435	37
24	1.3131	1.5429	36
25	1.3135	1.5424	35
26	1.3138	1.5419	34
27	1.3141	1.5413	33
28	1.3144	1.5408	32
29	1.3148	1.5403	31
30	1.3151	1.5398	30
31	1.3154	1.5392	29
32	1.3157	1.5387	28
33	1.3161	1.5382	27
34	1.3164	1.5377	26
35	1.3167	1.5372	25
36	1.3171	1.5366	24
37	1.3174	1.5361	23
38	1.3177	1.5356	22
39	1.3180	1.5351	21
40	1.3184	1.5345	20
41	1.3187	1.5340	19
42	1.3190	1.5335	18
43	1.3194	1.5330	17
44	1.3197	1.5325	16
45	1.3200	1.5320	15
46	1.3203	1.5314	14
47	1.3207	1.5309	13
48	1.3210	1.5304	12
49	1.3213	1.5299	11
50	1.3217	1.5294	10
51	1.3220	1.5289	9
52	1.3223	1.5283	8
53	1.3227	1.5278	7
54	1.3230	1.5273	6
55	1.3233	1.5268	5
56	1.3237	1.5263	4
57	1.3240	1.5258	3
58	1.3243	1.5253	2
59	1.3247	1.5248	1
60	1.3250	1.5243	0
'	Csc	Sec	'

'	Sec	Csc	'
0	1.3250	1.5243	60
1	1.3253	1.5237	59
2	1.3257	1.5232	58
3	1.3260	1.5227	57
4	1.3264	1.5222	56
5	1.3267	1.5217	55
6	1.3270	1.5212	54
7	1.3274	1.5207	53
8	1.3277	1.5202	52
9	1.3280	1.5197	51
10	1.3284	1.5192	50
11	1.3287	1.5187	49
12	1.3291	1.5182	48
13	1.3294	1.5177	47
14	1.3297	1.5172	46
15	1.3301	1.5167	45
16	1.3304	1.5162	44
17	1.3307	1.5156	43
18	1.3311	1.5151	42
19	1.3314	1.5146	41
20	1.3318	1.5141	40
21	1.3321	1.5136	39
22	1.3325	1.5131	38
23	1.3328	1.5126	37
24	1.3331	1.5121	36
25	1.3335	1.5116	35
26	1.3338	1.5111	34
27	1.3342	1.5107	33
28	1.3345	1.5102	32
29	1.3348	1.5097	31
30	1.3352	1.5092	30
31	1.3355	1.5087	29
32	1.3359	1.5082	28
33	1.3362	1.5077	27
34	1.3366	1.5072	26
35	1.3369	1.5067	25
36	1.3373	1.5062	24
37	1.3376	1.5057	23
38	1.3380	1.5052	22
39	1.3383	1.5047	21
40	1.3386	1.5042	20
41	1.3390	1.5037	19
42	1.3393	1.5032	18
43	1.3397	1.5027	17
44	1.3400	1.5023	16
45	1.3404	1.5018	15
46	1.3407	1.5013	14
47	1.3411	1.5008	13
48	1.3414	1.5003	12
49	1.3418	1.4998	11
50	1.3421	1.4993	10
51	1.3425	1.4988	9
52	1.3428	1.4984	8
53	1.3432	1.4979	7
54	1.3435	1.4974	6
55	1.3439	1.4969	5
56	1.3442	1.4964	4
57	1.3446	1.4959	3
58	1.3449	1.4954	2
59	1.3453	1.4950	1
60	1.3456	1.4945	0
'	Csc	Sec	'

129° (309°) **(230°) 50°** **130° (310°)** **(229°) 49°** **131° (311°)** **(228°) 48°**

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

42° (222°)			(317°) 137°			43° (223°)			(316°) 136°			44° (224°)			(315°) 135°		
'	Sec	Csc	'	Sec	Csc	'	Sec	Csc	'	Sec	Csc	'	Sec	Csc	'	Sec	Csc
0	1.3456	1.4945	60	1.3673	1.4663	60	1.3673	1.4663	60	1.3902	1.4396	60	1.3902	1.4396	60	1.3902	1.4396
1	1.3460	1.4940	59	1.3677	1.4658	59	1.3677	1.4658	59	1.3906	1.4391	59	1.3906	1.4391	59	1.3906	1.4391
2	1.3463	1.4935	58	1.3681	1.4654	58	1.3681	1.4654	58	1.3909	1.4387	58	1.3909	1.4387	58	1.3909	1.4387
3	1.3467	1.4930	57	1.3684	1.4649	57	1.3684	1.4649	57	1.3913	1.4383	57	1.3913	1.4383	57	1.3913	1.4383
4	1.3470	1.4925	56	1.3688	1.4645	56	1.3688	1.4645	56	1.3917	1.4378	56	1.3917	1.4378	56	1.3917	1.4378
5	1.3474	1.4921	55	1.3692	1.4640	55	1.3692	1.4640	55	1.3921	1.4374	55	1.3921	1.4374	55	1.3921	1.4374
6	1.3478	1.4916	54	1.3696	1.4635	54	1.3696	1.4635	54	1.3925	1.4370	54	1.3925	1.4370	54	1.3925	1.4370
7	1.3481	1.4911	53	1.3699	1.4631	53	1.3699	1.4631	53	1.3929	1.4365	53	1.3929	1.4365	53	1.3929	1.4365
8	1.3485	1.4906	52	1.3703	1.4626	52	1.3703	1.4626	52	1.3933	1.4361	52	1.3933	1.4361	52	1.3933	1.4361
9	1.3488	1.4901	51	1.3707	1.4622	51	1.3707	1.4622	51	1.3937	1.4357	51	1.3937	1.4357	51	1.3937	1.4357
10	1.3492	1.4897	50	1.3711	1.4617	50	1.3711	1.4617	50	1.3941	1.4352	50	1.3941	1.4352	50	1.3941	1.4352
11	1.3495	1.4892	49	1.3714	1.4613	49	1.3714	1.4613	49	1.3945	1.4348	49	1.3945	1.4348	49	1.3945	1.4348
12	1.3499	1.4887	48	1.3718	1.4608	48	1.3718	1.4608	48	1.3949	1.4344	48	1.3949	1.4344	48	1.3949	1.4344
13	1.3502	1.4882	47	1.3722	1.4604	47	1.3722	1.4604	47	1.3953	1.4340	47	1.3953	1.4340	47	1.3953	1.4340
14	1.3506	1.4878	46	1.3726	1.4599	46	1.3726	1.4599	46	1.3957	1.4335	46	1.3957	1.4335	46	1.3957	1.4335
15	1.3510	1.4873	45	1.3729	1.4595	45	1.3729	1.4595	45	1.3961	1.4331	45	1.3961	1.4331	45	1.3961	1.4331
16	1.3513	1.4868	44	1.3733	1.4590	44	1.3733	1.4590	44	1.3965	1.4327	44	1.3965	1.4327	44	1.3965	1.4327
17	1.3517	1.4863	43	1.3737	1.4586	43	1.3737	1.4586	43	1.3969	1.4322	43	1.3969	1.4322	43	1.3969	1.4322
18	1.3520	1.4859	42	1.3741	1.4581	42	1.3741	1.4581	42	1.3972	1.4318	42	1.3972	1.4318	42	1.3972	1.4318
19	1.3524	1.4854	41	1.3744	1.4577	41	1.3744	1.4577	41	1.3976	1.4314	41	1.3976	1.4314	41	1.3976	1.4314
20	1.3527	1.4849	40	1.3748	1.4572	40	1.3748	1.4572	40	1.3980	1.4310	40	1.3980	1.4310	40	1.3980	1.4310
21	1.3531	1.4844	39	1.3752	1.4568	39	1.3752	1.4568	39	1.3984	1.4305	39	1.3984	1.4305	39	1.3984	1.4305
22	1.3535	1.4840	38	1.3756	1.4563	38	1.3756	1.4563	38	1.3988	1.4301	38	1.3988	1.4301	38	1.3988	1.4301
23	1.3538	1.4835	37	1.3759	1.4559	37	1.3759	1.4559	37	1.3992	1.4297	37	1.3992	1.4297	37	1.3992	1.4297
24	1.3542	1.4830	36	1.3763	1.4554	36	1.3763	1.4554	36	1.3996	1.4293	36	1.3996	1.4293	36	1.3996	1.4293
25	1.3545	1.4825	35	1.3767	1.4550	35	1.3767	1.4550	35	1.4000	1.4288	35	1.4000	1.4288	35	1.4000	1.4288
26	1.3549	1.4821	34	1.3771	1.4545	34	1.3771	1.4545	34	1.4004	1.4284	34	1.4004	1.4284	34	1.4004	1.4284
27	1.3553	1.4816	33	1.3775	1.4541	33	1.3775	1.4541	33	1.4008	1.4280	33	1.4008	1.4280	33	1.4008	1.4280
28	1.3556	1.4811	32	1.3778	1.4536	32	1.3778	1.4536	32	1.4012	1.4276	32	1.4012	1.4276	32	1.4012	1.4276
29	1.3560	1.4807	31	1.3782	1.4532	31	1.3782	1.4532	31	1.4016	1.4271	31	1.4016	1.4271	31	1.4016	1.4271
30	1.3563	1.4802	30	1.3786	1.4527	30	1.3786	1.4527	30	1.4020	1.4267	30	1.4020	1.4267	30	1.4020	1.4267
31	1.3567	1.4797	29	1.3790	1.4523	29	1.3790	1.4523	29	1.4024	1.4263	29	1.4024	1.4263	29	1.4024	1.4263
32	1.3571	1.4792	28	1.3794	1.4518	28	1.3794	1.4518	28	1.4028	1.4259	28	1.4028	1.4259	28	1.4028	1.4259
33	1.3574	1.4788	27	1.3797	1.4514	27	1.3797	1.4514	27	1.4032	1.4255	27	1.4032	1.4255	27	1.4032	1.4255
34	1.3578	1.4783	26	1.3801	1.4510	26	1.3801	1.4510	26	1.4036	1.4250	26	1.4036	1.4250	26	1.4036	1.4250
35	1.3582	1.4778	25	1.3805	1.4505	25	1.3805	1.4505	25	1.4040	1.4246	25	1.4040	1.4246	25	1.4040	1.4246
36	1.3585	1.4774	24	1.3809	1.4501	24	1.3809	1.4501	24	1.4044	1.4242	24	1.4044	1.4242	24	1.4044	1.4242
37	1.3589	1.4769	23	1.3813	1.4496	23	1.3813	1.4496	23	1.4048	1.4238	23	1.4048	1.4238	23	1.4048	1.4238
38	1.3592	1.4764	22	1.3817	1.4492	22	1.3817	1.4492	22	1.4052	1.4234	22	1.4052	1.4234	22	1.4052	1.4234
39	1.3596	1.4760	21	1.3820	1.4487	21	1.3820	1.4487	21	1.4057	1.4229	21	1.4057	1.4229	21	1.4057	1.4229
40	1.3600	1.4755	20	1.3824	1.4483	20	1.3824	1.4483	20	1.4061	1.4225	20	1.4061	1.4225	20	1.4061	1.4225
41	1.3603	1.4750	19	1.3828	1.4479	19	1.3828	1.4479	19	1.4065	1.4221	19	1.4065	1.4221	19	1.4065	1.4221
42	1.3607	1.4746	18	1.3832	1.4474	18	1.3832	1.4474	18	1.4069	1.4217	18	1.4069	1.4217	18	1.4069	1.4217
43	1.3611	1.4741	17	1.3836	1.4470	17	1.3836	1.4470	17	1.4073	1.4213	17	1.4073	1.4213	17	1.4073	1.4213
44	1.3614	1.4737	16	1.3840	1.4465	16	1.3840	1.4465	16	1.4077	1.4208	16	1.4077	1.4208	16	1.4077	1.4208
45	1.3618	1.4732	15	1.3843	1.4461	15	1.3843	1.4461	15	1.4081	1.4204	15	1.4081	1.4204	15	1.4081	1.4204
46	1.3622	1.4727	14	1.3847	1.4457	14	1.3847	1.4457	14	1.4085	1.4200	14	1.4085	1.4200	14	1.4085	1.4200
47	1.3625	1.4723	13	1.3851	1.4452	13	1.3851	1.4452	13	1.4089	1.4196	13	1.4089	1.4196	13	1.4089	1.4196
48	1.3629	1.4718	12	1.3855	1.4448	12	1.3855	1.4448	12	1.4093	1.4192	12	1.4093	1.4192	12	1.4093	1.4192
49	1.3633	1.4713	11	1.3859	1.4443	11	1.3859	1.4443	11	1.4097	1.4188	11	1.4097	1.4188	11	1.4097	1.4188
50	1.3636	1.4709	10	1.3863	1.4439	10	1.3863	1.4439	10	1.4101	1.4183	10	1.4101	1.4183	10	1.4101	1.4183
51	1.3640	1.4704	9	1.3867	1.4435	9	1.3867	1.4435	9	1.4105	1.4179	9	1.4105	1.4179	9	1.4105	1.4179
52	1.3644	1.4700	8	1.3871	1.4430	8	1.3871	1.4430	8	1.4109	1.4175	8	1.4109	1.4175	8	1.4109	1.4175
53	1.3647	1.4695	7	1.3874	1.4426	7	1.3874	1.4426	7	1.4113	1.4171	7	1.4113	1.4171	7	1.4113	1.4171
54	1.3651	1.4690	6	1.3878	1.4422	6	1.3878	1.4422	6	1.4118	1.4167	6	1.4118	1.4167	6	1.4118	1.4167
55	1.3655	1.4686	5	1.3882	1.4417	5	1.3882	1.4417	5	1.4122	1.4163	5	1.4122	1.4163	5	1.4122	1.4163
56	1.3658	1.4681	4	1.3886	1.4413	4	1.3886	1.4413	4	1.4126	1.4159	4	1.4126	1.4159	4	1.4126	1.4159
57	1.3662	1.4677	3	1.3890	1.4409	3	1.3890	1.4409	3	1.4130	1.4154	3	1.4130	1.4154	3	1.4130	1.4154
58	1.3666	1.4672	2	1.3894	1.4404	2	1.3894	1.4404	2	1.4134	1.4150	2	1.4134	1.4150	2	1.4134	1.4150
59	1.3670	1.4667	1	1.3898	1.4400	1	1.3898	1.4400	1	1.4138	1.4146	1	1.4138	1.4146	1	1.4138	1.4146
60	1.3673	1.4663	0	1.3902	1.4396	0	1.3902	1.4396	0	1.4142	1.4142	0	1.4142	1.4142	0	1.4142	1.4142
'	Csc	Sec	'	Csc	Sec	'	Csc	Sec	'	Csc	Sec	'	Csc	Sec	'	Csc	Sec

132° (312°) (227°) 47° 133° (313°) (226°) 46° 134° (314°) (225°) 45°

NATURAL TRIGONOMETRIC FUNCTIONS FOR ANGLES IN DEGREES AND DECIMALS

Deg.	Sin	Tan	Cot	Cos	Deg.	Deg.	Sin	Tan	Cot	Cos	Deg.
0.0	.00000	.00000	∞	1.0000	90.0	6.0	.10453	.10510	9.514	0.9945	84.0
.1	.00175	.00175	573.0	1.0000	89.9	.1	.10626	.10687	9.357	.9943	83.9
.2	.00349	.00349	286.5	1.0000	.8	.2	.1080	.10863	9.205	.9942	.8
.3	.00524	.00524	191.0	1.0000	.7	.3	.10973	.11040	9.058	.9940	.7
.4	.00698	.00698	143.24	1.0000	.6	.4	.11147	.11217	8.915	.9938	.6
.5	.00873	.00873	114.59	1.0000	.5	.5	.11320	.11394	8.777	.9936	.5
.6	.01047	.01047	95.49	0.9999	.4	.6	.11494	.11570	8.643	.9934	.4
.7	.01222	.01222	81.85	.9999	.3	.7	.11667	.11747	8.513	.9932	.3
.8	.01396	.01396	71.62	.9999	.2	.8	.11840	.11924	8.386	.9930	.2
.9	.01571	.01571	63.66	.9999	89.1	.9	.12014	.12101	8.264	.9928	83.1
1.0	.01745	.01746	57.29	0.9998	89.0	7.0	.12187	.12278	8.144	0.9925	83.0
.1	.01920	.01920	52.08	.9998	88.9	.1	.12360	.12456	8.028	.9923	82.9
.2	.02094	.02095	47.74	.9998	.8	.2	.12533	.12633	7.916	.9921	.8
.3	.02269	.02269	44.07	.9997	.7	.3	.12706	.12810	7.806	.9919	.7
.4	.02443	.02444	40.92	.9997	.6	.4	.12880	.12988	7.700	.9917	.6
.5	.02618	.02619	38.19	.9997	.5	.5	.13053	.13165	7.596	.9914	.5
.6	.02792	.02793	35.80	.9996	.4	.6	.13226	.13343	7.495	.9912	.4
.7	.02967	.02968	33.69	.9996	.3	.7	.13399	.13521	7.396	.9910	.3
.8	.03141	.03143	31.82	.9995	.2	.8	.13572	.13698	7.300	.9907	.2
.9	.03316	.03317	30.14	.9995	88.1	.9	.13744	.13876	7.207	.9905	82.1
2.0	.03490	.03492	28.64	0.9994	88.0	8.0	.13917	.14054	7.115	0.9903	82.0
.1	.03664	.03667	27.27	.9993	87.9	.1	.14090	.14232	7.026	.9900	81.9
.2	.03839	.03842	26.03	.9993	.8	.2	.14263	.14410	6.940	.9898	.8
.3	.04013	.04016	24.90	.9992	.7	.3	.14436	.14588	6.855	.9895	.7
.4	.04188	.04191	23.86	.9991	.6	.4	.14608	.14767	6.772	.9893	.6
.5	.04362	.04366	22.90	.9990	.5	.5	.14781	.14945	6.691	.9890	.5
.6	.04536	.04541	22.02	.9990	.4	.6	.14954	.15124	6.612	.9888	.4
.7	.04711	.04716	21.20	.9989	.3	.7	.15126	.15302	6.535	.9885	.3
.8	.04885	.04891	20.45	.9988	.2	.8	.15299	.15481	6.460	.9882	.2
.9	.05059	.05066	19.74	.9987	87.1	.9	.15471	.15660	6.386	.9880	81.1
3.0	.05234	.05241	19.081	0.9986	87.0	9.0	.15643	.15838	6.314	0.9877	81.0
.1	.05408	.05416	18.464	.9985	86.9	.1	.15816	.16017	6.243	.9874	80.9
.2	.05582	.05591	17.886	.9984	.8	.2	.15988	.16196	6.174	.9871	.8
.3	.05756	.05766	17.343	.9983	.7	.3	.16160	.16376	6.107	.9869	.7
.4	.05931	.05941	16.832	.9982	.6	.4	.16333	.16555	6.041	.9866	.6
.5	.06105	.06116	16.350	.9981	.5	.5	.16505	.16734	5.976	.9863	.5
.6	.06279	.06291	15.895	.9980	.4	.6	.16677	.16914	5.912	.9860	.4
.7	.06453	.06467	15.464	.9979	.3	.7	.16849	.17093	5.850	.9857	.3
.8	.06627	.06642	15.056	.9978	.2	.8	.17021	.17273	5.789	.9854	.2
.9	.06802	.06817	14.669	.9977	86.1	.9	.17193	.17453	5.730	.9851	80.1
4.0	.06976	.06993	14.301	0.9976	86.0	10.0	.1736	.1763	5.671	0.9848	80.0
.1	.07150	.07163	13.951	.9974	85.9	.1	.1754	.1781	5.614	.9845	79.9
.2	.07324	.07344	13.617	.9973	.8	.2	.1771	.1799	5.558	.9842	.8
.3	.07498	.07519	13.300	.9972	.7	.3	.1788	.1817	5.503	.9839	.7
.4	.07672	.07695	12.996	.9971	.6	.4	.1805	.1835	5.449	.9836	.6
.5	.07846	.07870	12.706	.9969	.5	.5	.1822	.1853	5.396	.9833	.5
.6	.08020	.08046	12.429	.9968	.4	.6	.1840	.1871	5.343	.9829	.4
.7	.08194	.08221	12.163	.9966	.3	.7	.1857	.1890	5.292	.9826	.3
.8	.08368	.08397	11.909	.9965	.2	.8	.1874	.1908	5.242	.9823	.2
.9	.08542	.08573	11.664	.9963	85.1	.9	.1891	.1926	5.193	.9820	79.1
5.0	.08716	.08749	11.430	0.9962	85.0	11.0	.1908	.1944	5.145	0.9816	79.0
.1	.08889	.08925	11.205	.9960	84.9	.1	.1925	.1962	5.097	.9813	78.9
.2	.09063	.09101	10.988	.9959	.8	.2	.1942	.1980	5.050	.9810	.8
.3	.09237	.09277	10.780	.9957	.7	.3	.1959	.1998	5.005	.9806	.7
.4	.09411	.09453	10.579	.9956	.6	.4	.1977	.2016	4.959	.9803	.6
.5	.09585	.09629	10.385	.9954	.5	.5	.1994	.2035	4.915	.9799	.5
.6	.09758	.09805	10.199	.9952	.4	.6	.2011	.2053	4.872	.9796	.4
.7	.09932	.09981	10.019	.9951	.3	.7	.2028	.2071	4.829	.9792	.3
.8	.10106	.10158	9.845	.9949	.2	.8	.2045	.2089	4.787	.9789	.2
.9	.10279	.10334	9.677	.9947	84.1	.9	.2062	.2107	4.745	.9785	78.1
6.0	.10453	.10510	9.514	0.9945	84.0	12.0	.2079	.2126	4.705	0.9781	78.0
Deg.	Cos	Cot	Tan	Sin	Deg.	Deg.	Cos	Cot	Tan	Sin	Deg.

NATURAL FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg.	Sin	Tan	Cot	Cos	Deg.	Deg.	Sin	Tan	Cot	Cos	Deg.
12.0	0.2079	0.2126	4.705	0.9781	78.0	18.0	0.3090	0.3249	3.078	0.9511	72.0
.1	.2096	.2144	4.665	.9778	77.9	.1	.3107	.3269	3.060	.9505	71.9
.2	.2113	.2162	4.625	.9774	.8	.2	.3123	.3288	3.042	.9500	.8
.3	.2130	.2180	4.586	.9770	.7	.3	.3140	.3307	3.024	.9494	.7
.4	.2147	.2199	4.548	.9767	.6	.4	.3156	.3327	3.006	.9489	.6
.5	.2164	.2217	4.511	.9763	.5	.5	.3173	.3346	2.989	.9483	.5
.6	.2181	.2235	4.474	.9759	.4	.6	.3190	.3365	2.971	.9478	.4
.7	.2198	.2254	4.437	.9755	.3	.7	.3206	.3385	2.954	.9472	.3
.8	.2215	.2272	4.402	.9751	.2	.8	.3223	.3404	2.937	.9466	.2
.9	.2233	.2290	4.366	.9748	77.1	.9	.3239	.3424	2.921	.9461	71.1
13.0	0.2250	0.2309	4.331	0.9744	77.0	19.0	0.3256	0.3443	2.904	0.9455	71.0
.1	.2267	.2327	4.297	.9740	76.9	.1	.3272	.3463	2.888	.9449	70.9
.2	.2284	.2345	4.264	.9736	.8	.2	.3289	.3482	2.872	.9444	.8
.3	.2300	.2364	4.230	.9732	.7	.3	.3305	.3502	2.856	.9438	.7
.4	.2317	.2382	4.198	.9728	.6	.4	.3322	.3522	2.840	.9432	.6
.5	.2334	.2401	4.165	.9724	.5	.5	.3338	.3541	2.824	.9426	.5
.6	.2351	.2419	4.134	.9720	.4	.6	.3355	.3561	2.808	.9421	.4
.7	.2368	.2438	4.102	.9715	.3	.7	.3371	.3581	2.793	.9415	.3
.8	.2385	.2456	4.071	.9711	.2	.8	.3387	.3600	2.778	.9409	.2
.9	.2402	.2475	4.041	.9707	76.1	.9	.3404	.3620	2.762	.9403	70.1
14.0	0.2419	0.2493	4.011	0.9703	76.0	20.0	0.3420	0.3640	2.747	0.9397	70.0
.1	.2436	.2512	3.981	.9699	75.9	.1	.3437	.3659	2.733	.9391	69.9
.2	.2453	.2530	3.952	.9694	.8	.2	.3453	.3679	2.718	.9385	.8
.3	.2470	.2549	3.923	.9690	.7	.3	.3469	.3699	2.703	.9379	.7
.4	.2487	.2568	3.895	.9686	.6	.4	.3486	.3719	2.689	.9373	.6
.5	.2504	.2586	3.867	.9681	.5	.5	.3502	.3739	2.675	.9367	.5
.6	.2521	.2605	3.839	.9677	.4	.6	.3518	.3759	2.660	.9361	.4
.7	.2538	.2623	3.812	.9673	.3	.7	.3535	.3779	2.646	.9354	.3
.8	.2554	.2642	3.785	.9668	.2	.8	.3551	.3799	2.633	.9348	.2
.9	.2571	.2661	3.758	.9664	75.1	.9	.3567	.3819	2.619	.9342	69.1
15.0	0.2588	0.2679	3.732	0.9659	75.0	21.0	0.3584	0.3839	2.605	0.9336	69.0
.1	.2605	.2698	3.706	.9655	74.9	.1	.3600	.3859	2.592	.9330	68.9
.2	.2622	.2717	3.681	.9650	.8	.2	.3616	.3879	2.578	.9323	.8
.3	.2639	.2736	3.655	.9646	.7	.3	.3633	.3899	2.565	.9317	.7
.4	.2656	.2754	3.630	.9641	.6	.4	.3649	.3919	2.552	.9311	.6
.5	.2672	.2773	3.606	.9636	.5	.5	.3665	.3939	2.539	.9304	.5
.6	.2689	.2792	3.582	.9632	.4	.6	.3681	.3959	2.526	.9298	.4
.7	.2706	.2811	3.558	.9627	.3	.7	.3697	.3979	2.513	.9291	.3
.8	.2723	.2830	3.534	.9622	.2	.8	.3714	.4000	2.500	.9285	.2
.9	.2740	.2849	3.511	.9617	74.1	.9	.3730	.4020	2.488	.9278	68.1
16.0	0.2756	0.2867	3.487	0.9613	74.0	22.0	0.3746	0.4040	2.475	0.9272	68.0
.1	.2773	.2886	3.465	.9608	73.9	.1	.3762	.4061	2.463	.9265	67.9
.2	.2790	.2905	3.442	.9603	.8	.2	.3778	.4081	2.450	.9259	.8
.3	.2807	.2924	3.420	.9598	.7	.3	.3795	.4101	2.438	.9252	.7
.4	.2823	.2943	3.398	.9593	.6	.4	.3811	.4122	2.426	.9245	.6
.5	.2840	.2962	3.376	.9588	.5	.5	.3827	.4142	2.414	.9239	.5
.6	.2857	.2981	3.354	.9583	.4	.6	.3843	.4163	2.402	.9232	.4
.7	.2874	.3000	3.333	.9578	.3	.7	.3859	.4183	2.391	.9225	.3
.8	.2890	.3019	3.312	.9573	.2	.8	.3875	.4204	2.379	.9219	.2
.9	.2907	.3038	3.291	.9568	73.1	.9	.3891	.4224	2.367	.9212	67.1
17.0	0.2924	0.3057	3.271	0.9563	73.0	23.0	0.3907	0.4245	2.356	0.9205	67.0
.1	.2940	.3076	3.251	.9558	72.9	.1	.3923	.4265	2.344	.9198	66.9
.2	.2957	.3096	3.230	.9553	.8	.2	.3939	.4286	2.333	.9191	.8
.3	.2974	.3115	3.211	.9548	.7	.3	.3955	.4307	2.322	.9184	.7
.4	.2990	.3134	3.191	.9542	.6	.4	.3971	.4327	2.311	.9178	.6
.5	.3007	.3153	3.172	.9537	.5	.5	.3987	.4348	2.300	.9171	.5
.6	.3024	.3172	3.152	.9532	.4	.6	.4003	.4369	2.289	.9164	.4
.7	.3040	.3191	3.133	.9527	.3	.7	.4019	.4390	2.278	.9157	.3
.8	.3057	.3211	3.115	.9521	.2	.8	.4035	.4411	2.267	.9150	.2
.9	.3074	.3230	3.096	.9516	72.1	.9	.4051	.4431	2.257	.9143	66.1
18.0	0.3090	0.3249	3.078	0.9511	72.0	24.0	0.4067	0.4452	2.246	0.9135	66.0
Deg.	Cos	Cot	Tan	Sin	Deg.	Deg.	Cos	Cot	Tan	Sin	Deg.

NATURAL FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg.	Sin	Tan	Cot	Cos	Deg.
24.0	0.4067	0.4452	2.246	0.9135	66.0
.1	.4083	.4473	2.236	.9128	65.9
.2	.4099	.4494	2.225	.9121	.8
.3	.4115	.4515	2.215	.9114	.7
.4	.4131	.4536	2.204	.9107	.6
.5	.4147	.4557	2.194	.9100	.5
.6	.4163	.4578	2.184	.9092	.4
.7	.4179	.4599	2.174	.9085	.3
.8	.4195	.4621	2.164	.9078	.2
.9	.4210	.4642	2.154	.9070	65.1
25.0	0.4226	0.4663	2.145	0.9063	65.0
.1	.4242	.4684	2.135	.9056	64.9
.2	.4258	.4706	2.125	.9048	.8
.3	.4274	.4727	2.116	.9041	.7
.4	.4289	.4748	2.106	.9033	.6
.5	.4305	.4770	2.097	.9026	.5
.6	.4321	.4791	2.087	.9018	.4
.7	.4337	.4813	2.078	.9011	.3
.8	.4352	.4834	2.069	.9003	.2
.9	.4368	.4856	2.059	.8996	64.1
26.0	0.4384	0.4877	2.050	0.8988	64.0
.1	.4399	.4899	2.041	.8980	63.9
.2	.4415	.4921	2.032	.8973	.8
.3	.4431	.4942	2.023	.8965	.7
.4	.4446	.4964	2.014	.8957	.6
.5	.4462	.4986	2.006	.8949	.5
.6	.4478	.5008	1.997	.8942	.4
.7	.4493	.5029	1.988	.8934	.3
.8	.4509	.5051	1.980	.8926	.2
.9	.4524	.5073	1.971	.8918	63.1
27.0	0.4540	0.5095	1.963	0.8910	63.0
.1	.4555	.5117	1.954	.8902	62.9
.2	.4571	.5139	1.946	.8894	.8
.3	.4586	.5161	1.937	.8886	.7
.4	.4602	.5184	1.929	.8878	.6
.5	.4617	.5206	1.921	.8870	.5
.6	.4633	.5228	1.913	.8862	.4
.7	.4648	.5250	1.905	.8854	.3
.8	.4664	.5272	1.897	.8846	.2
.9	.4679	.5295	1.889	.8838	62.1
28.0	0.4695	0.5317	1.881	0.8829	62.0
.1	.4710	.5340	1.873	.8821	61.9
.2	.4726	.5362	1.865	.8813	.8
.3	.4741	.5384	1.857	.8805	.7
.4	.4756	.5407	1.849	.8796	.6
.5	.4772	.5430	1.842	.8788	.5
.6	.4787	.5452	1.834	.8780	.4
.7	.4802	.5475	1.827	.8771	.3
.8	.4818	.5498	1.819	.8763	.2
.9	.4833	.5520	1.811	.8755	61.1
29.0	0.4848	0.5543	1.804	0.8746	61.0
.1	.4863	.5566	1.797	.8738	60.9
.2	.4879	.5589	1.789	.8729	.8
.3	.4894	.5612	1.782	.8721	.7
.4	.4909	.5635	1.775	.8712	.6
.5	.4924	.5658	1.767	.8704	.5
.6	.4939	.5681	1.760	.8695	.4
.7	.4955	.5704	1.753	.8686	.3
.8	.4970	.5727	1.746	.8678	.2
.9	.4985	.5750	1.739	.8669	60.1
30.0	0.5000	0.5774	1.732	0.8660	60.0
Deg.	Cos	Cot	Tan	Sin	Deg.

Deg.	Sin	Tan	Cot	Cos	Deg.
30.0	0.5000	0.5774	1.7321	0.8660	60.0
.1	.5015	.5797	1.7251	.8652	59.9
.2	.5030	.5820	1.7182	.8643	.8
.3	.5045	.5844	1.7113	.8634	.7
.4	.5060	.5867	1.7045	.8625	.6
.5	.5075	.5890	1.6977	.8616	.5
.6	.5090	.5914	1.6909	.8607	.4
.7	.5105	.5938	1.6842	.8599	.3
.8	.5120	.5961	1.6775	.8590	.2
.9	.5135	.5985	1.6709	.8581	59.1
31.0	0.5150	0.6009	1.6643	0.8572	59.0
.1	.5165	.6032	1.6577	.8563	58.9
.2	.5180	.6056	1.6512	.8554	.8
.3	.5195	.6080	1.6447	.8545	.7
.4	.5210	.6104	1.6383	.8536	.6
.5	.5225	.6128	1.6319	.8526	.5
.6	.5240	.6152	1.6255	.8517	.4
.7	.5255	.6176	1.6191	.8508	.3
.8	.5270	.6200	1.6128	.8499	.2
.9	.5284	.6224	1.6066	.8490	58.1
32.0	0.5299	0.6249	1.6003	0.8480	58.0
.1	.5314	.6273	1.5941	.8471	57.9
.2	.5329	.6297	1.5880	.8462	.8
.3	.5344	.6322	1.5818	.8453	.7
.4	.5358	.6346	1.5757	.8443	.6
.5	.5373	.6371	1.5697	.8434	.5
.6	.5388	.6395	1.5637	.8425	.4
.7	.5402	.6420	1.5577	.8415	.3
.8	.5417	.6445	1.5517	.8406	.2
.9	.5432	.6469	1.5458	.8396	57.1
33.0	0.5446	0.6494	1.5399	0.8387	57.0
.1	.5461	.6519	1.5340	.8377	56.9
.2	.5476	.6544	1.5282	.8368	.8
.3	.5490	.6569	1.5224	.8358	.7
.4	.5505	.6594	1.5166	.8348	.6
.5	.5519	.6619	1.5108	.8339	.5
.6	.5534	.6644	1.5051	.8329	.4
.7	.5548	.6669	1.4994	.8320	.3
.8	.5563	.6694	1.4938	.8310	.2
.9	.5577	.6720	1.4882	.8300	56.1
34.0	0.5592	0.6745	1.4826	0.8290	56.0
.1	.5606	.6771	1.4770	.8281	55.9
.2	.5621	.6796	1.4715	.8271	.8
.3	.5635	.6822	1.4659	.8261	.7
.4	.5650	.6847	1.4605	.8251	.6
.5	.5664	.6873	1.4550	.8241	.5
.6	.5678	.6899	1.4496	.8231	.4
.7	.5693	.6924	1.4442	.8221	.3
.8	.5707	.6950	1.4388	.8211	.2
.9	.5721	.6976	1.4335	.8202	55.1
35.0	0.5736	0.7002	1.4281	0.8192	55.0
.1	.5750	.7028	1.4229	.8181	54.9
.2	.5764	.7054	1.4176	.8171	.8
.3	.5779	.7080	1.4124	.8161	.7
.4	.5793	.7107	1.4071	.8151	.6
.5	.5807	.7133	1.4019	.8141	.5
.6	.5821	.7159	1.3968	.8131	.4
.7	.5835	.7186	1.3916	.8121	.3
.8	.5850	.7212	1.3865	.8111	.2
.9	.5864	.7239	1.3814	.8100	54.1
36.0	0.5878	0.7265	1.3764	0.8090	54.0
Deg.	Cos	Cot	Tan	Sin	Deg.

NATURAL FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg.	Sin	Tan	Cot	Cos	Deg.
36.0	0.5878	0.7265	1.3764	0.8090	54.0
.1	.5892	.7292	1.3713	.8080	53.9
.2	.5906	.7319	1.3663	.8070	.8
.3	.5920	.7346	1.3613	.8059	.7
.4	.5934	.7373	1.3564	.8049	.6
.5	.5948	.7400	1.3514	.8039	.5
.6	.5962	.7427	1.3465	.8028	.4
.7	.5976	.7454	1.3416	.8018	.3
.8	.5990	.7481	1.3367	.8007	.2
.9	.6004	.7508	1.3319	.7997	53.1
37.0	0.6018	0.7536	1.3270	0.7986	53.0
.1	.6032	.7563	1.3222	.7976	52.9
.2	.6046	.7590	1.3175	.7965	.8
.3	.6060	.7618	1.3127	.7955	.7
.4	.6074	.7646	1.3079	.7944	.6
.5	.6088	.7673	1.3032	.7934	.5
.6	.6101	.7701	1.2985	.7923	.4
.7	.6115	.7729	1.2938	.7912	.3
.8	.6129	.7757	1.2892	.7902	.2
.9	.6143	.7785	1.2846	.7891	52.1
38.0	0.6157	0.7813	1.2799	0.7880	52.0
.1	.6170	.7841	1.2753	.7869	51.9
.2	.6184	.7869	1.2708	.7859	.8
.3	.6198	.7898	1.2662	.7848	.7
.4	.6211	.7926	1.2617	.7837	.6
.5	.6225	.7954	1.2572	.7826	.5
.6	.6239	.7983	1.2527	.7815	.4
.7	.6252	.8012	1.2482	.7804	.3
.8	.6266	.8040	1.2437	.7793	.2
.9	.6280	.8069	1.2393	.7782	51.1
39.0	0.6293	0.8098	1.2349	0.7771	51.0
.1	.6307	.8127	1.2305	.7760	50.9
.2	.6320	.8156	1.2261	.7749	.8
.3	.6334	.8185	1.2218	.7738	.7
.4	.6347	.8214	1.2174	.7727	.6
.5	.6361	.8243	1.2131	.7716	.5
.6	.6374	.8273	1.2088	.7705	.4
.7	.6388	.8302	1.2045	.7694	.3
.8	.6401	.8332	1.2002	.7683	.2
.9	.6414	.8361	1.1960	.7672	50.1
40.0	0.6428	0.8391	1.1918	0.7660	50.0
.1	.6441	.8421	1.1875	.7649	49.9
.2	.6455	.8451	1.1833	.7638	.8
.3	.6468	.8481	1.1792	.7627	.7
.4	.6481	.8511	1.1750	.7615	.6
40.5	0.6494	0.8541	1.1708	0.7604	49.5
Deg.	Cos	Cot	Tan	Sin	Deg.

Deg.	Sin	Tan	Cot	Cos	Deg.
40.5	0.6494	0.8541	1.1708	0.7604	49.5
.6	.6508	.8571	1.1667	.7593	.4
.7	.6521	.8601	1.1626	.7581	.3
.8	.6534	.8632	1.1585	.7570	.2
.9	.6547	.8662	1.1544	.7559	49.1
41.0	0.6561	0.8693	1.1504	0.7547	49.0
.1	.6574	.8724	1.1463	.7536	48.9
.2	.6587	.8754	1.1423	.7524	.8
.3	.6600	.8785	1.1383	.7513	.7
.4	.6613	.8816	1.1343	.7501	.6
.5	.6626	.8847	1.1303	.7490	.5
.6	.6639	.8878	1.1263	.7478	.4
.7	.6652	.8910	1.1224	.7466	.3
.8	.6665	.8941	1.1184	.7455	.2
.9	.6678	.8972	1.1145	.7443	48.1
42.0	0.6691	0.9004	1.1106	0.7431	48.0
.1	.6704	.9036	1.1067	.7420	47.9
.2	.6717	.9067	1.1028	.7408	.8
.3	.6730	.9099	1.0990	.7396	.7
.4	.6743	.9131	1.0951	.7385	.6
.5	.6756	.9163	1.0913	.7373	.5
.6	.6769	.9195	1.0875	.7361	.4
.7	.6782	.9228	1.0837	.7349	.3
.8	.6794	.9260	1.0799	.7337	.2
.9	.6807	.9293	1.0761	.7325	47.1
43.0	0.6820	0.9325	1.0724	0.7314	47.0
.1	.6833	.9358	1.0686	.7302	46.9
.2	.6845	.9391	1.0649	.7290	.8
.3	.6858	.9424	1.0612	.7278	.7
.4	.6871	.9457	1.0575	.7266	.6
.5	.6884	.9490	1.0538	.7254	.5
.6	.6896	.9523	1.0501	.7242	.4
.7	.6909	.9556	1.0464	.7230	.3
.8	.6921	.9590	1.0428	.7218	.2
.9	.6934	.9623	1.0392	.7206	46.1
44.0	0.6947	0.9657	1.0355	0.7193	46.0
.1	.6959	.9691	1.0319	.7181	45.9
.2	.6972	.9725	1.0283	.7169	.8
.3	.6984	.9759	1.0247	.7157	.7
.4	.6997	.9793	1.0212	.7145	.6
.5	.7009	.9827	1.0176	.7133	.5
.6	.7022	.9861	1.0141	.7120	.4
.7	.7034	.9896	1.0105	.7108	.3
.8	.7046	.9930	1.0070	.7096	.2
.9	.7059	.9965	1.0035	.7083	45.1
45.0	0.7071	1.0000	1.0000	0.7071	45.0
Deg.	Cos	Cot	Tan	Sin	Deg.

LOGARITHMS OF TRIGONOMETRIC FUNCTIONS FOR ANGLES IN DEGREES AND DECIMALS

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
0.0	— ∞	— ∞	=	0.0000	90.0
.1	7.2419	7.2419	2.7581	0.0000	89.9
.2	7.5429	7.5429	2.4571	0.0000	.8
.3	7.7190	7.7190	2.2810	0.0000	.7
.4	7.8439	7.8439	2.1561	0.0000	.6
.5	7.9408	7.9409	2.0591	0.0000	.5
.6	8.0200	8.0200	1.9800	0.0000	.4
.7	8.0870	8.0870	1.9130	0.0000	.3
.8	8.1450	8.1450	1.8550	0.0000	.2
.9	8.1961	8.1962	1.8038	9.9999	89.1
1.0	8.2419	8.2419	1.7581	9.9999	89.0
.1	8.2832	8.2833	1.7167	9.9999	88.9
.2	8.3210	8.3211	1.6789	9.9999	.8
.3	8.3558	8.3559	1.6441	9.9999	.7
.4	8.3880	8.3881	1.6119	9.9999	.6
.5	8.4179	8.4181	1.5819	9.9999	.5
.6	8.4459	8.4461	1.5539	9.9998	.4
.7	8.4723	8.4725	1.5275	9.9998	.3
.8	8.4971	8.4973	1.5027	9.9998	.2
.9	8.5206	8.5208	1.4792	9.9998	88.1
2.0	8.5428	8.5431	1.4569	9.9997	88.0
.1	8.5640	8.5643	1.4357	9.9997	87.9
.2	8.5842	8.5845	1.4155	9.9997	.8
.3	8.6035	8.6038	1.3962	9.9996	.7
.4	8.6220	8.6223	1.3777	9.9996	.6
.5	8.6397	8.6401	1.3599	9.9996	.5
.6	8.6567	8.6571	1.3429	9.9996	.4
.7	8.6731	8.6736	1.3264	9.9995	.3
.8	8.6889	8.6894	1.3106	9.9995	.2
.9	8.7041	8.7046	1.2954	9.9994	87.1
3.0	8.7188	8.7194	1.2806	9.9994	87.0
.1	8.7330	8.7337	1.2663	9.9994	86.9
.2	8.7468	8.7475	1.2525	9.9993	.8
.3	8.7602	8.7609	1.2391	9.9993	.7
.4	8.7731	8.7739	1.2261	9.9992	.6
.5	8.7857	8.7865	1.2135	9.9992	.5
.6	8.7979	8.7988	1.2012	9.9991	.4
.7	8.8098	8.8107	1.1893	9.9991	.3
.8	8.8213	8.8223	1.1777	9.9990	.2
.9	8.8326	8.8336	1.1664	9.9990	86.1
4.0	8.8436	8.8446	1.1554	9.9989	86.0
.1	8.8543	8.8554	1.1446	9.9989	85.9
.2	8.8647	8.8659	1.1341	9.9988	.8
.3	8.8749	8.8762	1.1238	9.9988	.7
.4	8.8849	8.8862	1.1138	9.9987	.6
.5	8.8946	8.8960	1.1040	9.9987	.5
.6	8.9042	8.9056	1.0944	9.9986	.4
.7	8.9135	8.9150	1.0850	9.9985	.3
.8	8.9226	8.9241	1.0759	9.9985	.2
.9	8.9315	8.9331	1.0669	9.9984	85.1
5.0	8.9403	8.9420	1.0580	9.9983	85.0
.1	8.9489	8.9506	1.0494	9.9983	84.9
.2	8.9573	8.9591	1.0409	9.9982	.8
.3	8.9655	8.9674	1.0326	9.9981	.7
.4	8.9736	8.9756	1.0244	9.9981	.6
.5	8.9816	8.9836	1.0164	9.9980	.5
.6	8.9894	8.9915	1.0085	9.9979	.4
.7	8.9970	8.9992	1.0008	9.9978	.3
.8	9.0046	9.0068	0.9932	9.9978	.2
.9	9.0120	9.0143	0.9857	9.9977	84.1
6.0	9.0192	9.0216	0.9784	9.9976	84.0

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
6.0	9.0192	9.0216	0.9784	9.9976	84.0
.1	9.0264	9.0289	0.9711	9.9975	83.9
.2	9.0334	9.0360	0.9640	9.9975	.8
.3	9.0403	9.0430	0.9570	9.9974	.7
.4	9.0472	9.0499	0.9501	9.9973	.6
.5	9.0539	9.0567	0.9433	9.9972	.5
.6	9.0605	9.0633	0.9367	9.9971	.4
.7	9.0670	9.0699	0.9301	9.9970	.3
.8	9.0734	9.0764	0.9236	9.9969	.2
.9	9.0797	9.0828	0.9172	9.9968	83.1
7.0	9.0859	9.0891	0.9109	9.9968	83.0
.1	9.0920	9.0954	0.9046	9.9967	82.9
.2	9.0981	9.1015	0.8985	9.9966	.8
.3	9.1040	9.1076	0.8924	9.9965	.7
.4	9.1099	9.1135	0.8865	9.9964	.6
.5	9.1157	9.1194	0.8806	9.9963	.5
.6	9.1214	9.1252	0.8748	9.9962	.4
.7	9.1271	9.1310	0.8690	9.9961	.3
.8	9.1326	9.1367	0.8633	9.9960	.2
.9	9.1381	9.1423	0.8577	9.9959	82.1
8.0	9.1436	9.1478	0.8522	9.9958	82.0
.1	9.1489	9.1533	0.8467	9.9956	81.9
.2	9.1542	9.1587	0.8413	9.9955	.8
.3	9.1594	9.1640	0.8360	9.9954	.7
.4	9.1646	9.1693	0.8307	9.9953	.6
.5	9.1697	9.1745	0.8255	9.9952	.5
.6	9.1747	9.1797	0.8203	9.9951	.4
.7	9.1797	9.1848	0.8152	9.9950	.3
.8	9.1847	9.1898	0.8102	9.9949	.2
.9	9.1895	9.1948	0.8052	9.9947	81.1
9.0	9.1943	9.1997	0.8003	9.9946	81.0
.1	9.1991	9.2046	0.7954	9.9945	80.9
.2	9.2038	9.2094	0.7906	9.9944	.8
.3	9.2085	9.2142	0.7858	9.9943	.7
.4	9.2131	9.2189	0.7811	9.9941	.6
.5	9.2176	9.2236	0.7764	9.9940	.5
.6	9.2221	9.2282	0.7718	9.9939	.4
.7	9.2266	9.2328	0.7672	9.9937	.3
.8	9.2310	9.2374	0.7626	9.9936	.2
.9	9.2353	9.2419	0.7581	9.9935	80.1
10.0	9.2397	9.2463	0.7537	9.9934	80.0
.1	9.2439	9.2507	0.7493	9.9932	79.9
.2	9.2482	9.2551	0.7449	9.9931	.8
.3	9.2524	9.2594	0.7406	9.9929	.7
.4	9.2565	9.2637	0.7363	9.9928	.6
.5	9.2606	9.2680	0.7320	9.9927	.5
.6	9.2647	9.2722	0.7278	9.9925	.4
.7	9.2687	9.2764	0.7236	9.9924	.3
.8	9.2727	9.2805	0.7195	9.9922	.2
.9	9.2767	9.2846	0.7154	9.9921	79.1
11.0	9.2806	9.2887	0.7113	9.9919	79.0
.1	9.2845	9.2927	0.7073	9.9918	78.9
.2	9.2883	9.2967	0.7033	9.9916	.8
.3	9.2921	9.3006	0.6994	9.9915	.7
.4	9.2959	9.3046	0.6954	9.9913	.6
.5	9.2997	9.3085	0.6915	9.9912	.5
.6	9.3034	9.3123	0.6877	9.9910	.4
.7	9.3070	9.3162	0.6838	9.9909	.3
.8	9.3107	9.3200	0.6800	9.9907	.2
.9	9.3143	9.3237	0.6763	9.9906	78.1
12.0	9.3179	9.3275	0.6725	9.9904	78.0

LOGARITHMS OF FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg	L. Sin	L. Tan	L. Cot	L. Cos	Deg
12.0	9.3179	9.3275	0.6725	9.9904	78.0
.1	9.3214	9.3312	0.6688	9.9902	77.9
.2	9.3250	9.3349	0.6651	9.9901	.8
.3	9.3284	9.3385	0.6615	9.9899	.7
.4	9.3319	9.3422	0.6578	9.9897	.6
.5	9.3353	9.3458	0.6542	9.9896	.5
.6	9.3387	9.3493	0.6507	9.9894	.4
.7	9.3421	9.3529	0.6471	9.9892	.3
.8	9.3455	9.3564	0.6436	9.9891	.2
.9	9.3488	9.3599	0.6401	9.9889	77.1
13.0	9.3521	9.3634	0.6366	9.9887	77.0
.1	9.3554	9.3668	0.6332	9.9885	76.9
.2	9.3586	9.3702	0.6298	9.9884	.8
.3	9.3618	9.3736	0.6264	9.9882	.7
.4	9.3650	9.3770	0.6230	9.9880	.6
.5	9.3682	9.3804	0.6196	9.9878	.5
.6	9.3713	9.3837	0.6163	9.9876	.4
.7	9.3745	9.3870	0.6130	9.9875	.3
.8	9.3775	9.3903	0.6097	9.9873	.2
.9	9.3806	9.3935	0.6065	9.9871	76.1
14.0	9.3837	9.3968	0.6032	9.9869	76.0
.1	9.3867	9.4000	0.6000	9.9867	75.9
.2	9.3897	9.4032	0.5968	9.9865	.8
.3	9.3927	9.4064	0.5936	9.9863	.7
.4	9.3957	9.4095	0.5905	9.9861	.6
.5	9.3986	9.4127	0.5873	9.9859	.5
.6	9.4015	9.4158	0.5842	9.9857	.4
.7	9.4044	9.4189	0.5811	9.9855	.3
.8	9.4073	9.4220	0.5780	9.9853	.2
.9	9.4102	9.4250	0.5750	9.9851	75.1
15.0	9.4130	9.4281	0.5719	9.9849	75.0
.1	9.4158	9.4311	0.5689	9.9847	74.9
.2	9.4186	9.4341	0.5659	9.9845	.8
.3	9.4214	9.4371	0.5629	9.9843	.7
.4	9.4242	9.4400	0.5600	9.9841	.6
.5	9.4269	9.4430	0.5570	9.9839	.5
.6	9.4296	9.4459	0.5541	9.9837	.4
.7	9.4323	9.4488	0.5512	9.9835	.3
.8	9.4350	9.4517	0.5483	9.9833	.2
.9	9.4377	9.4546	0.5454	9.9831	74.1
16.0	9.4403	9.4575	0.5425	9.9828	74.0
.1	9.4430	9.4603	0.5397	9.9826	73.9
.2	9.4456	9.4632	0.5368	9.9824	.8
.3	9.4482	9.4660	0.5340	9.9822	.7
.4	9.4508	9.4688	0.5312	9.9820	.6
.5	9.4533	9.4716	0.5284	9.9817	.5
.6	9.4559	9.4744	0.5256	9.9815	.4
.7	9.4584	9.4771	0.5229	9.9813	.3
.8	9.4609	9.4799	0.5201	9.9811	.2
.9	9.4634	9.4826	0.5174	9.9808	73.1
17.0	9.4659	9.4853	0.5147	9.9806	73.0
.1	9.4684	9.4880	0.5120	9.9804	72.9
.2	9.4709	9.4907	0.5093	9.9801	.8
.3	9.4733	9.4934	0.5066	9.9799	.7
.4	9.4757	9.4961	0.5039	9.9797	.6
.5	9.4781	9.4987	0.5013	9.9794	.5
.6	9.4805	9.5014	0.4986	9.9792	.4
.7	9.4829	9.5040	0.4960	9.9789	.3
.8	9.4853	9.5066	0.4934	9.9787	.2
.9	9.4876	9.5092	0.4908	9.9785	72.1
18.0	9.4900	9.5118	0.4882	9.9782	72.0

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg
18.0	9.4900	9.5118	0.4882	9.9782	72.0
.1	9.4923	9.5143	0.4857	9.9780	71.9
.2	9.4946	9.5169	0.4831	9.9777	.8
.3	9.4969	9.5195	0.4805	9.9775	.7
.4	9.4992	9.5220	0.4780	9.9772	.6
.5	9.5015	9.5245	0.4755	9.9770	.5
.6	9.5037	9.5270	0.4730	9.9767	.4
.7	9.5060	9.5295	0.4705	9.9764	.3
.8	9.5082	9.5320	0.4680	9.9762	.2
.9	9.5104	9.5345	0.4655	9.9759	71.1
19.0	9.5128	9.5370	0.4630	9.9757	71.0
.1	9.5148	9.5394	0.4606	9.9754	70.9
.2	9.5170	9.5419	0.4581	9.9751	.8
.3	9.5192	9.5443	0.4557	9.9749	.7
.4	9.5213	9.5467	0.4533	9.9746	.6
.5	9.5235	9.5491	0.4509	9.9743	.5
.6	9.5256	9.5516	0.4484	9.9741	.4
.7	9.5278	9.5539	0.4461	9.9738	.3
.8	9.5299	9.5563	0.4437	9.9735	.2
.9	9.5320	9.5587	0.4413	9.9733	70.1
20.0	9.5341	9.5611	0.4389	9.9730	70.0
.1	9.5361	9.5634	0.4366	9.9727	69.9
.2	9.5382	9.5658	0.4342	9.9724	.8
.3	9.5402	9.5681	0.4319	9.9722	.7
.4	9.5423	9.5704	0.4296	9.9719	.6
.5	9.5443	9.5727	0.4273	9.9716	.5
.6	9.5463	9.5750	0.4250	9.9713	.4
.7	9.5484	9.5773	0.4227	9.9710	.3
.8	9.5504	9.5796	0.4204	9.9707	.2
.9	9.5523	9.5819	0.4181	9.9704	69.1
21.0	9.5543	9.5842	0.4158	9.9702	69.0
.1	9.5563	9.5864	0.4136	9.9699	68.9
.2	9.5583	9.5887	0.4113	9.9696	.8
.3	9.5602	9.5909	0.4091	9.9693	.7
.4	9.5621	9.5932	0.4068	9.9690	.6
.5	9.5641	9.5954	0.4046	9.9687	.5
.6	9.5660	9.5976	0.4024	9.9684	.4
.7	9.5679	9.5998	0.4002	9.9681	.3
.8	9.5698	9.6020	0.3980	9.9678	.2
.9	9.5717	9.6042	0.3958	9.9675	68.1
22.0	9.5736	9.6064	0.3936	9.9672	68.0
.1	9.5754	9.6086	0.3914	9.9669	67.9
.2	9.5773	9.6108	0.3892	9.9666	.8
.3	9.5792	9.6129	0.3871	9.9662	.7
.4	9.5810	9.6151	0.3849	9.9659	.6
.5	9.5828	9.6172	0.3828	9.9656	.5
.6	9.5847	9.6194	0.3806	9.9653	.4
.7	9.5865	9.6215	0.3785	9.9650	.3
.8	9.5883	9.6236	0.3764	9.9647	.2
.9	9.5901	9.6257	0.3743	9.9643	67.1
23.0	9.5919	9.6279	0.3721	9.9640	67.0
.1	9.5937	9.6300	0.3700	9.9637	66.9
.2	9.5954	9.6321	0.3679	9.9634	.8
.3	9.5972	9.6341	0.3659	9.9631	.7
.4	9.5990	9.6362	0.3638	9.9627	.6
.5	9.6007	9.6383	0.3617	9.9624	.5
.6	9.6024	9.6404	0.3596	9.9621	.4
.7	9.6042	9.6424	0.3576	9.9617	.3
.8	9.6059	9.6445	0.3555	9.9614	.2
.9	9.6076	9.6465	0.3535	9.9611	66.1
24.0	9.6093	9.6486	0.3514	9.9607	66.0

LOGARITHMS OF FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
24.0	9.6093	9.6486	0.3514	9.9607	66.0
1	9.6110	9.6506	0.3494	9.9604	65.9
2	9.6127	9.6527	0.3473	9.9601	.8
3	9.6144	9.6547	0.3453	9.9597	.7
4	9.6161	9.6567	0.3433	9.9594	.6
5	9.6177	9.6587	0.3413	9.9590	.5
6	9.6194	9.6607	0.3393	9.9587	.4
7	9.6210	9.6627	0.3373	9.9583	.3
8	9.6227	9.6647	0.3353	9.9580	.2
9	9.6243	9.6667	0.3333	9.9576	65.1
25.0	9.6259	9.6687	0.3313	9.9573	65.0
1	9.6276	9.6706	0.3294	9.9569	64.9
2	9.6292	9.6726	0.3274	9.9566	.8
3	9.6308	9.6746	0.3254	9.9562	.7
4	9.6324	9.6765	0.3235	9.9558	.6
5	9.6340	9.6785	0.3215	9.9555	.5
6	9.6356	9.6804	0.3196	9.9551	.4
7	9.6371	9.6824	0.3176	9.9548	.3
8	9.6387	9.6843	0.3157	9.9544	.2
9	9.6403	9.6863	0.3137	9.9540	64.1
26.0	9.6418	9.6882	0.3118	9.9537	64.0
1	9.6434	9.6901	0.3099	9.9533	63.9
2	9.6449	9.6920	0.3080	9.9529	.8
3	9.6465	9.6939	0.3061	9.9525	.7
4	9.6480	9.6958	0.3042	9.9522	.6
5	9.6495	9.6977	0.3023	9.9518	.5
6	9.6510	9.6996	0.3004	9.9514	.4
7	9.6526	9.7015	0.2985	9.9510	.3
8	9.6541	9.7034	0.2966	9.9506	.2
9	9.6556	9.7053	0.2947	9.9503	63.1
27.0	9.6570	9.7072	0.2928	9.9499	63.0
1	9.6585	9.7090	0.2910	9.9495	62.9
2	9.6600	9.7109	0.2891	9.9491	.8
3	9.6615	9.7128	0.2872	9.9487	.7
4	9.6629	9.7146	0.2854	9.9483	.6
5	9.6644	9.7165	0.2835	9.9479	.5
6	9.6659	9.7183	0.2817	9.9475	.4
7	9.6673	9.7202	0.2798	9.9471	.3
8	9.6687	9.7220	0.2780	9.9467	.2
9	9.6702	9.7238	0.2762	9.9463	62.1
28.0	9.6716	9.7257	0.2743	9.9459	62.0
1	9.6730	9.7275	0.2725	9.9455	61.9
2	9.6744	9.7293	0.2707	9.9451	.8
3	9.6759	9.7311	0.2689	9.9447	.7
4	9.6773	9.7330	0.2670	9.9443	.6
5	9.6787	9.7348	0.2652	9.9439	.5
6	9.6801	9.7366	0.2634	9.9435	.4
7	9.6814	9.7384	0.2616	9.9431	.3
8	9.6828	9.7402	0.2598	9.9427	.2
9	9.6842	9.7420	0.2580	9.9422	61.1
29.0	9.6856	9.7438	0.2562	9.9418	61.0
1	9.6869	9.7455	0.2545	9.9414	60.9
2	9.6883	9.7473	0.2527	9.9410	.8
3	9.6896	9.7491	0.2509	9.9406	.7
4	9.6910	9.7509	0.2491	9.9401	.6
5	9.6923	9.7526	0.2474	9.9397	.5
6	9.6937	9.7544	0.2456	9.9393	.4
7	9.6950	9.7562	0.2438	9.9388	.3
8	9.6963	9.7579	0.2421	9.9384	.2
9	9.6977	9.7597	0.2403	9.9380	60.1
30.0	9.6990	9.7614	0.2386	9.9375	60.0
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
30.0	9.6990	9.7614	0.2386	9.9375	60.0
1	9.7003	9.7632	0.2368	9.9371	59.9
2	9.7016	9.7649	0.2351	9.9367	.8
3	9.7029	9.7667	0.2333	9.9362	.7
4	9.7042	9.7684	0.2316	9.9358	.6
5	9.7055	9.7701	0.2299	9.9353	.5
6	9.7068	9.7719	0.2281	9.9349	.4
7	9.7080	9.7736	0.2264	9.9344	.3
8	9.7093	9.7753	0.2247	9.9340	.2
9	9.7106	9.7771	0.2229	9.9335	59.1
31.0	9.7118	9.7788	0.2212	9.9331	59.0
1	9.7131	9.7805	0.2195	9.9326	58.9
2	9.7144	9.7822	0.2178	9.9322	.8
3	9.7156	9.7839	0.2161	9.9317	.7
4	9.7168	9.7856	0.2144	9.9312	.6
5	9.7181	9.7873	0.2127	9.9308	.5
6	9.7193	9.7890	0.2110	9.9303	.4
7	9.7205	9.7907	0.2093	9.9298	.3
8	9.7218	9.7924	0.2076	9.9294	.2
9	9.7230	9.7941	0.2059	9.9289	58.1
32.0	9.7242	9.7958	0.2042	9.9284	58.0
1	9.7254	9.7975	0.2025	9.9279	57.9
2	9.7266	9.7992	0.2008	9.9275	.8
3	9.7278	9.8008	0.1992	9.9270	.7
4	9.7290	9.8025	0.1975	9.9265	.6
5	9.7302	9.8042	0.1958	9.9260	.5
6	9.7314	9.8059	0.1941	9.9255	.4
7	9.7326	9.8075	0.1925	9.9251	.3
8	9.7338	9.8092	0.1908	9.9246	.2
9	9.7349	9.8109	0.1891	9.9241	57.1
33.0	9.7361	9.8125	0.1875	9.9236	57.0
1	9.7373	9.8142	0.1858	9.9231	56.9
2	9.7384	9.8158	0.1842	9.9226	.8
3	9.7396	9.8175	0.1825	9.9221	.7
4	9.7407	9.8191	0.1809	9.9216	.6
5	9.7419	9.8208	0.1792	9.9211	.5
6	9.7430	9.8224	0.1776	9.9206	.4
7	9.7442	9.8241	0.1759	9.9201	.3
8	9.7453	9.8257	0.1743	9.9196	.2
9	9.7464	9.8274	0.1726	9.9191	56.1
34.0	9.7476	9.8290	0.1710	9.9186	56.0
1	9.7487	9.8306	0.1694	9.9181	55.9
2	9.7498	9.8323	0.1677	9.9175	.8
3	9.7509	9.8339	0.1661	9.9170	.7
4	9.7520	9.8355	0.1645	9.9165	.6
5	9.7531	9.8371	0.1629	9.9160	.5
6	9.7542	9.8388	0.1612	9.9155	.4
7	9.7553	9.8404	0.1596	9.9149	.3
8	9.7564	9.8420	0.1580	9.9144	.2
9	9.7575	9.8436	0.1564	9.9139	55.1
35.0	9.7586	9.8452	0.1548	9.9134	55.0
1	9.7597	9.8468	0.1532	9.9128	54.9
2	9.7607	9.8484	0.1516	9.9123	.8
3	9.7618	9.8501	0.1499	9.9118	.7
4	9.7629	9.8517	0.1483	9.9112	.6
5	9.7640	9.8533	0.1467	9.9107	.5
6	9.7650	9.8549	0.1451	9.9101	.4
7	9.7661	9.8565	0.1435	9.9096	.3
8	9.7671	9.8581	0.1419	9.9091	.2
9	9.7682	9.8597	0.1403	9.9085	54.1
36.0	9.7692	9.8613	0.1387	9.9080	54.0
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

LOGARITHMS OF FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
36.0	9.7692	9.8613	0.1387	9.9080	54.0
.1	9.7703	9.8629	0.1371	9.9074	53.9
.2	9.7713	9.8644	0.1356	9.9069	.8
.3	9.7723	9.8660	0.1340	9.9063	.7
.4	9.7734	9.8676	0.1324	9.9057	.6
.5	9.7744	9.8692	0.1308	9.9052	.5
.6	9.7754	9.8708	0.1292	9.9046	.4
.7	9.7764	9.8724	0.1276	9.9041	.3
.8	9.7774	9.8740	0.1260	9.9035	.2
.9	9.7785	9.8755	0.1245	9.9029	53.1
37.0	9.7795	9.8771	0.1229	9.9023	53.0
.1	9.7805	9.8787	0.1213	9.9018	52.9
.2	9.7815	9.8803	0.1197	9.9012	.8
.3	9.7825	9.8818	0.1182	9.9006	.7
.4	9.7835	9.8834	0.1166	9.9000	.6
.5	9.7844	9.8850	0.1150	9.8995	.5
.6	9.7854	9.8865	0.1135	9.8989	.4
.7	9.7864	9.8881	0.1119	9.8983	.3
.8	9.7874	9.8897	0.1103	9.8977	.2
.9	9.7884	9.8912	0.1088	9.8971	52.1
38.0	9.7893	9.8928	0.1072	9.8965	52.0
.1	9.7903	9.8944	0.1056	9.8959	51.9
.2	9.7913	9.8959	0.1041	9.8953	.8
.3	9.7922	9.8975	0.1025	9.8947	.7
.4	9.7932	9.8990	0.1010	9.8941	.6
.5	9.7941	9.9006	0.0994	9.8935	.5
.6	9.7951	9.9022	0.0978	9.8929	.4
.7	9.7960	9.9037	0.0963	9.8923	.3
.8	9.7970	9.9053	0.0947	9.8917	.2
.9	9.7979	9.9068	0.0932	9.8911	51.1
39.0	9.7989	9.9084	0.0916	9.8905	51.0
.1	9.7998	9.9099	0.0901	9.8899	50.9
.2	9.8007	9.9115	0.0885	9.8893	.8
.3	9.8017	9.9130	0.0870	9.8887	.7
.4	9.8026	9.9146	0.0854	9.8880	.6
.5	9.8035	9.9161	0.0839	9.8874	.5
.6	9.8044	9.9176	0.0824	9.8868	.4
.7	9.8053	9.9192	0.0808	9.8862	.3
.8	9.8063	9.9207	0.0793	9.8855	.2
.9	9.8072	9.9223	0.0777	9.8849	50.1
40.0	9.8081	9.9238	0.0762	9.8843	50.0
.1	9.8090	9.9254	0.0746	9.8836	49.9
.2	9.8099	9.9269	0.0731	9.8830	.8
.3	9.8101	9.9284	0.0716	9.8823	.7
.4	9.8117	9.9300	0.0700	9.8817	.6
.5	9.8125	9.9315	0.0685	9.8810	.5
.6	9.8134	9.9330	0.0670	9.8804	.4
.7	9.8143	9.9346	0.0654	9.8797	.3
.8	9.8152	9.9361	0.0639	9.8791	.2
.9	9.8161	9.9376	0.0624	9.8784	49.1
41.0	9.8169	9.9392	0.0608	9.8778	49.0
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
41.0	9.8169	9.9392	0.0608	9.8778	49.0
.1	9.8178	9.9407	0.0593	9.8771	48.9
.2	9.8187	9.9422	0.0578	9.8765	.8
.3	9.8195	9.9438	0.0562	9.8758	.7
.4	9.8204	9.9453	0.0547	9.8751	.6
.5	9.8213	9.9468	0.0532	9.8745	.5
.6	9.8221	9.9483	0.0517	9.8738	.4
.7	9.8230	9.9499	0.0501	9.8731	.3
.8	9.8238	9.9514	0.0486	9.8724	.2
.9	9.8247	9.9529	0.0471	9.8718	48.1
42.0	9.8255	9.9544	0.0456	9.8711	48.0
.1	9.8264	9.9560	0.0440	9.8704	47.9
.2	9.8272	9.9575	0.0425	9.8697	.8
.3	9.8280	9.9590	0.0410	9.8690	.7
.4	9.8289	9.9605	0.0395	9.8683	.6
.5	9.8297	9.9621	0.0379	9.8676	.5
.6	9.8305	9.9636	0.0364	9.8669	.4
.7	9.8313	9.9651	0.0349	9.8662	.3
.8	9.8322	9.9666	0.0334	9.8655	.2
.9	9.8330	9.9681	0.0319	9.8648	47.1
43.0	9.8338	9.9697	0.0303	9.8641	47.0
.1	9.8346	9.9712	0.0288	9.8634	46.9
.2	9.8354	9.9727	0.0273	9.8627	.8
.3	9.8362	9.9742	0.0258	9.8620	.7
.4	9.8370	9.9757	0.0243	9.8613	.6
.5	9.8378	9.9772	0.0228	9.8606	.5
.6	9.8386	9.9788	0.0212	9.8598	.4
.7	9.8394	9.9803	0.0197	9.8591	.3
.8	9.8402	9.9818	0.0182	9.8584	.2
.9	9.8410	9.9833	0.0167	9.8577	46.1
44.0	9.8418	9.9848	0.0152	9.8569	46.0
.1	9.8426	9.9864	0.0136	9.8562	45.9
.2	9.8433	9.9879	0.0121	9.8555	.8
.3	9.8441	9.9894	0.0106	9.8547	.7
.4	9.8449	9.9909	0.0091	9.8540	.6
.5	9.8457	9.9924	0.0076	9.8532	.5
.6	9.8464	9.9939	0.0061	9.8525	.4
.7	9.8472	9.9955	0.0045	9.8517	.3
.8	9.8480	9.9970	0.0030	9.8510	.2
.9	9.8487	9.9985	0.0015	9.8502	45.1
45.0	9.8495	0.0000	0.0000	9.8495	45.0
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

NATURAL FUNCTIONS FOR ANGLES IN RADIANS

Rad.	Sin	Tan	Cot	Cos
.00	.00000	.00000	∞	1.0000
.01	.01000	.01000	99.997	.99995
.02	.02000	.02000	49.993	.99980
.03	.03000	.03001	33.323	.99955
.04	.03999	.04002	24.987	.99920
.05	.04998	.05004	19.983	.99875
.06	.05996	.06007	16.647	.99820
.07	.06994	.07011	14.262	.99755
.08	.07991	.08017	12.473	.99680
.09	.08988	.09024	11.081	.99595
.10	.09983	.10033	9.9666	.99500
.11	.10978	.11045	9.0542	.99396
.12	.11971	.12058	8.2933	.99281
.13	.12963	.13074	7.6489	.99156
.14	.13954	.14092	7.0961	.99022
.15	.14944	.15114	6.6166	.98877
.16	.15932	.16138	6.1966	.98723
.17	.16918	.17166	5.8256	.98558
.18	.17903	.18197	5.4954	.98384
.19	.18886	.19232	5.1997	.98200
.20	.19867	.20271	4.9332	.98007
.21	.20846	.21314	4.6917	.97803
.22	.21823	.22362	4.4719	.97590
.23	.22798	.23414	4.2709	.97367
.24	.23770	.24472	4.0864	.97134
.25	.24740	.25534	3.9163	.96891
.26	.25708	.26602	3.7591	.96639
.27	.26673	.27676	3.6133	.96377
.28	.27636	.28755	3.4776	.96106
.29	.28595	.29841	3.3511	.95824
.30	.29552	.30934	3.2327	.95534
.31	.30506	.32033	3.1218	.95233
.32	.31457	.33139	3.0176	.94924
.33	.32404	.34252	2.9195	.94604
.34	.33349	.35374	2.8270	.94275
.35	.34290	.36503	2.7395	.93937
.36	.35227	.37640	2.6567	.93590
.37	.36162	.38786	2.5782	.93233
.38	.37092	.39941	2.5037	.92866
.39	.38019	.41105	2.4328	.92491
.40	.38942	.42279	2.3652	.92106
.41	.39861	.43463	2.3008	.91712
.42	.40776	.44657	2.2393	.91309
.43	.41687	.45862	2.1804	.90897
.44	.42594	.47078	2.1241	.90475
.45	.43497	.48306	2.0702	.90045
.46	.44395	.49545	2.0184	.89605
.47	.45289	.50797	1.9686	.89157
.48	.46178	.52061	1.9208	.88699
.49	.47063	.53339	1.8748	.88233
.50	.47943	.54630	1.8305	.87758
Rad.	Sin	Tan	Cot	Cos

Rad.	Sin	Tan	Cot	Cos
.50	.47943	.54630	1.8305	.87758
.51	.48818	.55936	1.7878	.87274
.52	.49688	.57256	1.7465	.86782
.53	.50553	.58592	1.7067	.86281
.54	.51414	.59943	1.6683	.85771
.55	.52269	.61311	1.6310	.85252
.56	.53119	.62695	1.5950	.84726
.57	.53963	.64097	1.5601	.84190
.58	.54802	.65517	1.5263	.83646
.59	.55636	.66956	1.4935	.83094
.60	.56464	.68414	1.4617	.82534
.61	.57287	.69892	1.4308	.81965
.62	.58104	.71391	1.4007	.81388
.63	.58914	.72911	1.3715	.80803
.64	.59720	.74454	1.3431	.80210
.65	.60519	.76020	1.3154	.79608
.66	.61312	.77610	1.2885	.78999
.67	.62099	.79225	1.2622	.78382
.68	.62879	.80866	1.2366	.77757
.69	.63654	.82534	1.2116	.77125
.70	.64422	.84229	1.1872	.76484
.71	.65183	.85953	1.1634	.75836
.72	.65938	.87707	1.1402	.75181
.73	.66687	.89492	1.1174	.74517
.74	.67429	.91309	1.0952	.73847
.75	.68164	.93160	1.0734	.73169
.76	.68892	.95045	1.0521	.72484
.77	.69614	.96967	1.0313	.71791
.78	.70328	.98926	1.0109	.71091
.79	.71035	1.0092	.99084	.70385
.80	.71736	1.0296	.97121	.69671
.81	.72429	1.0505	.95197	.68950
.82	.73115	1.0717	.93309	.68222
.83	.73793	1.0934	.91455	.67488
.84	.74464	1.1156	.89635	.66746
.85	.75128	1.1383	.87848	.65998
.86	.75784	1.1616	.86091	.65244
.87	.76433	1.1853	.84365	.64483
.88	.77074	1.2097	.82668	.63715
.89	.77707	1.2346	.80998	.62941
.90	.78333	1.2602	.79355	.62161
.91	.78950	1.2864	.77738	.61375
.92	.79560	1.3133	.76146	.60582
.93	.80162	1.3409	.74578	.59783
.94	.80756	1.3692	.73034	.58979
.95	.81342	1.3984	.71511	.58168
.96	.81919	1.4284	.70010	.57352
.97	.82489	1.4592	.68531	.56530
.98	.83050	1.4910	.67071	.55702
.99	.83603	1.5237	.65631	.54869
1.00	.84147	1.5574	.64209	.54030
Rad.	Sin	Tan	Cot	Cos

FUNCTIONS FOR ANGLES IN RADIANS (Continued)

Rad.	Sin	Tan	Cot	Cos
1.00	.84147	1.5574	.64209	.54030
1.01	.84683	1.5922	.62806	.53186
1.02	.85211	1.6281	.61420	.52337
1.03	.85730	1.6652	.60051	.51482
1.04	.86240	1.7036	.58699	.50622
1.05	.86742	1.7433	.57362	.49757
1.06	.87236	1.7844	.56040	.48887
1.07	.87720	1.8270	.54734	.48012
1.08	.88196	1.8712	.53441	.47133
1.09	.88663	1.9171	.52162	.46249
1.10	.89121	1.9648	.50897	.45360
1.11	.89570	2.0143	.49644	.44466
1.12	.90010	2.0660	.48404	.43568
1.13	.90441	2.1193	.47175	.42666
1.14	.90863	2.1759	.45959	.41759
1.15	.91276	2.2345	.44753	.40849
1.16	.91680	2.2958	.43558	.39934
1.17	.92075	2.3600	.42373	.39015
1.18	.92461	2.4273	.41199	.38092
1.19	.92837	2.4979	.40034	.37166
1.20	.93204	2.5722	.38878	.36236
1.21	.93562	2.6503	.37731	.35302
1.22	.93910	2.7328	.36593	.34365
1.23	.94249	2.8198	.35463	.33424
1.24	.94578	2.9119	.34341	.32480
1.25	.94898	3.0096	.33227	.31532
1.26	.95209	3.1133	.32121	.30582
1.27	.95510	3.2236	.31021	.29628
1.28	.95802	3.3413	.29928	.28672
1.29	.96084	3.4672	.28842	.27712
1.30	.96356	3.6021	.27762	.26750
1.31	.96618	3.7471	.26687	.25785
1.32	.96872	3.9033	.25619	.24818
1.33	.97115	4.0723	.24556	.23848
1.34	.97348	4.2556	.23498	.22875
1.35	.97572	4.4552	.22446	.21901
1.36	.97786	4.6734	.21398	.20924
1.37	.97991	4.9131	.20354	.19945
1.38	.98185	5.1774	.19315	.18964
1.39	.98370	5.4707	.18279	.17981
1.40	.98545	5.7979	.17248	.16997
1.41	.98710	6.1654	.16220	.16010
1.42	.98865	6.5811	.15195	.15023
1.43	.99010	7.0555	.14173	.14033
1.44	.99146	7.6018	.13155	.13042
1.45	.99271	8.2381	.12139	.12050
1.46	.99387	8.9886	.11125	.11057
1.47	.99492	9.8874	.10114	.10063
1.48	.99588	10.983	.09105	.09067
1.49	.99674	12.350	.08097	.08071
1.50	.99749	14.101	.07091	.07074
Rad.	Sin	Tan	Cot	Cos

Rad.	Sin	Tan	Cot	Cos
1.50	.99749	14.101	.07091	.07074
1.51	.99815	16.428	.06087	.06076
1.52	.99871	19.670	.05084	.05077
1.53	.99917	24.498	.04082	.04079
1.54	.99953	32.461	.03081	.03079
1.55	.99978	48.078	.02080	.02079
1.56	.99994	92.621	.01080	.01080
1.57	1.0000	1255.8	.00080	.00080
1.58	.99996	-108.65	-.00920	-.00920
1.59	.99982	-52.067	-.01921	-.01920
1.60	.99957	-34.233	-.02921	-.02920
1.61	.99923	-25.495	-.03922	-.03919
1.62	.99879	-20.307	-.04924	-.04918
1.63	.99825	-16.871	-.05927	-.05917
1.64	.99761	-14.427	-.06931	-.06915
1.65	.99687	-12.599	-.07937	-.07912
1.66	.99602	-11.181	-.08944	-.08909
1.67	.99508	-10.047	-.09953	-.09904
1.68	.99404	-9.1208	-.10964	-.10899
1.69	.99290	-8.3492	-.11977	-.11892
1.70	.99166	-7.6966	-.12993	-.12884
1.71	.99033	-7.1373	-.14011	-.13875
1.72	.98889	-6.6524	-.15032	-.14865
1.73	.98735	-6.2281	-.16056	-.15853
1.74	.98572	-5.8535	-.17084	-.16840
1.75	.98399	-5.5204	-.18115	-.17825
1.76	.98215	-5.2221	-.19149	-.18808
1.77	.98022	-4.9534	-.20188	-.19789
1.78	.97820	-4.7101	-.21231	-.20768
1.79	.97607	-4.4887	-.22278	-.21745
1.80	.97385	-4.2863	-.23330	-.22720
1.81	.97153	-4.1005	-.24387	-.23693
1.82	.96911	-3.9294	-.25449	-.24663
1.83	.96659	-3.7712	-.26517	-.25631
1.84	.96398	-3.6245	-.27590	-.26596
1.85	.96128	-3.4881	-.28669	-.27559
1.86	.95847	-3.3608	-.29755	-.28519
1.87	.95557	-3.2419	-.30846	-.29476
1.88	.95258	-3.1304	-.31945	-.30430
1.89	.94949	-3.0257	-.33051	-.31381
1.90	.94630	-2.9271	-.34164	-.32329
1.91	.94302	-2.8341	-.35284	-.33274
1.92	.93965	-2.7463	-.36413	-.34215
1.93	.93618	-2.6632	-.37549	-.35153
1.94	.93262	-2.5843	-.38695	-.36087
1.95	.92896	-2.5095	-.39849	-.37018
1.96	.92521	-2.4383	-.41012	-.37945
1.97	.92137	-2.3705	-.42185	-.38868
1.98	.91744	-2.3058	-.43368	-.39788
1.99	.91341	-2.2441	-.44562	-.40703
2.00	.90930	-2.1850	-.45766	-.41615
Rad.	Sin	Tan	Cot	Cos

LOGARITHMS OF THE FUNCTIONS FOR ANGLES IN RADIANS

Rad.	L. Sin	L. Tan	L. Cot	L. Cos
.00	— ∞	— ∞	∞	0.00000
.01	7.99999	8.00001	1.99999	9.99998
.02	8.30100	8.30109	1.69891	9.99991
.03	8.47706	8.47725	1.52275	9.99980
.04	8.60194	8.60229	1.39771	9.99965
.05	8.69879	8.69933	1.30067	9.99946
.06	8.77789	8.77867	1.22133	9.99922
.07	8.84474	8.84581	1.15419	9.99894
.08	8.90263	8.90402	1.09598	9.99861
.09	8.95366	8.95542	1.04458	9.99824
.10	8.99928	9.00145	0.99855	9.99782
.11	9.04052	9.04315	0.95685	9.99737
.12	9.07814	9.08127	0.91873	9.99687
.13	9.11272	9.11640	0.88360	9.99632
.14	9.14471	9.14898	0.85102	9.99573
.15	9.17446	9.17937	0.82063	9.99510
.16	9.20227	9.20785	0.79215	9.99442
.17	9.22836	9.23466	0.76534	9.99369
.18	9.25292	9.26000	0.74000	9.99293
.19	9.27614	9.28402	0.71598	9.99211
.20	9.29813	9.30688	0.69312	9.99126
.21	9.31902	9.32867	0.67133	9.99035
.22	9.33891	9.34951	0.65049	9.98940
.23	9.35789	9.36948	0.63052	9.98841
.24	9.37603	9.38866	0.61134	9.98737
.25	9.39341	9.40712	0.59288	9.98628
.26	9.41007	9.42492	0.57508	9.98515
.27	9.42607	9.44210	0.55790	9.98397
.28	9.44147	9.45872	0.54128	9.98275
.29	9.45629	9.47482	0.52518	9.98148
.30	9.47059	9.49043	0.50957	9.98016
.31	9.48438	9.50559	0.49441	9.97879
.32	9.49771	9.52034	0.47966	9.97737
.33	9.51060	9.53469	0.46531	9.97591
.34	9.52308	9.54868	0.45132	9.97440
.35	9.53516	9.56233	0.43767	9.97284
.36	9.54688	9.57565	0.42435	9.97123
.37	9.55825	9.58868	0.41132	9.96957
.38	9.56928	9.60142	0.39858	9.96786
.39	9.58000	9.61390	0.38610	9.96610
.40	9.59042	9.62613	0.37387	9.96429
.41	9.60055	9.63812	0.36188	9.96243
.42	9.61041	9.64989	0.35011	9.96051
.43	9.62000	9.66145	0.33855	9.95855
.44	9.62935	9.67282	0.32718	9.95653
.45	9.63845	9.68400	0.31600	9.95446
.46	9.64733	9.69500	0.30500	9.95233
.47	9.65599	9.70583	0.29417	9.95015
.48	9.66443	9.71651	0.28349	9.94792
.49	9.67268	9.72704	0.27296	9.94563
.50	9.68072	9.73743	0.26257	9.94329
Rad	L. Sin	L. Tan	L. Cot	L. Cos

Rad.	L. Sin	L. Tan	L. Cot	L. Cos
.50	9.68072	9.73743	0.26257	9.94329
.51	9.68858	9.74769	0.25231	9.94089
.52	9.69625	9.75782	0.24218	9.93843
.53	9.70375	9.76784	0.23216	9.93591
.54	9.71108	9.77774	0.22226	9.93334
.55	9.71824	9.78754	0.21246	9.93071
.56	9.72525	9.79723	0.20277	9.92801
.57	9.73210	9.80684	0.19316	9.92526
.58	9.73880	9.81635	0.18365	9.92245
.59	9.74536	9.82579	0.17421	9.91957
.60	9.75177	9.83514	0.16486	9.91663
.61	9.75805	9.84443	0.15557	9.91363
.62	9.76420	9.85364	0.14636	9.91056
.63	9.77022	9.86280	0.13720	9.90743
.64	9.77612	9.87189	0.12811	9.90423
.65	9.78189	9.88093	0.11907	9.90096
.66	9.78754	9.88992	0.11008	9.89762
.67	9.79308	9.89886	0.10114	9.89422
.68	9.79851	9.90777	0.09223	9.89074
.69	9.80382	9.91663	0.08337	9.88719
.70	9.80903	9.92546	0.07454	9.88357
.71	9.81414	9.93426	0.06574	9.87988
.72	9.81914	9.94303	0.05697	9.87611
.73	9.82404	9.95178	0.04822	9.87226
.74	9.82885	9.96051	0.03949	9.86833
.75	9.83355	9.96923	0.03077	9.86433
.76	9.83817	9.97793	0.02207	9.86024
.77	9.84269	9.98662	0.01338	9.85607
.78	9.84713	9.99531	0.00469	9.85182
.79	9.85147	0.00400	9.99600	9.84748
.80	9.85573	0.01268	9.98732	9.84305
.81	9.85991	0.02138	9.97862	9.83853
.82	9.86400	0.03008	9.96992	9.83393
.83	9.86802	0.03879	9.96121	9.82922
.84	9.87195	0.04752	9.95248	9.82443
.85	9.87580	0.05627	9.94373	9.81953
.86	9.87958	0.06504	9.93496	9.81454
.87	9.88328	0.07384	9.92616	9.80944
.88	9.88691	0.08266	9.91734	9.80424
.89	9.89046	0.09153	9.90847	9.79894
.90	9.89394	0.10043	9.89957	9.79352
.91	9.89735	0.10937	9.89063	9.78799
.92	9.90070	0.11835	9.88165	9.78234
.93	9.90397	0.12739	9.87261	9.77658
.94	9.90717	0.13648	9.86352	9.77070
.95	9.91031	0.14563	9.85437	9.76469
.96	9.91339	0.15484	9.84516	9.75855
.97	9.91639	0.16412	9.83588	9.75228
.98	9.91934	0.17347	9.82653	9.74587
.99	9.92222	0.18289	9.81711	9.73933
1.00	9.92504	0.19240	9.80760	9.73264
Rad.	L. Sin	L. Tan	L. Cot	L. Cos

LOGARITHMS OF FUNCTIONS FOR ANGLES IN RADIANs (Continued)

Rad.	L. Sin	L. Tan	L. Cot	L. Cos
1.00	9.92504	0.19240	9.80760	9.73264
1.01	9.92780	0.20200	9.79800	9.72580
1.02	9.93049	0.21169	9.78831	9.71881
1.03	9.93313	0.22148	9.77852	9.71165
1.04	9.93571	0.23137	9.76863	9.70434
1.05	9.93823	0.24138	9.75862	9.69686
1.06	9.94069	0.25150	9.74850	9.68920
1.07	9.94310	0.26175	9.73825	9.68135
1.08	9.94545	0.27212	9.72788	9.67332
1.09	9.94774	0.28264	9.71736	9.66510
1.10	9.94998	0.29331	9.70669	9.65667
1.11	9.95216	0.30413	9.69587	9.64803
1.12	9.95429	0.31512	9.68488	9.63917
1.13	9.95637	0.32628	9.67372	9.63008
1.14	9.95839	0.33763	9.66237	9.62075
1.15	9.96036	0.34918	9.65082	9.61118
1.16	9.96228	0.36093	9.63907	9.60134
1.17	9.96414	0.37291	9.62709	9.59123
1.18	9.96596	0.38512	9.61488	9.58084
1.19	9.96772	0.39757	9.60243	9.57015
1.20	9.96943	0.41030	9.58970	9.55914
1.21	9.97110	0.42330	9.57670	9.54780
1.22	9.97271	0.43660	9.56340	9.53611
1.23	9.97428	0.45022	9.54978	9.52406
1.24	9.97579	0.46418	9.53582	9.51161
1.25	9.97726	0.47850	9.52150	9.49875
1.26	9.97868	0.49322	9.50678	9.48546
1.27	9.98005	0.50835	9.49165	9.47170
1.28	9.98137	0.52392	9.47608	9.45745
1.29	9.98265	0.53998	9.46002	9.44267
1.30	9.98388	0.55656	9.44344	9.42732
1.31	9.98506	0.57369	9.42631	9.41137
1.32	9.98620	0.59144	9.40856	9.39476
1.33	9.98729	0.60984	9.39016	9.37744
1.34	9.98833	0.62896	9.37104	9.35937
1.35	9.98933	0.64887	9.35113	9.34046
1.36	9.99028	0.66964	9.33036	9.32064
1.37	9.99119	0.69135	9.30865	9.29983
1.38	9.99205	0.71411	9.28589	9.27793
1.39	9.99286	0.73804	9.26196	9.25482
1.40	9.99363	0.76327	9.23673	9.23036
1.41	9.99436	0.78996	9.21004	9.20440
1.42	9.99504	0.81830	9.18170	9.17674
1.43	9.99568	0.84853	9.15147	9.14716
1.44	9.99627	0.88092	9.11908	9.11536
1.45	9.99682	0.91583	9.08417	9.08100
1.46	9.99733	0.95369	9.04631	9.04364
1.47	9.99779	0.99508	9.00492	9.00271
1.48	9.99821	1.04074	8.95926	8.95747
1.49	9.99858	1.09166	8.90834	8.90692
1.50	9.99891	1.14926	8.85074	8.84965
Rad.	L. Sin	L. Tan	L. Cot	L. Cos

Rad.	L. Sin	L. Tan	L. Cot	L. Cos
1.50	9.99891	1.14926	8.85074	8.84965
1.51	9.99920	1.21559	8.78441	8.78361
1.52	9.99944	1.29379	8.70621	8.70565
1.53	9.99964	1.38914	8.61086	8.61050
1.54	9.99979	1.51136	8.48864	8.48843
1.55	9.99991	1.68195	8.31805	8.31796
1.56	9.99997	1.96671	8.03329	8.03327
1.57	0.00000	3.09891	6.90109	6.90109
1.58	9.99998	2.03603*	7.96397*	7.96396*
1.59	9.99992	1.71656	8.28344	8.28336
1.60	9.99981	1.53444	8.46556	8.46538
1.61	9.99967	1.40645	8.59355	8.59323
1.62	9.99947	1.30765	8.69235	8.69182
1.63	9.99924	1.22714	8.77286	8.77209
1.64	9.99896	1.15918	8.84082	8.83978
1.65	9.99864	1.10035	8.89965	8.89829
1.66	9.99827	1.04847	8.95154	8.94981
1.67	9.99786	1.00204	8.99796	8.99582
1.68	9.99741	0.96003	9.03997	9.03737
1.69	9.99691	0.92165	9.07835	9.07526
1.70	9.99636	0.88630	9.11370	9.11007
1.71	9.99578	0.85333	9.14647	9.14225
1.72	9.99515	0.82298	9.17702	9.17217
1.73	9.99447	0.79436	9.20564	9.20012
1.74	9.99375	0.76742	9.23258	9.22634
1.75	9.99299	0.74197	9.25803	9.25102
1.76	9.99218	0.71784	9.28216	9.27434
1.77	9.99133	0.69490	9.30510	9.29642
1.78	9.99043	0.67303	9.32697	9.31740
1.79	9.98948	0.65212	9.34788	9.33736
1.80	9.98849	0.63208	9.36792	9.35641
1.81	9.98745	0.61284	9.38716	9.37462
1.82	9.98637	0.59432	9.40568	9.39205
1.83	9.98524	0.57648	9.42352	9.40877
1.84	9.98407	0.55925	9.44075	9.42482
1.85	9.98285	0.54258	9.45742	9.44026
1.86	9.98158	0.52645	9.47355	9.45513
1.87	9.98026	0.51080	9.48920	9.46947
1.88	9.97890	0.49560	9.50440	9.48330
1.89	9.97749	0.48082	9.51918	9.49667
1.90	9.97603	0.46644	9.53356	9.50959
1.91	9.97452	0.45242	9.54758	9.52210
1.92	9.97296	0.43875	9.56125	9.53422
1.93	9.97136	0.42549	9.57460	9.54597
1.94	9.96970	0.41235	9.58765	9.55735
1.95	9.96800	0.39958	9.60042	9.56841
1.96	9.96624	0.38708	9.61292	9.57916
1.97	9.96443	0.37484	9.62516	9.58960
1.98	9.96258	0.36283	9.63717	9.59975
1.99	9.96067	0.35104	9.64896	9.60963
2.00	9.95871	0.33946	9.66054	9.61925
Rad.	L. Sin	L. Tan	L. Cot	L. Cos

* Values of the cosine, tangent and cotangent for angles in the table, 1.58 radians and above, are negative.

HAVERSINES

The following table gives the values of the haversines and their logarithms for angles from 0 to 180° at 10 minute intervals. Characteristics of the logarithms are omitted.

°	0'		10'		20'		30'		40'		50'	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
0	.0000	—	.0000	6̄.3254	.0000	6̄.9275	.0000	5̄.2796	.0000	5̄.5295	.0001	5̄.7233
1	.0001	5̄.8817	.0001	.0156	.0001	.1316	.0002	.2339	.0002	.3234	.0003	.4081
2	.0003	.4837	.0004	.5532	.0004	.6176	.0005	.6775	.0005	.7336	.0006	.7862
3	.0007	.8358	.0008	.8828	.0008	.9273	.0009	.9697	.0010	.1010	.0011	.0457
4	.0012	.0856	.0013	.1211	.0014	.1551	.0015	.1879	.0017	.2195	.0018	.2499
5	.0019	.2794	.0020	.3078	.0022	.3354	.0023	.3621	.0024	.3880	.0026	.4132
6	.0027	.4376	.0029	.4614	.0031	.4845	.0032	.5071	.0034	.5290	.0036	.5504
7	.0037	.5714	.0039	.5918	.0041	.6117	.0043	.6312	.0045	.6503	.0047	.6689
8	.0049	.6872	.0051	.7051	.0053	.7226	.0055	.7397	.0057	.7566	.0059	.7731
9	.0062	.7893	.0064	.8052	.0066	.8208	.0069	.8361	.0071	.8512	.0073	.8660
10	.0076	.8806	.0079	.8949	.0081	.9090	.0084	.9229	.0086	.9365	.0089	.9491
11	.0092	.9631	.0095	.9762	.0097	.9890	.0100	.0016	.0103	.0141	.0106	.0264
12	.0109	.0385	.0112	.0504	.0115	.0622	.0119	.0738	.0122	.0852	.0125	.0966
13	.0128	.1077	.0131	.1187	.0135	.1296	.0138	.1404	.0142	.1510	.0145	.1614
14	.0149	.1718	.0152	.1820	.0156	.1921	.0159	.2021	.0163	.2120	.0167	.2217
15	.0170	.2314	.0174	.2409	.0178	.2504	.0182	.2597	.0186	.2689	.0190	.2781
16	.0194	.2871	.0198	.2961	.0202	.3049	.0206	.3137	.0210	.3223	.0214	.3309
17	.0218	.3394	.0223	.3478	.0227	.3561	.0231	.3644	.0236	.3726	.0240	.3807
18	.0245	.3887	.0249	.3966	.0254	.4045	.0258	.4123	.0263	.4200	.0268	.4276
19	.0272	.4352	.0277	.4427	.0282	.4502	.0287	.4576	.0292	.4649	.0297	.4721
20	.0302	.4793	.0307	.4865	.0312	.4935	.0317	.5006	.0322	.5075	.0327	.5144
21	.0332	.5213	.0337	.5281	.0343	.5348	.0348	.5415	.0353	.5481	.0359	.5547
22	.0364	.5612	.0370	.5677	.0375	.5741	.0381	.5805	.0386	.5868	.0392	.5931
23	.0397	.5993	.0403	.6055	.0409	.6116	.0415	.6177	.0421	.6238	.0426	.6298
24	.0432	.6358	.0438	.6417	.0444	.6476	.0450	.6534	.0456	.6592	.0462	.6650
25	.0468	.6707	.0475	.6764	.0481	.6820	.0487	.6876	.0493	.6932	.0500	.6987
26	.0506	.7042	.0512	.7096	.0519	.7150	.0525	.7204	.0532	.7258	.0538	.7311
27	.0545	.7364	.0552	.7416	.0558	.7468	.0565	.7520	.0572	.7572	.0578	.7623
28	.0585	.7674	.0592	.7724	.0599	.7774	.0606	.7824	.0613	.7874	.0620	.7923
29	.0627	.7972	.0634	.8021	.0641	.8069	.0648	.8117	.0655	.8165	.0663	.8213
30	.0670	.8260	.0677	.8307	.0684	.8354	.0692	.8400	.0699	.8446	.0707	.8492
31	.0714	.8538	.0722	.8583	.0729	.8629	.0737	.8673	.0744	.8718	.0752	.8763
32	.0760	.8807	.0767	.8851	.0775	.8894	.0783	.8938	.0791	.8981	.0799	.9024
33	.0807	.9067	.0815	.9109	.0823	.9152	.0831	.9194	.0839	.9236	.0847	.9277
34	.0855	.9319	.0863	.9360	.0871	.9401	.0879	.9442	.0888	.9482	.0896	.9523
35	.0904	.9563	.0913	.9603	.0921	.9643	.0929	.9682	.0938	.9721	.0946	.9761
36	.0955	.9800	.0963	.9838	.0972	.9877	.0981	.9915	.0989	.9954	.0998	.9992
37	.1007	.0030	.1016	.0067	.1024	.0105	.1033	.0142	.1042	.0179	.1051	.0218
38	.1060	.0253	.1069	.0289	.1078	.0326	.1087	.0362	.1096	.0398	.1105	.0344
39	.1114	.0470	.1123	.0505	.1133	.0541	.1142	.0576	.1151	.0611	.1160	.0646
40	.1170	.0681	.1179	.0716	.1189	.0750	.1198	.0784	.1207	.0819	.1217	.0853
41	.1226	.0887	.1236	.0920	.1246	.0954	.1255	.0987	.1265	.1020	.1275	.1054
42	.1284	.1087	.1294	.1119	.1304	.1152	.1314	.1185	.1323	.1217	.1333	.1249
43	.1343	.1282	.1353	.1314	.1363	.1345	.1373	.1377	.1383	.1409	.1393	.1440
44	.1403	.1472	.1413	.1503	.1424	.1534	.1434	.1565	.1444	.1596	.1454	.1626
45	.1464	.1657	.1475	.1687	.1485	.1718	.1495	.1748	.1506	.1778	.1516	.1808
46	.1527	.1838	.1537	.1867	.1548	.1897	.1558	.1926	.1569	.1956	.1579	.1985
47	.1590	.2014	.1601	.2043	.1611	.2072	.1622	.2101	.1633	.2129	.1644	.2158
48	.1654	.2186	.1665	.2215	.1676	.2243	.1687	.2271	.1698	.2299	.1709	.2327
49	.1720	.2355	.1731	.2382	.1742	.2410	.1753	.2437	.1764	.2465	.1775	.2492
50	.1786	.2519	.1797	.2546	.1808	.2573	.1820	.2600	.1831	.2627	.1842	.2653
51	.1853	.2680	.1865	.2706	.1876	.2732	.1887	.2759	.1899	.2785	.1910	.2811
52	.1922	.2837	.1933	.2863	.1945	.2888	.1956	.2914	.1968	.2940	.1979	.2965
53	.1991	.2991	.1903	.3016	.2014	.3041	.2026	.3066	.2038	.3091	.2049	.3116
54	.2061	.3141	.2073	.3166	.2085	.3190	.2096	.3215	.2108	.3239	.2120	.3264
55	.2132	.3288	.2144	.3312	.2156	.3336	.2168	.3361	.2180	.3384	.2192	.3408
56	.2204	.3432	.2216	.3456	.2228	.3480	.2240	.3503	.2252	.3527	.2265	.3550
57	.2277	.3573	.2289	.3596	.2301	.3620	.2314	.3643	.2326	.3666	.2338	.3689
58	.2350	.3711	.2363	.3734	.2375	.3757	.2388	.3779	.2400	.3802	.2412	.3824
59	.2425	.3847	.2437	.3869	.2450	.3891	.2462	.3913	.2475	.3935	.2487	.3957

HAVERSINES (Continued)

Characteristics of the logarithms are omitted.

°	0'		10'		20'		30'		40'		50'	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
60	.2500	.3979	.2513	.4001	.2525	.4023	.2538	.4045	.2551	.4066	.2563	.4088
61	.2576	.4109	.2589	.4131	.2601	.4152	.2614	.4173	.2627	.4195	.2640	.4216
62	.2653	.4237	.2665	.4258	.2678	.4279	.2691	.4300	.2704	.4320	.2717	.4341
63	.2730	.4362	.2743	.4382	.2756	.4403	.2769	.4423	.2782	.4444	.2795	.4464
64	.2808	.4484	.2821	.4504	.2834	.4524	.2847	.4545	.2861	.4565	.2874	.4584
65	.2887	.4604	.2900	.4624	.2913	.4644	.2927	.4664	.2940	.4683	.2953	.4703
66	.2966	.4722	.2980	.4742	.2993	.4761	.3006	.4780	.3020	.4799	.3033	.4819
67	.3046	.4838	.3060	.4857	.3073	.4876	.3087	.4895	.3100	.4914	.3113	.4932
68	.3127	.4951	.3140	.4970	.3154	.4989	.3167	.5007	.3181	.5026	.3195	.5044
69	.3208	.5063	.3222	.5081	.3235	.5099	.3249	.5117	.3263	.5136	.3276	.5154
70	.3290	.5172	.3304	.5190	.3317	.5208	.3331	.5226	.3345	.5244	.3358	.5261
71	.3372	.5279	.3386	.5297	.3400	.5314	.3413	.5332	.3427	.5349	.3441	.5367
72	.3455	.5384	.3469	.5402	.3483	.5419	.3496	.5436	.3510	.5454	.3524	.5471
73	.3538	.5488	.3552	.5505	.3566	.5522	.3580	.5539	.3594	.5556	.3608	.5572
74	.3622	.5589	.3636	.5606	.3650	.5623	.3664	.5639	.3678	.5656	.3692	.5672
75	.3706	.5689	.3720	.5705	.3734	.5722	.3748	.5738	.3762	.5754	.3776	.5771
76	.3790	.5787	.3805	.5803	.3819	.5819	.3833	.5835	.3847	.5851	.3861	.5867
77	.3875	.5883	.3889	.5899	.3904	.5915	.3918	.5930	.3932	.5946	.3946	.5962
78	.3960	.5977	.3975	.5993	.3989	.6009	.4003	.6024	.4017	.6039	.4032	.6055
79	.4046	.6070	.4060	.6086	.4075	.6101	.4089	.6116	.4103	.6131	.4117	.6146
80	.4132	.6161	.4146	.6176	.4160	.6191	.4175	.6206	.4189	.6221	.4203	.6236
81	.4218	.6251	.4232	.6266	.4247	.6280	.4261	.6295	.4275	.6310	.4290	.6324
82	.4304	.6339	.4319	.6353	.4333	.6368	.4347	.6382	.4362	.6397	.4376	.6411
83	.4391	.6425	.4405	.6440	.4420	.6454	.4434	.6468	.4448	.6482	.4463	.6496
84	.4477	.6510	.4492	.6524	.4506	.6538	.4521	.6552	.4535	.6566	.4550	.6580
85	.4564	.6594	.4579	.6607	.4593	.6621	.4608	.6635	.4622	.6648	.4637	.6662
86	.4651	.6676	.4666	.6689	.4680	.6703	.4695	.6716	.4709	.6730	.4724	.6743
87	.4738	.6756	.4753	.6770	.4767	.6783	.4782	.6796	.4796	.6809	.4811	.6822
88	.4826	.6835	.4840	.6848	.4855	.6862	.4869	.6875	.4884	.6887	.4898	.6900
89	.4913	.6913	.4927	.6926	.4942	.6939	.4956	.6952	.4971	.6964	.4985	.6977
90	.5000	.6990	.5015	.7002	.5029	.7015	.5044	.7027	.5058	.7040	.5073	.7052
91	.5087	.7065	.5102	.7077	.5116	.7090	.5131	.7102	.5145	.7114	.5160	.7126
92	.5174	.7139	.5189	.7151	.5204	.7163	.5218	.7175	.5233	.7187	.5247	.7199
93	.5232	.7211	.5276	.7223	.5291	.7235	.5305	.7247	.5320	.7259	.5334	.7271
94	.5349	.7283	.5363	.7294	.5378	.7306	.5392	.7318	.5407	.7329	.5421	.7341
95	.5436	.7353	.5450	.7364	.5465	.7376	.5479	.7387	.5494	.7399	.5508	.7410
96	.5523	.7421	.5537	.7433	.5552	.7444	.5566	.7455	.5580	.7467	.5595	.7478
97	.5609	.7489	.5624	.7500	.5638	.7511	.5653	.7523	.5667	.7534	.5681	.7545
98	.5696	.7556	.5710	.7567	.5725	.7577	.5739	.7588	.5753	.7599	.5768	.7610
99	.5782	.7621	.5797	.7632	.5811	.7642	.5825	.7653	.5840	.7664	.5854	.7674
100	.5868	.7685	.5883	.7696	.5897	.7706	.5911	.7717	.5925	.7727	.5940	.7738
101	.5954	.7748	.5968	.7759	.5983	.7769	.5997	.7779	.6011	.7790	.6025	.7800
102	.6040	.7810	.6054	.7820	.6068	.7830	.6082	.7841	.6096	.7851	.6111	.7861
103	.6125	.7871	.6139	.7881	.6153	.7891	.6167	.7901	.6181	.7911	.6195	.7921
104	.6210	.7931	.6224	.7940	.6238	.7950	.6252	.7960	.6266	.7970	.6280	.7980
105	.6294	.7989	.6308	.7999	.6322	.8009	.6336	.8018	.6350	.8028	.6364	.8037
106	.6378	.8047	.6392	.8056	.6406	.8066	.6420	.8075	.6434	.8085	.6448	.8094
107	.6462	.8104	.6476	.8113	.6490	.8122	.6504	.8131	.6517	.8141	.6531	.8150
108	.6545	.8159	.6559	.8168	.6573	.8177	.6587	.8187	.6600	.8196	.6614	.8205
109	.6628	.8214	.6642	.8223	.6655	.8232	.6669	.8241	.6683	.8250	.6696	.8258
110	.6710	.8267	.6724	.8276	.6737	.8285	.6751	.8294	.6765	.8302	.6778	.8311
111	.6792	.8320	.6805	.8329	.6819	.8337	.6833	.8346	.6846	.8354	.6860	.8363
112	.6873	.8371	.6887	.8380	.6900	.8388	.6913	.8397	.6927	.8405	.6940	.8414
113	.6954	.8422	.6967	.8430	.6980	.8439	.6994	.8447	.7007	.8455	.7020	.8464
114	.7034	.8472	.7047	.8480	.7060	.8488	.7073	.8496	.7087	.8504	.7100	.8513
115	.7113	.8521	.7126	.8529	.7139	.8537	.7153	.8545	.7166	.8553	.7179	.8561
116	.7192	.8568	.7205	.8576	.7218	.8584	.7231	.8592	.7244	.8600	.7257	.8608
117	.7270	.8615	.7283	.8623	.7296	.8631	.7309	.8638	.7322	.8646	.7335	.8654
118	.7347	.8661	.7360	.8669	.7373	.8676	.7386	.8684	.7399	.8691	.7411	.8699
119	.7424	.8706	.7437	.8714	.7449	.8721	.7462	.8729	.7475	.8736	.7487	.8743

HAVERSINES (Continued)

Characteristics of the logarithms are omitted.

°	0'		10'		20'		30'		40'		50'	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
120	.7500	.8751	.7513	.8758	.7525	.8765	.7538	.8772	.7550	.8780	.7563	.8787
121	.7575	.8794	.7588	.8801	.7600	.8808	.7612	.8815	.7625	.8822	.7637	.8829
122	.7650	.8836	.7662	.8843	.7674	.8850	.7686	.8857	.7699	.8864	.7711	.8871
123	.7723	.8878	.7735	.8885	.7748	.8892	.7760	.8898	.7772	.8905	.7784	.8912
124	.7796	.8919	.7808	.8925	.7820	.8932	.7832	.8939	.7844	.8945	.7856	.8952
125	.7868	.8959	.7880	.8965	.7892	.8972	.7904	.8978	.7915	.8985	.7927	.8991
126	.7939	.8998	.7951	.9004	.7962	.9010	.7974	.9017	.7986	.9023	.7997	.9030
127	.8009	.9036	.8021	.9042	.8032	.9048	.8044	.9055	.8055	.9061	.8067	.9067
128	.8078	.9073	.8090	.9079	.8101	.9085	.8113	.9092	.8124	.9098	.8135	.9104
129	.8147	.9110	.8158	.9116	.8169	.9122	.8180	.9128	.8192	.9134	.8203	.9140
130	.8214	.9146	.8225	.9151	.8236	.9157	.8247	.9163	.8258	.9169	.8269	.9175
131	.8280	.9180	.8291	.9186	.8302	.9192	.8313	.9198	.8324	.9203	.8335	.9209
132	.8346	.9215	.8356	.9220	.8367	.9226	.8378	.9231	.8389	.9237	.8399	.9242
133	.8410	.9248	.8421	.9253	.8431	.9259	.8442	.9264	.8452	.9270	.8463	.9275
134	.8473	.9281	.8484	.9286	.8494	.9291	.8505	.9297	.8515	.9302	.8525	.9307
135	.8536	.9312	.8546	.9318	.8556	.9323	.8566	.9328	.8576	.9333	.8587	.9338
136	.8597	.9343	.8607	.9348	.8617	.9353	.8627	.9359	.8637	.9364	.8647	.9369
137	.8657	.9374	.8667	.9379	.8677	.9383	.8686	.9388	.8696	.9393	.8706	.9398
138	.8716	.9403	.8725	.9408	.8735	.9413	.8745	.9417	.8754	.9422	.8764	.9427
139	.8774	.9432	.8783	.9436	.8793	.9441	.8802	.9446	.8811	.9450	.8821	.9455
140	.8830	.9460	.8840	.9464	.8849	.9469	.8858	.9473	.8867	.9478	.8877	.9482
141	.8886	.9487	.8895	.9491	.8904	.9496	.8913	.9500	.8922	.9505	.8931	.9509
142	.8940	.9513	.8949	.9518	.8958	.9522	.8967	.9526	.8976	.9531	.8984	.9535
143	.8993	.9539	.9002	.9543	.9011	.9548	.9019	.9552	.9028	.9556	.9037	.9560
144	.9045	.9564	.9054	.9568	.9062	.9572	.9071	.9576	.9079	.9580	.9087	.9584
145	.9096	.9588	.9104	.9592	.9112	.9596	.9121	.9600	.9129	.9604	.9137	.9608
146	.9145	.9612	.9153	.9616	.9161	.9620	.9169	.9623	.9177	.9627	.9185	.9631
147	.9193	.9635	.9201	.9638	.9209	.9642	.9217	.9646	.9225	.9650	.9233	.9653
148	.9240	.9657	.9248	.9660	.9256	.9664	.9263	.9668	.9271	.9671	.9278	.9675
149	.9286	.9678	.9293	.9682	.9301	.9685	.9308	.9689	.9316	.9692	.9323	.9695
150	.9330	.9699	.9337	.9702	.9345	.9706	.9352	.9709	.9359	.9712	.9366	.9716
151	.9373	.9719	.9380	.9722	.9387	.9725	.9394	.9729	.9401	.9732	.9408	.9735
152	.9415	.9738	.9422	.9741	.9428	.9744	.9435	.9747	.9442	.9751	.9448	.9754
153	.9455	.9757	.9462	.9760	.9468	.9763	.9475	.9766	.9481	.9769	.9488	.9772
154	.9494	.9774	.9500	.9777	.9507	.9780	.9513	.9783	.9519	.9786	.9525	.9789
155	.9532	.9792	.9538	.9794	.9544	.9797	.9550	.9800	.9556	.9803	.9562	.9805
156	.9568	.9808	.9574	.9811	.9579	.9813	.9585	.9816	.9591	.9819	.9597	.9821
157	.9603	.9824	.9608	.9826	.9614	.9829	.9619	.9831	.9625	.9834	.9630	.9836
158	.9636	.9839	.9641	.9841	.9647	.9844	.9652	.9846	.9657	.9849	.9663	.9851
159	.9668	.9853	.9673	.9856	.9678	.9858	.9683	.9860	.9688	.9863	.9693	.9865
160	.9698	.9867	.9703	.9869	.9708	.9871	.9713	.9874	.9718	.9876	.9723	.9878
161	.9728	.9880	.9732	.9882	.9737	.9884	.9742	.9886	.9746	.9888	.9751	.9890
162	.9755	.9892	.9760	.9894	.9764	.9896	.9769	.9898	.9773	.9900	.9777	.9902
163	.9782	.9904	.9786	.9906	.9790	.9908	.9794	.9910	.9798	.9911	.9802	.9913
164	.9806	.9915	.9810	.9917	.9814	.9919	.9818	.9920	.9822	.9922	.9826	.9924
165	.9830	.9925	.9833	.9927	.9837	.9929	.9841	.9930	.9844	.9932	.9848	.9933
166	.9851	.9935	.9855	.9937	.9858	.9938	.9862	.9940	.9865	.9941	.9869	.9943
167	.9872	.9944	.9875	.9945	.9878	.9947	.9881	.9948	.9885	.9950	.9888	.9951
168	.9891	.9952	.9894	.9954	.9897	.9955	.9900	.9956	.9903	.9957	.9905	.9959
169	.9908	.9960	.9911	.9961	.9914	.9962	.9916	.9963	.9919	.9965	.9921	.9966
170	.9924	.9967	.9927	.9968	.9929	.9969	.9931	.9970	.9934	.9971	.9936	.9972
171	.9938	.9973	.9941	.9974	.9943	.9975	.9945	.9976	.9947	.9977	.9949	.9978
172	.9951	.9979	.9953	.9980	.9955	.9981	.9957	.9981	.9959	.9982	.9961	.9983
173	.9963	.9984	.9964	.9985	.9966	.9985	.9968	.9986	.9969	.9987	.9971	.9987
174	.9973	.9988	.9974	.9989	.9976	.9989	.9977	.9990	.9978	.9991	.9980	.9991
175	.9981	.9992	.9982	.9992	.9983	.9993	.9985	.9993	.9986	.9994	.9987	.9994
176	.9988	.9995	.9989	.9995	.9990	.9996	.9991	.9996	.9992	.9996	.9992	.9997
177	.9993	.9997	.9994	.9997	.9995	.9998	.9995	.9998	.9996	.9998	.9996	.9998
178	.9997	.9999	.9997	.9999	.9998	.9999	.9998	.9999	.9999	.9999	.9999	.9999
179	.9999	.9999	.9999	.9999	1.0000	.0000	1.0000	.0000	1.0000	.0000	1.0000	.0000
180	1.0000	.0000										

SQUARE OF THE SINE AND COSINE AND THEIR PRODUCT

Compiled by Niel F. Beardsley

0° (180°)

(359°) 179°

1° (181°)

(358°) 178°

°	Sin ²	Sin · Cos	Cos ²	°
0	.00000	.00000	1.00000	60
1	.00000	.00029	1.00000	59
2	.00000	.00058	1.00000	58
3	.00000	.00087	1.00000	57
4	.00000	.00116	1.00000	56
5	.00000	.00145	1.00000	55
6	.00000	.00175	1.00000	54
7	.00000	.00204	1.00000	53
8	.00001	.00233	.99999	52
9	.00001	.00262	.99999	51
10	.00001	.00291	.99999	50
11	.00001	.00320	.99999	49
12	.00001	.00349	.99999	48
13	.00001	.00378	.99999	47
14	.00002	.00407	.99998	46
15	.00002	.00436	.99998	45
16	.00002	.00465	.99998	44
17	.00002	.00495	.99998	43
18	.00003	.00524	.99997	42
19	.00003	.00553	.99997	41
20	.00003	.00582	.99997	40
21	.00004	.00611	.99996	39
22	.00004	.00640	.99996	38
23	.00004	.00669	.99996	37
24	.00005	.00698	.99995	36
25	.00005	.00727	.99995	35
26	.00006	.00756	.99994	34
27	.00006	.00785	.99994	33
28	.00007	.00814	.99993	32
29	.00007	.00844	.99993	31
30	.00008	.00873	.99992	30
31	.00008	.00902	.99992	29
32	.00009	.00931	.99991	28
33	.00009	.00960	.99991	27
34	.00010	.00989	.99990	26
35	.00010	.01018	.99990	25
36	.00011	.01047	.99989	24
37	.00012	.01076	.99988	23
38	.00012	.01105	.99988	22
39	.00013	.01134	.99987	21
40	.00014	.01163	.99986	20
41	.00014	.01193	.99986	19
42	.00015	.01222	.99985	18
43	.00016	.01251	.99984	17
44	.00016	.01280	.99984	16
45	.00017	.01309	.99983	15
46	.00018	.01338	.99982	14
47	.00019	.01367	.99981	13
48	.00019	.01396	.99981	12
49	.00020	.01425	.99980	11
50	.00021	.01454	.99979	10
51	.00022	.01483	.99978	9
52	.00023	.01512	.99977	8
53	.00024	.01541	.99976	7
54	.00025	.01571	.99975	6
55	.00026	.01600	.99974	5
56	.00027	.01629	.99973	4
57	.00027	.01658	.99973	3
58	.00028	.01687	.99972	2
59	.00029	.01716	.99971	1
60	.00030	.01745	.99970	0
°	Cos ²	Sin · Cos	Sin ²	°

°	Sin ²	Sin · Cos	Cos ²	°
0	.00030	.01745	.99970	60
1	.00031	.01774	.99969	59
2	.00033	.01803	.99967	58
3	.00034	.01832	.99966	57
4	.00035	.01861	.99965	56
5	.00036	.01890	.99964	55
6	.00037	.01919	.99963	54
7	.00038	.01948	.99962	53
8	.00039	.01978	.99961	52
9	.00040	.02007	.99960	51
10	.00041	.02036	.99959	50
11	.00043	.02065	.99957	49
12	.00044	.02094	.99956	48
13	.00045	.02123	.99955	47
14	.00046	.02152	.99954	46
15	.00048	.02181	.99952	45
16	.00049	.02210	.99951	44
17	.00050	.02239	.99950	43
18	.00051	.02268	.99949	42
19	.00053	.02297	.99947	41
20	.00054	.02326	.99946	40
21	.00056	.02355	.99944	39
22	.00057	.02384	.99943	38
23	.00058	.02413	.99942	37
24	.00060	.02442	.99940	36
25	.00061	.02472	.99939	35
26	.00063	.02501	.99937	34
27	.00064	.02530	.99936	33
28	.00066	.02559	.99934	32
29	.00067	.02588	.99933	31
30	.00069	.02617	.99931	30
31	.00070	.02646	.99930	29
32	.00072	.02675	.99928	28
33	.00073	.02704	.99927	27
34	.00075	.02733	.99925	26
35	.00076	.02762	.99924	25
36	.00078	.02791	.99922	24
37	.00080	.02820	.99920	23
38	.00081	.02849	.99919	22
39	.00083	.02878	.99917	21
40	.00085	.02907	.99915	20
41	.00086	.02936	.99914	19
42	.00088	.02965	.99912	18
43	.00090	.02994	.99910	17
44	.00091	.03023	.99909	16
45	.00093	.03052	.99907	15
46	.00095	.03081	.99905	14
47	.00097	.03110	.99903	13
48	.00099	.03140	.99901	12
49	.00100	.03169	.99900	11
50	.00102	.03198	.99898	10
51	.00104	.03227	.99896	9
52	.00106	.03256	.99894	8
53	.00108	.03285	.99892	7
54	.00110	.03314	.99890	6
55	.00112	.03343	.99888	5
56	.00114	.03372	.99886	4
57	.00116	.03401	.99884	3
58	.00118	.03430	.99882	2
59	.00120	.03459	.99880	1
60	.00122	.03488	.99878	0
°	Cos ²	Sin · Cos	Sin ²	°

90° (270°)

(269°) 89°

91° (271°)

(268°) 88°

$\sin^2 x \quad \cos^2 x \quad \sin x \cos x$							
$2^\circ (182^\circ)$				$3^\circ (183^\circ)$			
$(357^\circ) 177^\circ$				$(356^\circ) 176^\circ$			
\sin^2	$\sin \cdot \cos$	\cos^2		\sin^2	$\sin \cdot \cos$	\cos^2	
0	.00122	.93488	60	0	.00274	.05226	60
1	.00124	.93517	59	1	.00277	.05255	59
2	.00126	.93546	58	2	.00280	.05284	58
3	.00128	.93575	57	3	.00283	.05313	57
4	.00130	.93604	56	4	.00286	.05342	56
5	.00132	.93633	55	5	.00289	.05371	55
6	.00134	.93662	54	6	.00292	.05400	54
7	.00136	.93691	53	7	.00296	.05429	53
8	.00139	.93720	52	8	.00299	.05458	52
9	.00141	.93749	51	9	.00302	.05487	51
10	.00143	.93778	50	10	.00305	.05516	50
11	.00145	.93807	49	11	.00308	.05545	49
12	.00147	.93836	48	12	.00312	.05573	48
13	.00150	.93865	47	13	.00315	.05602	47
14	.00152	.93894	46	14	.00318	.05631	46
15	.00154	.93923	45	15	.00321	.05660	45
16	.00156	.93952	44	16	.00325	.05689	44
17	.00159	.93981	43	17	.00328	.05718	43
18	.00161	.94010	42	18	.00331	.05747	42
19	.00163	.94039	41	19	.00335	.05776	41
20	.00166	.94068	40	20	.00338	.05805	40
21	.00168	.94097	39	21	.00341	.05834	39
22	.00171	.94126	38	22	.00345	.05862	38
23	.00173	.94155	37	23	.00348	.05891	37
24	.00175	.94184	36	24	.00352	.05920	36
25	.00178	.94213	35	25	.00355	.05949	35
26	.00180	.94242	34	26	.00359	.05978	34
27	.00183	.94271	33	27	.00362	.06007	33
28	.00185	.94300	32	28	.00366	.06036	32
29	.00188	.94329	31	29	.00369	.06065	31
30	.00190	.94358	30	30	.00373	.06093	30
31	.00193	.94387	29	31	.00376	.06122	29
32	.00195	.94416	28	32	.00380	.06151	28
33	.00198	.94445	27	33	.00383	.06180	27
34	.00201	.94474	26	34	.00387	.06209	26
35	.00203	.94503	25	35	.00391	.06238	25
36	.00206	.94532	24	36	.00394	.06267	24
37	.00208	.94561	23	37	.00398	.06296	23
38	.00211	.94590	22	38	.00402	.06324	22
39	.00214	.94619	21	39	.00405	.06353	21
40	.00216	.94647	20	40	.00409	.06382	20
41	.00219	.94676	19	41	.00413	.06411	19
42	.00222	.94705	18	42	.00416	.06440	18
43	.00225	.94734	17	43	.00420	.06469	17
44	.00227	.94763	16	44	.00424	.06497	16
45	.00230	.94792	15	45	.00428	.06526	15
46	.00233	.94821	14	46	.00432	.06555	14
47	.00236	.94850	13	47	.00435	.06584	13
48	.00239	.94879	12	48	.00439	.06613	12
49	.00241	.94908	11	49	.00443	.06642	11
50	.00244	.94937	10	50	.00447	.06670	10
51	.00247	.94966	9	51	.00451	.06699	9
52	.00250	.94995	8	52	.00455	.06728	8
53	.00253	.95024	7	53	.00459	.06757	7
54	.00256	.95053	6	54	.00463	.06786	6
55	.00259	.95082	5	55	.00467	.06815	5
56	.00262	.95111	4	56	.00471	.06843	4
57	.00265	.95140	3	57	.00475	.06872	3
58	.00268	.95169	2	58	.00479	.06900	2
59	.00271	.95197	1	59	.00483	.06930	1
60	.00274	.95226	0	60	.00487	.06959	0
\cos^2	$\sin \cdot \cos$	\sin^2		\cos^2	$\sin \cdot \cos$	\sin^2	
$92^\circ (272^\circ)$				$93^\circ (273^\circ)$			
$(267^\circ) 87^\circ$				$(266^\circ) 86^\circ$			

$\text{Sin}^2 x$ $\text{Cos}^2 x$ $\text{Sin } x \text{ Cos } x$

4° (184°)

(355°) 175°

5° (185°)

(354°) (174°)

	Sin^2	$\text{Sin} \cdot \text{Cos}$	Cos^2	
0	.00487	.06959	.99513	60
1	.00491	.06987	.99509	59
2	.00495	.07016	.99505	58
3	.00499	.07045	.99501	57
4	.00503	.07074	.99497	56
5	.00507	.07103	.99493	55
6	.00511	.07131	.99489	54
7	.00515	.07160	.99485	53
8	.00520	.07189	.99480	52
9	.00524	.07218	.99476	51
10	.00528	.07247	.99472	50
11	.00532	.07275	.99468	49
12	.00536	.07304	.99464	48
13	.00541	.07333	.99459	47
14	.00545	.07362	.99455	46
15	.00549	.07390	.99451	45
16	.00554	.07419	.99446	44
17	.00558	.07448	.99442	43
18	.00562	.07477	.99438	42
19	.00567	.07506	.99433	41
20	.00571	.07534	.99429	40
21	.00575	.07563	.99425	39
22	.00580	.07592	.99420	38
23	.00584	.07621	.99416	37
24	.00589	.07649	.99411	36
25	.00593	.07678	.99407	35
26	.00598	.07707	.99402	34
27	.00602	.07736	.99398	33
28	.00607	.07764	.99393	32
29	.00611	.07793	.99389	31
30	.00616	.07822	.99384	30
31	.00620	.07850	.99380	29
32	.00625	.07879	.99375	28
33	.00629	.07908	.99371	27
34	.00634	.07937	.99366	26
35	.00639	.07965	.99361	25
36	.00643	.07994	.99357	24
37	.00648	.08023	.99352	23
38	.00653	.08051	.99347	22
39	.00657	.08080	.99343	21
40	.00662	.08109	.99338	20
41	.00667	.08138	.99333	19
42	.00671	.08166	.99329	18
43	.00676	.08195	.99324	17
44	.00681	.08224	.99319	16
45	.00686	.08252	.99314	15
46	.00691	.08281	.99309	14
47	.00695	.08310	.99305	13
48	.00700	.08338	.99300	12
49	.00705	.08367	.99295	11
50	.00710	.08396	.99290	10
51	.00715	.08424	.99285	9
52	.00720	.08453	.99280	8
53	.00725	.08482	.99275	7
54	.00730	.08510	.99270	6
55	.00735	.08539	.99265	5
56	.00740	.08568	.99260	4
57	.00745	.08596	.99255	3
58	.00750	.08625	.99250	2
59	.00755	.08654	.99245	1
60	.00760	.08682	.99240	0
	Cos^2	$\text{Sin} \cdot \text{Cos}$	Sin^2	

94° (274°)

(265°) 85°

	Sin^2	$\text{Sin} \cdot \text{Cos}$	Cos^2	
0	.00760	.08682	.99240	60
1	.00765	.08711	.99235	59
2	.00770	.08740	.99230	58
3	.00775	.08768	.99225	57
4	.00780	.08797	.99220	56
5	.00785	.08826	.99215	55
6	.00790	.08854	.99210	54
7	.00795	.08883	.99205	53
8	.00801	.08911	.99199	52
9	.00806	.08940	.99194	51
10	.00811	.08969	.99189	50
11	.00816	.08997	.99184	49
12	.00821	.09026	.99179	48
13	.00827	.09055	.99173	47
14	.00832	.09083	.99168	46
15	.00837	.09112	.99163	45
16	.00843	.09140	.99157	44
17	.00848	.09169	.99152	43
18	.00853	.09198	.99147	42
19	.00859	.09226	.99141	41
20	.00864	.09255	.99136	40
21	.00869	.09283	.99131	39
22	.00875	.09312	.99125	38
23	.00880	.09340	.99120	37
24	.00886	.09369	.99114	36
25	.00891	.09398	.99109	35
26	.00897	.09426	.99103	34
27	.00902	.09455	.99098	33
28	.00908	.09483	.99092	32
29	.00913	.09512	.99087	31
30	.00919	.09540	.99081	30
31	.00924	.09569	.99076	29
32	.00930	.09598	.99070	28
33	.00935	.09626	.99065	27
34	.00941	.09655	.99059	26
35	.00947	.09683	.99053	25
36	.00952	.09712	.99048	24
37	.00958	.09740	.99042	23
38	.00964	.09769	.99036	22
39	.00969	.09797	.99031	21
40	.00975	.09826	.99025	20
41	.00981	.09854	.99019	19
42	.00986	.09883	.99014	18
43	.00992	.09911	.99008	17
44	.00998	.09940	.99002	16
45	.01004	.09968	.98996	15
46	.01010	.09997	.98990	14
47	.01015	.10025	.98985	13
48	.01021	.10054	.98979	12
49	.01027	.10082	.98973	11
50	.01033	.10111	.98967	10
51	.01039	.10139	.98961	9
52	.01045	.10168	.98955	8
53	.01051	.10196	.98949	7
54	.01057	.10225	.98943	6
55	.01063	.10253	.98937	5
56	.01069	.10282	.98931	4
57	.01075	.10310	.98925	3
58	.01081	.10339	.98919	2
59	.01087	.10367	.98913	1
60	.01093	.10396	.98907	0
	Cos^2	$\text{Sin} \cdot \text{Cos}$	Sin^2	

95° (275°)

(264°) 84°

$\text{Sin}^2 x \quad \text{Cos}^2 x \quad \text{Sin } x \text{ Cos } x$							
$6^\circ (186^\circ)$				$(353^\circ) 173^\circ$			
	Sin^2	$\text{Sin} \cdot \text{Cos}$	Cos^2				
0	.01093	.10396	.98907	60	.01485	.12096	.98515
1	.01099	.10424	.98901	59	.01492	.12124	.98508
2	.01105	.10452	.98895	58	.01499	.12153	.98501
3	.01111	.10481	.98889	57	.01506	.12181	.98494
4	.01117	.10509	.98883	56	.01513	.12209	.98487
5	.01123	.10538	.98877	55	.01521	.12237	.98479
6	.01129	.10566	.98871	54	.01528	.12265	.98472
7	.01135	.10595	.98865	53	.01535	.12294	.98465
8	.01142	.10623	.98858	52	.01542	.12322	.98458
9	.01148	.10652	.98852	51	.01549	.12350	.98451
10	.01154	.10680	.98846	50	.01556	.12378	.98444
11	.01160	.10708	.98840	49	.01564	.12406	.98436
12	.01166	.10737	.98834	48	.01571	.12434	.98429
13	.01173	.10765	.98827	47	.01578	.12463	.98422
14	.01179	.10794	.98821	46	.01585	.12491	.98415
15	.01185	.10822	.98815	45	.01593	.12519	.98407
16	.01192	.10850	.98808	44	.01600	.12547	.98400
17	.01198	.10879	.98802	43	.01607	.12575	.98393
18	.01204	.10907	.98796	42	.01615	.12603	.98385
19	.01211	.10936	.98789	41	.01622	.12632	.98378
20	.01217	.10964	.98783	40	.01629	.12660	.98371
21	.01223	.10992	.98777	39	.01637	.12688	.98363
22	.01230	.11021	.98770	38	.01644	.12716	.98356
23	.01236	.11049	.98764	37	.01651	.12744	.98349
24	.01243	.11077	.98757	36	.01659	.12772	.98341
25	.01249	.11106	.98751	35	.01666	.12800	.98334
26	.01255	.11134	.98745	34	.01674	.12829	.98326
27	.01262	.11163	.98738	33	.01681	.12857	.98319
28	.01268	.11191	.98732	32	.01689	.12885	.98311
29	.01275	.11219	.98725	31	.01696	.12913	.98304
30	.01281	.11248	.98719	30	.01704	.12941	.98296
31	.01288	.11276	.98712	29	.01711	.12969	.98289
32	.01295	.11304	.98705	28	.01719	.12997	.98281
33	.01301	.11333	.98699	27	.01726	.13025	.98274
34	.01308	.11361	.98692	26	.01734	.13053	.98266
35	.01314	.11389	.98686	25	.01742	.13081	.98258
36	.01321	.11418	.98679	24	.01749	.13109	.98251
37	.01328	.11446	.98672	23	.01757	.13138	.98243
38	.01334	.11474	.98666	22	.01764	.13166	.98236
39	.01341	.11502	.98659	21	.01772	.13194	.98228
40	.01348	.11531	.98652	20	.01780	.13222	.98220
41	.01354	.11559	.98646	19	.01788	.13250	.98212
42	.01361	.11587	.98639	18	.01795	.13278	.98205
43	.01368	.11616	.98632	17	.01803	.13306	.98197
44	.01375	.11644	.98625	16	.01811	.13334	.98189
45	.01382	.11672	.98618	15	.01818	.13362	.98182
46	.01388	.11701	.98612	14	.01826	.13390	.98174
47	.01395	.11729	.98605	13	.01834	.13418	.98166
48	.01402	.11757	.98598	12	.01842	.13446	.98158
49	.01409	.11785	.98591	11	.01850	.13474	.98150
50	.01416	.11814	.98584	10	.01858	.13502	.98142
51	.01423	.11842	.98577	9	.01865	.13530	.98135
52	.01429	.11870	.98571	8	.01873	.13558	.98127
53	.01436	.11898	.98564	7	.01881	.13586	.98119
54	.01443	.11927	.98557	6	.01889	.13614	.98111
55	.01450	.11955	.98550	5	.01897	.13642	.98103
56	.01457	.11983	.98543	4	.01905	.13670	.98095
57	.01464	.12011	.98536	3	.01913	.13698	.98087
58	.01471	.12040	.98529	2	.01921	.13726	.98079
59	.01478	.12068	.98522	1	.01929	.13754	.98071
60	.01485	.12096	.98515	0	.01937	.13782	.98063
	Cos^2	$\text{Sin} \cdot \text{Cos}$	Sin^2		Cos^2	$\text{Sin} \cdot \text{Cos}$	Sin^2
$96^\circ (276^\circ)$				$(263^\circ) 83^\circ$			

				$7^\circ (187^\circ)$			
	Sin^2	$\text{Sin} \cdot \text{Cos}$	Cos^2				
0	.01485	.12096	.98515	60	.01485	.12096	.98515
1	.01492	.12124	.98508	59	.01492	.12124	.98508
2	.01499	.12153	.98501	58	.01499	.12153	.98501
3	.01506	.12181	.98494	57	.01506	.12181	.98494
4	.01513	.12209	.98487	56	.01513	.12209	.98487
5	.01521	.12237	.98479	55	.01521	.12237	.98479
6	.01528	.12265	.98472	54	.01528	.12265	.98472
7	.01535	.12294	.98465	53	.01535	.12294	.98465
8	.01542	.12322	.98458	52	.01542	.12322	.98458
9	.01549	.12350	.98451	51	.01549	.12350	.98451
10	.01556	.12378	.98444	50	.01556	.12378	.98444
11	.01564	.12406	.98436	49	.01564	.12406	.98436
12	.01571	.12434	.98429	48	.01571	.12434	.98429
13	.01578	.12463	.98422	47	.01578	.12463	.98422
14	.01585	.12491	.98415	46	.01585	.12491	.98415
15	.01593	.12519	.98407	45	.01593	.12519	.98407
16	.01600	.12547	.98400	44	.01600	.12547	.98400
17	.01607	.12575	.98393	43	.01607	.12575	.98393
18	.01615	.12603	.98385	42	.01615	.12603	.98385
19	.01622	.12632	.98378	41	.01622	.12632	.98378
20	.01629	.12660	.98371	40	.01629	.12660	.98371
21	.01637	.12688	.98363	39	.01637	.12688	.98363
22	.01644	.12716	.98356	38	.01644	.12716	.98356
23	.01651	.12744	.98349	37	.01651	.12744	.98349
24	.01659	.12772	.98341	36	.01659	.12772	.98341
25	.01666	.12800	.98334	35	.01666	.12800	.98334
26	.01674	.12829	.98326	34	.01674	.12829	.98326
27	.01681	.12857	.98319	33	.01681	.12857	.98319
28	.01689	.12885	.98311	32	.01689	.12885	.98311
29	.01696	.12913	.98304	31	.01696	.12913	.98304
30	.01704	.12941	.98296	30	.01704	.12941	.98296
31	.01711	.12969	.98289	29	.01711	.12969	.98289
32	.01719	.12997	.98281	28	.01719	.12997	.98281
33	.01726	.13025	.98274	27	.01726	.13025	.98274
34	.01734	.13053	.98266	26	.01734	.13053	.98266
35	.01742	.13081	.98258	25	.01742	.13081	.98258
36	.01749	.13109	.98251	24	.01749	.13109	.98251
37	.01757	.13138	.98243	23	.01757	.13138	.98243
38	.01764	.13166	.98236	22	.01764	.13166	.98236
39	.01772	.13194	.98228	21	.01772	.13194	.98228
40	.01780	.13222	.98220	20	.01780	.13222	.98220
41	.01788	.13250	.98212	19	.01788	.13250	.98212
42	.01795	.13278	.98205	18	.01795	.13278	.98205
43	.01803	.13306	.98197	17	.01803	.13306	.98197
44	.01811	.13334	.98189	16	.01811	.13334	.98189
45	.01818	.13362	.98182	15	.01818	.13362	.98182
46	.01826	.13390	.98174	14	.01826	.13390	.98174
47	.01834	.13418	.98166	13	.01834	.13418	.98166
48	.01842	.13446	.98158	12	.01842	.13446	.98158
49	.01850	.13474	.98150	11	.01850	.13474	.98150
50	.01858	.13502	.98142	10	.01858	.13502	.98142
51	.01865	.13530	.98135	9	.01865	.13530	.98135
52	.01873	.13558	.98127	8	.01873	.13558	.98127
53	.01881	.13586	.98119	7	.01881	.13586	.98119
54	.01889	.13614	.98111	6	.01889	.13614	.98111
55	.01897	.13642	.98103	5	.01897	.13642	.98103
56	.01905	.13670	.98095	4	.01905	.13670	.98095
57	.01913	.13698	.98087	3	.01913	.13698	.98087
58	.01921	.13726	.98079	2	.01921	.13726	.98079
59	.01929	.13754	.98071	1	.01929	.13754	.98071
60	.01937	.13782	.98063	0	.01937	.13782	.98063
	Cos^2	$\text{Sin} \cdot \text{Cos}$	Sin^2		Cos^2	$\text{Sin} \cdot \text{Cos}$	Sin^2
$97^\circ (277^\circ)$				$(262^\circ) 82^\circ$			

Sin² x Cos² x Sin x Cos x

8° (188°)

(351°) **171°**

9° (189°)

(350°) **170°**

	Sin ²	Sin · Cos	Cos ²	
0	.01937	.13782	.98063	60
1	.01945	.13810	.98055	59
2	.01953	.13838	.98047	58
3	.01961	.13866	.98039	57
4	.01969	.13894	.98031	56
5	.01977	.13922	.98023	55
6	.01985	.13950	.98015	54
7	.01993	.13977	.98007	53
8	.02002	.14005	.97998	52
9	.02010	.14033	.97990	51
10	.02018	.14061	.97982	50
11	.02026	.14089	.97974	49
12	.02034	.14117	.97966	48
13	.02043	.14145	.97957	47
14	.02051	.14173	.97949	46
15	.02059	.14201	.97941	45
16	.02067	.14229	.97933	44
17	.02076	.14257	.97924	43
18	.02084	.14284	.97916	42
19	.02092	.14312	.97908	41
20	.02101	.14340	.97899	40
21	.02109	.14368	.97891	39
22	.02117	.14396	.97883	38
23	.02126	.14424	.97874	37
24	.02134	.14452	.97866	36
25	.02142	.14479	.97858	35
26	.02151	.14507	.97849	34
27	.02159	.14535	.97841	33
28	.02168	.14563	.97832	32
29	.02176	.14591	.97824	31
30	.02185	.14619	.97815	30
31	.02193	.14646	.97807	29
32	.02202	.14674	.97798	28
33	.02210	.14702	.97790	27
34	.02219	.14730	.97781	26
35	.02227	.14758	.97773	25
36	.02236	.14785	.97764	24
37	.02245	.14813	.97755	23
38	.02253	.14841	.97747	22
39	.02262	.14869	.97738	21
40	.02271	.14897	.97729	20
41	.02279	.14924	.97721	19
42	.02288	.14952	.97712	18
43	.02297	.14980	.97703	17
44	.02305	.15008	.97695	16
45	.02314	.15035	.97686	15
46	.02323	.15063	.97677	14
47	.02332	.15091	.97668	13
48	.02340	.15118	.97660	12
49	.02349	.15146	.97651	11
50	.02358	.15174	.97642	10
51	.02367	.15202	.97633	9
52	.02376	.15229	.97624	8
53	.02385	.15257	.97615	7
54	.02394	.15285	.97606	6
55	.02402	.15312	.97598	5
56	.02411	.15340	.97589	4
57	.02420	.15368	.97580	3
58	.02429	.15396	.97571	2
59	.02438	.15423	.97562	1
60	.02447	.15451	.97553	0
	Cos ²	Sin · Cos	Sin ²	

98° (278°)

(261°) **81°**

	Sin ²	Sin · Cos	Cos ²	
0	.02447	.15451	.97553	60
1	.02456	.15479	.97544	59
2	.02465	.15506	.97535	58
3	.02474	.15534	.97526	57
4	.02483	.15561	.97517	56
5	.02492	.15589	.97508	55
6	.02501	.15617	.97499	54
7	.02510	.15644	.97490	53
8	.02520	.15672	.97480	52
9	.02529	.15700	.97471	51
10	.02538	.15727	.97462	50
11	.02547	.15755	.97453	49
12	.02556	.15782	.97444	48
13	.02565	.15810	.97435	47
14	.02575	.15838	.97425	46
15	.02584	.15865	.97416	45
16	.02593	.15893	.97407	44
17	.02602	.15920	.97398	43
18	.02612	.15948	.97388	42
19	.02621	.15976	.97379	41
20	.02630	.16003	.97370	40
21	.02639	.16031	.97361	39
22	.02649	.16058	.97351	38
23	.02658	.16086	.97342	37
24	.02668	.16113	.97332	36
25	.02677	.16141	.97323	35
26	.02686	.16168	.97314	34
27	.02696	.16196	.97304	33
28	.02705	.16223	.97295	32
29	.02715	.16251	.97285	31
30	.02724	.16278	.97276	30
31	.02734	.16306	.97266	29
32	.02743	.16333	.97257	28
33	.02753	.16361	.97247	27
34	.02762	.16388	.97238	26
35	.02772	.16416	.97228	25
36	.02781	.16443	.97219	24
37	.02791	.16471	.97209	23
38	.02800	.16498	.97200	22
39	.02810	.16526	.97190	21
40	.02820	.16553	.97180	20
41	.02829	.16581	.97171	19
42	.02839	.16608	.97161	18
43	.02849	.16635	.97151	17
44	.02858	.16663	.97142	16
45	.02868	.16690	.97132	15
46	.02878	.16718	.97122	14
47	.02887	.16745	.97113	13
48	.02897	.16773	.97103	12
49	.02907	.16800	.97093	11
50	.02917	.16827	.97083	10
51	.02926	.16855	.97074	9
52	.02936	.16882	.97064	8
53	.02946	.16910	.97054	7
54	.02956	.16937	.97044	6
55	.02966	.16964	.97034	5
56	.02976	.16992	.97024	4
57	.02986	.17019	.97014	3
58	.02996	.17046	.97004	2
59	.03005	.17074	.96995	1
60	.03015	.17101	.96985	0
	Cos ²	Sin · Cos	Sin ²	

99° (279°)

(260°) **80°**

$\text{Sin}^2 x$ $\text{Cos}^2 x$ $\text{Sin } x \text{ Cos } x$

10° (190°)

(349°) 169°

11° (191°)

(348°) 168°

	Sin ²	Sin · Cos	Cos ²	
0	.03015	.17101	.96985	60
1	.03025	.17128	.96975	59
2	.03035	.17156	.96965	58
3	.03045	.17183	.96955	57
4	.03055	.17210	.96945	56
5	.03065	.17238	.96935	55
6	.03075	.17265	.96925	54
7	.03085	.17292	.96915	53
8	.03095	.17319	.96905	52
9	.03106	.17347	.96894	51
10	.03116	.17374	.96884	50
11	.03126	.17401	.96874	49
12	.03136	.17429	.96864	48
13	.03146	.17456	.96854	47
14	.03156	.17483	.96844	46
15	.03166	.17510	.96834	45
16	.03177	.17538	.96823	44
17	.03187	.17565	.96813	43
18	.03197	.17592	.96803	42
19	.03207	.17619	.96793	41
20	.03218	.17647	.96782	40
21	.03228	.17674	.96772	39
22	.03238	.17701	.96762	38
23	.03248	.17728	.96752	37
24	.03259	.17755	.96741	36
25	.03269	.17783	.96731	35
26	.03279	.17810	.96721	34
27	.03290	.17837	.96710	33
28	.03300	.17864	.96700	32
29	.03311	.17891	.96689	31
30	.03321	.17918	.96679	30
31	.03331	.17946	.96669	29
32	.03342	.17973	.96658	28
33	.03352	.18000	.96648	27
34	.03363	.18027	.96637	26
35	.03373	.18054	.96627	25
36	.03384	.18081	.96616	24
37	.03394	.18108	.96606	23
38	.03405	.18135	.96595	22
39	.03415	.18163	.96585	21
40	.03426	.18190	.96574	20
41	.03437	.18217	.96563	19
42	.03447	.18244	.96553	18
43	.03458	.18271	.96542	17
44	.03468	.18298	.96532	16
45	.03479	.18325	.96521	15
46	.03490	.18352	.96510	14
47	.03500	.18379	.96500	13
48	.03511	.18406	.96489	12
49	.03522	.18433	.96478	11
50	.03533	.18460	.96467	10
51	.03543	.18487	.96457	9
52	.03554	.18514	.96446	8
53	.03565	.18541	.96435	7
54	.03576	.18568	.96424	6
55	.03587	.18595	.96413	5
56	.03597	.18622	.96403	4
57	.03608	.18649	.96392	3
58	.03619	.18676	.96381	2
59	.03630	.18703	.96370	1
60	.03641	.18730	.96359	0
	Cos ²	Sin · Cos	Sin ²	

100° (280°)

(259°) 79°

	Sin ²	Sin · Cos	Cos ²	
0	.03641	.18730	.96359	60
1	.03652	.18757	.96348	59
2	.03663	.18784	.96337	58
3	.03674	.18811	.96326	57
4	.03685	.18838	.96315	56
5	.03695	.18865	.96305	55
6	.03706	.18892	.96294	54
7	.03717	.18919	.96283	53
8	.03728	.18946	.96272	52
9	.03740	.18973	.96260	51
10	.03751	.19000	.96249	50
11	.03762	.19027	.96238	49
12	.03773	.19054	.96227	48
13	.03784	.19080	.96216	47
14	.03795	.19107	.96205	46
15	.03806	.19134	.96194	45
16	.03817	.19161	.96183	44
17	.03828	.19188	.96172	43
18	.03839	.19215	.96161	42
19	.03851	.19242	.96149	41
20	.03862	.19268	.96138	40
21	.03873	.19295	.96127	39
22	.03884	.19322	.96116	38
23	.03896	.19349	.96104	37
24	.03907	.19376	.96093	36
25	.03918	.19403	.96082	35
26	.03929	.19429	.96071	34
27	.03941	.19456	.96059	33
28	.03952	.19483	.96048	32
29	.03963	.19510	.96037	31
30	.03975	.19537	.96025	30
31	.03986	.19563	.96014	29
32	.03998	.19590	.96002	28
33	.04009	.19617	.95991	27
34	.04020	.19644	.95980	26
35	.04032	.19670	.95968	25
36	.04043	.19697	.95957	24
37	.04055	.19724	.95945	23
38	.04066	.19751	.95934	22
39	.04078	.19777	.95922	21
40	.04089	.19804	.95911	20
41	.04101	.19831	.95899	19
42	.04112	.19857	.95888	18
43	.04124	.19884	.95876	17
44	.04135	.19911	.95865	16
45	.04147	.19937	.95853	15
46	.04159	.19964	.95841	14
47	.04170	.19991	.95830	13
48	.04182	.20017	.95818	12
49	.04194	.20044	.95806	11
50	.04205	.20071	.95795	10
51	.04217	.20097	.95783	9
52	.04229	.20124	.95771	8
53	.04240	.20151	.95760	7
54	.04252	.20177	.95748	6
55	.04264	.20204	.95736	5
56	.04276	.20230	.95724	4
57	.04287	.20257	.95713	3
58	.04299	.20284	.95701	2
59	.04311	.20310	.95689	1
60	.04323	.20337	.95677	0
	Cos ²	Sin · Cos	Sin ²	

101° (281°)

(258°) 78°

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$
 $12^\circ (192^\circ)$
 $(347^\circ) 167^\circ$
 $13^\circ (193^\circ)$
 $(346^\circ) 166^\circ$

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.04323	.20337	.95677	60
1	.04335	.20363	.95665	59
2	.04346	.20390	.95654	58
3	.04358	.20417	.95642	57
4	.04370	.20443	.95630	56
5	.04382	.20470	.95618	55
6	.04394	.20496	.95606	54
7	.04406	.20523	.95594	53
8	.04418	.20549	.95582	52
9	.04430	.20576	.95570	51
10	.04442	.20602	.95558	50
11	.04454	.20629	.95546	49
12	.04466	.20655	.95534	48
13	.04478	.20682	.95522	47
14	.04490	.20708	.95510	46
15	.04502	.20735	.95498	45
16	.04514	.20761	.95486	44
17	.04526	.20788	.95474	43
18	.04538	.20814	.95462	42
19	.04550	.20840	.95450	41
20	.04562	.20867	.95438	40
21	.04575	.20893	.95425	39
22	.04587	.20920	.95413	38
23	.04599	.20946	.95401	37
24	.04611	.20973	.95389	36
25	.04623	.20999	.95377	35
26	.04636	.21025	.95364	34
27	.04648	.21052	.95352	33
28	.04660	.21078	.95340	32
29	.04672	.21105	.95328	31
30	.04685	.21131	.95315	30
31	.04697	.21157	.95303	29
32	.04709	.21184	.95291	28
33	.04722	.21210	.95278	27
34	.04734	.21236	.95266	26
35	.04746	.21263	.95254	25
36	.04759	.21289	.95241	24
37	.04771	.21315	.95229	23
38	.04783	.21342	.95217	22
39	.04796	.21368	.95204	21
40	.04808	.21394	.95192	20
41	.04821	.21420	.95179	19
42	.04833	.21447	.95167	18
43	.04846	.21473	.95154	17
44	.04858	.21499	.95142	16
45	.04871	.21526	.95129	15
46	.04883	.21552	.95117	14
47	.04896	.21578	.95104	13
48	.04908	.21604	.95092	12
49	.04921	.21631	.95079	11
50	.04934	.21657	.95066	10
51	.04946	.21683	.95054	9
52	.04959	.21709	.95041	8
53	.04971	.21735	.95029	7
54	.04984	.21762	.95016	6
55	.04997	.21788	.95003	5
56	.05009	.21814	.94991	4
57	.05022	.21840	.94978	3
58	.05035	.21866	.94965	2
59	.05048	.21892	.94952	1
60	.05060	.21919	.94940	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

 $102^\circ (282^\circ)$
 $(257^\circ) 77^\circ$

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.05060	.21919	.94940	60
1	.05073	.21945	.94927	59
2	.05086	.21971	.94914	58
3	.05099	.21997	.94901	57
4	.05111	.22023	.94889	56
5	.05124	.22049	.94876	55
6	.05137	.22075	.94863	54
7	.05150	.22101	.94850	53
8	.05163	.22127	.94837	52
9	.05176	.22154	.94824	51
10	.05189	.22180	.94811	50
11	.05201	.22206	.94799	49
12	.05214	.22232	.94786	48
13	.05227	.22258	.94773	47
14	.05240	.22284	.94760	46
15	.05253	.22310	.94747	45
16	.05266	.22336	.94734	44
17	.05279	.22362	.94721	43
18	.05292	.22388	.94708	42
19	.05305	.22414	.94695	41
20	.05318	.22440	.94682	40
21	.05331	.22466	.94669	39
22	.05345	.22492	.94655	38
23	.05358	.22518	.94642	37
24	.05371	.22544	.94629	36
25	.05384	.22570	.94616	35
26	.05397	.22596	.94603	34
27	.05410	.22622	.94590	33
28	.05423	.22648	.94577	32
29	.05436	.22674	.94564	31
30	.05450	.22700	.94550	30
31	.05463	.22725	.94537	29
32	.05476	.22751	.94524	28
33	.05489	.22777	.94511	27
34	.05503	.22803	.94497	26
35	.05516	.22829	.94484	25
36	.05529	.22855	.94471	24
37	.05542	.22881	.94458	23
38	.05556	.22907	.94444	22
39	.05569	.22932	.94431	21
40	.05582	.22958	.94418	20
41	.05596	.22984	.94404	19
42	.05609	.23010	.94391	18
43	.05623	.23036	.94377	17
44	.05636	.23062	.94364	16
45	.05649	.23087	.94351	15
46	.05663	.23113	.94337	14
47	.05676	.23139	.94324	13
48	.05690	.23165	.94310	12
49	.05703	.23191	.94297	11
50	.05717	.23216	.94283	10
51	.05730	.23242	.94270	9
52	.05744	.23268	.94256	8
53	.05757	.23294	.94243	7
54	.05771	.23319	.94229	6
55	.05785	.23345	.94215	5
56	.05798	.23371	.94202	4
57	.05812	.23396	.94188	3
58	.05825	.23422	.94175	2
59	.05839	.23448	.94161	1
60	.05853	.23474	.94147	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

 $103^\circ (283^\circ)$
 $(256^\circ) 76^\circ$

Sin² x Cos² x Sin x Cos x

14° (194°)

(345°) 165°

15° (195°)

(344°) 164°

°	Sin ²	Sin · Cos	Cos ²	°
0	.05853	.23474	.94147	60
1	.05866	.23499	.94134	59
2	.05880	.23525	.94120	58
3	.05894	.23551	.94106	57
4	.05907	.23576	.94093	56
5	.05921	.23602	.94079	55
6	.05935	.23628	.94065	54
7	.05949	.23653	.94051	53
8	.05962	.23679	.94038	52
9	.05976	.23704	.94024	51
10	.05990	.23730	.94010	50
11	.06004	.23756	.93996	49
12	.06018	.23781	.93982	48
13	.06031	.23807	.93969	47
14	.06045	.23832	.93955	46
15	.06059	.23858	.93941	45
16	.06073	.23883	.93927	44
17	.06087	.23909	.93913	43
18	.06101	.23935	.93899	42
19	.06115	.23960	.93885	41
20	.06129	.23986	.93871	40
21	.06143	.24011	.93857	39
22	.06157	.24037	.93843	38
23	.06171	.24062	.93829	37
24	.06185	.24088	.93815	36
25	.06199	.24113	.93801	35
26	.06213	.24139	.93787	34
27	.06227	.24164	.93773	33
28	.06241	.24190	.93759	32
29	.06255	.24215	.93745	31
30	.06269	.24240	.93731	30
31	.06283	.24266	.93717	29
32	.06297	.24291	.93703	28
33	.06311	.24317	.93689	27
34	.06326	.24342	.93674	26
35	.06340	.24368	.93660	25
36	.06354	.24393	.93646	24
37	.06368	.24418	.93632	23
38	.06382	.24444	.93618	22
39	.06397	.24469	.93603	21
40	.06411	.24494	.93589	20
41	.06425	.24520	.93575	19
42	.06439	.24545	.93561	18
43	.06454	.24571	.93546	17
44	.06468	.24596	.93532	16
45	.06482	.24621	.93518	15
46	.06497	.24646	.93503	14
47	.06511	.24672	.93489	13
48	.06525	.24697	.93475	12
49	.06540	.24722	.93460	11
50	.06554	.24748	.93446	10
51	.06568	.24773	.93432	9
52	.06583	.24798	.93417	8
53	.06597	.24823	.93403	7
54	.06612	.24849	.93388	6
55	.06626	.24874	.93374	5
56	.06641	.24899	.93359	4
57	.06655	.24924	.93345	3
58	.06670	.24950	.93330	2
59	.06684	.24975	.93316	1
60	.06699	.25000	.93301	0
°	Cos ²	Sin · Cos	Sin ²	°

104° (284°)

(255°) 75°

°	Sin ²	Sin · Cos	Cos ²	°
0	.06699	.25000	.93301	50
1	.06713	.25025	.93287	59
2	.06728	.25050	.93272	58
3	.06742	.25076	.93258	57
4	.06757	.25101	.93243	56
5	.06772	.25126	.93228	55
6	.06786	.25151	.93214	54
7	.06801	.25176	.93199	53
8	.06816	.25201	.93184	52
9	.06830	.25226	.93170	51
10	.06845	.25251	.93155	50
11	.06860	.25277	.93140	49
12	.06874	.25302	.93126	48
13	.06889	.25327	.93111	47
14	.06904	.25352	.93096	46
15	.06919	.25377	.93081	45
16	.06933	.25402	.93067	44
17	.06948	.25427	.93052	43
18	.06963	.25452	.93037	42
19	.06978	.25477	.93022	41
20	.06993	.25502	.93007	40
21	.07007	.25527	.92993	39
22	.07022	.25552	.92978	38
23	.07037	.25577	.92963	37
24	.07052	.25602	.92948	36
25	.07067	.25627	.92933	35
26	.07082	.25652	.92918	34
27	.07097	.25677	.92903	33
28	.07112	.25702	.92888	32
29	.07127	.25727	.92873	31
30	.07142	.25752	.92858	30
31	.07157	.25777	.92843	29
32	.07172	.25802	.92828	28
33	.07187	.25827	.92813	27
34	.07202	.25852	.92798	26
35	.07217	.25876	.92783	25
36	.07232	.25901	.92768	24
37	.07247	.25926	.92753	23
38	.07262	.25951	.92738	22
39	.07277	.25976	.92723	21
40	.07292	.26001	.92708	20
41	.07307	.26026	.92693	19
42	.07322	.26050	.92678	18
43	.07338	.26075	.92662	17
44	.07353	.26100	.92647	16
45	.07368	.26125	.92632	15
46	.07383	.26150	.92617	14
47	.07398	.26175	.92602	13
48	.07414	.26199	.92586	12
49	.07429	.26224	.92571	11
50	.07444	.26249	.92556	10
51	.07459	.26274	.92541	9
52	.07475	.26298	.92525	8
53	.07490	.26323	.92510	7
54	.07505	.26348	.92495	6
55	.07521	.26373	.92479	5
56	.07536	.26397	.92464	4
57	.07551	.26422	.92449	3
58	.07567	.26447	.92433	2
59	.07582	.26471	.92418	1
60	.07598	.26496	.92402	0
°	Cos ²	Sin · Cos	Sin ²	°

105° (285°)

(254°) 74°

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

16° (196°)

(343°) 163°

17° (197°)

(342°) 162°

'	\sin^2	$\sin \cdot \cos$	\cos^2	'
0	.07598	.26494	.92402	60
1	.07613	.26521	.92387	59
2	.07628	.26545	.92372	58
3	.07644	.26570	.92356	57
4	.07659	.26595	.92341	56
5	.07675	.26619	.92325	55
6	.07690	.26644	.92310	54
7	.07706	.26668	.92294	53
8	.07721	.26693	.92279	52
9	.07737	.26718	.92263	51
10	.07752	.26742	.92248	50
11	.07768	.26767	.92232	49
12	.07784	.26791	.92216	48
13	.07799	.26816	.92201	47
14	.07815	.26840	.92185	46
15	.07830	.26865	.92170	45
16	.07846	.26890	.92154	44
17	.07862	.26914	.92138	43
18	.07877	.26939	.92123	42
19	.07893	.26963	.92107	41
20	.07909	.26988	.92091	40
21	.07924	.27012	.92076	39
22	.07940	.27036	.92060	38
23	.07956	.27061	.92044	37
24	.07972	.27085	.92028	36
25	.07987	.27110	.92013	35
26	.08003	.27134	.91997	34
27	.08019	.27159	.91981	33
28	.08035	.27183	.91965	32
29	.08051	.27208	.91949	31
30	.08066	.27232	.91934	30
31	.08082	.27256	.91918	29
32	.08098	.27281	.91902	28
33	.08114	.27305	.91886	27
34	.08130	.27329	.91870	26
35	.08146	.27354	.91854	25
36	.08162	.27378	.91838	24
37	.08178	.27402	.91822	23
38	.08194	.27427	.91806	22
39	.08210	.27451	.91790	21
40	.08226	.27475	.91774	20
41	.08242	.27500	.91758	19
42	.08258	.27524	.91742	18
43	.08274	.27548	.91726	17
44	.08290	.27573	.91710	16
45	.08306	.27597	.91694	15
46	.08322	.27621	.91678	14
47	.08338	.27645	.91662	13
48	.08354	.27670	.91646	12
49	.08370	.27694	.91630	11
50	.08386	.27718	.91614	10
51	.08402	.27742	.91598	9
52	.08418	.27766	.91582	8
53	.08435	.27791	.91565	7
54	.08451	.27815	.91549	6
55	.08467	.27839	.91533	5
56	.08483	.27863	.91517	4
57	.08499	.27887	.91501	3
58	.08516	.27911	.91484	2
59	.08532	.27936	.91468	1
60	.08548	.27960	.91452	0
'	\cos^2	$\sin \cdot \cos$	\sin^2	'

106° (286°)

(253°) 73°

'	\sin^2	$\sin \cdot \cos$	\cos^2	'
0	.08548	.27960	.91452	60
1	.08564	.27984	.91436	59
2	.08581	.28008	.91419	58
3	.08597	.28032	.91403	57
4	.08613	.28056	.91387	56
5	.08630	.28080	.91370	55
6	.08646	.28104	.91354	54
7	.08662	.28128	.91338	53
8	.08679	.28152	.91321	52
9	.08695	.28176	.91305	51
10	.08711	.28200	.91289	50
11	.08728	.28224	.91272	49
12	.08744	.28248	.91256	48
13	.08761	.28272	.91239	47
14	.08777	.28296	.91223	46
15	.08794	.28320	.91206	45
16	.08810	.28344	.91190	44
17	.08827	.28368	.91173	43
18	.08843	.28392	.91157	42
19	.08860	.28416	.91140	41
20	.08876	.28440	.91124	40
21	.08893	.28464	.91107	39
22	.08909	.28488	.91091	38
23	.08926	.28512	.91074	37
24	.08943	.28536	.91057	36
25	.08959	.28560	.91041	35
26	.08976	.28583	.91024	34
27	.08992	.28607	.91008	33
28	.09009	.28631	.90991	32
29	.09026	.28655	.90974	31
30	.09042	.28679	.90958	30
31	.09059	.28703	.90941	29
32	.09076	.28726	.90924	28
33	.09093	.28750	.90907	27
34	.09109	.28774	.90891	26
35	.09126	.28798	.90874	25
36	.09143	.28822	.90857	24
37	.09160	.28845	.90840	23
38	.09176	.28869	.90824	22
39	.09193	.28893	.90807	21
40	.09210	.28917	.90790	20
41	.09227	.28940	.90773	19
42	.09244	.28964	.90756	18
43	.09260	.28988	.90740	17
44	.09277	.29011	.90723	16
45	.09294	.29035	.90706	15
46	.09311	.29059	.90689	14
47	.09328	.29082	.90672	13
48	.09345	.29106	.90655	12
49	.09362	.29130	.90638	11
50	.09379	.29153	.90621	10
51	.09396	.29177	.90604	9
52	.09413	.29201	.90587	8
53	.09430	.29224	.90570	7
54	.09447	.29248	.90553	6
55	.09464	.29271	.90536	5
56	.09481	.29295	.90519	4
57	.09498	.29319	.90502	3
58	.09515	.29342	.90485	2
59	.09532	.29366	.90468	1
60	.09549	.29389	.90451	0
'	\cos^2	$\sin \cdot \cos$	\sin^2	'

107° (287°)

(252°) 72°

$\text{Sin}^2 x \quad \text{Cos}^2 x \quad \text{Sin} x \text{ Cos} x$							
18° (198°)				(341°) 161°			
				19° (199°)			
				(340°) 160°			
	Sin ²	Sin · Cos	Cos ²		Sin ²	Sin · Cos	Cos ²
0	.09549	.29389	.90451	60	.10599	.30783	.89401
1	.09566	.29413	.90434	59	.10617	.30806	.89383
2	.09583	.29436	.90417	58	.10635	.30829	.89365
3	.09601	.29460	.90399	57	.10653	.30852	.89347
4	.09618	.29483	.90382	56	.10671	.30875	.89329
5	.09635	.29507	.90365	55	.10689	.30898	.89311
6	.09652	.29530	.90348	54	.10707	.30920	.89293
7	.09669	.29554	.90331	53	.10725	.30943	.89275
8	.09686	.29577	.90314	52	.10743	.30966	.89257
9	.09704	.29601	.90296	51	.10761	.30989	.89239
10	.09721	.29624	.90279	50	.10779	.31012	.89221
11	.09738	.29648	.90262	49	.10797	.31035	.89203
12	.09755	.29671	.90245	48	.10815	.31057	.89185
13	.09773	.29694	.90227	47	.10833	.31080	.89167
14	.09790	.29718	.90210	46	.10851	.31103	.89149
15	.09807	.29741	.90193	45	.10870	.31126	.89130
16	.09824	.29765	.90176	44	.10888	.31148	.89112
17	.09842	.29788	.90158	43	.10906	.31171	.89094
18	.09859	.29811	.90141	42	.10924	.31194	.89076
19	.09876	.29835	.90124	41	.10942	.31217	.89058
20	.09894	.29858	.90106	40	.10960	.31239	.89040
21	.09911	.29881	.90089	39	.10978	.31262	.89022
22	.09929	.29905	.90071	38	.10997	.31285	.89003
23	.09946	.29928	.90054	37	.11015	.31308	.88985
24	.09963	.29951	.90037	36	.11033	.31330	.88967
25	.09981	.29974	.90019	35	.11051	.31353	.88949
26	.09998	.29998	.90002	34	.11070	.31376	.88930
27	.10016	.30021	.89984	33	.11088	.31398	.88912
28	.10033	.30044	.89967	32	.11106	.31421	.88894
29	.10051	.30068	.89949	31	.11124	.31443	.88876
30	.10068	.30091	.89932	30	.11143	.31466	.88857
31	.10086	.30114	.89914	29	.11161	.31489	.88839
32	.10103	.30137	.89897	28	.11179	.31511	.88821
33	.10121	.30160	.89879	27	.11198	.31534	.88802
34	.10138	.30184	.89862	26	.11216	.31556	.88784
35	.10156	.30207	.89844	25	.11234	.31579	.88766
36	.10174	.30230	.89826	24	.11253	.31601	.88747
37	.10191	.30253	.89809	23	.11271	.31624	.88729
38	.10209	.30276	.89791	22	.11290	.31647	.88710
39	.10226	.30299	.89774	21	.11308	.31669	.88692
40	.10244	.30323	.89756	20	.11326	.31692	.88674
41	.10262	.30346	.89738	19	.11345	.31714	.88655
42	.10279	.30369	.89721	18	.11363	.31737	.88637
43	.10297	.30392	.89703	17	.11382	.31759	.88618
44	.10315	.30415	.89685	16	.11400	.31781	.88600
45	.10332	.30438	.89668	15	.11419	.31804	.88581
46	.10350	.30461	.89650	14	.11437	.31826	.88563
47	.10368	.30484	.89632	13	.11456	.31849	.88544
48	.10386	.30507	.89614	12	.11474	.31871	.88526
49	.10403	.30530	.89597	11	.11493	.31894	.88507
50	.10421	.30553	.89579	10	.11511	.31916	.88489
51	.10439	.30576	.89561	9	.11530	.31938	.88470
52	.10457	.30599	.89543	8	.11549	.31961	.88451
53	.10474	.30622	.89526	7	.11567	.31983	.88433
54	.10492	.30645	.89508	6	.11586	.32005	.88414
55	.10510	.30668	.89490	5	.11604	.32028	.88396
56	.10528	.30691	.89472	4	.11623	.32050	.88377
57	.10546	.30714	.89454	3	.11642	.32072	.88358
58	.10564	.30737	.89436	2	.11660	.32095	.88340
59	.10582	.30760	.89418	1	.11679	.32117	.88321
60	.10599	.30783	.89401	0	.11698	.32139	.88302
	Cos ²	Sin · Cos	Sin ²		Cos ²	Sin · Cos	Sin ²
108° (288°)				(251°) 71°			
109° (289°)				(250°) 70°			

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

20° (200°)

(339°) 159°

21° (201°)

(338°) 158°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.11698	.32139	.88302	60
1	.11716	.32162	.88284	59
2	.11735	.32184	.88265	58
3	.11754	.32206	.88246	57
4	.11773	.32228	.88227	56
5	.11791	.32251	.88209	55
6	.11810	.32273	.88190	54
7	.11829	.32295	.88171	53
8	.11848	.32317	.88152	52
9	.11867	.32339	.88133	51
10	.11885	.32362	.88115	50
11	.11904	.32384	.88096	49
12	.11923	.32406	.88077	48
13	.11942	.32428	.88058	47
14	.11961	.32450	.88039	46
15	.11980	.32472	.88020	45
16	.11999	.32495	.88001	44
17	.12018	.32517	.87982	43
18	.12036	.32539	.87964	42
19	.12055	.32561	.87945	41
20	.12074	.32583	.87926	40
21	.12093	.32605	.87907	39
22	.12112	.32627	.87888	38
23	.12131	.32649	.87869	37
24	.12150	.32671	.87850	36
25	.12169	.32693	.87831	35
26	.12188	.32715	.87812	34
27	.12207	.32737	.87793	33
28	.12226	.32759	.87774	32
29	.12245	.32781	.87755	31
30	.12265	.32803	.87735	30
31	.12284	.32825	.87716	29
32	.12303	.32847	.87697	28
33	.12322	.32869	.87678	27
34	.12341	.32891	.87659	26
35	.12360	.32913	.87640	25
36	.12379	.32934	.87621	24
37	.12398	.32956	.87602	23
38	.12418	.32978	.87582	22
39	.12437	.33000	.87563	21
40	.12456	.33022	.87544	20
41	.12475	.33044	.87525	19
42	.12494	.33066	.87506	18
43	.12514	.33087	.87486	17
44	.12533	.33109	.87467	16
45	.12552	.33131	.87448	15
46	.12571	.33153	.87429	14
47	.12591	.33175	.87409	13
48	.12610	.33196	.87390	12
49	.12629	.33218	.87371	11
50	.12649	.33240	.87351	10
51	.12668	.33262	.87332	9
52	.12687	.33283	.87313	8
53	.12707	.33305	.87293	7
54	.12726	.33327	.87274	6
55	.12746	.33348	.87254	5
56	.12765	.33370	.87235	4
57	.12784	.33392	.87216	3
58	.12804	.33413	.87196	2
59	.12823	.33435	.87177	1
60	.12843	.33457	.87157	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

110° (290°)

(249°) 69°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.12843	.33457	.87157	60
1	.12862	.33478	.87138	59
2	.12882	.33500	.87118	58
3	.12901	.33521	.87099	57
4	.12921	.33543	.87079	56
5	.12940	.33564	.87060	55
6	.12960	.33586	.87040	54
7	.12979	.33608	.87021	53
8	.12999	.33629	.87001	52
9	.13018	.33651	.86982	51
10	.13038	.33672	.86962	50
11	.13058	.33694	.86942	49
12	.13077	.33715	.86923	48
13	.13097	.33737	.86903	47
14	.13116	.33758	.86884	46
15	.13136	.33780	.86864	45
16	.13156	.33801	.86844	44
17	.13175	.33822	.86825	43
18	.13195	.33844	.86805	42
19	.13215	.33865	.86785	41
20	.13235	.33887	.86765	40
21	.13254	.33908	.86746	39
22	.13274	.33929	.86726	38
23	.13294	.33951	.86706	37
24	.13314	.33972	.86686	36
25	.13333	.33993	.86667	35
26	.13353	.34015	.86647	34
27	.13373	.34036	.86627	33
28	.13393	.34057	.86607	32
29	.13412	.34079	.86588	31
30	.13432	.34100	.86568	30
31	.13452	.34121	.86548	29
32	.13472	.34142	.86528	28
33	.13492	.34164	.86508	27
34	.13512	.34185	.86488	26
35	.13532	.34206	.86468	25
36	.13552	.34227	.86448	24
37	.13571	.34249	.86429	23
38	.13591	.34270	.86409	22
39	.13611	.34291	.86389	21
40	.13631	.34312	.86369	20
41	.13651	.34333	.86349	19
42	.13671	.34354	.86329	18
43	.13691	.34376	.86309	17
44	.13711	.34397	.86289	16
45	.13731	.34418	.86269	15
46	.13751	.34439	.86249	14
47	.13771	.34460	.86229	13
48	.13791	.34481	.86209	12
49	.13811	.34502	.86189	11
50	.13832	.34523	.86168	10
51	.13852	.34544	.86148	9
52	.13872	.34565	.86128	8
53	.13892	.34586	.86108	7
54	.13912	.34607	.86088	6
55	.13932	.34628	.86068	5
56	.13952	.34649	.86048	4
57	.13972	.34670	.86028	3
58	.13993	.34691	.86007	2
59	.14013	.34712	.85987	1
60	.14033	.34733	.85967	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

111° (291°)

(248°) 68°

$\text{Sin}^2 x$				$\text{Cos}^2 x$				$\text{Sin } x \text{ Cos } x$			
22° (202°)				(337°) 157°				23° (203°)			
								(336°) 156°			
	Sin ²	Sin · Cos	Cos ²						Sin ²	Sin · Cos	Cos ²
0	.14033	.34733	.85967	60				0	.15267	.35967	.84733
1	.14053	.34754	.85947	59				1	.15288	.35987	.84712
2	.14073	.34775	.85927	58				2	.15309	.36007	.84691
3	.14094	.34796	.85906	57				3	.15330	.36028	.84670
4	.14114	.34817	.85886	56				4	.15351	.36048	.84649
5	.14134	.34837	.85866	55				5	.15372	.36068	.84628
6	.14154	.34858	.85846	54				6	.15393	.36088	.84607
7	.14175	.34879	.85825	53				7	.15414	.36108	.84586
8	.14195	.34900	.85805	52				8	.15435	.36128	.84565
9	.14215	.34921	.85785	51				9	.15456	.36148	.84544
10	.14236	.34942	.85764	50				10	.15477	.36168	.84523
11	.14256	.34962	.85744	49				11	.15498	.36189	.84502
12	.14276	.34983	.85724	48				12	.15519	.36209	.84481
13	.14297	.35004	.85703	47				13	.15540	.36229	.84460
14	.14317	.35025	.85683	46				14	.15561	.36249	.84439
15	.14337	.35045	.85663	45				15	.15582	.36269	.84418
16	.14358	.35066	.85642	44				16	.15603	.36289	.84397
17	.14378	.35087	.85622	43				17	.15624	.36309	.84376
18	.14399	.35108	.85601	42				18	.15646	.36329	.84354
19	.14419	.35128	.85581	41				19	.15667	.36349	.84333
20	.14440	.35149	.85560	40				20	.15688	.36369	.84312
21	.14460	.35170	.85540	39				21	.15709	.36389	.84291
22	.14480	.35190	.85520	38				22	.15730	.36409	.84270
23	.14501	.35211	.85499	37				23	.15751	.36429	.84249
24	.14521	.35232	.85479	36				24	.15773	.36448	.84227
25	.14542	.35252	.85458	35				25	.15794	.36468	.84206
26	.14562	.35273	.85438	34				26	.15815	.36488	.84185
27	.14583	.35294	.85417	33				27	.15836	.36508	.84164
28	.14604	.35314	.85396	32				28	.15858	.36528	.84142
29	.14624	.35335	.85376	31				29	.15879	.36548	.84121
30	.14645	.35355	.85355	30				30	.15900	.36568	.84100
31	.14665	.35376	.85335	29				31	.15921	.36588	.84079
32	.14686	.35396	.85314	28				32	.15943	.36607	.84057
33	.14706	.35417	.85294	27				33	.15964	.36627	.84036
34	.14727	.35438	.85273	26				34	.15985	.36647	.84015
35	.14748	.35458	.85252	25				35	.16007	.36667	.83993
36	.14768	.35479	.85232	24				36	.16028	.36686	.83972
37	.14789	.35499	.85211	23				37	.16049	.36706	.83951
38	.14810	.35520	.85190	22				38	.16071	.36726	.83929
39	.14830	.35540	.85170	21				39	.16092	.36746	.83908
40	.14851	.35560	.85149	20				40	.16113	.36765	.83887
41	.14872	.35581	.85128	19				41	.16135	.36785	.83865
42	.14892	.35601	.85108	18				42	.16156	.36805	.83844
43	.14913	.35622	.85087	17				43	.16178	.36825	.83822
44	.14934	.35642	.85066	16				44	.16199	.36844	.83801
45	.14955	.35663	.85045	15				45	.16220	.36864	.83780
46	.14975	.35683	.85025	14				46	.16242	.36884	.83758
47	.14996	.35703	.85004	13				47	.16263	.36903	.83737
48	.15017	.35724	.84983	12				48	.16285	.36923	.83715
49	.15038	.35744	.84962	11				49	.16306	.36942	.83694
50	.15058	.35764	.84942	10				50	.16328	.36962	.83672
51	.15079	.35785	.84921	9				51	.16349	.36982	.83651
52	.15100	.35805	.84900	8				52	.16371	.37001	.83629
53	.15121	.35825	.84879	7				53	.16392	.37021	.83608
54	.15142	.35846	.84858	6				54	.16414	.37040	.83586
55	.15163	.35866	.84837	5				55	.16436	.37060	.83564
56	.15183	.35886	.84817	4				56	.16457	.37079	.83543
57	.15204	.35906	.84796	3				57	.16479	.37099	.83521
58	.15225	.35927	.84775	2				58	.16500	.37118	.83500
59	.15246	.35947	.84754	1				59	.16522	.37138	.83478
60	.15267	.35967	.84733	0				60	.16543	.37157	.83457
	Cos ²	Sin · Cos	Sin ²						Cos ²	Sin · Cos	Sin ²
112° (292°)				(247°) 67°				113° (293°)			
								(246°) 66°			

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

24° (204°)

(335°) 155°

25° (205°)

(334°) 154°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.16543	.37157	.83457	60
1	.16565	.37177	.83435	59
2	.16587	.37196	.83413	58
3	.16608	.37216	.83392	57
4	.16630	.37235	.83370	56
5	.16652	.37254	.83348	55
6	.16673	.37274	.83327	54
7	.16695	.37293	.83305	53
8	.16717	.37313	.83283	52
9	.16738	.37332	.83262	51
10	.16760	.37351	.83240	50
11	.16782	.37371	.83218	49
12	.16804	.37390	.83196	48
13	.16825	.37409	.83175	47
14	.16847	.37429	.83153	46
15	.16869	.37448	.83131	45
16	.16891	.37467	.83109	44
17	.16913	.37486	.83087	43
18	.16934	.37506	.83066	42
19	.16956	.37525	.83044	41
20	.16978	.37544	.83022	40
21	.17000	.37563	.83000	39
22	.17022	.37582	.82978	38
23	.17044	.37602	.82956	37
24	.17066	.37621	.82934	36
25	.17087	.37640	.82913	35
26	.17109	.37659	.82891	34
27	.17131	.37678	.82869	33
28	.17153	.37697	.82847	32
29	.17175	.37716	.82825	31
30	.17197	.37735	.82803	30
31	.17219	.37755	.82781	29
32	.17241	.37774	.82759	28
33	.17263	.37793	.82737	27
34	.17285	.37812	.82715	26
35	.17307	.37831	.82693	25
36	.17329	.37850	.82671	24
37	.17351	.37869	.82649	23
38	.17373	.37888	.82627	22
39	.17395	.37907	.82605	21
40	.17417	.37926	.82583	20
41	.17439	.37945	.82561	19
42	.17461	.37964	.82539	18
43	.17483	.37982	.82517	17
44	.17505	.38001	.82495	16
45	.17528	.38020	.82472	15
46	.17550	.38039	.82450	14
47	.17572	.38058	.82428	13
48	.17594	.38077	.82406	12
49	.17616	.38096	.82384	11
50	.17638	.38115	.82362	10
51	.17661	.38133	.82339	9
52	.17683	.38152	.82317	8
53	.17705	.38171	.82295	7
54	.17727	.38190	.82273	6
55	.17749	.38209	.82251	5
56	.17772	.38227	.82228	4
57	.17794	.38246	.82206	3
58	.17816	.38265	.82184	2
59	.17838	.38284	.82162	1
60	.17861	.38302	.82139	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

114° (294°)

(245°) 65°

115° (295°)

(244°) 64°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.17861	.38302	.82139	60
1	.17883	.38321	.82117	59
2	.17905	.38340	.82095	58
3	.17928	.38358	.82072	57
4	.17950	.38377	.82050	56
5	.17972	.38396	.82028	55
6	.17995	.38414	.82005	54
7	.18017	.38433	.81983	53
8	.18039	.38451	.81961	52
9	.18062	.38470	.81938	51
10	.18084	.38489	.81916	50
11	.18106	.38507	.81894	49
12	.18129	.38526	.81871	48
13	.18151	.38544	.81849	47
14	.18174	.38563	.81826	46
15	.18196	.38581	.81804	45
16	.18219	.38600	.81781	44
17	.18241	.38618	.81759	43
18	.18263	.38637	.81737	42
19	.18286	.38655	.81714	41
20	.18308	.38674	.81692	40
21	.18331	.38692	.81669	39
22	.18353	.38710	.81647	38
23	.18376	.38729	.81624	37
24	.18399	.38747	.81601	36
25	.18421	.38766	.81579	35
26	.18444	.38784	.81556	34
27	.18466	.38802	.81534	33
28	.18489	.38821	.81511	32
29	.18511	.38839	.81489	31
30	.18534	.38857	.81466	30
31	.18557	.38876	.81443	29
32	.18579	.38894	.81421	28
33	.18602	.38912	.81398	27
34	.18624	.38930	.81376	26
35	.18647	.38949	.81353	25
36	.18670	.38967	.81330	24
37	.18692	.38985	.81308	23
38	.18715	.39003	.81285	22
39	.18738	.39022	.81262	21
40	.18761	.39040	.81239	20
41	.18783	.39058	.81217	19
42	.18806	.39076	.81194	18
43	.18829	.39094	.81171	17
44	.18852	.39112	.81148	16
45	.18874	.39130	.81126	15
46	.18897	.39149	.81103	14
47	.18920	.39167	.81080	13
48	.18943	.39185	.81057	12
49	.18965	.39203	.81035	11
50	.18988	.39221	.81012	10
51	.19011	.39239	.80989	9
52	.19034	.39257	.80966	8
53	.19057	.39275	.80943	7
54	.19080	.39293	.80920	6
55	.19102	.39311	.80898	5
56	.19125	.39329	.80875	4
57	.19148	.39347	.80852	3
58	.19171	.39365	.80829	2
59	.19194	.39383	.80806	1
60	.19217	.39401	.80783	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

26° (206°)

(333°) 153°

27° (207°)

(332°) 152°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.19217	.39401	.80783	60
1	.19240	.39418	.80760	59
2	.19263	.39436	.80737	58
3	.19286	.39454	.80714	57
4	.19309	.39472	.80691	56
5	.19332	.39490	.80668	55
6	.19355	.39508	.80645	54
7	.19378	.39526	.80622	53
8	.19401	.39543	.80599	52
9	.19424	.39561	.80576	51
10	.19447	.39579	.80553	50
11	.19470	.39597	.80530	49
12	.19493	.39614	.80507	48
13	.19516	.39632	.80484	47
14	.19539	.39650	.80461	46
15	.19562	.39668	.80438	45
16	.19585	.39685	.80415	44
17	.19608	.39703	.80392	43
18	.19631	.39721	.80369	42
19	.19654	.39738	.80346	41
20	.19677	.39756	.80323	40
21	.19701	.39774	.80299	39
22	.19724	.39791	.80276	38
23	.19747	.39809	.80253	37
24	.19770	.39826	.80230	36
25	.19793	.39844	.80207	35
26	.19816	.39862	.80184	34
27	.19840	.39879	.80160	33
28	.19863	.39897	.80137	32
29	.19886	.39914	.80114	31
30	.19909	.39932	.80091	30
31	.19932	.39949	.80068	29
32	.19956	.39967	.80044	28
33	.19979	.39984	.80021	27
34	.20002	.40002	.79998	26
35	.20026	.40019	.79974	25
36	.20049	.40037	.79951	24
37	.20072	.40054	.79928	23
38	.20095	.40071	.79905	22
39	.20119	.40089	.79881	21
40	.20142	.40106	.79858	20
41	.20165	.40124	.79835	19
42	.20189	.40141	.79811	18
43	.20212	.40158	.79788	17
44	.20235	.40176	.79765	16
45	.20259	.40193	.79741	15
46	.20282	.40210	.79718	14
47	.20306	.40227	.79694	13
48	.20329	.40245	.79671	12
49	.20352	.40262	.79648	11
50	.20376	.40279	.79624	10
51	.20399	.40296	.79601	9
52	.20423	.40314	.79577	8
53	.20446	.40331	.79554	7
54	.20470	.40348	.79530	6
55	.20493	.40365	.79507	5
56	.20517	.40382	.79483	4
57	.20540	.40399	.79460	3
58	.20564	.40417	.79436	2
59	.20587	.40434	.79413	1
60	.20611	.40451	.79389	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

116° (296°)

(243°) 63°

117° (297°)

(242°) 62°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.20611	.40451	.79389	60
1	.20634	.40468	.79366	59
2	.20658	.40485	.79342	58
3	.20681	.40502	.79319	57
4	.20705	.40519	.79295	56
5	.20729	.40536	.79271	55
6	.20752	.40553	.79248	54
7	.20776	.40570	.79224	53
8	.20799	.40587	.79201	52
9	.20823	.40604	.79177	51
10	.20847	.40621	.79153	50
11	.20870	.40638	.79130	49
12	.20894	.40655	.79106	48
13	.20918	.40672	.79082	47
14	.20941	.40689	.79059	46
15	.20965	.40706	.79035	45
16	.20989	.40723	.79011	44
17	.21012	.40740	.78988	43
18	.21036	.40756	.78964	42
19	.21060	.40773	.78940	41
20	.21083	.40790	.78917	40
21	.21107	.40807	.78893	39
22	.21131	.40824	.78869	38
23	.21155	.40840	.78845	37
24	.21178	.40857	.78822	36
25	.21202	.40874	.78798	35
26	.21226	.40891	.78774	34
27	.21250	.40907	.78750	33
28	.21274	.40924	.78726	32
29	.21297	.40941	.78703	31
30	.21321	.40958	.78679	30
31	.21345	.40974	.78655	29
32	.21369	.40991	.78631	28
33	.21393	.41008	.78607	27
34	.21417	.41024	.78583	26
35	.21440	.41041	.78560	25
36	.21464	.41057	.78536	24
37	.21488	.41074	.78512	23
38	.21512	.41091	.78488	22
39	.21536	.41107	.78464	21
40	.21560	.41124	.78440	20
41	.21584	.41140	.78416	19
42	.21608	.41157	.78392	18
43	.21632	.41173	.78368	17
44	.21656	.41190	.78344	16
45	.21680	.41206	.78320	15
46	.21704	.41223	.78296	14
47	.21728	.41239	.78272	13
48	.21752	.41256	.78248	12
49	.21776	.41272	.78224	11
50	.21800	.41289	.78200	10
51	.21824	.41305	.78176	9
52	.21848	.41321	.78152	8
53	.21872	.41338	.78128	7
54	.21896	.41354	.78104	6
55	.21920	.41370	.78080	5
56	.21944	.41387	.78056	4
57	.21968	.41403	.78032	3
58	.21992	.41419	.78008	2
59	.22016	.41436	.77984	1
60	.22040	.41452	.77960	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

23° (208°)

(331°) 151°

29° (209°)

(330°) 150°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.22040	.41452	.77960	60
1	.22064	.41468	.77936	59
2	.22089	.41484	.77911	58
3	.22113	.41501	.77887	57
4	.22137	.41517	.77863	56
5	.22161	.41533	.77839	55
6	.22185	.41549	.77815	54
7	.22209	.41565	.77791	53
8	.22234	.41582	.77766	52
9	.22258	.41598	.77742	51
10	.22282	.41614	.77718	50
11	.22306	.41630	.77694	49
12	.22330	.41646	.77670	48
13	.22355	.41662	.77645	47
14	.22379	.41678	.77621	46
15	.22403	.41694	.77597	45
16	.22427	.41710	.77573	44
17	.22452	.41726	.77548	43
18	.22476	.41742	.77524	42
19	.22500	.41758	.77500	41
20	.22525	.41774	.77475	40
21	.22549	.41790	.77451	39
22	.22573	.41806	.77427	38
23	.22598	.41822	.77402	37
24	.22622	.41838	.77378	36
25	.22646	.41854	.77354	35
26	.22671	.41870	.77329	34
27	.22695	.41886	.77305	33
28	.22719	.41902	.77281	32
29	.22744	.41918	.77256	31
30	.22768	.41934	.77232	30
31	.22792	.41949	.77208	29
32	.22817	.41965	.77183	28
33	.22841	.41981	.77159	27
34	.22866	.41997	.77134	26
35	.22890	.42013	.77110	25
36	.22915	.42028	.77085	24
37	.22939	.42044	.77061	23
38	.22964	.42060	.77036	22
39	.22988	.42076	.77012	21
40	.23012	.42091	.76988	20
41	.23037	.42107	.76963	19
42	.23061	.42123	.76939	18
43	.23086	.42138	.76914	17
44	.23110	.42154	.76890	16
45	.23135	.42170	.76865	15
46	.23160	.42185	.76840	14
47	.23184	.42201	.76816	13
48	.23209	.42216	.76791	12
49	.23233	.42232	.76767	11
50	.23258	.42248	.76742	10
51	.23282	.42263	.76718	9
52	.23307	.42279	.76693	8
53	.23332	.42294	.76668	7
54	.23356	.42310	.76644	6
55	.23381	.42325	.76619	5
56	.23405	.42341	.76595	4
57	.23430	.42356	.76570	3
58	.23455	.42372	.76545	2
59	.23479	.42387	.76521	1
60	.23504	.42402	.76496	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

118° (298°)

(241°) 61°

119° (299°)

(240°) 60°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.23504	.42402	.76496	60
1	.23529	.42418	.76471	59
2	.23553	.42433	.76447	58
3	.23578	.42449	.76422	57
4	.23603	.42464	.76397	56
5	.23627	.42479	.76373	55
6	.23652	.42495	.76348	54
7	.23677	.42510	.76323	53
8	.23702	.42525	.76298	52
9	.23726	.42541	.76274	51
10	.23751	.42556	.76249	50
11	.23776	.42571	.76224	49
12	.23801	.42586	.76199	48
13	.23825	.42602	.76175	47
14	.23850	.42617	.76150	46
15	.23875	.42632	.76125	45
16	.23900	.42647	.76100	44
17	.23925	.42662	.76075	43
18	.23950	.42678	.76050	42
19	.23974	.42693	.76026	41
20	.23999	.42708	.76001	40
21	.24024	.42723	.75976	39
22	.24049	.42738	.75951	38
23	.24074	.42753	.75926	37
24	.24099	.42768	.75901	36
25	.24124	.42783	.75876	35
26	.24148	.42798	.75852	34
27	.24173	.42813	.75827	33
28	.24198	.42828	.75802	32
29	.24223	.42843	.75777	31
30	.24248	.42858	.75752	30
31	.24273	.42873	.75727	29
32	.24298	.42888	.75702	28
33	.24323	.42903	.75677	27
34	.24348	.42918	.75652	26
35	.24373	.42933	.75627	25
36	.24398	.42948	.75602	24
37	.24423	.42963	.75577	23
38	.24448	.42978	.75552	22
39	.24473	.42993	.75527	21
40	.24498	.43007	.75502	20
41	.24523	.43022	.75477	19
42	.24548	.43037	.75452	18
43	.24573	.43052	.75427	17
44	.24598	.43067	.75402	16
45	.24623	.43081	.75377	15
46	.24648	.43096	.75352	14
47	.24673	.43111	.75327	13
48	.24698	.43126	.75302	12
49	.24723	.43140	.75277	11
50	.24749	.43155	.75251	10
51	.24774	.43170	.75226	9
52	.24799	.43184	.75201	8
53	.24824	.43199	.75176	7
54	.24849	.43214	.75151	6
55	.24874	.43228	.75126	5
56	.24899	.43243	.75101	4
57	.24924	.43258	.75076	3
58	.24950	.43272	.75050	2
59	.24975	.43287	.75025	1
60	.25000	.43301	.75000	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

$\text{Sin}^2 x \quad \text{Cos}^2 x \quad \text{Sin } x \text{ Cos } x$							
30° (210°)				(329°) 149°			
				31° (211°)			
				(328°) 148°			
	Sin ²	Sin · Cos	Cos ²		Sin ²	Sin · Cos	Cos ²
0	.25000	.43301	.75000	0	.26526	.44147	.73474
1	.25025	.43316	.74975	1	.26552	.44161	.73448
2	.25050	.43330	.74950	2	.26578	.44175	.73422
3	.25076	.43345	.74924	3	.26604	.44188	.73396
4	.25101	.43359	.74899	4	.26629	.44202	.73371
5	.25126	.43374	.74874	5	.26655	.44215	.73345
6	.25151	.43388	.74849	6	.26681	.44229	.73319
7	.25177	.43403	.74823	7	.26706	.44243	.73294
8	.25202	.43417	.74798	8	.26732	.44256	.73268
9	.25227	.43432	.74773	9	.26758	.44270	.73242
10	.25252	.43446	.74748	10	.26784	.44283	.73216
11	.25278	.43460	.74722	11	.26809	.44297	.73191
12	.25303	.43475	.74697	12	.26835	.44310	.73165
13	.25328	.43489	.74672	13	.26861	.44324	.73139
14	.25354	.43503	.74646	14	.26887	.44337	.73113
15	.25379	.43518	.74621	15	.26913	.44351	.73087
16	.25404	.43532	.74596	16	.26938	.44364	.73062
17	.25429	.43546	.74571	17	.26964	.44377	.73036
18	.25455	.43561	.74545	18	.26990	.44391	.73010
19	.25480	.43575	.74520	19	.27016	.44404	.72984
20	.25506	.43589	.74494	20	.27042	.44418	.72958
21	.25531	.43603	.74469	21	.27068	.44431	.72932
22	.25556	.43618	.74444	22	.27093	.44444	.72907
23	.25582	.43632	.74418	23	.27119	.44458	.72881
24	.25607	.43646	.74393	24	.27145	.44471	.72855
25	.25632	.43660	.74368	25	.27171	.44484	.72829
26	.25658	.43674	.74342	26	.27197	.44497	.72803
27	.25683	.43689	.74317	27	.27223	.44511	.72777
28	.25709	.43703	.74291	28	.27249	.44524	.72751
29	.25734	.43717	.74266	29	.27275	.44537	.72725
30	.25760	.43731	.74240	30	.27300	.44550	.72700
31	.25785	.43745	.74215	31	.27326	.44564	.72674
32	.25810	.43759	.74190	32	.27352	.44577	.72648
33	.25836	.43773	.74164	33	.27378	.44590	.72622
34	.25861	.43787	.74139	34	.27404	.44603	.72596
35	.25887	.43801	.74113	35	.27430	.44616	.72570
36	.25912	.43815	.74088	36	.27456	.44629	.72544
37	.25938	.43829	.74062	37	.27482	.44642	.72518
38	.25963	.43843	.74037	38	.27508	.44655	.72492
39	.25989	.43857	.74011	39	.27534	.44669	.72466
40	.26014	.43871	.73986	40	.27560	.44682	.72440
41	.26040	.43885	.73960	41	.27586	.44695	.72414
42	.26065	.43899	.73935	42	.27612	.44708	.72388
43	.26091	.43913	.73909	43	.27638	.44721	.72362
44	.26117	.43927	.73883	44	.27664	.44734	.72336
45	.26142	.43941	.73858	45	.27690	.44747	.72310
46	.26168	.43955	.73832	46	.27716	.44760	.72284
47	.26193	.43969	.73807	47	.27742	.44773	.72258
48	.26219	.43982	.73781	48	.27768	.44786	.72232
49	.26244	.43996	.73756	49	.27794	.44799	.72206
50	.26270	.44010	.73730	50	.27820	.44811	.72180
51	.26296	.44024	.73704	51	.27846	.44824	.72154
52	.26321	.44038	.73679	52	.27873	.44837	.72127
53	.26347	.44051	.73653	53	.27899	.44850	.72101
54	.26372	.44065	.73628	54	.27925	.44863	.72075
55	.26398	.44079	.73602	55	.27951	.44876	.72049
56	.26424	.44093	.73576	56	.27977	.44889	.72023
57	.26449	.44106	.73551	57	.28003	.44901	.71997
58	.26475	.44120	.73525	58	.28029	.44914	.71971
59	.26501	.44134	.73499	59	.28055	.44927	.71945
60	.26526	.44147	.73474	60	.28081	.44940	.71919
	Cos ²	Sin · Cos	Sin ²		Cos ²	Sin · Cos	Sin ²
120° (300°)				(239°) 59°			
				121° (301°)			
				(238°) 58°			

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

32° (212°)

(327°) 147°

33° (213°)

(326°) 146°

	\sin^2	$\sin \cdot \cos$	\cos^2	
1	.28081	.44940	.71919	60
2	.28108	.44952	.71892	59
3	.28134	.44965	.71866	58
4	.28160	.44978	.71840	57
5	.28186	.44991	.71814	56
6	.28212	.45003	.71788	55
7	.28238	.45016	.71762	54
8	.28265	.45029	.71735	53
9	.28291	.45041	.71709	52
10	.28317	.45054	.71683	51
11	.28343	.45066	.71657	50
12	.28369	.45079	.71631	49
13	.28396	.45092	.71604	48
14	.28422	.45104	.71578	47
15	.28448	.45117	.71552	46
16	.28474	.45129	.71526	45
17	.28501	.45142	.71499	44
18	.28527	.45154	.71473	43
19	.28553	.45167	.71447	42
20	.28580	.45179	.71420	41
21	.28606	.45192	.71394	40
22	.28632	.45204	.71368	39
23	.28658	.45217	.71342	38
24	.28685	.45229	.71315	37
25	.28711	.45241	.71289	36
26	.28737	.45254	.71263	35
27	.28764	.45266	.71236	34
28	.28790	.45278	.71210	33
29	.28816	.45291	.71184	32
30	.28843	.45303	.71157	31
31	.28869	.45315	.71131	30
32	.28895	.45328	.71105	29
33	.28922	.45340	.71078	28
34	.28948	.45352	.71052	27
35	.28975	.45364	.71025	26
36	.29001	.45377	.70999	25
37	.29027	.45389	.70973	24
38	.29054	.45401	.70946	23
39	.29080	.45413	.70920	22
40	.29107	.45425	.70893	21
41	.29133	.45438	.70867	20
42	.29160	.45450	.70840	19
43	.29186	.45462	.70814	18
44	.29212	.45474	.70788	17
45	.29239	.45486	.70761	16
46	.29265	.45498	.70735	15
47	.29292	.45510	.70708	14
48	.29318	.45522	.70682	13
49	.29345	.45534	.70655	12
50	.29371	.45546	.70629	11
51	.29398	.45558	.70602	10
52	.29424	.45570	.70576	9
53	.29451	.45582	.70549	8
54	.29477	.45594	.70523	7
55	.29504	.45606	.70496	6
56	.29530	.45618	.70470	5
57	.29557	.45630	.70443	4
58	.29583	.45642	.70417	3
59	.29610	.45654	.70390	2
60	.29637	.45665	.70363	1
61	.29663	.45677	.70337	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

122° (302°)

(237°) 57°

123° (303°)

(236°) 56°

	\sin^2	$\sin \cdot \cos$	\cos^2	
1	.29663	.45677	.70337	60
2	.29690	.45689	.70310	59
3	.29716	.45701	.70284	58
4	.29743	.45713	.70257	57
5	.29770	.45724	.70230	56
6	.29796	.45736	.70204	55
7	.29823	.45748	.70177	54
8	.29849	.45760	.70151	53
9	.29876	.45771	.70124	52
10	.29903	.45783	.70097	51
11	.29929	.45795	.70071	50
12	.29956	.45806	.70044	49
13	.29983	.45818	.70017	48
14	.30009	.45830	.69991	47
15	.30036	.45841	.69964	46
16	.30063	.45853	.69937	45
17	.30089	.45865	.69911	44
18	.30116	.45876	.69884	43
19	.30143	.45888	.69857	42
20	.30169	.45899	.69831	41
21	.30196	.45911	.69804	40
22	.30223	.45922	.69777	39
23	.30249	.45934	.69751	38
24	.30276	.45945	.69724	37
25	.30303	.45957	.69697	36
26	.30330	.45968	.69670	35
27	.30356	.45980	.69644	34
28	.30383	.45991	.69617	33
29	.30410	.46002	.69590	32
30	.30437	.46014	.69563	31
31	.30463	.46025	.69537	30
32	.30490	.46037	.69510	29
33	.30517	.46048	.69483	28
34	.30544	.46059	.69456	27
35	.30571	.46071	.69429	26
36	.30597	.46082	.69403	25
37	.30624	.46093	.69376	24
38	.30651	.46104	.69349	23
39	.30678	.46116	.69322	22
40	.30705	.46127	.69295	21
41	.30732	.46138	.69268	20
42	.30758	.46149	.69242	19
43	.30785	.46161	.69215	18
44	.30812	.46172	.69188	17
45	.30839	.46183	.69161	16
46	.30866	.46194	.69134	15
47	.30893	.46205	.69107	14
48	.30920	.46216	.69080	13
49	.30946	.46227	.69054	12
50	.30973	.46238	.69027	11
51	.31000	.46249	.69000	10
52	.31027	.46260	.68973	9
53	.31054	.46272	.68946	8
54	.31081	.46283	.68919	7
55	.31108	.46294	.68892	6
56	.31135	.46305	.68865	5
57	.31162	.46315	.68838	4
58	.31189	.46326	.68811	3
59	.31216	.46337	.68784	2
60	.31243	.46348	.68757	1
61	.31270	.46359	.68730	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

Sin² x Cos² x Sin x Cos x

34° (214°)

(325°) 145°

35° (215°)

(324°) 144°

	Sin ²	Sin · Cos	Cos ²	
0	.31270	.46359	.68730	60
1	.31297	.46370	.68703	59
2	.31324	.46381	.68676	58
3	.31351	.46392	.68649	57
4	.31378	.46403	.68622	56
5	.31405	.46413	.68595	55
6	.31432	.46424	.68568	54
7	.31459	.46435	.68541	53
8	.31486	.46446	.68514	52
9	.31513	.46457	.68487	51
10	.31540	.46467	.68460	50
11	.31567	.46478	.68433	49
12	.31594	.46489	.68406	48
13	.31621	.46500	.68379	47
14	.31648	.46510	.68352	46
15	.31675	.46521	.68325	45
16	.31702	.46532	.68298	44
17	.31729	.46542	.68271	43
18	.31756	.46553	.68244	42
19	.31783	.46563	.68217	41
20	.31810	.46574	.68190	40
21	.31837	.46585	.68163	39
22	.31865	.46595	.68135	38
23	.31892	.46606	.68108	37
24	.31919	.46616	.68081	36
25	.31946	.46627	.68054	35
26	.31973	.46637	.68027	34
27	.32000	.46648	.68000	33
28	.32027	.46658	.67973	32
29	.32054	.46669	.67946	31
30	.32082	.46679	.67918	30
31	.32109	.46689	.67891	29
32	.32136	.46700	.67864	28
33	.32163	.46710	.67837	27
34	.32190	.46721	.67810	26
35	.32217	.46731	.67783	25
36	.32245	.46741	.67755	24
37	.32272	.46752	.67728	23
38	.32299	.46762	.67701	22
39	.32326	.46772	.67674	21
40	.32353	.46782	.67647	20
41	.32381	.46793	.67619	19
42	.32408	.46803	.67592	18
43	.32435	.46813	.67565	17
44	.32462	.46823	.67538	16
45	.32490	.46834	.67510	15
46	.32517	.46844	.67483	14
47	.32544	.46854	.67456	13
48	.32571	.46864	.67429	12
49	.32599	.46874	.67401	11
50	.32626	.46884	.67374	10
51	.32653	.46894	.67347	9
52	.32681	.46905	.67319	8
53	.32708	.46915	.67292	7
54	.32735	.46925	.67265	6
55	.32762	.46935	.67238	5
56	.32790	.46945	.67210	4
57	.32817	.46955	.67183	3
58	.32844	.46965	.67156	2
59	.32872	.46975	.67128	1
60	.32899	.46985	.67101	0
	Cos ²	Sin · Cos	Sin ²	

124° (304°)

(235°) 55°

125° (305°)

(234°) 54°

	Sin ²	Sin · Cos	Cos ²	
0	.32899	.46985	.67101	60
1	.32926	.46995	.67074	59
2	.32954	.47004	.67046	58
3	.32981	.47014	.67019	57
4	.33008	.47024	.66992	56
5	.33036	.47034	.66964	55
6	.33063	.47044	.66937	54
7	.33090	.47054	.66910	53
8	.33118	.47064	.66882	52
9	.33145	.47074	.66855	51
10	.33173	.47083	.66827	50
11	.33200	.47093	.66800	49
12	.33227	.47103	.66773	48
13	.33255	.47113	.66745	47
14	.33282	.47122	.66718	46
15	.33310	.47132	.66690	45
16	.33337	.47142	.66663	44
17	.33365	.47151	.66635	43
18	.33392	.47161	.66608	42
19	.33419	.47171	.66581	41
20	.33447	.47180	.66553	40
21	.33474	.47190	.66526	39
22	.33502	.47200	.66498	38
23	.33529	.47209	.66471	37
24	.33557	.47219	.66443	36
25	.33584	.47228	.66416	35
26	.33612	.47238	.66388	34
27	.33639	.47247	.66361	33
28	.33667	.47257	.66333	32
29	.33694	.47266	.66306	31
30	.33722	.47276	.66278	30
31	.33749	.47285	.66251	29
32	.33777	.47295	.66223	28
33	.33804	.47304	.66196	27
34	.33832	.47314	.66168	26
35	.33859	.47323	.66141	25
36	.33887	.47332	.66113	24
37	.33914	.47342	.66086	23
38	.33942	.47351	.66058	22
39	.33969	.47361	.66031	21
40	.33997	.47370	.66003	20
41	.34024	.47379	.65976	19
42	.34052	.47388	.65948	18
43	.34080	.47398	.65920	17
44	.34107	.47407	.65893	16
45	.34135	.47416	.65865	15
46	.34162	.47425	.65838	14
47	.34190	.47435	.65810	13
48	.34218	.47444	.65782	12
49	.34245	.47453	.65755	11
50	.34273	.47462	.65727	10
51	.34300	.47471	.65700	9
52	.34328	.47480	.65672	8
53	.34356	.47490	.65644	7
54	.34383	.47499	.65617	6
55	.34411	.47508	.65589	5
56	.34439	.47517	.65561	4
57	.34466	.47526	.65534	3
58	.34494	.47535	.65506	2
59	.34521	.47544	.65479	1
60	.34549	.47553	.65451	0
	Cos ²	Sin · Cos	Sin ²	

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

36° (216°)

(323°) 143°

37° (217°)

(322°) 142°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.34549	.47553	.65451	60
1	.34577	.47562	.65423	59
2	.34604	.47571	.65396	58
3	.34632	.47580	.65368	57
4	.34660	.47589	.65340	56
5	.34688	.47598	.65312	55
6	.34715	.47606	.65285	54
7	.34743	.47615	.65257	53
8	.34771	.47624	.65229	52
9	.34798	.47633	.65202	51
10	.34826	.47642	.65174	50
11	.34854	.47651	.65146	49
12	.34882	.47660	.65118	48
13	.34909	.47668	.65091	47
14	.34937	.47677	.65063	46
15	.34965	.47686	.65035	45
16	.34992	.47695	.65008	44
17	.35020	.47703	.64980	43
18	.35048	.47712	.64952	42
19	.35076	.47721	.64924	41
20	.35103	.47729	.64897	40
21	.35131	.47738	.64869	39
22	.35159	.47747	.64841	38
23	.35187	.47755	.64813	37
24	.35215	.47764	.64785	36
25	.35242	.47773	.64758	35
26	.35270	.47781	.64730	34
27	.35298	.47790	.64702	33
28	.35326	.47798	.64674	32
29	.35354	.47807	.64646	31
30	.35381	.47815	.64619	30
31	.35409	.47824	.64591	29
32	.35437	.47832	.64563	28
33	.35465	.47841	.64535	27
34	.35493	.47849	.64507	26
35	.35521	.47858	.64479	25
36	.35548	.47866	.64452	24
37	.35576	.47874	.64424	23
38	.35604	.47883	.64396	22
39	.35632	.47891	.64368	21
40	.35660	.47899	.64340	20
41	.35688	.47908	.64312	19
42	.35716	.47916	.64284	18
43	.35743	.47924	.64257	17
44	.35771	.47933	.64229	16
45	.35799	.47941	.64201	15
46	.35827	.47949	.64173	14
47	.35855	.47957	.64145	13
48	.35883	.47966	.64117	12
49	.35911	.47974	.64089	11
50	.35939	.47982	.64061	10
51	.35967	.47990	.64033	9
52	.35995	.47998	.64005	8
53	.36023	.48007	.63977	7
54	.36050	.48015	.63950	6
55	.36078	.48023	.63922	5
56	.36106	.48031	.63894	4
57	.36134	.48039	.63866	3
58	.36162	.48047	.63838	2
59	.36190	.48055	.63810	1
60	.36218	.48063	.63782	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

126° (306°)

(233°) 53°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.36218	.48063	.63782	60
1	.36246	.48071	.63754	59
2	.36274	.48079	.63726	58
3	.36302	.48087	.63698	57
4	.36330	.48095	.63670	56
5	.36358	.48103	.63642	55
6	.36386	.48111	.63614	54
7	.36414	.48119	.63586	53
8	.36442	.48127	.63558	52
9	.36470	.48135	.63530	51
10	.36498	.48142	.63502	50
11	.36526	.48150	.63474	49
12	.36554	.48158	.63446	48
13	.36582	.48166	.63418	47
14	.36610	.48174	.63390	46
15	.36638	.48182	.63362	45
16	.36666	.48189	.63334	44
17	.36694	.48197	.63306	43
18	.36722	.48205	.63278	42
19	.36750	.48212	.63250	41
20	.36778	.48220	.63222	40
21	.36806	.48228	.63194	39
22	.36834	.48236	.63166	38
23	.36862	.48243	.63138	37
24	.36891	.48251	.63109	36
25	.36919	.48258	.63081	35
26	.36947	.48266	.63053	34
27	.36975	.48274	.63025	33
28	.37003	.48281	.62997	32
29	.37031	.48289	.62969	31
30	.37059	.48296	.62941	30
31	.37087	.48304	.62913	29
32	.37115	.48311	.62885	28
33	.37143	.48319	.62857	27
34	.37171	.48326	.62829	26
35	.37200	.48334	.62800	25
36	.37228	.48341	.62772	24
37	.37256	.48349	.62744	23
38	.37284	.48356	.62716	22
39	.37312	.48363	.62688	21
40	.37340	.48371	.62660	20
41	.37368	.48378	.62632	19
42	.37397	.48385	.62603	18
43	.37425	.48393	.62575	17
44	.37453	.48400	.62547	16
45	.37481	.48407	.62519	15
46	.37509	.48415	.62491	14
47	.37537	.48422	.62463	13
48	.37566	.48429	.62434	12
49	.37594	.48436	.62406	11
50	.37622	.48444	.62378	10
51	.37650	.48451	.62350	9
52	.37678	.48458	.62322	8
53	.37706	.48465	.62294	7
54	.37735	.48472	.62265	6
55	.37763	.48479	.62237	5
56	.37791	.48487	.62209	4
57	.37819	.48494	.62181	3
58	.37847	.48501	.62153	2
59	.37876	.48508	.62124	1
60	.37904	.48515	.62096	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

127° (307°)

(232°) 52°

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

38° (218°)

(321°) 141°

39° (219°)

(320°) 140°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.37904	.48515	.62096	60
1	.37932	.48522	.62068	59
2	.37960	.48529	.62040	58
3	.37989	.48536	.62011	57
4	.38017	.48543	.61983	56
5	.38045	.48550	.61955	55
6	.38073	.48557	.61927	54
7	.38102	.48564	.61898	53
8	.38130	.48571	.61870	52
9	.38158	.48577	.61842	51
10	.38186	.48584	.61814	50
11	.38215	.48591	.61785	49
12	.38243	.48598	.61757	48
13	.38271	.48605	.61729	47
14	.38299	.48612	.61701	46
15	.38328	.48618	.61672	45
16	.38356	.48625	.61644	44
17	.38384	.48632	.61616	43
18	.38413	.48639	.61587	42
19	.38441	.48646	.61559	41
20	.38469	.48652	.61531	40
21	.38498	.48659	.61502	39
22	.38526	.48666	.61474	38
23	.38554	.48672	.61446	37
24	.38582	.48679	.61418	36
25	.38611	.48686	.61389	35
26	.38639	.48692	.61361	34
27	.38667	.48699	.61333	33
28	.38696	.48705	.61304	32
29	.38724	.48712	.61276	31
30	.38752	.48719	.61248	30
31	.38781	.48725	.61219	29
32	.38809	.48732	.61191	28
33	.38837	.48738	.61163	27
34	.38866	.48745	.61134	26
35	.38894	.48751	.61106	25
36	.38923	.48757	.61077	24
37	.38951	.48764	.61049	23
38	.38979	.48770	.61021	22
39	.39008	.48777	.60992	21
40	.39036	.48783	.60964	20
41	.39064	.48789	.60936	19
42	.39093	.48796	.60907	18
43	.39121	.48802	.60879	17
44	.39150	.48808	.60850	16
45	.39178	.48815	.60822	15
46	.39206	.48821	.60794	14
47	.39235	.48827	.60765	13
48	.39263	.48834	.60737	12
49	.39292	.48840	.60708	11
50	.39320	.48846	.60680	10
51	.39348	.48852	.60652	9
52	.39377	.48858	.60623	8
53	.39405	.48865	.60595	7
54	.39434	.48871	.60566	6
55	.39462	.48877	.60538	5
56	.39491	.48883	.60509	4
57	.39519	.48889	.60481	3
58	.39548	.48895	.60452	2
59	.39576	.48901	.60424	1
60	.39604	.48907	.60396	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

128° (308°)

(231°) 51°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.39604	.48907	.60396	60
1	.39633	.48913	.60367	59
2	.39661	.48919	.60339	58
3	.39690	.48925	.60310	57
4	.39718	.48931	.60282	56
5	.39747	.48937	.60253	55
6	.39775	.48943	.60225	54
7	.39804	.48949	.60196	53
8	.39832	.48955	.60168	52
9	.39861	.48961	.60139	51
10	.39889	.48967	.60111	50
11	.39918	.48973	.60082	49
12	.39946	.48979	.60054	48
13	.39975	.48985	.60025	47
14	.40003	.48990	.59997	46
15	.40032	.48996	.59968	45
16	.40060	.49002	.59940	44
17	.40089	.49008	.59911	43
18	.40117	.49014	.59883	42
19	.40146	.49019	.59854	41
20	.40174	.49025	.59826	40
21	.40203	.49031	.59797	39
22	.40231	.49036	.59769	38
23	.40260	.49042	.59740	37
24	.40288	.49048	.59712	36
25	.40317	.49053	.59683	35
26	.40345	.49059	.59655	34
27	.40374	.49065	.59626	33
28	.40402	.49070	.59598	32
29	.40431	.49076	.59569	31
30	.40460	.49081	.59540	30
31	.40488	.49087	.59512	29
32	.40517	.49092	.59483	28
33	.40545	.49098	.59455	27
34	.40574	.49103	.59426	26
35	.40602	.49109	.59398	25
36	.40631	.49114	.59369	24
37	.40660	.49120	.59340	23
38	.40688	.49125	.59312	22
39	.40717	.49131	.59283	21
40	.40745	.49136	.59255	20
41	.40774	.49141	.59226	19
42	.40802	.49147	.59198	18
43	.40831	.49152	.59169	17
44	.40860	.49157	.59140	16
45	.40888	.49163	.59112	15
46	.40917	.49168	.59083	14
47	.40945	.49173	.59055	13
48	.40974	.49179	.59026	12
49	.41003	.49184	.58997	11
50	.41031	.49189	.58969	10
51	.41060	.49194	.58940	9
52	.41089	.49199	.58911	8
53	.41117	.49205	.58883	7
54	.41146	.49210	.58854	6
55	.41174	.49215	.58826	5
56	.41203	.49220	.58797	4
57	.41232	.49225	.58768	3
58	.41260	.49230	.58740	2
59	.41289	.49235	.58711	1
60	.41318	.49240	.58682	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

129° (309°)

(230°) 50°

Sin² x Cos² x Sin x Cos x

40° (220°)

(319°) 139°

41° (221°)

(318°) 138°

	Sin ²	Sin · Cos	Cos ²	
0	.41318	.49240	.58682	60
1	.41346	.49245	.58654	59
2	.41375	.49250	.58625	58
3	.41404	.49255	.58596	57
4	.41432	.49260	.58568	56
5	.41461	.49265	.58539	55
6	.41490	.49270	.58510	54
7	.41518	.49275	.58482	53
8	.41547	.49280	.58453	52
9	.41576	.49285	.58424	51
10	.41604	.49290	.58396	50
11	.41633	.49295	.58367	49
12	.41662	.49300	.58338	48
13	.41690	.49305	.58310	47
14	.41719	.49309	.58281	46
15	.41748	.49314	.58252	45
16	.41776	.49319	.58224	44
17	.41805	.49324	.58195	43
18	.41834	.49329	.58166	42
19	.41862	.49333	.58138	41
20	.41891	.49338	.58109	40
21	.41920	.49343	.58080	39
22	.41949	.49347	.58051	38
23	.41977	.49352	.58023	37
24	.42006	.49357	.57994	36
25	.42035	.49361	.57965	35
26	.42063	.49366	.57937	34
27	.42092	.49371	.57908	33
28	.42121	.49375	.57879	32
29	.42150	.49380	.57850	31
30	.42178	.49384	.57822	30
31	.42207	.49389	.57793	29
32	.42236	.49393	.57764	28
33	.42264	.49398	.57736	27
34	.42293	.49402	.57707	26
35	.42322	.49407	.57678	25
36	.42351	.49411	.57649	24
37	.42379	.49416	.57621	23
38	.42408	.49420	.57592	22
39	.42437	.49425	.57563	21
40	.42466	.49429	.57534	20
41	.42494	.49433	.57506	19
42	.42523	.49438	.57477	18
43	.42552	.49442	.57448	17
44	.42581	.49446	.57419	16
45	.42610	.49451	.57390	15
46	.42638	.49455	.57362	14
47	.42667	.49459	.57333	13
48	.42696	.49464	.57304	12
49	.42725	.49468	.57275	11
50	.42753	.49472	.57247	10
51	.42782	.49476	.57218	9
52	.42811	.49480	.57189	8
53	.42840	.49485	.57160	7
54	.42869	.49489	.57131	6
55	.42897	.49493	.57103	5
56	.42926	.49497	.57074	4
57	.42955	.49501	.57045	3
58	.42984	.49505	.57016	2
59	.43013	.49509	.56987	1
60	.43041	.49513	.56959	0
	Cos ²	Sin · Cos	Sin ²	

130° (310°)

(229°) 49°

	Sin ²	Sin · Cos	Cos ²	
0	.43041	.49513	.56959	60
1	.43070	.49517	.56930	59
2	.43099	.49521	.56901	58
3	.43128	.49525	.56872	57
4	.43157	.49529	.56843	56
5	.43185	.49533	.56815	55
6	.43214	.49537	.56786	54
7	.43243	.49541	.56757	53
8	.43272	.49545	.56728	52
9	.43301	.49549	.56699	51
10	.43330	.49553	.56670	50
11	.43358	.49557	.56642	49
12	.43387	.49561	.56613	48
13	.43416	.49565	.56584	47
14	.43445	.49568	.56555	46
15	.43474	.49572	.56526	45
16	.43503	.49576	.56497	44
17	.43531	.49580	.56469	43
18	.43560	.49584	.56440	42
19	.43589	.49587	.56411	41
20	.43618	.49591	.56382	40
21	.43647	.49595	.56353	39
22	.43676	.49598	.56324	38
23	.43704	.49602	.56296	37
24	.43733	.49606	.56267	36
25	.43762	.49609	.56238	35
26	.43791	.49613	.56209	34
27	.43820	.49617	.56180	33
28	.43849	.49620	.56151	32
29	.43878	.49624	.56122	31
30	.43907	.49627	.56093	30
31	.43935	.49631	.56065	29
32	.43964	.49634	.56036	28
33	.43993	.49638	.56007	27
34	.44022	.49641	.55978	26
35	.44051	.49645	.55949	25
36	.44080	.49648	.55920	24
37	.44109	.49652	.55891	23
38	.44138	.49655	.55862	22
39	.44166	.49659	.55834	21
40	.44195	.49662	.55805	20
41	.44224	.49665	.55776	19
42	.44253	.49669	.55747	18
43	.44282	.49672	.55718	17
44	.44311	.49675	.55689	16
45	.44340	.49679	.55660	15
46	.44369	.49682	.55631	14
47	.44398	.49685	.55602	13
48	.44427	.49688	.55573	12
49	.44455	.49692	.55545	11
50	.44484	.49695	.55516	10
51	.44513	.49698	.55487	9
52	.44542	.49701	.55458	8
53	.44571	.49704	.55429	7
54	.44600	.49708	.55400	6
55	.44629	.49711	.55371	5
56	.44658	.49714	.55342	4
57	.44687	.49717	.55313	3
58	.44716	.49720	.55284	2
59	.44745	.49723	.55255	1
60	.44774	.49726	.55226	0
	Cos ²	Sin · Cos	Sin ²	

131° (311°)

(228°) 48°

$\sin^2 x$ $\cos^2 x$ $\sin x \cos x$

42° (222°)

(317°) 137°

43° (223°)

(316°) 136°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.44774	.49726	.55226	60
1	.44803	.49729	.55197	59
2	.44831	.49732	.55169	58
3	.44860	.49735	.55140	57
4	.44889	.49738	.55111	56
5	.44918	.49741	.55082	55
6	.44947	.49744	.55053	54
7	.44976	.49747	.55024	53
8	.45005	.49750	.54995	52
9	.45034	.49753	.54966	51
10	.45063	.49756	.54937	50
11	.45092	.49759	.54908	49
12	.45121	.49761	.54879	48
13	.45150	.49764	.54850	47
14	.45179	.49767	.54821	46
15	.45208	.49770	.54792	45
16	.45237	.49773	.54763	44
17	.45266	.49775	.54734	43
18	.45295	.49778	.54705	42
19	.45324	.49781	.54676	41
20	.45353	.49784	.54647	40
21	.45381	.49786	.54619	39
22	.45410	.49789	.54590	38
23	.45439	.49792	.54561	37
24	.45468	.49794	.54532	36
25	.45497	.49797	.54503	35
26	.45526	.49799	.54474	34
27	.45555	.49802	.54445	33
28	.45584	.49805	.54416	32
29	.45613	.49807	.54387	31
30	.45642	.49810	.54358	30
31	.45671	.49812	.54329	29
32	.45700	.49815	.54300	28
33	.45729	.49817	.54271	27
34	.45758	.49820	.54242	26
35	.45787	.49822	.54213	25
36	.45816	.49825	.54184	24
37	.45845	.49827	.54155	23
38	.45874	.49829	.54126	22
39	.45903	.49832	.54097	21
40	.45932	.49834	.54068	20
41	.45961	.49837	.54039	19
42	.45990	.49839	.54010	18
43	.46019	.49841	.53981	17
44	.46048	.49844	.53952	16
45	.46077	.49846	.53923	15
46	.46106	.49848	.53894	14
47	.46135	.49850	.53865	13
48	.46164	.49853	.53836	12
49	.46193	.49855	.53807	11
50	.46222	.49857	.53778	10
51	.46251	.49859	.53749	9
52	.46280	.49861	.53720	8
53	.46309	.49864	.53691	7
54	.46338	.49866	.53662	6
55	.46367	.49868	.53633	5
56	.46396	.49870	.53604	4
57	.46425	.49872	.53575	3
58	.46454	.49874	.53546	2
59	.46483	.49876	.53517	1
60	.46512	.49878	.53488	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

132° (312°)

(227°) 47°

	\sin^2	$\sin \cdot \cos$	\cos^2	
0	.46512	.49878	.53488	60
1	.46541	.49880	.53459	59
2	.46570	.49882	.53430	58
3	.46599	.49884	.53401	57
4	.46628	.49886	.53372	56
5	.46657	.49888	.53343	55
6	.46686	.49890	.53314	54
7	.46715	.49892	.53285	53
8	.46744	.49894	.53256	52
9	.46773	.49896	.53227	51
10	.46802	.49898	.53198	50
11	.46831	.49900	.53169	49
12	.46860	.49901	.53140	48
13	.46890	.49903	.53110	47
14	.46919	.49905	.53081	46
15	.46948	.49907	.53052	45
16	.46977	.49909	.53023	44
17	.47006	.49910	.52994	43
18	.47035	.49912	.52965	42
19	.47064	.49914	.52936	41
20	.47093	.49915	.52907	40
21	.47122	.49917	.52878	39
22	.47151	.49919	.52849	38
23	.47180	.49920	.52820	37
24	.47209	.49922	.52791	36
25	.47238	.49924	.52762	35
26	.47267	.49925	.52733	34
27	.47296	.49927	.52704	33
28	.47325	.49928	.52675	32
29	.47354	.49930	.52646	31
30	.47383	.49931	.52617	30
31	.47412	.49933	.52588	29
32	.47441	.49934	.52559	28
33	.47470	.49936	.52530	27
34	.47499	.49937	.52501	26
35	.47528	.49939	.52472	25
36	.47558	.49940	.52442	24
37	.47587	.49942	.52413	23
38	.47616	.49943	.52384	22
39	.47645	.49944	.52355	21
40	.47674	.49946	.52326	20
41	.47703	.49947	.52297	19
42	.47732	.49949	.52268	18
43	.47761	.49950	.52239	17
44	.47790	.49951	.52210	16
45	.47819	.49952	.52181	15
46	.47848	.49954	.52152	14
47	.47877	.49955	.52123	13
48	.47906	.49956	.52094	12
49	.47935	.49957	.52065	11
50	.47964	.49959	.52036	10
51	.47993	.49960	.52007	9
52	.48022	.49961	.51978	8
53	.48052	.49962	.51948	7
54	.48081	.49963	.51919	6
55	.48110	.49964	.51890	5
56	.48139	.49965	.51861	4
57	.48168	.49966	.51832	3
58	.48197	.49967	.51803	2
59	.48226	.49969	.51774	1
60	.48255	.49970	.51745	0
	\cos^2	$\sin \cdot \cos$	\sin^2	

133° (313°)

(226°) 46°

Sin² x Cos² x Sin x Cos x

44° (224°)

(315°) 135°

	Sin ²	Sin · Cos	Cos ²
0	.48255	.49970	.51745 60
1	.48284	.49971	.51716 59
2	.48313	.49972	.51687 58
3	.48342	.49973	.51658 57
4	.48371	.49973	.51629 56
5	.48400	.49974	.51600 55
6	.48429	.49975	.51571 54
7	.48459	.49976	.51541 53
8	.48488	.49977	.51512 52
9	.48517	.49978	.51483 51
10	.48546	.49979	.51454 50
11	.48575	.49980	.51425 49
12	.48604	.49981	.51396 48
13	.48633	.49981	.51367 47
14	.48662	.49982	.51338 46
15	.48691	.49983	.51309 45
16	.48720	.49984	.51280 44
17	.48749	.49984	.51251 43
18	.48778	.49985	.51222 42
19	.48807	.49986	.51193 41
20	.48837	.49986	.51163 40
21	.48866	.49987	.51134 39
22	.48895	.49988	.51105 38
23	.48924	.49988	.51076 37
24	.48953	.49989	.51047 36
25	.48982	.49990	.51018 35
26	.49011	.49990	.50989 34
27	.49040	.49991	.50960 33
28	.49069	.49991	.50931 32
29	.49098	.49992	.50902 31
30	.49127	.49992	.50873 30
31	.49156	.49993	.50844 29
32	.49186	.49993	.50814 28
33	.49215	.49994	.50785 27
34	.49244	.49994	.50756 26
35	.49273	.49995	.50727 25
36	.49302	.49995	.50698 24
37	.49331	.49996	.50669 23
38	.49360	.49996	.50640 22
39	.49389	.49996	.50611 21
40	.49418	.49997	.50582 20
41	.49447	.49997	.50553 19
42	.49476	.49997	.50524 18
43	.49505	.49998	.50495 17
44	.49535	.49998	.50465 16
45	.49564	.49998	.50436 15
46	.49593	.49998	.50407 14
47	.49622	.49999	.50378 13
48	.49651	.49999	.50349 12
49	.49680	.49999	.50320 11
50	.49709	.49999	.50291 10
51	.49738	.49999	.50262 9
52	.49767	.49999	.50233 8
53	.49796	.50000	.50204 7
54	.49825	.50000	.50175 6
55	.49855	.50000	.50145 5
56	.49884	.50000	.50116 4
57	.49913	.50000	.50087 3
58	.49942	.50000	.50058 2
59	.49971	.50000	.50029 1
60	.50000	.50000	.50000 0
	Cos ²	Sin · Cos	Sin ²

134° (314°)

(225°) 45°

NATURAL OR NAPERIAN LOGARITHMS

0.000-0.499

N	0	1	2	3	4	5	6	7	8	9
0.00	— ∞	—6†	—6	—5	—5	—5	—5	—4	—4	—4
		.90776	.21461	.80914	.52146	.29832	.11600	.96185	.82831	.71053
.01	—4.60517	.50986	.42285	.34281	.26870	.19971	.13517	.07454	.01738	*.96332
.02	—3.91202	.86323	.81671	.77226	.72970	.68888	.64966	.61192	.57555	.54046
.03	.50656	.47377	.44202	.41125	.38139	.35241	.32424	.29684	.27017	.24419
.04	.21888	.19418	.17009	.14656	.12357	.10109	.07911	.05761	.03655	.01593
.05	—2.99573	.97593	.95651	.93746	.91877	.90042	.88240	.86470	.84731	.83022
.06	.81341	.79688	.78062	.76462	.74887	.73337	.71810	.70306	.68825	.67365
.07	.65926	.64508	.63109	.61730	.60369	.59027	.57702	.56395	.55105	.53831
.08	.52573	.51331	.50104	.48891	.47694	.46510	.45341	.44185	.43042	.41912
.09	.40795	.39690	.38597	.37516	.36446	.35388	.34341	.33304	.32279	.31264
0.10	—2.30259	.29263	.28278	.27303	.26336	.25379	.24432	.23493	.22562	.21641
.11	.20727	.19823	.18926	.18037	.17156	.16282	.15417	.14558	.13707	.12863
.12	.12026	.11196	.10373	.09557	.08747	.07944	.07147	.06357	.05573	.04794
.13	.04022	.03256	.02495	.01741	.00992	.00248	*.99510	*.98777	*.98050	*.97328
.14	—1.96611	.95900	.95193	.94491	.93794	.93102	.92415	.91732	.91054	.90381
.15	.89712	.89048	.88387	.87732	.87080	.86433	.85790	.85151	.84516	.83885
.16	.83258	.82635	.82016	.81401	.80789	.80181	.79577	.78976	.78379	.77786
.17	.77196	.76609	.76026	.75446	.74870	.74297	.73727	.73161	.72597	.72037
.18	.71480	.70926	.70375	.69827	.69282	.68740	.68201	.67665	.67131	.66601
.19	.66073	.65548	.65026	.64507	.63990	.63476	.62964	.62455	.61949	.61445
0.20	—1.60944	.60445	.59949	.59455	.58964	.58475	.57988	.57504	.57022	.56542
.21	.56065	.55590	.55117	.54646	.54178	.53712	.53248	.52786	.52326	.51868
.22	.51413	.50959	.50508	.50058	.49611	.49165	.48722	.48281	.47841	.47403
.23	.46968	.46534	.46102	.45672	.45243	.44817	.44392	.43970	.43548	.43129
.24	.42712	.42296	.41882	.41469	.41059	.40650	.40242	.39837	.39433	.39030
.25	.38629	.38230	.37833	.37437	.37042	.36649	.36258	.35868	.35480	.35093
.26	.34707	.34323	.33941	.33560	.33181	.32803	.32426	.32051	.31677	.31304
.27	.30933	.30564	.30195	.29828	.29463	.29098	.28735	.28374	.28013	.27654
.28	.27297	.26940	.26585	.26231	.25878	.25527	.25176	.24827	.24479	.24133
.29	.23787	.23443	.23100	.22758	.22418	.22078	.21740	.21402	.21066	.20731
0.30	—1.20397	.20065	.19733	.19402	.19073	.18744	.18417	.18091	.17766	.17441
.31	.17118	.16796	.16475	.16155	.15836	.15518	.15201	.14885	.14570	.14256
.32	.13943	.13631	.13320	.13010	.12701	.12393	.12086	.11780	.11474	.11170
.33	.10866	.10564	.10262	.09961	.09661	.09362	.09064	.08767	.08471	.08176
.34	.07881	.07587	.07294	.07002	.06711	.06421	.06132	.05843	.05555	.05268
.35	—1.04982	.04697	.04412	.04129	.03846	.03564	.03282	.03002	.02722	.02443
.36	.02165	.01888	.01611	.01335	.01060	.00786	.00512	.00239	*.99967	*.99696
.37	—0.99425	.99155	.98886	.98618	.98350	.98083	.97817	.97551	.97286	.97022
.38	.96758	.96496	.96233	.95972	.95711	.95451	.95192	.94933	.94675	.94418
.39	.94161	.93905	.93649	.93395	.93140	.92887	.92634	.92382	.92130	.91879
0.40	—0.91629	.91379	.91130	.90882	.90634	.90387	.90140	.89894	.89649	.89404
.41	.89160	.88916	.88673	.88431	.88189	.87948	.87707	.87467	.87227	.86988
.42	.86750	.86512	.86275	.86038	.85802	.85567	.85332	.85097	.84863	.84630
.43	.84397	.84165	.83933	.83702	.83471	.83241	.83011	.82782	.82554	.82326
.44	.82098	.81871	.81645	.81419	.81193	.80968	.80744	.80520	.80296	.80073
.45	.79851	.79629	.79407	.79186	.78966	.78746	.78526	.78307	.78089	.77871
.46	.77653	.77436	.77219	.77003	.76787	.76572	.76357	.76143	.75929	.75715
.47	.75502	.75290	.75078	.74866	.74655	.74444	.74234	.74024	.73814	.73605
.48	.73397	.73189	.72981	.72774	.72567	.72361	.72155	.71949	.71744	.71539
.49	.71335	.71131	.70928	.70725	.70522	.70320	.70118	.69917	.69716	.69515

† Note that the characteristics are given *above* the mantissa for the first line. In the second and following lines they are given at the left.

NATURAL OR NAPERIAN LOGARITHMS (Continued)

0.509-0.999

N	0	1	2	3	4	5	6	7	8	9
0.50	-0.69315	.69115	.68916	.68717	.68518	.68320	.68122	.67924	.67727	.67531
.51	.67334	.67139	.66943	.66748	.66553	.66359	.66165	.65971	.65778	.65585
.52	.65393	.65201	.65009	.64817	.64626	.64436	.64245	.64055	.63866	.63677
.53	.63488	.63299	.63111	.62923	.62736	.62549	.62362	.62176	.61990	.61804
.54	.61619	.61434	.61249	.61065	.60881	.60697	.60514	.60331	.60148	.59966
.55	.59784	.59602	.59421	.59240	.59059	.58879	.58699	.58519	.58340	.58161
.56	.57982	.57803	.57625	.57448	.57270	.57093	.56916	.56740	.56563	.56387
.57	.56212	.56037	.55862	.55687	.55513	.55339	.55165	.54991	.54818	.54645
.58	.54473	.54300	.54128	.53957	.53785	.53614	.53444	.53273	.53103	.52933
.59	.52763	.52594	.52425	.52256	.52088	.51919	.51751	.51584	.51416	.51249
0.60	-0.51083	.50916	.50750	.50584	.50418	.50253	.50088	.49923	.49758	.49594
.61	.49430	.49266	.49102	.48939	.48776	.48613	.48451	.48289	.48127	.47965
.62	.47804	.47642	.47482	.47321	.47160	.47000	.46840	.46681	.46522	.46362
.63	.46204	.46045	.45887	.45728	.45571	.45413	.45256	.45099	.44942	.44785
.64	.44629	.44473	.44317	.44161	.44006	.43850	.43696	.43541	.43386	.43232
.65	.43078	.42925	.42771	.42618	.42465	.42312	.42159	.42007	.41855	.41703
.66	.41552	.41400	.41249	.41098	.40947	.40797	.40647	.40497	.40347	.40197
.67	.40048	.39899	.39750	.39601	.39453	.39304	.39156	.39008	.38861	.38713
.68	.38566	.38419	.38273	.38126	.37980	.37834	.37688	.37542	.37397	.37251
.69	.37106	.36962	.36817	.36673	.36528	.36384	.36241	.36097	.35954	.35810
0.70	-0.35667	.35525	.35382	.35240	.35098	.34956	.34814	.34672	.34531	.34390
.71	.34249	.34108	.33968	.33827	.33687	.33547	.33408	.33268	.33129	.32989
.72	.32850	.32712	.32573	.32435	.32296	.32158	.32021	.31883	.31745	.31608
.73	.31471	.31334	.31197	.31061	.30925	.30788	.30653	.30517	.30381	.30246
.74	.30111	.29975	.29841	.29706	.29571	.29437	.29303	.29169	.29035	.28902
.75	.28768	.28635	.28502	.28369	.28236	.28104	.27971	.27839	.27707	.27575
.76	.27444	.27312	.27181	.27050	.26919	.26788	.26657	.26527	.26397	.26266
.77	.26136	.26007	.25877	.25748	.25618	.25489	.25360	.25231	.25103	.24974
.78	.24846	.24718	.24590	.24462	.24335	.24207	.24080	.23953	.23826	.23699
.79	.23572	.23446	.23319	.23193	.23067	.22941	.22816	.22690	.22565	.22439
0.80	-0.22314	.22189	.22065	.21940	.21816	.21691	.21567	.21443	.21319	.21196
.81	.21072	.20949	.20825	.20702	.20579	.20457	.20334	.20212	.20089	.19967
.82	.19845	.19723	.19601	.19480	.19358	.19237	.19116	.18995	.18874	.18754
.83	.18633	.18513	.18392	.18272	.18152	.18032	.17913	.17793	.17674	.17554
.84	.17435	.17316	.17198	.17079	.16960	.16842	.16724	.16605	.16487	.16370
.85	-0.16252	.16134	.16017	.15900	.15782	.15665	.15548	.15432	.15315	.15199
.86	.15032	.14966	.14850	.14734	.14618	.14503	.14387	.14272	.14156	.14041
.87	.13926	.13811	.13697	.13582	.13467	.13353	.13239	.13125	.13011	.12897
.88	.12783	.12670	.12556	.12443	.12330	.12217	.12104	.11991	.11878	.11766
.89	.11653	.11541	.11429	.11317	.11205	.11093	.10981	.10870	.10759	.10647
0.90	-0.10536	.10425	.10314	.10203	.10093	.09982	.09872	.09761	.09651	.09541
.91	.09431	.09321	.09212	.09102	.08992	.08883	.08774	.08665	.08556	.08447
.92	.08338	.08230	.08121	.08013	.07904	.07796	.07688	.07580	.07472	.07365
.93	.07257	.07150	.07042	.06935	.06828	.06721	.06614	.06507	.06401	.06294
.94	.06188	.06081	.05975	.05869	.05763	.05657	.05551	.05446	.05340	.05235
.95	.05129	.05024	.04919	.04814	.04709	.04604	.04500	.04395	.04291	.04186
.96	.04082	.03978	.03874	.03770	.03666	.03563	.03459	.03356	.03252	.03149
.97	.03046	.02943	.02840	.02737	.02634	.02532	.02429	.02327	.02225	.02122
.98	.02020	.01918	.01816	.01715	.01613	.01511	.01410	.01309	.01207	.01106
.99	.01005	.00904	.00803	.00702	.00602	.00501	.00401	.00300	.00200	.00100

NATURAL OR NAPERIAN LOGARITHMS (Continued)

To find the natural logarithm of a number which is $10, 100, 1000$, etc. of a number whose logarithm is given, subtract from the given logarithm $\log_e 10, 2 \log_e 10, 3 \log_e 10$, etc.

To find the natural logarithm of a number which is $10, 100, 1000$, etc. times a number whose logarithm is given, add to the given logarithm $\log_e 10, 2 \log_e 10, 3 \log_e 10$, etc.

$\log_e 10 = 2.30258$	50930	$6 \log_e 10 = 13.81551$	05580
$2 \log_e 10 = 4.60517$	01860	$7 \log_e 10 = 16.11809$	55510
$3 \log_e 10 = 6.90775$	52790	$8 \log_e 10 = 18.42068$	07440
$4 \log_e 10 = 9.21034$	03720	$9 \log_e 10 = 20.72326$	58369
$5 \log_e 10 = 11.51292$	54650	$10 \log_e 10 = 23.02585$	09299

See preceding table for logarithms for numbers between 0.000 and 0.999.

1.00-4.99

N	0	1	2	3	4	5	6	7	8	9
1.0	0.00000	.00995	.01980	.02956	.03922	.04879	.05827	.06766	.07696	.08618
.1	.09531	.10436	.11333	.12222	.13103	.13976	.14842	.15700	.16551	.17395
.2	.18232	.19062	.19885	.20701	.21511	.22314	.23111	.23902	.24686	.25464
.3	.26236	.27003	.27763	.28518	.29267	.30010	.30748	.31481	.32208	.32930
.4	.33647	.34359	.35066	.35767	.36464	.37156	.37844	.38526	.39204	.39878
.5	.40547	.41211	.41871	.42527	.43178	.43825	.44469	.45108	.45742	.46373
.6	.47000	.47623	.48243	.48858	.49470	.50078	.50682	.51282	.51879	.52473
.7	.53063	.53649	.54232	.54812	.55389	.55962	.56531	.57098	.57661	.58222
.8	.58779	.59333	.59884	.60432	.60977	.61519	.62058	.62594	.63127	.63658
.9	.64185	.64710	.65233	.65752	.66269	.66783	.67294	.67803	.68310	.68813
2.0	0.69315	.69813	.70310	.70804	.71295	.71784	.72271	.72755	.73237	.73716
.1	.74194	.74669	.75142	.75612	.76081	.76547	.77011	.77473	.77932	.78390
.2	.78846	.79299	.79751	.80200	.80648	.81093	.81536	.81978	.82418	.82855
.3	.83291	.83725	.84157	.84587	.85015	.85442	.85866	.86289	.86710	.87129
.4	.87547	.87963	.88377	.88789	.89200	.89609	.90016	.90422	.90826	.91228
.5	.91629	.92028	.92426	.92822	.93216	.93609	.94001	.94391	.94779	.95166
.6	.95551	.95935	.96317	.96698	.97078	.97456	.97833	.98208	.98582	.98954
.7	.99325	.99695	*.00063	*.00430	*.00796	*.01160	*.01523	*.01885	*.02245	*.02604
.8	1.02962	.03318	.03674	.04028	.04380	.04732	.05082	.05431	.05779	.06126
.9	.06471	.06815	.07158	.07500	.07841	.08181	.08519	.08855	.09192	.09527
3.0	1.09861	.10194	.10526	.10856	.11186	.11514	.11841	.12168	.12493	.12817
.1	.13140	.13462	.13783	.14103	.14422	.14740	.15057	.15373	.15688	.16002
.2	.16315	.16627	.16938	.17248	.17557	.17865	.18173	.18479	.18784	.19089
.3	.19392	.19695	.19996	.20297	.20597	.20896	.21194	.21491	.21788	.22083
.4	.22378	.22671	.22964	.23256	.23547	.23837	.24127	.24415	.24703	.24990
.5	.25276	.25562	.25846	.26130	.26413	.26695	.26976	.27257	.27536	.27815
.6	.28093	.28371	.28647	.28923	.29198	.29473	.29746	.30019	.30291	.30563
.7	.30833	.31103	.31372	.31641	.31909	.32176	.32442	.32708	.32972	.33237
.8	.33500	.33763	.34025	.34286	.34547	.34807	.35067	.35325	.35584	.35841
.9	.36098	.36354	.36609	.36864	.37118	.37372	.37624	.37877	.38128	.38379
4.0	1.38629	.38879	.39128	.39377	.39624	.39872	.40118	.40364	.40610	.40854
.1	.41099	.41342	.41585	.41828	.42070	.42311	.42552	.42792	.43031	.43270
.2	.43508	.43746	.43984	.44220	.44456	.44692	.44927	.45161	.45395	.45629
.3	.45862	.46094	.46326	.46557	.46787	.47018	.47247	.47476	.47705	.47933
.4	.48160	.48387	.48614	.48840	.49065	.49290	.49515	.49739	.49962	.50185
.5	.50408	.50630	.50851	.51072	.51293	.51513	.51732	.51951	.52170	.52388
.6	.52606	.52823	.53039	.53256	.53471	.53687	.53902	.54116	.54330	.54543
.7	.54756	.54969	.55181	.55393	.55604	.55814	.56025	.56235	.56444	.56653
.8	.56862	.57070	.57277	.57485	.57691	.57898	.58104	.58309	.58515	.58719
.9	.58924	.59127	.59331	.59534	.59737	.59939	.60141	.60342	.60543	.60744

NATURAL OR NAPERIAN LOGARITHMS (Continued)

5.00-9.99

N	0	1	2	3	4	5	6	7	8	9
5.0	1.60944	.61144	.61343	.61542	.61741	.61939	.62137	.62334	.62531	.62728
.1	.62924	.63120	.63315	.63511	.63705	.63900	.64094	.64287	.64481	.64673
.2	.64866	.65058	.65250	.65441	.65632	.65823	.66013	.66203	.66393	.66582
.3	.66771	.66959	.67147	.67335	.67523	.67710	.67896	.68083	.68269	.68455
.4	.68640	.68825	.69010	.69194	.69378	.69562	.69745	.69928	.70111	.70293
.5	.70475	.70656	.70838	.71019	.71199	.71380	.71560	.71740	.71919	.72098
.6	.72277	.72455	.72633	.72811	.72988	.73166	.73342	.73519	.73695	.73871
.7	.74047	.74222	.74397	.74572	.74746	.74920	.75094	.75267	.75440	.75613
.8	.75786	.75958	.76130	.76302	.76473	.76644	.76815	.76985	.77156	.77326
.9	.77495	.77665	.77834	.78002	.78171	.78339	.78507	.78675	.78842	.79009
6.0	1.79176	.79342	.79509	.79675	.79840	.80006	.80171	.80336	.80500	.80665
.1	.80829	.80993	.81156	.81319	.81482	.81645	.81808	.81970	.82132	.82294
.2	.82455	.82616	.82777	.82938	.83098	.83258	.83418	.83578	.83737	.83896
.3	.84055	.84214	.84372	.84530	.84688	.84845	.85003	.85160	.85317	.85473
.4	.85630	.85786	.85942	.86097	.86253	.86408	.86563	.86718	.86872	.87026
.5	.87180	.87334	.87487	.87641	.87794	.87947	.88099	.88251	.88403	.88555
.6	.88707	.88858	.89010	.89160	.89311	.89462	.89612	.89762	.89912	.90061
.7	.90211	.90360	.90509	.90658	.90806	.90954	.91102	.91250	.91398	.91545
.8	.91692	.91839	.91986	.92132	.92279	.92425	.92571	.92716	.92862	.93007
.9	.93152	.93297	.93442	.93586	.93730	.93874	.94018	.94162	.94305	.94448
7.0	1.94591	.94734	.94876	.95019	.95161	.95303	.95445	.95586	.95727	.95869
.1	.96009	.96150	.96291	.96431	.96571	.96711	.96851	.96991	.97130	.97269
.2	.97408	.97547	.97685	.97824	.97962	.98100	.98238	.98376	.98513	.98650
.3	.98787	.98924	.99061	.99198	.99334	.99470	.99606	.99742	.99877	*.00013
.4	2.00148	.00283	.00418	.00553	.00687	.00821	.00956	.01089	.01223	.01357
.5	.01490	.01624	.01757	.01890	.02022	.02155	.02287	.02419	.02551	.02683
.6	.02815	.02946	.03078	.03209	.03340	.03471	.03601	.03732	.03862	.03992
.7	.04122	.04252	.04381	.04511	.04640	.04769	.04898	.05027	.05156	.05284
.8	.05412	.05540	.05668	.05796	.05924	.06051	.06179	.06306	.06433	.06560
.9	.06686	.06813	.06939	.07065	.07191	.07317	.07443	.07568	.07694	.07819
8.0	2.07944	.08069	.08194	.08318	.08443	.08567	.08691	.08815	.08939	.09063
.1	.09186	.09310	.09433	.09556	.09679	.09802	.09924	.10047	.10169	.10291
.2	.10413	.10535	.10657	.10779	.10900	.11021	.11142	.11263	.11384	.11505
.3	.11626	.11746	.11866	.11986	.12106	.12226	.12346	.12465	.12585	.12704
.4	.12823	.12942	.13061	.13180	.13298	.13417	.13535	.13653	.13771	.13889
.5	.14007	.14124	.14242	.14359	.14476	.14593	.14710	.14827	.14943	.15060
.6	.15176	.15292	.15409	.15524	.15640	.15756	.15871	.15987	.16102	.16217
.7	.16332	.16447	.16562	.16677	.16791	.16905	.17020	.17134	.17248	.17361
.8	.17475	.17589	.17702	.17816	.17929	.18042	.18155	.18267	.18380	.18493
.9	.18605	.18717	.18830	.18942	.19054	.19165	.19277	.19389	.19500	.19611
9.0	2.19722	.19834	.19944	.20055	.20166	.20276	.20387	.20497	.20607	.20717
.1	.20827	.20937	.21047	.21157	.21266	.21375	.21485	.21594	.21703	.21812
.2	.21920	.22029	.22138	.22246	.22354	.22462	.22570	.22678	.22786	.22894
.3	.23001	.23109	.23216	.23324	.23431	.23538	.23645	.23751	.23858	.23965
.4	.24071	.24177	.24284	.24390	.24496	.24601	.24707	.24813	.24918	.25024
.5	.25129	.25234	.25339	.25444	.25549	.25654	.25759	.25863	.25968	.26072
.6	.26176	.26280	.26384	.26488	.26592	.26696	.26799	.26903	.27006	.27109
.7	.27213	.27316	.27419	.27521	.27624	.27727	.27829	.27932	.28034	.28136
.8	.28238	.28340	.28442	.28544	.28646	.28747	.28849	.28950	.29051	.29152
.9	.29253	.29354	.29455	.29556	.29657	.29757	.29858	.29958	.30058	.30158

NATURAL OR NAPERIAN LOGARITHMS (Continued)

Constants

$\log_e 10 = 2.30258 \ 50930$
 $2 \log_e 10 = 4.60517 \ 01860$
 $3 \log_e 10 = 6.90775 \ 52790$
 $4 \log_e 10 = 9.21034 \ 03720$
 $5 \log_e 10 = 11.51292 \ 54650$

$6 \log_e 10 = 13.81551 \ 05580$
 $7 \log_e 10 = 16.11809 \ 56510$
 $8 \log_e 10 = 18.42068 \ 07440$
 $9 \log_e 10 = 20.72326 \ 58369$
 $10 \log_e 10 = 23.02585 \ 09299$

10.0-49.9

N	0	1	2	3	4	5	6	7	8	9
10.	2.30259	.31254	.32239	.33214	.34181	.35138	.36085	.37024	.37955	.38876
11.	.39790	.40695	.41591	.42480	.43361	.44235	.45101	.45959	.46810	.47654
12.	.48491	.49321	.50144	.50960	.51770	.52573	.53370	.54160	.54945	.55723
13.	.56495	.57261	.58022	.58776	.59525	.60269	.61007	.61740	.62467	.63189
14.	.63906	.64617	.65324	.66026	.66723	.67415	.68102	.68785	.69463	.70136
15.	.70805	.71469	.72130	.72785	.73437	.74084	.74727	.75366	.76001	.76632
16.	.77259	.77882	.78501	.79117	.79728	.80336	.80940	.81541	.82138	.82731
17.	.83321	.83908	.84491	.85071	.85647	.86220	.86790	.87356	.87920	.88480
18.	.89037	.89591	.90142	.90690	.91235	.91777	.92316	.92852	.93386	.93916
19.	.94444	.94969	.95491	.96011	.96527	.97041	.97553	.98062	.98568	.99072
20.	2.99573	*.00072	*.00568	*.01062	*.01553	*.02042	*.02529	*.03013	*.03495	*.03975
21.	3.04452	.04927	.05400	.05871	.06339	.06805	.07269	.07731	.08191	.08649
22.	.09104	.09558	.10009	.10459	.10906	.11352	.11795	.12236	.12676	.13114
23.	.13549	.13983	.14415	.14845	.15274	.15700	.16125	.16548	.16969	.17388
24.	.17805	.18221	.18635	.19048	.19458	.19867	.20275	.20680	.21084	.21487
25.	.21888	.22287	.22684	.23080	.23475	.23868	.24259	.24649	.25037	.25424
26.	.25810	.26194	.26576	.26957	.27336	.27714	.28091	.28466	.28840	.29213
27.	.29584	.29953	.30322	.30689	.31054	.31419	.31782	.32143	.32504	.32863
28.	.33220	.33577	.33932	.34286	.34639	.34990	.35341	.35690	.36038	.36384
29.	.36730	.37074	.37417	.37759	.38099	.38439	.38777	.39115	.39451	.39786
30.	3.40120	.40453	.40784	.41115	.41444	.41773	.42100	.42426	.42751	.43076
31.	.43399	.43721	.44042	.44362	.44681	.44999	.45316	.45632	.45947	.46261
32.	.46574	.46886	.47197	.47507	.47816	.48124	.48431	.48738	.49043	.49347
33.	.49651	.49953	.50255	.50556	.50856	.51155	.51453	.51750	.52046	.52342
34.	.52636	.52930	.53223	.53515	.53806	.54096	.54385	.54674	.54962	.55249
35.	.55535	.55820	.56105	.56388	.56671	.56953	.57235	.57515	.57795	.58074
36.	.58352	.58629	.58906	.59182	.59457	.59731	.60005	.60278	.60550	.60821
37.	.61092	.61362	.61631	.61899	.62167	.62434	.62700	.62966	.63231	.63495
38.	.63759	.64021	.64284	.64545	.64806	.65066	.65325	.65584	.65842	.66099
39.	.66356	.66612	.66868	.67122	.67377	.67630	.67883	.68135	.68387	.68638
40.	3.68888	.69138	.69387	.69635	.69883	.70130	.70377	.70623	.70868	.71113
41.	.71357	.71601	.71844	.72086	.72328	.72569	.72810	.73050	.73290	.73529
42.	.73767	.74005	.74242	.74479	.74715	.74950	.75185	.75420	.75654	.75887
43.	.76120	.76352	.76584	.76815	.77046	.77276	.77506	.77735	.77963	.78191
44.	.78419	.78646	.78872	.79098	.79324	.79549	.79773	.79997	.80221	.80444
45.	.80666	.80888	.81110	.81331	.81551	.81771	.81991	.82210	.82428	.82647
46.	.82864	.83081	.83298	.83514	.83730	.83945	.84160	.84374	.84588	.84802
47.	.85015	.85227	.85439	.85651	.85862	.86073	.86283	.86493	.86703	.86912
48.	.87120	.87328	.87536	.87743	.87950	.88156	.88362	.88568	.88773	.88978
49.	.89182	.89386	.89589	.89792	.89995	.90197	.90399	.90600	.90801	.91002

NATURAL OR NAPERIAN LOGARITHMS (Continued)

50.0-99.9

N	0	1	2	3	4	5	6	7	8	9
50.	3.91202	.91402	.91602	.91801	.91999	.92197	.92395	.92593	.92790	.92986
51.	.93183	.93378	.93574	.93769	.93964	.94158	.94352	.94546	.94739	.94932
52.	.95124	.95316	.95508	.95700	.95891	.96081	.96272	.96462	.96651	.96840
53.	.97029	.97218	.97406	.97594	.97781	.97968	.98155	.98341	.98527	.98713
54.	.98898	.99083	.99268	.99452	.99636	.99820	*.00003	*.00186	*.00369	*.00551
55.	4.00733	.00915	.01096	.01277	.01458	.01638	.01818	.01998	.02177	.02356
56.	.02535	.02714	.02892	.03069	.03247	.03424	.03601	.03777	.03954	.04130
57.	.04305	.04480	.04655	.04830	.05004	.05178	.05352	.05526	.05699	.05872
58.	.06044	.06217	.06389	.06560	.06732	.06903	.07073	.07244	.07414	.07584
59.	.07754	.07923	.08092	.08261	.08429	.08598	.08766	.08933	.09101	.09268
60.	4.09434	.09601	.09767	.09933	.10099	.10264	.10429	.10594	.10759	.10923
61.	.11087	.11251	.11415	.11578	.11741	.11904	.12066	.12228	.12390	.12552
62.	.12713	.12875	.13036	.13196	.13357	.13517	.13677	.13836	.13996	.14155
63.	.14313	.14472	.14630	.14789	.14946	.15104	.15261	.15418	.15575	.15732
64.	.15888	.16044	.16200	.16356	.16511	.16667	.16821	.16976	.17131	.17285
65.	.17439	.17592	.17746	.17899	.18052	.18205	.18358	.18510	.18662	.18814
66.	.18965	.19117	.19268	.19419	.19570	.19720	.19870	.20020	.20170	.20320
67.	.20469	.20618	.20767	.20916	.21065	.21213	.21361	.21509	.21656	.21804
68.	.21951	.22098	.22244	.22391	.22537	.22683	.22829	.22975	.23120	.23266
69.	.23411	.23555	.23700	.23844	.23989	.24133	.24276	.24420	.24563	.24707
70.	4.24850	.24992	.25135	.25277	.25419	.25561	.25703	.25845	.25986	.26127
71.	.26268	.26409	.26549	.26690	.26830	.26970	.27110	.27249	.27388	.27528
72.	.27667	.27805	.27944	.28082	.28221	.28359	.28496	.28634	.28772	.28909
73.	.29046	.29183	.29320	.29456	.29592	.29729	.29865	.30000	.30136	.30271
74.	.30407	.30542	.30676	.30811	.30946	.31080	.31214	.31348	.31482	.31615
75.	.31749	.31882	.32015	.32149	.32281	.32413	.32546	.32678	.32810	.32942
76.	.33073	.33205	.33336	.33467	.33598	.33729	.33860	.33990	.34120	.34251
77.	.34381	.34510	.34640	.34769	.34899	.35028	.35157	.35286	.35414	.35543
78.	.35671	.35800	.35927	.36055	.36182	.36310	.36437	.36564	.36691	.36818
79.	.36945	.37071	.37198	.37324	.37450	.37576	.37701	.37827	.37952	.38078
80.	4.38203	.38328	.38452	.38577	.38701	.38826	.38950	.39074	.39198	.39321
81.	.39445	.39568	.39692	.39815	.39938	.40060	.40183	.40305	.40428	.40550
82.	.40672	.40794	.40916	.41037	.41159	.41280	.41401	.41522	.41643	.41764
83.	.41884	.42004	.42125	.42245	.42365	.42485	.42604	.42724	.42843	.42963
84.	.43082	.43201	.43319	.43438	.43557	.43675	.43793	.43912	.44030	.44147
85.	.44265	.44383	.44500	.44617	.44735	.44852	.44969	.45085	.45202	.45318
86.	.45435	.45551	.45667	.45783	.45899	.46014	.46130	.46245	.46361	.46476
87.	.46591	.46706	.46820	.46935	.47050	.47164	.47278	.47392	.47506	.47620
88.	.47734	.47847	.47961	.48074	.48187	.48300	.48413	.48526	.48639	.48751
89.	.48864	.48976	.49088	.49200	.49312	.49424	.49536	.49647	.49758	.49870
90.	4.49981	.50092	.50203	.50314	.50424	.50535	.50645	.50756	.50866	.50976
91.	.51086	.51196	.51305	.51415	.51525	.51634	.51743	.51852	.51961	.52070
92.	.52179	.52287	.52396	.52504	.52613	.52721	.52829	.52937	.53045	.53152
93.	.53260	.53367	.53475	.53582	.53689	.53796	.53903	.54010	.54116	.54223
94.	.54329	.54436	.54542	.54648	.54754	.54860	.54966	.55071	.55177	.55282
95.	.55388	.55493	.55598	.55703	.55808	.55913	.56017	.56122	.56226	.56331
96.	.56435	.56539	.56643	.56747	.56851	.56954	.57058	.57161	.57265	.57368
97.	.57471	.57574	.57677	.57780	.57883	.57985	.58088	.58190	.58292	.58395
98.	.58497	.58599	.58701	.58802	.58904	.59006	.59107	.59208	.59310	.59411
99.	.59512	.59613	.59714	.59815	.59915	.60016	.60116	.60217	.60317	.60417

NATURAL OR NAPERIAN LOGARITHMS (Continued)

0-499

N	0	1	2	3	4	5	6	7	8	9
0	=	0.00000	0.69315	1.09861	.38629	.60944	.79176	.94591	*.07944	*.19722
1	2.30259	.39790	.48491	.56495	.63906	.70805	.77259	.83321	.89037	.94444
2	.99573	*.04452	*.09104	*.13549	*.17805	*.21888	*.25810	*.29584	*.33220	*.36780
3	3.40120	.43399	.46574	.49651	.52636	.55535	.58352	.61092	.63759	.66356
4	.68888	.71357	.73767	.76120	.78419	.80666	.82864	.85015	.87120	.89182
5	.91202	.93183	.95124	.97029	.98898	*.00733	*.02535	*.04305	*.06044	*.07754
6	4.09434	.11087	.12713	.14313	.15888	.17439	.18965	.20469	.21951	.23411
7	.24850	.26268	.27667	.29046	.30407	.31749	.33073	.34381	.35671	.36945
8	.38203	.39445	.40672	.41884	.43082	.44265	.45435	.46591	.47734	.48864
9	.49981	.51086	.52179	.53260	.54329	.55388	.56435	.57471	.58497	.59512
10	4.60517	.61512	.62497	.63473	.64439	.65396	.66344	.67283	.68213	.69135
11	.70048	.70953	.71850	.72739	.73620	.74493	.75359	.76217	.77068	.77912
12	.78749	.79579	.80402	.81218	.82028	.82831	.83628	.84419	.85203	.85981
13	.86753	.87520	.88280	.89035	.89784	.90527	.91265	.91998	.92725	.93447
14	.94164	.94876	.95583	.96284	.96981	.97673	.98361	.99043	.99721	*.00395
15	5.01064	.01728	.02388	.03044	.03695	.04343	.04986	.05625	.06260	.06890
16	.07517	.08140	.08760	.09375	.09987	.10595	.11199	.11799	.12396	.12990
17	.13580	.14166	.14749	.15329	.15906	.16479	.17048	.17615	.18178	.18739
18	.19296	.19850	.20401	.20949	.21494	.22036	.22575	.23111	.23644	.24175
19	.24702	.25227	.25750	.26269	.26786	.27300	.27811	.28320	.28827	.29330
20	5.29832	.30330	.30827	.31321	.31812	.32301	.32788	.33272	.33754	.34233
21	.34711	.35186	.35659	.36129	.36598	.37064	.37528	.37990	.38450	.38907
22	.39363	.39816	.40268	.40717	.41165	.41610	.42053	.42495	.42935	.43372
23	.43808	.44242	.44674	.45104	.45532	.45959	.46383	.46806	.47227	.47646
24	.48064	.48480	.48894	.49306	.49717	.50126	.50533	.50939	.51343	.51745
25	.52146	.52545	.52943	.53339	.53733	.54126	.54518	.54908	.55296	.55683
26	.56068	.56452	.56834	.57215	.57595	.57973	.58350	.58725	.59099	.59471
27	.59842	.60212	.60580	.60947	.61313	.61677	.62040	.62402	.62762	.63121
28	.63479	.63835	.64191	.64545	.64897	.65249	.65599	.65948	.66296	.66643
29	.66988	.67332	.67675	.68017	.68358	.68698	.69036	.69373	.69709	.70044
30	5.70378	.70711	.71043	.71373	.71703	.72031	.72359	.72685	.73010	.73334
31	.73657	.73979	.74300	.74620	.74939	.75257	.75574	.75890	.76205	.76519
32	.76832	.77144	.77455	.77765	.78074	.78383	.78690	.78996	.79301	.79606
33	.79909	.80212	.80513	.80814	.81114	.81413	.81711	.82008	.82305	.82600
34	.82895	.83188	.83481	.83773	.84064	.84354	.84644	.84932	.85220	.85507
35	.85793	.86079	.86363	.86647	.86930	.87212	.87493	.87774	.88053	.88332
36	.88610	.88888	.89164	.89440	.89715	.89990	.90263	.90536	.90808	.91080
37	.91350	.91620	.91889	.92158	.92426	.92693	.92959	.93225	.93489	.93754
38	.94017	.94280	.94542	.94803	.95064	.95324	.95584	.95842	.96101	.96358
39	.96615	.96871	.97126	.97381	.97635	.97889	.98141	.98394	.98645	.98896
40	5.99146	.99396	.99645	.99894	*.00141	*.00389	*.00635	*.00881	*.01127	*.01372
41	6.01616	.01859	.02102	.02345	.02587	.02828	.03069	.03309	.03548	.03787
42	.04025	.04263	.04501	.04737	.04973	.05209	.05444	.05678	.05912	.06146
43	.06379	.06611	.06843	.07074	.07304	.07535	.07764	.07993	.08222	.08450
44	.08677	.08904	.09131	.09357	.09582	.09807	.10032	.10256	.10479	.10702
45	.10925	.11147	.11368	.11589	.11810	.12030	.12249	.12468	.12687	.12905
46	.13123	.13340	.13556	.13773	.13988	.14204	.14419	.14633	.14847	.15060
47	.15273	.15486	.15698	.15910	.16121	.16331	.16542	.16752	.16961	.17170
48	.17379	.17587	.17794	.18002	.18208	.18415	.18621	.18826	.19032	.19236
49	.19441	.19644	.19848	.20051	.20254	.20456	.20658	.20859	.21060	.21261

NATURAL OR NAPERIAN LOGARITHMS (Continued)

500-999

N	0	1	2	3	4	5	6	7	8	9
50	6.21461	.21661	.21860	.22059	.22258	.22456	.22654	.22851	.23048	.23245
51	.23441	.23637	.23832	.24028	.24222	.24417	.24611	.24804	.24998	.25190
52	.25383	.25575	.25767	.25958	.26149	.26340	.26530	.26720	.26910	.27099
53	.27288	.27476	.27664	.27852	.28040	.28227	.28413	.28600	.28786	.28972
54	.29157	.29342	.29527	.29711	.29895	.30079	.30262	.30445	.30628	.30810
55	.30992	.31173	.31355	.31536	.31716	.31897	.32077	.32257	.32436	.32615
56	.32794	.32972	.33150	.33328	.33505	.33683	.33859	.34036	.34212	.34388
57	.34564	.34739	.34914	.35089	.35263	.35437	.35611	.35784	.35957	.36130
58	.36303	.36475	.36647	.36819	.36990	.37161	.37332	.37502	.37673	.37843
59	.38012	.38182	.38351	.38519	.38688	.38856	.39024	.39192	.39359	.39526
60	6.30693	.30859	.40026	.40192	.40357	.40523	.40688	.40853	.41017	.41182
61	.41346	.41510	.41673	.41836	.41999	.42162	.42325	.42487	.42649	.42811
62	.42972	.43133	.43294	.43455	.43615	.43775	.43935	.44095	.44254	.44413
63	.44572	.44731	.44889	.45047	.45205	.45362	.45520	.45677	.45834	.45990
64	.46147	.46303	.46459	.46614	.46770	.46925	.47080	.47235	.47389	.47543
65	.47697	.47851	.48004	.48158	.48311	.48464	.48616	.48768	.48920	.49072
66	.49224	.49375	.49527	.49677	.49828	.49979	.50129	.50279	.50429	.50578
67	.50728	.50877	.51026	.51175	.51323	.51471	.51619	.51767	.51915	.52062
68	.52209	.52356	.52503	.52649	.52796	.52942	.53088	.53233	.53379	.53524
69	.53669	.53814	.53959	.54103	.54247	.54391	.54535	.54679	.54822	.54965
70	6.55108	.55251	.55393	.55536	.55678	.55820	.55962	.56103	.56244	.56386
71	.56526	.56667	.56808	.56948	.57088	.57228	.57368	.57508	.57647	.57786
72	.57925	.58064	.58203	.58341	.58479	.58617	.58755	.58893	.59030	.59167
73	.59304	.59441	.59578	.59715	.59851	.59987	.60123	.60259	.60394	.60530
74	.60665	.60800	.60935	.61070	.61204	.61338	.61473	.61607	.61740	.61874
75	.62007	.62141	.62274	.62407	.62539	.62672	.62804	.62936	.63068	.63200
76	.63332	.63463	.63595	.63726	.63857	.63988	.64118	.64249	.64379	.64509
77	.64639	.64769	.64898	.65028	.65157	.65286	.65415	.65544	.65673	.65801
78	.65929	.66058	.66185	.66313	.66441	.66568	.66696	.66823	.66950	.67077
79	.67203	.67330	.67456	.67582	.67708	.67834	.67960	.68085	.68211	.68336
80	6.68461	.68586	.68711	.68835	.68960	.69084	.69208	.69332	.69456	.69580
81	.69703	.69827	.69950	.70073	.70196	.70319	.70441	.70564	.70686	.70808
82	.70930	.71052	.71174	.71296	.71417	.71538	.71659	.71780	.71901	.72022
83	.72143	.72263	.72383	.72503	.72623	.72743	.72863	.72983	.73102	.73221
84	.73340	.73459	.73578	.73697	.73815	.73934	.74052	.74170	.74288	.74406
85	.74524	.74641	.74759	.74876	.74993	.75110	.75227	.75344	.75460	.75577
86	.75693	.75809	.75926	.76041	.76157	.76273	.76388	.76504	.76619	.76734
87	.76849	.76964	.77079	.77194	.77308	.77422	.77537	.77651	.77765	.77878
88	.77992	.78106	.78219	.78333	.78446	.78559	.78672	.78784	.78897	.79010
89	.79122	.79234	.79347	.79459	.79571	.79682	.79794	.79906	.80017	.80128
90	6.80239	.80351	.80461	.80572	.80683	.80793	.80904	.81014	.81124	.81235
91	.81344	.81454	.81564	.81674	.81783	.81892	.82002	.82111	.82220	.82329
92	.82437	.82546	.82655	.82763	.82871	.82979	.83087	.83195	.83303	.83411
93	.83518	.83626	.83733	.83841	.83948	.84055	.84162	.84268	.84375	.84482
94	.84588	.84694	.84801	.84907	.85013	.85118	.85224	.85330	.85435	.85541
95	.85646	.85751	.85857	.85961	.86066	.86171	.86276	.86380	.86485	.86589
96	.86693	.86797	.86901	.87005	.87109	.87213	.87316	.87420	.87523	.87626
97	.87730	.87833	.87936	.88038	.88141	.88244	.88346	.88449	.88551	.88653
98	.88755	.88857	.88959	.89061	.89163	.89264	.89366	.89467	.89568	.89669
99	.89770	.89871	.89972	.90073	.90174	.90274	.90375	.90475	.90575	.90675

EXPONENTIAL FUNCTIONS

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
0.00	1.0000	0.00000	1.000000	0.50	1.6487	0.21715	0.606531
0.01	1.0101	.00434	0.990050	0.51	1.6653	.22149	.600496
0.02	1.0202	.00869	.980199	0.52	1.6820	.22583	.594521
0.03	1.0305	.01303	.970446	0.53	1.6989	.23018	.588605
0.04	1.0408	.01737	.960789	0.54	1.7160	.23452	.582748
0.05	1.0513	0.02171	0.951229	0.55	1.7333	0.23886	0.576950
0.06	1.0618	.02606	.941765	0.56	1.7507	.24320	.571209
0.07	1.0725	.03040	.932394	0.57	1.7683	.24755	.565525
0.08	1.0833	.03474	.923116	0.58	1.7860	.25189	.559898
0.09	1.0942	.03909	.913931	0.59	1.8040	.25623	.554327
0.10	1.1052	0.04343	0.904837	0.60	1.8221	0.26058	0.548812
0.11	1.1163	.04777	.895834	0.61	1.8404	.26492	.543351
0.12	1.1275	.05212	.886920	0.62	1.8589	.26926	.537944
0.13	1.1388	.05646	.878095	0.63	1.8776	.27361	.532592
0.14	1.1503	.06080	.869358	0.64	1.8965	.27795	.527292
0.15	1.1618	0.06514	0.860708	0.65	1.9155	0.28229	0.522046
0.16	1.1735	.06949	.852144	0.66	1.9348	.28663	.516851
0.17	1.1853	.07383	.843665	0.67	1.9542	.29098	.511709
0.18	1.1972	.07817	.835270	0.68	1.9739	.29532	.506617
0.19	1.2092	.08252	.826959	0.69	1.9937	.29966	.501576
0.20	1.2214	0.08686	0.818731	0.70	2.0138	0.30401	0.496585
0.21	1.2337	.09120	.810584	0.71	2.0340	.30835	.491644
0.22	1.2461	.09554	.802519	0.72	2.0544	.31269	.486752
0.23	1.2586	.09989	.794534	0.73	2.0751	.31703	.481909
0.24	1.2712	.10423	.786628	0.74	2.0959	.32138	.477114
0.25	1.2840	0.10857	0.778801	0.75	2.1170	0.32572	0.472367
0.26	1.2969	.11292	.771052	0.76	2.1383	.33006	.467666
0.27	1.3100	.11726	.763379	0.77	2.1598	.33441	.463013
0.28	1.3231	.12160	.755784	0.78	2.1815	.33875	.458406
0.29	1.3364	.12595	.748264	0.79	2.2034	.34309	.453845
0.30	1.3499	0.13029	0.740818	0.80	2.2255	0.34744	0.449329
0.31	1.3634	.13463	.733447	0.81	2.2479	.35178	.444858
0.32	1.3771	.13897	.726149	0.82	2.2705	.35612	.440432
0.33	1.3910	.14332	.718924	0.83	2.2933	.36046	.436049
0.34	1.4049	.14766	.711770	0.84	2.3164	.36481	.431711
0.35	1.4191	0.15200	0.704688	0.85	2.3396	0.36915	0.427415
0.36	1.4333	.15635	.697676	0.86	2.3632	.37349	.423162
0.37	1.4477	.16069	.690734	0.87	2.3869	.37784	.418952
0.38	1.4623	.16503	.683861	0.88	2.4109	.38218	.414783
0.39	1.4770	.16937	.677057	0.89	2.4351	.38652	.410656
0.40	1.4918	0.17372	0.670320	0.90	2.4596	0.39087	0.406570
0.41	1.5068	.17806	.663650	0.91	2.4843	.39521	.402524
0.42	1.5220	.18240	.657047	0.92	2.5093	.39955	.398519
0.43	1.5373	.18675	.650509	0.93	2.5345	.40389	.394554
0.44	1.5527	.19109	.644036	0.94	2.5600	.40824	.390628
0.45	1.5683	0.19543	0.637628	0.95	2.5857	0.41258	0.386741
0.46	1.5841	.19978	.631284	0.96	2.6117	.41692	.382893
0.47	1.6000	.20412	.625002	0.97	2.6379	.42127	.379083
0.48	1.6161	.20846	.618783	0.98	2.6645	.42561	.375311
0.49	1.6323	.21280	.612626	0.99	2.6912	.42995	.371577
0.50	1.6487	0.21715	0.606531	1.00	2.7183	0.43429	0.367879

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
1.00	2.7183	0.43429	0.367879	1.50	4.4817	0.65144	0.223130
1.01	2.7456	.43864	.364219	1.51	4.5267	.65578	.220910
1.02	2.7732	.44298	.360595	1.52	4.5722	.66013	.218712
1.03	2.8011	.44732	.357007	1.53	4.6182	.66447	.216536
1.04	2.8292	.45167	.353455	1.54	4.6646	.66881	.214381
1.05	2.8577	0.45601	0.349938	1.55	4.7115	0.67316	0.212248
1.06	2.8864	.46035	.346456	1.56	4.7588	.67750	.210136
1.07	2.9154	.46470	.343009	1.57	4.8066	.68184	.208045
1.08	2.9447	.46904	.339596	1.58	4.8550	.68619	.205975
1.09	2.9743	.47338	.336216	1.59	4.9037	.69053	.203926
1.10	3.0042	0.47772	0.332871	1.60	4.9530	0.69487	0.201897
1.11	3.0344	.48207	.329559	1.61	5.0028	.69921	.199888
1.12	3.0649	.48641	.326280	1.62	5.0531	.70356	.197899
1.13	3.0957	.49075	.323033	1.63	5.1039	.70790	.195930
1.14	3.1268	.49510	.319819	1.64	5.1552	.71224	.193980
1.15	3.1582	0.49944	0.316637	1.65	5.2070	0.71659	0.192050
1.16	3.1899	.50378	.313486	1.66	5.2593	.72093	.190139
1.17	3.2220	.50812	.310367	1.67	5.3122	.72527	.188247
1.18	3.2544	.51247	.307279	1.68	5.3656	.72961	.186374
1.19	3.2871	.51681	.304221	1.69	5.4195	.73396	.184520
1.20	3.3201	0.52115	0.301194	1.70	5.4739	0.73830	0.182684
1.21	3.3535	.52550	.298197	1.71	5.5290	.74264	.180866
1.22	3.3872	.52984	.295230	1.72	5.5845	.74699	.179066
1.23	3.4212	.53418	.292293	1.73	5.6407	.75133	.177284
1.24	3.4556	.53853	.289384	1.74	5.6973	.75567	.175520
1.25	3.4903	0.54287	0.286505	1.75	5.7546	0.76002	0.173774
1.26	3.5254	.54721	.283654	1.76	5.8124	.76436	.172045
1.27	3.5609	.55155	.280832	1.77	5.8709	.76870	.170333
1.28	3.5966	.55590	.278037	1.78	5.9299	.77304	.168638
1.29	3.6328	.56024	.275271	1.79	5.9895	.77739	.166960
1.30	3.6693	0.56458	0.272532	1.80	6.0496	0.78173	0.165299
1.31	3.7062	.56893	.269820	1.81	6.1104	.78607	.163654
1.32	3.7434	.57327	.267135	1.82	6.1719	.79042	.162026
1.33	3.7810	.57761	.264477	1.83	6.2339	.79476	.160414
1.34	3.8190	.58195	.261846	1.84	6.2965	.79910	.158817
1.35	3.8574	0.58630	0.259240	1.85	6.3598	0.80344	0.157237
1.36	3.8962	.59064	.256661	1.86	6.4237	.80779	.155673
1.37	3.9354	.59498	.254107	1.87	6.4883	.81213	.154124
1.38	3.9749	.59933	.251579	1.88	6.5535	.81647	.152590
1.39	4.0149	.60367	.249075	1.89	6.6194	.82082	.151072
1.40	4.0552	0.60801	0.246597	1.90	6.6859	0.82516	0.149569
1.41	4.0960	.61236	.244143	1.91	6.7531	.82950	.148080
1.42	4.1371	.61670	.241714	1.92	6.8210	.83385	.146607
1.43	4.1787	.62104	.239309	1.93	6.8895	.83819	.145148
1.44	4.2207	.62538	.236928	1.94	6.9588	.84253	.143704
1.45	4.2631	0.62973	0.234570	1.95	7.0287	0.84687	0.142274
1.46	4.3060	.63407	.232236	1.96	7.0993	.85122	.140858
1.47	4.3492	.63841	.229925	1.97	7.1707	.85556	.139457
1.48	4.3929	.64276	.227638	1.98	7.2427	.85990	.138069
1.49	4.4371	.64710	.225373	1.99	7.3155	.86425	.136695
1.50	4.4817	0.65144	0.223130	2.00	7.3891	0.86859	0.135335

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
2.00	7.3891	0.86859	0.135335	2.50	12.182	1.08574	0.082085
2.01	7.4633	.87293	.133989	2.51	12.305	1.09008	.081268
2.02	7.5383	.87727	.132655	2.52	12.429	1.09442	.080460
2.03	7.6141	.88162	.131336	2.53	12.554	1.09877	.079659
2.04	7.6906	.88596	.130029	2.54	12.680	1.10311	.078866
2.05	7.7679	0.89030	0.128735	2.55	12.807	1.10745	0.078082
2.06	7.8460	.89465	.127454	2.56	12.936	1.11179	.077305
2.07	7.9248	.89899	.126186	2.57	13.066	1.11614	.076536
2.08	8.0045	.90333	.124930	2.58	13.197	1.12048	.075774
2.09	8.0849	.90768	.123687	2.59	13.330	1.12482	.075020
2.10	8.1662	0.91202	0.122456	2.60	13.464	1.12917	0.074274
2.11	8.2482	.91636	.121238	2.61	13.599	1.13351	.073535
2.12	8.3311	.92070	.120032	2.62	13.736	1.13785	.072803
2.13	8.4149	.92505	.118837	2.63	13.874	1.14219	.072078
2.14	8.4994	.92939	.117655	2.64	14.013	1.14654	.071361
2.15	8.5849	0.93373	0.116484	2.65	14.154	1.15088	0.070651
2.16	8.6711	.93808	.115325	2.66	14.296	1.15522	.069948
2.17	8.7583	.94242	.114178	2.67	14.440	1.15957	.069252
2.18	8.8463	.94676	.113042	2.68	14.585	1.16391	.068563
2.19	8.9352	.95110	.111917	2.69	14.732	1.16825	.067881
2.20	9.0250	0.95545	0.110803	2.70	14.880	1.17260	0.067206
2.21	9.1157	.95979	.109701	2.71	15.029	1.17694	.066537
2.22	9.2073	.96413	.108609	2.72	15.180	1.18128	.065875
2.23	9.2999	.96848	.107528	2.73	15.333	1.18562	.065219
2.24	9.3933	.97282	.106459	2.74	15.487	1.18997	.064570
2.25	9.4877	0.97716	0.105399	2.75	15.643	1.19431	0.063928
2.26	9.5831	.98151	.104350	2.76	15.800	1.19865	.063292
2.27	9.6794	.98585	.103312	2.77	15.959	1.20300	.062662
2.28	9.7767	.99019	.102284	2.78	16.119	1.20734	.062039
2.29	9.8749	.99453	.101266	2.79	16.281	1.21168	.061421
2.30	9.9742	0.99888	0.100259	2.80	16.445	1.21602	0.060810
2.31	10.074	1.00322	.099261	2.81	16.610	1.22037	.060205
2.32	10.176	1.00756	.098274	2.82	16.777	1.22471	.059606
2.33	10.278	1.01191	.097296	2.83	16.945	1.22905	.059013
2.34	10.381	1.01625	.096328	2.84	17.116	1.23340	.058426
2.35	10.486	1.02059	0.095369	2.85	17.288	1.23774	0.057844
2.36	10.591	1.02493	.094420	2.86	17.462	1.24208	.057269
2.37	10.697	1.02928	.093481	2.87	17.637	1.24643	.056699
2.38	10.805	1.03362	.092551	2.88	17.814	1.25077	.056135
2.39	10.913	1.03796	.091630	2.89	17.993	1.25511	.055576
2.40	11.023	1.04231	0.090718	2.90	18.174	1.25945	0.055023
2.41	11.134	1.04665	.089815	2.91	18.357	1.26380	.054476
2.42	11.246	1.05099	.088922	2.92	18.541	1.26814	.053934
2.43	11.359	1.05534	.088037	2.93	18.728	1.27248	.053397
2.44	11.473	1.05968	.087161	2.94	18.916	1.27683	.052866
2.45	11.588	1.06402	0.086294	2.95	19.106	1.28117	0.052340
2.46	11.705	1.06836	.085435	2.96	19.298	1.28551	.051819
2.47	11.822	1.07271	.084585	2.97	19.492	1.28985	.051303
2.48	11.941	1.07705	.083743	2.98	19.688	1.29420	.050793
2.49	12.061	1.08139	.082910	2.99	19.886	1.29854	.050287
2.50	12.182	1.08574	0.082085	3.00	20.086	1.30288	0.049787

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
3.00	20.086	1.30288	0.049787	3.50	33.115	1.52003	0.030197
3.01	20.287	1.30723	.049292	3.51	33.448	1.52437	.029897
3.02	20.491	1.31157	.048801	3.52	33.784	1.52872	.029599
3.03	20.697	1.31591	.048316	3.53	34.124	1.53306	.029305
3.04	20.905	1.32026	.047835	3.54	34.467	1.53740	.029013
3.05	21.115	1.32460	0.047359	3.55	34.813	1.54175	0.028725
3.06	21.328	1.32894	.046888	3.56	35.163	1.54609	.028439
3.07	21.542	1.33328	.046421	3.57	35.517	1.55043	.028156
3.08	21.758	1.33763	.045959	3.58	35.874	1.55477	.027876
3.09	21.977	1.34197	.045502	3.59	36.234	1.55912	.027598
3.10	22.198	1.34631	0.045049	3.60	36.598	1.56346	0.027324
3.11	22.421	1.35066	.044601	3.61	36.966	1.56780	.027052
3.12	22.646	1.35500	.044157	3.62	37.338	1.57215	.026783
3.13	22.874	1.35934	.043718	3.63	37.713	1.57649	.026516
3.14	23.104	1.36368	.043283	3.64	38.092	1.58083	.026252
3.15	23.336	1.36803	0.042852	3.65	38.475	1.58517	0.025991
3.16	23.571	1.37237	.042426	3.66	38.861	1.58952	.025733
3.17	23.807	1.37671	.042004	3.67	39.252	1.59386	.025476
3.18	24.047	1.38106	.041586	3.68	39.646	1.59820	.025223
3.19	24.288	1.38540	.041172	3.69	40.045	1.60255	.024972
3.20	24.533	1.38974	0.040762	3.70	40.447	1.60689	0.024724
3.21	24.779	1.39409	.040357	3.71	40.854	1.61123	.024478
3.22	25.028	1.39843	.039955	3.72	41.264	1.61558	.024234
3.23	25.280	1.40277	.039557	3.73	41.679	1.61992	.023993
3.24	25.534	1.40711	.039164	3.74	42.098	1.62426	.023754
3.25	25.790	1.41146	0.038774	3.75	42.521	1.62860	0.023518
3.26	26.050	1.41580	.038388	3.76	42.948	1.63295	.023284
3.27	26.311	1.42014	.038006	3.77	43.380	1.63729	.023052
3.28	26.576	1.42449	.037628	3.78	43.816	1.64163	.022823
3.29	26.843	1.42883	.037254	3.79	44.256	1.64598	.022596
3.30	27.113	1.43317	0.036883	3.80	44.701	1.65032	0.022371
3.31	27.385	1.43751	.036516	3.81	45.150	1.65466	.022148
3.32	27.660	1.44186	.036153	3.82	45.604	1.65900	.021928
3.33	27.938	1.44620	.035793	3.83	46.063	1.66335	.021710
3.34	28.219	1.45054	.035437	3.84	46.525	1.66769	.021494
3.35	28.503	1.45489	0.035084	3.85	46.993	1.67203	0.021280
3.36	28.789	1.45923	.034735	3.86	47.465	1.67638	.021068
3.37	29.079	1.46357	.034390	3.87	47.942	1.68072	.020853
3.38	29.371	1.46792	.034047	3.88	48.424	1.68506	.020651
3.39	29.666	1.47226	.033709	3.89	48.911	1.68941	.020445
3.40	29.964	1.47660	0.033373	3.90	49.402	1.69375	0.020242
3.41	30.265	1.48094	.033041	3.91	49.899	1.69809	.020041
3.42	30.569	1.48529	.032712	3.92	50.400	1.70243	.019841
3.43	30.877	1.48963	.032387	3.93	50.907	1.70678	.019644
3.44	31.187	1.49397	.032065	3.94	51.419	1.71112	.019448
3.45	31.500	1.49832	0.031746	3.95	51.935	1.71546	0.019255
3.46	31.817	1.50266	.031430	3.96	52.457	1.71981	.019063
3.47	32.137	1.50700	.031117	3.97	52.985	1.72415	.018873
3.48	32.460	1.51134	.030807	3.98	53.517	1.72849	.018686
3.49	32.786	1.51569	.030501	3.99	54.055	1.73283	.018500
3.50	33.115	1.52003	0.030197	4.00	54.598	1.73718	0.018316

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
1.00	54.598	1.73718	0.018316	4.50	90.017	1.95433	0.011109
4.01	55.147	1.74152	.018133	4.51	90.922	1.95867	.010998
4.02	55.701	1.74586	.017953	4.52	91.836	1.96301	.010889
4.03	56.261	1.75021	.017774	4.53	92.759	1.96735	.010781
4.04	56.826	1.75455	.017597	4.54	93.691	1.97170	.010673
4.05	57.397	1.75889	0.017422	4.55	94.632	1.97604	0.010567
4.06	57.974	1.76324	.017249	4.56	95.583	1.98038	.010462
4.07	58.557	1.76758	.017077	4.57	96.544	1.98473	.010358
4.08	59.145	1.77192	.016907	4.58	97.514	1.98907	.010255
4.09	59.740	1.77626	.016739	4.59	98.494	1.99341	.010153
4.10	60.340	1.78061	0.016573	4.60	99.484	1.99775	0.010052
4.11	60.947	1.78495	.016408	4.61	100.48	2.00210	.009952
4.12	61.559	1.78929	.016245	4.62	101.49	2.00644	.009853
4.13	62.178	1.79364	.016083	4.63	102.51	2.01078	.009755
4.14	62.803	1.79798	.015923	4.64	103.54	2.01513	.009658
4.15	63.434	1.80232	0.015764	4.65	104.58	2.01947	0.009562
4.16	64.072	1.80667	.015608	4.66	105.64	2.02381	.009466
4.17	64.715	1.81101	.015452	4.67	106.70	2.02816	.009372
4.18	65.366	1.81535	.015299	4.68	107.77	2.03250	.009279
4.19	66.023	1.81969	.015146	4.69	108.85	2.03684	.009187
4.20	66.686	1.82404	0.014996	4.70	109.95	2.04118	0.009095
4.21	67.357	1.82838	.014846	4.71	111.05	2.04553	.009005
4.22	68.033	1.83272	.014699	4.72	112.17	2.04987	.008915
4.23	68.717	1.83707	.014552	4.73	113.30	2.05421	.008826
4.24	69.408	1.84141	.014408	4.74	114.43	2.05856	.008739
4.25	70.105	1.84575	0.014264	4.75	115.58	2.06290	0.008652
4.26	70.810	1.85009	.014122	4.76	116.75	2.06724	.008566
4.27	71.522	1.85444	.013982	4.77	117.92	2.07158	.008480
4.28	72.240	1.85878	.013843	4.78	119.10	2.07593	.008396
4.29	72.966	1.86312	.013705	4.79	120.30	2.08027	.008312
4.30	73.700	1.86747	0.013569	4.80	121.51	2.08461	0.008230
4.31	74.440	1.87181	.013434	4.81	122.73	2.08896	.008148
4.32	75.189	1.87615	.013300	4.82	123.97	2.09330	.008067
4.33	75.944	1.88050	.013168	4.83	125.21	2.09764	.007987
4.34	76.708	1.88484	.013037	4.84	126.47	2.10199	.007907
4.35	77.478	1.88918	0.012907	4.85	127.74	2.10633	0.007828
4.36	78.257	1.89352	.012778	4.86	129.02	2.11067	.007750
4.37	79.044	1.89787	.012651	4.87	130.32	2.11501	.007673
4.38	79.838	1.90221	.012525	4.88	131.63	2.11936	.007597
4.39	80.640	1.90655	.012401	4.89	132.95	2.12370	.007521
4.40	81.451	1.91090	0.012277	4.90	134.29	2.12804	0.007447
4.41	82.269	1.91524	.012155	4.91	135.64	2.13239	.007372
4.42	83.096	1.91958	.012034	4.92	137.00	2.13673	.007299
4.43	83.931	1.92392	.011914	4.93	138.38	2.14107	.007227
4.44	84.775	1.92827	.011796	4.94	139.77	2.14541	.007155
4.45	85.627	1.93261	0.011679	4.95	141.17	2.14976	0.007083
4.46	86.488	1.93695	.011562	4.96	142.59	2.15410	.007013
4.47	87.357	1.94130	.011447	4.97	144.03	2.15844	.006943
4.48	88.235	1.94564	.011333	4.98	145.47	2.16279	.006874
4.49	89.121	1.94998	.011221	4.99	146.94	2.16713	.006806
4.50	90.017	1.95433	0.011109	5.00	148.41	2.17147	0.006738

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
5.00	148.41	2.17147	0.006738	5.0	148.41	2.17147	0.006738
5.01	149.90	2.17582	.006671	5.1	164.02	2.21490	.006097
5.02	151.41	2.18016	.006605	5.2	181.27	2.25833	.005517
5.03	152.93	2.18450	.006539	5.3	200.34	2.30176	.004992
5.04	154.47	2.18884	.006474	5.4	221.41	2.34519	.004517
5.05	156.02	2.19319	0.006409	5.5	244.69	2.38862	0.004087
5.06	157.59	2.19753	.006346	5.6	270.43	2.43205	.003698
5.07	159.17	2.20187	.006282	5.7	298.87	2.47548	.003346
5.08	160.77	2.20622	.006220	5.8	330.30	2.51891	.003028
5.09	162.39	2.21056	.006158	5.9	365.04	2.56234	.002739
5.10	164.02	2.21490	0.006097	6.0	403.43	2.60577	0.002479
5.11	165.67	2.21924	.006036	6.1	445.86	2.64920	.002243
5.12	167.34	2.22359	.005976	6.2	492.75	2.69263	.002029
5.13	169.02	2.22793	.005917	6.3	544.57	2.73606	.001836
5.14	170.72	2.23227	.005858	6.4	601.85	2.77948	.001662
5.15	172.43	2.23662	0.005799	6.5	665.14	2.82291	0.001503
5.16	174.16	2.24096	.005742	6.6	735.10	2.86634	.001360
5.17	175.91	2.24530	.005685	6.7	812.41	2.90977	.001231
5.18	177.68	2.24965	.005628	6.8	897.85	2.95320	.001114
5.19	179.47	2.25399	.005572	6.9	992.27	2.99663	.001008
5.20	181.27	2.25833	0.005517	7.0	1096.6	3.04006	0.000912
5.21	183.09	2.26267	.005462	7.1	1212.0	3.08349	.000825
5.22	184.93	2.26702	.005407	7.2	1339.4	3.12692	.000747
5.23	186.79	2.27136	.005354	7.3	1480.3	3.17035	.000676
5.24	188.67	2.27570	.005300	7.4	1636.0	3.21378	.000611
5.25	190.57	2.28005	0.005248	7.5	1808.0	3.25721	0.000553
5.26	192.48	2.28439	.005195	7.6	1998.2	3.30064	.000500
5.27	194.42	2.28873	.005144	7.7	2208.3	3.34407	.000453
5.28	196.37	2.29307	.005092	7.8	2440.6	3.38750	.000410
5.29	198.34	2.29742	.005042	7.9	2697.3	3.43093	.000371
5.30	200.34	2.30176	0.004992	8.0	2981.0	3.47436	0.000335
5.31	202.35	2.30610	.004942	8.1	3294.5	3.51779	.000304
5.32	204.38	2.31045	.004893	8.2	3641.0	3.56121	.000275
5.33	206.44	2.31479	.004844	8.3	4023.9	3.60464	.000249
5.34	208.51	2.31913	.004796	8.4	4447.1	3.64807	.000225
5.35	210.61	2.32348	0.004748	8.5	4914.8	3.69150	0.000203
5.36	212.72	2.32782	.004701	8.6	5431.7	3.73493	.000184
5.37	214.86	2.33216	.004654	8.7	6002.9	3.77836	.000167
5.38	217.02	2.33650	.004608	8.8	6634.2	3.82179	.000151
5.39	219.20	2.34085	.004562	8.9	7332.0	3.86522	.000136
5.40	221.41	2.34519	0.004517	9.0	8103.1	3.90865	0.000123
5.41	223.63	2.34953	.004472	9.1	8955.3	3.95208	.000112
5.42	225.88	2.35388	.004427	9.2	9897.1	3.99551	.000101
5.43	228.15	2.35822	.004383	9.3	10938	4.03894	.000091
5.44	230.44	2.36256	.004339	9.4	12088	4.08237	.000083
5.45	232.76	2.36690	0.004296	9.5	13360	4.12580	0.000075
5.46	235.10	2.37125	.004254	9.6	14765	4.16923	.000068
5.47	237.46	2.37559	.004211	9.7	16318	4.21266	.000061
5.48	239.85	2.37993	.004169	9.8	18034	4.25609	.000055
5.49	242.26	2.38428	.004128	9.9	19930	4.29952	.000050
5.50	244.69	2.38862	0.004087	10.0	22026	4.34294	0.000045

HYPERBOLIC FUNCTIONS

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	\log_{10}	Value	\log_{10}	Value	\log_{10}	Value	\log_{10}
0.00	0.00000	$-\infty$	1.00000	.00000	0.00000	$-\infty$	∞	∞
0.01	.01000	.00001	1.00005	.00002	.01000	.99999	100.003	.00001
0.02	.02000	.30106	1.00020	.00009	.02000	.30097	50.007	.69903
0.03	.03000	.47719	1.00045	.00020	.02999	.47699	33.343	.52301
0.04	.04001	.60218	1.00080	.00035	.03998	.60183	25.013	.39817
0.05	0.05002	.69915	1.00125	.00054	0.04993	.69861	20.017	.30139
0.06	.06004	.77841	1.00180	.00078	.05993	.77763	16.687	.22237
0.07	.07006	.84545	1.00245	.00106	.06989	.84439	14.309	.15561
0.08	.08009	.90355	1.00320	.00139	.07983	.90216	12.527	.09784
0.09	.09012	.95483	1.00405	.00176	.08976	.95307	11.141	.04693
0.10	0.10017	.00072	1.00500	.00217	0.09967	.99856	10.0333	.00144
0.11	.11022	.04227	1.00606	.00262	.10956	.03965	9.1275	.96035
0.12	.12029	.08022	1.00721	.00312	.11943	.07710	8.3733	.92290
0.13	.13037	.11517	1.00846	.00366	.12927	.11151	7.7356	.88849
0.14	.14046	.14755	1.00982	.00424	.13909	.14330	7.1895	.85670
0.15	0.15056	.17772	1.01127	.00487	0.14889	.17285	6.7166	.82715
0.16	.16068	.20597	1.01283	.00554	.15865	.20044	6.3032	.79956
0.17	.17082	.23254	1.01448	.00625	.16838	.22629	5.9389	.77371
0.18	.18097	.25762	1.01624	.00700	.17808	.25062	5.6154	.74938
0.19	.19115	.28136	1.01810	.00779	.18775	.27357	5.3263	.72643
0.20	0.20134	.30392	1.02007	.00863	0.19738	.29529	5.0665	.70471
0.21	.21155	.32541	1.02213	.00951	.20697	.31590	4.8317	.68410
0.22	.22178	.34592	1.02430	.01043	.21652	.33549	4.6186	.66451
0.23	.23203	.36555	1.02657	.01139	.22603	.35416	4.4242	.64584
0.24	.24231	.38437	1.02894	.01239	.23550	.37198	4.2464	.62802
0.25	0.25261	.40245	1.03141	.01343	0.24492	.38902	4.0830	.61098
0.26	.26294	.41986	1.03399	.01452	.25430	.40534	3.9324	.59466
0.27	.27329	.43663	1.03667	.01564	.26362	.42099	3.7933	.57901
0.28	.28367	.45282	1.03946	.01681	.27291	.43601	3.6643	.56399
0.29	.29408	.46847	1.04235	.01801	.28213	.45046	3.5444	.54954
0.30	0.30452	.48362	1.04534	.01926	0.29131	.46436	3.4327	.53564
0.31	.31499	.49830	1.04844	.02054	.30044	.47775	3.3285	.52225
0.32	.32549	.51254	1.05164	.02187	.30951	.49067	3.2309	.50933
0.33	.33602	.52637	1.05495	.02323	.31852	.50314	3.1395	.49686
0.34	.34659	.53981	1.05836	.02463	.32748	.51518	3.0536	.48482
0.35	0.35719	.55290	1.06188	.02607	0.33638	.52682	2.9729	.47318
0.36	.36783	.56564	1.06550	.02755	.34521	.53809	2.8968	.46191
0.37	.37850	.57807	1.06923	.02907	.35399	.54899	2.8249	.45101
0.38	.38921	.59019	1.07307	.03063	.36271	.55956	2.7570	.44044
0.39	.39996	.60202	1.07702	.03222	.37136	.56980	2.6928	.43020
0.40	0.41075	.61358	1.08107	.03385	0.37995	.57973	2.6319	.42027
0.41	.42158	.62488	1.08523	.03552	.38847	.58936	2.5742	.41064
0.42	.43246	.63594	1.08950	.03723	.39693	.59871	2.5193	.40129
0.43	.44337	.64677	1.09388	.03897	.40532	.60780	2.4672	.39220
0.44	.45434	.65738	1.09837	.04075	.41364	.61663	2.4175	.38337
0.45	0.46534	.66777	1.10297	.04256	0.42190	.62521	2.3702	.37479
0.46	.47640	.67797	1.10768	.04441	.43008	.63355	2.3251	.36645
0.47	.48750	.68797	1.11250	.04630	.43820	.64167	2.2821	.35833
0.48	.49865	.69779	1.11743	.04822	.44624	.64957	2.2409	.35043
0.49	.50984	.70744	1.12247	.05018	.45422	.65726	2.2016	.34274

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	log ₁₀	Value	log ₁₀	Value	log ₁₀	Value	log ₁₀
0.50	0.52110	.71692	1.12763	.05217	0.46212	.66475	2.1640	.33525
0.51	.53240	.72624	1.13289	.05419	.46995	.67205	2.1279	.32795
0.52	.54375	.73540	1.13827	.05625	.47770	.67916	2.0934	.32084
0.53	.55516	.74442	1.14377	.05834	.48538	.68608	2.0602	.31392
0.54	.56663	.75330	1.14938	.06046	.49299	.69284	2.0284	.30716
0.55	0.57815	.76204	1.15510	.06262	0.50052	.69942	1.9979	.30058
0.56	.58973	.77065	1.16094	.06481	.50798	.70584	1.9686	.29416
0.57	.60137	.77914	1.16690	.06703	.51536	.71211	1.9404	.28789
0.58	.61307	.78751	1.17297	.06929	.52267	.71822	1.9133	.28178
0.59	.62483	.79576	1.17916	.07157	.52990	.72419	1.8872	.27581
0.60	0.63665	.80390	1.18547	.07389	0.53705	.73001	1.8620	.26999
0.61	.64854	.81194	1.19189	.07624	.54413	.73570	1.8378	.26430
0.62	.66049	.81987	1.19844	.07861	.55113	.74125	1.8145	.25875
0.63	.67251	.82770	1.20510	.08102	.55805	.74667	1.7919	.25333
0.64	.68459	.83543	1.21189	.08346	.56490	.75197	1.7702	.24803
0.65	0.69675	.84308	1.21879	.08593	0.57167	.75715	1.7493	.24285
0.66	.70897	.85063	1.22582	.08843	.57836	.76220	1.7290	.23780
0.67	.72126	.85809	1.23297	.09095	.58498	.76714	1.7095	.23286
0.68	.73363	.86548	1.24025	.09351	.59152	.77197	1.6906	.22803
0.69	.74607	.87278	1.24765	.09609	.59798	.77669	1.6723	.22331
0.70	0.75858	.88000	1.25517	.09870	0.60437	.78130	1.6546	.21870
0.71	.77117	.88715	1.26282	.10134	.61068	.78581	1.6375	.21419
0.72	.78384	.89423	1.27059	.10401	.61691	.79022	1.6210	.20978
0.73	.79659	.90123	1.27849	.10670	.62307	.79453	1.6050	.20547
0.74	.80941	.90817	1.28652	.10942	.62915	.79875	1.5895	.20125
0.75	0.82232	.91504	1.29468	.11216	0.63515	.80288	1.5744	.19712
0.76	.83530	.92185	1.30297	.11493	.64108	.80691	1.5599	.19309
0.77	.84838	.92859	1.31139	.11773	.64693	.81086	1.5458	.18914
0.78	.86153	.93527	1.31994	.12055	.65271	.81472	1.5321	.18528
0.79	.87478	.94190	1.32862	.12340	.65841	.81850	1.5188	.18150
0.80	0.88811	.94846	1.33743	.12627	0.66404	.82219	1.5059	.17781
0.81	.90152	.95498	1.34638	.12917	.66959	.82581	1.4935	.17419
0.82	.91503	.96144	1.35547	.13209	.67507	.82935	1.4813	.17065
0.83	.92863	.96784	1.36468	.13503	.68048	.83281	1.4696	.16719
0.84	.94233	.97420	1.37404	.13800	.68581	.83620	1.4581	.16380
0.85	0.95612	.98051	1.38353	.14099	0.69107	.83952	1.4470	.16048
0.86	.97000	.98677	1.39316	.14400	.69626	.84277	1.4362	.15723
0.87	.98398	.99299	1.40293	.14704	.70137	.84595	1.4258	.15405
0.88	.99806	.99916	1.41284	.15009	.70642	.84906	1.4156	.15094
0.89	1.01224	.00528	1.42289	.15317	.71139	.85211	1.4057	.14789
0.90	1.02652	.01137	1.43309	.15627	0.71630	.85509	1.3961	.14491
0.91	1.04090	.01741	1.44342	.15939	.72113	.85801	1.3867	.14199
0.92	1.05539	.02341	1.45390	.16254	.72590	.86088	1.3776	.13912
0.93	1.06998	.02937	1.46453	.16570	.73059	.86368	1.3687	.13632
0.94	1.08468	.03530	1.47530	.16888	.73522	.86642	1.3601	.13358
0.95	1.09948	.04119	1.48623	.17208	0.73978	.86910	1.3517	.13090
0.96	1.11440	.04704	1.49729	.17531	.74428	.87173	1.3436	.12827
0.97	1.12943	.05286	1.50851	.17855	.74870	.87431	1.3356	.12569
0.98	1.14457	.05864	1.51988	.18181	.75307	.87683	1.3279	.12317
0.99	1.15983	.06439	1.53141	.18509	.75736	.87930	1.3204	.12070

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	log ₁₀	Value	log ₁₀	Value	log ₁₀	Value	log ₁₀
1.00	1.17520	.07011	1.54308	.18839	0.76159	.88172	1.3130	.11828
1.01	1.19069	.07580	1.55491	.19171	.76576	.88409	1.3059	.11591
1.02	1.20630	.08146	1.56689	.19504	.76987	.88642	1.2989	.11358
1.03	1.22203	.08708	1.57904	.19839	.77391	.88869	1.2921	.11131
1.04	1.23788	.09268	1.59134	.20176	.77789	.89092	1.2855	.10908
1.05	1.25386	.09825	1.60379	.20515	0.78181	.89310	1.2791	.10690
1.06	1.26996	.10379	1.61641	.20855	.78566	.89524	1.2728	.10476
1.07	1.28619	.10930	1.62919	.21197	.78946	.89733	1.2667	.10267
1.08	1.30254	.11479	1.64214	.21541	.79320	.89938	1.2607	.10062
1.09	1.31903	.12025	1.65525	.21886	.79688	.90139	1.2549	.09861
1.10	1.33565	.12569	1.66852	.22233	0.80050	.90336	1.2492	.09664
1.11	1.35240	.13111	1.68196	.22582	.80406	.90529	1.2437	.09471
1.12	1.36929	.13649	1.69557	.22931	.80757	.90718	1.2383	.09282
1.13	1.38631	.14186	1.70934	.23283	.81102	.90903	1.2330	.09097
1.14	1.40347	.14720	1.72329	.23636	.81441	.91085	1.2279	.08915
1.15	1.42078	.15253	1.73741	.23990	0.81775	.91262	1.2229	.08738
1.16	1.43822	.15783	1.75171	.24346	.82104	.91436	1.2180	.08564
1.17	1.45581	.16311	1.76618	.24703	.82427	.91607	1.2132	.08393
1.18	1.47355	.16836	1.78083	.25062	.82745	.91774	1.2085	.08226
1.19	1.49143	.17360	1.79565	.25422	.83058	.91938	1.2040	.08062
1.20	1.50946	.17882	1.81066	.25784	0.83365	.92099	1.1995	.07901
1.21	1.52764	.18402	1.82584	.26146	.83668	.92256	1.1952	.07744
1.22	1.54598	.18920	1.84121	.26510	.83965	.92410	1.1910	.07590
1.23	1.56447	.19437	1.85676	.26876	.84258	.92561	1.1868	.07439
1.24	1.58311	.19951	1.87250	.27242	.84546	.92709	1.1828	.07291
1.25	1.60192	.20464	1.88842	.27610	0.84828	.92854	1.1789	.07146
1.26	1.62088	.20975	1.90454	.27979	.85106	.92996	1.1750	.07004
1.27	1.64001	.21485	1.92084	.28349	.85380	.93135	1.1712	.06865
1.28	1.65930	.21993	1.93734	.28721	.85648	.93272	1.1676	.06728
1.29	1.67876	.22499	1.95403	.29093	.85913	.93406	1.1640	.06594
1.30	1.69838	.23004	1.97091	.29467	0.86172	.93537	1.1605	.06463
1.31	1.71818	.23507	1.98800	.29842	.86428	.93665	1.1570	.06335
1.32	1.73814	.24009	2.00528	.30217	.86678	.93791	1.1537	.06209
1.33	1.75828	.24509	2.02276	.30594	.86925	.93914	1.1504	.06086
1.34	1.77860	.25008	2.04044	.30972	.87167	.94035	1.1472	.05965
1.35	1.79909	.25505	2.05833	.31352	0.87405	.94154	1.1441	.05846
1.36	1.81977	.26002	2.07643	.31732	.87639	.94270	1.1410	.05730
1.37	1.84062	.26496	2.09473	.32113	.87869	.94384	1.1381	.05616
1.38	1.86166	.26990	2.11324	.32495	.88095	.94495	1.1351	.05505
1.39	1.88289	.27482	2.13196	.32878	.88317	.94604	1.1323	.05396
1.40	1.90430	.27974	2.15090	.33262	0.88535	.94712	1.1295	.05288
1.41	1.92591	.28464	2.17005	.33647	.88749	.94817	1.1268	.05183
1.42	1.94770	.28952	2.18942	.34033	.88960	.94919	1.1241	.05081
1.43	1.96970	.29440	2.20900	.34420	.89167	.95020	1.1215	.04980
1.44	1.99188	.29926	2.22881	.34807	.89370	.95119	1.1189	.04881
1.45	2.01427	.30412	2.24884	.35196	0.89569	.95216	1.1165	.04784
1.46	2.03686	.30896	2.26910	.35585	.89765	.95311	1.1140	.04689
1.47	2.05965	.31379	2.28958	.35976	.89958	.95404	1.1116	.04596
1.48	2.08265	.31862	2.31029	.36367	.90147	.95495	1.1093	.04505
1.49	2.10586	.32343	2.33123	.36759	.90332	.95584	1.1070	.04416

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	\log_{10}	Value	\log_{10}	Value	\log_{10}	Value	\log_{10}
1.50	2.12928	.32823	2.35241	.37151	0.90515	.95672	1.1048	.04328
1.51	2.15291	.33303	2.37382	.37545	.90694	.95758	1.1026	.04242
1.52	2.17676	.33781	2.39547	.37939	.90870	.95842	1.1005	.04158
1.53	2.20082	.34258	2.41736	.38334	.91042	.95924	1.0984	.04076
1.54	2.22510	.34735	2.43949	.38730	.91212	.96005	1.0963	.03995
1.55	2.24961	.35211	2.46186	.39126	0.91379	.96084	1.0943	.03916
1.56	2.27434	.35686	2.48448	.39524	.91542	.96162	1.0924	.03838
1.57	2.29930	.36160	2.50735	.39921	.91703	.96238	1.0905	.03762
1.58	2.32449	.36633	2.53047	.40320	.91860	.96313	1.0886	.03687
1.59	2.34991	.37105	2.55384	.40719	.92015	.96386	1.0868	.03614
1.60	2.37557	.37577	2.57746	.41119	0.92167	.96457	1.0850	.03543
1.61	2.40146	.38048	2.60135	.41520	.92316	.96528	1.0832	.03472
1.62	2.42760	.38518	2.62549	.41921	.92462	.96597	1.0815	.03403
1.63	2.45397	.38987	2.64990	.42323	.92606	.96664	1.0798	.03336
1.64	2.48059	.39456	2.67457	.42725	.92747	.96730	1.0782	.03270
1.65	2.50746	.39923	2.69951	.43129	0.92886	.96795	1.0766	.03205
1.66	2.53459	.40391	2.72472	.43532	.93022	.96858	1.0750	.03142
1.67	2.56196	.40857	2.75021	.43937	.93155	.96921	1.0735	.03079
1.68	2.58959	.41323	2.77596	.44341	.93286	.96982	1.0720	.03018
1.69	2.61748	.41788	2.80200	.44747	.93415	.97042	1.0705	.02958
1.70	2.64563	.42253	2.82832	.45153	.93541	.97100	1.0691	.02900
1.71	2.67405	.42717	2.85491	.45559	.93665	.97158	1.0676	.02842
1.72	2.70273	.43180	2.88180	.45966	.93786	.97214	1.0663	.02786
1.73	2.73168	.43643	2.90897	.46374	.93906	.97269	1.0649	.02731
1.74	2.76091	.44105	2.93643	.46782	.94023	.97323	1.0636	.02677
1.75	2.79041	.44567	2.96419	.47191	0.94138	.97376	1.0623	.02624
1.76	2.82020	.45028	2.99224	.47600	.94250	.97428	1.0610	.02572
1.77	2.85026	.45488	3.02059	.48009	.94361	.97479	1.0598	.02521
1.78	2.88061	.45948	3.04925	.48419	.94470	.97529	1.0585	.02471
1.79	2.91125	.46408	3.07821	.48830	.94576	.97578	1.0574	.02422
1.80	2.94217	.46867	3.10747	.49241	0.94681	.97626	1.0562	.02374
1.81	2.97340	.47325	3.13705	.49652	.94783	.97673	1.0550	.02327
1.82	3.00492	.47783	3.16694	.50064	.94884	.97719	1.0539	.02281
1.83	3.03674	.48241	3.19715	.50476	.94983	.97764	1.0528	.02236
1.84	3.06886	.48698	3.22768	.50889	.95080	.97809	1.0518	.02191
1.85	3.10129	.49154	3.25853	.51302	0.95175	.97852	1.0507	.02148
1.86	3.13403	.49610	3.28970	.51716	.95268	.97895	1.0497	.02105
1.87	3.16709	.50066	3.32121	.52130	.95359	.97936	1.0487	.02064
1.88	3.20046	.50521	3.35305	.52544	.95449	.97977	1.0477	.02023
1.89	3.23415	.50976	3.38522	.52959	.95537	.98017	1.0467	.01983
1.90	3.26816	.51430	3.41773	.53374	0.95624	.98057	1.0458	.01943
1.91	3.30250	.51884	3.45058	.53789	.95709	.98095	1.0448	.01905
1.92	3.33718	.52338	3.48378	.54205	.95792	.98133	1.0439	.01867
1.93	3.37218	.52791	3.51733	.54621	.95873	.98170	1.0430	.01830
1.94	3.40752	.53244	3.55123	.55038	.95953	.98206	1.0422	.01794
1.95	3.44321	.53696	3.58548	.55455	0.96032	.98242	1.0413	.01758
1.96	3.47923	.54148	3.62009	.55872	.96109	.98276	1.0405	.01724
1.97	3.51561	.54600	3.65507	.56290	.96185	.98311	1.0397	.01689
1.98	3.55234	.55051	3.69041	.56707	.96259	.98344	1.0389	.01656
1.99	3.58942	.55502	3.72611	.57126	.96331	.98377	1.0381	.01623

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	log ₁₀	Value	log ₁₀	Value	log ₁₀	Value	log ₁₀
2.00	3.62686	.55953	3.76220	.57544	0.96403	.98409	1.0373	.01591
2.01	3.66466	.56403	3.79865	.57963	.96473	.98440	1.0366	.01560
2.02	3.70283	.56853	3.83549	.58382	.96541	.98471	1.0358	.01529
2.03	3.74138	.57303	3.87271	.58802	.96609	.98502	1.0351	.01498
2.04	3.78029	.57753	3.91032	.59221	.96675	.98531	1.0344	.01469
2.05	3.81958	.58202	3.94832	.59641	0.96740	.98560	1.0337	.01440
2.06	3.85926	.58650	3.98671	.60061	.96803	.98589	1.0330	.01411
2.07	3.89932	.59099	4.02550	.60482	.96865	.98617	1.0324	.01383
2.08	3.93977	.59547	4.06470	.60903	.96926	.98644	1.0317	.01356
2.09	3.98061	.59995	4.10430	.61324	.96986	.98671	1.0311	.01329
2.10	4.02186	.60443	4.14431	.61745	0.97045	.98697	1.0304	.01303
2.11	4.06350	.60890	4.18474	.62167	.97103	.98723	1.0298	.01277
2.12	4.10555	.61337	4.22558	.62589	.97159	.98748	1.0292	.01252
2.13	4.14801	.61784	4.26685	.63011	.97215	.98773	1.0286	.01227
2.14	4.19089	.62231	4.30855	.63433	.97269	.98798	1.0281	.01202
2.15	4.23419	.62677	4.35067	.63856	0.97323	.98821	1.0275	.01179
2.16	4.27791	.63123	4.39323	.64278	.97375	.98845	1.0270	.01155
2.17	4.32205	.63569	4.43623	.64701	.97426	.98868	1.0264	.01132
2.18	4.36663	.64015	4.47967	.65125	.97477	.98890	1.0259	.01110
2.19	4.41165	.64460	4.52356	.65548	.97526	.98912	1.0254	.01088
2.20	4.45711	.64905	4.56791	.65972	0.97574	.98934	1.0249	.01066
2.21	4.50301	.65350	4.61271	.66396	.97622	.98955	1.0244	.01045
2.22	4.54936	.65795	4.65797	.66820	.97668	.98975	1.0239	.01025
2.23	4.59617	.66240	4.70370	.67244	.97714	.98996	1.0234	.01004
2.24	4.64344	.66684	4.74989	.67668	.97759	.99016	1.0229	.00984
2.25	4.69117	.67128	4.79657	.68093	0.97803	.99035	1.0225	.00965
2.26	4.73937	.67572	4.84372	.68518	.97846	.99054	1.0220	.00946
2.27	4.78804	.68016	4.89136	.68943	.97888	.99073	1.0216	.00927
2.28	4.83720	.68459	4.93948	.69368	.97929	.99091	1.0211	.00909
2.29	4.88684	.68903	4.98810	.69794	.97970	.99109	1.0207	.00891
2.30	4.93696	.69346	5.03722	.70219	0.98010	.99127	1.0203	.00873
2.31	4.98758	.69789	5.08684	.70645	.98049	.99144	1.0199	.00856
2.32	5.03870	.70232	5.13697	.71071	.98087	.99161	1.0195	.00839
2.33	5.09032	.70675	5.18762	.71497	.98124	.99178	1.0191	.00822
2.34	5.14245	.71117	5.23878	.71923	.98161	.99194	1.0187	.00806
2.35	5.19510	.71559	5.29047	.72349	0.98197	.99210	1.0184	.00790
2.36	5.24827	.72002	5.34269	.72776	.98233	.99226	1.0180	.00774
2.37	5.30196	.72444	5.39544	.73203	.98267	.99241	1.0176	.00759
2.38	5.35618	.72885	5.44873	.73630	.98301	.99256	1.0173	.00744
2.39	5.41093	.73327	5.50256	.74056	.98335	.99271	1.0169	.00729
2.40	5.46623	.73769	5.55695	.74484	0.98367	.99285	1.0166	.00715
2.41	5.52207	.74210	5.61189	.74911	.98400	.99299	1.0163	.00701
2.42	5.57847	.74652	5.66739	.75338	.98431	.99313	1.0159	.00687
2.43	5.63542	.75093	5.72346	.75766	.98462	.99327	1.0156	.00673
2.44	5.69294	.75534	5.78010	.76194	.98492	.99340	1.0153	.00660
2.45	5.75103	.75975	5.83732	.76621	0.98522	.99353	1.0150	.00647
2.46	5.80969	.76415	5.89512	.77049	.98551	.99366	1.0147	.00634
2.47	5.86893	.76856	5.95352	.77477	.98579	.99379	1.0144	.00621
2.48	5.92876	.77296	6.01250	.77906	.98607	.99391	1.0141	.00609
2.49	5.98918	.77737	6.07209	.78334	.98635	.99403	1.0138	.00597

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	log ₁₀	Value	log ₁₀	Value	log ₁₀	Value	log ₁₀
2.50	6.05020	.78177	6.13229	.78762	0.98661	.99415	1.0136	.00585
2.51	6.11183	.78617	6.19310	.79191	.98688	.99426	1.0133	.00574
2.52	6.17407	.79057	6.25453	.79619	.98714	.99438	1.0130	.00562
2.53	6.23692	.79497	6.31658	.80048	.98739	.99449	1.0128	.00551
2.54	6.30040	.79937	6.37927	.80477	.98764	.99460	1.0125	.00540
2.55	6.36451	.80377	6.44259	.80906	0.98788	.99470	1.0123	.00530
2.56	6.42926	.80816	6.50656	.81335	.98812	.99481	1.0120	.00519
2.57	6.49464	.81256	6.57118	.81764	.98835	.99491	1.0118	.00509
2.58	6.56068	.81695	6.63646	.82194	.98858	.99501	1.0115	.00499
2.59	6.62738	.82134	6.70240	.82623	.98881	.99511	1.0113	.00489
2.60	6.69473	.82573	6.76901	.83052	0.98903	.99521	1.0111	.00479
2.61	6.76276	.83012	6.83629	.83482	.98924	.99530	1.0109	.00470
2.62	6.83146	.83451	6.90426	.83912	.98946	.99540	1.0107	.00460
2.63	6.90085	.83890	6.97292	.84341	.98966	.99549	1.0104	.00451
2.64	6.97092	.84329	7.04228	.84771	.98987	.99558	1.0102	.00442
2.65	7.04169	.84768	7.11234	.85201	0.99007	.99566	1.0100	.00434
2.66	7.11317	.85206	7.18312	.85631	.99026	.99575	1.0098	.00425
2.67	7.18536	.85645	7.25461	.86061	.99045	.99583	1.0096	.00417
2.68	7.25827	.86083	7.32683	.86492	.99064	.99592	1.0094	.00408
2.69	7.33190	.86522	7.39978	.86922	.99083	.99600	1.0093	.00400
2.70	7.40626	.86960	7.47347	.87352	0.99101	.99608	1.0091	.00392
2.71	7.48137	.87398	7.54791	.87783	.99118	.99615	1.0089	.00385
2.72	7.55722	.87836	7.62310	.88213	.99136	.99623	1.0087	.00377
2.73	7.63383	.88274	7.69905	.88644	.99153	.99631	1.0085	.00369
2.74	7.71121	.88712	7.77578	.89074	.99170	.99638	1.0084	.00362
2.75	7.78935	.89150	7.85328	.89505	0.99186	.99645	1.0082	.00355
2.76	7.86828	.89588	7.93157	.89936	.99202	.99652	1.0080	.00348
2.77	7.94799	.90026	8.01065	.90367	.99218	.99659	1.0079	.00341
2.78	8.02849	.90463	8.09053	.90798	.99233	.99666	1.0077	.00334
2.79	8.10980	.90901	8.17122	.91229	.99248	.99672	1.0076	.00328
2.80	8.19192	.91339	8.25273	.91660	0.99263	.99679	1.0074	.00321
2.81	8.27486	.91776	8.33506	.92091	.99278	.99685	1.0073	.00315
2.82	8.35862	.92213	8.41823	.92522	.99292	.99691	1.0071	.00309
2.83	8.44322	.92651	8.50224	.92953	.99306	.99698	1.0070	.00302
2.84	8.52867	.93088	8.58710	.93385	.99320	.99704	1.0069	.00296
2.85	8.61497	.93525	8.67281	.93816	0.99333	.99709	1.0067	.00291
2.86	8.70213	.93963	8.75940	.94247	.99346	.99715	1.0066	.00285
2.87	8.79016	.94400	8.84686	.94679	.99359	.99721	1.0065	.00279
2.88	8.87907	.94837	8.93520	.95110	.99372	.99726	1.0063	.00274
2.89	8.96887	.95274	9.02444	.95542	.99384	.99732	1.0062	.00268
2.90	9.05956	.95711	9.11458	.95974	0.99396	.99737	1.0061	.00263
2.91	9.15116	.96148	9.20564	.96405	.99408	.99742	1.0060	.00258
2.92	9.24368	.96584	9.29761	.96837	.99420	.99747	1.0058	.00253
2.93	9.33712	.97021	9.39051	.97269	.99431	.99752	1.0057	.00248
2.94	9.43149	.97458	9.48436	.97701	.99443	.99757	1.0056	.00243
2.95	9.52681	.97895	9.57915	.98133	0.99454	.99762	1.0055	.00238
2.96	9.62308	.98331	9.67490	.98565	.99464	.99767	1.0054	.00233
2.97	9.72031	.98768	9.77161	.98997	.99475	.99771	1.0053	.00229
2.98	9.81851	.99205	9.86930	.99429	.99485	.99776	1.0052	.00224
2.99	9.91770	.99641	9.96798	.99861	.99496	.99780	1.0051	.00220
3.00	10.01787	.00078	10.06766	.00293	0.99505	.99785	1.0050	.00215

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	\log_{10}	Value	\log_{10}	Value	\log_{10}	Value	\log_{10}
3.0	10.0179	.00078	10.0677	.00293	0.99505	.99785	1.0050	.00215
3.1	11.0765	.04440	11.1215	.04616	.99595	.99824	1.0041	.00176
3.2	12.2459	.08799	12.2866	.08943	.99668	.99856	1.0033	.00144
3.3	13.5379	.13155	13.5748	.13273	.99728	.99882	1.0027	.00118
3.4	14.9654	.17509	14.9987	.17605	.99777	.99903	1.0022	.00097
3.5	16.5426	.21860	16.5728	.21940	0.99818	.99921	1.0018	.00079
3.6	18.2855	.26211	18.3128	.26275	.99851	.99935	1.0015	.00065
3.7	20.2113	.30559	20.2360	.30612	.99878	.99947	1.0012	.00053
3.8	22.3394	.34907	22.3618	.34951	.99900	.99957	1.0010	.00043
3.9	24.6911	.39254	24.7113	.39290	.99918	.99964	1.0008	.00036
4.0	27.2899	.43600	27.3082	.43629	0.99933	.99971	1.0007	.00029
4.1	30.1619	.47946	30.1784	.47970	.99945	.99976	1.0005	.00024
4.2	33.3357	.52291	33.3507	.52310	.99955	.99980	1.0004	.00020
4.3	36.8431	.56636	36.8567	.56652	.99963	.99984	1.0004	.00016
4.4	40.7193	.60980	40.7316	.60993	.99970	.99987	1.0003	.00013
4.5	45.0030	.65324	45.0141	.65335	0.99975	.99989	1.0002	.00011
4.6	49.7371	.69668	49.7472	.69677	.99980	.99991	1.0002	.00009
4.7	54.9690	.74012	54.9781	.74019	.99983	.99993	1.0002	.00007
4.8	60.7511	.78355	60.7593	.78361	.99986	.99994	1.0001	.00006
4.9	67.1412	.82699	67.1486	.82704	.99989	.99995	1.0001	.00005
5.0	74.2032	.87042	74.2099	.87046	0.99991	.99996	1.0001	.00004

FACTORIALS, EXACT VALUES AND RECIPROCAL

n	$n!$	n	$n!$	n	$1/n!$	n	$1/n!$
1	1	11	39916800	1	1	11	.25052 $\times 10^{-7}$
2	2	12	479001600	2	0.5	12	.20877 $\times 10^{-8}$
3	6	13	6227020800	3	.16667	13	.16059 $\times 10^{-9}$
4	24	14	87178291200	4	.41667 $\times 10^{-1}$	14	.11471 $\times 10^{-10}$
5	120	15	1307674368000	5	.83333 $\times 10^{-2}$	15	.76472 $\times 10^{-12}$
6	720	16	20922789888000	6	.13889 $\times 10^{-2}$	16	.47795 $\times 10^{-13}$
7	5040	17	355687428096000	7	.19841 $\times 10^{-3}$	17	.28115 $\times 10^{-14}$
8	40320	18	6402373705728000	8	.24802 $\times 10^{-4}$	18	.15619 $\times 10^{-15}$
9	362880	19	121645100408832000	9	.27557 $\times 10^{-5}$	19	.82206 $\times 10^{-17}$
10	3628800	20	2432902008176640000	10	.27557 $\times 10^{-6}$	20	.41103 $\times 10^{-18}$

DEGREES—RADIAN

1 radian = 57° 17' 44".80625

1 radian = 57.29577 95131 degrees	\log 1.75812 26324
1 radian = 3437.74677 07849 minutes	3.53627 38828
1 radian = 206264.80625 seconds	5.31442 51332
1 degree = 0.01745 32925 19943 radians	8.24187 73676-10
1 minute = 0.00029 08882 08666 radians	6.46372 61172-10
1 second = 0.00000 48481 36811 radians	4.68557 48668-10

DEGREES—RADIANs

The table gives in radians the angle which is expressed in degrees and minutes at the side and top. Angles expressed to the nearest minute and second can readily be converted to radians by adding to the equivalent of the whole number of degrees the equivalents of the minutes and seconds found on the third page of this table.

°	00'	10	20	30	40	50
0	0.00000	0.00291	0.00582	0.00873	0.01164	0.01454
1	0.01745	0.02036	0.02327	0.02618	0.02909	0.03200
2	0.03491	0.03782	0.04072	0.04363	0.04654	0.04945
3	0.05236	0.05527	0.05818	0.06109	0.06400	0.06690
4	0.06981	0.07272	0.07563	0.07854	0.08145	0.08436
5	0.08727	0.09018	0.09308	0.09599	0.09890	0.10181
6	0.10472	0.10763	0.11054	0.11345	0.11636	0.11926
7	0.12217	0.12508	0.12799	0.13090	0.13381	0.13672
8	0.13963	0.14254	0.14544	0.14835	0.15126	0.15417
9	0.15708	0.15999	0.16290	0.16581	0.16872	0.17162
10	0.17453	0.17744	0.18035	0.18326	0.18617	0.18908
11	0.19199	0.19490	0.19780	0.20071	0.20362	0.20653
12	0.20944	0.21235	0.21526	0.21817	0.22108	0.22398
13	0.22689	0.22980	0.23271	0.23562	0.23853	0.24144
14	0.24435	0.24725	0.25016	0.25307	0.25598	0.25889
15	0.26180	0.26471	0.26762	0.27053	0.27343	0.27634
16	0.27925	0.28216	0.28507	0.28798	0.29089	0.29380
17	0.29671	0.29961	0.30252	0.30543	0.30834	0.31125
18	0.31416	0.31707	0.31998	0.32289	0.32579	0.32870
19	0.33161	0.33452	0.33743	0.34034	0.34325	0.34616
20	0.34907	0.35197	0.35488	0.35779	0.36070	0.36361
21	0.36652	0.36943	0.37234	0.37525	0.37815	0.38106
22	0.38397	0.38688	0.38979	0.39270	0.39561	0.39852
23	0.40143	0.40433	0.40724	0.41015	0.41306	0.41597
24	0.41888	0.42179	0.42470	0.42761	0.43051	0.43342
25	0.43633	0.43924	0.44215	0.44506	0.44797	0.45088
26	0.45379	0.45669	0.45960	0.46251	0.46542	0.46833
27	0.47124	0.47415	0.47706	0.47997	0.48287	0.48578
28	0.48869	0.49160	0.49451	0.49742	0.50033	0.50324
29	0.50615	0.50905	0.51196	0.51487	0.51778	0.52069
30	0.52360	0.52651	0.52942	0.53233	0.53523	0.53814
31	0.54105	0.54396	0.54687	0.54978	0.55269	0.55560
32	0.55851	0.56141	0.56432	0.56723	0.57014	0.57305
33	0.57596	0.57887	0.58178	0.58469	0.58759	0.59050
34	0.59341	0.59632	0.59923	0.60214	0.60505	0.60796
35	0.61087	0.61377	0.61668	0.61959	0.62250	0.62541
36	0.62832	0.63123	0.63414	0.63705	0.63995	0.64286
37	0.64577	0.64868	0.65159	0.65450	0.65741	0.66032
38	0.66323	0.66613	0.66904	0.67195	0.67486	0.67777
39	0.68068	0.68359	0.68650	0.68941	0.69231	0.69522
40	0.69813	0.70104	0.70395	0.70686	0.70977	0.71268
41	0.71558	0.71849	0.72140	0.72431	0.72722	0.73013
42	0.73304	0.73595	0.73886	0.74176	0.74467	0.74758
43	0.75049	0.75340	0.75631	0.75922	0.76213	0.76504
44	0.76794	0.77085	0.77376	0.77667	0.77958	0.78249
45	0.78540	0.78831	0.79122	0.79412	0.79703	0.79994
46	0.80285	0.80576	0.80867	0.81158	0.81449	0.81740
47	0.82030	0.82321	0.82612	0.82903	0.83194	0.83485
48	0.83776	0.84067	0.84358	0.84648	0.84939	0.85230
49	0.85521	0.85812	0.86103	0.86394	0.86685	0.86976
50	0.87266	0.87557	0.87848	0.88139	0.88430	0.88721

DEGREES—RADIANS (Continued)

°	00'	10	20	30	40	50
50	0.87266	0.87557	0.87848	0.88139	0.88430	0.88721
51	0.89012	0.89303	0.89594	0.89884	0.90175	0.90466
52	0.90757	0.91048	0.91339	0.91630	0.91921	0.92212
53	0.92502	0.92793	0.93084	0.93375	0.93666	0.93957
54	0.94248	0.94539	0.94830	0.95120	0.95411	0.95702
55	0.95993	0.96284	0.96575	0.96866	0.97157	0.97448
56	0.97738	0.98029	0.98320	0.98611	0.98902	0.99193
57	0.99484	0.99775	1.00066	1.00356	1.00647	1.00938
58	1.01229	1.01520	1.01811	1.02102	1.02393	1.02684
59	1.02974	1.03265	1.03556	1.03847	1.04138	1.04429
60	1.04720	1.05011	1.05302	1.05592	1.05883	1.06174
61	1.06465	1.06756	1.07047	1.07338	1.07629	1.07920
62	1.08210	1.08501	1.08792	1.09083	1.09374	1.09665
63	1.09956	1.10247	1.10538	1.10828	1.11119	1.11410
64	1.11701	1.11992	1.12283	1.12574	1.12865	1.13156
65	1.13446	1.13737	1.14028	1.14319	1.14610	1.14901
66	1.15192	1.15483	1.15774	1.16064	1.16355	1.16646
67	1.16937	1.17228	1.17519	1.17810	1.18101	1.18392
68	1.18682	1.18973	1.19264	1.19555	1.19846	1.20137
69	1.20428	1.20719	1.21009	1.21300	1.21591	1.21882
70	1.22173	1.22464	1.22755	1.23046	1.23337	1.23627
71	1.23918	1.24209	1.24500	1.24791	1.25082	1.25373
72	1.25664	1.25955	1.26245	1.26536	1.26827	1.27118
73	1.27409	1.27700	1.27991	1.28282	1.28573	1.28863
74	1.29154	1.29445	1.29736	1.30027	1.30318	1.30609
75	1.30900	1.31191	1.31481	1.31772	1.32063	1.32354
76	1.32645	1.32936	1.33227	1.33518	1.33809	1.34099
77	1.34390	1.34681	1.34972	1.35263	1.35554	1.35845
78	1.36136	1.36427	1.36717	1.37008	1.37299	1.37590
79	1.37881	1.38172	1.38463	1.38754	1.39045	1.39335
80	1.39626	1.39917	1.40208	1.40499	1.40790	1.41081
81	1.41372	1.41663	1.41953	1.42244	1.42535	1.42826
82	1.43117	1.43408	1.43699	1.43990	1.44281	1.44571
83	1.44862	1.45153	1.45444	1.45735	1.46026	1.46317
84	1.46608	1.46899	1.47189	1.47480	1.47771	1.48062
85	1.48353	1.48644	1.48935	1.49226	1.49517	1.49807
86	1.50098	1.50389	1.50680	1.50971	1.51262	1.51553
87	1.51844	1.52135	1.52425	1.52716	1.53007	1.53298
88	1.53589	1.53880	1.54171	1.54462	1.54753	1.55043
89	1.55334	1.55625	1.55916	1.56207	1.56498	1.56789
90	1.57080	1.57371	1.57661	1.57952	1.58243	1.58534
91	1.58825	1.59116	1.59407	1.59698	1.59989	1.60279
92	1.60570	1.60861	1.61152	1.61443	1.61734	1.62025
93	1.62316	1.62607	1.62897	1.63188	1.63479	1.63770
94	1.64061	1.64352	1.64643	1.64934	1.65225	1.65515
95	1.65806	1.66097	1.66388	1.66679	1.66970	1.67261
96	1.67552	1.67842	1.68133	1.68424	1.68715	1.69006
97	1.69297	1.69588	1.69879	1.70170	1.70460	1.70751
98	1.71042	1.71333	1.71624	1.71915	1.72206	1.72497
99	1.72788	1.73078	1.73369	1.73660	1.73951	1.74242
100	1.74533	1.74824	1.75115	1.75406	1.75696	1.75987
101	1.76278	1.76569	1.76860	1.77151	1.77442	1.77733
102	1.78024	1.78314	1.78605	1.78896	1.79187	1.79478
103	1.79769	1.80060	1.80351	1.80642	1.80932	1.81223
104	1.81514	1.81805	1.82096	1.82387	1.82678	1.82969
105	1.83260	1.83550	1.83841	1.84132	1.84423	1.84714
106	1.85004	1.85295	1.85587	1.85878	1.86168	1.86459
107	1.86750	1.87041	1.87332	1.87623	1.87914	1.88205
108	1.88496	1.88786	1.89077	1.89368	1.89659	1.89950
109	1.90241	1.90532	1.90823	1.91114	1.91404	1.91695
110	1.91986	1.92277	1.92568	1.92859	1.93150	1.93441

DEGREES—RADIANS (Concluded)

Deg.	Radians	Deg.	Radians	Min.	Radians	Sec.	Radians
90	1.57080	150	2.61799	0	0.00000	0	0.00000
91	1.58825	151	2.63545	1	0.00029	1	0.00000
92	1.60570	152	2.65290	2	0.00058	2	0.00001
93	1.62316	153	2.67035	3	0.00087	3	0.00001
94	1.64061	154	2.68781	4	0.00116	4	0.00002
95	1.65806	155	2.70526	5	0.00145	5	0.00002
96	1.67552	156	2.72271	6	0.00175	6	0.00003
97	1.69297	157	2.74017	7	0.00204	7	0.00003
98	1.71042	158	2.75762	8	0.00233	8	0.00004
99	1.72788	159	2.77507	9	0.00262	9	0.00004
100	1.74533	160	2.79253	10	0.00291	10	0.00005
101	1.76278	161	2.80998	11	0.00320	11	0.00005
102	1.78024	162	2.82743	12	0.00349	12	0.00006
103	1.79769	163	2.84489	13	0.00378	13	0.00006
104	1.81514	164	2.86234	14	0.00407	14	0.00007
105	1.83260	165	2.87979	15	0.00436	15	0.00007
106	1.85005	166	2.89725	16	0.00465	16	0.00008
107	1.86750	167	2.91470	17	0.00495	17	0.00008
108	1.88496	168	2.93215	18	0.00524	18	0.00009
109	1.90241	169	2.94961	19	0.00553	19	0.00009
110	1.91986	170	2.96706	20	0.00582	20	0.00010
111	1.93732	171	2.98451	21	0.00611	21	0.00010
112	1.95477	172	3.00197	22	0.00640	22	0.00011
113	1.97222	173	3.01942	23	0.00669	23	0.00011
114	1.98968	174	3.03687	24	0.00698	24	0.00012
115	2.00713	175	3.05433	25	0.00727	25	0.00012
116	2.02458	176	3.07178	26	0.00756	26	0.00013
117	2.04204	177	3.08923	27	0.00785	27	0.00013
118	2.05949	178	3.10669	28	0.00814	28	0.00014
119	2.07694	179	3.12414	29	0.00844	29	0.00014
120	2.09440	180	3.14159	30	0.00873	30	0.00015
121	2.11185	190	3.31613	31	0.00902	31	0.00015
122	2.12930	200	3.49066	32	0.00931	32	0.00016
123	2.14676	210	3.66519	33	0.00960	33	0.00016
124	2.16421	220	3.83972	34	0.00989	34	0.00016
125	2.18166	230	4.01426	35	0.01018	35	0.00017
126	2.19911	240	4.18879	36	0.01047	36	0.00017
127	2.21657	250	4.36332	37	0.01076	37	0.00018
128	2.23402	260	4.53786	38	0.01105	38	0.00018
129	2.25147	270	4.71239	39	0.01134	39	0.00019
130	2.26893	280	4.88692	40	0.01164	40	0.00019
131	2.28638	290	5.06145	41	0.01193	41	0.00020
132	2.30383	300	5.23599	42	0.01222	42	0.00020
133	2.32129	310	5.41052	43	0.01251	43	0.00021
134	2.33874	320	5.58505	44	0.01280	44	0.00021
135	2.35619	330	5.75959	45	0.01309	45	0.00022
136	2.37365	340	5.93412	46	0.01338	46	0.00022
137	2.39110	350	6.10865	47	0.01367	47	0.00023
138	2.40855	360	6.28319	48	0.01396	48	0.00023
139	2.42601	370	6.45772	49	0.01425	49	0.00024
140	2.44346	380	6.63225	50	0.01454	50	0.00024
141	2.46091	390	6.80678	51	0.01484	51	0.00025
142	2.47837	400	6.98132	52	0.01513	52	0.00025
143	2.49582	410	7.15585	53	0.01542	53	0.00026
144	2.51327	420	7.33038	54	0.01571	54	0.00026
145	2.53073	430	7.50492	55	0.01600	55	0.00027
146	2.54818	440	7.67945	56	0.01629	56	0.00027
147	2.56563	450	7.85398	57	0.01658	57	0.00028
148	2.58309	460	8.02851	58	0.01687	58	0.00028
149	2.60054	470	8.20305	59	0.01716	59	0.00029
150	2.61799	480	8.37758	60	0.01745	60	0.00029

DEGREES AND DECIMAL FRACTIONS TO RADIANS

The table below facilitates conversion of an angle expressed in degrees and decimal fractions into radians. To convert 25.78 into radians, find the equivalents, successively, of 20°, 5°, 0°.7, 0°.08 and add.

Deg.	Radians	Deg.	Radians	Deg.	Radians	Deg.	Radians	Deg.	Radians
10	0.174533	1	0.017453	0.1	0.001745	0.01	0.000175	0.001	0.000017
20	0.349066	2	.034907	.2	.003491	.02	.000349	.002	.000035
30	0.523599	3	.052360	.3	.005236	.03	.000524	.003	.000052
40	0.698132	4	.069813	.4	.006981	.04	.000698	.004	.000070
50	0.872665	5	.087266	.5	.008727	.05	.000873	.005	.000087
60	1.047198	6	.104720	.6	.010472	.06	.001047	.006	.000105
70	1.221730	7	.122173	.7	.012217	.07	.001222	.007	.000122
80	1.396263	8	.139626	.8	.013963	.08	.001396	.008	.000140
90	1.570796	9	.157080	.9	.015708	.09	.001571	.009	.000157

RADIANS—DEGREES

Radians	Degrees	Radians	Degrees	Radians	Degrees	Radians	Degrees
1	57.2958	0.1	5.7296	0.01	0.5730	0.001	0.0573
2	114.5916	.2	11.4592	.02	1.1459	.002	.1146
3	171.8873	.3	17.1887	.03	1.7189	.003	.1719
4	229.1831	.4	22.9183	.04	2.2918	.004	.2292
5	286.4789	.5	28.6479	.05	2.8648	.005	.2865
6	343.7747	.6	34.3775	.06	3.4377	.006	.3438
7	401.0705	.7	40.1070	.07	4.0107	.007	.4011
8	458.3662	.8	45.8366	.08	4.5837	.008	.4584
9	515.6620	.9	51.5662	.09	5.1566	.009	.5157
10	572.9578	1.0	57.2958	.10	5.7296	.010	.5730

RADIANS—DEGREES

Multiples and Fractions of π Radians

Radians	Radians	Deg.	Radians	Radians	Deg.	Radians	Radians	Deg.
π	3.1416	180	$\pi/2$	1.5708	90	$2\pi/3$	2.0944	120
2π	6.2832	360	$\pi/3$	1.0472	60	$3\pi/4$	2.3562	135
3π	9.4248	540	$\pi/4$	0.7854	45	$5\pi/6$	2.6180	150
4π	12.5664	720	$\pi/5$	0.6283	36	$7\pi/6$	3.6652	210
5π	15.7080	900	$\pi/6$	0.5236	30	$5\pi/4$	3.9270	225
6π	18.8496	1080	$\pi/7$	0.4488	25.714	$4\pi/3$	4.1888	240
7π	21.9911	1260	$\pi/8$	0.3927	22.5	$3\pi/2$	4.7124	270
8π	25.1327	1440	$\pi/9$	0.3491	20	$5\pi/3$	5.2360	300
9π	28.2743	1620	$\pi/10$	0.3142	18	$7\pi/4$	5.4978	315
10π	31.4159	1800	$\pi/12$	0.2618	15	$11\pi/6$	5.7596	330

CONVERSION OF ANGLES FROM ARC TO TIME

Arc	Time	Arc	Time	Arc	Time	Arc	Time
°	h m	°	h m	°	s	°	s
'	m s	'	m s	"	"	"	"
0	0 00	20	1 20	0	0.00	8	0.53
1	0 04	30	2 00	1	0.07	9	0.60
2	0 08	40	2 40	2	0.13	10	0.67
3	0 12	50	3 20	3	0.20	20	1.33
4	0 16	60	4 00	4	0.27	30	2.00
5	0 20	70	4 40	5	0.33	40	2.67
6	0 24	80	5 20	6	0.40	50	3.33
7	0 28	90	6 00	7	0.47	60	4.00
8	0 32	100	6 40				
9	0 36	200	13 20				
10	0 40	300	20 00				

MINUTES AND SECONDS TO DECIMAL PARTS OF A DEGREE

MINUTES AND SECONDS TO DECIMAL PARTS OF A DEG.			DECIMAL PARTS OF A DEGREE TO MINUTES AND SECONDS					
Min. Degrees		Sec. Degrees	Deg. ' "			Deg. ' "		
0	0.00000	0	0.00	0	00	0.60	36	
1	.01667	1	.01	0	36	.61	36	36
2	.03333	2	.02	1	12	.62	37	12
3	.05	3	.03	1	48	.63	37	48
4	.06667	4	.04	2	24	.64	38	24
5	.08333	5	.05	3		.65	39	
6	.10	6	.06	3	36	.66	39	36
7	.11667	7	.07	4	12	.67	40	12
8	.13333	8	.08	4	48	.68	40	48
9	.15	9	.09	5	24	.69	41	24
10	0.16667	10	0.10	6		0.70	42	
11	.18333	11	.11	6	36	.71	42	36
12	.20	12	.12	7	12	.72	43	12
13	.21667	13	.13	7	48	.73	43	48
14	.23333	14	.14	8	24	.74	44	24
15	.25	15	.15	9		.75	45	
16	.26667	16	.16	9	36	.76	45	36
17	.28333	17	.17	10	12	.77	46	12
18	.30	18	.18	10	48	.78	46	48
19	.31667	19	.19	11	24	.79	47	24
20	0.33333	20	0.20	12		0.80	48	
21	.35	21	.21	12	36	.81	48	36
22	.36667	22	.22	13	12	.82	49	12
23	.38333	23	.23	13	48	.83	49	48
24	.40	24	.24	14	24	.84	50	24
25	.41667	25	.25	15		.85	51	
26	.43333	26	.26	15	36	.86	51	36
27	.45	27	.27	16	12	.87	52	12
28	.46667	28	.28	16	48	.88	52	48
29	.48333	29	.29	17	24	.89	53	24
30	0.50	30	0.30	18		0.90	54	
31	.51667	31	.31	18	36	.91	54	36
32	.53333	32	.32	19	12	.92	55	12
33	.55	33	.33	19	48	.93	55	48
34	.56667	34	.34	20	24	.94	56	24
35	.58333	35	.35	21		.95	57	
36	.60	36	.36	21	36	.96	57	36
37	.61667	37	.37	22	12	.97	58	12
38	.63333	38	.38	22	48	.98	58	48
39	.65	39	.39	23	24	.99	59	24
40	0.66667	40	0.40	24		1.00	60	
41	.68333	41	.41	24	36			
42	.70	42	.42	25	12			
43	.71667	43	.43	25	48			
44	.73333	44	.44	26	24			
45	.75	45	.45	27				
46	.76667	46	.46	27	36			
47	.78333	47	.47	28	12			
48	.80	48	.48	28	48			
49	.81667	49	.49	29	24			
50	0.83333	50	0.50	30				
51	.85	51	.51	30	36			
52	.86667	52	.52	31	12			
53	.88333	53	.53	31	48			
54	.90	54	.54	32	24			
55	.91667	55	.55	33				
56	.93333	56	.56	33	36			
57	.95	57	.57	34	12			
58	.96667	58	.58	34	48			
59	.98333	59	.59	35	24			
60	1.00	60	0.60	36				

Deg.	Sec.
0.000	0.0
.001	3.6
.002	7.2
.003	10.8
.004	14.4
.005	18.
.006	21.6
.007	25.2
.008	28.8
.009	32.4
0.010	36.

NUMERICAL TABLES

Reciprocals, Circumference and Area of Circles

As a matter of convenience, the values of $1000 \times (1/n)$ are given in the table. To obtain the actual value of the reciprocal, shift the decimal point three places to the left.

Circumferences and areas of circles are given for the values of n as the diameter.

n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
0	∞	0.000000	0.000000	50	20.00000	157.0796	1963.495
1	1000.000	3.141593	.7853982	51	19.60784	160.2212	2042.821
2	500.0000	6.283185	3.141593	52	19.23077	163.3628	2123.717
3	333.3333	9.424778	7.068583	53	18.86792	166.5044	2206.183
4	250.0000	12.56637	12.56637	54	18.51852	169.6460	2290.221
5	200.0000	15.70796	19.63495	55	18.18182	172.7876	2375.829
6	166.6667	18.84956	28.27433	56	17.85714	175.9292	2463.009
7	142.8571	21.99115	38.48451	57	17.54386	179.0708	2551.759
8	125.0000	25.13274	50.26548	58	17.24138	182.2124	2642.079
9	111.1111	28.27433	63.61725	59	16.94915	185.3540	2733.971
10	100.0000	31.41593	78.53982	60	16.66667	188.4956	2827.433
11	90.90909	34.55752	95.03318	61	16.39344	191.6372	2922.467
12	83.33333	37.69911	113.0973	62	16.12903	194.7787	3019.071
13	76.92308	40.84070	132.7323	63	15.87302	197.9203	3117.245
14	71.42857	43.98230	153.9380	64	15.62500	201.0619	3216.991
15	66.66667	47.12389	176.7146	65	15.38462	204.2035	3318.307
16	62.50000	50.26548	201.0619	66	15.15152	207.3451	3421.194
17	58.82353	53.40708	226.9801	67	14.92537	210.4867	3525.652
18	55.55556	56.54867	254.4690	68	14.70588	213.6283	3631.681
19	52.63158	59.69026	283.5287	69	14.49275	216.7699	3739.281
20	50.00000	62.83185	314.1593	70	14.28571	219.9115	3848.451
21	47.61905	65.97345	346.3606	71	14.08451	223.0531	3959.192
22	45.45455	69.11504	380.1327	72	13.88889	226.1947	4071.504
23	43.47826	72.25663	415.4756	73	13.69863	229.3363	4185.387
24	41.66667	75.39822	452.3893	74	13.51351	232.4779	4300.840
25	40.00000	78.53982	490.8739	75	13.33333	235.6194	4417.865
26	38.46154	81.68141	530.9292	76	13.15789	238.7610	4536.466
27	37.03704	84.82300	572.5553	77	12.98701	241.9026	4656.626
28	35.71429	87.96459	615.7522	78	12.82051	245.0442	4778.362
29	34.48276	91.10619	660.5199	79	12.65823	248.1858	4901.670
30	33.33333	94.24778	706.8583	80	12.50000	251.3274	5026.548
31	32.25806	97.38937	754.7676	81	12.34568	254.4690	5152.997
32	31.25000	100.5310	804.2477	82	12.19512	257.6106	5281.017
33	30.30303	103.6726	855.2986	83	12.04819	260.7522	5410.608
34	29.41176	106.8142	907.9203	84	11.90476	263.8938	5541.769
35	28.57143	109.9557	962.1128	85	11.76471	267.0354	5674.502
36	27.77778	113.0973	1017.876	86	11.62791	270.1770	5808.805
37	27.02703	116.2389	1075.210	87	11.49425	273.3186	5944.679
38	26.31579	119.3805	1134.115	88	11.36364	276.4602	6082.123
39	25.64103	122.5221	1194.591	89	11.23596	279.6017	6221.139
40	25.00000	125.6637	1256.637	90	11.11111	282.7433	6361.725
41	24.39024	128.8053	1320.254	91	10.98901	285.8849	6503.882
42	23.80952	131.9469	1385.442	92	10.86957	289.0265	6647.610
43	23.25581	135.0885	1452.201	93	10.75269	292.1681	6792.909
44	22.72727	138.2301	1520.531	94	10.63830	295.3097	6939.778
45	22.22222	141.3717	1590.431	95	10.52632	298.4513	7088.218
46	21.73913	144.5133	1661.903	96	10.41667	301.5929	7238.229
47	21.27660	147.6549	1734.945	97	10.30928	304.7345	7389.811
48	20.83333	150.7964	1809.557	98	10.20408	307.8761	7542.964
49	20.40816	153.9380	1885.741	99	10.10101	311.0177	7697.687
50	20.00000	157.0796	1963.495	100	10.00000	314.1593	7853.982

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
100	10.00000	314.1593	7853.982	150	6.666 667	471.2389	17671.46
101	9.900 990	317.3009	8011.847	151	6.622 517	474.3805	17907.86
102	9.803 922	320.4425	8171.282	152	6.578 947	477.5221	18145.84
103	9.708 738	323.5840	8332.289	153	6.535 948	480.6637	18385.39
104	9.615 385	326.7256	8494.867	154	6.493 506	483.8053	18626.50
105	9.523 810	329.8672	8659.015	155	6.451 613	486.9469	18869.19
106	9.433 962	333.0088	8824.734	156	6.410 256	490.0885	19113.45
107	9.345 794	336.1504	8992.024	157	6.369 427	493.2300	19359.28
108	9.259 259	339.2920	9160.884	158	6.329 114	496.3716	19606.68
109	9.174 312	342.4336	9331.316	159	6.289 308	499.5132	19855.65
110	9.090 909	345.5752	9503.318	160	6.250 000	502.6548	20106.19
111	9.009 009	348.7168	9676.891	161	6.211 180	505.7964	20358.31
112	8.928 571	351.8584	9852.035	162	6.172 840	508.9380	20611.99
113	8.849 558	355.0000	10028.75	163	6.134 969	512.0796	20867.24
114	8.771 930	358.1416	10207.03	164	6.097 561	515.2212	21124.07
115	8.695 652	361.2832	10386.89	165	6.060 606	518.3628	21382.46
116	8.620 690	364.4247	10568.32	166	6.024 096	521.5044	21642.43
117	8.547 009	367.5663	10751.32	167	5.988 024	524.6460	21903.97
118	8.474 576	370.7079	10935.88	168	5.952 381	527.7876	22167.08
119	8.403 361	373.8495	11122.02	169	5.917 160	530.9292	22431.76
120	8.333 333	376.9911	11309.73	170	5.882 353	534.0708	22698.01
121	8.264 463	380.1327	11499.01	171	5.847 953	537.2123	22965.83
122	8.196 721	383.2743	11689.87	172	5.813 953	540.3539	23235.22
123	8.130 081	386.4159	11882.29	173	5.780 347	543.4955	23506.18
124	8.064 516	389.5575	12076.28	174	5.747 126	546.6371	23778.71
125	8.000 000	392.6991	12271.85	175	5.714 286	549.7787	24052.82
126	7.936 508	395.8407	12468.98	176	5.681 818	552.9203	24328.49
127	7.874 016	398.9823	12667.69	177	5.649 718	556.0619	24605.74
128	7.812 500	402.1239	12867.96	178	5.617 978	559.2035	24884.56
129	7.751 938	405.2655	13069.81	179	5.586 592	562.3451	25164.94
130	7.692 308	408.4070	13273.23	180	5.555 556	565.4867	25446.90
131	7.633 588	411.5486	13478.22	181	5.524 862	568.6283	25730.43
132	7.575 758	414.6902	13684.78	182	5.494 505	571.7699	26015.53
133	7.518 797	417.8318	13892.91	183	5.464 481	574.9115	26302.20
134	7.462 687	420.9734	14102.61	184	5.434 783	578.0530	26590.44
135	7.407 407	424.1150	14313.88	185	5.405 405	581.1946	26880.25
136	7.352 941	427.2566	14526.72	186	5.376 344	584.3362	27171.63
137	7.299 270	430.3982	14741.14	187	5.347 594	587.4778	27464.59
138	7.246 877	433.5398	14957.12	188	5.319 149	590.6194	27759.11
139	7.194 245	436.6814	15174.68	189	5.291 005	593.7610	28055.21
140	7.142 857	439.8230	15393.80	190	5.263 158	596.9026	28352.87
141	7.092 199	442.9646	15614.50	191	5.235 602	600.0442	28652.11
142	7.042 254	446.1062	15836.77	192	5.208 333	603.1858	28952.92
143	6.993 007	449.2477	16060.61	193	5.181 347	606.3274	29255.30
144	6.944 444	452.3893	16286.02	194	5.154 639	609.4690	29559.25
145	6.896 552	455.5309	16513.00	195	5.128 205	612.6106	29864.77
146	6.849 315	458.6725	16741.55	196	5.102 041	615.7522	30171.86
147	6.802 721	461.8141	16971.67	197	5.076 142	618.8938	30480.52
148	6.756 757	464.9557	17203.36	198	5.050 505	622.0353	30790.75
149	6.711 409	468.0973	17436.62	199	5.025 126	625.1769	31102.55
150	6.666 667	471.2389	17671.46	200	5.000 000	628.3185	31415.93

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
200	5.000 000	628.3185	31415.93	250	4.000 000	785.3982	49087.39
201	4.975 124	631.4601	31730.87	251	3.984 064	788.5398	49480.87
202	4.950 495	634.6017	32047.39	252	3.968 254	791.6813	49875.92
203	4.926 108	637.7433	32365.47	253	3.952 569	794.8229	50272.55
204	4.901 961	640.8849	32685.13	254	3.937 008	797.9645	50670.75
205	4.878 049	644.0265	33006.36	255	3.921 569	801.1061	51070.52
206	4.854 369	647.1681	33329.16	256	3.906 250	804.2477	51471.85
207	4.830 918	650.3097	33653.53	257	3.891 051	807.3893	51874.76
208	4.807 692	653.4513	33979.47	258	3.875 969	810.5309	52279.24
209	4.784 689	656.5929	34306.98	259	3.861 004	813.6725	52685.29
210	4.761 905	659.7345	34636.06	260	3.846 154	816.8141	53092.92
211	4.739 336	662.8760	34966.71	261	3.831 418	819.9557	53502.11
212	4.716 981	666.0176	35298.94	262	3.816 794	823.0973	53912.87
213	4.694 836	669.1592	35632.73	263	3.802 281	826.2389	54325.21
214	4.672 897	672.3008	35968.09	264	3.787 879	829.3805	54739.11
215	4.651 163	675.4424	36305.03	265	3.773 585	832.5221	55154.59
216	4.629 630	678.5840	36643.54	266	3.759 398	835.6636	55571.63
217	4.608 295	681.7256	36983.61	267	3.745 318	838.8052	55990.25
218	4.587 156	684.8672	37325.26	268	3.731 343	841.9468	56416.44
219	4.566 210	688.0088	37668.48	269	3.717 472	845.0884	56832.20
220	4.545 455	691.1504	38013.27	270	3.703 704	848.2300	57255.53
221	4.524 887	694.2920	38359.63	271	3.690 037	851.3716	57680.43
222	4.504 505	697.4336	38707.56	272	3.676 471	854.5132	58106.90
223	4.484 305	700.5752	39057.07	273	3.663 004	857.6548	58534.94
224	4.464 286	703.7168	39408.14	274	3.649 635	860.7964	58964.55
225	4.444 444	706.8583	39760.78	275	3.636 364	863.9380	59395.74
226	4.424 779	709.9999	40115.00	276	3.623 188	867.0796	59828.49
227	4.405 286	713.1415	40470.78	277	3.610 108	870.2212	60262.82
228	4.385 965	716.2831	40828.14	278	3.597 122	873.3628	60698.71
229	4.366 812	719.4247	41187.07	279	3.584 229	876.5044	61136.18
230	4.347 826	722.5663	41547.56	280	3.571 429	879.6459	61575.22
231	4.329 004	725.7079	41909.63	281	3.558 719	882.7875	62015.82
232	4.310 345	728.8495	42273.27	282	3.546 099	885.9291	62458.00
233	4.291 845	731.9911	42638.48	283	3.533 569	889.0707	62901.75
234	4.273 504	735.1327	43005.26	284	3.521 127	892.2123	63347.07
235	4.255 319	738.2743	43373.61	285	3.508 772	895.3539	63793.97
236	4.237 288	741.4159	43743.54	286	3.496 503	898.4955	64242.43
237	4.219 409	744.5575	44115.03	287	3.484 321	901.6371	64692.46
238	4.201 681	747.6991	44488.09	288	3.472 222	904.7787	65144.07
239	4.184 100	750.8406	44862.73	289	3.460 208	907.9203	65597.24
240	4.166 667	753.9822	45238.93	290	3.448 276	911.0619	66051.99
241	4.149 378	757.1238	45616.71	291	3.436 426	914.2035	66508.30
242	4.132 231	760.2654	45996.06	292	3.424 658	917.3451	66966.19
243	4.115 226	763.4070	46376.98	293	3.412 969	920.4866	67425.65
244	4.098 361	766.5486	46759.47	294	3.401 361	923.6282	67886.68
245	4.081 633	769.6902	47143.52	295	3.389 831	926.7698	68349.28
246	4.065 041	772.8318	47529.16	296	3.378 378	929.9114	68813.45
247	4.048 583	775.9734	47916.36	297	3.367 003	933.0530	69279.19
248	4.032 258	779.1150	48305.13	298	3.355 705	936.1946	69746.50
249	4.016 064	782.2566	48695.47	299	3.344 482	939.3362	70215.38
250	4.000 000	785.3982	49087.39	300	3.333 333	942.4778	70685.83

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
300	3.333 333	942.4778	70685.83	350	2.857 143	1099.557	96211.28
301	3.322 259	945.6194	71157.86	351	2.849 003	1102.699	96761.84
302	3.311 258	948.7610	71631.45	352	2.840 909	1105.841	97313.97
303	3.300 330	951.9026	72106.62	353	2.832 861	1108.982	97867.68
304	3.289 474	955.0442	72583.36	354	2.824 859	1112.124	98422.96
305	3.278 689	958.1858	73061.66	355	2.816 901	1115.265	98979.80
306	3.267 974	961.3274	73541.54	356	2.808 989	1118.407	99538.22
307	3.257 329	964.4689	74022.99	357	2.801 120	1121.549	100 098.2
308	3.246 753	967.6105	74506.01	358	2.793 296	1124.690	100 659.8
309	3.236 246	970.7521	74990.60	359	2.785 515	1127.832	101 222.9
310	3.225 806	973.8937	75476.76	360	2.777 778	1130.973	101 787.6
311	3.215 434	977.0353	75964.50	361	2.770 083	1134.115	102 353.9
312	3.205 128	980.1769	76453.80	362	2.762 431	1137.257	102 921.7
313	3.194 888	983.3185	76944.67	363	2.754 821	1140.398	103 491.1
314	3.184 713	986.4601	77437.12	364	2.747 253	1143.540	104 062.1
315	3.174 603	989.6017	77931.13	365	2.739 726	1146.681	104 634.7
316	3.164 557	992.7433	78426.72	366	2.732 240	1149.823	105 208.8
317	3.154 574	995.8849	78923.88	367	2.724 796	1152.965	105 784.5
318	3.144 654	999.0265	79422.60	368	2.717 391	1156.106	106 361.8
319	3.134 796	1002.168	79922.90	369	2.710 027	1159.248	106 940.6
320	3.125 000	1005.310	80424.77	370	2.702 703	1162.389	107 521.0
321	3.115 265	1008.451	80928.21	371	2.695 418	1165.531	108 103.0
322	3.105 590	1011.593	81433.22	372	2.688 172	1168.672	108 686.5
323	3.095 975	1014.734	81939.80	373	2.680 965	1171.814	109 271.7
324	3.086 420	1017.876	82447.96	374	2.673 797	1174.956	109 858.4
325	3.076 923	1021.018	82957.68	375	2.666 667	1178.097	110 446.6
326	3.067 485	1024.159	83468.98	376	2.659 574	1181.239	111 036.5
327	3.058 104	1027.301	83981.84	377	2.652 520	1184.380	111 627.9
328	3.048 780	1030.442	84496.28	378	2.645 503	1187.522	112 220.8
329	3.039 514	1033.584	85012.28	379	2.638 522	1190.664	112 815.4
330	3.030 303	1036.726	85529.86	380	2.631 579	1193.805	113 411.5
331	3.021 148	1039.867	86049.01	381	2.624 672	1196.947	114 009.2
332	3.012 048	1043.009	86569.73	382	2.617 801	1200.088	114 608.4
333	3.003 003	1046.150	87092.02	383	2.610 966	1203.230	115 209.3
334	2.994 012	1049.292	87615.88	384	2.604 167	1206.372	115 811.7
335	2.985 075	1052.434	88141.31	385	2.597 403	1209.513	116 415.6
336	2.976 190	1055.575	88668.31	386	2.590 674	1212.655	117 021.2
337	2.967 359	1058.717	89196.88	387	2.583 979	1215.796	117 628.3
338	2.958 580	1061.858	89727.03	388	2.577 320	1218.938	118 237.0
339	2.949 853	1065.000	90258.74	389	2.570 694	1222.080	118 847.2
340	2.941 176	1068.142	90792.03	390	2.564 103	1225.221	119 459.1
341	2.932 551	1071.283	91326.88	391	2.557 545	1228.363	120 072.5
342	2.923 977	1074.425	91863.31	392	2.551 020	1231.504	120 687.4
343	2.915 452	1077.566	92401.31	393	2.544 529	1234.646	121 304.0
344	2.906 977	1080.708	92940.88	394	2.538 071	1237.788	121 922.1
345	2.898 551	1083.849	93482.02	395	2.531 646	1240.929	122 541.7
346	2.890 173	1086.991	94024.73	396	2.525 253	1244.071	123 163.0
347	2.881 844	1090.133	94569.01	397	2.518 892	1247.212	123 785.8
348	2.873 563	1093.274	95114.86	398	2.512 563	1250.354	124 410.2
349	2.865 330	1096.416	95662.28	399	2.506 266	1253.495	125 036.2
350	2.857 143	1099.557	96211.28	400	2.500 000	1256.637	125 663.7

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$		$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
400	2.500 000	1256.637	125 663.7	450	2.222 222	1413.717	159 043.1
401	2.493 766	1259.779	126 292.8	451	2.217 295	1416.858	159 750.8
402	2.487 562	1262.920	126 923.5	452	2.212 389	1420.000	160 460.0
403	2.481 390	1266.062	127 555.7	453	2.207 506	1423.141	161 170.8
404	2.475 248	1269.203	128 189.5	454	2.202 643	1426.283	161 883.1
405	2.469 136	1272.345	128 824.9	455	2.197 802	1429.425	162 597.1
406	2.463 054	1275.487	129 461.9	456	2.192 982	1432.566	163 312.6
407	2.457 002	1278.628	130 100.4	457	2.188 184	1435.708	164 029.6
408	2.450 980	1281.770	130 740.5	458	2.183 406	1438.849	164 748.3
409	2.444 988	1284.911	131 382.2	459	2.178 649	1441.991	165 468.5
410	2.439 024	1288.053	132 025.4	460	2.173 913	1445.133	166 190.3
411	2.433 090	1291.195	132 670.2	461	2.169 197	1448.274	166 913.6
412	2.427 184	1294.336	133 316.6	462	2.164 502	1451.416	167 638.5
413	2.421 308	1297.478	133 964.6	463	2.159 827	1454.557	168 365.0
414	2.415 459	1300.619	134 614.1	464	2.155 172	1457.699	169 093.1
415	2.409 639	1303.761	135 265.2	465	2.150 538	1460.841	169 822.7
416	2.403 846	1306.903	135 917.9	466	2.145 923	1463.982	170 553.9
417	2.398 082	1310.044	136 572.1	467	2.141 328	1467.124	171 286.7
418	2.392 344	1313.186	137 227.9	468	2.136 752	1470.265	172 021.0
419	2.386 635	1316.327	137 885.3	469	2.132 196	1473.407	172 757.0
420	2.380 952	1319.469	138 544.2	470	2.127 660	1476.549	173 494.5
421	2.375 297	1322.611	139 204.8	471	2.123 142	1479.690	174 233.5
422	2.369 668	1325.752	139 866.8	472	2.118 644	1482.832	174 974.1
423	2.364 066	1328.894	140 530.5	473	2.114 165	1485.973	175 716.3
424	2.358 491	1332.035	141 195.7	474	2.109 705	1489.115	176 460.1
425	2.352 941	1335.177	141 862.5	475	2.105 263	1492.257	177 205.5
426	2.347 418	1338.318	142 530.9	476	2.100 840	1495.398	177 952.4
427	2.341 920	1341.460	143 200.9	477	2.096 436	1498.540	178 700.9
428	2.336 449	1344.602	143 872.4	478	2.092 050	1501.681	179 450.9
429	2.331 002	1347.743	144 545.5	479	2.087 683	1504.823	180 202.5
430	2.325 581	1350.885	145 220.1	480	2.083 333	1507.964	180 955.7
431	2.320 186	1354.026	145 896.3	481	2.079 002	1511.106	181 710.5
432	2.314 815	1357.168	146 574.1	482	2.074 689	1514.248	182 466.8
433	2.309 469	1360.310	147 253.5	483	2.070 393	1517.389	183 224.8
434	2.304 147	1363.451	147 934.5	484	2.066 116	1520.531	183 984.2
435	2.298 851	1366.593	148 617.0	485	2.061 856	1523.672	184 745.3
436	2.293 578	1369.734	149 301.0	486	2.057 613	1526.814	185 507.9
437	2.288 330	1372.876	149 986.7	487	2.053 388	1529.956	186 272.1
438	2.283 105	1376.018	150 673.9	488	2.049 180	1533.097	187 037.9
439	2.277 904	1379.159	151 362.7	489	2.044 990	1536.239	187 805.2
440	2.272 727	1382.301	152 053.1	490	2.040 816	1539.380	188 574.1
441	2.267 574	1385.442	152 745.0	491	2.036 660	1542.522	189 344.6
442	2.262 443	1388.584	153 438.5	492	2.032 520	1545.664	190 116.6
443	2.257 336	1391.726	154 133.6	493	2.028 398	1548.805	190 890.2
444	2.252 252	1394.867	154 830.3	494	2.024 291	1551.947	191 665.4
445	2.247 191	1398.009	155 528.5	495	2.020 202	1555.088	192 442.2
446	2.242 152	1401.150	156 228.3	496	2.016 129	1558.230	193 220.5
447	2.237 136	1404.292	156 929.6	497	2.012 072	1561.372	194 000.4
448	2.232 143	1407.434	157 632.6	498	2.008 032	1564.513	194 781.9
449	2.227 171	1410.575	158 337.1	499	2.004 008	1567.655	195 564.9
450	2.222 222	1413.717	159 043.1	500	2.000 000	1570.796	196 349.5

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
500	2.000 000	1570.796	196 349.5	550	1.818 182	1727.876	237 582.9
501	1.996 008	1573.938	197 135.7	551	1.814 882	1731.018	238 447.7
502	1.992 032	1577.080	197 923.5	552	1.811 594	1734.159	239 314.0
503	1.988 072	1580.221	198 712.8	553	1.808 318	1737.301	240 181.8
504	1.984 127	1583.363	199 503.7	554	1.805 054	1740.442	241 051.3
505	1.980 198	1586.504	200 296.2	555	1.801 802	1743.584	241 922.3
506	1.976 285	1589.646	201 090.2	556	1.798 561	1746.726	242 794.8
507	1.972 387	1592.787	201 885.8	557	1.795 332	1749.867	243 669.0
508	1.968 504	1595.929	202 683.0	558	1.792 115	1753.009	244 544.7
509	1.964 637	1599.071	203 481.7	559	1.788 909	1756.150	245 422.0
510	1.960 784	1602.212	204 282.1	560	1.785 714	1759.292	246 300.9
511	1.956 947	1605.354	205 084.0	561	1.782 531	1762.433	247 181.3
512	1.953 125	1608.495	205 887.4	562	1.779 359	1765.575	248 063.3
513	1.949 318	1611.637	206 692.4	563	1.776 199	1768.717	248 946.9
514	1.945 525	1614.779	207 499.1	564	1.773 050	1771.858	249 832.0
515	1.941 748	1617.920	208 307.2	565	1.769 912	1775.000	250 718.7
516	1.937 984	1621.062	209 117.0	566	1.766 784	1778.141	251 607.0
517	1.934 236	1624.203	209 928.3	567	1.763 668	1781.283	252 496.9
518	1.930 502	1627.345	210 741.2	568	1.760 563	1784.425	253 388.3
519	1.926 782	1630.487	211 555.6	569	1.757 469	1787.566	254 281.3
520	1.923 077	1633.628	212 371.7	570	1.754 386	1790.708	255 175.9
521	1.919 386	1636.770	213 189.3	571	1.751 313	1793.849	256 072.0
522	1.915 709	1639.911	214 008.4	572	1.748 252	1796.991	256 969.7
523	1.912 046	1643.053	214 829.2	573	1.745 201	1800.133	257 869.0
524	1.908 397	1646.195	215 651.5	574	1.742 160	1803.274	258 769.8
525	1.904 762	1649.336	216 475.4	575	1.739 130	1806.416	259 672.3
526	1.901 141	1652.478	217 300.8	576	1.736 111	1809.557	260 576.3
527	1.897 533	1655.619	218 127.8	577	1.733 102	1812.699	261 481.8
528	1.893 939	1658.761	218 956.4	578	1.730 104	1815.841	262 389.0
529	1.890 359	1661.903	219 786.6	579	1.727 116	1818.982	263 297.7
530	1.886 792	1665.044	220 618.3	580	1.724 138	1822.124	264 207.9
531	1.883 239	1668.186	221 451.7	581	1.721 170	1825.265	265 119.8
532	1.879 699	1671.327	222 286.5	582	1.718 213	1828.407	266 033.2
533	1.876 173	1674.469	223 123.0	583	1.715 266	1831.549	266 948.2
534	1.872 659	1677.610	223 961.0	584	1.712 329	1834.690	267 864.8
535	1.869 159	1680.752	224 800.6	585	1.709 402	1837.832	268 782.9
536	1.865 672	1683.894	225 641.8	586	1.706 485	1840.973	269 702.6
537	1.862 197	1687.035	226 484.6	587	1.703 578	1844.115	270 623.9
538	1.858 736	1690.177	227 328.8	588	1.700 680	1847.256	271 546.7
539	1.855 288	1693.318	228 174.7	589	1.697 793	1850.398	272 471.1
540	1.851 852	1696.460	229 022.1	590	1.694 915	1853.540	273 397.1
541	1.848 429	1699.602	229 871.1	591	1.692 047	1856.681	274 324.7
542	1.845 018	1702.743	230 721.7	592	1.689 189	1859.823	275 253.8
543	1.841 621	1705.885	231 573.9	593	1.686 341	1862.964	276 184.5
544	1.838 235	1709.026	232 427.6	594	1.683 502	1866.106	277 116.7
545	1.834 862	1712.168	233 282.9	595	1.680 672	1869.248	278 050.6
546	1.831 502	1715.310	234 139.8	596	1.677 852	1872.389	278 986.0
547	1.828 154	1718.451	234 998.2	597	1.675 042	1875.531	279 923.0
548	1.824 818	1721.593	235 858.2	598	1.672 241	1878.672	280 861.5
549	1.821 494	1724.734	236 719.8	599	1.669 449	1881.814	281 801.6
550	1.818 182	1727.876	237 582.9	600	1.666 667	1884.956	282 743.3

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
600	1.666 667	1884.956	282 743.3	650	1.538 462	2042.035	331 830.7
601	1.663 894	1888.097	283 686.6	651	1.536 098	2045.177	332 852.5
602	1.661 130	1891.239	284 631.4	652	1.533 742	2048.318	333 875.9
603	1.658 375	1894.380	285 577.8	653	1.531 394	2051.460	334 900.8
604	1.655 629	1897.522	286 525.8	654	1.529 052	2054.602	335 927.4
605	1.652 893	1900.664	287 475.4	655	1.526 718	2057.743	336 955.4
606	1.650 165	1903.805	288 426.5	656	1.524 390	2060.885	337 985.1
607	1.647 446	1906.947	289 379.2	657	1.522 070	2064.026	339 016.3
608	1.644 737	1910.088	290 333.4	658	1.519 757	2067.168	340 049.1
609	1.642 036	1913.230	291 289.3	659	1.517 451	2070.310	341 083.5
610	1.639 344	1916.372	292 246.7	660	1.515 152	2073.451	342 119.4
611	1.636 661	1919.513	293 205.6	661	1.512 859	2076.593	343 157.0
612	1.633 987	1922.655	294 166.2	662	1.510 574	2079.734	344 196.0
613	1.631 321	1925.796	295 128.3	663	1.508 296	2082.876	345 236.7
614	1.628 664	1928.938	296 092.0	664	1.506 024	2086.018	346 278.9
615	1.626 016	1932.079	297 057.2	665	1.503 759	2089.159	347 322.7
616	1.623 377	1935.221	298 024.0	666	1.501 502	2092.301	348 368.1
617	1.620 746	1938.363	298 992.4	667	1.499 250	2095.442	349 415.0
618	1.618 123	1941.504	299 962.4	668	1.497 006	2098.584	350 463.5
619	1.615 509	1944.646	300 933.9	669	1.494 768	2101.725	351 513.6
620	1.612 903	1947.787	301 907.1	670	1.492 537	2104.867	352 565.2
621	1.610 306	1950.929	302 881.7	671	1.490 313	2108.009	353 618.5
622	1.607 717	1954.071	303 858.0	672	1.488 095	2111.150	354 673.2
623	1.605 136	1957.212	304 835.8	673	1.485 884	2114.292	355 729.6
624	1.602 564	1960.354	305 815.2	674	1.483 680	2117.433	356 787.5
625	1.600 000	1963.495	306 796.2	675	1.481 481	2120.575	357 847.0
626	1.597 444	1966.637	307 778.7	676	1.479 290	2123.717	358 908.1
627	1.594 896	1969.779	308 762.8	677	1.477 105	2126.858	359 970.8
628	1.592 357	1972.920	309 748.5	678	1.474 926	2130.000	361 035.0
629	1.589 825	1976.062	310 735.7	679	1.472 754	2133.141	362 100.8
630	1.587 302	1979.203	311 724.5	680	1.470 588	2136.283	363 168.1
631	1.584 786	1982.345	312 714.9	681	1.468 429	2139.425	364 237.0
632	1.582 278	1985.437	313 706.9	682	1.466 276	2142.566	365 307.5
633	1.579 779	1988.628	314 700.4	683	1.464 129	2145.708	366 379.6
634	1.577 287	1991.770	315 695.5	684	1.461 988	2148.849	367 453.2
635	1.574 803	1994.911	316 692.2	685	1.459 854	2151.991	368 528.5
636	1.572 327	1998.053	317 690.4	686	1.457 726	2155.133	369 605.2
637	1.569 859	2001.195	318 690.2	687	1.455 604	2158.274	370 683.6
638	1.567 398	2004.336	319 691.6	688	1.453 488	2161.416	371 763.5
639	1.564 945	2007.478	320 694.6	689	1.451 379	2164.557	372 845.0
640	1.562 500	2010.619	321 699.1	690	1.449 275	2167.699	373 928.1
641	1.560 062	2013.761	322 705.2	691	1.447 178	2170.841	375 012.7
642	1.557 632	2016.902	323 712.8	692	1.445 087	2173.982	376 098.9
643	1.555 210	2020.044	324 722.1	693	1.443 001	2177.124	377 186.7
644	1.552 795	2023.186	325 732.9	694	1.440 922	2180.265	378 276.0
645	1.550 388	2026.327	326 745.3	695	1.438 849	2183.407	379 366.9
646	1.547 988	2029.469	327 759.2	696	1.436 782	2186.548	380 459.4
647	1.545 595	2032.610	328 774.7	697	1.434 720	2189.690	381 553.5
648	1.543 210	2035.752	329 791.8	698	1.432 665	2192.832	382 649.1
649	1.540 832	2038.894	330 810.5	699	1.430 615	2195.973	383 746.3
650	1.538 462	2042.035	331 830.7	700	1.428 571	2199.115	384 845.1

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
700	1.428 571	2199.115	384 845.1	750	1.333 333	2356.194	441 786.5
701	1.426 534	2202.256	385 945.4	751	1.331 558	2359.336	442 965.3
702	1.424 501	2205.398	387 047.4	752	1.329 787	2362.478	444 145.8
703	1.422 475	2208.540	388 150.8	753	1.328 021	2365.619	445 327.8
704	1.420 455	2211.681	389 255.9	754	1.326 260	2368.761	446 511.4
705	1.418 440	2214.823	390 362.5	755	1.324 503	2371.902	447 696.6
706	1.416 431	2217.964	391 470.7	756	1.322 751	2375.044	448 883.3
707	1.414 427	2221.106	392 580.5	757	1.321 004	2378.186	450 071.6
708	1.412 429	2224.248	393 691.8	758	1.319 261	2381.327	451 261.5
709	1.410 437	2227.389	394 804.7	759	1.317 523	2384.469	452 453.0
710	1.408 451	2230.531	395 919.2	760	1.315 789	2387.610	453 646.0
711	1.406 470	2233.672	397 035.3	761	1.314 060	2390.752	454 840.6
712	1.404 494	2236.814	398 152.9	762	1.312 336	2393.894	456 036.7
713	1.402 525	2239.956	399 272.1	763	1.310 616	2397.035	457 234.5
714	1.400 560	2243.097	400 392.8	764	1.308 901	2400.177	458 433.8
715	1.398 601	2246.239	401 515.2	765	1.307 190	2403.318	459 634.6
716	1.396 648	2249.380	402 639.1	766	1.305 483	2406.460	460 837.1
717	1.394 700	2252.522	403 764.6	767	1.303 781	2409.602	462 041.1
718	1.392 758	2255.664	404 891.6	768	1.302 083	2412.743	463 246.7
719	1.390 821	2258.805	406 020.2	769	1.300 390	2415.885	464 453.8
720	1.388 889	2261.947	407 150.4	770	1.298 701	2419.026	465 662.6
721	1.386 963	2265.088	408 282.2	771	1.297 017	2422.168	466 872.9
722	1.385 042	2268.230	409 415.5	772	1.295 337	2425.310	468 084.7
723	1.383 126	2271.371	410 550.4	773	1.293 661	2428.451	469 298.2
724	1.381 215	2274.513	411 686.9	774	1.291 990	2431.593	470 513.2
725	1.379 310	2277.655	412 824.9	775	1.290 323	2434.734	471 729.8
726	1.377 410	2280.796	413 964.5	776	1.288 660	2437.876	472 947.9
727	1.375 516	2283.938	415 105.7	777	1.287 001	2441.017	474 167.6
728	1.373 626	2287.079	416 248.5	778	1.285 347	2444.159	475 388.9
729	1.371 742	2290.221	417 392.8	779	1.283 697	2447.301	476 611.8
730	1.369 863	2293.363	418 538.7	780	1.282 051	2450.442	477 836.2
731	1.367 989	2296.504	419 686.1	781	1.280 410	2453.584	479 062.2
732	1.366 120	2299.646	420 835.2	782	1.278 772	2456.725	480 289.8
733	1.364 256	2302.787	421 985.8	783	1.277 139	2459.867	481 519.0
734	1.362 398	2305.929	423 138.0	784	1.275 510	2463.009	482 749.7
735	1.360 544	2309.071	424 291.7	785	1.273 885	2466.150	483 982.0
736	1.358 696	2312.212	425 447.0	786	1.272 265	2469.292	485 215.8
737	1.356 852	2315.354	426 603.9	787	1.270 648	2472.433	486 451.3
738	1.355 014	2318.495	427 762.4	788	1.269 036	2475.575	487 688.3
739	1.353 180	2321.637	428 922.4	789	1.267 427	2478.717	488 926.9
740	1.351 351	2324.779	430 084.0	790	1.265 823	2481.858	490 167.0
741	1.349 528	2327.920	431 247.2	791	1.264 223	2485.000	491 408.7
742	1.347 709	2331.062	432 412.0	792	1.262 626	2488.141	492 652.0
743	1.345 895	2334.203	433 578.3	793	1.261 034	2491.283	493 896.8
744	1.344 086	2337.345	434 746.2	794	1.259 446	2494.425	495 143.3
745	1.342 282	2340.487	435 915.6	795	1.257 862	2497.566	496 391.3
746	1.340 483	2343.628	437 086.6	796	1.256 281	2500.708	497 640.8
747	1.338 688	2346.770	438 259.2	797	1.254 705	2503.849	498 892.0
748	1.336 898	2349.911	439 433.4	798	1.253 133	2506.991	500 144.7
749	1.335 113	2353.053	440 609.2	799	1.251 564	2510.133	501 399.0
750	1.333 333	2356.194	441 786.5	800	1.250 000	2513.274	502 654.8

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$\frac{1}{1000-n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
800	1.250 000	2513.274	502 654.8	850	1.176 471	2670.354	567 450.2
801	1.248 439	2516.416	503 912.2	851	1.175 088	2673.495	568 786.1
802	1.246 883	2519.557	505 171.2	852	1.173 709	2676.637	570 123.7
803	1.245 330	2522.699	506 431.8	853	1.172 333	2679.779	571 462.8
804	1.243 781	2525.840	507 693.9	854	1.170 960	2682.920	572 803.4
805	1.242 236	2528.982	508 957.6	855	1.169 591	2686.062	574 145.7
806	1.240 695	2532.124	510 222.9	856	1.168 224	2689.203	575 489.5
807	1.239 157	2535.265	511 489.8	857	1.166 861	2692.345	576 834.9
808	1.237 624	2538.407	512 758.2	858	1.165 501	2695.486	578 181.9
809	1.236 094	2541.548	514 028.2	859	1.164 144	2698.628	579 530.4
810	1.234 568	2544.690	515 299.7	860	1.162 791	2701.770	580 880.5
811	1.233 046	2547.832	516 572.9	861	1.161 440	2704.911	582 232.2
812	1.231 527	2550.973	517 847.6	862	1.160 093	2708.053	583 585.4
813	1.230 012	2554.115	519 123.8	863	1.158 749	2711.194	584 940.2
814	1.228 501	2557.256	520 401.7	864	1.157 407	2714.336	586 296.6
815	1.226 994	2560.398	521 681.1	865	1.156 069	2717.478	587 654.5
816	1.225 490	2563.540	522 962.1	866	1.154 734	2720.619	589 014.1
817	1.223 990	2566.681	524 244.6	867	1.153 403	2723.761	590 375.2
818	1.222 494	2569.823	525 528.8	868	1.152 074	2726.902	591 737.8
819	1.221 001	2572.964	526 814.5	869	1.150 748	2730.044	593 102.1
820	1.219 512	2576.106	528 101.7	870	1.149 425	2733.186	594 467.9
821	1.218 027	2579.248	529 390.6	871	1.148 106	2736.327	595 835.2
822	1.216 545	2582.389	530 681.0	872	1.146 789	2739.469	597 204.2
823	1.215 067	2585.531	531 973.0	873	1.145 475	2742.610	598 574.7
824	1.213 592	2588.672	533 266.5	874	1.144 165	2745.752	599 946.8
825	1.212 121	2591.814	534 561.6	875	1.142 857	2748.894	601 320.5
826	1.210 654	2594.956	535 858.3	876	1.141 553	2752.035	602 695.7
827	1.209 190	2598.097	537 156.6	877	1.140 251	2755.177	604 072.5
828	1.207 729	2601.239	538 456.4	878	1.138 952	2758.318	605 450.9
829	1.206 273	2604.380	539 757.8	879	1.137 656	2761.460	606 830.8
830	1.204 819	2607.522	541 060.8	880	1.136 364	2764.602	608 212.1
831	1.203 369	2610.663	542 365.3	881	1.135 074	2767.743	609 595.4
832	1.201 923	2613.805	543 671.5	882	1.133 787	2770.885	610 980.1
833	1.200 480	2616.947	544 979.1	883	1.132 503	2774.026	612 366.3
834	1.199 041	2620.088	546 288.4	884	1.131 222	2777.168	613 754.1
835	1.197 605	2623.230	547 599.2	885	1.129 944	2780.309	615 143.5
836	1.196 172	2626.371	548 911.6	886	1.128 668	2783.451	616 534.4
837	1.194 743	2629.513	550 225.6	887	1.127 396	2786.593	617 926.9
838	1.193 317	2632.655	551 541.1	888	1.126 126	2789.734	619 321.0
839	1.191 895	2635.796	552 858.3	889	1.124 859	2792.876	620 716.7
840	1.190 476	2638.938	554 176.9	890	1.123 596	2796.017	622 113.9
841	1.189 061	2642.079	555 497.2	891	1.122 334	2799.159	623 512.7
842	1.187 648	2645.221	556 819.0	892	1.121 076	2802.301	624 913.0
843	1.186 240	2648.363	558 142.4	893	1.119 821	2805.442	626 315.0
844	1.184 834	2651.504	559 467.4	894	1.118 568	2808.584	627 718.5
845	1.183 432	2654.646	560 793.9	895	1.117 318	2811.725	629 123.6
846	1.182 033	2657.787	562 122.0	896	1.116 071	2814.867	630 530.2
847	1.180 638	2660.929	563 451.7	897	1.114 827	2818.009	631 938.4
848	1.179 245	2664.071	564 783.0	898	1.113 586	2821.150	633 348.2
849	1.177 856	2667.212	566 115.8	899	1.112 347	2824.292	634 759.6
850	1.176 471	2670.354	567 450.2	900	1.111 111	2827.433	636 172.5

RECIPROCAL, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$\frac{1}{1000-n}$	Circum- ference πn	Area $\frac{\pi n^2}{4}$	n	$\frac{1}{1000-n}$	Circum- ference πn	Area $\frac{\pi n^2}{4}$
900	1.111 111	2827.433	636 172.5	950	1.052 632	2984.513	708 821.8
901	1.109 878	2830.575	637 587.0	951	1.051 525	2987.655	710 314.9
902	1.108 647	2833.717	639 003.1	952	1.050 420	2990.796	711 809.5
903	1.107 420	2836.858	640 420.7	953	1.049 318	2993.938	713 305.7
904	1.106 195	2840.000	641 839.9	954	1.048 218	2997.079	714 803.4
905	1.104 972	2843.141	643 260.7	955	1.047 120	3000.221	716 302.8
906	1.103 753	2846.283	644 683.1	956	1.046 025	3003.363	717 803.7
907	1.102 536	2849.425	646 107.0	957	1.044 932	3006.504	719 306.1
908	1.101 322	2852.566	647 532.5	958	1.043 841	3009.646	720 810.2
909	1.100 110	2855.708	648 959.6	959	1.042 753	3012.787	722 315.8
910	1.098 901	2858.849	650 388.2	960	1.041 667	3015.929	723 822.9
911	1.097 695	2861.991	651 818.4	961	1.040 583	3019.071	725 331.7
912	1.096 491	2865.133	653 250.2	962	1.039 501	3022.212	726 842.0
913	1.095 290	2868.274	654 683.6	963	1.038 422	3025.354	728 353.9
914	1.094 092	2871.416	656 118.5	964	1.037 344	3028.495	729 867.4
915	1.092 896	2874.557	657 555.0	965	1.036 269	3031.637	731 382.4
916	1.091 703	2877.699	658 993.0	966	1.035 197	3034.779	732 899.0
917	1.090 513	2880.840	660 432.7	967	1.034 126	3037.920	734 417.2
918	1.089 325	2883.982	661 873.9	968	1.033 058	3041.062	735 936.9
919	1.088 139	2887.124	663 316.7	969	1.031 992	3044.203	737 458.2
920	1.086 957	2890.265	664 761.0	970	1.030 928	3047.345	738 981.1
921	1.085 776	2893.407	666 206.9	971	1.029 866	3050.486	740 505.6
922	1.084 599	2896.548	667 654.4	972	1.028 807	3053.628	742 031.6
923	1.083 424	2899.690	669 103.5	973	1.027 749	3056.770	743 559.2
924	1.082 251	2902.832	670 554.1	974	1.026 694	3059.911	745 088.4
925	1.081 081	2905.973	672 006.3	975	1.025 641	3063.053	746 619.1
926	1.079 914	2909.115	673 460.1	976	1.024 590	3066.194	748 151.4
927	1.078 749	2912.256	674 915.4	977	1.023 541	3069.336	749 685.3
928	1.077 586	2915.398	676 372.3	978	1.022 495	3072.478	751 220.8
929	1.076 426	2918.540	677 830.8	979	1.021 450	3075.619	752 757.8
930	1.075 269	2921.681	679 290.9	980	1.020 408	3078.761	754 296.4
931	1.074 114	2924.823	680 752.5	981	1.019 368	3081.902	755 836.6
932	1.072 961	2927.964	682 215.7	982	1.018 330	3085.044	757 378.3
933	1.071 811	2931.106	683 680.5	983	1.017 294	3088.186	758 921.6
934	1.070 664	2934.248	685 146.8	984	1.016 260	3091.327	760 466.5
935	1.069 519	2937.389	686 614.7	985	1.015 228	3094.469	762 012.9
936	1.068 376	2940.531	688 084.2	986	1.014 199	3097.610	763 561.0
937	1.067 236	2943.672	689 555.2	987	1.013 171	3100.752	765 110.5
938	1.066 098	2946.814	691 027.9	988	1.012 146	3103.894	766 661.7
939	1.064 963	2949.956	692 502.1	989	1.011 122	3107.035	768 214.4
940	1.063 830	2953.097	693 977.8	990	1.010 101	3110.177	769 768.7
941	1.062 699	2956.239	695 455.2	991	1.009 082	3113.318	771 324.6
942	1.061 571	2959.380	696 934.1	992	1.008 065	3116.460	772 882.1
943	1.060 445	2962.522	698 414.5	993	1.007 049	3119.602	774 441.1
944	1.059 322	2965.663	699 896.6	994	1.006 036	3122.743	776 001.7
945	1.058 201	2968.805	701 380.2	995	1.005 025	3125.885	777 563.8
946	1.057 082	2971.947	702 865.4	996	1.004 016	3129.026	779 127.5
947	1.055 966	2975.088	704 352.1	997	1.003 009	3132.168	780 692.8
948	1.054 852	2978.230	705 840.5	998	1.002 004	3135.309	782 259.7
949	1.053 741	2981.371	707 330.4	999	1.001 001	3138.451	783 828.2
950	1.052 632	2984.513	708 821.8	1000	1.000 000	3141.593	785 398.2

Squares, Cubes and Roots

Roots of numbers other than those given directly may be found by the following relations:

$$\begin{aligned} \sqrt{100n} &= 10 \sqrt{n}; & \sqrt{1000n} &= 10 \sqrt{10n}; & \sqrt{\frac{1}{10}n} &= \frac{1}{10} \sqrt{10n}; & \sqrt{\frac{1}{100}n} &= \frac{1}{10} \sqrt{n}, \\ \sqrt[3]{\frac{1}{1000}n} &= \frac{1}{100} \sqrt[3]{10n}; & \sqrt[3]{1000n} &= 10 \sqrt[3]{n}; & \sqrt[3]{10,000n} &= 10 \sqrt[3]{10n}; & \sqrt[3]{100,000n} &= 10 \sqrt[3]{100n}, \\ 10 \sqrt[3]{100n}; & \sqrt[3]{\frac{1}{10}n} &= \frac{1}{10} \sqrt[3]{100n}; & \sqrt[3]{\frac{1}{100}n} &= \frac{1}{10} \sqrt[3]{10n}; & \sqrt[3]{\frac{1}{1000}n} &= \frac{1}{10} \sqrt[3]{n}. \end{aligned}$$

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
1	1	1.000 000	3.162 278	1	1.000 000	2.154 435	4.641 589
2	4	1.414 214	4.472 136	8	1.259 921	2.714 418	5.848 035
3	9	1.732 051	5.477 226	27	1.442 250	3.107 233	6.694 330
4	16	2.000 000	6.324 555	64	1.587 401	3.419 952	7.368 063
5	25	2.236 068	7.071 068	125	1.709 976	3.684 031	7.937 005
6	36	2.449 490	7.745 967	216	1.817 121	3.914 868	8.434 327
7	49	2.645 751	8.366 600	343	1.912 931	4.121 285	8.879 040
8	64	2.828 427	8.944 272	512	2.000 000	4.308 869	9.283 178
9	81	3.000 000	9.486 833	729	2.080 084	4.481 405	9.654 894
10	100	3.162 278	10.00000	1 000	2.154 435	4.641 589	10.00000
11	121	3.316 625	10.48809	1 331	2.223 980	4.791 420	10.32280
12	144	3.464 102	10.95445	1 728	2.289 428	4.932 424	10.62659
13	169	3.605 551	11.40175	2 197	2.351 335	5.065 797	10.91393
14	196	3.741 657	11.83216	2 744	2.410 142	5.192 494	11.18689
15	225	3.872 983	12.24745	3 375	2.466 212	5.313 293	11.44714
16	256	4.000 000	12.64911	4 096	2.519 842	5.428 835	11.69607
17	289	4.123 106	13.03840	4 913	2.571 282	5.539 658	11.93483
18	324	4.242 641	13.41641	5 832	2.620 741	5.646 216	12.16440
19	361	4.358 899	13.78405	6 859	2.668 402	5.748 897	12.38562
20	400	4.472 136	14.14214	8 000	2.714 418	5.848 035	12.59921
21	441	4.582 576	14.49138	9 261	2.758 924	5.943 922	12.90579
22	484	4.690 416	14.83240	10 648	2.802 039	6.036 811	13.00591
23	529	4.795 832	15.16575	12 167	2.843 867	6.126 926	13.20006
24	576	4.898 979	15.49193	13 824	2.884 499	6.214 465	13.38866
25	625	5.000 000	15.81139	15 625	2.924 018	6.299 605	13.57209
26	676	5.099 020	16.12452	17 576	2.962 496	6.382 504	13.75069
27	729	5.196 152	16.43168	19 683	3.000 000	6.463 304	13.92477
28	784	5.291 503	16.73320	21 952	3.036 589	6.542 133	14.09460
29	841	5.385 165	17.02939	24 389	3.072 317	6.619 106	14.26043
30	900	5.477 226	17.32051	27 000	3.107 233	6.694 330	14.42250
31	961	5.567 764	17.60682	29 791	3.141 381	6.767 899	14.58100
32	1 024	5.656 854	17.88854	32 768	3.174 802	6.839 904	14.73613
33	1 089	5.744 563	18.16590	35 937	3.207 534	6.910 423	14.88806
34	1 156	5.830 952	18.43909	39 304	3.239 612	6.979 532	15.03695
35	1 225	5.916 080	18.70829	42 875	3.271 066	7.047 299	15.18294
36	1 296	6.000 000	18.97367	46 656	3.301 927	7.113 787	15.32619
37	1 369	6.082 763	19.23538	50 653	3.332 222	7.179 054	15.46680
38	1 444	6.164 414	19.49359	54 872	3.361 975	7.243 156	15.60491
39	1 521	6.244 998	19.74842	59 319	3.391 211	7.306 144	15.74061
40	1 600	6.324 555	20.00000	64 000	3.419 952	7.368 063	15.87401
41	1 681	6.403 124	20.24846	68 921	3.448 217	7.428 959	16.00521
42	1 764	6.480 741	20.49390	74 088	3.476 027	7.488 872	16.13429
43	1 849	6.557 439	20.73644	79 507	3.503 398	7.547 842	16.26133
44	1 936	6.633 250	20.97618	85 184	3.530 348	7.605 905	16.38643
45	2 025	6.708 204	21.21320	91 125	3.556 893	7.663 094	16.50964
46	2 116	6.782 330	21.44761	97 336	3.583 048	7.719 443	16.63103
47	2 209	6.855 655	21.67948	103 823	3.608 826	7.774 980	16.75069
48	2 304	6.928 203	21.90890	110 592	3.634 241	7.829 735	16.86885
49	2 401	7.000 000	22.13594	117 649	3.659 306	7.883 735	16.98499
50	2 500	7.071 068	22.36068	125 000	3.684 031	7.937 005	17.09976

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
50	2 500	7.071 068	22.36068	125 000	3.684 031	7.937 005	17.09976
51	2 601	7.141 428	22.58318	132 651	3.708 430	7.989 570	17.21301
52	2 704	7.211 103	22.80351	140 608	3.732 511	8.041 452	17.32478
53	2 809	7.280 110	23.02173	148 877	3.756 286	8.092 672	17.43513
54	2 916	7.348 469	23.23790	157 464	3.779 763	8.143 253	17.54411
55	3 025	7.416 198	23.45208	166 375	3.802 952	8.193 213	17.65174
56	3 136	7.483 315	23.66432	175 616	3.825 862	8.242 571	17.75808
57	3 249	7.549 834	23.87467	185 193	3.848 501	8.291 344	17.86316
58	3 364	7.615 773	24.08319	195 112	3.870 877	8.339 551	17.96702
59	3 481	7.681 146	24.28992	205 379	3.892 996	8.387 207	18.06969
60	3 600	7.745 967	24.49490	216 000	3.914 868	8.434 327	18.17121
61	3 721	7.810 250	24.69818	226 981	3.936 497	8.480 926	18.27160
62	3 844	7.874 008	24.89980	238 328	3.957 892	8.527 019	18.37091
63	3 969	7.937 254	25.09980	250 047	3.979 057	8.572 619	18.46915
64	4 096	8.000 000	25.29822	262 144	4.000 000	8.617 739	18.56636
65	4 225	8.062 258	25.49510	274 625	4.020 726	8.662 391	18.66256
66	4 356	8.124 038	25.69047	287 496	4.041 240	8.706 588	18.75777
67	4 489	8.185 353	25.88436	300 763	4.061 548	8.750 340	18.85204
68	4 624	8.246 211	26.07681	314 432	4.081 655	8.793 659	18.94536
69	4 761	8.306 624	26.26785	328 509	4.101 566	8.836 556	19.03778
70	4 900	8.366 600	26.45751	343 000	4.121 285	8.879 040	19.12931
71	5 041	8.426 150	26.64583	357 911	4.140 818	8.921 121	19.21997
72	5 184	8.485 281	26.83282	373 248	4.160 168	8.962 809	19.30979
73	5 329	8.544 004	27.01851	389 017	4.179 339	9.004 113	19.39877
74	5 476	8.602 325	27.20294	405 224	4.198 336	9.045 042	19.48695
75	5 625	8.660 254	27.38613	421 875	4.217 163	9.085 603	19.57434
76	5 776	8.717 798	27.56810	438 976	4.235 824	9.125 805	19.66095
77	5 929	8.774 964	27.74887	456 533	4.254 321	9.165 656	19.74681
78	6 084	8.831 761	27.92848	474 552	4.272 659	9.205 164	19.83192
79	6 241	8.888 194	28.10694	493 039	4.290 840	9.244 335	19.91632
80	6 400	8.944 272	28.28427	512 000	4.308 869	9.283 178	20.00000
81	6 561	9.000 000	28.46050	531 441	4.326 749	9.321 698	20.08299
82	6 724	9.055 385	28.63564	551 368	4.344 481	9.359 902	20.16530
83	6 889	9.110 434	28.80972	571 787	4.362 071	9.397 796	20.24694
84	7 056	9.165 151	28.98275	592 704	4.379 519	9.435 388	20.32793
85	7 225	9.219 544	29.15476	614 125	4.396 830	9.472 682	20.40828
86	7 396	9.273 618	29.32576	636 056	4.414 005	9.509 685	20.48800
87	7 569	9.327 379	29.49576	658 503	4.431 048	9.546 403	20.56710
88	7 744	9.380 832	29.66479	681 472	4.447 960	9.582 840	20.64560
89	7 921	9.433 981	29.83287	704 969	4.464 745	9.619 002	20.72351
90	8 100	9.486 833	30.00000	729 000	4.481 405	9.654 894	20.80084
91	8 281	9.539 392	30.16621	753 571	4.497 941	9.690 521	20.87759
92	8 464	9.591 663	30.33150	778 688	4.514 357	9.725 888	20.95370
93	8 649	9.643 651	30.49590	804 357	4.530 655	9.761 000	21.02944
94	8 836	9.695 360	30.65942	830 584	4.546 836	9.795 861	21.10454
95	9 025	9.746 794	30.82207	857 375	4.562 903	9.830 476	21.17912
96	9 216	9.797 959	30.98387	884 736	4.578 857	9.864 848	21.25317
97	9 409	9.848 858	31.14482	912 673	4.594 701	9.898 983	21.32671
98	9 604	9.899 495	31.30495	941 192	4.610 436	9.932 884	21.39975
99	9 801	9.949 874	31.46427	970 299	4.626 065	9.966 555	21.47229
100	10 000	10.00000	31.62278	1 000 000	4.641 589	10.00000	21.54435

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
100	10 000	10.00000	31.62278	1 000 000	4.641 589	10.00000	21.54435
101	10 201	10.04988	31.78050	1 030 301	4.657 010	10.03322	21.61592
102	10 404	10.09950	31.93744	1 061 208	4.672 329	10.06623	21.68703
103	10 609	10.14889	32.09361	1 092 727	4.687 548	10.09902	21.75767
104	10 816	10.19804	32.24903	1 124 864	4.702 669	10.13159	21.82786
105	11 025	10.24695	32.40370	1 157 625	4.717 694	10.16396	21.89760
106	11 236	10.29563	32.55764	1 191 016	4.732 623	10.19613	21.96689
107	11 449	10.34408	32.71085	1 225 043	4.747 459	10.22800	22.03575
108	11 664	10.39230	32.86335	1 259 712	4.762 203	10.25986	22.10419
109	11 881	10.44031	33.01515	1 295 029	4.776 856	10.29142	22.17220
110	12 100	10.48809	33.16625	1 331 000	4.791 420	10.32280	22.23980
111	12 321	10.53565	33.31666	1 367 631	4.805 896	10.35399	22.30699
112	12 544	10.58301	33.46640	1 404 928	4.820 285	10.38499	22.37378
113	12 769	10.63015	33.61547	1 442 897	4.834 588	10.41580	22.44017
114	12 996	10.67708	33.76389	1 481 544	4.848 808	10.44644	22.50617
115	13 225	10.72381	33.91165	1 520 875	4.862 944	10.47690	22.57179
116	13 456	10.77033	34.05877	1 560 896	4.876 999	10.50718	22.63702
117	13 689	10.81665	34.20526	1 601 613	4.890 973	10.53728	22.70189
118	13 924	10.86278	34.35113	1 643 032	4.904 868	10.56722	22.76638
119	14 161	10.90871	34.49638	1 685 159	4.918 685	10.59699	22.83051
120	14 400	10.95445	34.64102	1 728 000	4.932 424	10.62659	22.89428
121	14 641	11.00000	34.78505	1 771 561	4.946 087	10.65602	22.95770
122	14 884	11.04536	34.92850	1 815 848	4.959 676	10.68530	23.02078
123	15 129	11.09054	35.07136	1 860 867	4.973 190	10.71441	23.08350
124	15 376	11.13553	35.21363	1 906 624	4.986 631	10.74337	23.14589
125	15 625	11.18034	35.35534	1 953 125	5.000 000	10.77217	23.20794
126	15 876	11.22497	35.49648	2 000 376	5.013 298	10.80082	23.26967
127	16 129	11.26943	35.63706	2 048 383	5.026 526	10.82932	23.33107
128	16 384	11.31371	35.77709	2 097 152	5.039 684	10.85767	23.39214
129	16 641	11.35782	35.91657	2 146 689	5.052 774	10.88587	23.45290
130	16 900	11.40175	36.05551	2 197 000	5.065 797	10.91393	23.51335
131	17 161	11.44552	36.19392	2 248 091	5.078 753	10.94184	23.57348
132	17 424	11.48913	36.33180	2 299 968	5.091 643	10.96961	23.63332
133	17 689	11.53256	36.46917	2 352 637	5.104 469	10.99724	23.69285
134	17 956	11.57584	36.60601	2 406 104	5.117 230	11.02474	23.75208
135	18 225	11.61895	36.74235	2 460 375	5.129 928	11.05209	23.81102
136	18 496	11.66190	36.87818	2 515 456	5.142 563	11.07932	23.86966
137	18 769	11.70470	37.01351	2 571 353	5.155 137	11.10641	23.92803
138	19 044	11.74734	37.14835	2 628 072	5.167 649	11.13336	23.98610
139	19 321	11.78983	37.28270	2 685 619	5.180 101	11.16019	24.04390
140	19 600	11.83216	37.41657	2 744 000	5.192 494	11.18689	24.10142
141	19 881	11.87434	37.54997	2 803 221	5.204 828	11.21346	24.15867
142	20 164	11.91638	37.68289	2 863 288	5.217 103	11.23991	24.21565
143	20 449	11.95826	37.81534	2 924 207	5.229 322	11.26623	24.27236
144	20 736	12.00000	37.94733	2 985 984	5.241 483	11.29243	24.32881
145	21 025	12.04159	38.07887	3 048 625	5.253 588	11.31851	24.38499
146	21 316	12.08305	38.20995	3 112 136	5.265 637	11.34447	24.44092
147	21 609	12.12436	38.34058	3 176 523	5.277 632	11.37031	24.49660
148	21 904	12.16553	38.47077	3 241 792	5.289 572	11.39604	24.55202
149	22 201	12.20656	38.60052	3 307 949	5.301 459	11.42165	24.60719
150	22 500	12.24745	38.72983	3 375 000	5.313 293	11.44714	24.66212

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
150	22 500	12.24745	38.72983	3 375 000	5.313 293	11.44714	24.66212
151	22 801	12.28821	38.85872	3 442 951	5.325 074	11.47252	24.71680
152	23 104	12.32883	38.98718	3 511 808	5.336 803	11.49779	24.77125
153	23 409	12.36932	39.11521	3 581 577	5.348 481	11.52295	24.82545
154	23 716	12.40967	39.24283	3 652 264	5.360 108	11.54800	24.87942
155	24 025	12.44990	39.37004	3 723 875	5.371 685	11.57295	24.93315
156	24 336	12.49000	39.49684	3 796 416	5.383 213	11.59778	24.98666
157	24 649	12.52996	39.62323	3 869 893	5.394 691	11.62251	25.03994
158	24 964	12.56981	39.74921	3 944 312	5.406 120	11.64713	25.09299
159	25 281	12.60952	39.87480	4 019 679	5.417 502	11.67165	25.14581
160	25 600	12.64911	40.00000	4 096 000	5.428 835	11.69607	25.19842
161	25 921	12.68858	40.12481	4 173 281	5.440 122	11.72039	25.25081
162	26 244	12.72792	40.24922	4 251 528	5.451 362	11.74460	25.30298
163	26 569	12.76715	40.37326	4 330 747	5.462 556	11.76872	25.35494
164	26 896	12.80625	40.49691	4 410 944	5.473 704	11.79274	25.40668
165	27 225	12.84523	40.62019	4 492 125	5.484 807	11.81666	25.45822
166	27 556	12.88410	40.74310	4 574 296	5.495 865	11.84048	25.50954
167	27 889	12.92285	40.86563	4 657 463	5.506 878	11.86421	25.56067
168	28 224	12.96148	40.98780	4 741 632	5.517 848	11.88784	25.61158
169	28 561	13.00000	41.10961	4 826 809	5.528 775	11.91138	25.66230
170	28 900	13.03840	41.23106	4 913 000	5.539 658	11.93483	25.71282
171	29 241	13.07670	41.35215	5 000 211	5.550 499	11.95819	25.76313
172	29 584	13.11488	41.47288	5 088 448	5.561 298	11.98145	25.81326
173	29 929	13.15295	41.59327	5 177 717	5.572 055	12.00463	25.86319
174	30 276	13.19091	41.71331	5 268 024	5.582 770	12.02771	25.91292
175	30 625	13.22876	41.83300	5 359 375	5.593 445	12.05071	25.96247
176	30 976	13.26650	41.95235	5 451 776	5.604 079	12.07362	26.01183
177	31 329	13.30413	42.07137	5 545 233	5.614 672	12.09645	26.06100
178	31 684	13.34166	42.19005	5 639 752	5.625 226	12.11918	26.10999
179	32 041	13.37909	42.30839	5 735 339	5.635 741	12.14184	26.15879
180	32 400	13.41641	42.42641	5 832 000	5.646 216	12.16440	26.20741
181	32 761	13.45362	42.54409	5 929 741	5.656 653	12.18689	26.25586
182	33 124	13.49074	42.66146	6 028 568	5.667 051	12.20929	26.30412
183	33 489	13.52775	42.77850	6 128 487	5.677 411	12.23161	26.35221
184	33 856	13.56466	42.89522	6 229 504	5.687 734	12.25385	26.40012
185	34 225	13.60147	43.01163	6 331 625	5.698 019	12.27601	26.44786
186	34 596	13.63818	43.12772	6 434 856	5.708 267	12.29809	26.49543
187	34 969	13.67479	43.24350	6 539 203	5.718 479	12.32009	26.54283
188	35 344	13.71131	43.35897	6 644 672	5.728 654	12.34201	26.59006
189	35 721	13.74773	43.47413	6 751 269	5.738 794	12.36386	26.63712
190	36 100	13.78405	43.58899	6 859 000	5.748 897	12.38562	26.68402
191	36 481	13.82027	43.70355	6 967 871	5.758 965	12.40731	26.73075
192	36 864	13.85641	43.81780	7 077 888	5.768 998	12.42893	26.77732
193	37 249	13.89244	43.93177	7 189 057	5.778 997	12.45047	26.82373
194	37 636	13.92839	44.04543	7 301 384	5.788 960	12.47194	26.86997
195	38 025	13.96424	44.15880	7 414 875	5.798 890	12.49333	26.91606
196	38 416	14.00000	44.27189	7 529 536	5.808 786	12.51465	26.96199
197	38 809	14.03567	44.38468	7 645 373	5.818 648	12.53590	27.00777
198	39 204	14.07125	44.49719	7 762 392	5.828 477	12.55707	27.05339
199	39 601	14.10674	44.60942	7 880 599	5.838 272	12.57818	27.09886
200	40 000	14.14214	44.72136	8 000 000	5.848 035	12.59921	27.14418

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
200	40 000	14.14214	44.72136	8 000 000	5.848 035	12.59921	27.14418
201	40 401	14.17745	44.83302	8 120 601	5.857 766	12.62017	27.18934
202	40 804	14.21267	44.94441	8 242 408	5.867 464	12.64107	27.23436
203	41 209	14.24781	45.05552	8 365 427	5.877 131	12.66189	27.27922
204	41 616	14.28286	45.16636	8 489 664	5.886 765	12.68265	27.32394
205	42 025	14.31782	45.27693	8 615 125	5.896 369	12.70334	27.36852
206	42 436	14.35270	45.38722	8 741 816	5.905 941	12.72396	27.41295
207	42 849	14.38749	45.49725	8 869 743	5.915 482	12.74452	27.45723
208	43 264	14.42221	45.60702	8 998 912	5.924 992	12.76501	27.50138
209	43 681	14.45683	45.71652	9 129 329	5.934 472	12.78543	27.54538
210	44 100	14.49138	45.82576	9 261 000	5.943 922	12.80579	27.58924
211	44 521	14.52584	45.93474	9 393 931	5.953 342	12.82609	27.63296
212	44 944	14.56022	46.04346	9 528 128	5.962 732	12.84632	27.67655
213	45 369	14.59452	46.15192	9 663 597	5.972 093	12.86648	27.72000
214	45 796	14.62874	46.26013	9 800 344	5.981 424	12.88659	27.76331
215	46 225	14.66288	46.36809	9 938 375	5.990 726	12.90663	27.80649
216	46 656	14.69694	46.47580	10 077 696	6.000 000	12.92661	27.84953
217	47 089	14.73092	46.58326	10 218 313	6.009 245	12.94653	27.89244
218	47 524	14.76482	46.69047	10 360 232	6.018 462	12.96638	27.93522
219	47 961	14.79865	46.79744	10 503 459	6.027 650	12.98618	27.97787
220	48 400	14.83240	46.90416	10 648 000	6.036 811	13.00591	28.02039
221	48 841	14.86607	47.01064	10 793 861	6.045 944	13.02559	28.06278
222	49 284	14.89966	47.11688	10 941 048	6.055 049	13.04521	28.10505
223	49 729	14.93318	47.22288	11 089 567	6.064 127	13.06477	28.14718
224	50 176	14.96663	47.32864	11 239 424	6.073 178	13.08427	28.18919
225	50 625	15.00000	47.43416	11 390 625	6.082 202	13.10371	28.23108
226	51 076	15.03330	47.53946	11 543 176	6.091 199	13.12309	28.27284
227	51 529	15.06652	47.64452	11 697 083	6.100 170	13.14242	28.31448
228	51 984	15.09967	47.74935	11 852 352	6.109 115	13.16169	28.35600
229	52 441	15.13275	47.85394	12 008 989	6.118 033	13.18090	28.39739
230	52 900	15.16575	47.95832	12 167 000	6.126 926	13.20006	28.43867
231	53 361	15.19868	48.06246	12 326 391	6.135 792	13.21916	28.47983
232	53 824	15.23155	48.16638	12 487 168	6.144 634	13.23821	28.52086
233	54 289	15.26434	48.27007	12 649 337	6.153 449	13.25721	28.56178
234	54 756	15.29706	48.37355	12 812 904	6.162 240	13.27614	28.60259
235	55 225	15.32971	48.47680	12 977 875	6.171 006	13.29503	28.64327
236	55 696	15.36229	48.57983	13 144 256	6.179 747	13.31386	28.68384
237	56 169	15.39480	48.68265	13 312 053	6.188 463	13.33264	28.72430
238	56 644	15.42725	48.78524	13 481 272	6.197 154	13.35136	28.76464
239	57 121	15.45962	48.88763	13 651 919	6.205 822	13.37004	28.80487
240	57 600	15.49193	48.98979	13 824 000	6.214 465	13.38866	28.84499
241	58 081	15.52417	49.09175	13 997 521	6.223 084	13.40723	28.88500
242	58 564	15.55635	49.19350	14 172 488	6.231 680	13.42575	28.92489
243	59 049	15.58846	49.29503	14 348 907	6.240 251	13.44421	28.96468
244	59 536	15.62050	49.39636	14 526 784	6.248 800	13.46263	29.00436
245	60 025	15.65248	49.49747	14 706 125	6.257 325	13.48100	29.04393
246	60 516	15.68439	49.59839	14 886 936	6.265 827	13.49931	29.08339
247	61 009	15.71623	49.69909	15 069 223	6.274 305	13.51758	29.12275
248	61 504	15.74802	49.79960	15 252 992	6.282 761	13.53580	29.16199
249	62 001	15.77973	49.89990	15 438 249	6.291 195	13.55397	29.20114
250	62 500	15.81139	50.00000	15 625 000	6.299 605	13.57209	29.24018

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
251	63 001	15.84298	50.09990	15 813 251	6.307 994	13.59016	29.27911
252	63 504	15.87451	50.19960	16 003 008	6.316 360	13.60818	29.31794
253	64 009	15.90597	50.29911	16 194 277	6.324 704	13.62616	29.35667
254	64 516	15.93738	50.39841	16 387 064	6.333 026	13.64409	29.39530
255	65 025	15.96872	50.49752	16 581 375	6.341 326	13.66197	29.43383
256	65 536	16.00000	50.59644	16 777 216	6.349 604	13.67981	29.47225
257	66 049	16.03122	50.69517	16 974 593	6.357 861	13.69760	29.51058
258	66 564	16.06238	50.79370	17 173 512	6.366 097	13.71534	29.54880
259	67 081	16.09348	50.89204	17 373 979	6.374 311	13.73304	29.58693
260	67 600	16.12452	50.99020	17 576 000	6.382 504	13.75069	29.62496
261	68 121	16.15549	51.08816	17 779 581	6.390 677	13.76830	29.66289
262	68 644	16.18641	51.18594	17 984 728	6.398 828	13.78586	29.70073
263	69 169	16.21727	51.28353	18 191 447	6.406 959	13.80337	29.73847
264	69 696	16.24808	51.38093	18 399 744	6.415 069	13.82085	29.77611
265	70 225	16.27882	51.47815	18 609 625	6.423 158	13.83828	29.81366
266	70 756	16.30951	51.57519	18 821 096	6.431 228	13.85566	29.85111
267	71 289	16.34013	51.67204	19 034 163	6.439 277	13.87300	29.88847
268	71 824	16.37071	51.76872	19 248 832	6.447 306	13.89030	29.92574
269	72 361	16.40122	51.86521	19 465 109	6.455 315	13.90755	29.96292
270	72 900	16.43168	51.96152	19 683 000	6.463 304	13.92477	30.00000
271	73 441	16.46208	52.05766	19 902 511	6.471 274	13.94194	30.03699
272	73 984	16.49242	52.15362	20 123 648	6.479 224	13.95906	30.07389
273	74 529	16.52271	52.24940	20 346 417	6.487 154	13.97615	30.11070
274	75 076	16.55295	52.34501	20 570 824	6.495 065	13.99319	30.14742
275	75 625	16.58312	52.44044	20 796 875	6.502 957	14.01020	30.18405
276	76 176	16.61325	52.53570	21 024 576	6.510 830	14.02716	30.22060
277	76 729	16.64332	52.63079	21 253 933	6.518 684	14.04408	30.25705
278	77 284	16.67333	52.72571	21 484 952	6.526 519	14.06096	30.29342
279	77 841	16.70329	52.82045	21 717 639	6.534 335	14.07780	30.32970
280	78 400	16.73320	52.91503	21 952 000	6.542 133	14.09460	30.36589
281	78 961	16.76305	53.00943	22 188 041	6.549 912	14.11136	30.40200
282	79 524	16.79286	53.10367	22 425 768	6.557 672	14.12808	30.43802
283	80 089	16.82260	53.19774	22 665 187	6.565 414	14.14476	30.47395
284	80 656	16.85230	53.29165	22 906 304	6.573 138	14.16140	30.50981
285	81 225	16.88194	53.38539	23 149 125	6.580 844	14.17800	30.54557
286	81 796	16.91153	53.47897	23 393 656	6.588 532	14.19456	30.58126
287	82 369	16.94107	53.57238	23 639 903	6.596 202	14.21109	30.61686
288	82 944	16.97056	53.66563	23 887 872	6.603 854	14.22757	30.65238
289	83 521	17.00000	53.75872	24 137 569	6.611 489	14.24402	30.68781
290	84 100	17.02939	53.85165	24 389 000	6.619 106	14.26043	30.72317
291	84 681	17.05872	53.94442	24 642 171	6.626 705	14.27680	30.75844
292	85 264	17.08801	54.03702	24 897 088	6.634 287	14.29314	30.79363
293	85 849	17.11724	54.12947	25 153 757	6.641 852	14.30944	30.82875
294	86 436	17.14643	54.22177	25 412 184	6.649 400	14.32570	30.86378
295	87 025	17.17556	54.31390	25 672 375	6.656 930	14.34192	30.89873
296	87 616	17.20465	54.40588	25 934 336	6.664 444	14.35811	30.93361
297	88 209	17.23369	54.49771	26 198 073	6.671 940	14.37426	30.96840
298	88 804	17.26268	54.58938	26 463 592	6.679 420	14.39037	31.00312
299	89 401	17.29162	54.68089	26 730 899	6.686 883	14.40645	31.03776
300	90 000	17.32051	54.77226	27 000 000	6.694 330	14.42250	31.07233

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
300	90 000	17.32051	54.77226	27 000 000	6.694 330	14.42250	31.07233
301	90 601	17.34935	54.86347	27 270 901	6.701 759	14.43850	31.10681
302	91 204	17.37815	54.95453	27 543 608	6.709 173	14.45447	31.14122
303	91 809	17.40690	55.04544	27 818 127	6.716 570	14.47041	31.17556
304	92 416	17.43560	55.13620	28 094 464	6.723 951	14.48631	31.20982
305	93 025	17.46425	55.22681	28 372 625	6.731 315	14.50218	31.24400
306	93 636	17.49286	55.31727	28 652 616	6.738 664	14.51801	31.27811
307	94 249	17.52142	55.40758	28 934 443	6.745 997	14.53381	31.31214
308	94 864	17.54993	55.49775	29 218 112	6.753 313	14.54957	31.34610
309	95 481	17.57840	55.58777	29 503 629	6.760 614	14.56530	31.37990
310	96 100	17.60682	55.67764	29 791 000	6.767 899	14.58100	31.41381
311	96 721	17.63519	55.76737	30 080 231	6.775 169	14.59666	31.44756
312	97 344	17.66352	55.85696	30 371 328	6.782 423	14.61229	31.48122
313	97 969	17.69181	55.94640	30 664 297	6.789 661	14.62788	31.51482
314	98 596	17.72005	56.03570	30 959 144	6.796 884	14.64344	31.54834
315	99 225	17.74824	56.12486	31 255 875	6.804 092	14.65897	31.58180
316	99 856	17.77639	56.21388	31 554 496	6.811 285	14.67447	31.61518
317	100 489	17.80449	56.30275	31 855 013	6.818 462	14.68993	31.64850
318	101 124	17.83255	56.39149	32 157 432	6.825 624	14.70536	31.68174
319	101 761	17.86057	56.48008	32 461 759	6.832 771	14.72076	31.71492
320	102 400	17.88854	56.56854	32 768 000	6.839 904	14.73613	31.74802
321	103 041	17.91647	56.65686	33 076 161	6.847 021	14.75146	31.78106
322	103 684	17.94436	56.74504	33 386 248	6.854 124	14.76676	31.81403
323	104 329	17.97220	56.83309	33 698 267	6.861 212	14.78203	31.84693
324	104 976	18.00000	56.92100	34 012 224	6.868 285	14.79727	31.87976
325	105 625	18.02776	57.00877	34 328 125	6.875 344	14.81248	31.91252
326	106 276	18.05547	57.09641	34 645 976	6.882 389	14.82766	31.94522
327	106 929	18.08314	57.18391	34 965 783	6.889 419	14.84280	31.97785
328	107 584	18.11077	57.27128	35 287 552	6.896 434	14.85792	32.01041
329	108 241	18.13836	57.35852	35 611 289	6.903 436	14.87300	32.04291
330	108 900	18.16590	57.44563	35 937 000	6.910 423	14.88806	32.07534
331	109 561	18.19341	57.53260	36 264 691	6.917 396	14.90308	32.10771
332	110 224	18.22087	57.61944	36 594 368	6.924 356	14.91807	32.14001
333	110 889	18.24829	57.70615	36 926 037	6.931 301	14.93303	32.17225
334	111 556	18.27567	57.79273	37 259 704	6.938 232	14.94797	32.20442
335	112 225	18.30301	57.87918	37 595 375	6.945 150	14.96287	32.23653
336	112 896	18.33030	57.96551	37 933 056	6.952 053	14.97774	32.26857
337	113 569	18.35756	58.05170	38 272 753	6.958 943	14.99259	32.30055
338	114 244	18.38478	58.13777	38 614 472	6.965 820	15.00740	32.33247
339	114 921	18.41195	58.22371	38 958 219	6.972 683	15.02219	32.36433
340	115 600	18.43909	58.30952	39 304 000	6.979 532	15.03695	32.39612
341	116 281	18.46619	58.39521	39 651 821	6.986 368	15.05167	32.42785
342	116 964	18.49324	58.48077	40 001 688	6.993 191	15.06637	32.45952
343	117 649	18.52026	58.56620	40 353 607	7.000 000	15.08104	32.49112
344	118 336	18.54724	58.65151	40 707 584	7.006 796	15.09568	32.52267
345	119 025	18.57418	58.73670	41 063 625	7.013 579	15.11030	32.55415
346	119 716	18.60108	58.82176	41 421 736	7.020 349	15.12488	32.58557
347	120 409	18.62794	58.90671	41 781 923	7.027 106	15.13944	32.61694
348	121 104	18.65476	58.99152	42 144 192	7.033 850	15.15397	32.64824
349	121 801	18.68154	59.07622	42 508 549	7.040 581	15.16847	32.67948
350	122 500	18.70829	59.16080	42 875 000	7.047 299	15.18294	32.71066

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
350	122 500	18.70829	59.16080	42 875 000	7.047 299	15.18294	32.71066
351	123 201	18.73499	59.24525	43 243 551	7.054 004	15.19739	32.74179
352	123 904	18.76166	59.32959	43 614 208	7.060 697	15.21181	32.77285
353	124 609	18.78829	59.41380	43 986 977	7.067 377	15.22620	32.80386
354	125 316	18.81489	59.49790	44 361 864	7.074 044	15.24057	32.83480
355	126 025	18.84144	59.58188	44 738 875	7.080 699	15.25490	32.86569
356	126 736	18.86796	59.66574	45 118 016	7.087 341	15.26921	32.89652
357	127 449	18.89444	59.74948	45 499 293	7.093 971	15.28350	32.92730
358	128 164	18.92089	59.83310	45 882 712	7.100 588	15.29775	32.95801
359	128 881	18.94730	59.91661	46 268 279	7.107 194	15.31198	32.98867
360	129 600	18.97367	60.00000	46 656 000	7.113 787	15.32619	33.01927
361	130 321	19.00000	60.08328	47 045 881	7.120 367	15.34037	33.04982
362	131 044	19.02630	60.16644	47 437 928	7.126 936	15.35452	33.08031
363	131 769	19.05256	60.24948	47 832 147	7.133 492	15.36864	33.11074
364	132 496	19.07878	60.33241	48 228 544	7.140 037	15.38274	33.14112
365	133 225	19.10497	60.41523	48 627 125	7.146 569	15.39682	33.17144
366	133 956	19.13113	60.49793	49 027 896	7.153 090	15.41087	33.20170
367	134 689	19.15724	60.58052	49 430 863	7.159 599	15.42489	33.23191
368	135 424	19.18333	60.66300	49 836 032	7.166 096	15.43889	33.26207
369	136 161	19.20937	60.74537	50 243 409	7.172 581	15.45286	33.29217
370	136 900	19.23538	60.82763	50 653 000	7.179 054	15.46680	33.32222
371	137 641	19.26136	60.90977	51 064 811	7.185 516	15.48073	33.35221
372	138 384	19.28730	60.99180	51 478 848	7.191 966	15.49462	33.38215
373	139 129	19.31321	61.07373	51 895 117	7.198 405	15.50849	33.41204
374	139 876	19.33908	61.15554	52 313 624	7.204 832	15.52234	33.44187
375	140 625	19.36492	61.23724	52 734 375	7.211 248	15.53616	33.47165
376	141 376	19.39072	61.31884	53 157 376	7.217 652	15.54996	33.50137
377	142 129	19.41649	61.40033	53 582 633	7.224 045	15.56373	33.53105
378	142 884	19.44222	61.48170	54 010 152	7.230 427	15.57748	33.56067
379	143 641	19.46792	61.56298	54 439 939	7.236 797	15.59121	33.59024
380	144 400	19.49359	61.64414	54 872 000	7.243 156	15.60491	33.61975
381	145 161	19.51922	61.72520	55 306 341	7.249 505	15.61858	33.64922
382	145 924	19.54482	61.80615	55 742 968	7.255 842	15.63224	33.67863
383	146 689	19.57039	61.88699	56 181 887	7.262 167	15.64587	33.70800
384	147 456	19.59592	61.96773	56 623 104	7.268 482	15.65947	33.73731
385	148 225	19.62142	62.04837	57 066 625	7.274 786	15.67305	33.76657
386	148 996	19.64688	62.12890	57 512 456	7.281 079	15.68661	33.79578
387	149 769	19.67232	62.20932	57 960 603	7.287 362	15.70014	33.82494
388	150 544	19.69772	62.28965	58 411 072	7.293 633	15.71366	33.85405
389	151 321	19.72308	62.36986	58 863 869	7.299 894	15.72714	33.88310
390	152 100	19.74842	62.44998	59 319 000	7.306 144	15.74061	33.91211
391	152 881	19.77372	62.52999	59 776 471	7.312 383	15.75405	33.94107
392	153 664	19.79899	62.60990	60 236 288	7.318 611	15.76747	33.96999
393	154 449	19.82423	62.68971	60 698 457	7.324 829	15.78087	33.99885
394	155 236	19.84943	62.76942	61 162 984	7.331 037	15.79424	34.02766
395	156 025	19.87461	62.84903	61 629 875	7.337 234	15.80759	34.05642
396	156 816	19.89975	62.92853	62 099 136	7.343 420	15.82092	34.08514
397	157 609	19.92486	63.00794	62 570 773	7.349 597	15.83423	34.11381
398	158 404	19.94994	63.08724	63 044 792	7.355 762	15.84751	34.14242
399	159 201	19.97498	63.16645	63 521 199	7.361 918	15.86077	34.17106
400	160 000	20.00000	63.24555	64 000 000	7.368 063	15.87401	34.19952

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
400	160 000	20.00000	63.24555	64 000 000	7.368 063	15.87401	34.19952
401	160 801	20.02498	63.32456	64 481 201	7.374 198	15.88723	34.22799
402	161 604	20.04994	63.40347	64 964 808	7.380 323	15.90042	34.25642
403	162 409	20.07486	63.48228	65 450 827	7.386 437	15.91360	34.28480
404	163 216	20.09975	63.56099	65 939 264	7.392 542	15.92675	34.31314
405	164 025	20.12461	63.63961	66 430 125	7.398 636	15.93988	34.34143
406	164 836	20.14944	63.71813	66 923 416	7.404 721	15.95299	34.36967
407	165 649	20.17424	63.79655	67 419 143	7.410 795	15.96607	34.39786
408	166 464	20.19901	63.87488	67 917 312	7.416 860	15.97914	34.42601
409	167 281	20.22375	63.95311	68 417 929	7.422 914	15.99218	34.45412
410	168 100	20.24846	64.03124	68 921 000	7.428 959	16.00521	34.48217
411	168 921	20.27313	64.10928	69 426 531	7.434 994	16.01821	34.51018
412	169 744	20.29778	64.18723	69 934 528	7.441 019	16.03119	34.53815
413	170 569	20.32240	64.26508	70 444 997	7.447 034	16.04415	34.56607
414	171 396	20.34699	64.34283	70 957 944	7.453 040	16.05709	34.59395
415	172 225	20.37155	64.42049	71 473 375	7.459 036	16.07001	34.62178
416	173 056	20.39608	64.49806	71 991 296	7.465 022	16.08290	34.64956
417	173 889	20.42058	64.57554	72 511 713	7.470 999	16.09578	34.67731
418	174 724	20.44505	64.65292	73 034 632	7.476 966	16.10864	34.70500
419	175 561	20.46949	64.73021	73 560 059	7.482 924	16.12147	34.73266
420	176 400	20.49390	64.80741	74 088 000	7.488 872	16.13429	34.76027
421	177 241	20.51828	64.88451	74 618 461	7.494 811	16.14708	34.78783
422	178 084	20.54264	64.96153	75 151 448	7.500 741	16.15986	34.81538
423	178 929	20.56696	65.03845	75 686 967	7.506 661	16.17261	34.84283
424	179 776	20.59126	65.11528	76 225 024	7.512 572	16.18534	34.87027
425	180 625	20.61553	65.19202	76 765 625	7.518 473	16.19806	34.89766
426	181 476	20.63977	65.26868	77 308 776	7.524 365	16.21075	34.92501
427	182 329	20.66398	65.34524	77 854 483	7.530 248	16.22343	34.95232
428	183 184	20.68816	65.42171	78 402 752	7.536 122	16.23608	34.97958
429	184 041	20.71232	65.49809	78 953 589	7.541 987	16.24872	35.00680
430	184 900	20.73644	65.57439	79 507 000	7.547 842	16.26133	35.03398
431	185 761	20.76054	65.65059	80 062 991	7.553 689	16.27393	35.06112
432	186 624	20.78461	65.72671	80 621 568	7.559 526	16.28651	35.08821
433	187 489	20.80865	65.80274	81 182 737	7.565 355	16.29906	35.11527
434	188 356	20.83267	65.87868	81 746 504	7.571 174	16.31160	35.14228
435	189 225	20.85665	65.95453	82 312 875	7.576 985	16.32412	35.16925
436	190 096	20.88061	66.03030	82 881 856	7.582 787	16.33662	35.19618
437	190 969	20.90454	66.10598	83 453 453	7.588 579	16.34910	35.22307
438	191 844	20.92845	66.18157	84 027 672	7.594 363	16.36156	35.24991
439	192 721	20.95233	66.25708	84 604 519	7.600 139	16.37400	35.27672
440	193 600	20.97618	66.33250	85 184 000	7.605 905	16.38643	35.30348
441	194 481	21.00000	66.40783	85 766 121	7.611 663	16.39883	35.33021
442	195 364	21.02380	66.48308	86 350 888	7.617 412	16.41122	35.35689
443	196 249	21.04757	66.55825	86 938 307	7.623 152	16.42358	35.38354
444	197 136	21.07131	66.63332	87 528 384	7.628 884	16.43593	35.41014
445	198 025	21.09502	66.70832	88 121 125	7.634 607	16.44826	35.43671
446	198 916	21.11871	66.78323	88 716 536	7.640 321	16.46057	35.46323
447	199 809	21.14237	66.85806	89 314 623	7.646 027	16.47287	35.48971
448	200 704	21.16601	66.93280	89 915 392	7.651 725	16.48514	35.51616
449	201 601	21.18962	67.00746	90 518 849	7.657 414	16.49740	35.54257
450	202 500	21.21320	67.08204	91 125 000	7.663 094	16.50964	35.56893

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
450	202 500	21.21320	67.08204	91 125 000	7.663 094	16.50964	35.56893
451	203 401	21.23676	67.15653	91 733 851	7.668 766	16.52186	35.59526
452	204 304	21.26029	67.23095	92 345 408	7.674 430	16.53406	35.62155
453	205 209	21.28380	67.30527	92 959 677	7.680 086	16.54624	35.64780
454	206 116	21.30728	67.37952	93 576 664	7.685 733	16.55841	35.67401
455	207 025	21.33073	67.45369	94 196 375	7.691 372	16.57056	35.70018
456	207 936	21.35416	67.52777	94 818 816	7.697 002	16.58269	35.72632
457	208 849	21.37756	67.60178	95 443 993	7.702 625	16.59480	35.75242
458	209 764	21.40093	67.67570	96 071 912	7.708 239	16.60690	35.77848
459	210 681	21.42429	67.74954	96 702 579	7.713 845	16.61897	35.80450
460	211 600	21.44761	67.82330	97 336 000	7.719 443	16.63103	35.83048
461	212 521	21.47091	67.89698	97 972 181	7.725 032	16.64308	35.85642
462	213 444	21.49419	67.97058	98 611 128	7.730 614	16.65510	35.88233
463	214 369	21.51743	68.04410	99 252 847	7.736 188	16.66711	35.90820
464	215 296	21.54066	68.11755	99 897 344	7.741 753	16.67910	35.93404
465	216 225	21.56386	68.19091	100 544 625	7.747 311	16.69108	35.95983
466	217 156	21.58703	68.26419	101 194 696	7.752 861	16.70303	35.98559
467	218 089	21.61018	68.33740	101 847 563	7.758 402	16.71497	36.01131
468	219 024	21.63331	68.41053	102 503 232	7.763 936	16.72689	36.03700
469	219 961	21.65641	68.48357	103 161 709	7.769 462	16.73880	36.06265
470	220 900	21.67948	68.55655	103 823 000	7.774 980	16.75069	36.08826
471	221 841	21.70253	68.62944	104 487 111	7.780 490	16.76256	36.11384
472	222 784	21.72556	68.70226	105 154 048	7.785 993	16.77441	36.13938
473	223 729	21.74856	68.77500	105 823 817	7.791 488	16.78625	36.16488
474	224 676	21.77154	68.84766	106 496 424	7.796 975	16.79807	36.19035
475	225 625	21.79449	68.92024	107 171 875	7.802 454	16.80988	36.21578
476	226 576	21.81742	68.99275	107 850 176	7.807 925	16.82167	36.24118
477	227 529	21.84033	69.06519	108 531 333	7.813 389	16.83344	36.26654
478	228 484	21.86321	69.13754	109 215 352	7.818 846	16.84519	36.29187
479	229 441	21.88607	69.20983	109 902 239	7.824 294	16.85693	36.31716
480	230 400	21.90890	69.28203	110 592 000	7.829 735	16.86865	36.34241
481	231 361	21.93171	69.35416	111 284 641	7.835 169	16.88036	36.36763
482	232 324	21.95450	69.42622	111 980 168	7.840 595	16.89205	36.39282
483	233 289	21.97726	69.49820	112 678 587	7.846 013	16.90372	36.41797
484	234 256	22.00000	69.57011	113 379 904	7.851 424	16.91538	36.44308
485	235 225	22.02272	69.64194	114 084 125	7.856 828	16.92702	36.46817
486	236 196	22.04541	69.71370	114 791 256	7.862 224	16.93865	36.49321
487	237 169	22.06808	69.78539	115 501 303	7.867 613	16.95026	36.51822
488	238 144	22.09072	69.85700	116 214 272	7.872 994	16.96185	36.54320
489	239 121	22.11334	69.92853	116 930 169	7.878 368	16.97343	36.56815
490	240 100	22.13594	70.00000	117 649 000	7.883 735	16.98499	36.59306
491	241 081	22.15852	70.07139	118 370 771	7.889 095	16.99654	36.61793
492	242 064	22.18107	70.14271	119 095 488	7.894 447	17.00807	36.64278
493	243 049	22.20360	70.21396	119 823 157	7.899 792	17.01959	36.66758
494	244 036	22.22611	70.28513	120 553 784	7.905 129	17.03108	36.69236
495	245 025	22.24860	70.35624	121 287 375	7.910 460	17.04257	36.71710
496	246 016	22.27106	70.42727	122 023 936	7.915 783	17.05404	36.74181
497	247 009	22.29350	70.49823	122 763 473	7.921 099	17.06549	36.76649
498	248 004	22.31591	70.56912	123 505 992	7.926 408	17.07693	36.79113
499	249 001	22.33831	70.63993	124 251 499	7.931 710	17.08835	36.81574
500	250 000	22.36068	70.71068	125 000 000	7.937 005	17.09976	36.84031

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
500	250 000	22.36068	70.71068	125 000 000	7.937 005	17.09976	36.84031
501	251 001	22.38303	70.78135	125 751 501	7.942 293	17.11115	36.86486
502	252 004	22.40536	70.85196	126 506 008	7.947 574	17.12253	36.88937
503	253 009	22.42766	70.92249	127 263 527	7.952 848	17.13389	36.91385
504	254 016	22.44994	70.99296	128 024 064	7.958 114	17.14524	36.93830
505	255 025	22.47221	71.06335	128 787 625	7.963 374	17.15657	36.96271
506	256 036	22.49444	71.13368	129 554 216	7.968 627	17.16789	36.98709
507	257 049	22.51666	71.20393	130 323 843	7.973 873	17.17919	37.01144
508	258 064	22.53886	71.27412	131 096 512	7.979 112	17.19048	37.03576
509	259 081	22.56103	71.34424	131 872 229	7.984 344	17.20175	37.06004
510	260 100	22.58318	71.41428	132 651 000	7.989 570	17.21301	37.08430
511	261 121	22.60531	71.48426	133 432 831	7.994 788	17.22425	37.10852
512	262 144	22.62742	71.55418	134 217 728	8.000 000	17.23548	37.13271
513	263 169	22.64950	71.62402	135 005 697	8.005 205	17.24669	37.15687
514	264 196	22.67157	71.69379	135 796 744	8.010 403	17.25789	37.18100
515	265 225	22.69361	71.76350	136 590 875	8.015 595	17.26908	37.20509
516	266 256	22.71563	71.83314	137 388 096	8.020 779	17.28025	37.22916
517	267 289	22.73763	71.90271	138 188 413	8.025 957	17.29140	37.25319
518	268 324	22.75961	71.97222	138 991 832	8.031 129	17.30254	37.27720
519	269 361	22.78157	72.04165	139 798 359	8.036 293	17.31367	37.30117
520	270 400	22.80351	72.11103	140 608 000	8.041 452	17.32478	37.32511
521	271 441	22.82542	72.18033	141 420 761	8.046 603	17.33588	37.34902
522	272 484	22.84732	72.24957	142 236 648	8.051 748	17.34696	37.37290
523	273 529	22.86919	72.31874	143 055 667	8.056 886	17.35804	37.39675
524	274 576	22.89105	72.38784	143 877 824	8.062 018	17.36909	37.42057
525	275 625	22.91288	72.45688	144 703 125	8.067 143	17.38013	37.44436
526	276 676	22.93469	72.52586	145 531 576	8.072 262	17.39116	37.46812
527	277 729	22.95648	72.59477	146 363 183	8.077 374	17.40218	37.49185
528	278 784	22.97825	72.66361	147 197 952	8.082 480	17.41318	37.51555
529	279 841	23.00000	72.73239	148 035 889	8.087 579	17.42416	37.53922
530	280 900	23.02173	72.80110	148 877 000	8.092 672	17.43513	37.56286
531	281 961	23.04344	72.86975	149 721 291	8.097 759	17.44609	37.58647
532	283 024	23.06513	72.93833	150 568 768	8.102 839	17.45704	37.61005
533	284 089	23.08679	73.00685	151 419 437	8.107 913	17.46797	37.63360
534	285 156	23.10844	73.07530	152 273 304	8.112 980	17.47889	37.65712
535	286 225	23.13007	73.14369	153 130 375	8.118 041	17.48979	37.68061
536	287 296	23.15167	73.21202	153 990 656	8.123 096	17.50068	37.70407
537	288 369	23.17326	73.28028	154 854 153	8.128 145	17.51156	37.72751
538	289 444	23.19483	73.34848	155 720 872	8.133 187	17.52242	37.75091
539	290 521	23.21637	73.41662	156 590 819	8.138 223	17.53327	37.77429
540	291 600	23.23790	73.48469	157 464 000	8.143 253	17.54411	37.79763
541	292 681	23.25941	73.55270	158 340 421	8.148 276	17.55493	37.82095
542	293 764	23.28089	73.62065	159 220 088	8.153 294	17.56574	37.84424
543	294 849	23.30236	73.68853	160 103 007	8.158 305	17.57654	37.86750
544	295 936	23.32381	73.75636	160 989 184	8.163 310	17.58732	37.89073
545	297 025	23.34524	73.82412	161 878 625	8.168 309	17.59809	37.91393
546	298 116	23.36664	73.89181	162 771 336	8.173 302	17.60885	37.93711
547	299 209	23.38803	73.95945	163 667 323	8.178 289	17.61959	37.96025
548	300 304	23.40940	74.02702	164 566 592	8.183 269	17.63032	37.98337
549	301 401	23.43075	74.09453	165 469 149	8.188 244	17.64104	38.00646
550	302 500	23.45208	74.16198	166 375 000	8.193 213	17.65174	38.02952

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
550	302 500	23.45208	74.16198	166 375 000	8.193 213	17.65174	38.02952
551	303 601	23.47339	74.22937	167 284 151	8.198 175	17.66243	38.05256
552	304 704	23.49468	74.29670	168 196 608	8.203 132	17.67311	38.07557
553	305 809	23.51595	74.36397	169 112 377	8.208 082	17.68378	38.09854
554	306 916	23.53720	74.43118	170 031 464	8.213 027	17.69443	38.12149
555	308 025	23.55844	74.49832	170 953 875	8.217 966	17.70507	38.14442
556	309 136	23.57965	74.56541	171 879 616	8.222 899	17.71570	38.16731
557	310 249	23.60085	74.63243	172 808 693	8.227 825	17.72631	38.19018
558	311 364	23.62202	74.69940	173 741 112	8.232 746	17.73691	38.21302
559	312 481	23.64318	74.76630	174 676 879	8.237 661	17.74750	38.23584
560	313 600	23.66432	74.83315	175 616 000	8.242 571	17.75808	38.25862
561	314 721	23.68544	74.89993	176 558 481	8.247 474	17.76864	38.28138
562	315 844	23.70654	74.96666	177 504 328	8.252 372	17.77920	38.30412
563	316 969	23.72762	75.03333	178 453 547	8.257 263	17.78973	38.32682
564	318 096	23.74868	75.09993	179 406 144	8.262 149	17.80026	38.34950
565	319 225	23.76973	75.16648	180 362 125	8.267 029	17.81077	38.37215
566	320 356	23.79075	75.23297	181 321 496	8.271 904	17.82128	38.39478
567	321 489	23.81176	75.29940	182 284 263	8.276 773	17.83177	38.41737
568	322 624	23.83275	75.36577	183 250 432	8.281 635	17.84224	38.43995
569	323 761	23.85372	75.43209	184 220 009	8.286 493	17.85271	38.46249
570	324 900	23.87467	75.49834	185 193 000	8.291 344	17.86316	38.48501
571	326 041	23.89561	75.56454	186 169 411	8.296 190	17.87360	38.50750
572	327 184	23.91652	75.63068	187 149 248	8.301 031	17.88403	38.52997
573	328 329	23.93742	75.69676	188 132 517	8.305 865	17.89444	38.55241
574	329 476	23.95830	75.76279	189 119 224	8.310 694	17.90485	38.57482
575	330 625	23.97916	75.82875	190 109 375	8.315 517	17.91524	38.59721
576	331 776	24.00000	75.89466	191 102 976	8.320 335	17.92562	38.61958
577	332 929	24.02082	75.96052	192 100 033	8.325 148	17.93599	38.64191
578	334 084	24.04163	76.02631	193 100 552	8.329 954	17.94634	38.66422
579	335 241	24.06242	76.09205	194 104 539	8.334 755	17.95669	38.68651
580	336 400	24.08319	76.15773	195 112 000	8.339 551	17.96702	38.70877
581	337 561	24.10394	76.22336	196 122 941	8.344 341	17.97734	38.73100
582	338 724	24.12468	76.28892	197 137 368	8.349 126	17.98765	38.75321
583	339 889	24.14539	76.35444	198 155 287	8.353 905	17.99794	38.77539
584	341 056	24.16609	76.41989	199 176 704	8.358 678	18.00823	38.79755
585	342 225	24.18677	76.48529	200 201 625	8.363 447	18.01850	38.81968
586	343 396	24.20744	76.55064	201 230 056	8.368 209	18.02876	38.84179
587	344 569	24.22808	76.61593	202 262 003	8.372 967	18.03901	38.86387
588	345 744	24.24871	76.68116	203 297 472	8.377 719	18.04925	38.88593
589	346 921	24.26932	76.74634	204 336 469	8.382 465	18.05947	38.90796
590	348 100	24.28992	76.81146	205 379 000	8.387 207	18.06969	38.92996
591	349 281	24.31049	76.87652	206 425 071	8.391 942	18.07989	38.95195
592	350 464	24.33105	76.94154	207 474 688	8.396 673	18.09008	38.97390
593	351 649	24.35159	77.00649	208 527 857	8.401 398	18.10026	38.99584
594	352 836	24.37212	77.07140	209 584 584	8.406 118	18.11043	39.01774
595	354 025	24.39262	77.13624	210 644 875	8.410 833	18.12059	39.03963
596	355 216	24.41311	77.20104	211 708 736	8.415 542	18.13074	39.06149
597	356 409	24.43358	77.26578	212 776 173	8.420 246	18.14087	39.08332
598	357 604	24.45404	77.33046	213 847 192	8.424 945	18.15099	39.10513
599	358 801	24.47448	77.39509	214 921 799	8.429 638	18.16111	39.12692
600	360 000	24.49490	77.45967	216 000 000	8.434 327	18.17121	39.14868

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
600	360 000	24.49490	77.45967	216 000 000	8.434 327	18.17121	39.14868
601	361 201	24.51530	77.52419	217 081 801	8.439 010	18.18130	39.17041
602	362 404	24.53569	77.58866	218 167 208	8.443 688	18.19137	39.19213
603	363 609	24.55606	77.65307	219 256 227	8.448 361	18.20144	39.21382
604	364 816	24.57641	77.71744	220 348 864	8.453 028	18.21150	39.23548
605	366 025	24.59675	77.78175	221 445 125	8.457 691	18.22154	39.25712
606	367 236	24.61707	77.84600	222 545 016	8.462 348	18.23158	39.27874
607	368 449	24.63737	77.91020	223 648 543	8.467 000	18.24160	39.30033
608	369 664	24.65766	77.97435	224 755 712	8.471 647	18.25161	39.32190
609	370 881	24.67793	78.03845	225 866 529	8.476 289	18.26161	39.34345
610	372 100	24.69818	78.10250	226 981 000	8.480 926	18.27160	39.36497
611	373 321	24.71841	78.16649	228 099 131	8.485 558	18.28158	39.38647
612	374 544	24.73863	78.23043	229 220 928	8.490 185	18.29155	39.40795
613	375 769	24.75884	78.29432	230 346 397	8.494 807	18.30151	39.42940
614	376 996	24.77902	78.35815	231 475 544	8.499 423	18.31145	39.45083
615	378 225	24.79919	78.42194	232 608 375	8.504 035	18.32139	39.47223
616	379 456	24.81935	78.48567	233 744 896	8.508 642	18.33131	39.49362
617	380 689	24.83948	78.54935	234 885 113	8.513 243	18.34123	39.51498
618	381 924	24.85961	78.61298	236 029 032	8.517 840	18.35113	39.53631
619	383 161	24.87971	78.67655	237 176 659	8.522 432	18.36102	39.55763
620	384 400	24.89980	78.74008	238 328 000	8.527 019	18.37091	39.57892
621	385 641	24.91987	78.80355	239 483 061	8.531 601	18.38078	39.60018
622	386 884	24.93993	78.86698	240 641 848	8.536 178	18.39064	39.62143
623	388 129	24.95997	78.93035	241 804 367	8.540 750	18.40049	39.64265
624	389 376	24.97999	78.99367	242 970 624	8.545 317	18.41033	39.66388
625	390 625	25.00000	79.05694	244 140 625	8.549 880	18.42016	39.68503
626	391 876	25.01999	79.12016	245 314 376	8.554 437	18.42998	39.70618
627	393 129	25.03997	79.18333	246 491 893	8.558 990	18.43978	39.72731
628	394 384	25.05993	79.24645	247 673 152	8.563 538	18.44958	39.74842
629	395 641	25.07987	79.30952	248 858 189	8.568 081	18.45937	39.76951
630	396 900	25.09980	79.37254	250 047 000	8.572 619	18.46915	39.79057
631	398 161	25.11971	79.43551	251 239 591	8.577 152	18.47891	39.81161
632	399 424	25.13961	79.49843	252 435 968	8.581 681	18.48867	39.83263
633	400 689	25.15949	79.56130	253 636 137	8.586 205	18.49842	39.85363
634	401 956	25.17936	79.62412	254 840 104	8.590 724	18.50815	39.87461
635	403 225	25.19921	79.68689	256 047 875	8.595 238	18.51788	39.89556
636	404 496	25.21904	79.74961	257 259 456	8.599 748	18.52759	39.91649
637	405 769	25.23886	79.81228	258 474 853	8.604 252	18.53730	39.93740
638	407 044	25.25866	79.87490	259 694 072	8.608 753	18.54700	39.95829
639	408 321	25.27845	79.93748	260 917 119	8.613 248	18.55668	39.97916
640	409 600	25.29822	80.00000	262 144 000	8.617 739	18.56636	40.00000
641	410 881	25.31798	80.06248	263 374 721	8.622 225	18.57602	40.02082
642	412 164	25.33772	80.12490	264 609 288	8.626 706	18.58568	40.04162
643	413 449	25.35744	80.18728	265 847 707	8.631 183	18.59532	40.06240
644	414 736	25.37716	80.24961	267 089 984	8.635 655	18.60495	40.08316
645	416 025	25.39685	80.31189	268 336 125	8.640 123	18.61458	40.10390
646	417 316	25.41653	80.37413	269 586 136	8.644 585	18.62419	40.12461
647	418 609	25.43619	80.43631	270 840 023	8.649 044	18.63380	40.14530
648	419 904	25.45584	80.49845	272 097 792	8.653 497	18.64340	40.16598
649	421 201	25.47548	80.56054	273 359 449	8.657 947	18.65298	40.18663
650	422 500	25.49510	80.62258	274 625 000	8.662 391	18.66256	40.20726

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
650	422 500	25.49510	80.62258	274 625 000	8.662 391	18.66256	40.20726
651	423 801	25.51470	80.68457	275 894 451	8.666 831	18.67212	40.22787
652	425 104	25.53429	80.74652	277 167 808	8.671 266	18.68168	40.24845
653	426 409	25.55386	80.80842	278 445 077	8.675 697	18.69122	40.26902
654	427 716	25.57342	80.87027	279 726 264	8.680 124	18.70076	40.28957
655	429 025	25.59297	80.93207	281 011 375	8.684 546	18.71029	40.31009
656	430 336	25.61250	80.99383	282 300 416	8.688 963	18.71980	40.33059
657	431 649	25.63201	81.05554	283 593 393	8.693 376	18.72931	40.35108
658	432 964	25.65151	81.11720	284 890 312	8.697 784	18.73881	40.37154
659	434 281	25.67100	81.17881	286 191 179	8.702 188	18.74830	40.39198
660	435 600	25.69047	81.24038	287 496 000	8.706 588	18.75777	40.41240
661	436 921	25.70992	81.30191	288 804 781	8.710 983	18.76724	40.43280
662	438 244	25.72936	81.36338	290 117 528	8.715 373	18.77670	40.45318
663	439 569	25.74879	81.42481	291 434 247	8.719 760	18.78615	40.47354
664	440 896	25.76820	81.48620	292 754 944	8.724 141	18.79559	40.49388
665	442 225	25.78759	81.54753	294 079 625	8.728 519	18.80502	40.51420
666	443 556	25.80698	81.60882	295 408 296	8.732 892	18.81444	40.53449
667	444 889	25.82634	81.67007	296 740 963	8.737 260	18.82386	40.55477
668	446 224	25.84570	81.73127	298 077 632	8.741 625	18.83326	40.57503
669	447 561	25.86503	81.79242	299 418 309	8.745 985	18.84265	40.59526
670	448 900	25.88436	81.85353	300 763 000	8.750 340	18.85204	40.61548
671	450 241	25.90367	81.91459	302 111 711	8.754 691	18.86141	40.63568
672	451 584	25.92296	81.97561	303 464 448	8.759 038	18.87078	40.65585
673	452 929	25.94224	82.03658	304 821 217	8.763 381	18.88013	40.67601
674	454 276	25.96151	82.09750	306 182 024	8.767 719	18.88948	40.69615
675	455 625	25.98076	82.15838	307 546 875	8.772 053	18.89882	40.71626
676	456 976	26.00000	82.21922	308 915 776	8.776 383	18.90814	40.73636
677	458 329	26.01922	82.28001	310 288 733	8.780 708	18.91746	40.75644
678	459 684	26.03843	82.34076	311 665 752	8.785 030	18.92677	40.77650
679	461 041	26.05763	82.40146	313 046 839	8.789 347	18.93607	40.79653
680	462 400	26.07681	82.46211	314 432 000	8.793 659	18.94536	40.81655
681	463 761	26.09598	82.52272	315 821 241	8.797 968	18.95465	40.83655
682	465 124	26.11513	82.58329	317 214 568	8.802 272	18.96392	40.85653
683	466 489	26.13427	82.64381	318 611 987	8.806 572	18.97318	40.87649
684	467 856	26.15339	82.70429	320 013 504	8.810 868	18.98244	40.89643
685	469 225	26.17250	82.76473	321 419 125	8.815 160	18.99169	40.91635
686	470 596	26.19160	82.82512	322 828 856	8.819 447	19.00092	40.93625
687	471 969	26.21068	82.88546	324 242 703	8.823 731	19.01015	40.95613
688	473 344	26.22975	82.94577	325 660 672	8.828 010	19.01937	40.97599
689	474 721	26.24881	83.00602	327 082 769	8.832 285	19.02858	40.99584
690	476 100	26.26785	83.06624	328 509 000	8.836 556	19.03778	41.01566
691	477 481	26.28688	83.12641	329 939 371	8.840 823	19.04698	41.03546
692	478 864	26.30589	83.18654	331 373 888	8.845 085	19.05616	41.05525
693	480 249	26.32489	83.24662	332 812 557	8.849 344	19.06533	41.07502
694	481 636	26.34388	83.30666	334 255 384	8.853 599	19.07450	41.09476
695	483 025	26.36285	83.36666	335 702 375	8.857 849	19.08366	41.11449
696	484 416	26.38181	83.42661	337 153 536	8.862 095	19.09281	41.13420
697	485 809	26.40076	83.48653	338 608 873	8.866 338	19.10195	41.15389
698	487 204	26.41969	83.54639	340 068 392	8.870 576	19.11108	41.17357
699	488 601	26.43861	83.60622	341 532 099	8.874 810	19.12020	41.19322
700	490 000	26.45751	83.66600	343 000 000	8.879 040	19.12931	41.21285

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
700	490 000	26.45751	83.66600	343 000 000	8.879 040	19.12931	41.21285
701	491 401	26.47640	83.72574	344 472 101	8.883 266	19.13842	41.23247
702	492 804	26.49528	83.78544	345 948 408	8.887 488	19.14751	41.25207
703	494 209	26.51415	83.84510	347 428 927	8.891 706	19.15660	41.27164
704	495 616	26.53300	83.90471	348 913 664	8.895 920	19.16568	41.29120
705	497 025	26.55184	83.96428	350 402 625	8.900 130	19.17475	41.31075
706	498 436	26.57066	84.02381	351 895 816	8.904 337	19.18381	41.33027
707	499 849	26.58947	84.08329	353 393 243	8.908 539	19.19286	41.34977
708	501 264	26.60827	84.14274	354 894 912	8.912 737	19.20191	41.36926
709	502 681	26.62705	84.20214	356 400 829	8.916 931	19.21095	41.38873
710	504 100	26.64583	84.26150	357 911 000	8.921 121	19.21997	41.40818
711	505 521	26.66458	84.32082	359 425 431	8.925 308	19.22899	41.42761
712	506 944	26.68333	84.38009	360 944 128	8.929 490	19.23800	41.44702
713	508 369	26.70206	84.43933	362 467 097	8.933 669	19.24701	41.46642
714	509 796	26.72078	84.49852	363 994 344	8.937 843	19.25600	41.48579
715	511 225	26.73948	84.55767	365 525 875	8.942 014	19.26499	41.50515
716	512 656	26.75818	84.61678	367 061 696	8.946 181	19.27396	41.52449
717	514 089	26.77686	84.67585	368 601 813	8.950 344	19.28293	41.54382
718	515 524	26.79552	84.73488	370 146 232	8.954 503	19.29189	41.56312
719	516 961	26.81418	84.79387	371 694 959	8.958 658	19.30084	41.58241
720	518 400	26.83282	84.85281	373 248 000	8.962 809	19.30979	41.60168
721	519 841	26.85144	84.91172	374 805 361	8.966 957	19.31872	41.62093
722	521 284	26.87006	84.97058	376 367 048	8.971 101	19.32765	41.64016
723	522 729	26.88866	85.02941	377 933 067	8.975 241	19.33657	41.65938
724	524 176	26.90725	85.08819	379 503 424	8.979 377	19.34548	41.67857
725	525 625	26.92582	85.14693	381 078 125	8.983 509	19.35438	41.69775
726	527 076	26.94439	85.20563	382 657 176	8.987 637	19.36328	41.71692
727	528 529	26.96294	85.26429	384 240 583	8.991 762	19.37216	41.73606
728	529 984	26.98148	85.32292	385 828 352	8.995 883	19.38104	41.75519
729	531 441	27.00000	85.38150	387 420 489	9.000 000	19.38991	41.77430
730	532 900	27.01851	85.44004	389 017 000	9.004 113	19.39877	41.79339
731	534 361	27.03701	85.49854	390 617 891	9.008 223	19.40763	41.81247
732	535 824	27.05550	85.55700	392 223 168	9.012 329	19.41647	41.83152
733	537 289	27.07397	85.61542	393 832 837	9.016 431	19.42531	41.85056
734	538 756	27.09243	85.67380	395 446 904	9.020 529	19.43414	41.86959
735	540 225	27.11088	85.73214	397 065 375	9.024 624	19.44296	41.88859
736	541 696	27.12932	85.79044	398 688 256	9.028 715	19.45178	41.90758
737	543 169	27.14774	85.84870	400 315 553	9.032 802	19.46058	41.92655
738	544 644	27.16616	85.90693	401 947 272	9.036 886	19.46938	41.94551
739	546 121	27.18455	85.96511	403 583 419	9.040 966	19.47817	41.96444
740	547 600	27.20294	86.02325	405 224 000	9.045 042	19.48695	41.98336
741	549 081	27.22132	86.08136	406 869 021	9.049 114	19.49573	42.00227
742	550 564	27.23968	86.13942	408 518 488	9.053 183	19.50449	42.02115
743	552 049	27.25803	86.19745	410 172 407	9.057 248	19.51325	42.04002
744	553 536	27.27636	86.25543	411 830 784	9.061 310	19.52200	42.05887
745	555 025	27.29469	86.31338	413 493 625	9.065 368	19.53074	42.07771
746	556 516	27.31300	86.37129	415 160 936	9.069 422	19.53948	42.09653
747	558 009	27.33130	86.42916	416 832 723	9.073 473	19.54820	42.11533
748	559 504	27.34959	86.48699	418 508 992	9.077 520	19.55692	42.13411
749	561 001	27.36786	86.54479	420 189 749	9.081 563	19.56563	42.15288
750	562 500	27.38613	86.60254	421 875 000	9.085 603	19.57434	42.17163

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
750	562 500	27.38613	86.60254	421 875 000	9.085 603	19.57434	42.17163
751	564 001	27.40438	86.66026	423 564 751	9.089 639	19.58303	42.19037
752	565 504	27.42262	86.71793	425 259 008	9.093 672	19.59172	42.20909
753	567 009	27.44085	86.77557	426 957 777	9.097 701	19.60040	42.22779
754	568 516	27.45906	86.83317	428 661 064	9.101 727	19.60908	42.24647
755	570 025	27.47726	86.89074	430 368 875	9.105 748	19.61774	42.26514
756	571 536	27.49545	86.94826	432 081 216	9.109 767	19.62640	42.28379
757	573 049	27.51363	87.00575	433 798 093	9.113 782	19.63505	42.30243
758	574 564	27.53180	87.06320	435 519 512	9.117 793	19.64369	42.32105
759	576 081	27.54995	87.12061	437 245 479	9.121 801	19.65232	42.33965
760	577 600	27.56810	87.17798	438 976 000	9.125 805	19.66095	42.35824
761	579 121	27.58623	87.23531	440 711 081	9.129 806	19.66957	42.37681
762	580 644	27.60435	87.29261	442 450 728	9.133 803	19.67818	42.39536
763	582 169	27.62245	87.34987	444 194 947	9.137 797	19.68679	42.41390
764	583 696	27.64055	87.40709	445 943 744	9.141 787	19.69538	42.43242
765	585 225	27.65863	87.46428	447 697 125	9.145 774	19.70397	42.45092
766	586 756	27.67671	87.52143	449 455 096	9.149 758	19.71256	42.46941
767	588 289	27.69476	87.57854	451 217 663	9.153 738	19.72113	42.48789
768	589 824	27.71281	87.63561	452 984 832	9.157 714	19.72970	42.50634
769	591 361	27.73085	87.69265	454 756 609	9.161 687	19.73826	42.52478
770	592 900	27.74887	87.74964	456 533 000	9.165 656	19.74681	42.54321
771	594 441	27.76689	87.80661	458 314 011	9.169 623	19.75535	42.56162
772	595 984	27.78489	87.86353	460 099 648	9.173 585	19.76389	42.58001
773	597 529	27.80288	87.92042	461 889 917	9.177 544	19.77242	42.59839
774	599 076	27.82086	87.97727	463 684 824	9.181 500	19.78094	42.61675
775	600 625	27.83882	88.03408	465 484 375	9.185 453	19.78946	42.63509
776	602 176	27.85678	88.09086	467 288 576	9.189 402	19.79797	42.65342
777	603 729	27.87472	88.14760	469 097 433	9.193 347	19.80647	42.67174
778	605 284	27.89265	88.20431	470 910 952	9.197 290	19.81496	42.69004
779	606 841	27.91057	88.26098	472 729 139	9.201 229	19.82345	42.70832
780	608 400	27.92848	88.31761	474 552 000	9.205 164	19.83192	42.72659
781	609 961	27.94638	88.37420	476 379 541	9.209 096	19.84040	42.74484
782	611 524	27.96426	88.43076	478 211 768	9.213 025	19.84886	42.76307
783	613 089	27.98214	88.48729	480 048 687	9.216 950	19.85732	42.78129
784	614 656	28.00000	88.54377	481 890 304	9.220 873	19.86577	42.79950
785	616 225	28.01785	88.60023	483 736 625	9.224 791	19.87421	42.81769
786	617 796	28.03569	88.65664	485 587 656	9.228 707	19.88265	42.83586
787	619 369	28.05352	88.71302	487 443 403	9.232 619	19.89107	42.85402
788	620 944	28.07134	88.76936	489 303 872	9.236 528	19.89950	42.87216
789	622 521	28.08914	88.82567	491 169 069	9.240 433	19.90791	42.89029
790	624 100	28.10694	88.88194	493 039 000	9.244 335	19.91632	42.90840
791	625 681	28.12472	88.93818	494 913 671	9.248 234	19.92472	42.92650
792	627 264	28.14249	88.99438	496 793 088	9.252 130	19.93311	42.94458
793	628 849	28.16026	89.05055	498 677 257	9.256 022	19.94150	42.96265
794	630 436	28.17801	89.10668	500 566 184	9.259 911	19.94987	42.98070
795	632 025	28.19574	89.16277	502 459 875	9.263 797	19.95825	42.99874
796	633 616	28.21347	89.21883	504 358 336	9.267 680	19.96661	43.01678
797	635 209	28.23119	89.27486	506 261 573	9.271 559	19.97497	43.03477
798	636 804	28.24889	89.33085	508 169 592	9.275 435	19.98332	43.05276
799	638 401	28.26659	89.38680	510 082 399	9.279 308	19.99166	43.07073
800	640 000	28.28427	89.44272	512 000 000	9.283 178	20.00000	43.08869

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
800	640 000	28.28427	89.44272	512 000 000	9.283 178	20.00000	43.08869
801	641 601	28.30194	89.49860	513 922 401	9.287 044	20.00833	43.10664
802	643 204	28.31960	89.55445	515 849 608	9.290 907	20.01665	43.12457
803	644 809	28.33725	89.61027	517 781 627	9.294 767	20.02497	43.14249
804	646 416	28.35489	89.66605	519 718 464	9.298 624	20.03328	43.16039
805	648 025	28.37252	89.72179	521 660 125	9.302 477	20.04158	43.17823
806	649 636	28.39014	89.77750	523 606 616	9.306 328	20.04988	43.19615
807	651 249	28.40775	89.83318	525 557 943	9.310 175	20.05816	43.21400
808	652 864	28.42534	89.88882	527 514 112	9.314 019	20.06645	43.23185
809	654 481	28.44293	89.94443	529 475 129	9.317 860	20.07472	43.24967
810	656 100	28.46050	90.00000	531 441 000	9.321 698	20.08299	43.26749
811	657 721	28.47806	90.05554	533 411 731	9.325 532	20.09125	43.28529
812	659 344	28.49561	90.11104	535 387 328	9.329 363	20.09950	43.30307
813	660 969	28.51315	90.16651	537 367 797	9.333 192	20.10775	43.32084
814	662 596	28.53069	90.22195	539 353 144	9.337 017	20.11599	43.33859
815	664 225	28.54820	90.27735	541 343 375	9.340 839	20.12423	43.35633
816	665 856	28.56571	90.33272	543 338 496	9.344 657	20.13245	43.37406
817	667 489	28.58321	90.38805	545 338 513	9.348 473	20.14067	43.39177
818	669 124	28.60070	90.44335	547 343 432	9.352 286	20.14889	43.40947
819	670 761	28.61818	90.49862	549 353 259	9.356 095	20.15710	43.42715
820	672 400	28.63564	90.55385	551 368 000	9.359 902	20.16530	43.44481
821	674 041	28.65310	90.60905	553 387 661	9.363 705	20.17349	43.46247
822	675 684	28.67054	90.66422	555 412 248	9.367 505	20.18168	43.48011
823	677 329	28.68798	90.71935	557 441 767	9.371 302	20.18986	43.49773
824	678 976	28.70540	90.77445	559 476 224	9.375 096	20.19803	43.51534
825	680 625	28.72281	90.82951	561 515 625	9.378 887	20.20620	43.53294
826	682 276	28.74022	90.88454	563 559 976	9.382 675	20.21436	43.55052
827	683 929	28.75761	90.93954	565 609 283	9.386 460	20.22252	43.56809
828	685 584	28.77499	90.99451	567 663 552	9.390 242	20.23066	43.58564
829	687 241	28.79236	91.04944	569 722 789	9.394 021	20.23880	43.60318
830	688 900	28.80972	91.10434	571 787 000	9.397 796	20.24694	43.62071
831	690 561	28.82707	91.15920	573 856 191	9.401 569	20.25507	43.63822
832	692 224	28.84441	91.21403	575 930 368	9.405 339	20.26319	43.65572
833	693 889	28.86174	91.26883	578 009 537	9.409 105	20.27130	43.67320
834	695 556	28.87906	91.32360	580 093 704	9.412 869	20.27941	43.69067
835	697 225	28.89637	91.37833	582 182 875	9.416 630	20.28751	43.70812
836	698 896	28.91366	91.43304	584 277 056	9.420 387	20.29561	43.72556
837	700 569	28.93095	91.48770	586 376 253	9.424 142	20.30370	43.74299
838	702 244	28.94823	91.54234	588 480 472	9.427 894	20.31178	43.76041
839	703 921	28.96550	91.59694	590 589 719	9.431 642	20.31986	43.77781
840	705 600	28.98275	91.65151	592 704 000	9.435 388	20.32793	43.79519
841	707 281	29.00000	91.70605	594 823 321	9.439 131	20.33599	43.81256
842	708 964	29.01724	91.76056	596 947 688	9.442 870	20.34405	43.82992
843	710 649	29.03446	91.81503	599 077 107	9.446 607	20.35210	43.84727
844	712 336	29.05168	91.86947	601 211 584	9.450 341	20.36014	43.86460
845	714 025	29.06888	91.92388	603 351 125	9.454 072	20.36818	43.88191
846	715 716	29.08608	91.97826	605 495 736	9.457 800	20.37621	43.89922
847	717 409	29.10326	92.03260	607 645 423	9.461 525	20.38424	43.91651
848	719 104	29.12044	92.08692	609 800 192	9.465 247	20.39226	43.93378
849	720 801	29.13760	92.14120	611 960 049	9.468 966	20.40027	43.95105
850	722 500	29.15476	92.19544	614 125 000	9.472 682	20.40828	43.96830

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
850	722 500	29.15476	92.19544	614 125 000	9.472 682	20.40828	43.96830
851	724 201	29.17190	92.24966	616 295 051	9.476 396	20.41628	43.98553
852	725 904	29.18904	92.30385	618 470 208	9.480 106	20.42427	44.00275
853	727 609	29.20616	92.35800	620 650 477	9.483 814	20.43226	44.01996
854	729 316	29.22328	92.41212	622 835 864	9.487 518	20.44024	44.03716
855	731 025	29.24038	92.46621	625 026 375	9.491 220	20.44821	44.05434
856	732 736	29.25748	92.52027	627 222 016	9.494 919	20.45618	44.07151
857	734 449	29.27456	92.57429	629 422 793	9.498 615	20.46415	44.08866
858	736 164	29.29164	92.62829	631 628 712	9.502 308	20.47210	44.10581
859	737 881	29.30870	92.68225	633 839 779	9.505 998	20.48005	44.12293
860	739 600	29.32576	92.73618	636 056 000	9.509 685	20.48800	44.14005
861	741 321	29.34280	92.79009	638 277 381	9.513 370	20.49593	44.15715
862	743 044	29.35984	92.84396	640 503 928	9.517 052	20.50387	44.17424
863	744 769	29.37686	92.89779	642 735 647	9.520 730	20.51179	44.19132
864	746 496	29.39388	92.95160	644 972 544	9.524 406	20.51971	44.20838
865	748 225	29.41088	93.00538	647 214 625	9.528 079	20.52762	44.22543
866	749 956	29.42788	93.05912	649 461 896	9.531 750	20.53553	44.24246
867	751 689	29.44486	93.11283	651 714 363	9.535 417	20.54343	44.25949
868	753 424	29.46184	93.16652	653 972 032	9.539 082	20.55133	44.27650
869	755 161	29.47881	93.22017	656 234 909	9.542 744	20.55922	44.29349
870	756 900	29.49576	93.27379	658 503 000	9.546 403	20.56710	44.31048
871	758 641	29.51271	93.32738	660 776 311	9.550 059	20.57498	44.32745
872	760 384	29.52965	93.38094	663 054 848	9.553 712	20.58285	44.34440
873	762 129	29.54657	93.43447	665 338 617	9.557 363	20.59071	44.36135
874	763 876	29.56349	93.48797	667 627 624	9.561 011	20.59857	44.37828
875	765 625	29.58040	93.54143	669 921 875	9.564 656	20.60643	44.39520
876	767 376	29.59730	93.59487	672 221 376	9.568 298	20.61427	44.41211
877	769 129	29.61419	93.64828	674 526 133	9.571 938	20.62211	44.42900
878	770 884	29.63106	93.70165	676 836 152	9.575 574	20.62995	44.44588
879	772 641	29.64793	93.75500	679 151 439	9.579 208	20.63778	44.46275
880	774 400	29.66479	93.80832	681 472 000	9.582 840	20.64560	44.47960
881	776 161	29.68164	93.86160	683 797 841	9.586 468	20.65342	44.49644
882	777 924	29.69848	93.91486	686 128 968	9.590 094	20.66123	44.51327
883	779 689	29.71532	93.96808	688 465 387	9.593 717	20.66904	44.53009
884	781 456	29.73214	94.02127	690 807 104	9.597 337	20.67684	44.54689
885	783 225	29.74895	94.07444	693 154 125	9.600 955	20.68463	44.56368
886	784 996	29.76575	94.12757	695 506 456	9.604 570	20.69242	44.58046
887	786 769	29.78255	94.18068	697 864 103	9.608 182	20.70020	44.59723
888	788 544	29.79933	94.23375	700 227 072	9.611 791	20.70798	44.61398
889	790 321	29.81610	94.28680	702 595 369	9.615 398	20.71575	44.63072
890	792 100	29.83287	94.33981	704 969 000	9.619 002	20.72351	44.64745
891	793 881	29.84962	94.39280	707 347 971	9.622 603	20.73127	44.66417
892	795 664	29.86637	94.44575	709 732 288	9.626 202	20.73902	44.68087
893	797 449	29.88311	94.49868	712 121 957	9.629 797	20.74677	44.69756
894	799 236	29.89983	94.55157	714 516 984	9.633 391	20.75451	44.71424
895	801 025	29.91655	94.60444	716 917 375	9.636 981	20.76225	44.73090
896	802 816	29.93326	94.65728	719 323 136	9.640 569	20.76998	44.74756
897	804 609	29.94996	94.71008	721 734 273	9.644 154	20.77770	44.76420
898	806 404	29.96665	94.76286	724 150 792	9.647 737	20.78542	44.78083
899	808 201	29.98333	94.81561	726 572 699	9.651 317	20.79313	44.79744
900	810 000	30.00000	94.86833	729 000 000	9.654 894	20.80084	44.81405

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
900	810 000	30.00000	94.86833	729 000 000	9.654 894	20.80084	44.81405
901	811 801	30.01666	94.92102	731 432 701	9.658 468	20.80654	44.83064
902	813 604	30.03331	94.97368	733 870 808	9.662 040	20.81623	44.84722
903	815 409	30.04996	95.02631	736 314 327	9.665 610	20.82392	44.86379
904	817 216	30.06659	95.07891	738 763 264	9.669 176	20.83161	44.88034
905	819 025	30.08322	95.13149	741 217 625	9.672 740	20.83929	44.89688
906	820 836	30.09983	95.18403	743 677 416	9.676 302	20.84696	44.91341
907	822 649	30.11644	95.23655	746 142 643	9.679 860	20.85463	44.92993
908	824 464	30.13304	95.28903	748 613 312	9.683 417	20.86229	44.94644
909	826 281	30.14963	95.34149	751 089 429	9.686 970	20.86994	44.96293
910	828 100	30.16621	95.39392	753 571 000	9.690 521	20.87759	44.97941
911	829 921	30.18278	95.44632	756 058 031	9.694 069	20.88524	44.99588
912	831 744	30.19934	95.49869	758 550 528	9.697 615	20.89288	45.01234
913	833 569	30.21589	95.55103	761 048 497	9.701 158	20.90051	45.02879
914	835 396	30.23243	95.60335	763 551 944	9.704 699	20.90814	45.04522
915	837 225	30.24897	95.65563	766 060 875	9.708 237	20.91578	45.06164
916	839 056	30.26549	95.70789	768 575 296	9.711 772	20.92338	45.07805
917	840 889	30.28201	95.76012	771 095 213	9.715 305	20.93099	45.09445
918	842 724	30.29851	95.81232	773 620 632	9.718 835	20.93860	45.11084
919	844 561	30.31501	95.86449	776 151 559	9.722 363	20.94620	45.12721
920	846 400	30.33150	95.91663	778 688 000	9.725 888	20.95379	45.14357
921	848 241	30.34798	95.96874	781 229 961	9.729 411	20.96138	45.15992
922	850 084	30.36445	96.02083	783 777 448	9.732 931	20.96896	45.17626
923	851 929	30.38092	96.07289	786 330 467	9.736 448	20.97654	45.19259
924	853 776	30.39737	96.12492	788 889 024	9.739 963	20.98411	45.20891
925	855 625	30.41381	96.17692	791 453 125	9.743 476	20.99168	45.22521
926	857 476	30.43025	96.22889	794 022 776	9.746 986	20.99924	45.24150
927	859 329	30.44667	96.28084	796 597 983	9.750 493	21.00680	45.25778
928	861 184	30.46309	96.33276	799 178 752	9.753 998	21.01435	45.27405
929	863 041	30.47950	96.38465	801 765 089	9.757 500	21.02190	45.29030
930	864 900	30.49590	96.43651	804 357 000	9.761 000	21.02944	45.30655
931	866 761	30.51229	96.48834	806 954 491	9.764 497	21.03697	45.32278
932	868 624	30.52868	96.54015	809 557 568	9.767 992	21.04450	45.33900
933	870 489	30.54505	96.59193	812 166 237	9.771 485	21.05203	45.35521
934	872 356	30.56141	96.64368	814 780 504	9.774 974	21.05954	45.37141
935	874 225	30.57777	96.69540	817 400 375	9.778 462	21.06706	45.38760
936	876 096	30.59412	96.74709	820 025 856	9.781 946	21.07456	45.40377
937	877 969	30.61046	96.79876	822 656 953	9.785 429	21.08207	45.41994
938	879 844	30.62679	96.85040	825 293 672	9.788 909	21.08956	45.43609
939	881 721	30.64311	96.90201	827 936 019	9.792 386	21.09706	45.45223
940	883 600	30.65942	96.95360	830 584 000	9.795 861	21.10454	45.46836
941	885 481	30.67572	97.00515	833 237 621	9.799 334	21.11202	45.48448
942	887 364	30.69202	97.05668	835 896 888	9.802 804	21.11950	45.50058
943	889 249	30.70831	97.10819	838 561 807	9.806 271	21.12697	45.51668
944	891 136	30.72458	97.15966	841 232 384	9.809 736	21.13444	45.53276
945	893 025	30.74085	97.21111	843 908 625	9.813 199	21.14190	45.54883
946	894 916	30.75711	97.26253	846 590 536	9.816 659	21.14935	45.56490
947	896 809	30.77337	97.31393	849 278 123	9.820 117	21.15680	45.58095
948	898 704	30.78961	97.36529	851 971 392	9.823 572	21.16424	45.59698
949	900 601	30.80584	97.41663	854 670 349	9.827 025	21.17168	45.61301
950	902 500	30.82207	97.46794	857 375 000	9.830 476	21.17912	45.62903

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	\sqrt{n}	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
950	902 500	30.82207	97.46794	857 375 000	9.830 476	21.17912	45.62903
951	904 401	30.83829	97.51923	860 085 351	9.833 924	21.18655	45.64503
952	906 304	30.85450	97.57049	862 801 408	9.837 369	21.19397	45.66102
953	908 209	30.87070	97.62172	865 523 177	9.840 813	21.20139	45.67701
954	910 116	30.88689	97.67292	868 250 664	9.844 254	21.20880	45.69298
955	912 025	30.90307	97.72410	870 983 875	9.847 692	21.21621	45.70894
956	913 936	30.91925	97.77525	873 722 816	9.851 128	21.22361	45.72489
957	915 849	30.93542	97.82638	876 467 493	9.854 562	21.23101	45.74082
958	917 764	30.95158	97.87747	879 217 912	9.857 993	21.23840	45.75675
959	919 681	30.96773	97.92855	881 974 079	9.861 422	21.24579	45.77267
960	921 600	30.98387	97.97959	884 736 000	9.864 848	21.25317	45.78857
961	923 521	31.00000	98.03061	887 503 681	9.868 272	21.26055	45.80446
962	925 444	31.01612	98.08160	890 277 128	9.871 694	21.26792	45.82035
963	927 369	31.03224	98.13256	893 056 347	9.875 113	21.27529	45.83622
964	929 296	31.04835	98.18350	895 841 344	9.878 530	21.28265	45.85208
965	931 225	31.06445	98.23441	898 632 125	9.881 945	21.29001	45.86793
966	933 156	31.08054	98.28530	901 428 696	9.885 357	21.29736	45.88376
967	935 089	31.09662	98.33616	904 231 063	9.888 767	21.30470	45.89959
968	937 024	31.11270	98.38699	907 039 232	9.892 175	21.31204	45.91541
969	938 961	31.12876	98.43780	909 853 209	9.895 580	21.31938	45.93121
970	940 900	31.14482	98.48858	912 673 000	9.898 983	21.32671	45.94701
971	942 841	31.16087	98.53933	915 498 611	9.902 384	21.33404	45.96279
972	944 784	31.17691	98.59006	918 330 048	9.905 782	21.34136	45.97857
973	946 729	31.19295	98.64076	921 167 317	9.909 178	21.34868	45.99433
974	948 676	31.20897	98.69144	924 010 424	9.912 571	21.35599	46.01008
975	950 625	31.22499	98.74209	926 859 375	9.915 962	21.36329	46.02582
976	952 576	31.24100	98.79271	929 714 176	9.919 351	21.37059	46.04155
977	954 529	31.25700	98.84331	932 574 833	9.922 738	21.37789	46.05727
978	956 484	31.27299	98.89388	935 441 352	9.926 122	21.38518	46.07298
979	958 441	31.28898	98.94443	938 313 739	9.929 504	21.39247	46.08868
980	960 400	31.30495	98.99495	941 192 000	9.932 884	21.39975	46.10436
981	962 361	31.32092	99.04544	944 076 141	9.936 261	21.40708	46.12004
982	964 324	31.33688	99.09591	946 966 168	9.939 636	21.41430	46.13571
983	966 289	31.35283	99.14636	949 862 087	9.943 009	21.42156	46.15136
984	968 256	31.36877	99.19677	952 763 904	9.946 380	21.42888	46.16700
985	970 225	31.38471	99.24717	955 671 625	9.949 748	21.43608	46.18264
986	972 196	31.40064	99.29753	958 585 256	9.953 114	21.44333	46.19826
987	974 169	31.41656	99.34787	961 504 803	9.956 478	21.45058	46.21387
988	976 144	31.43247	99.39819	964 430 272	9.959 839	21.45782	46.22948
989	978 121	31.44837	99.44848	967 361 669	9.963 198	21.46506	46.24507
990	980 100	31.46427	99.49874	970 299 000	9.966 555	21.47229	46.26065
991	982 081	31.48015	99.54898	973 242 271	9.969 910	21.47952	46.27622
992	984 064	31.49603	99.59920	976 191 488	9.973 262	21.48674	46.29178
993	986 049	31.51190	99.64939	979 146 657	9.976 612	21.49396	46.30733
994	988 036	31.52777	99.69955	982 107 784	9.979 960	21.50117	46.32287
995	990 025	31.54362	99.74969	985 074 875	9.983 305	21.50838	46.33840
996	992 016	31.55947	99.79980	988 047 936	9.986 649	21.51558	46.35392
997	994 009	31.57531	99.84989	991 026 973	9.989 990	21.52278	46.36943
998	996 004	31.59114	99.89995	994 011 992	9.993 329	21.52997	46.38492
999	998 001	31.60696	99.94999	997 002 999	9.996 666	21.53716	46.40041
1000	1 000 000	31.62278	100.00000	1 000 000 000	10.000 000	21.54435	46.41589

POWERS OF NUMBERS

n	n^4	n^5	n^6	n^7	n^8
1	1	1	1	1	1
2	16	32	64	128	256
3	81	243	729	2187	6561
4	256	1024	4096	16384	65536
5	625	3125	15625	78125	390625
6	1296	7776	46656	279936	1679616
7	2401	16807	117649	823543	5764801
8	4096	32768	262144	2097152	16777216
9	6561	59049	531441	4782969	43046721
10	10000	100000	1000000	10000000	1.000000
11	14641	161051	1771561	19487171	2.143589
12	20736	248832	2985984	35831808	4.299817
13	28561	371293	4826809	62748517	8.157307
14	38416	537824	7529536	105413504	14.757891
15	50625	759375	11390625	170859375	25.628906
16	65536	1048576	16777216	268435456	42.949673
17	83521	1419857	24137569	410338673	69.757574
18	104976	1889568	34012224	612220032	110.199606
19	130321	2476099	47045881	893871739	169.835630
20	160000	3200000	64000000	1.280000	2.560000
21	194481	4084101	85766121	1.801089	3.782286
22	234256	5153632	113379904	2.494358	5.487587
23	279841	6436343	148035889	3.404825	7.831099
24	331776	7962624	191102976	4.586471	11.007531
25	390625	9765625	244140625	6.103516	15.258789
26	456976	11881376	308915776	8.031810	20.882706
27	531441	14348907	387420489	10.460353	28.242954
28	614656	17210368	481890304	13.492929	37.780200
29	707281	20511149	594823321	17.249876	50.024641
30	810000	24300000	7.290000	2.187000	6.561000
31	923521	28629151	8.875037	2.751261	8.528910
32	1048576	33554432	10.737418	3.435974	10.995116
33	1185921	39135393	12.914680	4.261844	14.064086
34	1336336	45435424	15.448044	5.252335	17.857939
35	1500625	52521875	18.382656	6.433930	22.518754
36	1679616	60466176	21.767823	7.836416	28.211099
37	1874161	69343957	25.657264	9.493188	35.124795
38	2085136	79235168	30.109364	11.441558	43.477921
39	2313441	90224199	35.187438	13.723101	53.520093
40	2560000	102400000	4.096000	16.384000	6.553600
41	2825761	115856201	4.750104	19.475427	7.984925
42	3111696	130691232	5.489032	23.053933	9.682652
43	3418801	147008443	6.321363	27.181861	11.688200
44	3748096	164916224	7.256314	31.927781	14.048224
45	4100625	184528125	8.303766	37.366945	16.815125
46	4477456	205962976	9.474297	43.581766	20.047612
47	4879681	229345007	10.779215	50.662312	23.811287
48	5308416	254803968	12.230590	58.706834	28.179280
49	5764801	282475249	13.841287	67.822307	33.232931
50	6250000	312500000	15.625000	78.125000	39.062500

POWERS OF NUMBERS (Continued)

n	n^4	n^5	n^6	n^7	n^8
			$\times 10^9$	$\times 10^{11}$	$\times 10^{13}$
50	6250000	312500000	15.625000	7.812500	3.906250
51	6765201	345025251	17.596288	8.974107	4.576794
52	7311616	380204032	19.770610	10.280717	5.345973
53	7890481	418195493	22.164361	11.747111	6.225969
54	8503056	459165024	24.794911	13.389252	7.230196
55	9150625	503284375	27.080641	15.224352	8.373394
56	9834496	550731776	30.840979	17.270948	9.671731
57	10556001	601692057	34.296447	19.548975	11.142916
58	11316496	656356768	38.068693	22.079842	12.806308
59	12117361	714924299	42.180534	24.886515	14.683044
		$\times 10^8$	$\times 10^{10}$	$\times 10^{11}$	$\times 10^{13}$
60	12960000	7.776000	4.665600	27.993600	16.796160
61	13845841	8.445963	5.152037	31.427428	19.170731
62	14776336	9.161328	5.680024	35.216146	21.834011
63	15752961	9.924365	6.252350	39.389806	24.815578
64	16777216	10.737418	6.871948	43.980465	28.147498
65	17850625	11.602906	7.541889	49.022279	31.864481
66	18974736	12.523326	8.265395	54.551607	36.004061
67	20151121	13.501251	9.045838	60.607116	40.606768
68	21381376	14.539336	9.886748	67.229888	45.716324
69	22667121	15.640313	10.791816	74.463533	51.379837
		$\times 10^8$	$\times 10^{10}$	$\times 10^{12}$	$\times 10^{14}$
70	24010000	16.807000	11.764900	8.235430	5.764801
71	25411681	18.042294	12.810028	9.095120	6.457535
72	26873856	19.349176	13.931407	10.030613	7.222041
73	28398241	20.730716	15.133423	11.047399	8.064601
74	29986576	22.190066	16.420649	12.151280	8.991947
75	31640625	23.730469	17.797852	13.348389	10.011292
76	33362176	25.355254	19.269993	14.645195	11.130348
77	35153041	27.067842	20.842238	16.048523	12.357363
78	37015056	28.871744	22.519960	17.565569	13.701144
79	38950081	30.770564	24.308746	19.203909	15.171088
		$\times 10^8$	$\times 10^{10}$	$\times 10^{12}$	$\times 10^{14}$
80	40960000	32.768000	26.214400	20.971520	16.777216
81	43046721	34.867844	28.242954	22.876792	18.530202
82	45212176	37.073984	30.400667	24.928547	20.441409
83	47458321	39.390406	32.694037	27.136051	22.522922
84	49787136	41.821194	35.129803	29.509035	24.787589
85	52200625	44.370531	37.714952	32.057709	27.249053
86	54700816	47.042702	40.456724	34.792782	29.921793
87	57289761	49.842092	43.362620	37.725479	32.821167
88	59969536	52.773192	46.440409	40.867560	35.963452
89	62742241	55.840594	49.698129	44.231335	39.365888
		$\times 10^9$	$\times 10^{11}$	$\times 10^{13}$	$\times 10^{15}$
90	65610000	5.904900	5.314410	4.782969	4.304672
91	68574961	6.240321	5.678693	5.167610	4.702525
92	71639296	6.590815	6.063550	5.578466	5.132189
93	74805201	6.956884	6.469902	6.017009	5.595818
94	78074896	7.339040	6.898698	6.484776	6.095689
95	81450625	7.737809	7.350919	6.983373	6.634204
96	84934656	8.153727	7.827578	7.514475	7.213896
97	88529281	8.587340	8.329720	8.079828	7.837434
98	92236816	9.039208	8.858424	8.681255	8.507630
99	96059601	9.509900	9.414801	9.320653	9.227447
100	100000000	10.000000	10.000000	10.000000	10.000000

FACTORIALS AND THEIR LOGARITHMS

n	$n!$	$\log n!$	n	$n!$	$\log n!$
1	1.0000	0.00000	50	3.0414×10^{64}	64.48307
2	2.0000	0.30103	51	1.5511×10^{66}	66.19065
3	6.0000	0.77815	52	8.0658×10^{67}	67.90665
4	2.4000×10	1.38021	53	4.2749×10^{69}	69.63092
5	1.2000×10^2	2.07918	54	2.3084×10^{71}	71.36332
6	7.2000×10^2	2.85733	55	1.2696×10^{73}	73.10368
7	5.0400×10^3	3.70243	56	7.1100×10^{74}	74.85187
8	4.0320×10^4	4.60552	57	4.0527×10^{76}	76.60774
9	3.6288×10^6	5.55976	58	2.3506×10^{78}	78.37117
10	3.6288×10^6	6.55976	59	1.3868×10^{80}	80.14202
11	3.9917×10^7	7.60116	60	8.3210×10^{81}	81.92017
12	4.7900×10^8	8.68034	61	5.0758×10^{83}	83.70550
13	6.2270×10^9	9.79428	62	3.1470×10^{85}	85.49790
14	8.7178×10^{10}	10.94041	63	1.9826×10^{87}	87.29724
15	1.3077×10^{12}	12.11650	64	1.2689×10^{89}	89.10342
16	2.0923×10^{13}	13.32062	65	8.2477×10^{90}	90.91633
17	3.5569×10^{14}	14.55107	66	5.4435×10^{92}	92.73587
18	6.4024×10^{15}	15.80634	67	3.6471×10^{94}	94.56195
19	1.2165×10^{17}	17.08509	68	2.4800×10^{96}	96.39446
20	2.4329×10^{18}	18.38612	69	1.7112×10^{98}	98.23331
21	5.1091×10^{19}	19.70834	70	1.1979×10^{100}	100.07841
22	1.1240×10^{21}	21.05077	71	8.5048×10^{101}	101.92966
23	2.5852×10^{22}	22.41249	72	6.1234×10^{103}	103.78700
24	6.2045×10^{23}	23.79271	73	4.4701×10^{105}	105.65032
25	1.5511×10^{25}	25.19065	74	3.3079×10^{107}	107.51955
26	4.0329×10^{26}	26.60562	75	2.4809×10^{109}	109.39461
27	1.0889×10^{28}	28.03698	76	1.8855×10^{111}	111.27543
28	3.0489×10^{29}	29.48414	77	1.4518×10^{113}	113.16192
29	8.8418×10^{30}	30.94654	78	1.1324×10^{115}	115.05401
30	2.6525×10^{32}	32.42366	79	8.9462×10^{116}	116.95164
31	8.2228×10^{33}	33.91502	80	7.1569×10^{118}	118.85473
32	2.6313×10^{35}	35.42017	81	5.7971×10^{120}	120.76321
33	8.6833×10^{36}	36.93869	82	4.7536×10^{122}	122.67703
34	2.9523×10^{38}	38.47016	83	3.9455×10^{124}	124.59610
35	1.0333×10^{40}	40.01423	84	3.3142×10^{126}	126.52038
36	3.7199×10^{41}	41.57054	85	2.8171×10^{128}	128.44980
37	1.3764×10^{43}	43.13874	86	2.4227×10^{130}	130.38430
38	5.2302×10^{44}	44.71852	87	2.1078×10^{132}	132.32382
39	2.0398×10^{46}	46.30959	88	1.8548×10^{134}	134.26830
40	8.1592×10^{47}	47.91165	89	1.6508×10^{136}	136.21769
41	3.3453×10^{49}	49.52443	90	1.4857×10^{138}	138.17194
42	1.4050×10^{51}	51.14768	91	1.3520×10^{140}	140.13098
43	6.0415×10^{52}	52.78115	92	1.2438×10^{142}	142.09477
44	2.6583×10^{54}	54.42460	93	1.1568×10^{144}	144.06325
45	1.1962×10^{56}	56.07781	94	1.0874×10^{146}	146.03638
46	5.5026×10^{57}	57.74057	95	1.0330×10^{148}	148.01410
47	2.5862×10^{59}	59.41267	96	9.9168×10^{149}	149.99637
48	1.2414×10^{61}	61.09391	97	9.6193×10^{151}	151.98314
49	6.0828×10^{62}	62.78410	98	9.4269×10^{153}	153.97437
50	3.0414×10^{64}	64.48307	99	9.3326×10^{155}	155.97000
			100	9.3326×10^{157}	157.97000

FACTORS FOR COMPUTING PROBABLE ERRORS

n	$\frac{1}{\sqrt{n}}$	$\frac{1}{\sqrt{n(n-1)}}$	$\frac{.6745}{\sqrt{n-1}}$	$\frac{.6745}{\sqrt{n(n-1)}}$	$\frac{.8453}{n\sqrt{n-1}}$	$\frac{.8453}{\sqrt{n(n-1)}}$
2	.707107	.707107	.6745	.4769	.4227	.5978
3	.577350	.408248	.4769	.2754	.1993	.3451
4	.500000	.288675	.3894	.1947	.1220	.2440
5	.447214	.223607	.3372	.1508	.0845	.1890
6	.408248	.182574	.3016	.1231	.0630	.1543
7	.377964	.154303	.2754	.1041	.0493	.1304
8	.353553	.133631	.2549	.0901	.0399	.1130
9	.333333	.117851	.2385	.0795	.0332	.0996
10	.316228	.105409	.2248	.0711	.0282	.0891
11	.301511	.095346	.2133	.0643	.0243	.0806
12	.288675	.087039	.2034	.0587	.0212	.0736
13	.277350	.080064	.1947	.0540	.0188	.0677
14	.267261	.074125	.1871	.0500	.0167	.0627
15	.258199	.069007	.1803	.0465	.0151	.0583
16	.250000	.064550	.1742	.0435	.0136	.0546
17	.242536	.060634	.1686	.0409	.0124	.0513
18	.235702	.057166	.1636	.0386	.0114	.0483
19	.229416	.054074	.1590	.0365	.0105	.0457
20	.223607	.051299	.1547	.0346	.0097	.0434
21	.218218	.048795	.1508	.0329	.0090	.0412
22	.213201	.046524	.1472	.0314	.0084	.0393
23	.208514	.044455	.1438	.0300	.0078	.0376
24	.204124	.042563	.1406	.0287	.0073	.0360
25	.200000	.040825	.1377	.0275	.0069	.0345
26	.196116	.039223	.1349	.0265	.0065	.0332
27	.192450	.037743	.1323	.0255	.0061	.0319
28	.188982	.036370	.1298	.0245	.0058	.0307
29	.185695	.035093	.1275	.0237	.0055	.0297
30	.182574	.033903	.1252	.0229	.0052	.0287
31	.179605	.032791	.1231	.0221	.0050	.0277
32	.176777	.031750	.1211	.0214	.0047	.0268
33	.174078	.030773	.1192	.0208	.0045	.0260
34	.171499	.029854	.1174	.0201	.0043	.0252
35	.169031	.028989	.1157	.0196	.0041	.0245
36	.166667	.028172	.1140	.0190	.0040	.0238
37	.164399	.027400	.1124	.0185	.0038	.0232
38	.162221	.026669	.1109	.0180	.0037	.0225
39	.160128	.025976	.1094	.0175	.0035	.0220
40	.158114	.025318	.1080	.0171	.0034	.0214
41	.156174	.024693	.1066	.0167	.0033	.0209
42	.154303	.024098	.1053	.0163	.0031	.0204
43	.152499	.023531	.1041	.0159	.0030	.0199
44	.150756	.022990	.1029	.0155	.0029	.0194
45	.149071	.022473	.1017	.0152	.0028	.0190
46	.147442	.021979	.1005	.0148	.0027	.0186
47	.145865	.021507	.0994	.0145	.0027	.0182
48	.144338	.021054	.0984	.0142	.0026	.0178
49	.142857	.020620	.0974	.0139	.0025	.0174
50	.141421	.020203	.0964	.0136	.0024	.0171

FACTORS FOR COMPUTING PROBABLE ERRORS (Continued)

n	$\frac{1}{\sqrt{n}}$	$\frac{1}{\sqrt{n(n-1)}}$	$\frac{.6745}{\sqrt{n-1}}$	$\frac{.6745}{\sqrt{n(n-1)}}$	$\frac{.8453}{n\sqrt{n-1}}$	$\frac{.8453}{\sqrt{n(n-1)}}$
50	.141421	.020203	.0964	.0136	.0024	.0171
51	.140028	.019803	.0954	.0134	.0023	.0167
52	.138675	.019418	.0945	.0131	.0023	.0164
53	.137361	.019048	.0935	.0129	.0022	.0161
54	.136083	.018692	.0927	.0126	.0022	.0158
55	.134840	.018349	.0918	.0124	.0021	.0155
56	.133631	.018019	.0910	.0122	.0020	.0152
57	.132453	.017700	.0901	.0119	.0020	.0150
58	.131306	.017392	.0893	.0117	.0019	.0147
59	.130189	.017095	.0886	.0115	.0019	.0145
60	.129099	.016807	.0878	.0113	.0018	.0142
61	.128037	.016529	.0871	.0112	.0018	.0140
62	.127000	.016261	.0864	.0110	.0018	.0138
63	.125988	.016001	.0857	.0108	.0017	.0135
64	.125000	.015749	.0850	.0106	.0017	.0133
65	.124035	.015504	.0843	.0105	.0016	.0131
66	.123091	.015268	.0837	.0103	.0016	.0129
67	.122169	.015038	.0830	.0101	.0016	.0127
68	.121268	.014815	.0824	.0100	.0015	.0125
69	.120386	.014599	.0818	.0099	.0015	.0123
70	.119523	.014389	.0812	.0097	.0015	.0122
71	.118678	.014185	.0806	.0096	.0014	.0120
72	.117851	.013986	.0801	.0094	.0014	.0118
73	.117041	.013793	.0795	.0093	.0014	.0117
74	.116248	.013606	.0789	.0092	.0013	.0115
75	.115470	.013423	.0784	.0091	.0013	.0113
76	.114708	.013245	.0779	.0089	.0013	.0112
77	.113961	.013072	.0773	.0088	.0013	.0111
78	.113228	.012904	.0769	.0087	.0012	.0109
79	.112509	.012739	.0764	.0086	.0012	.0108
80	.111803	.012579	.0759	.0085	.0012	.0106
81	.111111	.012423	.0754	.0084	.0012	.0105
82	.110432	.012270	.0749	.0083	.0012	.0104
83	.109764	.012121	.0745	.0082	.0011	.0103
84	.109109	.011976	.0740	.0081	.0011	.0101
85	.108465	.011835	.0736	.0080	.0011	.0100
86	.107833	.011696	.0732	.0079	.0011	.0099
87	.107211	.011561	.0727	.0078	.0011	.0098
88	.106600	.011429	.0723	.0077	.0010	.0097
89	.106000	.011300	.0719	.0076	.0010	.0096
90	.105409	.011173	.0715	.0075	.0010	.0094
91	.104828	.011050	.0711	.0075	.0010	.0093
92	.104257	.010929	.0707	.0074	.0010	.0092
93	.103695	.010811	.0703	.0073	.0010	.0091
94	.103142	.010695	.0699	.0072	.0009	.0090
95	.102598	.010582	.0696	.0071	.0009	.0089
96	.102062	.010471	.0692	.0071	.0009	.0089
97	.101535	.010363	.0688	.0070	.0009	.0088
98	.101015	.010257	.0685	.0069	.0009	.0087
99	.100504	.010152	.0681	.0069	.0009	.0086
100	.100000	.010050	.0678	.0068	.0008	.0085

PROBABILITY OF OCCURRENCE OF DEVIATIONS

Valid for thirty or more samples.

Probability of occurrence, expressed as per cent, and odds against ■ deviation as great or greater than that designated is given for various ratios of the deviation to the probable error and to the standard deviation.

(From Pearl, Medical Biometry and Statistics, W. B. Saunders Company, publishers, by permission.)

Ratio dev. to P.E.	Probable occurrence %	Odds against, to 1	Ratio dev. to std. dev.	Probable occurrence %	Odds against, to 1
1.0	50.00	1.00	0.67449	50.00	1.00
1.1	45.81	1.18	0.7	48.39	1.07
1.2	41.83	1.39	0.8	42.37	1.36
1.3	38.06	1.63	0.9	36.81	1.72
1.4	34.50	1.90	1.0	31.73	2.15
1.5	31.17	2.21	1.1	27.13	2.69
1.6	28.05	2.57	1.2	23.01	3.35
1.7	25.15	2.98	1.3	19.36	4.17
1.8	22.47	3.45	1.4	16.15	5.19
1.9	20.00	4.00	1.5	13.36	6.48
2.0	17.73	4.64	1.6	10.96	8.12
2.1	15.67	5.38	1.7	8.91	10.22
2.2	13.78	6.25	1.8	7.19	12.92
2.3	12.08	7.28	1.9	5.74	16.41
2.4	10.55	8.48	2.0	4.55	20.98
2.5	9.18	9.90	2.1	3.57	26.99
2.6	7.95	11.58	2.2	2.78	34.96
2.7	6.86	13.58	2.3	2.14	45.62
2.8	5.89	15.96	2.4	1.64	59.99
2.9	5.05	18.82	2.5	1.24	79.52
3.0	4.30	22.24	2.6	.932	106.3
3.1	3.65	26.37	2.7	.693	143.2
3.2	3.09	31.36	2.8	.511	194.7
3.3	2.60	37.42	2.9	.373	267.0
3.4	2.18	44.80	3.0	.270	369.4
3.5	1.82	53.82	3.1	.194	515.7
3.6	1.52	64.89	3.2	.137	726.7
3.7	1.26	78.53	3.3	.0967	1,033.
3.8	1.04	95.38	3.4	.0674	1,483.
3.9	.853	116.3	3.5	.0465	2,149.
4.0	.698	142.3	3.6	.0318	3,142.
4.1	.569	174.9	3.7	.0216	4,637.
4.2	.461	215.8	3.8	.0145	6,915.
4.3	.373	267.2	3.9	.00962	10,394.
4.4	.300	332.4	4.0	.00634	15,772.
4.5	.240	415.0	5.0	5.73×10^{-5}	1.744×10^6
4.6	.192	520.4	6.0	2.0×10^{-7}	5.0×10^8
4.7	.152	655.3	7.0	2.6×10^{-10}	3.9×10^{11}
4.8	.121	828.3			
4.9	.0950	1,052.			
5.0	.0745	1,341.			
6.0	.0052	19,300.			
7.0	.00023	4.27×10^5			
8.0	6.8×10^{-6}	1.47×10^7			
9.0	1.3×10^{-7}	7.30×10^8			
10.0	1.5×10^{-9}	6.5×10^{10}			

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR

The following table gives values of the area under the curve from the ordinate at $t = 0$ to the ordinate for the values of t given in the column at the left. Values of the ordinate and of the second, third and fourth derivatives are also given.

t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative	t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative
.00	.0000	.3989	— .3989	.0000	1.1968	.50	.1915	.3521	— .2641	.4841	.5501
.01	.0040	.3989	— .3989	.0120	1.1965	.51	.1950	.3503	— .2592	.4895	.5279
.02	.0080	.3989	— .3987	.0239	1.1956	.52	.1985	.3485	— .2543	.4947	.5056
.03	.0120	.3988	— .3984	.0359	1.1941	.53	.2019	.3467	— .2493	.4996	.4831
.04	.0160	.3986	— .3980	.0478	1.1920	.54	.2054	.3448	— .2443	.5043	.4605
.05	.0199	.3984	— .3975	.0597	1.1894	.55	.2088	.3429	— .2392	.5088	.4378
.06	.0239	.3982	— .3968	.0716	1.1861	.56	.2123	.3411	— .2341	.5131	.4150
.07	.0279	.3980	— .3960	.0834	1.1822	.57	.2157	.3391	— .2289	.5171	.3921
.08	.0319	.3977	— .3951	.0952	1.1778	.58	.2190	.3372	— .2238	.5209	.3691
.09	.0359	.3973	— .3941	.1070	1.1727	.59	.2224	.3352	— .2185	.5245	.3461
.10	.0398	.3970	— .3930	.1187	1.1671	.60	.2258	.3332	— .2133	.5278	.3231
.11	.0438	.3965	— .3917	.1303	1.1609	.61	.2291	.3312	— .2080	.5309	.3000
.12	.0478	.3961	— .3904	.1419	1.1541	.62	.2324	.3292	— .2027	.5338	.2770
.13	.0517	.3956	— .3889	.1534	1.1468	.63	.2357	.3271	— .1973	.5365	.2539
.14	.0557	.3951	— .3873	.1648	1.1389	.64	.2389	.3251	— .1919	.5389	.2309
.15	.0596	.3945	— .3856	.1762	1.1304	.65	.2422	.3230	— .1865	.5411	.2078
.16	.0636	.3939	— .3838	.1874	1.1214	.66	.2454	.3209	— .1811	.5431	.1849
.17	.0675	.3932	— .3819	.1986	1.1118	.67	.2486	.3187	— .1757	.5448	.1620
.18	.0714	.3925	— .3798	.2097	1.1017	.68	.2518	.3166	— .1702	.5463	.1391
.19	.0754	.3918	— .3777	.2206	1.0911	.69	.2549	.3144	— .1647	.5476	.1164
.20	.0793	.3910	— .3754	.2315	1.0799	.70	.2580	.3123	— .1593	.5486	.0937
.21	.0832	.3902	— .3730	.2422	1.0682	.71	.2612	.3101	— .1538	.5495	.0712
.22	.0871	.3894	— .3706	.2529	1.0560	.72	.2642	.3079	— .1483	.5501	.0487
.23	.0910	.3885	— .3680	.2634	1.0434	.73	.2673	.3056	— .1428	.5504	.0265
.24	.0948	.3876	— .3653	.2737	1.0302	.74	.2704	.3034	— .1373	.5506	.0043
.25	.0987	.3867	— .3625	.2840	1.0165	.75	.2734	.3011	— .1318	.5505	— .0176
.26	.1026	.3857	— .3596	.2941	1.0024	.76	.2764	.2989	— .1262	.5502	— .0394
.27	.1064	.3847	— .3566	.3040	0.9878	.77	.2794	.2966	— .1207	.5497	— .0611
.28	.1103	.3836	— .3535	.3138	0.9727	.78	.2823	.2943	— .1153	.5490	— .0825
.29	.1141	.3825	— .3504	.3235	0.9572	.79	.2852	.2920	— .1098	.5481	— .1037
.30	.1179	.3814	— .3471	.3330	0.9413	.80	.2881	.2897	— .1043	.5469	— .1247
.31	.1217	.3802	— .3437	.3423	0.9250	.81	.2910	.2874	— .0988	.5456	— .1455
.32	.1255	.3790	— .3402	.3515	0.9082	.82	.2939	.2850	— .0934	.5440	— .1660
.33	.1293	.3778	— .3367	.3605	0.8910	.83	.2967	.2827	— .0880	.5423	— .1862
.34	.1331	.3765	— .3330	.3693	0.8735	.84	.2996	.2803	— .0825	.5403	— .2063
.35	.1368	.3752	— .3293	.3779	0.8556	.85	.3023	.2780	— .0771	.5381	— .2260
.36	.1406	.3739	— .3255	.3864	0.8373	.86	.3051	.2756	— .0718	.5358	— .2455
.37	.1443	.3726	— .3216	.3947	0.8186	.87	.3079	.2732	— .0664	.5332	— .2646
.38	.1480	.3712	— .3176	.4028	0.7996	.88	.3106	.2709	— .0611	.5305	— .2835
.39	.1517	.3697	— .3135	.4107	0.7803	.89	.3133	.2685	— .0558	.5276	— .3021
.40	.1554	.3683	— .3094	.4184	0.7607	.90	.3159	.2661	— .0506	.5245	— .3203
.41	.1591	.3668	— .3051	.4259	0.7408	.91	.3186	.2637	— .0453	.5212	— .3383
.42	.1628	.3653	— .3008	.4332	0.7206	.92	.3212	.2613	— .0401	.5177	— .3559
.43	.1664	.3637	— .2965	.4403	0.7001	.93	.3238	.2589	— .0350	.5140	— .3731
.44	.1700	.3621	— .2920	.4472	0.6793	.94	.3264	.2565	— .0299	.5102	— .3901
.45	.1736	.3605	— .2875	.4539	0.6583	.95	.3289	.2541	— .0245	.5062	— .4066
.46	.1772	.3589	— .2830	.4603	0.6371	.96	.3315	.2516	— .0197	.5021	— .4228
.47	.1808	.3572	— .2783	.4666	0.6156	.97	.3340	.2492	— .0147	.4978	— .4387
.48	.1844	.3555	— .2736	.4727	0.5940	.98	.3365	.2468	— .0098	.4933	— .4541
.49	.1879	.3538	— .2689	.4785	0.5721	.99	.3389	.2444	— .0049	.4887	— .4692
.50	.1915	.3521	— .2641	.4841	0.5501	1.00	.3413	.2420	.0000	.4839	— .4839

AREAS ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR (Continued)

<i>t</i>	Area	Ordi- nate	Second deriva- tive	Third deriva- tive	Fourth deriva- tive	<i>t</i>	Area	Ordi- nate	Second deriva- tive	Third deriva- tive	Fourth deriva- tive
1.00	.3413	.2420	.0000	.4839	-.4839	1.50	.4332	.1295	.1619	.1457	-.7043
1.01	.3438	.2396	.0048	.4790	-.4983	1.51	.4345	.1276	.1633	.1387	-.6994
1.02	.3461	.2371	.0096	.4740	-.5122	1.52	.4357	.1257	.1647	.1317	-.6942
1.03	.3485	.2347	.0143	.4688	-.5257	1.53	.4370	.1238	.1660	.1248	-.6888
1.04	.3508	.2323	.0190	.4635	-.5389	1.54	.4382	.1219	.1672	.1180	-.6831
1.05	.3531	.2299	.0236	.4580	-.5516	1.55	.4394	.1200	.1683	.1111	-.6772
1.06	.3554	.2275	.0281	.4524	-.5639	1.56	.4406	.1182	.1694	.1044	-.6710
1.07	.3577	.2251	.0326	.4467	-.5758	1.57	.4418	.1163	.1704	.0977	-.6646
1.08	.3599	.2227	.0371	.4409	-.5873	1.58	.4430	.1145	.1714	.0911	-.6580
1.09	.3621	.2203	.0414	.4350	-.5984	1.59	.4441	.1127	.1722	.0846	-.6511
1.10	.3643	.2179	.0458	.4290	-.6091	1.60	.4452	.1109	.1730	.0781	-.6441
1.11	.3665	.2155	.0500	.4228	-.6193	1.61	.4463	.1092	.1738	.0717	-.6368
1.12	.3686	.2131	.0542	.4166	-.6292	1.62	.4474	.1074	.1745	.0654	-.6293
1.13	.3708	.2107	.0583	.4102	-.6386	1.63	.4485	.1057	.1751	.0591	-.6216
1.14	.3729	.2083	.0624	.4038	-.6476	1.64	.4495	.1040	.1757	.0529	-.6138
1.15	.3749	.2059	.0664	.3973	-.6561	1.65	.4505	.1023	.1762	.0468	-.6057
1.16	.3770	.2036	.0704	.3907	-.6643	1.66	.4515	.1006	.1766	.0408	-.5975
1.17	.3790	.2012	.0742	.3840	-.6720	1.67	.4525	.0989	.1770	.0349	-.5891
1.18	.3810	.1989	.0780	.3772	-.6792	1.68	.4535	.0973	.1773	.0290	-.5806
1.19	.3830	.1965	.0818	.3704	-.6861	1.69	.4545	.0957	.1776	.0233	-.5720
1.20	.3849	.1942	.0854	.3635	-.6926	1.70	.4554	.0941	.1778	.0176	-.5632
1.21	.3869	.1919	.0890	.3566	-.6986	1.71	.4564	.0925	.1779	.0120	-.5542
1.22	.3888	.1895	.0926	.3496	-.7042	1.72	.4573	.0909	.1780	.0065	-.5462
1.23	.3907	.1872	.0960	.3425	-.7094	1.73	.4582	.0893	.1780	.0011	-.5360
1.24	.3925	.1849	.0994	.3354	-.7141	1.74	.4591	.0878	.1780	-.0042	-.5267
1.25	.3944	.1827	.1027	.3282	-.7185	1.75	.4599	.0863	.1780	-.0094	-.5173
1.26	.3962	.1804	.1060	.3210	-.7224	1.76	.4608	.0848	.1778	-.0146	-.5079
1.27	.3980	.1781	.1092	.3138	-.7259	1.77	.4616	.0833	.1777	-.0196	-.4983
1.28	.3997	.1759	.1123	.3065	-.7291	1.78	.4625	.0818	.1774	-.0245	-.4887
1.29	.4015	.1736	.1153	.2992	-.7318	1.79	.4633	.0804	.1772	-.0294	-.4789
1.30	.4032	.1714	.1182	.2918	-.7341	1.80	.4641	.0790	.1769	-.0341	-.4692
1.31	.4049	.1692	.1211	.2845	-.7361	1.81	.4649	.0775	.1765	-.0388	-.4593
1.32	.4066	.1669	.1239	.2771	-.7376	1.82	.4656	.0761	.1761	-.0433	-.4494
1.33	.4082	.1647	.1267	.2697	-.7388	1.83	.4664	.0748	.1756	-.0477	-.4395
1.34	.4099	.1626	.1293	.2624	-.7395	1.84	.4671	.0734	.1751	-.0521	-.4295
1.35	.4115	.1604	.1319	.2550	-.7399	1.85	.4678	.0721	.1746	-.0563	-.4195
1.36	.4131	.1582	.1344	.2476	-.7400	1.86	.4686	.0707	.1740	-.0605	-.4095
1.37	.4147	.1561	.1369	.2402	-.7396	1.87	.4693	.0694	.1734	-.0645	-.3995
1.38	.4162	.1540	.1392	.2328	-.7389	1.88	.4700	.0681	.1727	-.0685	-.3894
1.39	.4177	.1518	.1415	.2254	-.7378	1.89	.4706	.0669	.1720	-.0723	-.3793
1.40	.4192	.1497	.1437	.2180	-.7364	1.90	.4713	.0656	.1713	-.0761	-.3693
1.41	.4207	.1476	.1459	.2107	-.7347	1.91	.4719	.0644	.1705	-.0797	-.3592
1.42	.4222	.1456	.1480	.2033	-.7326	1.92	.4726	.0632	.1697	-.0832	-.3492
1.43	.4236	.1435	.1500	.1960	-.7301	1.93	.4732	.0620	.1688	-.0867	-.3392
1.44	.4251	.1415	.1519	.1887	-.7274	1.94	.4738	.0608	.1679	-.0900	-.3292
1.45	.4265	.1394	.1537	.1815	-.7243	1.95	.4744	.0596	.1670	-.0933	-.3192
1.46	.4279	.1374	.1555	.1742	-.7209	1.96	.4750	.0584	.1661	-.0964	-.3093
1.47	.4292	.1354	.1572	.1670	-.7172	1.97	.4756	.0573	.1651	-.0994	-.2994
1.48	.4306	.1334	.1588	.1599	-.7132	1.98	.4762	.0562	.1641	-.1024	-.2895
1.49	.4319	.1315	.1604	.1528	-.7089	1.99	.4767	.0551	.1630	-.1052	-.2797
1.50	.4332	.1295	.1619	.1457	-.7043	2.00	.4773	.0540	.1620	-.1080	-.2700

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR (Continued)

<i>t</i>	Area	Ordi- nate	Second deriva- tive	Third deriva- tive	Fourth deriva- tive	<i>t</i>	Area	Ordi- nate	Second deriva- tive	Third deriva- tive	Fourth deriva- tive
2.00	.4773	.0540	.1620	-.1080	-.2700	2.50	.4938	.0175	.0920	-.1424	.0800
2.01	.4778	.0529	.1609	-.1106	-.2603	2.51	.4940	.0171	.0906	-.1416	.0836
2.02	.4783	.0519	.1598	-.1132	-.2506	2.52	.4941	.0167	.0892	-.1408	.0871
2.03	.4788	.0508	.1586	-.1157	-.2411	2.53	.4943	.0163	.0878	-.1399	.0905
2.04	.4793	.0498	.1575	-.1180	-.2316	2.54	.4945	.0159	.0864	-.1389	.0937
2.05	.4798	.0488	.1563	-.1203	-.2222	2.55	.4946	.0155	.0850	-.1380	.0968
2.06	.4803	.0478	.1550	-.1225	-.2129	2.56	.4948	.0151	.0836	-.1370	.0998
2.07	.4808	.0468	.1538	-.1245	-.2036	2.57	.4949	.0147	.0823	-.1360	.1027
2.08	.4812	.0459	.1526	-.1265	-.1945	2.58	.4951	.0143	.0809	-.1350	.1054
2.09	.4817	.0449	.1513	-.1284	-.1854	2.59	.4952	.0139	.0796	-.1339	.1080
2.10	.4821	.0440	.1500	-.1302	-.1765	2.60	.4953	.0136	.0782	-.1328	.1105
2.11	.4826	.0431	.1487	-.1320	-.1676	2.61	.4955	.0132	.0769	-.1317	.1129
2.12	.4830	.0422	.1474	-.1336	-.1588	2.62	.4956	.0129	.0756	-.1305	.1152
2.13	.4834	.0413	.1460	-.1351	-.1502	2.63	.4957	.0126	.0743	-.1294	.1173
2.14	.4838	.0404	.1446	-.1366	-.1416	2.64	.4959	.0122	.0730	-.1282	.1194
2.15	.4842	.0396	.1433	-.1380	-.1332	2.65	.4960	.0119	.0717	-.1270	.1213
2.16	.4846	.0387	.1419	-.1393	-.1249	2.66	.4961	.0116	.0705	-.1258	.1231
2.17	.4850	.0379	.1405	-.1405	-.1167	2.67	.4962	.0113	.0692	-.1245	.1248
2.18	.4854	.0371	.1391	-.1416	-.1086	2.68	.4963	.0110	.0680	-.1233	.1264
2.19	.4857	.0363	.1377	-.1426	-.1006	2.69	.4964	.0107	.0668	-.1220	.1279
2.20	.4861	.0355	.1362	-.1436	-.0927	2.70	.4965	.0104	.0656	-.1207	.1293
2.21	.4865	.0347	.1348	-.1445	-.0850	2.71	.4966	.0101	.0644	-.1194	.1306
2.22	.4868	.0339	.1333	-.1453	-.0774	2.72	.4967	.0099	.0632	-.1181	.1317
2.23	.4871	.0332	.1319	-.1460	-.0700	2.73	.4968	.0096	.0620	-.1168	.1328
2.24	.4875	.0325	.1304	-.1467	-.0626	2.74	.4969	.0094	.0608	-.1154	.1338
2.25	.4878	.0317	.1289	-.1473	-.0554	2.75	.4970	.0091	.0597	-.1141	.1347
2.26	.4881	.0310	.1275	-.1478	-.0484	2.76	.4971	.0089	.0585	-.1127	.1356
2.27	.4884	.0303	.1260	-.1483	-.0414	2.77	.4972	.0086	.0574	-.1114	.1363
2.28	.4887	.0297	.1245	-.1486	-.0346	2.78	.4973	.0084	.0563	-.1100	.1369
2.29	.4890	.0290	.1230	-.1490	-.0279	2.79	.4974	.0081	.0552	-.1087	.1375
2.30	.4893	.0283	.1215	-.1492	-.0214	2.80	.4974	.0079	.0541	-.1073	.1379
2.31	.4896	.0277	.1200	-.1494	-.0150	2.81	.4975	.0077	.0531	-.1059	.1383
2.32	.4898	.0271	.1185	-.1495	-.0088	2.82	.4976	.0075	.0520	-.1045	.1386
2.33	.4901	.0264	.1170	-.1496	-.0027	2.83	.4977	.0073	.0510	-.1031	.1389
2.34	.4904	.0258	.1155	-.1496	.0033	2.84	.4977	.0071	.0500	-.1017	.1390
2.35	.4906	.0252	.1141	-.1495	.0092	2.85	.4978	.0069	.0490	-.1003	.1391
2.36	.4909	.0246	.1126	-.1494	.0149	2.86	.4979	.0067	.0480	-.0990	.1391
2.37	.4911	.0241	.1111	-.1492	.0204	2.87	.4980	.0065	.0470	-.0976	.1391
2.38	.4913	.0235	.1096	-.1490	.0258	2.88	.4980	.0063	.0460	-.0962	.1389
2.39	.4916	.0229	.1081	-.1487	.0311	2.89	.4981	.0061	.0451	-.0948	.1388
2.40	.4918	.0224	.1066	-.1483	.0362	2.90	.4981	.0060	.0441	-.0934	.1385
2.41	.4920	.0219	.1051	-.1480	.0412	2.91	.4982	.0058	.0432	-.0920	.1382
2.42	.4922	.0213	.1036	-.1475	.0461	2.92	.4983	.0056	.0423	-.0906	.1378
2.43	.4925	.0208	.1022	-.1470	.0508	2.93	.4983	.0055	.0414	-.0893	.1374
2.44	.4927	.0203	.1007	-.1465	.0554	2.94	.4984	.0053	.0405	-.0879	.1369
2.45	.4929	.0198	.0992	-.1459	.0598	2.95	.4984	.0051	.0396	-.0865	.1364
2.46	.4931	.0194	.0978	-.1453	.0641	2.96	.4985	.0050	.0388	-.0852	.1358
2.47	.4932	.0189	.0963	-.1446	.0683	2.97	.4985	.0049	.0379	-.0838	.1352
2.48	.4934	.0184	.0949	-.1439	.0723	2.98	.4986	.0047	.0371	-.0825	.1345
2.49	.4936	.0180	.0935	-.1432	.0762	2.99	.4986	.0046	.0363	-.0811	.1337
2.50	.4938	.0175	.0920	-.1424	.0800	3.00	.4987	.0044	.0355	-.0798	.1330

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR (Continued)

<i>t</i>	Area	Ordi- nate	Second deriva- tive	Third deriva- tive	Fourth deriva- tive	<i>t</i>	Area	Ordi- nate	Second deriva- tive	Third deriva- tive	Fourth deriva- tive
3.00	.4987	.0044	.0355	-.0798	.1330	3.50	.4998	.0009	.0098	-.0283	.0694
3.01	.4987	.0043	.0347	-.0785	.1321	3.51	.4998	.0008	.0095	-.0276	.0681
3.02	.4987	.0042	.0339	-.0771	.1313	3.52	.4998	.0008	.0093	-.0269	.0669
3.03	.4988	.0041	.0331	-.0758	.1304	3.53	.4998	.0008	.0090	-.0262	.0656
3.04	.4988	.0039	.0324	-.0745	.1294	3.54	.4998	.0008	.0087	-.0256	.0643
3.05	.4989	.0038	.0316	-.0732	.1285	3.55	.4998	.0007	.0085	-.0249	.0631
3.06	.4989	.0037	.0309	-.0720	.1275	3.56	.4998	.0007	.0082	-.0243	.0618
3.07	.4989	.0036	.0302	-.0707	.1264	3.57	.4998	.0007	.0080	-.0237	.0606
3.08	.4990	.0035	.0295	-.0694	.1254	3.58	.4998	.0007	.0078	-.0231	.0594
3.09	.4990	.0034	.0288	-.0682	.1243	3.59	.4998	.0006	.0075	-.0225	.0582
3.10	.4990	.0033	.0281	-.0669	.1231	3.60	.4998	.0006	.0073	-.0219	.0570
3.11	.4991	.0032	.0275	-.0657	.1220	3.61	.4999	.0006	.0071	-.0214	.0559
3.12	.4991	.0031	.0268	-.0645	.1208	3.62	.4999	.0006	.0069	-.0208	.0547
3.13	.4991	.0030	.0262	-.0633	.1196	3.63	.4999	.0006	.0067	-.0203	.0536
3.14	.4992	.0029	.0256	-.0621	.1184	3.64	.4999	.0005	.0065	-.0198	.0524
3.15	.4992	.0028	.0249	-.0609	.1171	3.65	.4999	.0005	.0063	-.0192	.0513
3.16	.4992	.0027	.0243	-.0598	.1159	3.66	.4999	.0005	.0061	-.0187	.0502
3.17	.4992	.0026	.0237	-.0586	.1146	3.67	.4999	.0005	.0059	-.0182	.0492
3.18	.4993	.0025	.0232	-.0575	.1133	3.68	.4999	.0005	.0057	-.0177	.0481
3.19	.4993	.0025	.0226	-.0564	.1120	3.69	.4999	.0004	.0056	-.0173	.0470
3.20	.4993	.0024	.0220	-.0552	.1107	3.70	.4999	.0004	.0054	-.0168	.0460
3.21	.4993	.0023	.0215	-.0541	.1093	3.71	.4999	.0004	.0052	-.0164	.0450
3.22	.4994	.0022	.0210	-.0531	.1080	3.72	.4999	.0004	.0051	-.0159	.0440
3.23	.4994	.0022	.0204	-.0520	.1066	3.73	.4999	.0004	.0049	-.0155	.0430
3.24	.4994	.0021	.0199	-.0509	.1053	3.74	.4999	.0004	.0048	-.0150	.0420
3.25	.4994	.0020	.0194	-.0499	.1039	3.75	.4999	.0004	.0046	-.0146	.0410
3.26	.4994	.0020	.0189	-.0488	.1025	3.76	.4999	.0003	.0045	-.0142	.0401
3.27	.4995	.0019	.0184	-.0478	.1011	3.77	.4999	.0003	.0043	-.0138	.0392
3.28	.4995	.0018	.0180	-.0468	.0997	3.78	.4999	.0003	.0042	-.0134	.0382
3.29	.4995	.0018	.0175	-.0458	.0983	3.79	.4999	.0003	.0041	-.0131	.0373
3.30	.4995	.0017	.0170	-.0449	.0969	3.80	.4999	.0003	.0039	-.0127	.0365
3.31	.4995	.0017	.0166	-.0439	.0955	3.81	.4999	.0003	.0038	-.0123	.0356
3.32	.4996	.0016	.0162	-.0429	.0941	3.82	.4999	.0003	.0037	-.0120	.0347
3.33	.4996	.0016	.0157	-.0420	.0927	3.83	.4999	.0003	.0036	-.0116	.0339
3.34	.4996	.0015	.0153	-.0411	.0913	3.84	.4999	.0003	.0034	-.0113	.0331
3.35	.4996	.0015	.0149	-.0402	.0899	3.85	.4999	.0002	.0033	-.0110	.0323
3.36	.4996	.0014	.0145	-.0393	.0885	3.86	.4999	.0002	.0032	-.0107	.0315
3.37	.4996	.0014	.0141	-.0384	.0871	3.87	.5000	.0002	.0031	-.0104	.0307
3.38	.4996	.0013	.0138	-.0376	.0857	3.88	.5000	.0002	.0030	-.0100	.0299
3.39	.4997	.0013	.0134	-.0367	.0843	3.89	.5000	.0002	.0029	-.0098	.0292
3.40	.4997	.0012	.0130	-.0359	.0829	3.90	.5000	.0002	.0028	-.0095	.0284
3.41	.4997	.0012	.0127	-.0350	.0815	3.91	.5000	.0002	.0027	-.0092	.0277
3.42	.4937	.0012	.0123	-.0342	.0801	3.92	.5000	.0002	.0026	-.0089	.0270
3.43	.4997	.0011	.0120	-.0334	.0788	3.93	.5000	.0002	.0026	-.0086	.0263
3.44	.4997	.0011	.0116	-.0327	.0774	3.94	.5000	.0002	.0025	-.0084	.0256
3.45	.4997	.0010	.0113	-.0319	.0761	3.95	.5000	.0002	.0024	-.0081	.0250
3.46	.4997	.0010	.0110	-.0311	.0747	3.96	.5000	.0002	.0023	-.0079	.0243
3.47	.4997	.0010	.0107	-.0304	.0734	3.97	.5000	.0002	.0022	-.0076	.0237
3.48	.4998	.0009	.0104	-.0297	.0721	3.98	.5000	.0001	.0022	-.0074	.0230
3.49	.4998	.0009	.0101	-.0290	.0707	3.99	.5000	.0001	.0021	-.0072	.0224
3.50	.4998	.0009	.0098	-.0283	.0694	4.00	.5000	.0001	.0020	-.0070	.0218

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR (Continued)

<i>t</i>	Area	Ordi- nate	Second deriva- tive	Third deriva- tive	Fourth deriva- tive	<i>t</i>	Area	Ordi- nate	Second deriva- tive	Third deriva- tive	Fourth deriva- tive
4.00	.5000	.0001	.0020	-.0070	.0218	4.50	.5000	.0000	.0003	-.0012	.0047
4.01	.5000	.0001	.0019	-.0067	.0212	4.51	.5000	.0000	.0003	-.0012	.0045
4.02	.5000	.0001	.0019	-.0065	.0207	4.52	.5000	.0000	.0003	-.0012	.0044
4.03	.5000	.0001	.0018	-.0063	.0201	4.53	.5000	.0000	.0003	-.0011	.0042
4.04	.5000	.0001	.0018	-.0061	.0195	4.54	.5000	.0000	.0003	-.0011	.0041
4.05	.5000	.0001	.0017	-.0059	.0190	4.55	.5000	.0000	.0003	-.0010	.0039
4.06	.5000	.0001	.0016	-.0058	.0185	4.56	.5000	.0000	.0002	-.0010	.0038
4.07	.5000	.0001	.0016	-.0056	.0180	4.57	.5000	.0000	.0002	-.0010	.0037
4.08	.5000	.0001	.0015	-.0054	.0175	4.58	.5000	.0000	.0002	-.0009	.0035
4.09	.5000	.0001	.0015	-.0052	.0170	4.59	.5000	.0000	.0002	-.0009	.0034
4.10	.5000	.0001	.0014	-.0051	.0165	4.60	.5000	.0000	.0002	-.0009	.0033
4.11	.5000	.0001	.0014	-.0049	.0160	4.61	.5000	.0000	.0002	-.0008	.0032
4.12	.5000	.0001	.0013	-.0047	.0156	4.62	.5000	.0000	.0002	-.0008	.0031
4.13	.5000	.0001	.0013	-.0046	.0151	4.63	.5000	.0000	.0002	-.0008	.0030
4.14	.5000	.0001	.0012	-.0044	.0147	4.64	.5000	.0000	.0002	-.0007	.0028
4.15	.5000	.0001	.0012	-.0043	.0143	4.65	.5000	.0000	.0002	-.0007	.0027
4.16	.5000	.0001	.0011	-.0042	.0138	4.66	.5000	.0000	.0002	-.0007	.0026
4.17	.5000	.0001	.0011	-.0040	.0134	4.67	.5000	.0000	.0002	-.0006	.0026
4.18	.5000	.0001	.0011	-.0039	.0130	4.68	.5000	.0000	.0002	-.0006	.0025
4.19	.5000	.0001	.0010	-.0038	.0127	4.69	.5000	.0000	.0001	-.0006	.0024
4.20	.5000	.0001	.0010	-.0036	.0123	4.70	.5000	.0000	.0001	-.0006	.0023
4.21	.5000	.0001	.0009	-.0035	.0119	4.71	.5000	.0000	.0001	-.0006	.0022
4.22	.5000	.0001	.0009	-.0034	.0116	4.72	.5000	.0000	.0001	-.0005	.0021
4.23	.5000	.0001	.0009	-.0033	.0112	4.73	.5000	.0000	.0001	-.0005	.0020
4.24	.5000	.0001	.0009	-.0032	.0109	4.74	.5000	.0000	.0001	-.0005	.0020
4.25	.5000	.0001	.0008	-.0031	.0105	4.75	.5000	.0000	.0001	-.0005	.0019
4.26	.5000	.0001	.0008	-.0030	.0102	4.76	.5000	.0000	.0001	-.0005	.0018
4.27	.5000	.0000	.0008	-.0029	.0099	4.77	.5000	.0000	.0001	-.0004	.0018
4.28	.5000	.0000	.0007	-.0028	.0096	4.78	.5000	.0000	.0001	-.0004	.0017
4.29	.5000	.0000	.0007	-.0027	.0093	4.79	.5000	.0000	.0001	-.0004	.0016
4.30	.5000	.0000	.0007	-.0026	.0090	4.80	.5000	.0000	.0001	-.0004	.0016
4.31	.5000	.0000	.0007	-.0025	.0087	4.81	.5000	.0000	.0001	-.0004	.0015
4.32	.5000	.0000	.0006	-.0024	.0085	4.82	.5000	.0000	.0001	-.0004	.0015
4.33	.5000	.0000	.0006	-.0023	.0082	4.83	.5000	.0000	.0001	-.0003	.0014
4.34	.5000	.0000	.0006	-.0022	.0079	4.84	.5000	.0000	.0001	-.0003	.0013
4.35	.5000	.0000	.0006	-.0022	.0077	4.85	.5000	.0000	.0001	-.0003	.0013
4.36	.5000	.0000	.0005	-.0021	.0074	4.86	.5000	.0000	.0001	-.0003	.0012
4.37	.5000	.0000	.0005	-.0020	.0072	4.87	.5000	.0000	.0001	-.0003	.0012
4.38	.5000	.0000	.0005	-.0019	.0070	4.88	.5000	.0000	.0001	-.0003	.0012
4.39	.5000	.0000	.0005	-.0019	.0067	4.89	.5000	.0000	.0001	-.0003	.0011
4.40	.5000	.0000	.0005	-.0018	.0065	4.90	.5000	.0000	.0001	-.0003	.0011
4.41	.5000	.0000	.0004	-.0017	.0063	4.91	.5000	.0000	.0001	-.0002	.0010
4.42	.5000	.0000	.0004	-.0017	.0061	4.92	.5000	.0000	.0001	-.0002	.0010
4.43	.5000	.0000	.0004	-.0016	.0059	4.93	.5000	.0000	.0001	-.0002	.0009
4.44	.5000	.0000	.0004	-.0016	.0057	4.94	.5000	.0000	.0001	-.0002	.0009
4.45	.5000	.0000	.0004	-.0015	.0055	4.95	.5000	.0000	.0000	-.0002	.0009
4.46	.5000	.0000	.0004	-.0014	.0053	4.96	.5000	.0000	.0000	-.0002	.0008
4.47	.5000	.0000	.0004	-.0014	.0052	4.97	.5000	.0000	.0000	-.0002	.0008
4.48	.5000	.0000	.0003	-.0013	.0050	4.98	.5000	.0000	.0000	-.0002	.0008
4.49	.5000	.0000	.0003	-.0013	.0048	4.99	.5000	.0000	.0000	-.0002	.0007
4.50	.5000	.0000	.0003	-.0012	.0047						

COMPLETE ELLIPTIC INTEGRALS

$$K = \int_0^{\pi/2} \frac{d\phi}{\sqrt{1 - k^2 \sin^2 \phi}} \quad E = \int_0^{\pi/2} \sqrt{1 - k^2 \sin^2 \phi} \cdot d\phi.$$

$\sin^{-1} k$	K	$\log K$	$\sin^{-1} k$	K	$\log K$
0°	1.5708	0.196120	40°	1.7868	0.252068
1	1.5709	0.196153	41	1.7992	0.255085
2	1.5713	0.196252	42	1.8122	0.258197
3	1.5719	0.196418	43	1.8256	0.261406
4	1.5727	0.196649	44	1.8396	0.264716
5	1.5738	0.196947	45	1.8541	0.268127
6	1.5751	0.197312	46	1.8691	0.271644
7	1.5767	0.197743	47	1.8848	0.275267
8	1.5785	0.198241	48	1.9011	0.279001
9	1.5805	0.198806	49	1.9180	0.282848
10	1.5828	0.199438	50	1.9356	0.286811
11	1.5854	0.200137	51	1.9539	0.290895
12	1.5882	0.200904	52	1.9729	0.295101
13	1.5913	0.201740	53	1.9927	0.299435
14	1.5946	0.202643	54	2.0133	0.303901
15	1.5981	0.203615	55	2.0347	0.308504
16	1.6020	0.204657	56	2.0571	0.313247
17	1.6061	0.205768	57	2.0804	0.318138
18	1.6105	0.206948	58	2.1047	0.323182
19	1.6151	0.208200	59	2.1300	0.328384
20	1.6200	0.209522	60	2.1565	0.333753
21	1.6252	0.210916	61	2.1842	0.339295
22	1.6307	0.212382	62	2.2132	0.345020
23	1.6365	0.213921	63	2.2435	0.350936
24	1.6426	0.215533	64	2.2754	0.357053
25	1.6490	0.217219	65	2.3088	0.363384
26	1.6557	0.218981	66	2.3439	0.369940
27	1.6627	0.220818	67	2.3809	0.376736
28	1.6701	0.222732	68	2.4198	0.383787
29	1.6777	0.224723	69	2.4610	0.391112
30	1.6858	0.226793	70	2.5046	0.398730
31	1.6941	0.228943	71	2.5507	0.406665
32	1.7028	0.231173	72	2.5998	0.414943
33	1.7119	0.233485	73	2.6521	0.423596
34	1.7214	0.235880	74	2.7081	0.432660
35	1.7312	0.238359	75	2.7681	0.442176
36	1.7415	0.240923	76	2.8327	0.452196
37	1.7522	0.243575	77	2.9026	0.462782
38	1.7633	0.246315	78	2.9786	0.474008
39	1.7748	0.249146	79	3.0617	0.485967
40	1.7868	0.252068	80	3.1534	0.498777

COMPLETE ELLIPTIC INTEGRALS (Continued)

$\sin^{-1} k$	K	$\log K$	$\sin^{-1} k$	K	$\log K$
80°	3.1534	0.498777	85°	3.8317	0.583396
81	3.2553	0.512591	86	4.0528	0.607751
82	3.3699	0.527613	87	4.3387	0.637355
83	3.5004	0.544120	88	4.7427	0.676027
84	3.6519	0.562514	89	5.4349	0.735192
85	3.8317	0.583396	90	∞	∞

Values of K for $\sin^{-1} k = 85^\circ$ to 89° by 0.1° and 89° to 90° by minutes.

$\sin^{-1} k$	K	$\log K$	$\sin^{-1} k$	K	$\log K$
85.0°	3.832	0.58343	89° 0'	5.435	0.73520
85.1	3.852	0.58569	89 2	5.469	0.73791
85.2	3.872	0.58794	89 4	5.504	0.74068
85.3	3.893	0.59028	89 6	5.540	0.74351
85.4	3.914	0.59262	89 8	5.578	0.74648
85.5	3.936	0.59506	89 10	5.617	0.74950
85.6	3.958	0.59748	89 12	5.658	0.75266
85.7	3.981	0.59999	89 14	5.700	0.75587
85.8	4.004	0.60249	89 16	5.745	0.75929
85.9	4.028	0.60509	89 18	5.791	0.76275
86.0	4.053	0.60778	89 20	5.840	0.76641
86.1	4.078	0.61045	89 22	5.891	0.77019
86.2	4.104	0.61321	89 24	5.946	0.77422
86.3	4.130	0.61595	89 26	6.003	0.77837
86.4	4.157	0.61872	89 28	6.063	0.78269
86.5	4.185	0.62170	89 30	6.128	0.78732
86.6	4.214	0.62469	89 32	6.197	0.79218
86.7	4.244	0.62778	89 34	6.271	0.79734
86.8	4.274	0.63083	89 36	6.351	0.80284
86.9	4.306	0.63407	89 38	6.438	0.80875
87.0	4.339	0.63739	89 40	6.533	0.81511
87.1	4.372	0.64068	89 41	6.584	0.81849
87.2	4.407	0.64414	89 42	6.639	0.82210
87.3	4.444	0.64777	89 43	6.696	0.82582
87.4	4.481	0.65137	89 44	6.756	0.82969
87.5	4.520	0.65514	89 45	6.821	0.83385
87.6	4.562	0.65916	89 46	6.890	0.83822
87.7	4.603	0.66304	89 47	6.964	0.84286
87.8	4.648	0.66727	89 48	7.044	0.84782
87.9	4.694	0.67154	89 49	7.131	0.85315
88.0	4.743	0.67605	89 50	7.226	0.85890
88.1	4.794	0.68070	89 51	7.332	0.86522
88.2	4.848	0.68556	89 52	7.449	0.87210
88.3	4.905	0.69064	89 53	7.583	0.87984
88.4	4.965	0.69592	89 54	7.737	0.88857
88.5	5.030	0.70157	89 55	7.919	0.89867
88.6	5.099	0.70749	89 56	8.143	0.91078
88.7	5.173	0.71374	89 57	8.430	0.92583
88.8	5.253	0.72041	89 58	8.836	0.94626
88.9	5.340	0.72754	89 59	9.529	0.97905
89.0	5.435	0.73520	90 0	∞	∞

COMPLETE ELLIPTIC INTEGRALS (Continued)

$\sin^{-1} k$	E	$\log E$	$\sin^{-1} k$	E	$\log E$
0°	1.5708	0.196120	45°	1.3506	0.130541
1	1.5707	0.196087	46	1.3418	0.127690
2	1.5703	0.195988	47	1.3329	0.124788
3	1.5697	0.195822	48	1.3238	0.121836
4	1.5689	0.195591	49	1.3147	0.118836
5	1.5678	0.195293	50	1.3055	0.115790
6	1.5665	0.194930	51	1.2963	0.112698
7	1.5649	0.194500	52	1.2870	0.109563
8	1.5632	0.194004	53	1.2776	0.106386
9	1.5611	0.193442	54	1.2681	0.103169
10	1.5589	0.192815	55	1.2587	0.099915
11	1.5564	0.192121	56	1.2492	0.096626
12	1.5537	0.191362	57	1.2397	0.093303
13	1.5507	0.190537	58	1.2301	0.089950
14	1.5476	0.189646	59	1.2206	0.086569
15	1.5442	0.188690	60	1.2111	0.083164
16	1.5405	0.187668	61	1.2015	0.079738
17	1.5367	0.186581	62	1.1920	0.076293
18	1.5326	0.185428	63	1.1826	0.072834
19	1.5283	0.184210	64	1.1732	0.069364
20	1.5238	0.182928	65	1.1638	0.065889
21	1.5191	0.181580	66	1.1545	0.062412
22	1.5141	0.180168	67	1.1453	0.058937
23	1.5090	0.178691	68	1.1362	0.055472
24	1.5037	0.177150	69	1.1272	0.052020
25	1.4981	0.175545	70	1.1184	0.048589
26	1.4924	0.173876	71	1.1096	0.045183
27	1.4864	0.172144	72	1.1011	0.041812
28	1.4803	0.170348	73	1.0927	0.038481
29	1.4740	0.168489	74	1.0844	0.035200
30	1.4675	0.166567	75	1.0764	0.031976
31	1.4608	0.164583	76	1.0686	0.028819
32	1.4539	0.162537	77	1.0611	0.025740
33	1.4469	0.160429	78	1.0538	0.022749
34	1.4397	0.158261	79	1.0468	0.019858
35	1.4323	0.156031	80	1.0401	0.017081
36	1.4248	0.153742	81	1.0338	0.014432
37	1.4171	0.151393	82	1.0278	0.011927
38	1.4092	0.148985	83	1.0223	0.009584
39	1.4013	0.146519	84	1.0172	0.007422
40	1.3931	0.143995	85	1.0127	0.005465
41	1.3849	0.141414	86	1.0086	0.003740
42	1.3765	0.138778	87	1.0053	0.002278
43	1.3680	0.136086	88	1.0026	0.001121
44	1.3594	0.133340	89	1.0008	0.000326
45	1.3506	0.130541	90	1.0000	0.000000

FACTORS AND PRIMES

If n is prime the mantissa of its logarithm is given.

n	0	1	2	3	4
0	.....	0000000	3015300	4771213	2^2
1	$2 \cdot 5$	0413927	$2^2 \cdot 3$	1139434	$2 \cdot 7$
2	$2^2 \cdot 5$	$3 \cdot 7$	$2 \cdot 11$	3617278	$2^3 \cdot 3$
3	$2 \cdot 3 \cdot 5$	4913617	2^5	$3 \cdot 11$	$2 \cdot 17$
4	$2^3 \cdot 5$	6127839	$2 \cdot 3 \cdot 7$	6334685	$2^2 \cdot 11$
5	$2 \cdot 5^2$	$3 \cdot 17$	$2^2 \cdot 13$	7242759	$2 \cdot 3^3$
6	$2^2 \cdot 3 \cdot 5$	7853298	$2 \cdot 31$	$3^2 \cdot 7$	2^6
7	$2 \cdot 5 \cdot 7$	8512583	$2^3 \cdot 3^2$	8633229	$2 \cdot 37$
8	$2^4 \cdot 5$	3^4	$2 \cdot 41$	9190781	$2^2 \cdot 3 \cdot 7$
9	$2 \cdot 3^2 \cdot 5$	$7 \cdot 13$	$2^2 \cdot 23$	$3 \cdot 31$	$2 \cdot 47$
10	$2^2 \cdot 5^2$	0043214	$2 \cdot 3 \cdot 17$	0128372	$2^3 \cdot 13$
11	$2 \cdot 5 \cdot 11$	$3 \cdot 37$	$2^4 \cdot 7$	0530784	$2 \cdot 3 \cdot 19$
12	$2^3 \cdot 3 \cdot 5$	11^2	$2 \cdot 61$	$3 \cdot 41$	$2^2 \cdot 31$
13	$2 \cdot 5 \cdot 13$	1172713	$2^2 \cdot 3 \cdot 11$	$7 \cdot 19$	$2 \cdot 67$
14	$2^2 \cdot 5 \cdot 7$	$3 \cdot 47$	$2 \cdot 71$	$11 \cdot 13$	$2^4 \cdot 3^2$
15	$2 \cdot 3 \cdot 5^2$	1789769	$2^3 \cdot 19$	$3^2 \cdot 17$	$2 \cdot 7 \cdot 11$
16	$2^5 \cdot 5$	$7 \cdot 23$	$2 \cdot 3^4$	2121876	$2^2 \cdot 41$
17	$2 \cdot 5 \cdot 17$	$3^2 \cdot 19$	$2^2 \cdot 43$	2380461	$2 \cdot 3 \cdot 29$
18	$2^2 \cdot 3^2 \cdot 5$	2576786	$2 \cdot 7 \cdot 13$	$3 \cdot 61$	$2^3 \cdot 23$
19	$2 \cdot 5 \cdot 19$	2810334	$2^6 \cdot 3$	2855573	$2 \cdot 97$
20	$2^3 \cdot 5^2$	$3 \cdot 67$	$2 \cdot 101$	$7 \cdot 29$	$2^2 \cdot 3 \cdot 17$
21	$2 \cdot 3 \cdot 5 \cdot 7$	3242825	$2^2 \cdot 53$	$3 \cdot 71$	$2 \cdot 107$
22	$2^2 \cdot 5 \cdot 11$	$13 \cdot 17$	$2 \cdot 3 \cdot 37$	3483049	$2^5 \cdot 7$
23	$2 \cdot 5 \cdot 23$	$3 \cdot 7 \cdot 11$	$2^3 \cdot 29$	3673559	$2 \cdot 3^2 \cdot 13$
24	$2^4 \cdot 3 \cdot 5$	3820170	$2 \cdot 11^2$	3^5	$2^2 \cdot 61$
25	$2 \cdot 5^3$	3996737	$2^2 \cdot 3^2 \cdot 7$	$11 \cdot 23$	$2 \cdot 127$
26	$2^2 \cdot 5 \cdot 13$	$3^2 \cdot 29$	$2 \cdot 131$	4199557	$2^3 \cdot 3 \cdot 11$
27	$2 \cdot 3^3 \cdot 5$	4329693	$2^4 \cdot 17$	$3 \cdot 7 \cdot 13$	$2 \cdot 137$
28	$2^3 \cdot 5 \cdot 7$	4487063	$2 \cdot 3 \cdot 47$	4517864	$2^2 \cdot 71$
29	$2 \cdot 5 \cdot 29$	$3 \cdot 97$	$2^2 \cdot 73$	4668676	$2 \cdot 3 \cdot 7^2$
30	$2^2 \cdot 3 \cdot 5^2$	$7 \cdot 43$	$2 \cdot 151$	$3 \cdot 101$	$2^4 \cdot 19$
31	$2 \cdot 5 \cdot 31$	4927604	$2^3 \cdot 3 \cdot 13$	4955443	$2 \cdot 157$
32	$2^6 \cdot 5$	$3 \cdot 107$	$2 \cdot 7 \cdot 23$	$17 \cdot 19$	$2^2 \cdot 3^4$
33	$2 \cdot 3 \cdot 5 \cdot 11$	5198280	$2^2 \cdot 83$	$3^2 \cdot 37$	$2 \cdot 167$
34	$2^2 \cdot 5 \cdot 17$	$11 \cdot 31$	$2 \cdot 3^2 \cdot 19$	7^3	$2^3 \cdot 43$
35	$2 \cdot 5^2 \cdot 7$	$3^3 \cdot 13$	$2^5 \cdot 11$	5477747	$2 \cdot 3 \cdot 59$
36	$2^3 \cdot 3^2 \cdot 5$	19^2	$2 \cdot 181$	$3 \cdot 11^2$	$2^2 \cdot 7 \cdot 13$
37	$2 \cdot 5 \cdot 37$	$7 \cdot 53$	$2^2 \cdot 3 \cdot 31$	5717088	$2 \cdot 11 \cdot 17$
38	$2^2 \cdot 5 \cdot 19$	$3 \cdot 127$	$2 \cdot 191$	5831988	$2^7 \cdot 3$
39	$2 \cdot 3 \cdot 5 \cdot 13$	$17 \cdot 23$	$2^3 \cdot 7^2$	$3 \cdot 131$	$2 \cdot 197$
40	$2^4 \cdot 5^2$	6031444	$2 \cdot 3 \cdot 67$	$13 \cdot 31$	$2^2 \cdot 101$
41	$2 \cdot 5 \cdot 41$	$3 \cdot 137$	$2^2 \cdot 103$	$7 \cdot 59$	$2 \cdot 3^2 \cdot 23$
42	$2^2 \cdot 3 \cdot 5 \cdot 7$	6242821	$2 \cdot 211$	$3^2 \cdot 47$	$2^3 \cdot 53$
43	$2 \cdot 5 \cdot 43$	6344773	$2^4 \cdot 3^3$	6364879	$2 \cdot 7 \cdot 31$
44	$2^3 \cdot 5 \cdot 11$	$3^2 \cdot 7^2$	$2 \cdot 13 \cdot 17$	6464037	$2^2 \cdot 3 \cdot 37$
45	$2 \cdot 3^2 \cdot 5^2$	$11 \cdot 41$	$2^2 \cdot 113$	$3 \cdot 151$	$2 \cdot 227$
46	$2^2 \cdot 5 \cdot 23$	6637009	$2 \cdot 3 \cdot 7 \cdot 11$	6655810	$2^4 \cdot 29$
47	$2 \cdot 5 \cdot 47$	$3 \cdot 157$	$2^3 \cdot 59$	$11 \cdot 43$	$2 \cdot 3 \cdot 79$
48	$2^5 \cdot 3 \cdot 5$	$13 \cdot 37$	$2 \cdot 241$	$3 \cdot 7 \cdot 23$	$2^2 \cdot 11^2$
49	$2 \cdot 5 \cdot 7^2$	6910815	$2^2 \cdot 3 \cdot 41$	$17 \cdot 29$	$2 \cdot 13 \cdot 19$
50	$2^2 \cdot 5^3$	$3 \cdot 167$	$2 \cdot 251$	7015680	$2^3 \cdot 3^2 \cdot 7$

FACTORS AND PRIMES (Continued)

If n is not prime its prime factors are given.

n	5	6	7	8	9
0	6989700	2 · 3	8450980	2 ³	3 ²
1	3 · 5	2 ¹¹	2304489	2 · 3 ²	2787536
2	5 ²	2 · 13	3 ³	2 ² · 7	4623980
3	5 · 7	2 ² · 3 ²	5682017	2 · 19	3 · 13
4	3 ² · 5	2 · 23	6720979	2 ⁴ · 3	7 ²
5	5 · 11	2 ³ · 7	8 · 19	2 · 29	7708520
6	5 · 13	2 · 3 · 11	8260748	2 ² · 17	3 · 23
7	3 · 5 ²	2 ² · 19	7 · 11	2 · 3 · 13	8976271
8	5 · 17	2 · 43	3 · 29	2 ³ · 11	9493900
9	5 · 19	2 ⁵ · 3	9867717	2 · 7 ²	3 ² · 11
10	3 · 5 · 7	2 · 53	0293838	2 ² · 3 ³	0374265
11	5 · 23	2 ² · 29	3 ² · 13	2 · 59	7 · 17
12	5 ³	2 · 3 ² · 7	1038037	2 ⁷	3 · 43
13	3 ³ · 5	2 ³ · 17	1367206	2 · 3 · 23	1430148
14	5 · 29	2 · 73	3 · 7 ²	2 ² · 37	1731863
15	5 · 31	2 ² · 3 · 13	1958997	2 · 79	3 · 53
16	3 · 5 · 11	2 · 83	2227165	2 ³ · 3 · 7	13 ²
17	5 ² · 7	2 ⁴ · 11	3 · 59	2 · 89	2528530
18	5 · 37	2 · 3 · 31	11 · 17	2 ² · 47	3 ³ · 7
19	3 · 5 · 13	2 ² · 7 ²	2944662	2 · 3 ² · 11	2988531
20	5 · 41	2 · 103	3 ² · 23	2 ⁴ · 13	11 · 19
21	5 · 43	2 ³ · 3 ³	7 · 31	2 · 109	3 · 73
22	3 ² · 5 ²	2 · 113	3560259	2 ² · 3 · 19	3598355
23	5 · 47	2 ² · 59	3 · 79	2 · 7 · 17	3783979
24	5 · 7 ²	2 · 3 · 41	13 · 19	2 ³ · 31	3 · 83
25	3 · 5 · 17	2 ⁸	4099331	2 · 3 · 43	7 · 37
26	5 · 53	2 · 7 · 19	3 · 89	2 ² · 67	4297523
27	5 ² · 11	2 ² · 3 · 23	4424798	2 · 139	3 ² · 31
28	3 · 5 · 19	2 · 11 · 13	7 · 41	2 ⁵ · 3 ²	17 ²
29	5 · 59	2 ³ · 37	3 ³ · 11	2 · 149	13 · 23
30	5 · 61	2 · 3 ² · 17	4871384	2 ² · 7 · 11	3 · 103
31	3 ² · 5 · 7	2 ² · 79	5010593	2 · 3 · 53	11 · 29
32	5 ² · 13	2 · 163	3 · 109	2 ³ · 41	7 · 47
33	5 · 67	2 ⁴ · 3 · 7	5276299	2 · 13 ²	3 · 113
34	3 · 5 · 23	2 · 173	5403295	2 ² · 3 · 29	5428254
35	5 · 71	2 ² · 89	3 · 7 · 17	2 · 179	5550944
36	5 · 73	2 · 3 · 61	5646661	2 ⁴ · 23	3 ² · 41
37	3 · 5 ³	2 ³ · 47	13 · 29	2 · 3 ³ · 7	5786392
38	5 · 7 · 11	2 · 193	3 ² · 43	2 ² · 97	5899496
39	5 · 79	2 ² · 3 ² · 11	5987905	2 · 199	3 · 7 · 19
40	3 ⁴ · 5	2 · 7 · 29	11 · 37	2 ³ · 3 · 17	6117233
41	5 · 83	2 ⁵ · 13	3 · 139	2 · 11 · 19	6222140
42	5 ² · 17	2 · 3 · 71	7 · 61	2 ² · 107	3 · 11 · 13
43	3 · 5 · 29	2 ² · 109	19 · 23	2 · 3 · 73	6424645
44	5 · 89	2 · 223	3 · 149	2 ⁶ · 7	6522463
45	5 · 7 · 13	2 ³ · 3 · 19	6599162	2 · 229	3 ³ · 17
46	3 · 5 · 31	2 · 233	6693169	2 ² · 3 ² · 13	7 · 67
47	5 ² · 19	2 ² · 7 · 17	3 ² · 53	2 · 239	6803355
48	5 · 97	2 · 3 ⁵	6875290	2 ³ · 61	3 · 163
49	3 ² · 5 · 11	2 ⁴ · 31	7 · 71	2 · 3 · 83	6981005
50	5 · 101	2 · 11 · 23	3 · 13 ²	2 ² · 127	7067178

FACTORS AND PRIMES (Continued)

n	0	1	2	3	4
50	$2^2 \cdot 5^3$	$3 \cdot 167$	$2 \cdot 251$	7015680	$2^3 \cdot 3^2 \cdot 7$
51	$2 \cdot 3 \cdot 5 \cdot 17$	$7 \cdot 73$	2^9	$3^3 \cdot 19$	$2 \cdot 257$
52	$2^3 \cdot 5 \cdot 13$	7168377	$2 \cdot 3^2 \cdot 29$	7185017	$2^2 \cdot 131$
53	$2 \cdot 5 \cdot 53$	$3^2 \cdot 59$	$2^2 \cdot 7 \cdot 19$	$13 \cdot 41$	$2 \cdot 3 \cdot 89$
54	$2^2 \cdot 3^3 \cdot 5$	7331973	$2 \cdot 271$	$3 \cdot 181$	$2^5 \cdot 17$
55	$2 \cdot 5^2 \cdot 11$	$19 \cdot 29$	$2^3 \cdot 3 \cdot 23$	$7 \cdot 79$	$2 \cdot 277$
56	$2^4 \cdot 5 \cdot 7$	$3 \cdot 11 \cdot 17$	$2 \cdot 281$	7505084	$2^2 \cdot 3 \cdot 47$
57	$2 \cdot 3 \cdot 5 \cdot 19$	7566361	$2^2 \cdot 11 \cdot 13$	$3 \cdot 191$	$2 \cdot 7 \cdot 41$
58	$2^2 \cdot 5 \cdot 29$	$7 \cdot 83$	$2 \cdot 3 \cdot 97$	$11 \cdot 53$	$2^3 \cdot 73$
59	$2 \cdot 5 \cdot 59$	$3 \cdot 197$	$2^4 \cdot 37$	7730547	$2 \cdot 3^3 \cdot 11$
60	$2^3 \cdot 3 \cdot 5^2$	7788745	$2 \cdot 7 \cdot 43$	$3^2 \cdot 67$	$2^2 \cdot 151$
61	$2 \cdot 5 \cdot 61$	$13 \cdot 47$	$2^2 \cdot 3^2 \cdot 17$	7874605	$2 \cdot 307$
62	$2^2 \cdot 5 \cdot 31$	$3^3 \cdot 23$	$2 \cdot 311$	$7 \cdot 89$	$2^4 \cdot 3 \cdot 13$
63	$2 \cdot 3^2 \cdot 5 \cdot 7$	8000294	$2^3 \cdot 79$	$3 \cdot 211$	$2 \cdot 317$
64	$2^7 \cdot 5$	8068580	$2 \cdot 3 \cdot 107$	8082110	$2^2 \cdot 7 \cdot 23$
65	$2 \cdot 5^2 \cdot 13$	$3 \cdot 7 \cdot 31$	$2^2 \cdot 163$	8149132	$2 \cdot 3 \cdot 109$
66	$2^2 \cdot 3 \cdot 5 \cdot 11$	8202015	$2 \cdot 331$	$3 \cdot 13 \cdot 17$	$2^3 \cdot 83$
67	$2 \cdot 5 \cdot 67$	$11 \cdot 61$	$2^5 \cdot 3 \cdot 7$	8280151	$2 \cdot 337$
68	$2^3 \cdot 5 \cdot 17$	$3 \cdot 227$	$2 \cdot 11 \cdot 31$	8344207	$2^2 \cdot 3^2 \cdot 19$
69	$2 \cdot 3 \cdot 5 \cdot 23$	8394780	$2^2 \cdot 173$	$3^2 \cdot 7 \cdot 11$	$2 \cdot 347$
70	$2^2 \cdot 5^2 \cdot 7$	8457180	$2 \cdot 3^3 \cdot 13$	$19 \cdot 37$	$2^6 \cdot 11$
71	$2 \cdot 5 \cdot 71$	$3^2 \cdot 79$	$2^3 \cdot 89$	$23 \cdot 31$	$2 \cdot 3 \cdot 7 \cdot 17$
72	$2^4 \cdot 3^2 \cdot 5$	$7 \cdot 103$	$2 \cdot 19^2$	$3 \cdot 241$	$2^2 \cdot 181$
73	$2 \cdot 5 \cdot 73$	$17 \cdot 43$	$2^2 \cdot 3 \cdot 61$	8651040	$2 \cdot 367$
74	$2^2 \cdot 5 \cdot 37$	$3 \cdot 13 \cdot 19$	$2 \cdot 7 \cdot 53$	8709888	$2^3 \cdot 3 \cdot 31$
75	$2 \cdot 3 \cdot 5^3$	8756399	$2^4 \cdot 47$	$3 \cdot 251$	$2 \cdot 13 \cdot 29$
76	$2^3 \cdot 5 \cdot 19$	8813847	$2 \cdot 3 \cdot 127$	$7 \cdot 109$	$2^2 \cdot 191$
77	$2 \cdot 5 \cdot 7 \cdot 11$	$3 \cdot 257$	$2^2 \cdot 193$	8881795	$2 \cdot 3^2 \cdot 43$
78	$2^2 \cdot 3 \cdot 5 \cdot 13$	$11 \cdot 71$	$2 \cdot 17 \cdot 23$	$3^3 \cdot 29$	$2^4 \cdot 7^2$
79	$2 \cdot 5 \cdot 79$	$7 \cdot 113$	$2^3 \cdot 3^2 \cdot 11$	$13 \cdot 61$	$2 \cdot 397$
80	$2^5 \cdot 5^2$	$3^2 \cdot 89$	$2 \cdot 401$	$11 \cdot 73$	$2^2 \cdot 3 \cdot 67$
81	$2 \cdot 3^4 \cdot 5$	9090209	$2^2 \cdot 7 \cdot 29$	$3 \cdot 271$	$2 \cdot 11 \cdot 37$
82	$2^2 \cdot 5 \cdot 41$	9143432	$2 \cdot 3 \cdot 137$	9153998	$2^3 \cdot 103$
83	$2 \cdot 5 \cdot 83$	$3 \cdot 277$	$2^6 \cdot 13$	$7^2 \cdot 17$	$2 \cdot 3 \cdot 139$
84	$2^3 \cdot 3 \cdot 5 \cdot 7$	29^2	$2 \cdot 421$	$3 \cdot 281$	$2^2 \cdot 211$
85	$2 \cdot 5^2 \cdot 17$	$23 \cdot 37$	$2^2 \cdot 3 \cdot 71$	9309490	$2 \cdot 7 \cdot 61$
86	$2^2 \cdot 5 \cdot 43$	$3 \cdot 7 \cdot 41$	$2 \cdot 431$	9360108	$2^5 \cdot 3^3$
87	$2 \cdot 3 \cdot 5 \cdot 29$	$13 \cdot 67$	$2^3 \cdot 109$	$3^2 \cdot 97$	$2 \cdot 19 \cdot 23$
88	$2^4 \cdot 5 \cdot 11$	9449759	$2 \cdot 3^2 \cdot 7^2$	9459607	$2^2 \cdot 13 \cdot 17$
89	$2 \cdot 5 \cdot 89$	$3^4 \cdot 11$	$2^2 \cdot 223$	$19 \cdot 47$	$2 \cdot 3 \cdot 149$
90	$2^2 \cdot 3^2 \cdot 5^2$	$17 \cdot 53$	$2 \cdot 11 \cdot 41$	$3 \cdot 7 \cdot 43$	$2^3 \cdot 113$
91	$2 \cdot 5 \cdot 7 \cdot 13$	9595184	$2^4 \cdot 3 \cdot 19$	$11 \cdot 83$	$2 \cdot 457$
92	$2^3 \cdot 5 \cdot 23$	$3 \cdot 307$	$2 \cdot 461$	$13 \cdot 71$	$2^2 \cdot 3 \cdot 7 \cdot 11$
93	$2 \cdot 3 \cdot 5 \cdot 31$	$7^2 \cdot 19$	$2^2 \cdot 233$	$3 \cdot 311$	$2 \cdot 467$
94	$2^2 \cdot 5 \cdot 47$	9735896	$2 \cdot 3 \cdot 157$	$23 \cdot 41$	$2^4 \cdot 59$
95	$2 \cdot 5^2 \cdot 19$	$3 \cdot 317$	$2^3 \cdot 7 \cdot 17$	9790929	$2 \cdot 3^2 \cdot 53$
96	$2^6 \cdot 3 \cdot 5$	31^2	$2 \cdot 13 \cdot 37$	$3^2 \cdot 107$	$2^2 \cdot 241$
97	$2 \cdot 5 \cdot 97$	9872192	$2^2 \cdot 3^5$	$7 \cdot 139$	$2 \cdot 487$
98	$2^2 \cdot 5 \cdot 7^2$	$3^2 \cdot 109$	$2 \cdot 491$	9925535	$2^3 \cdot 3 \cdot 41$
99	$2 \cdot 3^2 \cdot 5 \cdot 11$	9960737	$2^5 \cdot 31$	$3 \cdot 331$	$2 \cdot 7 \cdot 71$
100	$2^3 \cdot 5^3$	$7 \cdot 11 \cdot 13$	$2 \cdot 3 \cdot 167$	$17 \cdot 59$	$2^2 \cdot 251$

FACTORS AND PRIMES (Continued)

n	5	6	7	8	9
50	5 · 101	2 · 11 · 23	3 · 13 ²	2 ² · 127	7067178
51	5 · 103	2 ² · 3 · 43	11 · 47	2 · 7 · 37	3 · 173
52	3 · 5 ² · 7	2 · 263	17 · 31	2 ⁴ · 3 · 11	23 ²
53	5 · 107	2 ³ · 67	3 · 179	2 · 269	7 ² · 11
54	5 · 109	2 · 3 · 7 · 13	7379873	2 ² · 137	3 ² · 61
55	3 · 5 · 37	2 ² · 139	7458552	2 · 3 ² · 31	13 · 43
56	5 · 113	2 · 283	3 ⁴ · 7	2 ³ · 71	7551123
57	5 ² · 23	2 ⁶ · 3 ²	7611758	2 · 17 ²	3 · 193
58	3 ² · 5 · 13	2 · 293	7686381	2 ² · 3 · 7 ²	19 · 31
59	5 · 7 · 17	2 ² · 149	3 · 199	2 · 13 · 23	7774268
60	5 · 11 ²	2 · 3 · 101	7831887	2 ⁵ · 19	3 · 7 · 29
61	3 · 5 · 41	2 ³ · 7 · 11	7902852	2 · 3 · 103	7916905
62	5 ⁴	2 · 313	3 · 11 · 19	2 ² · 157	17 · 37
63	5 · 127	2 ² · 3 · 53	7 ² · 13	2 · 11 · 29	3 ² · 71
64	3 · 5 · 43	2 · 17 · 19	8109043	2 ³ · 3 ⁴	11 · 59
65	5 · 131	2 ⁴ · 41	3 ² · 73	2 · 7 · 47	8188854
66	5 · 7 · 19	2 · 3 ² · 37	23 · 29	2 ² · 167	3 · 223
67	3 ³ · 5 ²	2 ² · 13 ²	8305887	2 · 3 · 113	7 · 97
68	5 · 137	2 · 7 ³	3 · 229	2 ⁴ · 43	13 · 53
69	5 · 139	2 ³ · 3 · 29	17 · 41	2 · 349	3 · 233
70	3 · 5 · 47	2 · 353	7 · 101	2 ² · 3 · 59	8506462
71	5 · 11 · 13	2 ² · 179	3 · 239	2 · 359	8567289
72	5 ² · 29	2 · 3 · 11 ²	8615344	2 ³ · 7 · 13	3 ⁶
73	3 · 5 · 7 ²	2 ⁵ · 23	11 · 67	2 · 3 ² · 41	8686444
74	5 · 149	2 · 373	3 ² · 83	2 ² · 11 · 17	7 · 107
75	5 · 151	2 ² · 3 ³ · 7	8790959	2 · 379	3 · 11 · 23
76	3 ² · 5 · 17	2 · 383	13 · 59	2 ⁸ · 3	8859263
77	5 ² · 31	2 ³ · 97	3 · 7 · 37	2 · 389	19 · 41
78	5 · 157	2 · 3 · 131	8959747	2 ² · 197	3 · 263
79	3 · 5 · 53	2 ² · 199	9014583	2 · 3 · 7 · 19	17 · 47
80	5 · 7 · 23	2 · 13 · 31	3 · 269	2 ³ · 101	9079485
81	5 · 163	2 ⁴ · 3 · 17	19 · 43	2 · 409	3 ² · 7 · 13
82	3 · 5 ² · 11	2 · 7 · 59	9175055	2 ² · 3 ² · 23	9185545
83	5 · 167	2 ² · 11 · 19	3 ³ · 31	2 · 419	9237620
84	5 · 13 ²	2 · 3 ² · 47	7 · 11 ²	2 ⁴ · 53	3 · 283
85	3 ² · 5 · 19	2 ³ · 107	9329808	2 · 3 · 11 · 13	9339932
86	5 · 173	2 · 433	3 · 17 ²	2 ² · 7 · 31	11 · 79
87	5 ³ · 7	2 ² · 3 · 73	9429095	2 · 439	3 · 293
88	3 · 5 · 59	2 · 443	9479236	2 ³ · 3 · 37	7 · 127
89	5 · 179	2 ⁷ · 7	3 · 13 · 23	2 · 449	29 · 31
90	5 · 181	2 · 3 · 151	9576073	2 ² · 227	3 ² · 101
91	3 · 5 · 61	2 ³ · 229	7 · 131	2 · 3 ³ · 17	9633155
92	5 ² · 37	2 · 463	3 ² · 103	2 ⁵ · 29	9680157
93	5 · 11 · 17	2 ³ · 3 ² · 13	9717396	2 · 7 · 67	3 · 313
94	3 ³ · 5 · 7	2 · 11 · 43	9763500	2 ² · 3 · 79	13 · 73
95	5 · 191	2 ² · 239	3 · 11 · 29	2 · 479	7 · 137
96	5 · 193	2 · 3 · 7 · 23	9854265	2 ³ · 11 ²	3 · 17 · 19
97	3 · 5 ² · 13	2 ⁴ · 61	9899940	2 · 3 · 163	11 · 89
98	5 · 197	2 · 17 · 29	3 · 7 · 47	2 ² · 13 · 19	23 · 43
99	5 · 199	2 ² · 3 · 83	9959952	2 · 499	3 ³ · 37
100	3 · 5 · 67	2 · 503	19 · 53	2 ⁴ · 3 ² · 7	0038912

FACTORS AND PRIMES (Continued)

<i>n</i>	0	1	2	3	4
100	$2^3 \cdot 5^3$	$7 \cdot 11 \cdot 13$	$2 \cdot 3 \cdot 167$	$17 \cdot 59$	$2^2 \cdot 251$
101	$2 \cdot 5 \cdot 101$	$3 \cdot 337$	$2^2 \cdot 11 \cdot 23$	0056094	$2 \cdot 3 \cdot 13^2$
102	$2^2 \cdot 3 \cdot 5 \cdot 17$	0090257	$2 \cdot 7 \cdot 73$	$3 \cdot 11 \cdot 31$	2^{10}
103	$2 \cdot 5 \cdot 103$	0132587	$2^3 \cdot 3 \cdot 43$	0141003	$2 \cdot 11 \cdot 47$
104	$2^4 \cdot 5 \cdot 13$	$3 \cdot 347$	$2 \cdot 521$	$7 \cdot 149$	$2^2 \cdot 3^2 \cdot 29$
105	$2 \cdot 3 \cdot 5^2 \cdot 7$	0216027	$2^2 \cdot 263$	$3^4 \cdot 13$	$2 \cdot 17 \cdot 31$
106	$2^2 \cdot 5 \cdot 53$	0257154	$2 \cdot 3^2 \cdot 59$	0265333	$2^3 \cdot 7 \cdot 19$
107	$2 \cdot 5 \cdot 107$	$3^2 \cdot 7 \cdot 17$	$2^4 \cdot 67$	$29 \cdot 37$	$2 \cdot 3 \cdot 179$
108	$2^3 \cdot 3^3 \cdot 5$	$23 \cdot 47$	$2 \cdot 541$	$3 \cdot 19^2$	$2^2 \cdot 271$
109	$2 \cdot 5 \cdot 109$	0378248	$2^2 \cdot 3 \cdot 7 \cdot 13$	0386202	$2 \cdot 547$
110	$2^2 \cdot 5^2 \cdot 11$	$3 \cdot 367$	$2 \cdot 19 \cdot 29$	0425755	$2^4 \cdot 3 \cdot 23$
111	$2 \cdot 3 \cdot 5 \cdot 37$	$11 \cdot 101$	$2^3 \cdot 139$	$3 \cdot 7 \cdot 53$	$2 \cdot 557$
112	$2^6 \cdot 5 \cdot 7$	$19 \cdot 59$	$2 \cdot 3 \cdot 11 \cdot 17$	0503798	$2^2 \cdot 281$
113	$2 \cdot 5 \cdot 113$	$3 \cdot 13 \cdot 29$	$2^2 \cdot 283$	$11 \cdot 103$	$2 \cdot 3^4 \cdot 7$
114	$2^2 \cdot 3 \cdot 5 \cdot 19$	$7 \cdot 163$	$2 \cdot 571$	$3^2 \cdot 127$	$2^3 \cdot 11 \cdot 13$
115	$2 \cdot 5^2 \cdot 23$	0610753	$27 \cdot 3^2$	0618293	$2 \cdot 577$
116	$2^3 \cdot 5 \cdot 29$	$3^3 \cdot 43$	$2 \cdot 7 \cdot 83$	0655797	$2^2 \cdot 3 \cdot 97$
117	$2 \cdot 3^2 \cdot 5 \cdot 13$	0685569	$2^2 \cdot 293$	$3 \cdot 17 \cdot 23$	$2 \cdot 587$
118	$2^2 \cdot 5 \cdot 59$	0722499	$2 \cdot 3 \cdot 197$	$7 \cdot 13^2$	$2^5 \cdot 37$
119	$2 \cdot 5 \cdot 7 \cdot 17$	$3 \cdot 397$	$2^3 \cdot 149$	0766404	$2 \cdot 3 \cdot 199$
120	$2^4 \cdot 3 \cdot 5^2$	0795430	$2 \cdot 601$	$3 \cdot 401$	$2^2 \cdot 7 \cdot 43$
121	$2 \cdot 5 \cdot 11^2$	$7 \cdot 173$	$2^2 \cdot 3 \cdot 101$	0838608	$2 \cdot 607$
122	$2^2 \cdot 5 \cdot 61$	$3 \cdot 11 \cdot 37$	$2 \cdot 13 \cdot 47$	0874265	$2^3 \cdot 3^2 \cdot 17$
123	$2 \cdot 3 \cdot 5 \cdot 41$	0902581	$2^4 \cdot 7 \cdot 11$	$3^2 \cdot 137$	$2 \cdot 617$
124	$2^3 \cdot 5 \cdot 31$	$17 \cdot 73$	$2 \cdot 3^3 \cdot 23$	$11 \cdot 113$	$2^2 \cdot 311$
125	$2 \cdot 5^4$	$3^2 \cdot 139$	$2^2 \cdot 313$	$7 \cdot 179$	$2 \cdot 3 \cdot 11 \cdot 19$
126	$2^2 \cdot 3^2 \cdot 5 \cdot 7$	$13 \cdot 97$	$2 \cdot 631$	$3 \cdot 421$	$2^4 \cdot 79$
127	$2 \cdot 5 \cdot 127$	$31 \cdot 41$	$2^3 \cdot 3 \cdot 53$	$19 \cdot 67$	$2 \cdot 7^2 \cdot 13$
128	$2^8 \cdot 5$	$3 \cdot 7 \cdot 61$	$2 \cdot 641$	1082267	$2^2 \cdot 3 \cdot 107$
129	$2 \cdot 3 \cdot 5 \cdot 43$	1109262	$2^2 \cdot 17 \cdot 19$	$3 \cdot 431$	$2 \cdot 647$
130	$2^2 \cdot 5^2 \cdot 13$	1142773	$2 \cdot 3 \cdot 7 \cdot 31$	1149444	$2^3 \cdot 163$
131	$2 \cdot 5 \cdot 131$	$3 \cdot 19 \cdot 23$	$2^5 \cdot 41$	$13 \cdot 101$	$2 \cdot 3^2 \cdot 73$
132	$2^3 \cdot 3 \cdot 5 \cdot 11$	1209038	$2 \cdot 661$	$3^3 \cdot 7^2$	$2^2 \cdot 331$
133	$2 \cdot 5 \cdot 7 \cdot 19$	11^3	$2^2 \cdot 3^2 \cdot 37$	$31 \cdot 43$	$2 \cdot 23 \cdot 29$
134	$2^2 \cdot 5 \cdot 67$	$3^2 \cdot 149$	$2 \cdot 11 \cdot 61$	$17 \cdot 79$	$2^6 \cdot 3 \cdot 7$
135	$2 \cdot 3^3 \cdot 5^2$	$7 \cdot 193$	$2^3 \cdot 13^2$	$3 \cdot 11 \cdot 41$	$2 \cdot 677$
136	$2^4 \cdot 5 \cdot 17$	1338581	$2 \cdot 3 \cdot 227$	$29 \cdot 47$	$2^2 \cdot 11 \cdot 31$
137	$2 \cdot 5 \cdot 137$	$3 \cdot 457$	$2^2 \cdot 7^3$	1376705	$2 \cdot 3 \cdot 229$
138	$2^2 \cdot 3 \cdot 5 \cdot 23$	1401937	$2 \cdot 691$	$3 \cdot 461$	$2^3 \cdot 173$
139	$2 \cdot 5 \cdot 139$	$13 \cdot 107$	$2^4 \cdot 3 \cdot 29$	$7 \cdot 199$	$2 \cdot 17 \cdot 41$
140	$2^3 \cdot 5^2 \cdot 7$	$3 \cdot 467$	$2 \cdot 701$	$23 \cdot 61$	$2^2 \cdot 3^3 \cdot 13$
141	$2 \cdot 3 \cdot 5 \cdot 47$	$17 \cdot 83$	$2^2 \cdot 353$	$3^2 \cdot 157$	$2 \cdot 7 \cdot 101$
142	$2^2 \cdot 5 \cdot 71$	$7^2 \cdot 29$	$2 \cdot 3^2 \cdot 79$	1532049	$2^4 \cdot 89$
143	$2 \cdot 5 \cdot 11 \cdot 13$	$3^3 \cdot 53$	$2^3 \cdot 179$	1562462	$2 \cdot 3 \cdot 239$
144	$2^6 \cdot 3^2 \cdot 5$	$11 \cdot 131$	$2 \cdot 7 \cdot 103$	$3 \cdot 13 \cdot 37$	$2^2 \cdot 19^2$
145	$2 \cdot 5^2 \cdot 29$	1616674	$2^2 \cdot 3 \cdot 11^2$	1622656	$2 \cdot 727$
146	$2^2 \cdot 5 \cdot 73$	$3 \cdot 487$	$2 \cdot 17 \cdot 43$	$7 \cdot 11 \cdot 19$	$2^3 \cdot 3 \cdot 61$
147	$2 \cdot 3 \cdot 5 \cdot 7^2$	1676127	$2^4 \cdot 23$	$3 \cdot 491$	$2 \cdot 11 \cdot 67$
148	$2^3 \cdot 5 \cdot 37$	1705551	$2 \cdot 3 \cdot 13 \cdot 19$	1711412	$2^2 \cdot 7 \cdot 53$
149	$2 \cdot 5 \cdot 149$	$3 \cdot 7 \cdot 71$	$2^3 \cdot 373$	1740598	$2 \cdot 3^2 \cdot 83$
150	$2^2 \cdot 3 \cdot 5^3$	$19 \cdot 79$	$2 \cdot 751$	$3^2 \cdot 167$	$2^5 \cdot 47$

FACTORS AND PRIMES (Continued)

<i>n</i>	5	6	7	8	9
100	3 · 5 · 67	2 · 503	19 · 53	2 ⁴ · 3 ² · 7	0038912
101	5 · 7 · 29	2 ³ · 127	3 ² · 113	2 · 509	0081742
102	5 ² · 41	2 · 3 ³ · 19	13 · 79	2 ² · 257	3 · 7 ³
103	3 ² · 5 · 23	2 ² · 7 · 37	17 · 61	2 · 3 · 173	0166155
104	5 · 11 · 19	2 · 523	3 · 349	2 ³ · 131	0207755
105	5 · 211	2 ⁵ · 3 · 11	7 · 151	2 · 23 ²	3 · 353
106	3 · 5 · 71	2 · 13 · 41	11 · 97	2 ² · 3 · 89	0289777
107	5 ² · 43	2 ² · 269	3 · 359	2 · 7 ² · 11	13 · 83
108	5 · 7 · 31	2 · 3 · 181	0362295	2 ⁶ · 17	3 ² · 11 ²
109	3 · 5 · 73	2 ³ · 137	0402066	2 · 3 ² · 61	7 · 157
110	5 · 13 · 17	2 · 7 · 79	3 ³ · 41	2 ² · 277	0449315
111	5 · 223	2 ² · 3 ² · 31	0480532	2 · 13 · 43	3 · 373
112	3 ² · 5 ³	2 · 563	7 ² · 23	2 ³ · 3 · 47	0526939
113	5 · 227	2 ⁴ · 71	3 · 379	2 · 569	17 · 67
114	5 · 229	2 · 3 · 191	31 · 37	2 ² · 7 · 41	3 · 383
115	3 · 5 · 7 · 11	2 ² · 17 ²	13 · 89	2 · 3 · 193	19 · 61
116	5 · 233	2 · 11 · 53	3 · 389	2 ⁴ · 73	7 · 167
117	5 ² · 47	2 ³ · 3 · 7 ²	11 · 107	2 · 19 · 31	3 ² · 131
118	3 · 5 · 79	2 · 593	0744507	2 ² · 3 ³ · 11	29 · 41
119	5 · 239	2 ² · 13 · 23	3 ² · 7 · 19	2 · 599	11 · 109
120	5 · 241	2 · 3 ² · 67	17 · 71	2 ³ · 151	3 · 13 · 31
121	3 ⁵ · 5	2 ⁶ · 19	0852906	2 · 3 · 7 · 29	23 · 53
122	5 ² · 7 ²	2 · 613	3 · 409	2 ² · 307	0895519
123	5 · 13 · 19	2 ² · 3 · 103	0923697	2 · 619	3 · 7 · 59
124	3 · 5 · 83	2 · 7 · 89	29 · 43	2 ⁵ · 3 · 13	0965624
125	5 · 251	2 ³ · 157	3 · 419	2 · 17 · 37	1000257
126	5 · 11 · 23	2 · 3 · 211	7 · 181	2 ² · 317	3 ³ · 47
127	3 · 5 ² · 17	2 ² · 11 · 29	1061909	2 · 3 ² · 71	1068705
128	5 · 257	2 · 643	3 ² · 11 · 13	2 ³ · 7 · 23	1102529
129	5 · 7 · 37	2 ⁴ · 3 ⁴	1129400	2 · 11 · 59	3 · 433
130	3 ² · 5 · 29	2 · 653	1162756	2 ² · 3 · 109	7 · 11 · 17
131	5 · 263	2 ² · 7 · 47	3 · 439	2 · 659	1202448
132	5 ² · 53	2 · 3 · 13 · 17	1228709	2 ⁴ · 83	3 · 443
133	3 · 5 · 89	2 ³ · 167	7 · 191	2 · 3 · 223	13 · 103
134	5 · 269	2 · 673	3 · 449	2 ² · 337	19 · 71
135	5 · 271	2 ² · 3 · 113	23 · 59	2 · 7 · 97	3 ² · 151
136	3 · 5 · 7 · 13	2 · 683	1357685	2 ³ · 3 ² · 19	37 ²
137	5 ³ · 11	2 ⁵ · 43	3 ⁴ · 17	2 · 13 · 53	7 · 197
138	5 · 277	2 · 3 ² · 7 · 11	19 · 73	2 ² · 347	3 · 463
139	3 ² · 5 · 31	2 ² · 349	11 · 127	2 · 3 · 233	1458177
140	5 · 281	2 · 19 · 37	3 · 7 · 67	2 ⁷ · 11	1489110
141	5 · 283	2 ³ · 3 · 59	13 · 109	2 · 709	3 · 11 · 43
142	3 · 5 ² · 19	2 · 23 · 31	1544240	2 ² · 3 · 7 · 17	1550322
143	5 · 7 · 41	2 ² · 359	3 · 479	2 · 719	1580005
144	5 · 17 ²	2 · 3 · 241	1604685	2 ³ · 181	3 ² · 7 · 23
145	3 · 5 · 97	2 ⁴ · 7 · 13	31 · 47	2 · 3 ⁴	1640553
146	5 · 293	2 · 733	3 ² · 163	2 ² · 367	13 · 113
147	5 ² · 59	2 ² · 3 ² · 41	7 · 211	2 · 739	3 · 17 · 29
148	3 ³ · 5 · 11	2 · 743	1723110	2 ⁴ · 3 · 31	1728947
149	5 · 13 · 23	2 ³ · 11 · 17	3 · 499	2 · 7 · 107	1758016
150	5 · 7 · 43	2 · 3 · 251	11 · 137	2 ² · 13 · 29	3 · 503

FACTORS AND PRIMES (Continued)

n	0	1	2	3	4
150	$2^2 \cdot 3 \cdot 5^3$	19 · 79	2 · 751	$3^2 \cdot 167$	$2^5 \cdot 47$
151	$2 \cdot 5 \cdot 151$	1792645	$2^3 \cdot 3^3 \cdot 7$	17 · 89	2 · 757
152	$2^4 \cdot 5 \cdot 19$	$3^2 \cdot 13^2$	2 · 761	1826999	$2^2 \cdot 3 \cdot 127$
153	$2 \cdot 3^2 \cdot 5 \cdot 17$	1849752	$2^2 \cdot 383$	$3 \cdot 7 \cdot 73$	$2 \cdot 13 \cdot 59$
154	$2^2 \cdot 5 \cdot 7 \cdot 11$	23 · 67	$2 \cdot 3 \cdot 257$	1883659	$2^3 \cdot 193$
155	$2 \cdot 5^2 \cdot 31$	$3 \cdot 11 \cdot 47$	$2^4 \cdot 97$	1911715	$2 \cdot 3 \cdot 7 \cdot 37$
156	$2^3 \cdot 3 \cdot 5 \cdot 13$	7 · 223	$2 \cdot 11 \cdot 71$	3 · 521	$2^2 \cdot 17 \cdot 23$
157	$2 \cdot 5 \cdot 157$	1961762	$2^2 \cdot 3 \cdot 131$	$11^2 \cdot 13$	2 · 787
158	$2^2 \cdot 5 \cdot 79$	$3 \cdot 17 \cdot 31$	$2 \cdot 7 \cdot 113$	1994809	$2^4 \cdot 3^2 \cdot 11$
159	$2 \cdot 3 \cdot 5 \cdot 53$	37 · 43	$2^3 \cdot 199$	$3^3 \cdot 59$	2 · 797
160	$2^6 \cdot 5^2$	2043913	$2 \cdot 3^2 \cdot 89$	7 · 229	$2^2 \cdot 401$
161	$2 \cdot 5 \cdot 7 \cdot 23$	$3^2 \cdot 179$	$2^2 \cdot 13 \cdot 31$	2076344	$2 \cdot 3 \cdot 269$
162	$2^2 \cdot 3^4 \cdot 5$	2097830	2 · 811	3 · 541	$2^3 \cdot 7 \cdot 29$
163	$2 \cdot 5 \cdot 163$	7 · 233	$2^5 \cdot 3 \cdot 17$	23 · 71	$2 \cdot 19 \cdot 43$
164	$2^3 \cdot 5 \cdot 41$	3 · 547	$2 \cdot 821$	31 · 53	$2^2 \cdot 3 \cdot 137$
165	$2 \cdot 3 \cdot 5 \cdot 11$	13 · 127	$2^2 \cdot 7 \cdot 59$	$3 \cdot 19 \cdot 29$	2 · 827
166	$2^2 \cdot 5 \cdot 83$	11 · 151	$2 \cdot 3 \cdot 277$	2208922	$2^7 \cdot 13$
167	$2 \cdot 5 \cdot 167$	3 · 557	$2^3 \cdot 11 \cdot 19$	7 · 239	$2 \cdot 3^3 \cdot 31$
168	$2^4 \cdot 3 \cdot 5 \cdot 7$	41^2	$2 \cdot 29^2$	$3^2 \cdot 11 \cdot 17$	$2^2 \cdot 421$
169	$2 \cdot 5 \cdot 13^2$	19 · 89	$2^2 \cdot 3^2 \cdot 47$	2286570	$2 \cdot 7 \cdot 11^2$
170	$2^2 \cdot 5^2 \cdot 17$	$3^5 \cdot 7$	$2 \cdot 23 \cdot 37$	13 · 131	$2^3 \cdot 3 \cdot 71$
171	$2 \cdot 3^2 \cdot 5 \cdot 19$	29 · 59	$2^4 \cdot 107$	3 · 571	2 · 857
172	$2^3 \cdot 5 \cdot 43$	2357809	$2 \cdot 3 \cdot 7 \cdot 41$	2362853	$2^2 \cdot 431$
173	$2 \cdot 5 \cdot 173$	3 · 577	$2^2 \cdot 433$	2387986	$2 \cdot 3 \cdot 17^2$
174	$2^2 \cdot 3 \cdot 5 \cdot 29$	2407988	$2 \cdot 13 \cdot 67$	$3 \cdot 7 \cdot 83$	$2^4 \cdot 109$
175	$2 \cdot 5^3 \cdot 7$	17 · 103	$2^3 \cdot 3 \cdot 73$	2437819	2 · 877
176	$2^5 \cdot 5 \cdot 11$	3 · 587	2 · 881	41 · 43	$2^2 \cdot 3^2 \cdot 7^2$
177	$2 \cdot 3 \cdot 5 \cdot 59$	$7 \cdot 11 \cdot 23$	$2^2 \cdot 443$	$3^2 \cdot 197$	2 · 887
178	$2^2 \cdot 5 \cdot 89$	13 · 137	$2 \cdot 3^4 \cdot 11$	2511513	$2^3 \cdot 223$
179	$2 \cdot 5 \cdot 179$	$3^2 \cdot 199$	$2^8 \cdot 7$	11 · 163	$2 \cdot 3 \cdot 13 \cdot 23$
180	$2^3 \cdot 3^2 \cdot 5^2$	2555137	$2 \cdot 17 \cdot 53$	3 · 601	$2^2 \cdot 11 \cdot 41$
181	$2 \cdot 5 \cdot 181$	2579185	$2^2 \cdot 3 \cdot 151$	$7^2 \cdot 37$	2 · 907
182	$2^2 \cdot 5 \cdot 7 \cdot 13$	3 · 607	2 · 911	2607867	$2^5 \cdot 3 \cdot 19$
183	$2 \cdot 3 \cdot 5 \cdot 61$	2626883	$2^3 \cdot 229$	$3 \cdot 13 \cdot 47$	$2 \cdot 7 \cdot 131$
184	$2^4 \cdot 5 \cdot 23$	7 · 263	$2 \cdot 3 \cdot 307$	19 · 97	$2^2 \cdot 461$
185	$2 \cdot 5^2 \cdot 37$	3 · 617	$2^2 \cdot 463$	17 · 109	$2 \cdot 3^2 \cdot 103$
186	$2^2 \cdot 3 \cdot 5 \cdot 31$	2697464	$2 \cdot 7^2 \cdot 19$	$3^4 \cdot 23$	$2^3 \cdot 233$
187	$2 \cdot 5 \cdot 11 \cdot 17$	2720738	$2^4 \cdot 3^2 \cdot 13$	2725378	2 · 937
188	$2^3 \cdot 5 \cdot 47$	$3^2 \cdot 11 \cdot 19$	2 · 941	7 · 269	$2^2 \cdot 3 \cdot 157$
189	$2 \cdot 3^3 \cdot 5 \cdot 7$	31 · 61	$2^2 \cdot 11 \cdot 43$	3 · 631	2 · 947
190	$2^2 \cdot 5^2 \cdot 19$	2789821	$2 \cdot 3 \cdot 317$	11 · 173	$2^4 \cdot 7 \cdot 17$
191	$2 \cdot 5 \cdot 191$	$3 \cdot 7^2 \cdot 13$	$2^3 \cdot 239$	2817150	$2 \cdot 3 \cdot 11 \cdot 29$
192	$2^7 \cdot 3 \cdot 5$	17 · 113	$2 \cdot 31^2$	3 · 641	$2^2 \cdot 13 \cdot 37$
193	$2 \cdot 5 \cdot 193$	2857823	$2^2 \cdot 3 \cdot 7 \cdot 23$	2862319	2 · 967
194	$2^2 \cdot 5 \cdot 97$	3 · 647	$2 \cdot 971$	29 · 67	$2^3 \cdot 3^5$
195	$2 \cdot 3 \cdot 5^2 \cdot 13$	2902573	$2^5 \cdot 61$	$3^2 \cdot 7 \cdot 31$	2 · 977
196	$2^3 \cdot 5 \cdot 7^2$	37 · 53	$2 \cdot 3^2 \cdot 109$	13 · 151	$2^2 \cdot 491$
197	$2 \cdot 5 \cdot 197$	$3^3 \cdot 73$	$2^2 \cdot 17 \cdot 29$	2951271	$2 \cdot 3 \cdot 7 \cdot 47$
198	$2^2 \cdot 3^2 \cdot 5 \cdot 11$	7 · 283	2 · 991	3 · 661	$2^6 \cdot 31$
199	$2 \cdot 5 \cdot 199$	11 · 181	$2^3 \cdot 3 \cdot 83$	2995073	2 · 997
200	$2^4 \cdot 5^3$	$3 \cdot 23 \cdot 29$	$2 \cdot 7 \cdot 11 \cdot 13$	3016809	$2^2 \cdot 3 \cdot 167$

FACTORS AND PRIMES (Continued)

<i>n</i>	5	6	7	8	9
150	5 · 7 · 43	2 · 3 · 251	11 · 137	2 ² · 13 · 29	3 · 503
151	3 · 5 · 101	2 ² · 379	37 · 41	2 · 3 · 11 · 23	7 ² · 31
152	5 ² · 61	2 · 7 · 109	3 · 509	2 ³ · 191	11 · 139
153	5 · 307	2 ⁹ · 3	29 · 53	2 · 769	3 ⁴ · 19
154	3 · 5 · 103	2 · 773	7 · 13 · 17	2 ² · 3 ² · 43	1909511
155	5 · 311	2 ² · 389	3 ² · 173	2 · 19 · 41	1928461
156	5 · 313	2 · 3 ³ · 29	1950690	2 ⁵ · 7 ²	3 · 523
157	3 ² · 5 ² · 7	2 ³ · 197	19 · 83	2 · 3 · 263	1983821
158	5 · 317	2 · 13 · 61	3 · 23 ²	2 ² · 397	7 · 227
159	5 · 11 · 29	2 ² · 3 · 7 · 19	2033049	2 · 17 · 47	3 · 13 · 41
160	3 · 5 · 107	2 · 11 · 73	2060159	2 ³ · 3 · 67	2065600
161	5 · 17 · 19	2 ⁴ · 101	3 · 7 ² · 11	2 · 809	2062409
162	5 ³ · 13	2 · 3 · 271	2113876	2 ² · 11 · 37	3 ² · 181
163	3 · 5 · 109	2 ² · 409	2140487	2 · 3 ² · 7 · 13	11 · 149
164	5 · 7 · 47	2 · 823	3 ³ · 61	2 ⁴ · 103	17 · 97
165	5 · 331	2 ³ · 3 ² · 23	2193225	2 · 829	3 · 7 · 79
166	3 ² · 5 · 37	2 · 7 ² · 17	2219356	2 ² · 3 · 139	2224661
167	5 ² · 67	2 ² · 419	3 · 13 · 43	2 · 839	23 · 73
168	5 · 337	2 · 3 · 281	7 · 241	2 ³ · 211	3 · 563
169	3 · 5 · 113	2 ⁵ · 53	2296818	2 · 3 · 283	2301934
170	5 · 11 · 31	2 · 853	3 · 569	2 ² · 7 · 61	2327421
171	5 · 7 ³	2 ² · 3 · 11 · 13	17 · 101	2 · 859	3 ² · 191
172	3 · 5 ² · 23	2 · 863	11 · 157	2 ⁶ · 3 ³	7 · 13 · 19
173	5 · 347	2 ³ · 7 · 31	3 ² · 193	2 · 11 · 79	37 · 47
174	5 · 349	2 · 3 ² · 97	2422929	2 ² · 19 · 23	3 · 11 · 53
175	3 ³ · 5 · 13	2 ² · 439	7 · 251	2 · 3 · 293	2452658
176	5 · 353	2 · 883	3 · 19 · 31	2 ³ · 13 · 17	29 · 61
177	5 ² · 71	2 ⁴ · 3 · 37	2496874	2 · 7 · 127	3 · 593
178	3 · 5 · 7 · 17	2 · 19 · 47	2521246	2 ² · 3 · 149	2526103
179	5 · 359	2 ² · 449	3 · 599	2 · 29 · 31	7 · 257
180	5 · 19 ²	2 · 3 · 7 · 43	13 · 139	2 ⁴ · 113	3 ³ · 67
181	3 · 5 · 11 ²	2 ³ · 227	23 · 79	2 · 3 ² · 101	17 · 107
182	5 ² · 73	2 · 11 · 83	3 ² · 7 · 29	2 ² · 457	31 · 59
183	5 · 367	2 ² · 3 ³ · 17	11 · 167	2 · 919	3 · 613
184	3 ² · 5 · 41	2 · 13 · 71	2664669	2 ³ · 3 · 7 · 11	43 ²
185	5 · 7 · 53	2 ⁴ · 29	3 · 619	2 · 929	11 · 13 ²
186	5 · 373	2 · 3 · 311	2711443	2 ² · 467	3 · 7 · 89
187	3 · 5 ⁴	2 ² · 7 · 67	2734643	2 · 939	2739268
188	5 · 13 · 29	2 · 23 · 41	3 · 17 · 37	2 ⁵ · 59	2762320
189	5 · 379	2 ³ · 3 · 79	7 · 271	2 · 13 · 73	3 ² · 211
190	3 · 5 · 127	2 · 953	2803507	2 ² · 3 ² · 53	23 · 83
191	5 · 383	2 ² · 479	3 ³ · 71	2 · 7 · 137	19 · 101
192	5 ² · 7 · 11	2 · 3 ² · 107	41 · 47	2 ³ · 241	3 · 643
193	3 ² · 5 · 43	2 ⁴ · 11 ²	13 · 149	2 · 3 · 17 · 19	7 · 277
194	5 · 389	2 · 7 · 139	3 · 11 · 59	2 ² · 487	2898118
195	5 · 17 · 23	2 ² · 3 · 163	19 · 103	2 · 11 · 89	3 · 653
196	3 · 5 · 131	2 · 983	7 · 281	2 ⁴ · 3 · 41	11 · 179
197	5 ² · 79	2 ³ · 13 · 19	3 · 659	2 · 23 · 43	2964458
198	5 · 397	2 · 3 · 331	2981979	2 ² · 7 · 71	3 ² · 13 · 17
199	3 · 5 · 7 · 19	2 ² · 499	3003781	2 · 3 ³ · 37	3005128
200	5 · 401	2 · 17 · 59	3 ² · 223	2 ³ · 251	7 ² · 41

CALCULUS

DIFFERENTIALS

$$d(ax) = adx$$

$$d e^x = e^x dx$$

$$d(u + v) = du + dv$$

$$d e^{ax} = a e^{ax} dx$$

$$d uv = u dv + v du$$

$$d a^x = a^x \log_e a dx$$

$$d \frac{u}{v} = \frac{v du - u dv}{v^2}$$

$$d \log_e x = x^{-1} dx$$

$$d x^n = n x^{n-1} dx$$

$$d \log_a x = x^{-1} \log_a e dx$$

$$d x^y = y x^{y-1} dx + x^y \log_e x dy$$

$$d x^x = x^x (1 + \log_e x) dx$$

$$d \sin x = \cos x dx$$

$$d \operatorname{vers}^{-1} x = (2x - x^2)^{-\frac{1}{2}} dx$$

$$d \cos x = -\sin x dx$$

$$d \sinh x = \cosh x dx$$

$$d \tan x = \sec^2 x dx$$

$$d \cosh x = \sinh x dx$$

$$d \cot x = -\operatorname{csc}^2 x dx$$

$$d \tanh x = \operatorname{sech}^2 x dx$$

$$d \sec x = \tan x \sec x dx$$

$$d \coth x = -\operatorname{csch}^2 x dx$$

$$d \csc x = -\cot x \cdot \csc x dx$$

$$d \operatorname{sech} x = -\operatorname{sech} x \tanh x dx$$

$$d \operatorname{vers} x = \sin x dx$$

$$d \operatorname{csch} x = -\operatorname{csch} x \coth x dx$$

$$d \sin^{-1} x = (1 - x^2)^{-\frac{1}{2}} dx$$

$$d \sinh^{-1} x = (x^2 + 1)^{-\frac{1}{2}} dx$$

$$d \cos^{-1} x = -(1 - x^2)^{-\frac{1}{2}} dx$$

$$d \cosh^{-1} x = (x^2 - 1)^{-\frac{1}{2}} dx$$

$$d \tan^{-1} x = (1 + x^2)^{-1} dx$$

$$d \tanh^{-1} x = (1 - x^2)^{-1} dx$$

$$d \cot^{-1} x = -(1 + x^2)^{-1} dx$$

$$d \coth^{-1} x = -(x^2 - 1)^{-1} dx$$

$$d \sec^{-1} x = x^{-1} (x^2 - 1)^{-\frac{1}{2}} dx$$

$$d \operatorname{sech}^{-1} x = -x^{-1} (1 - x^2)^{-\frac{1}{2}} dx$$

$$d \csc^{-1} x = -x^{-1} (x^2 - 1)^{-\frac{1}{2}} dx$$

$$d \operatorname{csch}^{-1} x = -x^{-1} (x^2 + 1)^{-\frac{1}{2}} dx$$

INTEGRALS

ELEMENTARY FORMS

1. $\int a \, dx = ax.$
2. $\int a \cdot f(x)dx = a \int f(x)dx.$
3. $\int \phi(y)dx = \int \frac{\phi(y)}{y'} \, dy,$ where $y' = dy/dx.$
4. $\int (u + v) \, dx = \int u \, dx + \int v \, dx,$ where u and v are any functions of $x.$
5. $\int u \, dv = uv - \int v \, du.$
6. $\int u \frac{dv}{dx} \, dx = uv - \int v \frac{du}{dx} \, dx.$
7. $\int x^n \, dx = \frac{x^{n+1}}{n+1},$ except $n = -1.$
8. $\int \frac{f'(x) \, dx}{f(x)} = \log f(x),$ $[d f(x) = f'(x) \, dx].$
9. $\int \frac{dx}{x} = \log x, \text{ or } \log (-x).$
10. $\int \frac{f'(x) \, dx}{2 \sqrt{f(x)}} = \sqrt{f(x)},$ $[d f(x) = f'(x) \, dx].$
11. $\int e^x \, dx = e^x.$
12. $\int e^{ax} \, dx = e^{ax}/a.$
13. $\int b^{ax} \, dx = \frac{b^{ax}}{a \log b}.$
14. $\int \log x \, dx = x \log x - x.$
15. $\int a^x \log a \, dx = a^x.$
16. $\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \tan^{-1} \left(\frac{x}{a} \right), \text{ or } -\frac{1}{a} \cot^{-1} \left(\frac{x}{a} \right).$
17. $\int \frac{dx}{a^2 - x^2} = \frac{1}{a} \tanh^{-1} \left(\frac{x}{a} \right), \text{ or } \frac{1}{2a} \log \frac{a+x}{a-x}.$
18. $\int \frac{dx}{x^2 - a^2} = -\frac{1}{a} \coth^{-1} \left(\frac{x}{a} \right), \text{ or } \frac{1}{2a} \log \frac{x-a}{x+a}.$
19. $\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \left(\frac{x}{a} \right), \text{ or } -\cos^{-1} \left(\frac{x}{a} \right).$
20. $\int \frac{dx}{\sqrt{x^2 \pm a^2}} = \log (x + \sqrt{x^2 \pm a^2}).$
21. $\int \frac{dx}{x \sqrt{x^2 - a^2}} = \frac{1}{a} \cos^{-1} \left(\frac{a}{x} \right).$
22. $\int \frac{dx}{x \sqrt{a^2 \pm x^2}} = -\frac{1}{a} \log \left(\frac{a + \sqrt{a^2 \pm x^2}}{x} \right).$

INTEGRALS (Continued)

$$23. \int \frac{dx}{x \sqrt{a+bx}} = \frac{2}{\sqrt{-a}} \tan^{-1} \sqrt{\frac{a+bx}{-a}}, \text{ or } \frac{-2}{\sqrt{a}} \tanh^{-1} \sqrt{\frac{a+bx}{a}}.$$

FORMS CONTAINING $(a+bx)$

$$24. \int (a+bx)^n dx = \frac{(a+bx)^{n+1}}{(n+1)b}, \text{ except } n = -1.$$

$$25. \int x (a+bx)^n dx = \frac{1}{b^2(n+2)} (a+bx)^{n+2} - \frac{a}{b^2(n+1)} (a+bx)^{n+1}, \text{ except } n = -1 \text{ or } -2.$$

$$26. \int x^2 (a+bx)^n dx = \frac{1}{b^3} \left[\frac{(a+bx)^{n+3}}{n+3} - 2a \frac{(a+bx)^{n+2}}{n+2} + a^2 \frac{(a+bx)^{n+1}}{n+1} \right].$$

$$27. \int x^m (a+bx)^n dx = \frac{x^{m+1} (a+bx)^n}{m+n+1} + \frac{an}{m+n+1} \int x^m (a+bx)^{n-1} dx.$$

$$28. \int \frac{dx}{a+bx} = \frac{1}{b} \log (a+bx).$$

$$29. \int \frac{dx}{(a+bx)^2} = -\frac{1}{b(a+bx)}.$$

$$30. \int \frac{dx}{(a+bx)^3} = -\frac{1}{2b(a+bx)^2}.$$

$$31. \int \frac{xdx}{a+bx} = \frac{1}{b^2} [a+bx - a \log (a+bx)].$$

$$32. \int \frac{xdx}{(a+bx)^2} = \frac{1}{b^2} \left[\log (a+bx) + \frac{a}{a+bx} \right].$$

$$33. \int \frac{xdx}{(a+bx)^3} = \frac{1}{b^2} \left[-\frac{1}{a+bx} + \frac{a}{2(a+bx)^2} \right].$$

$$34. \int \frac{x^2 dx}{a+bx} = \frac{1}{b^3} \left[\frac{1}{2} (a+bx)^2 - 2a(a+bx) + a^2 \log (a+bx) \right]$$

$$35. \int \frac{x^2 dx}{(a+bx)^2} = \frac{1}{b^3} \left[a+bx - 2a \log (a+bx) - \frac{a^2}{a+bx} \right]$$

$$36. \int \frac{x^2 dx}{(a+bx)^3} = \frac{1}{b^3} \left[\log (a+bx) + \frac{2a}{a+bx} - \frac{a^2}{2(a+bx)^2} \right]$$

INTEGRALS (Continued)

$$37. \int \frac{dx}{x(a+bx)} = -\frac{1}{a} \log \frac{a+bx}{x}.$$

$$38. \int \frac{dx}{x(a+bx)^2} = \frac{1}{a(a+bx)} - \frac{1}{a^2} \log \frac{a+bx}{x}.$$

$$39. \int \frac{dx}{x^2(a+bx)} = -\frac{1}{ax} + \frac{b}{a^2} \log \frac{a+bx}{x}.$$

$$40. \int \frac{dx}{x^2(a+bx)^2} = -\frac{a+2bx}{a^2x(a+bx)} + \frac{2b}{a^3} \log \frac{a+bx}{x}.$$

FORMS CONTAINING $c^2 \pm x^2, x^2 - c^2$

$$41. \int \frac{dx}{c^2+x^2} = \frac{1}{c} \tan^{-1} \frac{x}{c}, \text{ or } \frac{1}{c} \sin^{-1} \frac{x}{\sqrt{c^2+x^2}}.$$

$$42. \int \frac{dx}{c^2-x^2} = \frac{1}{2c} \log \frac{c+x}{c-x}, \text{ or } \frac{1}{c} \tanh^{-1} \left(\frac{x}{c} \right).$$

$$43. \int \frac{dx}{x^2-c^2} = \frac{1}{2c} \log \frac{x-c}{x+c}, \text{ or } -\frac{1}{c} \coth^{-1} \left(\frac{x}{c} \right).$$

FORMS CONTAINING $a+bx$ AND $a'+b'x$

$$44. \int \frac{dx}{(a+bx)(a'+b'x)} = \frac{1}{ab'-a'b} \cdot \log \left(\frac{a'+b'x}{a+bx} \right).$$

$$45. \int \frac{x dx}{(a+bx)(a'+b'x)} = \frac{1}{ab'-a'b} \left[\frac{a}{b} \log(a+bx) - \frac{a'}{b'} \log(a'+b'x) \right].$$

$$46. \int \frac{dx}{(a+bx)^2(a'+b'x)} = \frac{1}{ab'-a'b} \left(\frac{1}{a+bx} + \frac{b'}{ab'-a'b} \log \frac{a'+b'x}{a+bx} \right).$$

$$47. \int \frac{x dx}{(a+bx)^2(a'+b'x)} = \frac{-a}{b(ab'-a'b)(a+bx)} - \frac{a'}{(ab'-a'b)^2} \log \frac{a'+b'x}{a+bx}.$$

$$48. \int \frac{x^2 dx}{(a+bx)^2(a'+b'x)} = \frac{a^2}{b^2(ab'-a'b)(a+bx)} + \frac{1}{(ab'-a'b)^2} \left[\frac{a'^2}{b'} \log(a'+b'x) + \frac{a(ab'-2a'b)}{b^2} \log(a+bx) \right].$$

$$49. \int \frac{dx}{(a+bx)^n(a'+b'x)^m} = \frac{1}{(m-1)(ab'-a'b)} \left(\frac{1}{(a+bx)^{n-1}(a'+b'x)^{m-1}} - (m+n-2)b \int \frac{dx}{(a+bx)^n(a'+b'x)^{m-1}} \right).$$

INTEGRALS (Continued)

FORMS CONTAINING $\sqrt{a+bx}$ AND $\sqrt{a'+b'x}$ $u = a+bx$
 $v = a'+b'x$ $k = ab' - a'b$

$$50. \int \sqrt{uv} \, dx = \frac{k+2bv}{4bb'} \sqrt{uv} - \frac{k^2}{8bb'} \int \frac{dx}{\sqrt{uv}}.$$

$$51. \int \frac{dx}{v\sqrt{u}} = \frac{1}{\sqrt{kb'}} \log \frac{b'\sqrt{u} - \sqrt{kb'}}{b'\sqrt{u} + \sqrt{kb'}} = \frac{2}{\sqrt{-kb'}} \tan^{-1} \frac{b'\sqrt{u}}{\sqrt{-kb'}}.$$

$$52. \int \frac{dx}{\sqrt{uv}} = \frac{2}{\sqrt{bb'}} \log (\sqrt{bb'u} + b\sqrt{v}) = \frac{2}{\sqrt{-bb'}} \tan^{-1} \frac{\sqrt{-b'u}}{bv},$$

$$\text{or } \frac{2}{\sqrt{bb'}} \tanh^{-1} \sqrt{\frac{b'u}{bv}} = \frac{1}{\sqrt{-bb'}} \sin^{-1} \frac{2bb'x + a'b + ab'}{k}.$$

$$53. \int \frac{xdx}{\sqrt{uv}} = \frac{\sqrt{uv}}{bb'} - \frac{ab' + a'b}{2bb'} \int \frac{dx}{\sqrt{uv}}.$$

$$54. \int \frac{dx}{v\sqrt{uv}} = -\frac{2\sqrt{u}}{k\sqrt{v}}.$$

$$55. \int \frac{\sqrt{v} \, dx}{\sqrt{u}} = \frac{1}{b} \sqrt{uv} - \frac{k}{2b} \int \frac{dx}{\sqrt{uv}}.$$

$$56. \int v^m \sqrt{u} \, dx = \frac{1}{(2m+3)b'} \left(2v^{m+1} \sqrt{u} + k \int \frac{v^m dx}{\sqrt{u}} \right).$$

$$57. \int \frac{dx}{v^m \sqrt{u}} = -\frac{1}{(m-1)k} \left(\frac{\sqrt{u}}{v^{m-1}} + \left(m - \frac{3}{2} \right) b \int \frac{dx}{v^{m-1} \sqrt{u}} \right).$$

FORMS CONTAINING $(a+bx^n)$

$$58. \int \frac{dx}{a+bx^2} = \frac{1}{\sqrt{ab}} \tan^{-1} \frac{x\sqrt{ab}}{a}.$$

$$59. \int \frac{dx}{a+bx^2} = \frac{1}{2\sqrt{-ab}} \log \frac{a+x\sqrt{-ab}}{a-x\sqrt{-ab}}, \text{ or } \frac{1}{\sqrt{-ab}} \tanh^{-1} \frac{x\sqrt{-ab}}{a}.$$

$$60. \int \frac{xdx}{a+bx^2} = \frac{1}{2b} \log \left(x^2 + \frac{a}{b} \right).$$

$$61. \int \frac{x^2 dx}{a+bx^2} = \frac{x}{b} - \frac{a}{b} \int \frac{dx}{a+bx^2}.$$

INTEGRALS (Continued)

$$62. \int \frac{dx}{(a + bx^2)^2} = \frac{x}{2a(a + bx^2)} + \frac{1}{2a} \int \frac{dx}{a + bx^2}.$$

$$63. \int \frac{dx}{(a + bx^2)^{m+1}} = \frac{1}{2ma} \frac{x}{(a + bx^2)^m} + \frac{2m-1}{2ma} \int \frac{dx}{(a + bx^2)^m}.$$

$$64. \int \frac{xdx}{(a + bx^2)^{m+1}} = \frac{1}{2} \int \frac{dz}{(a + bz)^{m+1}}, \quad [z = x^2].$$

$$65. \int \frac{x^2 dx}{(a + bx^2)^{m+1}} = \frac{-x}{2mb(a + bx^2)^m} + \frac{1}{2mb} \int \frac{dx}{(a + bx^2)^m}.$$

$$66. \int \frac{dx}{x^2(a + bx^2)^{m+1}} = \frac{1}{a} \int \frac{dx}{x^2(a + bx^2)^m} - \frac{b}{a} \int \frac{dx}{(a + bx^2)^{m+1}}.$$

$$67. \int \frac{dx}{x(a + bx^2)} = \frac{1}{2a} \log \frac{x^2}{a + bx^2}.$$

$$68. \int \frac{dx}{x^2(a + bx^2)} = -\frac{1}{ax} - \frac{b}{a} \int \frac{dx}{a + bx^2}.$$

$$69. \int \frac{dx}{a + bx^3} = \frac{k}{3a} \left[\frac{1}{2} \log \frac{(k+x)^2}{k^2 - kx + x^2} + \sqrt{3} \tan^{-1} \frac{2x - k}{k\sqrt{3}} \right], [bk^3 = a].$$

$$70. \int \frac{xdx}{a + bx^3} = \frac{1}{3bk} \left[\frac{1}{2} \log \frac{k^2 - kx + x^2}{(k+x)^2} + \sqrt{3} \tan^{-1} \frac{2x - k}{k\sqrt{3}} \right], [bk^3 = a].$$

$$71. \int \frac{dx}{x(a + bx^n)} = \frac{1}{an} \log \frac{x^n}{a + bx^n}.$$

$$72. \int \frac{dx}{(a + bx^n)^{m+1}} = \frac{1}{a} \int \frac{dx}{(a + bx^n)^m} - \frac{b}{a} \int \frac{x^n dx}{(a + bx^n)^{m+1}}.$$

$$73. \int \frac{x^m dx}{(a + bx^n)^{p+1}} = \frac{1}{b} \int \frac{x^{m-n} dx}{(a + bx^n)^p} - \frac{a}{b} \int \frac{x^{m-n} dx}{(a + bx^n)^{p+1}}.$$

$$74. \int \frac{dx}{x^m(a + bx^n)^{p+1}} = \frac{1}{a} \int \frac{dx}{x^m(a + bx^n)^p} - \frac{b}{a} \int \frac{dx}{x^{m-n}(a + bx^n)^{p+1}}.$$

$$75. \int x^m(a + bx^n)^p dx = \frac{x^{m-n+1}(a + bx^n)^{p+1}}{b(np + m + 1)} - \frac{a(m - n + 1)}{b(np + m + 1)} \int x^{m-n}(a + bx^n)^p dx.$$

INTEGRALS (Continued)

$$76. \int x^m(a + bx^n)^p dx = \frac{x^{m+1}(a + bx^n)^p}{np + m + 1} + \frac{anp}{np + m + 1} \int x^m(a + bx^n)^{p-1} dx.$$

$$77. \int x^{m-1}(a + bx^n)^p dx = \frac{1}{b(m + np)} [x^{m-n}(a + bx^n)^{p+1} - (m - n) a \int x^{m-n-1}(a + bx^n)^p dx].$$

$$78. \int x^{m-1}(a + bx^n)^p dx = \frac{1}{m + np} [x^m(a + bx^n)^p + npa \int x^{m-1}(a + bx^n)^{p-1} dx].$$

$$79. \int x^{m-1}(a + bx^n)^p dx = \frac{1}{ma} [x^m(a + bx^n)^{p+1} - (m + np + n)b \int x^{m+n-1}(a + bx^n)^p dx].$$

$$80. \int x^{m-1}(a + bx^n)^p dx = \frac{1}{an(p + 1)} [-x^m(a + bx^n)^{p+1} + (m + np + n) \int x^{m-1}(a + bx^n)^{p+1} dx].$$

FORMS CONTAINING $(a + bx + cx^2)$
 $X = a + bx + cx^2$ and $q = 4ac - b^2$

$$81. \int \frac{dx}{X} = \frac{2}{\sqrt{q}} \tan^{-1} \frac{2cx + b}{\sqrt{q}}.$$

$$82. \int \frac{dx}{X} = \frac{-2}{\sqrt{-q}} \tanh^{-1} \frac{2cx + b}{\sqrt{-q}}.$$

$$83. \int \frac{dx}{X} = \frac{1}{\sqrt{-q}} \log \frac{2cx + b - \sqrt{-q}}{2cx + b + \sqrt{-q}}.$$

$$84. \int \frac{dx}{X^2} = \frac{2cx + b}{qX} + \frac{2c}{q} \int \frac{dx}{X}.$$

$$85. \int \frac{dx}{X^3} = \frac{2cx + b}{q} \left(\frac{1}{2X^2} + \frac{3c}{qX} \right) + \frac{6c^2}{q^2} \int \frac{dx}{X}.$$

$$86. \int \frac{dx}{X^{n+1}} = \frac{2cx + b}{nqX^n} + \frac{2(2n - 1)c}{qn} \int \frac{dx}{X^n}.$$

$$87. \int \frac{xdx}{X} = \frac{1}{2c} \log X - \frac{b}{2c} \int \frac{dx}{X}.$$

$$88. \int \frac{xdx}{X^2} = -\frac{bx + 2a}{qX} - \frac{b}{q} \int \frac{dx}{X}.$$

$$89. \int \frac{xdx}{X^{n+1}} = -\frac{2a + bx}{nqX^n} - \frac{b(2n - 1)}{nq} \int \frac{dx}{X^n}.$$

$$90. \int \frac{x^2 dx}{X} = \frac{x}{c} - \frac{b}{2c^2} \log X + \frac{b^2 - 2ac}{2c^2} \int \frac{dx}{X}.$$

$$91. \int \frac{x^2 dx}{X^2} = \frac{(b^2 - 2ac)x + ab}{cqX} + \frac{2a}{q} \int \frac{dx}{X}.$$

INTEGRALS (Continued)

$$92. \int \frac{x^m dx}{X^{n+1}} = -\frac{x^{m-1}}{(2n-m+1)cX^n} - \frac{n-m+1}{2n-m+1} \cdot \frac{b}{c} \int \frac{x^{m-1} dx}{X^{n+1}} + \frac{m-1}{2n-m+1} \cdot \frac{a}{c} \int \frac{x^{m-2} dx}{X^{n+1}}.$$

$$93. \int \frac{dx}{xX} = \frac{1}{2a} \log \frac{x^2}{X} - \frac{b}{2a} \int \frac{dx}{X}.$$

$$94. \int \frac{dx}{x^2 X} = \frac{b}{2a^2} \log \frac{X}{x^2} - \frac{1}{ax} + \left(\frac{b^2}{2a^2} - \frac{c}{a} \right) \int \frac{dx}{X}.$$

$$95. \int \frac{dx}{xX^n} = \frac{1}{2a(n-1)X^{n-1}} - \frac{b}{2a} \int \frac{dx}{X^n} + \frac{1}{a} \int \frac{dx}{xX^{n-1}}.$$

$$96. \int \frac{dx}{x^m X^{n+1}} = -\frac{1}{(m-1)ax^{m-1}X^n} - \frac{n+m-1}{m-1} \cdot \frac{b}{a} \int \frac{dx}{x^{m-1}X^{n+1}} - \frac{2n+m-1}{m-1} \cdot \frac{c}{a} \int \frac{dx}{x^{m-2}X^{n+1}}.$$

FORMS CONTAINING $\sqrt{a+bx}$

$$97. \int \sqrt{a+bx} dx = \frac{2}{3b} \sqrt{(a+bx)^3}.$$

$$98. \int x\sqrt{a+bx} dx = -\frac{2(2a-3bx)\sqrt{(a+bx)^3}}{15b^2}.$$

$$99. \int x^2\sqrt{a+bx} dx = \frac{2(8a^2-12abx+15b^2x^2)\sqrt{(a+bx)^3}}{105b^3}.$$

$$100. \int \frac{\sqrt{a+bx}}{x} dx = 2\sqrt{a+bx} + a \int \frac{dx}{x\sqrt{a+bx}}.$$

$$101. \int \frac{dx}{\sqrt{a+bx}} = \frac{2\sqrt{a+bx}}{b}.$$

$$102. \int \frac{xdx}{\sqrt{a+bx}} = -\frac{2(2a-bx)}{3b^2} \sqrt{a+bx}.$$

$$103. \int \frac{x^2dx}{\sqrt{a+bx}} = \frac{2(8a^2-4abx+3b^2x^2)}{15b^3} \sqrt{a+bx}.$$

$$104. \int \frac{x^m dx}{\sqrt{a+bx}} = \frac{2x^m\sqrt{a+bx}}{(2m+1)b} - \frac{2ma}{(2m+1)b} \int \frac{x^{m-1}dx}{\sqrt{a+bx}}.$$

$$105. \int \frac{dx}{x\sqrt{a+bx}} = \frac{1}{\sqrt{a}} \log \left(\frac{\sqrt{a+bx} - \sqrt{a}}{\sqrt{a+bx} + \sqrt{a}} \right).$$

$$106. \int \frac{dx}{x\sqrt{a+bx}} = \frac{-2}{\sqrt{a}} \tanh^{-1} \sqrt{\frac{a+bx}{a}}.$$

INTEGRALS (Continued)

$$107. \int \frac{dx}{x^2 \sqrt{a+bx}} = -\frac{\sqrt{a+bx}}{ax} - \frac{b}{2a} \int \frac{dx}{x\sqrt{a+bx}}.$$

$$108. \int \frac{dx}{x^n \sqrt{a+bx}} = -\frac{\sqrt{a+bx}}{(n-1)ax^{n-1}} - \frac{(2n-3)b}{(2n-2)a} \int \frac{dx}{x^{n-1} \sqrt{a+bx}}.$$

$$109. \int (a+bx)^{\pm n/2} dx = \frac{2(a+bx)^{\frac{2 \pm n}{2}}}{b(2 \pm n)}.$$

$$110. \int x(a+bx)^{\pm n/2} dx = \frac{2}{b^2} \left[\frac{(a+bx)^{\frac{4 \pm n}{2}}}{4 \pm n} - \frac{a(a+bx)^{\frac{2 \pm n}{2}}}{2 \pm n} \right].$$

$$111. \int \frac{dx}{x(a+bx)^{m/2}} = \frac{1}{a} \int \frac{dx}{x(a+bx)^{\frac{m-2}{2}}} - \frac{b}{a} \int \frac{dx}{(a+bx)^{m/2}}.$$

$$112. \int \frac{(a+bx)^{n/2} dx}{x} = b \int (a+bx)^{\frac{n-2}{2}} dx + a \int \frac{(a+bx)^{\frac{n-2}{2}}}{x} dx.$$

FORMS CONTAINING $\sqrt{x^2 \pm a^2}$

$$113. \int \sqrt{x^2 \pm a^2} dx = \frac{1}{2} [x\sqrt{x^2 \pm a^2} \pm a^2 \log (x + \sqrt{x^2 \pm a^2})].$$

$$114. \int \frac{dx}{\sqrt{x^2 \pm a^2}} = \log (x + \sqrt{x^2 \pm a^2}).$$

$$115. \int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a} \cos^{-1} \left(\frac{a}{x} \right), \text{ or } \frac{1}{a} \sec^{-1} \left(\frac{x}{a} \right).$$

$$116. \int \frac{dx}{x\sqrt{x^2 + a^2}} = -\frac{1}{a} \log \left(\frac{a + \sqrt{x^2 + a^2}}{x} \right).$$

$$117. \int \frac{\sqrt{x^2 + a^2}}{x} dx = \sqrt{x^2 + a^2} - a \log \left(\frac{a + \sqrt{x^2 + a^2}}{x} \right).$$

$$118. \int \frac{\sqrt{x^2 - a^2}}{x} dx = \sqrt{x^2 - a^2} - a \cos^{-1} \frac{a}{x}.$$

$$119. \int \frac{x dx}{\sqrt{x^2 \pm a^2}} = \sqrt{x^2 \pm a^2}.$$

$$120. \int x \sqrt{x^2 \pm a^2} dx = \frac{1}{3} \sqrt{(x^2 \pm a^2)^3}.$$

INTEGRALS (Continued)

$$121. \int \sqrt{(x^2 \pm a^2)^3} dx = \frac{1}{4} \left[x \sqrt{(x^2 \pm a^2)^3} \pm \frac{3a^2x}{2} \sqrt{x^2 \pm a^2} + \frac{3a^4}{2} \log (x + \sqrt{x^2 \pm a^2}) \right].$$

$$122. \int \frac{dx}{\sqrt{(x^2 \pm a^2)^3}} = \frac{\pm x}{a^2 \sqrt{x^2 \pm a^2}}.$$

$$123. \int \frac{x dx}{\sqrt{(x^2 \pm a^2)^3}} = \frac{-1}{\sqrt{x^2 \pm a^2}}.$$

$$124. \int x \sqrt{(x^2 \pm a^2)^3} dx = \frac{1}{5} \sqrt{(x^2 \pm a^2)^5}.$$

$$125. \int x^2 \sqrt{x^2 \pm a^2} dx = \frac{x}{4} \sqrt{(x^2 \pm a^2)^3} \mp \frac{a^2}{8} x \sqrt{x^2 \pm a^2} - \frac{a^4}{8} \log (x + \sqrt{x^2 \pm a^2}).$$

$$126. \int \frac{x^2 dx}{\sqrt{x^2 \pm a^2}} = \frac{x}{2} \sqrt{x^2 \pm a^2} \mp \frac{a^2}{2} \log (x + \sqrt{x^2 \pm a^2}).$$

$$127. \int \frac{dx}{x^2 \sqrt{x^2 \pm a^2}} = \mp \frac{\sqrt{x^2 \pm a^2}}{a^2 x}.$$

$$128. \int \frac{\sqrt{x^2 \pm a^2} dx}{x^2} = -\frac{\sqrt{x^2 \pm a^2}}{x} + \log (x + \sqrt{x^2 \pm a^2}).$$

$$129. \int \frac{x^2 dx}{\sqrt{(x^2 \pm a^2)^3}} = \frac{-x}{\sqrt{x^2 \pm a^2}} + \log (x + \sqrt{x^2 \pm a^2}).$$

FORMS CONTAINING $\sqrt{a^2 - x^2}$

$$130. \int \sqrt{a^2 - x^2} dx = \frac{1}{2} \left[x \sqrt{a^2 - x^2} + a^2 \sin^{-1} \left(\frac{x}{a} \right) \right].$$

$$131. \int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \left(\frac{x}{a} \right), \text{ or } -\cos^{-1} \left(\frac{x}{a} \right).$$

$$132. \int \frac{dx}{x \sqrt{a^2 - x^2}} = -\frac{1}{a} \log \left(\frac{a + \sqrt{a^2 - x^2}}{x} \right).$$

$$133. \int \frac{\sqrt{a^2 - x^2}}{x} dx = \sqrt{a^2 - x^2} - a \log \left(\frac{a + \sqrt{a^2 - x^2}}{x} \right).$$

$$134. \int \frac{x dx}{\sqrt{a^2 - x^2}} = -\sqrt{a^2 - x^2}.$$

$$135. \int x \sqrt{a^2 - x^2} dx = -\frac{1}{3} \sqrt{(a^2 - x^2)^3}.$$

$$136. \int \sqrt{(a^2 - x^2)^3} dx = \frac{1}{4} \left[x \sqrt{(a^2 - x^2)^3} + \frac{3a^2x}{2} \sqrt{a^2 - x^2} + \frac{3a^4}{2} \sin^{-1} \frac{x}{a} \right].$$

INTEGRALS (Continued)

$$137. \int \frac{dx}{\sqrt{(a^2 - x^2)^3}} = \frac{x}{a^2 \sqrt{a^2 - x^2}}.$$

$$138. \int \frac{x dx}{\sqrt{(a^2 - x^2)^3}} = \frac{1}{\sqrt{a^2 - x^2}}.$$

$$139. \int x \sqrt{(a^2 - x^2)^3} dx = -\frac{1}{5} \sqrt{(a^2 - x^2)^5}.$$

$$140. \int x^2 \sqrt{a^2 - x^2} dx = -\frac{x}{4} \sqrt{(a^2 - x^2)^3} + \frac{a^2}{8} \left(x \sqrt{a^2 - x^2} + a^2 \sin^{-1} \frac{x}{a} \right).$$

$$141. \int \frac{x^2 dx}{\sqrt{a^2 - x^2}} = -\frac{x}{2} \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a}.$$

$$142. \int \frac{dx}{x^2 \sqrt{a^2 - x^2}} = -\frac{\sqrt{a^2 - x^2}}{a^2 x}.$$

$$143. \int \frac{\sqrt{a^2 - x^2}}{x^2} dx = -\frac{\sqrt{a^2 - x^2}}{x} - \sin^{-1} \frac{x}{a}.$$

$$144. \int \frac{x^2 dx}{\sqrt{(a^2 - x^2)^3}} = \frac{x}{\sqrt{a^2 - x^2}} - \sin^{-1} \frac{x}{a}.$$

FORMS CONTAINING $\sqrt{a + bx + cx^2}$

$$X = a + bx + cx^2, q = 4ac - b^2, \text{ and } k = \frac{4c}{q}.$$

$$145. \int \frac{dx}{\sqrt{X}} = \frac{1}{\sqrt{c}} \log \left(\sqrt{X} + x \sqrt{c} + \frac{b}{2\sqrt{c}} \right).$$

$$146. \int \frac{dx}{\sqrt{X}} = \frac{1}{\sqrt{c}} \sinh^{-1} \left(\frac{2cx + b}{\sqrt{4ac - b^2}} \right), \quad \text{if } c > 0.$$

$$147. \int \frac{dx}{\sqrt{X}} = \frac{1}{\sqrt{-c}} \sin^{-1} \left(\frac{-2cx - b}{\sqrt{b^2 - 4ac}} \right), \quad \text{if } c < 0.$$

$$148. \int \frac{dx}{X \sqrt{X}} = \frac{2(2cx + b)}{q \sqrt{X}}.$$

$$149. \int \frac{dx}{X^2 \sqrt{X}} = \frac{2(2cx + b)}{3q \sqrt{X}} \left(\frac{1}{X} + 2k \right).$$

$$150. \int \frac{dx}{X^n \sqrt{X}} = \frac{2(2cx + b)\sqrt{X}}{(2n - 1)qX^n} + \frac{2k(n - 1)}{2n - 1}$$

$$\int \frac{dx}{X^{n-1} \sqrt{X}}.$$

$$151. \int \sqrt{X} dx = \frac{(2cx + b)\sqrt{X}}{4c} + \frac{1}{2k} \int \frac{dx}{\sqrt{X}}.$$

INTEGRALS (Continued)

$$152. \int X \sqrt{X} dx = \frac{(2cx + b) \sqrt{X}}{8c} \left(X + \frac{3}{2k} \right) + \frac{3}{8k^2} \int \frac{dx}{\sqrt{X}}.$$

$$153. \int X^2 \sqrt{X} dx = \frac{(2cx + b) \sqrt{X}}{12c} \left(X^2 + \frac{5X}{4k} + \frac{15}{8k^2} \right) + \frac{5}{16k^3} \int \frac{dx}{\sqrt{X}}.$$

$$154. \int X^n \sqrt{X} dx = \frac{(2cx + b) X^n \sqrt{X}}{4(n+1)c} + \frac{2n+1}{2(n+1)k} \int \frac{X^n dx}{\sqrt{X}}.$$

$$155. \int \frac{x dx}{\sqrt{X}} = \frac{\sqrt{X}}{c} - \frac{b}{2c} \int \frac{dx}{\sqrt{X}}.$$

$$156. \int \frac{x dx}{X \sqrt{X}} = -\frac{2(bx + 2a)}{q \sqrt{X}}.$$

$$157. \int \frac{x dx}{X^n \sqrt{X}} = -\frac{\sqrt{X}}{(2n-1)cX^n} - \frac{b}{2c} \int \frac{dx}{X^n \sqrt{X}}.$$

$$158. \int \frac{x^2 dx}{\sqrt{X}} = \left(\frac{x}{2c} - \frac{3b}{4c^2} \right) \sqrt{X} + \frac{3b^2 - 4ac}{8c^2} \int \frac{dx}{\sqrt{X}}.$$

$$159. \int \frac{x^2 dx}{X \sqrt{X}} = \frac{(2b^2 - 4ac)x + 2ab}{cq \sqrt{X}} + \frac{1}{c} \int \frac{dx}{\sqrt{X}}.$$

$$160. \int \frac{x^2 dx}{X^n \sqrt{X}} = \frac{(2b^2 - 4ac)x + 2ab}{(2n-1)cq X^{n-1} \sqrt{X}} + \frac{4ac + (2n-3)b^2}{(2n-1)cq} \int \frac{dx}{X^{n-1} \sqrt{X}}.$$

$$161. \int \frac{x^3 dx}{\sqrt{X}} = \left(\frac{x^2}{3c} - \frac{5bx}{12c^2} + \frac{5b^2}{8c^3} - \frac{2a}{3c^2} \right) \sqrt{X} + \left(\frac{3ab}{4c^2} - \frac{5b^3}{16c^3} \right) \int \frac{dx}{\sqrt{X}}.$$

$$162. \int x \sqrt{X} dx = \frac{X \sqrt{X}}{3c} - \frac{b}{2c} \int \sqrt{X} dx.$$

$$163. \int x X \sqrt{X} dx = \frac{X^2 \sqrt{X}}{5c} - \frac{b}{2c} \int X \sqrt{X} dx.$$

$$164. \int \frac{x X^n dx}{\sqrt{X}} = \frac{X^n \sqrt{X}}{(2n+1)c} - \frac{b}{2c} \int \frac{X^n dx}{\sqrt{X}}.$$

INTEGRALS (Continued)

$$165. \int x^2 \sqrt{X} dx = \left(x - \frac{5b}{6c}\right) \frac{X \sqrt{X}}{4c} + \frac{5b^2 - 4ac}{16c^2} \int \sqrt{X} dx.$$

$$166. \int \frac{dx}{x \sqrt{X}} = -\frac{1}{\sqrt{a}} \log \left(\frac{\sqrt{X} + \sqrt{a}}{x} + \frac{b}{2\sqrt{a}} \right), \quad \text{if } a > 0.$$

$$167. \int \frac{dx}{x \sqrt{X}} = \frac{1}{\sqrt{-a}} \sin^{-1} \left(\frac{bx + 2a}{x \sqrt{b^2 - 4ac}} \right), \quad \text{if } a < 0.$$

$$168. \int \frac{dx}{x \sqrt{X}} = -\frac{2\sqrt{X}}{bx}, \quad \text{if } a = 0.$$

$$169. \int \frac{dx}{x^2 \sqrt{X}} = -\frac{\sqrt{X}}{ax} - \frac{b}{2a} \int \frac{dx}{x \sqrt{X}}.$$

$$170. \int \frac{\sqrt{X} dx}{x} = \sqrt{X} + \frac{b}{2} \int \frac{dx}{\sqrt{X}} + a \int \frac{dx}{x \sqrt{X}}.$$

$$171. \int \frac{\sqrt{X} dx}{x^2} = -\frac{\sqrt{X}}{x} + \frac{b}{2} \int \frac{dx}{x \sqrt{X}} + c \int \frac{dx}{\sqrt{X}}.$$

MISCELLANEOUS ALGEBRAIC FORMS

$$172. \int \sqrt{2ax - x^2} dx = \frac{1}{2} [(x - a) \sqrt{2ax - x^2} + a^2 \sin^{-1} (x - a)/a].$$

$$173. \int \sqrt{ax^2 + c} dx = \frac{x}{2} \sqrt{ax^2 + c} + \frac{c}{2\sqrt{a}} \log (x\sqrt{a} + \sqrt{ax^2 + c}), \quad [a > 0].$$

$$= \frac{x}{2} \sqrt{ax^2 + c} + \frac{c}{2\sqrt{-a}} \sin^{-1} \left(x \sqrt{\frac{-a}{c}} \right), \quad [a < 0].$$

$$174. \int \frac{dx}{\sqrt{2ax - x^2}} = \cos^{-1} \left(\frac{a - x}{a} \right).$$

$$175. \int \frac{dx}{\sqrt{a + bx} \cdot \sqrt{a' + b'x}} = \frac{2}{\sqrt{-bb'}} \tan^{-1} \sqrt{\frac{-b'(a + bx)}{b(a' + b'x)}}.$$

$$176. \int \sqrt{\frac{1+x}{1-x}} dx = \sin^{-1} x - \sqrt{1-x^2}.$$

$$177. \int \frac{dx}{\sqrt{a \pm 2bx + cx^2}} = \frac{1}{\sqrt{c}} \log (\pm b + cx + \sqrt{c} \sqrt{a \pm 2bx + cx^2}).$$

INTEGRALS (Continued)

$$178. \int \frac{dx}{\sqrt{a \pm 2bx - cx^2}} = \frac{1}{\sqrt{c}} \sin^{-1} \frac{cx \mp b}{\sqrt{b^2 + ac}}.$$

$$179. \int \frac{xdx}{\sqrt{a \pm 2bx + cx^2}} = \frac{1}{c} \sqrt{a \pm 2bx + cx^2} - \frac{b}{\sqrt{c^3}} \log (\pm b + cx + \sqrt{c} \sqrt{a \pm 2bx + cx^2}).$$

$$180. \int \frac{xdx}{\sqrt{a \pm 2bx - cx^2}} = -\frac{1}{c} \sqrt{a \pm 2bx - cx^2} \pm \frac{b}{\sqrt{c^3}} \sin^{-1} \frac{cx \mp b}{\sqrt{b^2 + ac}}.$$

TRIGONOMETRIC FORMS

$$181. \int \sin x \, dx = -\cos x, \text{ or versin } x.$$

$$182. \int \cos x \, dx = \sin x, \text{ or } -\text{coversin } x.$$

$$183. \int \tan x \, dx = -\log \cos x, \text{ or } \log \sec x.$$

$$184. \int \cot x \, dx = \log \sin x.$$

$$185. \int \sec x \, dx = \log \tan \left(\frac{\pi}{4} + \frac{x}{2} \right).$$

$$186. \int \csc x \, dx = \log \tan \frac{1}{2} x.$$

$$187. \int \sin^2 x \, dx = -\frac{1}{2} \cos x \sin x + \frac{1}{2} x = \frac{1}{2} x - \frac{1}{4} \sin 2x.$$

$$188. \int \sin^3 x \, dx = -\frac{1}{3} \cos x (\sin^2 x + 2).$$

$$189. \int \sin^n x \, dx = -\frac{\sin^{n-1} x \cos x}{n} + \frac{n-1}{n} \int \sin^{n-2} x \, dx.$$

$$190. \int \cos^2 x \, dx = \frac{1}{2} \sin x \cos x + \frac{1}{2} x = \frac{1}{2} x + \frac{1}{4} \sin 2x.$$

$$191. \int \cos^3 x \, dx = \frac{1}{3} \sin x (\cos^2 x + 2).$$

$$192. \int \cos^n x \, dx = \frac{1}{n} \cos^{n-1} x \sin x + \frac{n-1}{n} \int \cos^{n-2} x \, dx.$$

$$193. \int \sin \frac{x}{a} \, dx = -a \cos \frac{x}{a}.$$

$$194. \int \cos \frac{x}{a} \, dx = a \sin \frac{x}{a}.$$

$$195. \int \sin (a + bx) \, dx = -\frac{1}{b} \cos (a + bx).$$

$$196. \int \cos (a + bx) \, dx = \frac{1}{b} \sin (a + bx).$$

$$197. \int \frac{dx}{\sin x} = -\frac{1}{2} \log \frac{1 + \cos x}{1 - \cos x} = \log \tan \frac{x}{2}.$$

$$198. \int \frac{dx}{\cos x} = \log \tan \left(\frac{\pi}{4} + \frac{x}{2} \right) = \frac{1}{2} \log \left(\frac{1 + \sin x}{1 - \sin x} \right).$$

$$199. \int \frac{dx}{\cos^2 x} = \tan x.$$

INTEGRALS (Continued)

$$200. \int \frac{dx}{\cos^n x} = \frac{1}{n-1} \cdot \frac{\sin x}{\cos^{n-1} x} + \frac{n-2}{n-1} \int \frac{dx}{\cos^{n-2} x}.$$

$$201. \int \frac{dx}{1 \pm \sin x} = \mp \tan \left(\frac{\pi}{4} \mp \frac{x}{2} \right).$$

$$202. \int \frac{dx}{1 + \cos x} = \tan \frac{x}{2}.$$

$$203. \int \frac{dx}{1 - \cos x} = -\cot \frac{x}{2}.$$

$$204. \int \frac{dx}{a + b \sin x} = \frac{2}{\sqrt{a^2 - b^2}} \tan^{-1} \frac{a \tan \frac{1}{2} x + b}{\sqrt{a^2 - b^2}},$$

$$= \frac{1}{\sqrt{b^2 - a^2}} \log \frac{a \tan \frac{1}{2} x + b - \sqrt{b^2 - a^2}}{a \tan \frac{1}{2} x + b + \sqrt{b^2 - a^2}}.$$

$$205. \int \frac{dx}{a + b \cos x} = \frac{2}{\sqrt{a^2 - b^2}} \tan^{-1} \frac{\sqrt{a^2 - b^2} \tan \frac{1}{2} x}{a + b},$$

$$= \frac{1}{\sqrt{b^2 - a^2}} \log \left(\frac{\sqrt{b^2 - a^2} \tan \frac{1}{2} x + a + b}{\sqrt{b^2 - a^2} \tan \frac{1}{2} x - a - b} \right).$$

$$206. \int \sin mx \sin nx \, dx = \frac{\sin (m-n)x}{2(m-n)} - \frac{\sin (m+n)x}{2(m+n)},$$

[$m^2 \neq n^2$].

$$207. \int x \sin^2 x \, dx = \frac{x^2}{4} - \frac{x \sin 2x}{4} - \frac{\cos 2x}{8}.$$

$$208. \int x^2 \sin^2 x \, dx = \frac{x^3}{6} - \left(\frac{x^2}{4} - \frac{1}{8} \right) \sin 2x - \frac{x \cos 2x}{4}.$$

$$209. \int x \sin^3 x \, dx = \frac{x \cos 3x}{12} - \frac{\sin 3x}{36} - \frac{3}{4} x \cos x + \frac{3}{4} \sin x.$$

$$210. \int \sin^4 x \, dx = \frac{3x}{8} - \frac{\sin 2x}{4} + \frac{\sin 4x}{32}.$$

$$211. \int \cos mx \cos nx \, dx = \frac{\sin (m-n)x}{2(m-n)} + \frac{\sin (m+n)x}{2(m+n)},$$

[$m^2 \neq n^2$].

$$212. \int x \cos^2 x \, dx = \frac{x^2}{4} + \frac{x \sin 2x}{4} + \frac{\cos 2x}{8}.$$

$$213. \int x^2 \cos^2 x \, dx = \frac{x^3}{6} + \left(\frac{x^2}{4} - \frac{1}{8} \right) \sin 2x + \frac{x \cos 2x}{4}.$$

$$214. \int x \cos^3 x \, dx = \frac{x \sin 3x}{12} + \frac{\cos 3x}{36} + \frac{3}{4} x \sin x + \frac{3}{4} \cos x.$$

$$215. \int \cos^4 x \, dx = \frac{3x}{8} + \frac{\sin 2x}{4} + \frac{\sin 4x}{32}.$$

INTEGRALS (Continued)

$$216. \int \frac{\sin x \, dx}{x^m} = -\frac{\sin x}{(m-1)x^{m-1}} + \frac{1}{m-1} \int \frac{\cos x \, dx}{x^{m-1}}.$$

$$217. \int \frac{\cos x \, dx}{x^m} = -\frac{\cos x}{(m-1)x^{m-1}} - \frac{1}{m-1} \int \frac{\sin x \, dx}{x^{m-1}}.$$

$$218. \int \tan^3 x \, dx = \frac{1}{2} \tan^2 x + \log \cos x.$$

$$219. \int \tan^4 x \, dx = \frac{1}{3} \tan^3 x - \tan x + x.$$

$$220. \int \cot^3 x \, dx = -\frac{1}{2} \cot^2 x - \log \sin x.$$

$$221. \int \cot^4 x \, dx = -\frac{1}{3} \cot^3 x + \cot x + x.$$

$$222. \int \cot^n x \, dx = -\frac{\cot^{n-1} x}{n-1} - \int \cot^{n-2} x \, dx, [n \neq 1].$$

$$223. \int \sin x \cos x \, dx = \frac{1}{2} \sin^2 x$$

$$224. \int \sin mx \cos nx \, dx = -\frac{\cos (m-n)x}{2(m-n)} - \frac{\cos (m+n)x}{2(m+n)}.$$

$$225. \int \sin^2 x \cos^2 x \, dx = -\frac{1}{8}(\frac{1}{4} \sin 4x - x).$$

$$226. \int \sin x \cos^m x \, dx = -\frac{\cos^{m+1} x}{m+1}.$$

$$227. \int \sin^m x \cos x \, dx = \frac{\sin^{m+1} x}{m+1}.$$

$$228. \int \cos^m x \sin^n x \, dx = \frac{\cos^{m-1} x \sin^{n+1} x}{m+n} + \frac{m-1}{m+n} \int \cos^{m-2} x \sin^n x \, dx,$$

$$229. \int \cos^m x \sin^n x \, dx = -\frac{\sin^{n-1} x \cos^{m+1} x}{m+n} + \frac{n-1}{m+n} \int \cos^m x \sin^{n-2} x \, dx.$$

$$230. \int \frac{\cos^m x \, dx}{\sin^n x} = -\frac{\cos^{m+1} x}{(n-1) \sin^{n-1} x} - \frac{m-n+2}{n-1} \int \frac{\cos^m x \, dx}{\sin^{n-2} x}.$$

$$231. \int \frac{\cos^m x \, dx}{\sin^n x} = \frac{\cos^{m-1} x}{(m-n) \sin^{n-1} x} + \frac{m-1}{m-n} \int \frac{\cos^{m-2} x \, dx}{\sin^n x}.$$

$$232. \int \frac{\sin^m x \, dx}{\cos^n x} = -\int \frac{\cos^m \left(\frac{\pi}{2} - x\right) d\left(\frac{\pi}{2} - x\right)}{\sin^n \left(\frac{\pi}{2} - x\right)}.$$

$$233. \int \frac{\sin x \, dx}{\cos^2 x} = \frac{1}{\cos x} = \sec x.$$

INTEGRALS (Continued)

$$234. \int \frac{\sin^2 x \, dx}{\cos x} = -\sin x + \log \tan \left(\frac{\pi}{4} + \frac{x}{2} \right).$$

$$235. \int \frac{\cos x \, dx}{\sin^2 x} = \frac{-1}{\sin x} = -\operatorname{cosec} x.$$

$$236. \int \frac{dx}{\sin x \cos x} = \log \tan x.$$

$$237. \int \frac{dx}{\sin x \cos^2 x} = \frac{1}{\cos x} + \log \tan \frac{x}{2}.$$

$$238. \int \frac{dx}{\sin x \cos^n x} = \frac{1}{(n-1) \cos^{n-1} x} + \int \frac{dx}{\sin x \cos^{n-2} x},$$

$[n \neq 1].$

$$239. \int \frac{dx}{\sin^2 x \cos x} = -\frac{1}{\sin x} + \log \tan \left(\frac{\pi}{4} + \frac{x}{2} \right).$$

$$240. \int \frac{dx}{\sin^2 x \cos^2 x} = -2 \cot 2x.$$

$$241. \int \frac{dx}{\sin^m x \cos^n x} = -\frac{1}{m-1} \cdot \frac{1}{\sin^{m-1} x \cdot \cos^{n-1} x} +$$

$$\frac{m+n-2}{m-1} \int \frac{dx}{\sin^{m-2} x \cdot \cos^n x}.$$

$$242. \int \frac{dx}{\sin^m x} = -\frac{1}{m-1} \cdot \frac{\cos x}{\sin^{m-1} x} + \frac{m-2}{m-1} \int \frac{dx}{\sin^{m-2} x}.$$

$$243. \int \frac{dx}{\sin^2 x} = -\cot x.$$

$$244. \int \tan^2 x \, dx = \tan x - x.$$

$$245. \int \tan^n x \, dx = \frac{\tan^{n-1} x}{n-1} - \int \tan^{n-2} x \, dx.$$

$$246. \int \cot^2 x \, dx = -\cot x - x.$$

$$247. \int \cot^n x \, dx = -\frac{\cot^{n-1} x}{n-1} - \int \cot^{n-2} x \, dx.$$

$$248. \int \sec^2 x \, dx = \tan x.$$

$$249. \int \sec^n x \, dx = \int \frac{dx}{\cos^n x}.$$

$$250. \int \csc^2 x \, dx = -\cot x.$$

$$251. \int \csc^n x \, dx = \int \frac{dx}{\sin^n x}.$$

$$252. \int x \sin x \, dx = \sin x - x \cos x.$$

$$253. \int x^2 \sin x \, dx = 2x \sin x - (x^2 - 2) \cos x.$$

$$254. \int x^3 \sin x \, dx = (3x^2 - 6) \sin x - (x^3 - 6x) \cos x.$$

$$255. \int x^m \sin x \, dx = -x^m \cos x + m \int x^{m-1} \cos x \, dx.$$

INTEGRALS (Continued)

256. $\int x \cos x \, dx = \cos x + x \sin x.$
257. $\int x^2 \cos x \, dx = 2 x \cos x + (x^2 - 2) \sin x.$
258. $\int x^3 \cos x \, dx = (3 x^2 - 6) \cos x + (x^3 - 6 x) \sin x.$
259. $\int x^m \cos x \, dx = x^m \sin x - m \int x^{m-1} \sin x \, dx.$
260. $\int \frac{\sin x}{x} \, dx = x - \frac{x^3}{3 \cdot 3!} + \frac{x^5}{5 \cdot 5!} - \frac{x^7}{7 \cdot 7!} + \frac{x^9}{9 \cdot 9!} \cdots$
261. $\int \frac{\cos x}{x} \, dx = \log x - \frac{x^2}{2 \cdot 2!} + \frac{x^4}{4 \cdot 4!} - \frac{x^6}{6 \cdot 6!} + \frac{x^8}{8 \cdot 8!} \cdots$
-
262. $\int \sin^{-1} x \, dx = x \sin^{-1} x + \sqrt{1 - x^2}.$
263. $\int \cos^{-1} x \, dx = x \cos^{-1} x - \sqrt{1 - x^2}.$
264. $\int \tan^{-1} x \, dx = x \tan^{-1} x - \frac{1}{2} \log (1 + x^2).$
265. $\int \cot^{-1} x \, dx = x \cot^{-1} x + \frac{1}{2} \log (1 + x^2).$
266. $\int \sec^{-1} x \, dx = x \sec^{-1} x - \log (x + \sqrt{x^2 - 1}).$
267. $\int \csc^{-1} x \, dx = x \csc^{-1} x + \log (x + \sqrt{x^2 - 1}).$
268. $\int \text{vers}^{-1} x \, dx = (x - 1) \text{vers}^{-1} x + \sqrt{2x - x^2}.$
269. $\int \sin^{-1} \frac{x}{a} \, dx = x \sin^{-1} \frac{x}{a} + \sqrt{a^2 - x^2}.$
270. $\int \cos^{-1} \frac{x}{a} \, dx = x \cos^{-1} \frac{x}{a} - \sqrt{a^2 - x^2}.$
271. $\int \tan^{-1} \frac{x}{a} \, dx = x \tan^{-1} \frac{x}{a} - \frac{a}{2} \log (a^2 + x^2).$
272. $\int \cot^{-1} \frac{x}{a} \, dx = x \cot^{-1} \frac{x}{a} + \frac{a}{2} \log (a^2 + x^2).$
273. $\int (\sin^{-1} x)^2 \, dx = x(\sin^{-1} x)^2 - 2x + 2\sqrt{1 - x^2} (\sin^{-1} x).$
274. $\int (\cos^{-1} x)^2 \, dx = x(\cos^{-1} x)^2 - 2x - 2\sqrt{1 - x^2} (\cos^{-1} x).$
275. $\int x \cdot \sin^{-1} x \, dx = \frac{1}{4} [(2 x^2 - 1) \sin^{-1} x + x \sqrt{1 - x^2}].$
276. $\int x^n \sin^{-1} x \, dx = \frac{x^{n+1} \sin^{-1} x}{n+1} - \frac{1}{n+1} \int \frac{x^{n+1} \, dx}{\sqrt{1 - x^2}}.$
277. $\int x^n \cos^{-1} x \, dx = \frac{x^{n+1} \cos^{-1} x}{n+1} + \frac{1}{n+1} \int \frac{x^{n+1} \, dx}{\sqrt{1 - x^2}}.$
278. $\int x^n \tan^{-1} x \, dx = \frac{x^{n+1} \tan^{-1} x}{n+1} - \frac{1}{n+1} \int \frac{x^{n+1} \, dx}{1 + x^2}.$
279. $\int \frac{\sin^{-1} x \, dx}{x^2} = \log \left(\frac{1 - \sqrt{1 - x^2}}{x} \right) - \frac{\sin^{-1} x}{x}.$
280. $\int \frac{\tan^{-1} x \, dx}{x^2} = \log x - \frac{1}{2} \log (1 + x^2) - \frac{\tan^{-1} x}{x}.$

INTEGRALS (Continued)

LOGARITHMIC FORMS

281. $\int \log x \, dx = x \log x - x.$
282. $\int x \log x \, dx = \frac{x^2}{2} \log x - \frac{x^2}{4}.$
283. $\int x^2 \log x \, dx = \frac{x^3}{3} \log x - \frac{x^3}{9}.$
284. $\int x^p \log (ax) \, dx = \frac{x^{p+1}}{p+1} \log (ax) - \frac{x^{p+1}}{(p+1)^2} [p \neq -1].$
285. $\int (\log x)^2 \, dx = x (\log x)^2 - 2x \log x + 2x.$
286. $\int (\log x)^n \, dx = x (\log x)^n - n \int (\log x)^{n-1} \, dx,$
 $[n \neq -1].$
287. $\int \frac{(\log x)^n}{x} \, dx = \frac{1}{n+1} (\log x)^{n+1}.$
288. $\int \frac{dx}{\log x} = \log (\log x) + \log x + \frac{(\log x)^2}{2 \cdot 2!} + \frac{(\log x)^3}{3 \cdot 3!} + \dots$
289. $\int \frac{dx}{x \log x} = \log (\log x)$
290. $\int \frac{dx}{x (\log x)^n} = -\frac{1}{(n-1) (\log x)^{n-1}}.$
291. $\int \frac{x^m \, dx}{(\log x)^n} = -\frac{x^{m+1}}{(n-1) (\log x)^{n-1}} + \frac{m+1}{n-1} \int \frac{x^m \, dx}{(\log x)^{n-1}}.$
292. $\int x^m \log x \, dx = x^{m+1} \left[\frac{\log x}{m+1} - \frac{1}{(m+1)^2} \right].$
293. $\int x^m (\log x)^n \, dx = \frac{x^{m+1} (\log x)^n}{m+1} - \frac{n}{m+1} \int x^m (\log x)^{n-1} \, dx, [m, n \neq -1].$
294. $\int \sin \log x \, dx = \frac{1}{2} x \sin \log x - \frac{1}{2} x \cos \log x.$
295. $\int \cos \log x \, dx = \frac{1}{2} x \sin \log x + \frac{1}{2} x \cos \log x.$

EXPONENTIAL FORMS

296. $\int e^x \, dx = e^x.$
297. $\int e^{-x} \, dx = -e^{-x}.$
298. $\int e^{ax} \, dx = \frac{e^{ax}}{a}.$
299. $\int x e^{ax} \, dx = \frac{e^{ax}}{a^2} (ax - 1).$
300. $\int x^m e^{ax} \, dx = \frac{x^m e^{ax}}{a} - \frac{m}{a} \int x^{m-1} e^{ax} \, dx.$
301. $\int \frac{e^{ax}}{x} \, dx = \log x + \frac{ax}{1!} + \frac{a^2 x^2}{2 \cdot 2!} + \frac{a^3 x^3}{3 \cdot 3!} + \dots$
302. $\int \frac{e^{ax}}{x^m} \, dx = -\frac{1}{m-1} \frac{e^{ax}}{x^{m-1}} + \frac{a}{m-1} \int \frac{e^{ax}}{x^{m-1}} \, dx.$

INTEGRALS (Continued)

$$303. \int e^{ax} \log x \, dx = \frac{e^{ax} \log x}{a} - \frac{1}{a} \int \frac{e^{ax}}{x} \, dx.$$

$$304. \int e^{ax} \cdot \sin px \, dx = \frac{e^{ax} (a \sin px - p \cos px)}{a^2 + p^2}.$$

$$305. \int e^{ax} \cdot \cos px \, dx = \frac{e^{ax} (a \cos px + p \sin px)}{a^2 + p^2}.$$

$$306. \int \frac{dx}{1 + e^x} = x - \log(1 + e^x) = \log \frac{e^x}{1 + e^x}.$$

$$307. \int \frac{dx}{a + be^{px}} = \frac{x}{a} - \frac{1}{ap} \log(a + be^{px}).$$

$$308. \int \frac{dx}{ae^{mx} + be^{-mx}} = \frac{1}{m\sqrt{ab}} \tan^{-1} \left(e^{mx} \sqrt{\frac{a}{b}} \right).$$

$$310. \int e^{ax} \cos px \, dx = \frac{e^{ax} (a \cos px + p \sin px)}{a^2 + p^2}.$$

$$311. \int e^{ax} \sin^n bx \, dx = \frac{1}{a^2 + n^2 b^2} \left((a \sin bx - nb \cos bx) e^{ax} \sin^{n-1} bx + n(n-1)b^2 \int e^{ax} \sin^{n-2} bx \cdot dx \right).$$

$$312. \int e^{ax} \cos^n bx \, dx = \frac{1}{a^2 + n^2 b^2} \left((a \cos bx + nb \sin bx) e^{ax} \cos^{n-1} bx + n(n-1)b^2 \int e^{ax} \cos^{n-2} bx \, dx \right).$$

$$313. \int \sinh x \, dx = \cosh x.$$

$$314. \int \cosh x \, dx = \sinh x.$$

$$315. \int \tanh x \, dx = \log \cosh x.$$

$$316. \int \coth x \, dx = \log \sinh x.$$

$$317. \int \operatorname{sech} x \, dx = 2 \tan^{-1}(e^x).$$

$$318. \int \operatorname{csch} x \, dx = \log \tanh \left(\frac{x}{2} \right).$$

$$319. \int x \sinh x \, dx = x \cosh x - \sinh x.$$

$$320. \int x \cosh x \, dx = x \sinh x - \cosh x.$$

$$321. \int \operatorname{sech} x \tanh x \, dx = -\operatorname{sech} x.$$

$$322. \int \operatorname{csch} x \coth x \, dx = -\operatorname{csch} x.$$

DEFINITE INTEGRALS

$$323. \int_0^\infty x^{n-1} e^{-x} \, dx = \int_0^1 \left(\log \frac{1}{x} \right)^{n-1} dx = \Gamma(n).$$

$$324. \Gamma(n), \text{ the gamma function is finite if } n > 0.$$

$$325. \Gamma(n+1) = n\Gamma(n).$$

DEFINITE INTEGRALS (Continued)

$$326. \Gamma(n) \cdot \Gamma(1-n) = \frac{\pi}{\sin n\pi}.$$

$$327. \Gamma(n) = (n-1)! \text{ if } n = \text{integer} > 0.$$

$$328. \Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}.$$

(See values of $\Gamma(n)$ at end of integral table.)

$$329. \int_0^1 x^{m-1} (1-x)^{n-1} dx = \int_0^1 \frac{x^{m-1} dx}{(1+x)^{m+n}} = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}.$$

$$330. \int_1^\infty \frac{dx}{x^m} = \frac{1}{m-1}, \quad [m > 1].$$

$$331. \int_0^\infty \frac{dx}{(1+x)x^p} = \pi \csc p\pi, \quad [p < 1].$$

$$332. \int_0^\infty \frac{dx}{(1-x)x^p} = -\pi \cot p\pi, \quad [p < 1].$$

$$333. \int_0^\infty \frac{x^{p-1} dx}{1+x} = \frac{\pi}{\sin p\pi}, \quad [0 < p < 1].$$

$$334. \int_0^\infty \frac{x^{m-1} dx}{1+x^n} = \frac{\pi}{n \sin \frac{m\pi}{n}}, \quad [0 < m < n].$$

$$335. \int_0^\infty \frac{dx}{(1+x)\sqrt{x}} = \pi.$$

$$336. \int_0^\infty \frac{a dx}{a^2 + x^2} = \frac{\pi}{2}, \text{ if } a > 0; 0, \text{ if } a = 0; -\frac{\pi}{2}, \text{ if } a < 0.$$

$$\begin{aligned} 337. \int_0^{\pi/2} \sin^n x dx &= \int_0^{\pi/2} \cos^n x dx \\ &= \frac{1 \cdot 3 \cdot 5 \cdots (n-1)}{2 \cdot 4 \cdot 6 \cdots (n)} \cdot \frac{\pi}{2}, \quad [n \text{ an even integer}], \\ &= \frac{2 \cdot 4 \cdot 6 \cdots (n-1)}{1 \cdot 3 \cdot 5 \cdot 7 \cdots n}, \quad [n \text{ an odd integer}], \\ &= \frac{1}{2} \sqrt{\pi} \frac{\Gamma\left(\frac{n+1}{2}\right)}{\Gamma\left(\frac{n}{2} + 1\right)}, \quad [n > -1]. \end{aligned}$$

$$338. \int_0^\infty \frac{\sin mx dx}{x} = \frac{\pi}{2}, \text{ if } m > 0; 0, \text{ if } m = 0; -\frac{\pi}{2}, \text{ if } m < 0.$$

$$339. \int_0^\infty \frac{\cos x dx}{x} = \infty.$$

$$340. \int_0^\infty \frac{\tan x dx}{x} = \frac{\pi}{2}.$$

DEFINITE INTEGRALS (Continued)

$$341. \int_0^\pi \sin kx \cdot \sin mx \, dx = \int_0^\pi \cos kx \cdot \cos mx \, dx = 0, \\ [k \neq m; m, k = \text{integers}].$$

$$342. \int_0^\infty \frac{\sin x \cos mx \, dx}{x} = 0, \, m < -1 \text{ or } m > 1, \\ = \frac{\pi}{4}, \text{ if } m = \pm 1; = \frac{\pi}{2}, \text{ if } m^2 < 1.$$

$$343. \int_0^\pi \sin^2 mx \, dx = \int_0^\pi \cos^2 mx \, dx = \frac{\pi}{2}.$$

$$344. \int_0^\infty \frac{\sin^2 x \, dx}{x^2} = \frac{\pi}{2}.$$

$$345. \int_0^\infty \frac{\cos mx}{1+x^2} \, dx = \frac{\pi}{2} e^{-m}, \quad [m > 0], \\ = \frac{\pi}{2} e^m, \quad [m < 0].$$

$$346. \int_0^\infty \cos(x^2) \, dx = \int_0^\infty \sin(x^2) \, dx = \frac{1}{2} \sqrt{\frac{\pi}{2}}.$$

$$347. \int_0^\infty \frac{\sin x \, dx}{\sqrt{x}} = \int_0^\infty \frac{\cos x \, dx}{\sqrt{x}} = \sqrt{\frac{\pi}{2}}.$$

$$348. \int_0^{\pi/2} \frac{dx}{1+a \cos x} = \frac{\cos^{-1} a}{\sqrt{1-a^2}}, \quad [a < 1].$$

$$349. \int_0^{2\pi} \frac{dx}{1+a \cos x} = \frac{2\pi}{\sqrt{1-a^2}}, \quad [a^2 < 1].$$

$$350. \int_0^\infty e^{-ax} \, dx = \frac{1}{a}. \quad [a > 0].$$

$$351. \int_0^\infty x^n e^{-ax} \, dx = \frac{\Gamma(n+1)}{a^{n+1}}, \quad [n > -1, a > 0], \\ = \frac{n!}{a^{n+1}}, \quad [n \text{ pos. integ., } a > 0].$$

$$352. \int_0^\infty e^{-a^2 x^2} \, dx = \frac{1}{2a} \sqrt{\pi} = \frac{1}{2a} \Gamma\left(\frac{1}{2}\right), \quad [a > 0].$$

$$353. \int_0^\infty x e^{-x^2} \, dx = \frac{1}{2}.$$

$$354. \int_0^\infty x^2 e^{-x^2} \, dx = \frac{\sqrt{\pi}}{4}.$$

$$355. \int_0^\infty x^{2n} e^{-ax^2} \, dx = \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{2^{n+1} a^n} \sqrt{\frac{\pi}{a}}.$$

$$356. \int_0^\infty e^{(-x^2 - a^2/x^2)} \, dx = \frac{e^{-2a} \sqrt{\pi}}{2}.$$

DEFINITE INTEGRALS (Continued)

357. $\int_0^{\infty} e^{-nx} \sqrt{x} dx = \frac{1}{2n} \sqrt{\frac{\pi}{n}}.$
358. $\int_0^{\infty} \frac{e^{-nx}}{\sqrt{x}} dx = \sqrt{\frac{\pi}{n}}.$
359. $\int_0^{\infty} e^{-ax} \cos mx dx = \frac{a}{a^2 + m^2},$ $[a > 0].$
360. $\int_0^{\infty} e^{-ax} \sin mx dx = \frac{m}{a^2 + m^2},$ $[a > 0].$
361. $\int_0^{\infty} e^{-a^2x^2} \cos bx dx = \frac{\sqrt{\pi} \cdot e^{-b^2/4a^2}}{2a},$ $[a > 0].$
362. $\int_0^1 (\log x)^n dx = (-1)^n \cdot n!.$
363. $\int_0^1 \left(\log \frac{1}{x}\right)^{\frac{1}{2}} dx = \frac{\sqrt{\pi}}{2}.$
364. $\int_0^1 \left(\log \frac{1}{x}\right)^{-\frac{1}{2}} dx = \sqrt{\pi}.$
365. $\int_0^1 \left(\log \frac{1}{x}\right)^n dx = n!.$
366. $\int_0^1 x \log (1 - x) dx = -\frac{3}{4}.$
367. $\int_0^1 x \log (1 + x) dx = \frac{1}{4}.$
368. $\int_0^1 \frac{\log x}{1 + x} dx = -\frac{\pi^2}{12}.$
369. $\int_0^1 \frac{\log x}{1 - x} dx = -\frac{\pi^2}{6}.$
370. $\int_0^1 \frac{\log x}{1 - x^2} dx = -\frac{\pi^2}{8}.$
371. $\int_0^1 \log \left(\frac{1 + x}{1 - x}\right) \cdot \frac{dx}{x} = \frac{\pi^2}{4}.$
372. $\int_0^1 \frac{\log x dx}{\sqrt{1 - x^2}} = -\frac{\pi}{2} \log 2.$
373. $\int_0^1 x^m \left(\log \frac{1}{x}\right)^n dx = \frac{\Gamma(n + 1)}{(m + 1)^{n+1}},$ if $m + 1 > 0,$
 $n + 1 > 0.$
374. $\int_0^1 \frac{(x^p - x^q)dx}{\log x} = \log \left(\frac{p + 1}{q + 1}\right),$ $[p + 1 > 0, q + 1 > 0].$
375. $\int_0^1 \frac{dx}{\sqrt{\log \left(\frac{1}{x}\right)}} = \sqrt{\pi}.$

DEFINITE INTEGRALS (Continued)

376. $\int_0^{\infty} \log \left(\frac{e^x + 1}{e^x - 1} \right) dx = \frac{\pi^2}{4}.$
377. $\int_0^{\pi} x \cdot \log \sin x \, dx = -\frac{\pi^2}{2} \log 2.$
378. $\int_0^{\pi/2} \log \sin x \, dx = \int_0^{\pi/2} \log \cos x \, dx = -\frac{\pi}{2} \cdot \log 2.$
379. $\int_0^{\pi/2} \sin x \log \sin x \, dx = \log 2 - 1.$
380. $\int_0^{\pi/2} \log \tan x \, dx = 0.$
381. $\int_0^{\pi} \log (a \pm b \cos x) \, dx = \pi \log \left(\frac{a + \sqrt{a^2 - b^2}}{2} \right), [a \geq b].$

GAMMA FUNCTION

$$\text{Values of } \Gamma(n) = \int_0^{\infty} e^{-x} x^{n-1} dx$$

<i>n</i>	$\Gamma(n)$	<i>n</i>	$\Gamma(n)$	<i>n</i>	$\Gamma(n)$	<i>n</i>	$\Gamma(n)$
1.00	1.00000	1.25	.90640	1.50	.88623	1.75	.91906
1.01	.99433	1.26	.90440	1.51	.88659	1.76	.92137
1.02	.98884	1.27	.90250	1.52	.88704	1.77	.92376
1.03	.98355	1.28	.90072	1.53	.88757	1.78	.92623
1.04	.97844	1.29	.89904	1.54	.88818	1.79	.92877
1.05	.97350	1.30	.89747	1.55	.88887	1.80	.93138
1.06	.96874	1.31	.89600	1.56	.88964	1.81	.93408
1.07	.96415	1.32	.89464	1.57	.89049	1.82	.93685
1.08	.95973	1.33	.89338	1.58	.89142	1.83	.93969
1.09	.95546	1.34	.89222	1.59	.89243	1.84	.94261
1.10	.95135	1.35	.89115	1.60	.89352	1.85	.94561
1.11	.94739	1.36	.89018	1.61	.89468	1.86	.94869
1.12	.94359	1.37	.88931	1.62	.89592	1.87	.95184
1.13	.93993	1.38	.88854	1.63	.89724	1.88	.95507
1.14	.93642	1.39	.88785	1.64	.89864	1.89	.95838
1.15	.93304	1.40	.88726	1.65	.90012	1.90	.96177
1.16	.92980	1.41	.88676	1.66	.90167	1.91	.96523
1.17	.92670	1.42	.88636	1.67	.90330	1.92	.96878
1.18	.92373	1.43	.88604	1.68	.90500	1.93	.97240
1.19	.92088	1.44	.88580	1.69	.90678	1.94	.97610
1.20	.91817	1.45	.88565	1.70	.90864	1.95	.97988
1.21	.91558	1.46	.88560	1.71	.91057	1.96	.98374
1.22	.91311	1.47	.88563	1.72	.91258	1.97	.98768
1.23	.91075	1.48	.88575	1.73	.91466	1.98	.99171
1.24	.90852	1.49	.88595	1.74	.91683	1.99	.99581
						2.00	1.00000

ALGEBRA

Factors and Expansions

$$(a \pm b)^2 = a^2 \pm 2ab + b^2.$$

$$(a \pm b)^3 = a^3 \pm 3a^2b + 3ab^2 \pm b^3.$$

$$(a \pm b)^4 = a^4 \pm 4a^3b + 6a^2b^2 \pm 4ab^3 + b^4.$$

$$a^2 - b^2 = (a - b)(a + b).$$

$$a^2 + b^2 = (a + b\sqrt{-1})(a - b\sqrt{-1}).$$

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2).$$

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2).$$

$$a^4 + b^4 = (a^2 + ab\sqrt{2} + b^2)(a^2 - ab\sqrt{2} + b^2).$$

$$a^n - b^n = (a - b)(a^{n-1} + a^{n-2}b + \dots + b^{n-1}).$$

$$a^n - b^n = (a + b)(a^{n-1} - a^{n-2}b + \dots - b^{n-1}),$$

for even values of n .

$$a^n + b^n = (a + b)(a^{n-1} - a^{n-2}b + \dots + b^{n-1}),$$

for odd values of n .

$$a^4 + a^2b^2 + b^4 = (a^2 + ab + b^2)(a^2 - ab + b^2).$$

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2ac + 2bc.$$

$$(a + b + c)^3 = a^3 + b^3 + c^3 + 3a^2(b + c) + 3b^2(a + c) + 3c^2(a + b) + 6abc.$$

$$(a + b + c + d + \dots)^2 = a^2 + b^2 + c^2 + d^2 + \dots + 2a(b + c + d + \dots) + 2b(c + d + \dots) + 2c(d + \dots) + \dots$$

See also under Series

Powers and Roots

$$a^x \times a^y = a^{(x+y)}.$$

$$a^0 = 1 \text{ [if } a \neq 0]. \quad (ab)^x = a^x b^x.$$

$$\frac{a^x}{a^y} = a^{(x-y)}.$$

$$a^{-x} = \frac{1}{a^x}. \quad \left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}.$$

$$(a^x)^y = a^{xy}.$$

$$a^{\frac{1}{x}} = \sqrt[x]{a}.$$

$$\sqrt[x]{ab} = \sqrt[x]{a} \sqrt[x]{b}.$$

$$\sqrt[x]{\sqrt[y]{a}} = \sqrt[xy]{a}.$$

$$a^{\frac{x}{y}} = \sqrt[y]{a^x}.$$

$$\sqrt[x]{\frac{a}{b}} = \frac{\sqrt[x]{a}}{\sqrt[x]{b}}.$$

Proportion

If $\frac{a}{b} = \frac{c}{d},$

then

$$\frac{a+b}{b} = \frac{c+d}{d},$$

$$\frac{a-b}{b} = \frac{c-d}{d},$$

$$\frac{a-b}{a+b} = \frac{c-d}{c+d}.$$

ALGEBRA—(Continued)

SUMS OF NUMBERS

The sum of the first n numbers,—

$$\Sigma(n) = 1 + 2 + 3 + 4 + 5 \dots + n = \frac{n(n+1)}{2}$$

The sum of the squares of the first n numbers,

$$\Sigma(n^2) = 1^2 + 2^2 + 3^2 + 4^2 + 5^2 \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

The sum of the cubes of the first n numbers,

$$\Sigma(n^3) = 1^3 + 2^3 + 3^3 + 4^3 + 5^3 \dots + n^3 = \frac{n^2(n+1)^2}{4}$$

ARITHMETICAL PROGRESSION

If a is the first term; l , the last term; d , the common difference; n , the number of terms and s , the sum of n terms,—

$$l = a + (n-1)d \quad s = \frac{n}{2}(a+l)$$

$$s = \frac{n}{2} \{ 2a + (n-1)d \}$$

GEOMETRICAL PROGRESSION

If a is the first term; l , the last term; r , the common ratio; n , the number of terms and s , the sum of n terms,—

$$l = ar^{n-1} \quad s = a \frac{(1-r^n)}{1-r}$$

$$s = a \frac{(r^n - 1)}{r - 1} \quad s = \frac{lr - a}{r - 1}$$

If n is infinity and r^2 less than unity,—

$$s = \frac{a}{1-r}$$

FACTORIALS

$$[n = n! = e^{-n} n^n \sqrt{2\pi n}, \text{ approximately.}]$$

PERMUTATIONS

If M denote the number of permutations of n things taken p at a time,—

$$M = n(n-1)(n-2) \dots (n-p+1)$$

COMBINATIONS

If M denote the number of combinations of n things taken p at a time,—

$$M = \frac{n(n-1)(n-2) \dots (n-p+1)}{p!}$$

$$M = \frac{n!}{p!(n-p)!}$$

ALGEBRA (Continued)

Quadratic Equations

Any quadratic equation may be reduced to the form, —
 $ax^2 + bx + c = 0$

$$\text{Then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

If $b^2 - 4ac$ is positive the roots are real and unequal.

If $b^2 - 4ac$ is zero the roots are real and equal.

If $b^2 - 4ac$ is negative the roots are imaginary and unequal.

If $b^2 - 4ac$ is a perfect square the roots are rational and unequal.

Cubic Equations

A cubic equation, $y^3 + py^2 + qy + r = 0$ may be reduced to the form, —

$$x^3 + ax + b = 0$$

by substituting for y the value, $\left(x - \frac{p}{3}\right)$. Here

$$a = \frac{1}{3}(3q - p^2) \text{ and } b = \frac{1}{27}(2p^3 - 9pq + 27r).$$

For solution let, —

$$A = \sqrt[3]{-\frac{b}{2} + \sqrt{\frac{b^2}{4} + \frac{a^3}{27}}}, \quad B = \sqrt[3]{-\frac{b}{2} - \sqrt{\frac{b^2}{4} + \frac{a^3}{27}}},$$

then the values of x will be given by,

$$x = A + B, \quad -\frac{A+B}{2} + \frac{A-B}{2}\sqrt{-3}, \quad -\frac{A+B}{2} - \frac{A-B}{2}\sqrt{-3}$$

If $\frac{b^2}{4} + \frac{a^3}{27} > 0$, there will be one real root and two conjugate imaginary roots.

If $\frac{b^2}{4} + \frac{a^3}{27} = 0$, there will be three real roots of which two at least are equal

If $\frac{b^2}{4} + \frac{a^3}{27} < 0$, there will be three real and unequal roots.

In the last case a trigonometric solution is useful. Compute the value of the angle ϕ in the expression, —

$$\cos \phi = -\frac{b}{2} \div \sqrt{\left(-\frac{a^3}{27}\right)},$$

then x will have the following values:—

$$2\sqrt{-\frac{a}{3}} \cos \frac{\phi}{3}, \quad 2\sqrt{-\frac{a}{3}} \cos\left(\frac{\phi}{3} + 120^\circ\right),$$

$$2\sqrt{-\frac{a}{3}} \cos\left(\frac{\phi}{3} + 240^\circ\right).$$

APPROXIMATIONS

If a and b are small quantities, the following relations are approximately true,—

$$(1 \pm a)^m = 1 \pm ma,$$

$$(1 \pm a)^m (1 \pm b)^n = 1 \pm ma \pm nb.$$

If n is nearly equal to m ,

$$\sqrt{mn} = \frac{n+m}{2}, \text{ approximately.}$$

If θ is a very small angle expressed in radians,—

$$\frac{\sin \theta}{\theta} = 1 \text{ and } \frac{\tan \theta}{\theta} = 1, \text{ approximately.}$$

SERIES

The expression in parentheses following certain of the series indicates the region of convergence. If not otherwise indicated it is to be understood that the series converges for all finite values of x .

BINOMIAL

$$(x+y)^n = x^n + nx^{n-1}y + \frac{n(n-1)}{2!} x^{n-2}y^2 +$$

$$\frac{n(n-1)(n-2)}{3!} x^{n-3}y^3 + \dots (y^2 < x^2)$$

$$(1 \pm x)^n = 1 \pm nx + \frac{n(n-1)x^2}{2!} \pm \frac{n(n-1)(n-2)x^3}{3!} + \dots \text{etc.} \quad (x^2 < 1)$$

$$(1 \pm x)^{-n} = 1 \mp nx + \frac{n(n+1)x^2}{2!} \mp \frac{n(n+1)(n+2)x^3}{3!} + \dots \text{etc.} \quad (x^2 < 1)$$

$$(1 \pm x)^{-1} = 1 \mp x + x^2 \mp x^3 + x^4 \mp x^5 + \dots \quad (x^2 < 1)$$

$$(1 \pm x)^{-2} = 1 \mp 2x + 3x^2 \mp 4x^3 + 5x^4 \mp 6x^5 + \dots \quad (x^2 < 1)$$

TAYLOR'S SERIES

$$f(x+h) = f(x) + hf'(x) + \frac{h^2}{2!} f''(x) + \frac{h^3}{3!} f'''(x) + \dots$$

$$= f(h) + xf'(h) + \frac{x^2}{2!} f''(h) + \frac{x^3}{3!} f'''(h) + \dots$$

MACLAURIN'S SERIES

$$f(x) = f(0) + xf'(0) + \frac{x^2}{2!} f''(0) + \frac{x^3}{3!} f'''(0) + \dots$$

EXPONENTIAL

$$e = 1 + \frac{1}{1} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$$

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$$

$$a^x = 1 + x \log a + \frac{(x \log a)^2}{2!} + \frac{(x \log a)^3}{3!} + \dots$$

SERIES (Continued)

LOGARITHMIC

$$\log_e x = \frac{x-1}{x} + \frac{1}{2} \left(\frac{x-1}{x} \right)^2 + \frac{1}{3} \left(\frac{x-1}{x} \right)^3 + \dots \quad (x > \frac{1}{2})$$

$$\log_e x = (x-1) - \frac{1}{2}(x-1)^2 + \frac{1}{3}(x-1)^3 - \dots \quad (2 > x > 0)$$

$$\log_e x = 2 \left[\frac{x-1}{x+1} + \frac{1}{3} \left(\frac{x-1}{x+1} \right)^3 + \frac{1}{5} \left(\frac{x-1}{x+1} \right)^5 + \dots \right] \quad (x > 0)$$

$$\log_e(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \dots \quad (-1 < x < 1)$$

$$\log_e(n+1) - \log_e(n-1) = 2 \left[\frac{1}{n} + \frac{1}{3n^3} + \frac{1}{5n^5} + \dots \right]$$

$$\log_e(a+x) = \log_e a + 2 \left[\frac{x}{2a+x} + \frac{1}{3} \left(\frac{x}{2a+x} \right)^3 + \frac{1}{5} \left(\frac{x}{2a+x} \right)^5 + \dots \right] \quad (a > 0, -a < x < +\infty)$$

TRIGONOMETRIC

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

$$\tan x = x + \frac{x^3}{3} + \frac{2x^5}{15} + \frac{17x^7}{315} + \frac{62x^9}{2835} + \dots \quad \left(x^2 < \frac{\pi^2}{4} \right)$$

$$\sin^{-1}x = x + \frac{x^3}{6} + \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{x^5}{5} + \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{5}{6} \cdot \frac{x^7}{7} + \dots \quad (x^2 < 1)$$

$$\tan^{-1}x = x - \frac{1}{3}x^3 + \frac{1}{5}x^5 - \frac{1}{7}x^7 + \dots \quad (x^2 < 1)$$

$$= \frac{\pi}{2} - \frac{1}{x} + \frac{1}{3x^3} - \frac{1}{5x^5} + \dots \quad (x^2 > 1)$$

$$\log_e \sin x = \log_e x - \frac{x^2}{6} - \frac{x^4}{180} - \frac{x^6}{2835} - \dots \quad (x^2 < \pi^2)$$

$$\log_e \cos x = -\frac{x^2}{2} - \frac{x^4}{12} - \frac{x^6}{45} - \frac{17x^8}{2520} - \dots \quad \left(x^2 < \frac{\pi^2}{4} \right)$$

$$\log_e \tan x = \log_e x + \frac{x^2}{3} + \frac{7x^4}{90} + \frac{62x^6}{2835} + \dots \quad \left(x^2 < \frac{\pi^2}{4} \right)$$

$$e^{\sin x} = 1 + x + \frac{x^2}{2!} - \frac{3x^4}{4!} - \frac{8x^5}{5!} - \frac{3x^6}{6!} + \frac{56x^7}{7!} + \dots$$

$$e^{\cos x} = e \left(1 - \frac{x^2}{2!} + \frac{4x^4}{4!} - \frac{31x^6}{6!} + \dots \right)$$

$$e^{\tan x} = 1 + x + \frac{x^2}{2!} + \frac{3x^3}{3!} + \frac{9x^4}{4!} + \frac{37x^5}{5!} + \dots \quad \left(x^2 < \frac{\pi^2}{4} \right)$$

ALGEBRA (Continued)

MISCELLANEOUS

The Sum (Σ , = Sigma) and Product (Π , = Pi) Notations

Σ denotes the **sum**, and Π , the **product** of all quantities of a given collection. In particular,

$\sum_{i=m}^{m+n} x_i$ means $x_m + x_{m+1} + \dots + x_{m+n}$, ($n + 1$ terms in all),

$\prod_{i=m}^{m+n} x_i$ means $x_m x_{m+1} \dots x_{m+n}$, ($n + 1$ factors in all).

For indicated **range**, R , (such as $m \leq i \leq m + n$), one may write $\sum_R x_i$, $\prod_R x_i$, respectively. Where the range is clear from

the context one writes Σx_i , Πx_i , or even Σx , Πx , respectively. For c a constant and for x_i and y_i with common range (say of n elements),

$$\Sigma c x_i = c \Sigma x_i, \quad \Sigma (x_i + y_i) = \Sigma x_i + \Sigma y_i, \quad \Sigma (x_i + c) = nc + \Sigma x_i.$$

Special Numerical Relations

(i) For range, $i = 1, 2, \dots, n$, with $x_i = i$.

$$\Sigma x_i = n(n+1)/2, \quad \Sigma (2x_i - 1) = n^2,$$

$$\Sigma x_i^2 = n(n+1)(2n+1)/6.$$

$$\Sigma x_i^3 = (\Sigma x_i)^2, \quad \Sigma x_i^4 = (\Sigma x_i^2)[6(\Sigma x_i) - 1]/5.$$

$$\Pi (c + 1 - x_i) = c^{(n)}, \quad \Pi x_i = n^{(n)} = n! \text{ ("factorial } n").$$

Hence $n! = n \cdot (n-1)!$ $0!$ is defined to be 1.

Stirling's formula (used for n large),

$$\sqrt{2n\pi}(n/e)^n < n! < \sqrt{2n\pi}(n/e)^n \left(1 + \frac{1}{12n-1}\right),$$

$$(\pi = 3.14159 \dots, e = 2.71828 \dots).$$

$n!/(n-m)!$ gives the number of **permutations** of n **distinct things** taken m at a time.

(ii) For range, $i = -\left(\frac{n-1}{2}\right), -\left(\frac{n-1}{2}\right) + 1, \dots,$
 $\left(\frac{n-1}{2}\right) - 1, \left(\frac{n-1}{2}\right)$, with

$x_i = i$ (whether n is odd or even),

$$\sum x_i = \sum x_i^3 = 0, \quad \sum x_i^2 = \frac{n(n^2-1)}{12}, \quad \sum x_i^4 = \frac{3n^2-7}{20} \sum x_i^2.$$

ALGEBRA (Continued)

(iii) The Binomial Coefficients, $\binom{n}{m}$.

$\binom{n}{m} = n! / [(n - m)!m!]$, for integers $m, n, 0 \leq m \leq n$. $\binom{n}{0} = \binom{n}{n} = 1$.

$(x + c)^n = \sum_r \binom{n}{r} x^{n-r} c^r$, ($0 \leq r \leq n$), the binomial expansion.

$\binom{n}{m}$ gives also the number of combinations of n distinct things taken m at a time.

$\binom{n}{m} + \binom{n}{m+1} = \binom{n+1}{m+1}$, recursion relation for binomial coefficients.

$$\binom{n}{n-m} = \binom{n}{m}, \sum_r (-1)^r \binom{n}{r} = 0, \sum_r \binom{n}{r}^2 = \binom{2n}{n}, \sum_{s=m}^n \binom{n}{s} = \binom{n+1}{m+1}.$$

Table of Binomial Coefficients

n	$\binom{n}{0}$	$\binom{n}{1}$	$\binom{n}{2}$	$\binom{n}{3}$	$\binom{n}{4}$	$\binom{n}{5}$	$\binom{n}{6}$	$\binom{n}{7}$	$\binom{n}{8}$	$\binom{n}{9}$	$\binom{n}{10}$
0	1										
1	1	1									
2	1	2	1								
3	1	3	3	1							
4	1	4	6	4	1						
5	1	5	10	10	5	1					
6	1	6	15	20	15	6	1				
7	1	7	21	35	35	21	7	1			
8	1	8	28	56	70	56	28	8	1		
9	1	9	36	84	126	126	84	36	9	1	
10	1	10	45	120	210	252	210	120	45	10	1
11	1	11	55	165	330	462	462	330	165	55	11
12	1	12	66	220	495	792	924	792	495	220	66
13	1	13	78	286	715	1287	1716	1716	1287	715	286
14	1	14	91	364	1001	2002	3003	3432	3003	2002	1001
15	1	15	105	455	1365	3003	5005	6435	6435	5005	3003
16	1	16	120	560	1820	4368	8008	11440	12870	11440	8008
17	1	17	136	680	2380	6188	12376	19448	24310	24310	19448
18	1	18	153	816	3060	8568	18564	31824	43758	48620	43758
19	1	19	171	969	3876	11628	27132	50388	75582	92378	92378
20	1	20	190	1140	4845	15504	38760	77520	125970	167960	184756

NOTE: $\binom{n}{m} = \frac{n(n-1)(n-2) \dots (n-m+1)}{m(m-1)(m-2) \dots 3.2.1}$; $\binom{n}{0} = 1$; $\binom{n}{1} = n$.

For coefficients missing from the above table, use the relation

$$\binom{n}{m} = \binom{n}{n-m}, \text{ e.g. } \binom{20}{11} = \binom{20}{9} = 167960.$$

ALGEBRA (Continued)

Finite Differences

For equi-spaced arguments x_i , and associated y_i , the successive advancing y -differences are, $\Delta^0 y_i = y_i$, $\Delta y_i = y_{i+1} - y_i$, $\Delta^2 y_i = \Delta y_{i+1} - \Delta y_i = y_{i+2} - 2y_{i+1} + y_i$, . . . , $\Delta^m y_i = \Delta^{m-1} y_{i+1} - \Delta^{m-1} y_i = \sum_r (-1)^r \binom{m}{r} y_{i+m-r}$. With arbitrary origin A and

class-interval length, $x_{i+1} - x_i = h$, using $u_i = (x_i - A)/h$, write $y(u_i)$ for y_i . Then if for some fixed m , for the portion of the table considered, the values of $\Delta^{m+1} y_i$ be zero (or approximately, if these be regarded as negligible) **Newton's formula** gives

$$y(u) = \sum_r \frac{u^{(r)}}{r!} \Delta^r y(0) = y(0) + u \Delta y(0) + \frac{u(u-1)}{1 \cdot 2} \Delta^2 y(0) + \dots + \frac{u(u-1) \dots (u-m+1)}{m!} \Delta^m y(0).$$

This formula reduces to an identity for $u = u_0, u_1, \dots, u_n$ ($u_i = i$), and may be used to interpolate for intermediate values.

Example. Given

x	-4, -2, 0, 2, 4, 6, 8, . . .
y	10, 14, 30, 64, 122, 210, 334, . . .

to find a value for y when $x = 10$, and when $x = 1$. Suppose for some reason A has been taken at $x = 2$. The work may be arranged as follows:

u	x	y	Δ	Δ^2	Δ^3	Δ^4
-3	-4	10				
			4			
-2	-2	14		12		
			16		6	
-1	0	30		18		0
			34		6	
0	2	64		24		0
			58		6	
1	4	122		30		0
			88		6	
2	6	210		36		—
			124		—	
3	8	334		—		—
			—		—	
—	—	—		—		—

$$y(u) = 64 + 58u + 30 \frac{u(u-1)}{1 \cdot 2} + 6 \frac{u(u-1)(u-2)}{1 \cdot 2 \cdot 3} \\ = 64 + 58u + 15u(u-1) + u(u-1)(u-2).$$

At $x = 10$, $u = 4$. Substituting $u = 4$, one has $y|_{x=10} = 500$.
At $x = 1$, $u = -\frac{1}{2}$. Substituting $u = -\frac{1}{2}$, one has $y|_{x=1} = 44\frac{2}{3}$.

STATISTICS

Central Measures

Here the range of i is from 1 to n . With each value x_i is associated a weighting factor $f_i \geq 0$ (such as the frequency, the probability, the mass, the reliability, or other multiplier).

N , the **total weight**, $= \sum f_i$.

\bar{x} , the **arithmetic mean**, $= \sum f_i x_i / N = \sum f_i x_i / \sum f_i$.

GM , the **geometric mean** (available when each x_i is positive),
 $= \sqrt[N]{\prod x_i^{f_i}}$. $\log GM = \sum f_i \log x_i / N$.

Mo , the **mode**, = value among (x_1, \dots, x_n) having maximum associated f_i (usually obtained by interpolating after the data are graduated). For unweighted items, x_i , a mode is a value about which the values of x_i cluster most densely.

RMS , the **root-mean-square**, $= \sqrt{\sum f_i x_i^2 / N}$.

Md , the **median** (see below). For unweighted items, the median is the value, equalled or exceeded by exactly half of the values x_i in the given list. In case of a central pair, the median is usually taken as the arithmetic mean of this pair.

Mm , the **mid-mean** (see below). For unweighted items, the mid-mean is the arithmetic mean of the half-list obtained upon dropping out the highest quarter and lowest quarter of the items.

$\text{Cum } f|_X$, the value of "cumulative f " at X , $= \sum_{x_i < X} f_i$ (interpolation being used for X if necessary).

The M-Tiles

For **ungrouped data**, X is called the r th m -tile (or r th m -tile mark) ($r = 0, 1, \dots, m$) if simultaneously, $\sum_{x_i < X} f_i / N \leq r/m$,

and $\sum_{x_i > X} f_i / N \leq (m - r)/m$. In particular the zeroth m -tile

is **min**, the minimal value among the list (x_1, \dots, x_n) , and the m th m -tile is **max**, the maximal value among the list.

For **grouped data**, the r th m -tile mark, X , is such that

$$\text{Cum } f|_X = Nr/m, \quad (r = 0, 1, 2, \dots, m).$$

$$\text{Cum } f|_{\min} = 0, \quad \text{Cum } f|_{\max} = N.$$

In particular, certain intermediate ($0 < r < m$) m -tile marks are named as follows:

m	$r = 1$	2	3	...
2	Md (median)			
3	T_1 (lower tertile)	T_2 (upper tertile)		
4	Q_1 (lower quartile)	Md	Q_3 (upper quartile)	
10	D_1 (first decile)	D_2	D_3	etc.
100	PC_1 (first percentile)	PC_2	PC_3	etc.

STATISTICS (Continued)

The term "rth m-tile" ($r = 1, \dots, m$) is also used to denote the class interval extending from the $(r - 1)$ st to r th m -tile mark as defined above.

Mm , the mid-mean, =

$$2 \sum_{Q_1 \leq x_i \leq Q_3} f_i x_i / N = \sum_{Q_1 \leq x_i \leq Q_3} f_i x_i / \sum_{Q_1 \leq x_i \leq Q_3} f_i.$$

When each x_i is positive, and not all are equal, one always has $0 < \min < GM < \bar{x} < RMS < \max$.

For moderately-skewed distributions, one has approximately $Mo - \bar{x} = 3(Md - \bar{x})$, or $3Md = Mo + 2\bar{x}$.

Measures of Dispersion and Skewness

Here A is an arbitrary reference value, usually a convenient integral measure near \bar{x} .

ν_k , k th moment about A , = $\sum f_i (x_i - A)^k / N$, ($k = 0, 1, \dots$).

$\nu_0 = 1$, $\nu_1 = \bar{x} - A$. ν_2 as function of A is minimum for $A = \bar{x}$.

μ_k , k th moment about \bar{x} , = $\sum f_i (x_i - \bar{x})^k / N$, ($k = 0, 1, \dots$).

$$\mu_0 = 1,$$

$$\mu_1 = 0,$$

$$\mu_2 = \nu_2 - \nu_1^2 \quad (\mu_2 = \text{variance}),$$

$$\mu_3 = \nu_3 - 3\nu_1\nu_2 + 2\nu_1^3,$$

$$\mu_4 = \nu_4 - 4\nu_1\nu_3 + 6\nu_1^2\nu_2 - 3\nu_1^4.$$

$$\beta_1 = \mu_3^2 / \mu_2^3, \quad \beta_2 = \mu_4 / \mu_2^2.$$

σ , standard deviation, = $\sqrt{\mu_2}$.

$\alpha_3/2$, momental skewness; $\alpha_3 = \sqrt{\beta_1} = \mu_3/\sigma^3$.

$(\alpha_4 - 3)/2$, kurtosis; $\alpha_4 = \beta_2$.

MD , mean deviation (from the mean), = $\sum f_i |x_i - \bar{x}| / N$
 = $2 \left[\bar{x} \sum_{x_i < \bar{x}} f_i - \sum_{x_i < \bar{x}} f_i x_i \right] / N$. (This latter form is convenient for computation.)

s , quartile deviation, = $|Q_3 - Q_1|/2$.

$P.E.$, probable error, = 0.6745σ .

V , coefficient of variation, = $100\sigma/\bar{x} \%$.

Pearson's measure of skewness = $(\bar{x} - Mo)/\sigma$. (Usually approximately $\alpha_3/2$.)

Bowley's measure of skewness = $(Q_3 - 2Md + Q_1)/(2s)$.

(Bowley's measure of skewness lies between -1 and $+1$.)

STATISTICS (Continued)

The Class Interval

$$\Delta x_i = x_{i+1} - x_i.$$

For equi-spaced arguments, $\Delta x_i = h$, the length of the class interval, x_i is the mid-value or class mark. The interval from $x_i - (h/2)$ to $x_i + (h/2)$ is the class interval with these as given initial and terminal end values.

$$\begin{aligned} u_i &= (x_i - A)/h. \\ \bar{u} &= \Sigma f_i u_i / N, \quad \bar{x} = h\bar{u} + A. \\ (\mu_k)_x &= h^k (\mu_k)_u, \quad (k = 0, 1, \dots). \\ \sigma_u^2 &= [\Sigma f_i u_i^2 / N] - \bar{u}^2, \quad \sigma_x = h\sigma_u. \\ (\beta_1)_x &= (\beta_1)_u, \quad (\beta_2)_x = (\beta_2)_u. \end{aligned}$$

Sheppard's corrections (to correct approximately for the error due to treating all elements in a given class interval of length h as though concentrated at the class mark).

For μ_0, μ_1, μ_3 , no corrections.

In x -units,

$$\text{corrected } (\mu_2)_x = \text{uncorrected } (\mu_2)_x - h^2/12,$$

$$\text{corrected } (\mu_4)_x = \text{uncorrected } (\mu_4)_x - h^2 \text{ uncorrected } (\mu_2)_x/2 + 7h^4/240.$$

In u -units, replace h by 1 in the formulae given above.

Least Squares

The normal equations for finding coefficients, a_0, a_1, \dots, a_m , in fitting a curve of the form $y = a_0 + a_1x + \dots + a_mx^m$ to data $(X_i, Y_i), i = 1, \dots, n, (n > m)$, are $m + 1$ in number as follows:

$$\begin{aligned} \Sigma Y_i &= a_0 n + a_1 \Sigma X_i + a_2 \Sigma X_i^2 + \dots + a_m \Sigma X_i^m, \\ \Sigma X_i Y_i &= a_0 \Sigma X_i + a_1 \Sigma X_i^2 + a_2 \Sigma X_i^3 + \dots + a_m \Sigma X_i^{m+1}, \end{aligned}$$

$$\Sigma \dot{X}_i^m Y_i = a_0 \Sigma \dot{X}_i^m + a_1 \Sigma \dot{X}_i^{m+1} + a_2 \Sigma \dot{X}_i^{m+2} + \dots + a_m \Sigma \dot{X}_i^{2m}.$$

Deviation from fitted curve,

$$d_i = Y_i - (a_0 + a_1 X_i + \dots + a_m X_i^m).$$

$$\Sigma d_i^2 = \Sigma Y_i^2 - (a_0 \Sigma Y_i + a_1 \Sigma X_i Y_i + \dots + a_m \Sigma X_i^m Y_i).$$

For $z = ab^x$, use $y = \log z, a_0 = \log a, a_1 = \log b$.

For $z = at^p$, use $y = \log z, a_0 = \log a, a_1 = p, x = \log t$.

S_y , standard error of estimate, = root-mean-square of the y -deviations about a fitted curve = $\sqrt{\Sigma d_i^2 / n}$.

Simple Correlation

PRODUCT MOMENT METHOD

Given n equi-spaced measurements $X_i, i = 1, 2, \dots, n$, with $h = X_{i+1} - X_i, x_i = X_i - \bar{X}$; and m equi-spaced measurements $Y_j, j = 1, 2, \dots, m$, with $k = Y_{j+1} - Y_j, y_j = Y_j - \bar{Y}$; and a weight (frequency, probability, etc.) $e_{ij} (\geq 0)$, associated with (X_i, Y_j) . Here e_{ij} is an entry in the table.

STATISTICS (Continued)

$$f_i = \sum_j e_{ij}, g_j = \sum_i e_{ij}.$$

$$N = \sum_{ij} e_{ij} = \sum_i f_i = \sum_j g_j. \quad (\text{Check})$$

$$\bar{x} = \sum_{ij} e_{ij} X_i / N = \sum_i f_i X_i / N; \bar{y} = \sum_{ij} e_{ij} Y_j / N = \sum_j g_j Y_j / N.$$

Let A and B be arbitrary reference values, usually convenient integral measures near \bar{X} and \bar{Y} , respectively.

$$u_i = (X_i - A)/h, v_j = (Y_j - B)/k;$$

$$\bar{u} = \sum f_i u_i / N, \bar{X} = h\bar{u} + A, \bar{v} = \sum g_j v_j / N, \bar{Y} = k\bar{v} + B.$$

$$\sigma_u^2 = (\mu_2)_u = (\sum f_i u_i^2 / N) - \bar{u}^2, \sigma_x = h\sigma_u, \sigma_v^2 = (\mu_2)_v = (\sum g_j v_j^2 / N) - \bar{v}^2, \sigma_y = k\sigma_v. \quad \text{Apply Sheppard's corrections.}$$

$$U_j = \sum_i e_{ij} u_i, V_i = \sum_j e_{ij} v_j, P = \sum u_i V_i = \sum v_j U_j. \quad (\text{Check})$$

$$p_{uv} = \sum_{ij} e_{ij} (u_i - \bar{u})(v_j - \bar{v}) / N = (\sum_{ij} e_{ij} u_i v_j / N) - \bar{u}\bar{v}.$$

$$p_{xy} = hkp_{uv}.$$

$r = p_{uv} / (\sigma_u \sigma_v) = p_{xy} / (\sigma_x \sigma_y)$ (product-moment) coefficient of correlation. In every case $-1 \leq r \leq 1$.

$$Y - \bar{Y} = r \frac{\sigma_y}{\sigma_x} (X - \bar{X}), \text{ or } y = r \frac{\sigma_y}{\sigma_x} x, \text{ regression line of } y \text{ on } x.$$

$$X - \bar{X} = r \frac{\sigma_x}{\sigma_y} (Y - \bar{Y}), \text{ or } x = r \frac{\sigma_x}{\sigma_y} y, \text{ regression line of } x \text{ on } y.$$

Example of Computation for Product-Moment Coefficient of Correlation

$\begin{array}{c} u_i \\ \hline v_j \end{array} \quad \begin{array}{c} x_i \\ \hline y_j \end{array}$		x_i						g_j	$g_j v_j$	$g_j v_j^2$	U_j $(= \sum_i e_{ij} u_i)$	$v_j U_j$
		-3	-2	-1	0	1	2					
		12	16	20	24	28	32					
2	21			1	5	7	1	14	28	56	8	16
1	18		1	3	7	5	2	18	18	18	4	4
0	15		2	3	4	1		10	0	0		0
-1	12		3	1	1			5	-5	5	-7	7
-2	9	2	1					3	-6	12	-8	16
f_i		2	7	8	17	13	3	50	35	91		43
$f_i u_i$		-6	-14	-8	0	13	6	-9	$A = 24, B = 15,$ $h = 4, k = 3,$ $N = \sum f_i = \sum g_j = 50,$ $\sum f_i u_i = -9, \sum g_j v_j = 35,$ $\sum f_i u_i^2 = 79, \sum g_j v_j^2 = 91,$ $P = \sum u_i V_i = \sum v_j U_j = 43.$			
$f_i u_i^2$		18	28	8	0	13	12	79				
$V_i, (= \sum_j e_{ij} v_j)$		-4	-4	4		19	4					
$u_i V_i$		12	8	-4	0	19	8	43				
$\bar{u} = -\frac{9}{50} = -.18$		$\bar{v} = \frac{35}{50} = .70$						$\sigma_u = 1.21$ $\sigma_v = 1.117$				
$\sigma_u^2 = (\frac{79}{50}) - (-.18)^2 = .083 = 1.46,$												
$\sigma_v^2 = (\frac{91}{50}) - (.70)^2 = .083 = 1.247,$												
$p_{uv} = (\frac{43}{50}) - (-.18)(.70) = +0.986$												
$r = +0.986 / (1.21 \times 1.117) = +.730$								Ans. $r = +.730$				

STATISTICS (Continued)

RANK DIFFERENCE METHOD

Given n corresponding pairs of measured items (X_i, Y_i) , ($i = 1, \dots, n$). Let (u_i, v_i) be the corresponding rank numbers. Here $u_i = 1$ for the largest X_i , 2 for the next largest X_i , etc., and similarly $v_i = 1$ for the largest Y_i , 2 for the next largest Y_i , etc. $\rho = 1 - \frac{6 \sum (u_i - v_i)^2}{n(n^2 - 1)}$, (rank difference) coefficient of correlation. In every case $-1 \leq \rho \leq 1$. Check: $\sum (u_i - v_i) = 0$.

Example of Computation for Rank-Difference Coefficient of Correlation

X_i	Y_i	u_i	v_i	$u_i - v_i$	$(u_i - v_i)^2$	
76	52	3	1	+2	4	Check: $\sum (u_i - v_i) = 0$.
66	34	8	9	-1	1	
63	32	10	10	0	0	$\rho = 1 - \frac{6 \times 62}{10(10^2 - 1)}$
74	45	4	4	0	0	
79	50	1	2	-1	1	
69	37	7	7	0	0	
77	35	2	8	-6	36	$= +0.63$
65	42	9	5	+4	16	
71	40	6	6	0	0	Ans. $\rho = +.63$
73	48	5	3	+2	4	
$N = 10$				0	62	

Probability

If among $a + b$ equi-probable and mutually exclusive events, a are regarded as favorable and b unfavorable, then for a single trial

$$p, \text{ probability of favorable outcome, } = \frac{a}{a + b},$$

$$q, \text{ probability of unfavorable outcome, } = 1 - p = \frac{b}{a + b}.$$

The successive terms in the binomial expansion $(p + q)^n = \sum_r \binom{n}{r} p^{n-r} q^r$ give the respective probabilities that in n trials, the event will be favorable exactly $n - r$ times, $r = 0, \dots, n$.

The mean number of favorable events is np , of unfavorable, nq ; the standard deviation is $\sigma = \sqrt{npq}$, $\alpha_s = (p - q)/\sigma$ (the positive direction being that of increasing unfavorability).

Normal curve (x measured in σ -units from the mean, and with area = 1):

$$y = \frac{1}{\sqrt{2\pi}} e^{-x^2/2} = 0.3989 e^{-x^2/2}.$$

STATISTICS (Continued)

MD (mean deviation from the mean) = $\sigma\sqrt{2/\pi} = 0.7979\sigma$.

s (quartile deviation from the mean) = $0.6745\sigma = 0.845 MD$.

Percentage areas, under normal curve, for successive class intervals measured from the mean:

Multiples of σ : 34 %, 14 %, 2 %.

Multiples of s : 25 %, 16 %, 7 %, 2 %.

Normal surface (x measured in σ_x -units y in σ_y -units from their means),

$$z = \frac{1}{2\pi\sqrt{1-r^2}} e^{-(x^2-2rxy+y^2)/[2(1-r^2)]}.$$

Goodness of Fit. For a universe of objects falling into n mutually exclusive classes with class marks, x_i ($i = 1, 2, \dots, n$), let p_i be the probability for the i th class. Given a sample of N items, with f_i items in the i th class ($\Sigma f_i = N$), the probability that a random sample of N items gives no better fit, expressed in terms of n and χ^2 ("Chi square"), = $\Sigma(f_i - Np_i)^2/(Np_i)$, is given by a table, portions of which are as follows:

Probability that a Random Sample Gives no Better Fit

$n \backslash \chi^2$	1	2	3	4	6	8	10	15	20
3	.607	.368	.223	.135	.050	.018	.007	.001	.000
4	.801	.572	.392	.261	.112	.046	.019	.002	.000
5	.910	.736	.558	.406	.199	.092	.040	.005	.000
6	.963	.849	.700	.549	.306	.156	.075	.010	.001
7	.986	.920	.809	.677	.423	.238	.125	.020	.003
8	.995	.960	.885	.780	.540	.333	.189	.036	.006
9	.998	.981	.934	.857	.647	.433	.265	.059	.010
10	.999	.991	.964	.911	.740	.534	.350	.091	.018
11	1.000	.996	.981	.947	.815	.629	.440	.132	.029
12	1.000	.998	.991	.970	.873	.713	.530	.182	.045

$n \backslash \chi^2$	8	10	12	14	16	18	20	25	30
10	.534	.350	.213	.122	.067	.035	.018	.003	.000
11	.629	.440	.285	.173	.100	.055	.029	.005	.001
12	.713	.530	.363	.233	.141	.082	.045	.009	.002
13	.785	.616	.446	.301	.191	.116	.067	.015	.003
14	.844	.694	.528	.374	.249	.158	.095	.023	.005
15	.889	.762	.606	.450	.313	.207	.130	.035	.008
16	.924	.820	.679	.526	.382	.263	.172	.050	.012
17	.949	.867	.744	.599	.453	.324	.220	.070	.018
18	.967	.904	.800	.667	.524	.389	.274	.095	.026
19	.979	.932	.847	.729	.593	.456	.333	.125	.037
20	.987	.953	.886	.784	.657	.522	.395	.161	.052

MENSURATION FORMULAE (Continued)

Plane Figures Bounded by Curved Lines

The **circumference of a circle** whose radius is r and diameter d ($d = 2r$)

$$= 2\pi r = \pi d. \quad (\pi = 3.14159)$$

The **area of a circle**

$$= \pi r^2 = \frac{1}{4}\pi d^2 = .7854d^2.$$

The **length of an arc** of a circle for an arc of θ degrees

$$= \frac{\pi r \theta}{180}.$$

NOTE.—In this and following similar formulæ r denotes the radius of the circle, (OC , Fig. 1).

For an arc of θ radians the length

$$= r\theta.$$

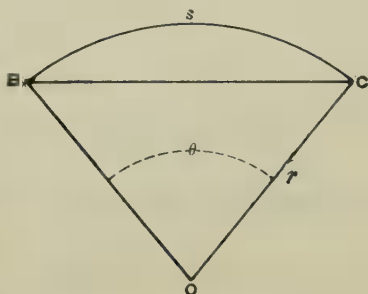


FIG. 1.

The **length of a chord** subtending an angle θ .

$$= 2r \sin \frac{1}{2}\theta.$$

The **area of a sector** where θ is the angle between the radii in degrees

$$= \frac{\pi r^2 \theta}{360}.$$

If s is the length of the arc, the area of the sector

$$= \frac{sr}{2}.$$

The **area of a segment** where θ is the angle between the two radii in degrees

$$= \frac{\pi r^2 \theta}{360} - \frac{r^2 \sin \theta}{2}.$$

MENSURATION FORMULAE (Continued)

If θ is in radians the area $= \frac{1}{2}r^2(\theta - \sin \theta)$.

The **area of the segment of a circle**

$$= \frac{\pi r^2}{2} - \left[x \sqrt{r^2 - x^2} + r^2 \sin^{-1} \left(\frac{x}{r} \right) \right]$$

where r is the radius of the circle and x the perpendicular distance of the chord from the center. The angle must be expressed in radians.

The **area of the ring** between two circles of radius r_1 and r_2 , one of which encloses the other,

$$= \pi(r_1 + r_2)(r_1 - r_2).$$

The two circles are not necessarily concentric.

Area of the sector of an annulus. (Fig. 2.)—If angle $GOH = \theta$ and the lines GO and $JO = r_1$ and r_2 respectively, the area $GHIJ = \frac{1}{2}\theta(r_1 + r_2)(r_1 - r_2)$.

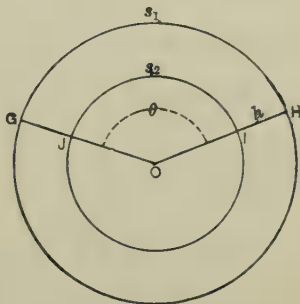


FIG. 2

If s_1 = the length of the arc GH and s_2 = the arc JI and $h = HI = r_1 - r_2$, the area $GHIJ = \frac{1}{2}h(s_1 + s_2)$.

The **circumference of an ellipse** whose semiaxes are a and b
See tables of elliptic integrals
 $= 2\pi \sqrt{\frac{a^2 + b^2}{2}}$ (approx.) $= 4aE$ exactly. for E , using $k = \sqrt{\frac{a^2 - b^2}{a^2}}$

The **area of an ellipse** $= \pi ab$.

The length of the **arc of a parabola**, as arc SPQ in Fig. 3, where $x = PR$, and $y = QR$

$$= 2 \sqrt{y^2 + \frac{4x^2}{3}}, \text{ approx. or } \sqrt{4x^2 + y^2} +$$

$$\frac{y^2}{2x} \log_e \frac{2x + \sqrt{4x^2 + y^2}}{y}$$

The **area of the section of the parabola** $PQRS$, $= \frac{4}{3}xy$.

MENSURATION FORMULAE (Continued)

Solids Bounded by Planes

The **lateral area of a regular prism** = perimeter of a right section \times the length.

The **volume of a regular prism** = area of base \times the altitude.

The **lateral area of a regular pyramid**, slant height l , length of one side of base a , and a number of sides n ,

$$= \frac{1}{2}nal.$$

The **volume of a pyramid** = $\frac{1}{3}$ area of base \times altitude.

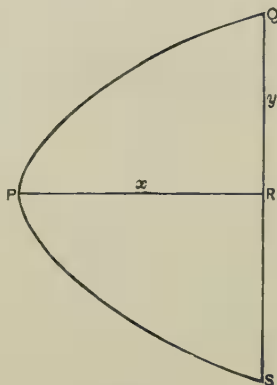


FIG. 3.

Surface and Volume of Regular Polyhedra

Surface and volume of regular polyhedra in terms of the length of one edge l .

Name.	Nature of surface.	Surface.	Volume.
Tetrahedron...	4 equilateral triangles	$1.73205l^2$	$0.11785l^3$
Hexahedron or cube.....	6 squares.....	$6.00000l^2$	$1.00000l^3$
Octahedron....	8 equilateral triangles	$3.46410l^2$	$0.47140l^3$
Dodecahedron.	12 pentagons.....	$20.64573l^2$	$7.66312l^3$
Icosahedron...	20 equilateral triangles	$8.66025l^2$	$2.18170l^3$

Solids Bounded by Curved Surfaces

The **surface of a sphere** of radius r and diameter $d (= 2r)$
 $= 4\pi r^2 = \pi d^2 = 12.57r^2.$

The **volume of a sphere**

$$= \frac{4}{3}\pi r^3 = \frac{1}{6}\pi d^3 = 4.189r^3.$$

MENSURATION FORMULAE (Continued)

The **area of a lune** on the surface of a sphere of radius r , included between two great circles whose inclination is θ radians.

$$= 2r^2\theta.$$

The **area of a spherical triangle** whose angles are A, B , and C (radians) on a sphere of radius r

$$= (A + B + C - \pi)r^2.$$

The **area of a spherical polygon** of n sides where θ is the sum of its angles in radians

$$= [\theta - (n - 2)\pi]r^2.$$

The area of the curved surface of a **spherical segment** of height h , radius of sphere r

$$= 2\pi rh.$$

The **volume of a spherical segment**, data as above

$$= \frac{1}{3}\pi h^2 (3r - h).$$

If a = radius of the base of the segment, the volume

$$= \frac{1}{6}\pi h(h^2 + 3a^2).$$

The **curved surface of a right cylinder** where r = the radius of the base and h , the altitude,

$$= 2\pi rh.$$

The **volume of a cylinder**, data as above,

$$= \pi r^2 h.$$

The **curved surface of a right cone** whose altitude is h and radius of base r

$$= \pi r \sqrt{r^2 + h^2}.$$

The **volume of a cone**, data as above,

$$= \frac{\pi}{3} r^2 h = 1.047 r^2 h.$$

The **curved surface of the frustum of a right cone**, radius of base r_1 , of top r_2 and altitude h ,

$$= \pi(r_1 + r_2) \sqrt{h^2 + (r_1 - r_2)^2}.$$

The **volume of the frustum of a cone**, data as above,

$$= \pi \frac{h}{3} (r_1^2 + r_1 r_2 + r_2^2).$$

The **oblate spheroid** is formed by the rotation of an ellipse about its minor axis. If a and b are the major and minor semi-axes respectively, and e the eccentricity, the surface

$$= 2\pi a^2 + \pi \frac{b^2}{e} \log_e \frac{1+e}{1-e},$$

and volume = $\frac{4}{3}\pi a^2 b$.

MENSURATION FORMULAE (Continued)

The prolate spheroid is formed by the rotation of an ellipse about its major axis ($2a$), data as above.

$$\begin{aligned}\text{Surface} &= 2\pi b^2 + 2\pi \frac{ab}{e} \sin^{-1} e, \\ \text{volume} &= \frac{4}{3} \pi ab^2.\end{aligned}$$

SIMPSON'S RULE FOR IRREGULAR AREAS

Divide the area into an even number ($2m$) of panels by means of $2m+1$ parallel lines, drawn at constant distance h apart; and denote the lengths of the intercepted segments by $y_0, y_1, \dots, y_{2m-1}, y_{2m}$. The first and last of these may be zero. The area will then be

$$A = \frac{1}{3}h[(y_0 + y_{2m}) + 4(y_1 + y_3 + \dots + y_{2m-1}) + 2(y_2 + y_4 + \dots + y_{2m-2})]$$

While the formula is exact in many simple cases, ordinarily the formula provides only an approximation, for which the accuracy increases with an increase in the number of divisions. Simpson's Rule may be applied to finding volumes, if the measures y_0, y_1, \dots, y_{2m} be interpreted as the areas of parallel plane sections at constant distance h apart.

PRISMOIDAL FORMULA

As a special case where $m=1$, and H , ($=2h$) is the distance between two limiting parallel planes, one has for the volume of a solid figure,

$$V = \frac{1}{3}H(S_0 + 4S_1 + S_2).$$

Here S_0 and S_2 are the cross-sectional areas in these limiting planes (lower and upper bases, respectively), and S_1 is the cross section of the mid-section. The formula is exact for the cone, sphere, ellipsoid, and prismoid.

TRIGONOMETRIC FORMULAE

TRIGONOMETRIC FUNCTIONS IN A RIGHT-ANGLED TRIANGLE

If A , B , and C are the vertices (C the right angle), and a , b , and h the sides opposite respectively,

$$\text{sine } A = \sin A = \frac{a}{h}, \quad \text{cosine } A = \cos A = \frac{b}{h},$$

$$\text{tangent } A = \tan A = \frac{a}{b}, \quad \text{cotangent } A = \cot A = \text{ctn } A = \frac{b}{a},$$

$$\text{secant } A = \sec A = \frac{h}{b}, \quad \text{cosecant } A = \csc A = \frac{h}{a},$$

$$\text{exsecant } A = \text{exsec } A = \sec A - 1$$

$$\begin{aligned} \text{versine } A &= \text{vers } A = 1 - \cos A \\ \text{coversine } A &= \text{covers } A = 1 - \sin A \\ \text{haversine } A &= \text{hav } A = \frac{1}{2} \text{vers } A \end{aligned}$$

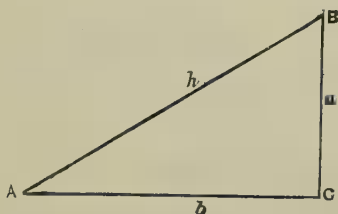


FIG. 4.

SIGNS AND LIMITS OF VALUE ASSUMED BY THE FUNCTIONS

Function.	Quadrant I.		Quadrant II.		Quadrant III.		Quadrant IV.	
	Sign.	Value.	Sign.	Value.	Sign.	Value.	Sign.	Value.
sin.....	+	0 to 1	+	1 to 0	-	0 to 1	-	1 to 0
cos.....	+	1 to 0	-	0 to 1	-	1 to 0	+	0 to 1
tan.....	+	0 to ∞	-	∞ to 0	+	0 to ∞	-	∞ to 0
cot.....	+	∞ to 0	-	0 to ∞	+	∞ to 0	-	0 to ∞
sec.....	+	1 to ∞	-	∞ to 1	-	1 to ∞	+	∞ to 1
cosec...	+	∞ to 1	+	1 to ∞	-	∞ to 1	-	1 to ∞

TRIGONOMETRIC FORMULAE (Continued)

VALUE OF THE FUNCTIONS OF VARIOUS ANGLES

	0°	30°	45°	60°	90°	180°	270°
sin.....	0	$\frac{1}{2}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}\sqrt{3}$	1	0	-1
cos.....	1	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}$	0	-1	0
tan.....	0	$\frac{1}{3}\sqrt{3}$	1	$\sqrt{3}$	∞	0	∞
cot.....	∞	$\sqrt{3}$	1	$\frac{1}{3}\sqrt{3}$	0	∞	0

RELATIONS OF THE FUNCTIONS

$$\sin x = \frac{1}{\operatorname{cosec} x}.$$

$$\operatorname{cosec} x = \frac{1}{\sin x}.$$

$$\cos x = \frac{1}{\sec x}.$$

$$\sec x = \frac{1}{\cos x}.$$

$$\tan x = \frac{1}{\cot x} = \frac{\sin x}{\cos x}.$$

$$\sin^2 x + \cos^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

$$\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}.$$

$$1 + \cot^2 x = \operatorname{cosec}^2 x$$

$$\sin x = \sqrt{1 - \cos^2 x}.$$

$$\cos x = \sqrt{1 - \sin^2 x}.$$

$$\tan x = \sqrt{\sec^2 x - 1}.$$

$$\sec x = \sqrt{\tan^2 x + 1}.$$

$$\cot x = \sqrt{\operatorname{cosec}^2 x - 1}.$$

$$\operatorname{cosec} x = \sqrt{\cot^2 x + 1}.$$

$$\sin x = \cos (90 - x) = \sin (180 - x).$$

$$\cos x = \sin (90 - x) = -\cos (180 - x).$$

$$\tan x = \cot (90 - x) = -\tan (180 - x).$$

$$\cot x = \tan (90 - x) = -\cot (180 - x).$$

$$\operatorname{cosec} x = \cot \frac{x}{2} - \cot x.$$

FUNCTIONS OF SUMS OF ANGLES

$$\sin (x + y) = \sin x \cos y + \cos x \sin y.$$

$$\sin (x - y) = \sin x \cos y - \cos x \sin y.$$

$$\cos (x + y) = \cos x \cos y - \sin x \sin y.$$

$$\cos (x - y) = \cos x \cos y + \sin x \sin y.$$

$$\tan (x + y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}.$$

$$\tan (x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}.$$

TRIGONOMETRIC FORMULAE (Continued)

FUNCTIONS OF MULTIPLE ANGLES

$$\sin 2x = 2 \sin x \cos x.$$

$$\cos 2x = \cos^2 x - \sin^2 x = 2 \cos^2 x - 1 = 1 - 2 \sin^2 x.$$

$$\sin 3x = 3 \sin x - 4 \sin^3 x.$$

$$\cos 3x = 4 \cos^3 x - 3 \cos x.$$

$$\sin 4x = 8 \cos^3 x \sin x - 4 \cos x \sin x.$$

$$\cos 4x = 8 \cos^4 x - 8 \cos^2 x + 1.$$

$$\sin 5x = 5 \sin x - 20 \sin^3 x + 16 \sin^5 x.$$

$$\cos 5x = 16 \cos^5 x - 20 \cos^3 x + 5 \cos x.$$

$$\sin 6x = 32 \cos^5 x \sin x - 32 \cos^3 x \sin x + 6 \cos x \sin x.$$

$$\cos 6x = 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1.$$

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}.$$

$$\cot 2x = \frac{\cot^2 x - 1}{2 \cot x}.$$

$$\tan 3x = \frac{3 \tan x - \tan^3 x}{1 - 3 \tan^2 x}.$$

$$\sin \frac{1}{2}x = \pm \sqrt{\frac{1 - \cos x}{2}}.$$

$$\cos \frac{1}{2}x = \pm \sqrt{\frac{1 + \cos x}{2}}.$$

$$\tan \frac{1}{2}x = \pm \sqrt{\frac{1 - \cos x}{1 + \cos x}} = \frac{1 - \cos x}{\sin x} = \frac{\sin x}{1 + \cos x}.$$

MISCELLANEOUS RELATIONS

$$\sin x \pm \sin y = 2 \sin \frac{1}{2}(x \pm y) \cdot \cos \frac{1}{2}(x \mp y).$$

$$\cos x + \cos y = 2 \cos \frac{1}{2}(x + y) \cdot \cos \frac{1}{2}(x - y).$$

$$\cos x - \cos y = -2 \sin \frac{1}{2}(x + y) \cdot \sin \frac{1}{2}(x - y).$$

$$\tan x \pm \tan y = \frac{\sin(x \pm y)}{\cos x \cdot \cos y}. \quad \cot x \pm \cot y = \frac{\pm \sin(x \pm y)}{\sin x \cdot \sin y}.$$

$$\frac{1 + \tan x}{1 - \tan x} = \tan(45^\circ + x) \quad \frac{\cot x + 1}{\cot x - 1} = \cot(45^\circ - x)$$

$$\frac{\sin x \pm \sin y}{\cos x + \cos y} = \tan \frac{1}{2}(x \pm y).$$

$$\frac{\sin x \pm \sin y}{\cos x - \cos y} = -\cot \frac{1}{2}(x \mp y).$$

$$\frac{\sin x + \sin y}{\sin x - \sin y} = \frac{\tan \frac{1}{2}(x + y)}{\tan \frac{1}{2}(x - y)}.$$

$$\sin^2 x - \sin^2 y = \sin(x + y) \cdot \sin(x - y).$$

$$\cos^2 x - \cos^2 y = -\sin(x + y) \sin(x - y).$$

$$\cos^2 x - \sin^2 y = \cos(x + y) \cos(x - y).$$

RELATIONS BETWEEN SIDES AND ANGLES OF ANY PLANE TRIANGLE

In a triangle with angles A , B , and C and sides opposite a , b , and c respectively,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = \text{diameter of the circumscribed circle.}$$

$$a^2 = b^2 + c^2 - 2bc \cos A.$$

$$a = b \cos C + c \cos B.$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}.$$

$$\tan \frac{A - B}{2} = \frac{a - b}{a + b} \cot \frac{C}{2}.$$

$$\sin A = \frac{2}{bc} \sqrt{s(s-a)(s-b)(s-c)},$$

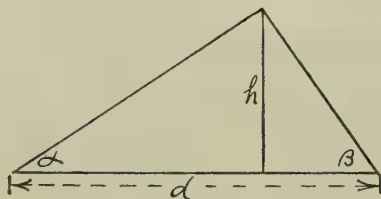
where $s = \frac{1}{2}(a+b+c)$ and $r = \sqrt{\frac{(s-a)(s-b)(s-c)}{s}}.$

$$\sin \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{bc}}.$$

$$\cos \frac{A}{2} = \sqrt{\frac{s(s-a)}{bc}}.$$

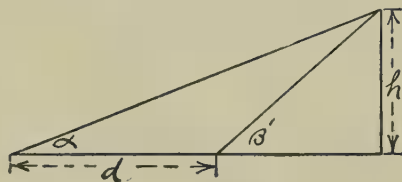
$$\tan \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}} = \frac{r}{s-a}.$$

$$\frac{a+b}{a-b} = \frac{\sin A + \sin B}{\sin A - \sin B} = \frac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)} = \frac{\cot \frac{1}{2}C}{\tan \frac{1}{2}(A-B)}.$$



$$h = d \frac{\sin \alpha \sin \beta}{\sin (\alpha + \beta)} = \frac{d}{\cot \alpha + \cot \beta}$$

Similarly



$$h = d \frac{\sin \alpha \sin \beta'}{\sin (\beta' - \alpha)} = \frac{d}{\cot \alpha - \cot \beta'}$$

FIG 5.

TRIGONOMETRIC FORMULAE (Continued)

RELATIONS IN ANY SPHERICAL TRIANGLE

If A , B and C be the three angles and a , b , and c the opposite sides,

$$\frac{\sin A}{\sin a} = \frac{\sin B}{\sin b} = \frac{\sin C}{\sin c}.$$

$$\cos a = \cos b \cos c + \sin b \sin c \cos A = \frac{\cos b \cos (c \pm \theta)}{\cos \theta}.$$

where $\tan \theta = \tan b \cos A$.

$$\cos A = -\cos B \cos C + \sin B \sin C \cos a.$$

$$\sin \frac{1}{2} A = \sqrt{\frac{\sin (s-b) \sin (s-c)}{\sin b \sin c}}.$$

where $s = \frac{1}{2}(a+b+c)$.

$$\cos \frac{1}{2} A = \sqrt{\frac{\sin s \sin (s-a)}{\sin b \sin c}}.$$

$$\tan \frac{1}{2} A = \frac{r}{\sin (s-a)}.$$

where $r = \sqrt{\frac{\sin (s-a) \sin (s-b) \sin (s-c)}{\sin s}}.$

$$\cos \frac{1}{2} a = \sqrt{\frac{\cos (S-B) \cos (S-C)}{\sin B \sin C}}.$$

where $S = \frac{1}{2}(A+B+C)$.

$$\sin \frac{1}{2} a = \sqrt{-\frac{\cos S \cos (S-A)}{\sin B \sin C}}.$$

$$\tan \frac{1}{2} a = R \cos (S-A)$$

where $R = \sqrt{\frac{-\cos S}{\cos (S-A) \cos (S-B) \cos (S-C)}}$

$$\frac{\tan \frac{a+b}{2}}{\tan \frac{c}{2}} = \frac{\cos \frac{A-B}{2}}{\cos \frac{A+B}{2}}, \quad \frac{\tan \frac{A+B}{2}}{\cot \frac{C}{2}} = \frac{\cos \frac{a-b}{2}}{\cos \frac{a+b}{2}}.$$

$$\frac{\tan \frac{a-b}{2}}{\tan \frac{c}{2}} = \frac{\sin \frac{A-B}{2}}{\sin \frac{A+B}{2}}, \quad \frac{\tan \frac{A-B}{2}}{\cot \frac{C}{2}} = \frac{\sin \frac{a-b}{2}}{\sin \frac{a+b}{2}}.$$

$$\text{hav } a = \text{hav } (b \sim c) + \sin b \sin c \text{ hav } A$$

$$\text{hav } A = \frac{\sqrt{\text{hav } [a + (b \sim c)] \text{ hav } [a - (b \sim c)]}}{\sin b \sin c}$$

ANALYTICAL GEOMETRY

The distance between two points x_1, y_1 , and x_2, y_2 , —rectangular coördinates:

$$d = \pm \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

For polar coördinates and points r_1, θ_1 , and r_2, θ_2 :

$$d = \pm \sqrt{r_1^2 + r_2^2 - 2r_1r_2 \cos (\theta_1 - \theta_2)}$$

The area of a triangle whose vertices are $x_1, y_1; x_2, y_2$, and x_3, y_3 :

$$A = \frac{1}{2}(x_1y_2 - x_2y_1 + x_2y_3 - x_3y_2 + x_3y_1 - x_1y_3)$$

For polar coördinates and vertices, $r_1, \theta_1; r_2, \theta_2$, and r_3, θ_3 :

$$A = \frac{1}{2}\{r_1r_2 \sin (\theta_2 - \theta_1) + r_2r_3 \sin (\theta_3 - \theta_2) + r_3r_1 \sin (\theta_1 - \theta_3)\}$$

The equation of a straight line where m is the tangent of the angle of inclination and c , the distance of intersection with the Y axis from the origin:

$$y = mx + c$$

If a line of slope m passes through the point x_1, y_1 its equation is:

$$y - y_1 = m(x - x_1)$$

The equation of a line through the points x_1, y_1 , and x_2, y_2 is:

$$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$$

If the intercepts on the X and Y axes are a and b respectively, the equation is:

$$\frac{x}{a} + \frac{y}{b} = 1$$

If the length of the perpendicular from the origin is p and its angle of inclination θ the equation is:

$$x \cos \theta + y \sin \theta = p$$

General equation of the straight line:

$$Ax + By + C = 0$$

The equation of a circle whose center is at a, b , and whose radius is c :

$$(x - a)^2 + (y - b)^2 = c^2$$

If the origin is at the center:

$$x^2 + y^2 = c^2$$

The polar equation of a circle with the origin on the circumference and its center at point c, α :

$$r = 2c \cos (\theta - \alpha).$$

If the origin is not on the circumference, the radius a and the center at a point, l, α , the equation becomes:

$$a^2 = r^2 + l^2 - 2rl \cos (\theta - \alpha)$$

ANALYTICAL GEOMETRY (Continued)

The equation of a parabola with the origin at the vertex, where f is the distance from the focus to the vertex:

$$y^2 = 4fx$$

If p is the semi-latus rectum ($= 2f$) the equation is:

$$y^2 = 2px$$

The polar equation where the pole is at the focus and p the semi-latus rectum is:

$$r = \frac{p}{1 - \cos \theta}$$

If the pole is at the vertex and p as above:

$$r = \frac{2p \cos \theta}{\sin^2 \theta}$$

The equation of the ellipse with the origin at the center and semi-axes a and b :

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Polar equation where the pole is at the center:

$$r^2 = \frac{a^2 b^2}{a^2 \sin^2 \theta + b^2 \cos^2 \theta}$$

The equation of the hyperbola with the origin at the center, semi-axes a and b :

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

Polar equation, pole at center:

$$r^2 = \frac{a^2 b^2}{a^2 \sin^2 \theta - b^2 \cos^2 \theta}$$

HYPERBOLIC FUNCTIONS

Definitions

An hyperbolic function represents a relation between the coordinates of a given portion on the arc of a rectangular hyperbola.

If O is the center, A the vertex, and P any point of the hyperbola APB,

$$OM = x, \quad MP = y, \quad OA = a.$$

The function u may be defined by the following relation,

$$u = \frac{2 \times \text{Area OAP}}{OA^2}$$

The hyperbolic sine of $u = \sinh u = y/a$.

The hyperbolic cosine of $u = \cosh u = x/a$.

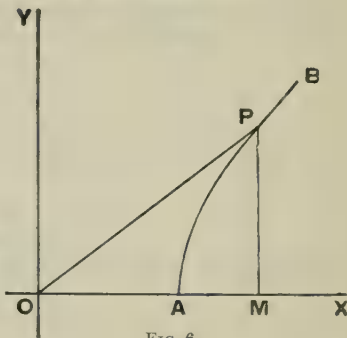


FIG. 6.

$$\sinh u = \frac{1}{2}(e^u - e^{-u}) = u + \frac{u^3}{3!} + \frac{u^5}{5!} + \dots$$

$$\cosh u = \frac{1}{2}(e^u + e^{-u}) = 1 + \frac{u^2}{2!} + \frac{u^4}{4!} + \dots$$

$$\tanh u = u - \frac{u^3}{3} + \frac{2u^5}{15} - \frac{17u^7}{315} + \dots \quad \left(u^2 < \frac{1}{4}\pi^2\right).$$

$$\sinh^{-1} u = u - \frac{1}{2} \cdot \frac{u^3}{3} + \frac{1 \cdot 3}{2 \cdot 4} \cdot \frac{u^5}{5} - \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6} \cdot \frac{u^7}{7} + \dots \quad (u^2 < 1).$$

$$\sinh^{-1} u = \log 2u + \frac{1}{2} \cdot \frac{1}{2u^3} - \frac{1 \cdot 3}{2 \cdot 4} \cdot \frac{1}{4u^5} + \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6} \cdot \frac{1}{6u^7} - \dots \quad (u^2 > 1).$$

$$\cosh^{-1} u = \log 2u - \frac{1}{2} \cdot \frac{1}{2u^2} - \frac{1 \cdot 3}{2 \cdot 4} \cdot \frac{1}{4u^4} - \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6} \cdot \frac{1}{6u^6} - \dots \quad (u^2 > 1).$$

$$\tanh^{-1} u = u + \frac{u^3}{3} + \frac{u^5}{5} + \frac{u^7}{7} + \dots \quad (u^2 < 1).$$

$$\tanh u = \frac{\sinh u}{\cosh u} \quad \operatorname{sech} u = \frac{1}{\cosh u}$$

HYPERBOLIC FUNCTIONS (Continued)

$$\coth u = \frac{1}{\tanh u}, \quad \operatorname{csch} u = \frac{1}{\sinh u}.$$

Relations of the Functions

$$\begin{aligned} \sinh x &= -\sinh(-x), & \operatorname{sech} x &= \operatorname{sech}(-x), \\ \cosh x &= \cosh(-x), & \operatorname{csch} x &= -\operatorname{csch}(-x), \\ \tanh x &= -\tanh(-x), & \coth x &= -\coth(-x). \end{aligned}$$

$$\sinh x = \frac{2 \tanh \frac{1}{2}x}{1 - \tanh^2 \frac{1}{2}x} = \frac{\tanh x}{\sqrt{1 - \tanh^2 x}}.$$

$$\cosh x = \frac{1 + \tanh^2 \frac{1}{2}x}{1 - \tanh^2 \frac{1}{2}x} = \frac{1}{\sqrt{1 - \tanh^2 x}}.$$

$$\cosh^2 x - \sinh^2 x = 1.$$

$$\begin{aligned} \tanh x &= \sqrt{1 - \operatorname{sech}^2 x}, & \operatorname{sech} x &= \sqrt{1 - \tanh^2 x}, \\ \coth x &= \sqrt{\operatorname{csch}^2 x + 1}, & \operatorname{csch} x &= \sqrt{\coth^2 x - 1}. \end{aligned}$$

$$\sinh \left(\frac{1}{2}x\right) = \sqrt{\frac{1}{2}(\cosh x - 1)}.$$

$$\cosh \left(\frac{1}{2}x\right) = \sqrt{\frac{1}{2}(\cosh x + 1)}.$$

$$\tanh \left(\frac{1}{2}x\right) = (\cosh x - 1) \div \sinh x = \sinh x \div (\cosh x + 1).$$

$$\sinh(2x) = 2 \sinh x \cosh x.$$

$$\cosh(2x) = \cosh^2 x + \sinh^2 x = 2 \cosh^2 x - 1 = 1 + 2 \sinh^2 x$$

$$\tanh(2x) = 2 \tanh x \div (1 + \tanh^2 x).$$

$$\sinh 3x = 3 \sinh x + 4 \sinh^3 x.$$

$$\cosh 3x = 4 \cosh^3 x - 3 \cosh x.$$

$$\tanh 3x = (3 \tanh x + \tanh^3 x) \div (1 + 3 \tanh^2 x).$$

$$\sinh(x \pm y) = \sinh x \cdot \cosh y \pm \cosh x \cdot \sinh y.$$

$$\cosh(x \pm y) = \cosh x \cdot \cosh y \pm \sinh x \cdot \sinh y.$$

$$\tanh(x \pm y) = (\tanh x \pm \tanh y) \div (1 \pm \tanh x \cdot \tanh y).$$

$$\sinh x + \sinh y = 2 \sinh \frac{1}{2}(x + y) \cdot \cosh \frac{1}{2}(x - y).$$

$$\sinh x - \sinh y = 2 \cosh \frac{1}{2}(x + y) \cdot \sinh \frac{1}{2}(x - y).$$

$$\cosh x + \cosh y = 2 \cosh \frac{1}{2}(x + y) \cdot \cosh \frac{1}{2}(x - y).$$

$$\cosh x - \cosh y = 2 \sinh \frac{1}{2}(x + y) \cdot \sinh \frac{1}{2}(x - y).$$

$$\sinh x + \cosh x = \frac{1 + \tanh \frac{1}{2}x}{1 - \tanh \frac{1}{2}x}$$

$$\tanh x \pm \tanh y = \frac{\sinh(x \pm y)}{\cosh x \cosh y}.$$

$$\coth x \pm \coth y = \pm \frac{\sinh(x \pm y)}{\sinh x \sinh y}.$$

Inverse Functions

$$\sinh^{-1} x = \log(x + \sqrt{x^2 + 1}) = \int \frac{dx}{\sqrt{x^2 + 1}} = \cosh^{-1} \sqrt{x^2 + 1}$$

HYPERBOLIC FUNCTIONS (Continued)

$$\cosh^{-1} x = \log (x + \sqrt{x^2 - 1}) = \int \frac{dx}{\sqrt{x^2 - 1}} = \sinh^{-1} \sqrt{x^2 - 1}.$$

$$\tanh^{-1} x = \frac{1}{2} \log (1 + x) - \frac{1}{2} \log (1 - x) = \int \frac{dx}{1 - x^2}.$$

$$\coth^{-1} x = \frac{1}{2} \log (1 + x) - \frac{1}{2} \log (x - 1) = \int \frac{dx}{1 - x^2}.$$

$$\operatorname{sech}^{-1} x = \log \left(\frac{1}{x} + \sqrt{\frac{1}{x^2} - 1} \right) = - \int \frac{dx}{x\sqrt{1 - x^2}}.$$

$$\operatorname{csch}^{-1} x = \log \left(\frac{1}{x} + \sqrt{\frac{1}{x^2} + 1} \right) = - \int \frac{dx}{x\sqrt{x^2 + 1}}.$$

Relations to Circular Functions

$$\begin{array}{ll} \sinh x = -i \sin ix. & \sinh ix = i \sin x. \\ \cosh x = \cos ix. & \cosh ix = \cos x. \\ \tanh x = -i \tan ix. & \tanh ix = i \tan x. \end{array}$$

$$\text{If } x = \log \tan \left(\frac{\pi}{4} + \frac{\theta}{2} \right) = \log (\sec \theta + \tan \theta),$$

θ = the **gudermannian** of $x = \operatorname{gd} x$.

$$\begin{array}{ll} \sinh x = \tan \operatorname{gd} x. & \tanh x = \sin \operatorname{gd} x. \\ \cosh x = \sec \operatorname{gd} x. & \tanh \frac{1}{2} x = \tan \frac{1}{2} \operatorname{gd} x. \end{array}$$

$$\frac{d \operatorname{gd} x}{dx} = \operatorname{sech} x.$$

Differentials

$$\begin{array}{ll} d \sinh x = \cosh x \cdot dx. & d \coth x = -\operatorname{csch}^2 x \cdot dx. \\ d \cosh x = \sinh x \cdot dx. & d \operatorname{sech} x = -\operatorname{sech} x \cdot \tanh x \cdot dx. \\ d \tanh x = \operatorname{sech}^2 x \cdot dx. & d \operatorname{csch} x = -\operatorname{csch} x \cdot \coth x \cdot dx. \end{array}$$

$$d \sinh^{-1} x = \frac{dx}{\sqrt{1 + x^2}}. \quad d \coth^{-1} x = -\frac{dx}{x^2 - 1}.$$

$$d \cosh^{-1} x = \frac{dx}{\sqrt{x^2 - 1}}. \quad d \operatorname{sech}^{-1} x = -\frac{dx}{x\sqrt{1 - x^2}}.$$

$$d \tanh^{-1} x = \frac{dx}{1 - x^2}. \quad d \operatorname{csch}^{-1} x = -\frac{dx}{x\sqrt{x^2 + 1}}.$$

Integrals involving the hyperbolic functions will be found in the table of integrals.

ELLIPTIC FUNCTIONS

$$u = F(k, \phi) = \int_0^\phi \frac{d\phi}{\sqrt{1 - k^2 \sin^2 \phi}}, \quad (k^2 < 1),$$

= elliptic integral of the first kind.

$$u = \int_0^x \frac{dx}{\sqrt{(1 - x^2)(1 - k^2 x^2)}}, \quad \text{where } x = \sin \phi.$$

ϕ is called the amplitude of u or $\text{am } u$.
 k is called the modulus.

$$k' = \sqrt{1 - k^2} = \text{the complementary modulus.}$$

$$\sin \phi = \text{sn } u = x, \quad \tan \phi = \text{tn } u = \frac{x}{\sqrt{1 - x^2}}.$$

$$\begin{array}{ll} \cos \phi = \text{cn } u = \sqrt{1 - x^2}. & \Delta \phi = \text{dn } u = \sqrt{1 - k^2 x^2}. \\ \text{am } 0 = 0. & \text{sn } 0 = 0. \\ \text{cn } 0 = 1. & \text{dn } 0 = 1. \\ \text{am } (-u) = -\text{am } u. & \text{sn } (-u) = -\text{sn } u. \\ \text{cn } (-u) = \text{cn } u. & \text{dn } (-u) = \text{dn } u. \\ \text{tn } (-u) = -\text{tn } u. & \\ \text{sn}^2 u + \text{cn}^2 u = 1. & \\ \text{dn}^2 u + k^2 \text{sn}^2 u = 1. & \\ \text{dn}^2 u - k^2 \text{cn}^2 u = 1 - k^2 = k'^2. & \end{array}$$

$$\begin{aligned} E(\phi, k) &= \int_0^\phi \sqrt{1 - k^2 \sin^2 \phi} \, d\phi \\ &= \int_0^x \frac{\sqrt{1 - k^2 x^2}}{\sqrt{1 - x^2}} \, dx \quad \text{where } x = \sin \phi. \\ &= \text{the elliptic integral of the second kind.} \end{aligned}$$

Complete Elliptic Integrals

$$\begin{aligned} K &= \int_0^{\pi/2} \frac{d\phi}{\sqrt{1 - k^2 \sin^2 \phi}}. \\ E &= \int_0^{\pi/2} \sqrt{1 - k^2 \sin^2 \phi} \, d\phi. \end{aligned}$$

See tables of values, page 233–235.

PROPERTIES AND PHYSICAL CONSTANTS

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ATOMIC WEIGHTS

Values in parentheses are approximate only and have not been adopted by the Committee on Atomic Weights.

Name	Symbol	At. No.	International atomic weight		Valence
			1925	1942	
Actinium.....	Ac	89	.....	(227)	.....
Alabamine (?).....	Ab	85	.....	(221)	1, 3, 5, 7
Aluminum.....	Al	13	26.97	26.97	3
Antimony, stibium.....	Sb	51	121.77	121.76	3, 5
Argon.....	A	18	39.91	39.944	0
Arsenic.....	As	33	74.96	74.91	3, 5
Barium.....	Ba	56	137.37	137.36	2
Beryllium, glucinum.....	Be	4	9.02	9.02	2
Bismuth.....	Bi	83	209.00	209.00	3, 5
Boron.....	B	5	10.82	10.82	3
Bromine.....	Br	35	79.916	79.916	1, 3, 5, 7
Cadmium.....	Cd	48	112.41	112.41	2
Calcium.....	Ca	20	40.07	40.08	2
Carbon.....	C	6	12.000	12.01	2, 4
Cassiopeium, see <i>Lutecium</i>					
Cerium.....	Ce	58	140.25	140.13	3, 4
Cesium.....	Cs	55	132.81	132.91	1
Chlorine.....	Cl	17	35.457	35.457	1, 3, 5, 7
Chromium.....	Cr	24	52.01	52.01	2, 3, 6
Cobalt.....	Co	27	58.94	58.94	2, 3
Columbium, niobium.....	Cb	41	93.1	92.91	3, 5
Copper.....	Cu	29	63.57	63.57	1, 2
Dysprosium.....	Dy	66	162.52	162.46	3
Erbium.....	Er	68	167.7	167.2	3
Europium.....	Eu	63	152.0	152.0	2, 3
Fluorine.....	F	9	19.00	19.000	1
Gadolinium.....	Gd	64	157.26	156.9	3
Gallium.....	Ga	31	69.72	69.72	2, 3
Germanium.....	Ge	32	72.60	72.60	4
Gold, aurum.....	Au	79	197.2	197.2	1, 3
Hafnium, celtium.....	Hf	72	.....	178.6	4
Helium.....	He	2	4.00	4.003	0
Holmium.....	Ho	67	163.4	164.94	3
Hydrogen.....	H	1	1.008	1.0080	1
Illinium,	Il	61	.....	(146)	(3)
Indium.....	In	49	114.8	114.76	3
Iodine.....	I	53	126.932	126.92	1, 3, 5, 7
Iridium.....	Ir	77	193.1	193.1	3, 4
Iron, ferrum.....	Fe	26	55.84	55.85	2, 3
Krypton.....	Kr	36	82.9	83.7	0

ATOMIC WEIGHTS (Continued)

Name	Symbol	At. No.	International atomic weight		Valence
			1925	1942	
Lanthanum.....	La	57	138.90	138.92	3
Lead, plumbum.....	Pb	82	207.20	207.21	2, 4
Lithium.....	Li	3	6.940	6.940	1
Lutecium.....	Lu	71	175.0	174.99	3
Magnesium.....	Mg	12	24.32	24.32	2
Manganese.....	Mn	25	54.93	54.93	2, 3, 4, 6, 7
Mercurium.....	Ma	43	.....	.....	.....
Mercury, hydrargyrum.....	Hg	80	200.61	200.61	1, 2
Molybdenum.....	Mo	42	96.0	95.95	3, 4, 6
Neodymium.....	Nd	60	144.27	144.27	3
Neon.....	Ne	10	20.2	20.183	0
Nickel.....	Ni	28	58.69	58.69	2, 3
Niton, see Radon.....	.....	.....	.....	.....	.....
Nitrogen.....	N	7	14.008	14.008	3, 5
Osmium.....	Os	76	190.8	190.2	2, 3, 4, 8
Oxygen.....	O	8	16.000	16.000	2
Palladium.....	Pd	46	106.7	106.7	2, 4
Phosphorus.....	P	15	31.027	30.98	3, 5
Platinum.....	Pt	78	195.23	195.23	2, 4
Polonium.....	Po	84	.....	(210)	.....
Potassium, kalium.....	K	19	39.096	39.096	1
Praseodymium.....	Pr	59	140.92	140.92	3
Protoactinium.....	Pa	91	.....	231	.....
Radium.....	Ra	88	225.95	226.05	2
Radon, niton.....	Rn	86	222	222	0
Rhenium.....	Re	75	.....	186.31	.....
Rhodium.....	Rh	45	102.91	102.91	3
Rubidium.....	Rb	37	85.44	85.48	1
Ruthenium.....	Ru	44	101.7	101.7	3, 4, 6, 8
Samarium.....	Sm, Sa	62	150.43	150.43	3
Scandium.....	Sc	21	45.10	45.10	3
Selenium.....	Se	34	79.2	78.96	2, 4, 6
Silicon.....	Si	14	28.06	28.06	4
Silver, argentum.....	Ag	47	107.880	107.880	1
Sodium, natrium.....	Na	11	22.997	22.997	1
Strontium.....	Sr	38	87.63	87.63	2
Sulfur.....	S	16	32.064	32.06	2, 4, 6
Tantalum.....	Ta	73	181.5	180.88	5
Tellurium.....	Te	52	127.5	127.61	2, 4, 6
Terbium.....	Tb	65	159.2	159.2	3
Thallium.....	Tl	81	204.39	204.39	1, 3
Thorium.....	Th	90	232.15	232.12	4
Thulium.....	Tm	69	169.4	169.4	3
Tin, stannum.....	Sn	50	118.70	118.70	2, 4
Titanium.....	Ti	22	48.1	47.90	3, 4
Tungsten, wolframium.....	W	74	184.0	183.92	6
Uranium.....	U	92	238.17	238.07	4, 6
Vanadium.....	V	23	50.96	50.95	3, 5
Virginium (?).....	Vi	87	.....	(224)	1
Xenon.....	Xe	54	130.2	131.3	0
Ytterbium.....	Yb	70	173.6	173.04	3
Yttrium.....	Y	39	88.9	88.92	3
Zinc.....	Zn	30	65.38	65.38	2
Zirconium.....	Zr	40	91	91.22	4

ELECTRONIC CONFIGURATION OF THE ELEMENTS

By Laurence S. Foster

References

- 1. Key furnished with "Periodic Chart of the Atoms," 1947 Ed, by Henry D. Hubbard and William F. Meggers, W. M. Welch Sci., Chicago.
- 2. "Electron Configurations of 'Rare Earth' Elements," by William F. Meggers, Science, May 16, 1947, page 514-516.

Atomic No.	Ele- ment	K	L	M	N	O	P	Q
		1	2	3	4	5	6	7
		s	s p	s p d	s p d f	s p d f	s p d f	s p d f
1 2	H He	1 2						
3 4 5 6 7 8 9	Li Be B C N O F	2 2 2 2 2 2 2	1 2 2 1 2 2 2 3 2 4 2 5					
10	Ne	2	2 6					
11 12 13 14 15 16 17	Na Mg Al Si P S Cl	2 2 2 2 2 2 2	2 6 2 6 2 6 2 6 2 6 2 6 2 6	1 2 2 1 2 2 2 3 2 4 2 5				
18	A	2	2 6	2 6				
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35	K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6	2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6 2 6	1 2 2 1 2 2 2 3 5* 1 5 2 6 2 7 2 8 2 10* 1 10 2 10 2 1 10 2 2 10 2 3 10 2 4 10 2 5			
36	Kr	2	2 6	2 6 10	2 6			

* Note irregularity.

ELECTRONIC CONFIGURATION OF THE ELEMENTS (Continued)

Atomic No.	Ele- ment	K		L	M			N			O			P			Q						
		1	2		3			4			5			6			7						
		s	s	p	s	p	d	s	p	d	f	s	p	d	f	s	p	d	f	s	p	d	f
37	Rb	2	2	6	2	6	10	2	6	..	..	1											
38	Sr	2	2	6	2	6	10	2	6	..	..	2											
39	Y	2	2	6	2	6	10	2	6	1	..	2											
40	Zr	2	2	6	2	6	10	2	6	2	..	2											
41	Cb	2	2	6	2	6	10	2	6	4*	..	1											
42	Mo	2	2	6	2	6	10	2	6	5	..	1											
43	To	2	2	6	2	6	10	2	6	6	..	1											
44	Ru	2	2	6	2	6	10	2	6	7	..	1											
45	Rh	2	2	6	2	6	10	2	6	8	..	1											
46	Pd	2	2	6	2	6	10	2	6	10*	..	..									
47	Ag	2	2	6	2	6	10	2	6	10	..	1											
48	Cd	2	2	6	2	6	10	2	6	10	..	2											
49	In	2	2	6	2	6	10	2	6	10	..	2	1										
50	Sn	2	2	6	2	6	10	2	6	10	..	2	2										
51	Sb	2	2	6	2	6	10	2	6	10	..	2	3										
52	Te	2	2	6	2	6	10	2	6	10	..	2	4										
53	I	2	2	6	2	6	10	2	6	10	..	2	5										
54	Xe	2	2	6	2	6	10	2	6	10	..	2	6										
55	Cs	2	2	6	2	6	10	2	6	10	..	2	6	..	1								
56	Ba	2	2	6	2	6	10	2	6	10	..	2	6	..	2								
57	La	2	2	6	2	6	10	2	6	10	..	2	6	1	..	2							
58	Ce	2	2	6	2	6	10	2	6	10	2*	2	6	..	2								
59	Pr	2	2	6	2	6	10	2	6	10	3	2	6	..	2								
60	Nd	2	2	6	2	6	10	2	6	10	4	2	6	..	2								
61	Pm	2	2	6	2	6	10	2	6	10	5	2	6	..	2								
62	Sm	2	2	6	2	6	10	2	6	10	6	2	6	..	2								
63	Eu	2	2	6	2	6	10	2	6	10	7	2	6	..	2								
64	Gd	2	2	6	2	6	10	2	6	10	7	2	6	1	..	2							
65	Tb	2	2	6	2	6	10	2	6	10	9*	2	6	..	2								
66	Dy	2	2	6	2	6	10	2	6	10	10	2	6	..	2								
67	Ho	2	2	6	2	6	10	2	6	10	11	2	6	..	2								
68	Er	2	2	6	2	6	10	2	6	10	12	2	6	..	2								
69	Tm	2	2	6	2	6	10	2	6	10	13	2	6	..	2								
70	Yb	2	2	6	2	6	10	2	6	10	14	2	6	..	2								
71	Lu	2	2	6	2	6	10	2	6	10	14	2	6	1	..	2							
72	Hf	2	2	6	2	6	10	2	6	10	14	2	6	2	..	2							
73	Ta	2	2	6	2	6	10	2	6	10	14	2	6	3	..	2							
74	W	2	2	6	2	6	10	2	6	10	14	2	6	4	..	2							
75	Re	2	2	6	2	6	10	2	6	10	14	2	6	5	..	2							
76	Os	2	2	6	2	6	10	2	6	10	14	2	6	6	..	2							
77	Ir	2	2	6	2	6	10	2	6	10	14	2	6	7	..	2							
78	Pt	2	2	6	2	6	10	2	6	10	14	2	6	9*	..	1							
79	Au	2	2	6	2	6	10	2	6	10	14	2	6	10	..	1							
80	Hg	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2							
81	Tl	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	1						
82	Pb	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	2						
83	Bi	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	3						
84	Po	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	4						
85	At	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	5						
86	Rn	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	6						
87	Fr	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	6	..	1				
88	Ra	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	6	..	2				
89	Ac	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	6	1	..	2			
90	Th	2	2	6	2	6	10	2	6	10	14	2	6	10	..	2	6	2	..	2			
91	Pa	2	2	6	2	6	10	2	6	10	14	2	6	10	2*	2	6	1	..	2			
92	U	2	2	6	2	6	10	2	6	10	14	2	6	10	3	..	2	6	1	..	2		
93	Np	2	2	6	2	6	10	2	6	10	14	2	6	10	4	..	2	6	1	..	2		
94	Pu	2	2	6	2	6	10	2	6	10	14	2	6	10	5	..	2	6	1	..	2		
95	Am	2	2	6	2	6	10	2	6	10	14	2	6	10	6	..	2	6	1	..	2		
96	Cm	2	2	6	2	6	10	2	6	10	14	2	6	10	6	..	2	6	1	..	2		

* Note irregularity.

THE ELEMENTS

Revised by Harrison Hale

The most striking fact about the elements is their unequal distribution and occurrence. In the earth's crust, including the ocean and the atmosphere, F. W. Clarke reported after careful calculation that oxygen makes up 50% and silicon 25%, the two elements being three-fourths of all matter. Further he concludes that twelve elements form 99% of all this material, leaving only 1% for the other eighty elements. Fully half of the elements are of minor commercial importance at present. No one knows when an element may become of unusual commercial importance. Several theories have been suggested to explain this wide difference in occurrence, but none of these is generally accepted. Of the twelve most common elements only one has an atomic weight of more than 40, iron with 56. The lightness of these common elements is emphasized by the heaviness of twelve or more other elements with atomic weights above 200. And yet by no means are all the light elements common.

Actinium (Gr. *aktis*, *aktinos*, beam or ray), Ac; at. wt. 227 (approx.); at. no. 89. Discovered in 1899 by Andre Debierne and independently by F. Giesel in 1902. Radioactive, decomposing into other elements of smaller atomic weight at certain intervals of time. (See Radioactive Elements.)

***Alabamine** (State of Alabama), Ab; at. wt. 221; at. no. 85; valence 1, 3, 5 or 7. Discovered in 1931 by Dr. Fred Allison and co-workers at Alabama Polytechnic Institute, by the magneto-optic method of analysis. Minima for HAb , HAbO , HAbO_2 , and HAbO_4 were measured. Ab can be oxidized in alkaline solution but more readily in acid solution. The peralabamates are the most stable compounds. (Existence questioned Ed.)

Aluminum (L. *alumen*, alum), Al, at. wt. 26.97; at. no. 13; m.p. 659.7°C; b.p. 1800°C; sp. gr. 2.699 (20°C); valence 3. Wöhler is generally accredited with obtaining the metal in 1827, though an impure form was prepared by Oersted two years earlier. The method of obtaining the metal by electrolysis of pure alumina dissolved in cryolite was patented independently by Hall in the United States and Heroult in France, soon after its discovery in 1886. Although aluminum occurs in larger quantities than any other metal, ranking third among all elements, it does not appear free. It is found as the silicate in clays, feldspars, etc., while the commercial ore at present is bauxite, an impure hydrated oxide. Its production from clay is possible. The metal is white and strongly resists the action of the air, becoming covered with a white oxide coating in time; it was selected as the cap for Washington's monument, and is widely used for outside building decoration. It stands second among metals in the scale of malleability, sixth in ductility. The electrical conductivity is about 60% that of copper per area of cross-section, but aluminum is much lighter, giving it use for transmission lines. It is but slightly magnetic and is strongly electro-positive, so that in contact with many other metals it corrodes rapidly. Its many alloys have strength and lightness, finding increasing use. The compounds of greatest importance are its oxide, its sulfate, and its double sulfate with potassium

* See element 85 at end of list.

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(alum). The oxide, alumina, occurs naturally as ruby, sapphire, corundum and emery, and is very hard, ranking next to the diamond. War's necessity has increased greatly the aluminum produced and this will widely extend its use in time of peace. In 1856 the price was about \$90 a pound; thirty years later just before Hall's discovery about \$5. Then the price dropped rapidly to 30¢ and has gone as low as 15¢.

* **Antimony** (L. *antimonium*), Sb (L. *stibium*, mark); at. wt. 121.76; at. no. 51; m.p. 630.5°C; b.p. 1380°C; sp. gr. 6.691 (20°C); valence 3 or 5. Recognized in compounds by the ancients; known as a metal at the beginning of the seventeenth century and possibly before that date. Antimony is a metallic element, common, but neither abundant nor widely diffused; sometimes found native, but more frequently as the sulfide, *stibnite* (Sb_2S_3); also as antimonides and sulfantimonides of the heavy metals, and as oxides. It is extracted from the sulfide by roasting to the oxide, which is reduced by salt and scrap iron; from its oxides it is also prepared by reduction with carbon. Antimony is an extremely brittle metal of a flaky, crystalline texture, blue-white color and metallic luster; hardness, 3 to 3.5; not acted on by air at room temperature, but burns brilliantly when heated with formation of white fumes of oxide Sb_2O_3 . It is a poor conductor of heat and electricity. Important alloys include type metal and friction reducing metals. The principal compounds are the sulfides, chlorides, and tartar emetic (hydrated potassium antimonyl tartrate).

Argon (Gr. *argon*, inactive), A; at. wt. 39.944; at. no. 18; m.p. -189.2°C; b.p. -185.7°C; density 1.78394 g/l; valence 0 (does not combine with any other element). Its presence in air was suspected by Cavendish in 1785; discovered by Lord Rayleigh and Sir William Ramsay in 1894. The gas is prepared by fractionation of liquid air, the atmosphere containing 0.94% argon. It is $2\frac{1}{2}$ times as soluble in water as nitrogen, having about the same solubility as oxygen; best recognized by the characteristic lines in the red end of the spectrum. It is used in electric light bulbs and in fluorescent tubes at a pressure of about 3 mm.

Arsenic (L. *arsenium*, Gr. *arsenikon*, yellow orpiment—identified with *arsenikos*, male, from the belief that metals were of different sexes—Arab. *az-zernikh*, the orpiment from Persian *zerni-zar*, gold-), As; at. wt. 74.91; at. no. 33; m.p. sublimes (500°C m.p. under pressure); b.p. 615°C; sp. gr. 5.73; valence 3 or 5. The amorphous form of arsenic has a sp. gr. of 3.70. It is believed that Albertus Magnus obtained the element in 1250. In 1649 Schroeder published two methods of preparing it. Found native, in sulfides, *realgar* and *orpiment*, as arsenides and sulfarsenides of heavy metals and as oxide, and arsenate. *Mispickel* or arsenopyrite (FeSAs) is the most common mineral, from which on heating the arsenic sublimes leaving ferrous sulfide. The element is a steel gray, very brittle, crystalline, semi-metallic solid, which sublimes on heating, being deposited partly as crystals and partly as a black, amorphous solid; it tarnishes in air and when heated is rapidly oxidized to arsenous

* Americium, see end of list.

THE ELEMENTS (Continued)

oxide (As_2O_3) with the odor of garlic. Though the free element is not considered poisonous, many of its compounds are extremely so, being used as insecticides. Arsenic is also used in bronzing pyrotechny, and for hardening and improving the sphericity of shot. The most important compounds are white arsenic (As_2O_3), the sulfide, Paris green (CuHAsO_3), calcium arsenate and lead arsenate, the last three being used in agricultural poisons. Marsh's test makes use of the formation and ready decomposition of arsine (AsH_3). Important war gases as Adamsite and Lewisite, are compounds of arsenic.

Barium (Gr. *barys*, heavy), Ba; at. wt. 137.36; at. no. 56; m.p. 850°C ; b.p. 1140°C ; sp. gr. 3.5 (20°C); valence 2. Baryta was distinguished from lime by Scheele in 1774; the element was discovered by Sir Humphry Davy in 1808. It is found only in combination with other elements chiefly in *barite* or *heavy spar* (sulfate) and *witherite* (carbonate) and is prepared by electrolysis of the chloride. Barium is a metallic element, soft and silvery white like lead; it belongs to the alkaline earth group, resembling calcium chemically. The most important compounds are the peroxide (BaO_2), chloride, sulfate, carbonate, nitrate and chlorate. The sulfate, as permanent white or *blanc fixé*, is used in paint, the carbonate as a rat poison, while the nitrate and chlorate give green colors in pyrotechny. The sulfide phosphoresces after exposure to the light. The compounds are not expensive and the metal is not in great demand.

Beryllium (L. fr. *beryl*; also called *Glucinum*, Gr. *glykys*, sweet), Be; at. wt. 9.02; at. no. 4; m.p. 1350°C ; b.p. 1500°C (5 mm.) sp. gr. 1.8 (20°C); valence 2. Discovered as the oxide by Vauquelin in beryl and in emerald in 1798; the metal was isolated in 1828 by Wöhler and by Bussy independently. Beryllium aluminum silicates are the chief sources of the metal today. It is prepared by electrolysis of the double fluoride, K_2BeF_4 . Hard enough to scratch glass, the metal resembles magnesium in appearance and chemical properties. Its soluble compounds are sweet. Its alloys are strong, light and resistant to corrosion. The metal is widely found, but in only small quantities of ore. The use in light alloys is increasing with the decrease in price of the metal. Addition of small amounts brings to the alloy much higher fatigue endurance.

Bismuth (Ger. *Weisse Masse*, white mass; later *Wismuth*). Bi; at. wt. 209.00; at. no. 83; m.p. 271.3°C ; b. p. 1450°C ; sp. gr. 9.78 (20°C); valence 3 or 5. In early times bismuth was confused with tin and lead. Claude Geoffroy showed it to be distinct from lead in 1753. It is a white, crystalline, brittle metal with a pinkish tinge. It occurs native, but the common ore is the sulfide, *bismuthinite*; from this it is extracted by melting out the free metal, the oxides and sulfides being decomposed by the addition of carbon and iron. It is also recovered as a by-product in lead smelting. Bismuth is a poor conductor of electricity, is very diamagnetic, solidifies with expansion, heated in air it burns with a blue flame forming yellow fumes of the oxide. It forms many alloys with metals, which are often used for their property of low melting (fusible metals) and because of

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their expansion on cooling, making them particularly suited for sharp castings of objects subject to damage by high temperatures. Its soluble salts are characterized by forming insoluble basic salts on the addition of water—a property sometimes used in detection. The important compounds are the trioxides and the subnitrates of medicinal use, (*pearl white*, *pearl powder*, *blanc de fard* and *blanc d'Espagne*).

Boron (Ar. *būraq*, Pers. *būrah*), B; at. wt. 10.82; at. no. 5; m.p. 2300°C; b.p. sublimes 2550°C; sp. gr. of crystals 2.54, of amorphous variety 2.45; valence 3. Discovered in 1808 by Sir Humphry Davy and by Gay-Lussac and Thenard. The element is not found free in nature, but occurs as orthoboric acid usually in certain volcanic spring waters and as borates in *borax* and *colemanite*. Boron is obtained by heating the trioxide with magnesium powder, and has little or no commercial value. The most important compounds are boric, or boracic, acid widely used as a mild antiseptic, and borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$), which serves as a cleansing flux in welding and as a water softener in washing powders.

Bromine (Gr. *bromos*, stench), Br; at. wt. 79.916; at. no. 35; m.p. -7.2°C; b.p. 58.78°C; density of gas 7.59 g/l, liquid 3.12 (20°C); valence 1, 3, 5, or 7. Discovered by Balard in 1826, but not prepared in quantity until 1860. A member of the halogen group of elements, it is obtained from natural brines from wells in Michigan and West Virginia and from sea water by displacement with chlorine; electrolysis might be used. Bromine is the only liquid non-metallic element. It is a heavy, mobile, reddish-brown liquid, volatilizing readily at room temperature to a red vapor with a strong disagreeable odor, resembling chlorine, and having a very irritating effect on the eyes and throat; it is readily soluble in water or carbon disulfide, forming a red solution; it is less active than chlorine but more so than iodine; it unites readily with many elements and has a bleaching action; when spilled on the skin it produces painful sores. It is chiefly employed for the preparation of its compounds, which are useful in photography, medicine, coal tar derivatives, and as ethylene bromide in anti-knock gasoline. Organic compounds are important.

Cadmium (Gr. *kadmia*, earth), Cd; at. wt. 112.41; at. no. 48; m.p. 320.9°C; b.p. 767°C; sp. gr. 8.65 (20°C); valence 2. Discovered by Stromeyer in 1817 from an impurity in zinc carbonate. Cadmium occurs in small quantities associated with zinc. It comes off before zinc in the preparation of the metal, condensing as the brown oxide, which is then reduced with carbon. It tarnishes in air and burns when heated, forming the oxide. It is a soft, bluish-white metal, used in standard cells for the accurate determination of E.M.F. The use of the metal industrially has increased greatly; it is a component of one of the lowest melting alloys; it is extensively used in bearing alloys with low coefficients of friction and great resistance to fatigue; it is used in electroplating. It forms a number of salts of which the sulfate is the most common; the sulfide is used as a yellow pigment.

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Calcium (*L. calx*, lime), Ca; at. wt. 40.08; at. no. 20; m.p. 810°C; b.p. 1170°C; sp. gr. 1.55 (20°C); valence 2. Though lime was prepared by the Romans in the first century under the name *calx*, not until 1808 was the metal discovered by Davy and by Berzelius and Pontin independently by preparation of an amalgam electrolytically and removal of the mercury by distillation. Calcium is a metallic element, fifth in abundance in the earth's crust, of which it forms more than three per cent; an essential constituent of leaves, bones, teeth and shells. Never found in nature uncombined, it occurs abundantly as *limestone* (CaCO_3), *gypsum* ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) and *fluorite* (CaF_2); *apatite* is the fluophosphate or chlorophosphate of calcium. It is prepared by electrolysis of the fused chloride; chemically it is one of the alkaline earth elements; it readily forms a white coating of oxide in the air, reacts with water, burns with a yellow red flame to the oxide. Its natural and prepared compounds are widely used. Quick lime (CaO) made by heating limestone and changed into slaked lime by the careful addition of water is the great cheap base of chemical industry with countless uses. Mixed with sand it hardens as mortar and plaster by taking up carbon dioxide from the air. The solubility of the carbonate in water containing carbon dioxide causes the formation of caves with stalactites and stalagmites and hardness in water. Other important compounds are the carbide (CaC_2), chloride (CaCl_2), cyanamide (CaCN_2) hypochlorite ($\text{Ca}(\text{OCl})_2$), nitrate $\text{Ca}(\text{NO}_3)_2$, and sulfide (CaS).

Carbon (*L. carbo*, charcoal), C; at. wt. 12.010; at. no. 6; m.p. sublimates above 3500°C; b.p. 4200°C; sp. gr. amorphous 1.88, graphite 2.25, diamond 3.51; valence 2, 3 or 4. Carbon, an element of prehistoric discovery and characteristic of organic matter, is very widely distributed in nature, occurring free as diamond and graphite. In combination it is found as carbon dioxide in the atmosphere and dissolved in all natural waters, as great rock masses composed of carbonates of calcium, magnesium and iron, as hydrocarbons in supplies of petroleum and natural gas. Coal consists chiefly of carbon compounds. It appears in three allotropic forms, diamond, graphite and amorphous, all solids, insoluble in any common solvent but dissolving in melted metals from which it crystallizes on cooling in the form of graphite; when the cooling takes place under pressure some of the carbon is obtained as diamond. Carbon is unique in forming an almost infinite number of compounds, often linking carbon atom to carbon atom, there being at present half a million known compounds. Some of the most important compounds are carbon dioxide, carbon monoxide, carbon disulfide, chloroform (CHCl_3), carbon tetrachloride (CCl_4), methane (CH_4), ethylene (C_2H_4), acetylene (C_2H_2), benzene (C_6H_6), ethyl alcohol ($\text{C}_2\text{H}_5\text{OH}$), acetic acid (CH_3COOH) and countless derivatives.

Cerium (named for the planetoid *Ceres*, which was discovered in 1801 only two years before the element), Ce; at. wt. 140.13; at. no. 58; m.p. 640°C; b.p. 1400°C; sp. gr. 6.90 (20°C); valence 3 or 4. Discovered in 1803 by Klaproth and by Berzelius and

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Hisinger; metal prepared by Hillebrand and Norton in 1875. Cerium is the most abundant of the metals from the so-called rare earths; it is found in a number of minerals including *orthite*, *cerite* and *samarskite* of North Carolina. Prepared by the electrolysis of the chloride it is a steel-gray lustrous metal; used as a pyrophoric alloy with iron, it gives off showers of sparks when struck. As the oxide it is an important constituent of incandescent gas mantles; as ceric sulfate it finds extensive use as a volumetric oxidizing agent in quantitative analysis.

Cesium (L. *caesius*, sky blue), Cs; at. wt. 132.91; at. no. 55; m.p. 28.5°C; b.p. 670°C; sp. gr. 1.873 (20°C); valence 1. The first metal discovered by Bunsen and Kirchhoff with the spectroscope. This was in 1860, the source being a mineral water from Dürkheim. Cesium is an alkali metal occurring in *lepidolite*, *pollucite* (a hydrated silicate of aluminum and cesium) and in the water from certain mineral springs; it is isolated by electrolysis of the fused cyanide. The metal is characterized by a spectrum containing two bright lines in the blue along with several others in the red, yellow and green. Because of its great affinity for oxygen the metal is used as a "getter" in radio tubes. It is also used in photo-electric cells, as well as for a catalyst in the hydrogenation of certain organic compounds. Its chief compounds are the chloride and the nitrate.

Chlorine (Gr. *chloros*, greenish-yellow), Cl; at. wt. 35.457; at. no. 17; m.p. -101.6°C; b.p. -34.6°C; density 3.214 g/l; sp. gr. 1.56 (-33.6°C); valence 1, 3, 5 or 7. Discovered in 1774 by Scheele, who thought it contained oxygen; named in 1810 by Davy, who insisted it was an element. In nature it is found in the combined state only, chiefly with sodium as common salt (NaCl), *carnallite* ($\text{KMgCl}_3 \cdot 6\text{H}_2\text{O}$), and *sylvite* (KCl). A member of the halogen (salt forming) group of elements it is obtained from chlorides by the action of oxidizing agents and more often by electrolysis; it is a greenish-yellow gas, with an irritating and suffocating odor, attacking the respiratory tract; combines directly with nearly all elements. At 10°C one volume of water dissolves 3.10 volumes of chlorine, at 30° only 1.77 volumes. Being a heavy gas, it was first used as a war gas by the Germans in 1915; most war gases contain chlorine. Berthollet suggested its use for bleaching, a most important reagent for vegetable fibers to-day. Around the globe it is used as a germicide in drinking water; further use is in the manufacture of bleaching powder, hypochlorites and chlorates, chloroform, carbon tetrachloride and in the extraction of bromine. Organic chemistry demands much both as an oxidizing agent and in substitution, since it often brings desired properties in an organic compound when substituted for hydrogen, as in one form of synthetic rubber.

Chromium (Gr. *chroma*, color), Cr; at. wt. 52.01; at. no. 24; m.p. 1615°C; b.p. 2200°C; sp. gr. 7.1 (20°C); valence 2, 3, or 6. Discovered in 1797 by Vauquelin, who prepared the metal the next year. Chromium is a metallic element, resembling iron, occurring chiefly in chrome iron ore ($\text{FeO} \cdot \text{Cr}_2\text{O}_3$), prepared by the reduction of the oxide with aluminum; it is a very infusible,

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hard gray metal, used to harden steel, to manufacture stainless steel and in many very useful alloys. Much is used in plating, giving a hard, beautiful surface. All compounds of chromium are colored; the most important are the chromates of sodium and potassium (K_2CrO_4) and the dichromates ($\text{K}_2\text{Cr}_2\text{O}_7$) and the potassium and ammonium chrome alums $\text{KCr}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$. The dichromates are used as oxidizing agents in quantitative analysis, also in tanning leather. Other compounds are of industrial value; lead chromate is chrome yellow, a valued pigment.

Cobalt (*kobold*, from the Greek, goblin or evil spirit), Co; at. wt. 58.94; at. no. 27; m.p. 1480°C ; b.p. 3000°C ; sp. gr. 8.9 (20°C); valence 2 or 3. Discovered by Brandt in 1735. Cobalt is a metal occurring in ores sparingly distributed, usually sulfide or arsenide. It is prepared by reducing the oxide with aluminum; it is brittle, hard, very magnetic, and of a gray color with a reddish tinge. Its alloys are important, as stainless steel, it is used in electroplating because of its appearance, hardness and resistance. The salts have been used for centuries for the production of brilliant and permanent blue colors in porcelain, glass, pottery, tiles and enamels, being the principal ingredient in *Sevres blue* and *Thenard's blue*. As little as 0.1 % of the metal gives an intense blue color. A solution of the chloride ($\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$) is used as sympathetic ink, the solution being pink and practically colorless when spread on paper, turns blue on heating which removes the water of crystallization. The cobalt amines are of interest; the oxide and the nitrate are important.

Columbium (*Columbia*, also called Niobium), Cb (or Nb); at. wt. 92.91; at. no. 41; m.p. 1950°C ; b.p. 2900°C ; sp. gr. 8.4 (20°C); valence 3 or 5. Discovered in 1801 by Hatchett in an ore sent to England more than a century before by John Winthrop, first governor of Connecticut. Metal prepared by Blomstrand, who reduced the chloride by heating in hydrogen in 1864. Columbium is a rare metallic element, found as *columbite* in pegmatite veins, volcanic intrusions through the earth's crust. Added to stainless steel this metal by combining with carbon preserves the corrosion resistance even when heated. This use has greatly increased the demand for the metal now obtained from an African ore. After removing tin from this ore, the residue is reduced with silicon or aluminum in an electric furnace, giving ferro-columbium, suited to steel making. The metal is gray; it forms an acid oxide, Cb_2O_5 , from which salts are derived.

Copper (*L. cuprum*, from the island of Cyprus), Cu; at. wt. 63.57; at. no. 29; m.p. 1083°C ; b.p. 2300°C ; sp. gr. 8.93–8.95; valence 1 or 2. The discovery of copper dates from prehistoric times; it is said to have been mined for more than 5000 years. Copper is a metallic element, reddish colored, bright, metallic luster, malleable, ductile, a good conductor of heat and electricity (second only to silver in electrical conductivity). It occurs native and in many minerals; the most important of these compounds are sulfides, oxides and carbonates. From these it is obtained by smelting, leaching or electrolysis. Its alloys, brass

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and bronze, long used are still most important; all American coins are copper alloys; monel and gun metals also contain copper. The most important compounds are the oxide and the sulfate, blue vitriol; the latter has wide use as an agricultural poison and as an algicide in water purification. Copper compounds are widely used in analytical chemistry, as Fehling's solution in tests for sugar.

* **Deuterium**, an isotope of hydrogen—see Hydrogen.

Dysprosium (Gr. *dysprositos*, hard to get at), Dy; at. wt. 162.46; at. no. 66; m.p. ; b.p. . . . ; sp. gr. . . . ; valence 3. Discovered in 1886 by Lecoq de Boisbaudran. The so-called rare earths may be divided into two groups, the cerium and the yttrium. Dysprosium is in the latter group, a member of the erbium family, closely related to holmium. It occurs in the minerals usually found in granite or in pegmatite veins, such as *xenotime*, *fergusonite*, *gadolinite*, *euxonite*, *polycrase* and *blomstrandine*. The free element has never been isolated; its salts are highly colored.

Erbium (Ytterby, a town in Sweden), Er; at. wt. 167.2; at. no. 68; m.p. ; b.p. ; sp. gr. 4.77 (?); valence 3. Discovered in 1843 by Mosander. Erbium is in the yttrium group of rare earth metals with atomic numbers of 64 to 71 in addition to yttrium, 39. In order of increasing basicity are included thulium, erbium, holmium and dysprosium, with decreasing atomic weights. Erbium occurs in the minerals mentioned under dysprosium above. It forms an oxide Er_2O_3 and highly colored salts.

Europium (Europe), Eu; at. wt. 152.0; at. no. 63; m.p. ; b.p. ; sp. gr. ; valence 2 or 3. Discovered in 1901 by Demarcay. Europium is in the cerium group with atomic numbers from 57 to 63 and related in order of discovery. It is very sparsely distributed and of slight importance at present. Salts of the type EuX_3 and EuX_2 , where X is a univalent atom or radical, are known.

Fluorine (L. *fluo*, flow), F; at. wt. 19.000; at. no. 9; m.p. -223°C ; b.p. -187°C ; density 1.69 g/l (15°C); sp. gr. of liquid 1.11 (-187°C); valence 1. Discovered by Scheele in 1771, but not isolated until 1886, by Moissan. It occurs chiefly in *fluorspar* (CaF_2) and *cryolite* (Na_3AlF_6), but seems rather widely distributed. Fluorine, a member of the halogen family of elements, is obtained by electrolyzing a solution of potassium hydrogen fluoride in anhydrous hydrogen fluoride in a vessel of metal or transparent fluorspar. It is a pale yellow gas, uniting directly with silicon, carbon, hydrogen and nearly all other elements in the dark; decomposes almost all compounds to form fluorides. The most important compounds are hydrogen fluoride, which is used in etching glass, and calcium fluoride. Freon, used in air conditioning, is difluoro di chloro methane. Both the element and hydrofluoric acid are dangerous poisons. The presence of fluorides in drinking water to the extent of two parts per million, or less, causes mottled enamel in teeth, when used by children acquiring permanent teeth. Organic compounds of fluorine are now receiving attention.

* Curium, see end of list.

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Gadolinium (*gadolinite*, name for Gadolin, a chemist of Finland), Gd; at. wt. 156.9; at. no. 64; m.p. . . . ; b.p. . . . ; sp. gr. . . . ; valence 3. Separated by Marignac in 1880 and by Lecoq de Boisbaudran in 1886. In order of discovery gadolinium belongs in the yttrium group, being a member of the terbium family. It is named for the mineral from which the earth was obtained. The free element has never been isolated; the element forms oxides of the type R_2O_3 , and its salts are usually more soluble than the corresponding terbium salts; its compounds are more plentiful than those of terbium or of europium. These elements decrease in order of basicity, Eu, Gd, Tb.

Gallium (L. *Gallia*, France), Ga; at. wt. 69.72; at. no. 31; m.p. 29.75°C; b.p. 1600°C; sp. gr. 5.91 (20°C); valence 2 or 3. Discovered spectroscopically by Lecoq de Boisbaudran in 1875, who in the same year obtained the free metal by electrolysis of a solution of the hydroxide in potassium hydroxide. A very rare metal, whose salts resemble those of aluminum; found in traces in many zinc blendes and nearly always in bauxite. Gallium was discovered in zinc blende from a mine in Hautes-Pyrenees; had been predicted and described as eka-aluminum by Mendeleeff. Besides mercury, cesium and rubidium, gallium is the only metal which can be liquid at near room temperatures; this makes possible its use in high temperature thermometers; the solid is hard and grayish-white. The metal forms two sets of oxides and salts in which it has a valence of two or of three.

Germanium (L. *Germania*, Germany), Ge; at. wt. 72.60; at. no. 32; m.p. 958.5°C; b.p. volatilizes at 2700°C; sp. gr. 5.36 (20°C); valence 4. Discovered by Winkler in 1886; had been predicted and described as eka-silicon by Mendeleeff. The metal is prepared by reducing the oxide with carbon or with hydrogen. The oxide was first obtained from *argyrodite*, a sulfide of germanium and silver; in 1916 the mineral, *germanite*, containing 8% of germanium was discovered. Being in the silicon group, the metal lies between silicon and tin in physical and chemical properties; it is a gray-white, brittle, crystalline metal, retaining its luster in air at room temperatures. The most important compounds are the oxide GeO_2 , and the halides, as $GeCl_4$, which is volatile.

Glucium—see *Beryllium*.

Gold (Sanskrit *Jval*; Anglo-Saxon *gold*), Au (L. *aurum*, shining dawn); at. wt. 197.2; at. no. 79; m.p. 1063°C; b.p. 2600°C; sp. gr. 19.32 (17.5°C); valence 1 or 3. Known and highly valued from earliest times. Gold is found in nature as the free metal and in tellurides; very widely distributed but almost always associated with quartz or pyrite; occurs in veins and in alluvial deposits. The metal is obtained from its ores by cyanidation, amalgamation and smelting. Refining is frequently done by electrolysis. It has been estimated that all the gold in the world could be placed in a single cube, forty feet on the side. As with most metals, recent production has greatly increased. Gold is a metallic element, having a yellow color when in mass, but when finely divided it may be black,

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ruby or purple; colloidal gold has been used to color ruby cathedral glass windows. It is the most malleable and ductile, and also one of the softest of the metals; it is a good conductor of heat and electricity and is not affected by air and most reagents. Its chief use is in coinage and jewelry, when it is alloyed with other metals, pure gold being expressed as 24 carat. When used as a standard of value by the United States, one Troy ounce was worth \$20.67 plus; since 1934 this value has been fixed by law and the President's order at \$35.00 per ounce. The commonest compounds are auric chloride (AuCl_3) and chlorauric acid (HAuCl_4), the latter being used in photography for toning the silver image. A mixture of one part of nitric acid with three of hydrochloric acid is called *aqua regia*, because it dissolves Gold, the King of Metals.

Hafnium (*Hafnia*, Copenhagen), Hf; at. wt. 178.6; at. no. 72; m.p. 1700°C ; b.p. above 3200°C ; sp. gr. 13.3; valence 4. Discovered in 1923 by D. Coster and G. von Hevesy in a *zircon* from Norway by means of Röntgen spectroscopic analysis. On the basis of the Bohr theory the new element was expected to be associated with zirconium. On treatment of the mineral with potassium bifluoride and separation K_2ZrF_6 , the mother liquors became richer in the new element. All the zirconium minerals examined except one contained hafnium. It has been separated from zirconia by repeated recrystallization of the double ammonium or potassium fluorides. Metallic hafnium was prepared by passing the vapor of the tetraiodide over a heated tungsten filament; this was done by van Arkel and deBoer; it has the same crystalline structure as zirconium. Hafnium also resembles zirconium in chemical properties. There is an oxide (HfO_2), a white powder, with corresponding hydroxide and salts.

Helium (Gr. *helios*, the sun), He; at. wt. 4.003; at. no. 2; m.p. below -272.2°C (26 atm.); b.p. -268.9°C ; density 0.177 g/l; valence 0. Evidence of the existence of helium was first obtained by Janssen during the eclipse of 1868, when he detected a new line in the solar spectrum; Lockyer and Frankland suggested the name for the new element; in 1895 Ramsay isolated helium from *uraninite*. Helium is a gas, inert chemically, obtained by compression and fractionation of the gas from certain wells and from many radioactive minerals. Onnes has cooled the element to the lowest temperature ever obtained, -272.918°C , and expressed the opinion that helium may remain a liquid even at absolute zero under normal pressure. In 1926 Keesom solidified it under a pressure of 26 atmospheres. Approximately twice as heavy as hydrogen it is used for inflating balloons because it will not burn. A mixture of 80% helium and 20% oxygen is used as an artificial atmosphere for divers and others working under pressure; since helium is less soluble in the blood than nitrogen it does not produce the "bends."

Holmium (L. *Holmia*, for Stockholm), Ho; at. wt. 164.94; at. no. 67; m.p. ; b.p. ; sp. gr. ; valence 3. Discovered by Cleve while working on erbia earth in 1879; pure holmia earth was isolated by Homberg in 1911. Holmium is in the yttrium group of rare earth metals in order of

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discovery; it is a member of the erbium family, which includes thulium, erbium, holmium, dysprosium in the order of increasing basicity. It occurs in gadolinite and similar minerals. The element has not been isolated, but the oxide (Ho_2O_3), a grayish-white powder, and corresponding salts have been prepared.

Hydrogen (Gr *hydro*, water, and *genes*, forming), H; at. wt. 1.0080; at. no. 1; m.p. -259.14°C ; b.p. -252.7°C , density 0.08988 g/l; sp. gr. liquid 0.070 (-252°C); valence 1 First recognized as a distinct substance by Cavendish in 1766; named by Lavoisier. Hydrogen occurs chiefly in combination with oxygen as water; also in acids, bases and alcohols as well as in carbohydrates, in petroleum and other hydrocarbons. It is usually a constituent of organic compounds, especially those used as fuels and as food. It is the lightest of all gases, insoluble in water, uniting with many elements to form compounds; it is used as a reducing agent, as a means of obtaining high temperature flames, in atomic hydrogen welding and for inflating balloons. Great quantities are required commercially for the fixation of nitrogen from the air in the Haber ammonia process and for the hydrogenation of fats and oils. It is prepared by action of steam on heated carbon, by the electrolysis of water, or by the displacement from acids by certain metals. In 1932 Urey announced the preparation of the isotope with an atomic weight of 2, commonly called deuterium; tritium with an atomic weight of 3 was discovered two years later. One part of deuterium is found to about 5000 ordinary hydrogen atoms; with tritium the ratio is only one to a billion.

***Illinium** (University and State of Illinois), II; at. wt. estimated 146; at. no. 61; m.p. . . . ; b.p. . . . , sp. gr. . . . ; valence doubtless 3. The discovery of illinium was announced in 1926 by Hopkins, Yntema and Harris on the basis of absorption, arc, and X-ray emission spectra. Later in the same year Rolla and Fernandez in Italy claimed prior discovery and proposed the name florentium. The late Charles James at the University of New Hampshire concentrated considerable illinium and other investigators have since confirmed the existence of the element in this material. Hopkins used material obtained from monazite sand. Illinium is a member of the cerium group of rare earth metals which includes lanthanum, cerium, praseodymium, neodymium, illinium and samarium in order of decreasing basicity. Neither the metal nor its salts have been prepared in an entirely pure state.

Indium (from its indigo blue spectrum), In; at. wt. 114.76; at. no. 49; m.p. 155°C ; b.p. 1450°C ; sp. gr. 7.28 (20°C); valence 1 or 3. Discovered in 1863 by the use of the spectroscope by Reich and Richter, who later isolated the metal. Indium is a rare metallic element, occurring usually in zinc blendes, sometimes with pyrites and siderite. The metal is obtained by electrolysis from baths of complex cyanide, chloride and sulfate. It belongs to the aluminum group in properties, being a very soft, silvery metal, not acted on by water or air, burning to the oxide (In_2O_3). Electroplates of indium increase the resist-

* See element 61 at end of list.

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ance of certain bearing alloys to organic acid corrosion. The metal finds use in alloys for jewelry and in dental alloys.

Iodine (Gr. *iodes*, violet), I; at. wt. 126.92; at. no. 53; m.p. 113.5°C; b.p. 184.35°; density of the gas 11.27 g/l; sp. gr. solid 4.93 (20°C); valence 1, 3, 5, or 7. Discovered by Courtois in 1811. Iodine, a halogen, occurs sparingly in the form of iodides in sea water from which it is assimilated by seaweeds, in Chile saltpeter, in brines from old sea deposits and in caliche (as sodium iodate); from iodides it is obtained on treatment with sulfuric acid and some oxidizing agent (MnO_2) and from the iodates by heating with sodium bisulfite; for about ten years it has been obtained from brines from salt wells by a new process using finely divided silver, which has so increased production that the price has been reduced to about one-third. It is a grayish-black, lustrous solid, volatilizing at ordinary temperatures into a blue-violet gas with an irritating odor; it forms compounds with many elements, but is less active than the other halogens, which displace it from iodides. It dissolves slightly in water, readily in chloroform, carbon tetrachloride or carbon disulfide to beautiful purple solutions. Iodine compounds are important in organic chemistry. The most common compounds are the iodides of sodium and potassium (KI) and the iodates (KIO_3). Lack of iodine is the cause of goiter. The iodide and thyroxin, which contains iodine, are used internally in medicine, and a solution of iodine in alcohol for external wounds. Potassium iodide finds some use in photography. The deep blue color with starch solution is characteristic of the free element.

Iridium (L. *iris*, rainbow), Ir; at. wt. 193.1; at. no. 77; m.p. 2350°C; b.p. above 4800°C; sp. gr. 22.42 (17°C); valence 3 or 4. Discovered in 1803 by Tennant in the residue left when crude platinum is dissolved by aqua regia. The name shows the colors of its salts—green, red, violet. Iridium, a metal of the platinum family, is white, very hard and brittle. It occurs uncombined with platinum and other metals of this family in alluvial deposits. It is used in apparatus for high temperatures; alloyed with platinum for standard weights and measures; alloyed with osmium in tipping pens and compass bearings. Iridium black, prepared by exposing alcoholic solutions of the sulfate to light, is used as a catalytic agent. The most important salt is IrCl_4 .

Iron (Anglo-Saxon, *iron*), Fe (L. *ferrum*); at. wt. 55.85; at. no. 26; m.p. 1535°C; b.p. 3000°C; sp. gr. 7.85–7.88 (20°C); valence 2, 3, or 6. Iron implements are said to have been made by the Egyptians 3000 B.C. The most common ore is *hematite* (Fe_2O_3), from which the metal is obtained by reduction with carbon. Iron is the most abundantly produced of the metals, though aluminum occurs in larger percentage in the earth's crust than iron. The pure metal, which is practically unknown in industry (although some grades of soft steel have a very high percentage of iron), is silver-white, very ductile and magnetic; the pure metal may be prepared by electrolytic deposition from ferrous sulfate, or by reduction of the pure oxide with hydrogen

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or aluminum. Pig iron is hard, brittle and fairly fusible, containing about 3% carbon and varying amounts of sulfur, silicon, manganese and phosphorus; wrought iron is tough, grayish-white and malleable, having usually a fibrous structure, very infusible, with only a few tenths per cent or less of carbon; steel is a solid solution of iron carbide in iron with a carbon content usually below 2%. Iron is the cheapest metal known, pig iron usually costing less than a cent a pound and steel about twice as much. Alloying with other metals has greatly improved the properties and widened the use of steel.

Krypton (Gr. *kryptos*, hidden), Kr; at. wt. 83.7; at. no. 36; m.p. -157°C ; b.p. -152.9°C ; density 3.708 g/l (0°C); valence 0. Discovered in 1898 by Ramsay and Travers in the residue left after liquid air had nearly boiled away. There is one part of krypton in a million parts of air; it is an inert, rare, gaseous element, and is characterized by brilliant green and yellow lines in its spectrum.

Lanthanum (Gr. *lanthano*, to conceal), La; at. wt. 138.92; at. no. 57; m.p. 826°C ; b.p. 1800°C ; sp. gr. 6.155; valence 3. Occurs in the cerium group of the rare earth metals, lanthana being separated from ceria by Mosander in 1839. It is found in ores *cerite*, *orthite* and *monazite*. The metal is prepared from the chloride by treatment with sodium, or by electrolysis of a fused bath of lanthanum and potassium chlorides and calcium fluoride. Lanthanum resembles iron in its physical properties, burning brilliantly in the air to form La_2O_3 .

Lead (Anglo-Saxon *lead*), Pb (L. *plumbum*); at. wt. 207.21; at. no. 82; m.p. 327.4°C ; b.p. 1620°C ; sp. gr. 11.35 (20°C); valence 2 or 4. Long known; mentioned in Exodus. Lead is obtained chiefly from galena (PbS) by a roasting process. It is a bluish-white metal of bright luster, very soft, highly malleable; has slight tenacity, is ductile and a poor conductor of electricity; lasts very long, since lead pipes bearing the insignia of Roman emperors, used as drains from the baths, are still in service. It is also used as containers for corrosive liquids, as in sulfuric acid chambers; it may be toughened by the addition of a small percentage of antimony or other metal. Its alloys include solder, type metal and various antifriction metals. Great weights of lead both as the metal and as the dioxide are used in storage batteries. White lead, the basic lead carbonate, sublimed white lead (PbSO_4), chrome yellow (PbCrO_4), red lead (Pb_3O_4) and other lead compounds are extensively used in paints. The nitrate and the acetate are soluble salts. Lead salts are used in medicine, as antiseptics and astringents. Care must be used in both medicine and industry as lead is a cumulative poison.

Lithium (Gr. *lithos*, stone), Li; at. wt. 6.940; at. no. 3; m.p. 186°C ; b.p. above 1220°C ; sp. gr. 0.534 (20°C); valence 1. Discovered by Arfvedson in 1817. Lithium is the lightest alkali metal; never found free in nature, traces of it occur in nearly all igneous rocks and in the waters of many mineral springs. *Lepidolite*, *spodumene*, *petalite* and *amblygonite* are the more important minerals containing it. The metal is pro-

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duced from the fused chloride electrolytically. It is the lightest metal known, soft and white; burned in air it forms Li_2O ; its salts are analogous to those of sodium and potassium. The carbonate and citrate are used in medicine to remove uric acid from the body, since lithium urate is soluble. To a limited extent the metal is used industrially in various alloys increasing tensile strength and resistance to corrosion. In the flame test for lithium a brilliant crimson is given.

Lutecium (*Lutetia*, ancient name of Paris—sometimes called cassiopeium by the Germans), Lu; at. wt. 174.99; at. no. 71; m.p. ; b.p. ; sp. gr. ; valence 3 or 4. In 1907 Urbain and in 1908 von Welsbach described a process by which Marignac's ytterbium (1879) could be separated into the two elements, ytterbium (neoytterbium) and lutecium. Both elements occur in very small amounts in nearly all minerals containing yttrium. Charles James of New Hampshire prepared lutecia independently. This rare earth has little practical use. The oxide, chloride and sulfate have been prepared.

Magnesium (Magnesia, district in Thessaly), Mg; at. wt. 24.32; at. no. 12; m.p. 651°C ; b.p. 1110°C ; sp. gr. 1.74 (20°C); valence 2. Compounds long known, recognized by Black as an element in 1755, isolated by Davy in 1808, prepared in coherent form by Bussy in 1831. Magnesium is one of the most abundant metals and the eighth element in estimated amount in the earth's crust. It does not occur uncombined but many carbonates and silicates contain considerable percentages, while soluble sulfate and chloride are found in mineral springs and in the ocean. It has been obtained by the electrolysis of the fused chloride; this method has been used for commercial production in the U.S. since 1916, using brines from wells and recently sea water from the Gulf of Mexico also. Electrothermic methods have also been proposed, being difficult because the metal combines when heated both with oxygen and with nitrogen. Recognition of its importance in war caused the one producing company in the U.S. in 1939 to expand its productive capacity six fold. By government direction this was expected to be increased ten times, raising an annual production of six to 400 million tons. It is a light, white and fairly tough metal; tarnishes slightly in air, and as ribbon, wire or powder ignites on heating, burning with a dazzling white flame. It is useful in flash-light photography, flares and for pyrotechnics, including incendiary bombs. It is one-third lighter than aluminum and in its alloys is essential for airplane construction. The first metallic magnesium produced commercially sold for \$10 a pound; the price is now less than 30¢. Important compounds are the oxide, chloride, sulfate and citrate, which find use in medicine. In Grignard's reaction, organic magnesium compounds are useful.

Manganese (L. *magnes*, magnet), Mn; at. wt. 54.93; at. no. 25; m.p. 1260°C ; b.p. 1900°C ; sp. gr. 7.2 (20°C); valence 2, 3, 4, 6, or 7. Recognized by Bergman, Scheele and others, discovered by Gahn in 1774 by reduction of dioxide with carbon.

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Manganese minerals are widely distributed, oxides, silicates and carbonates being most common. Pyrolusite (MnO_2) and psilomelane are common ores. The metal is obtained by reduction of the oxide with sodium, magnesium, aluminum, or by electrolysis. It is gray-white, resembling iron, but is harder and very brittle. Its alloys with iron, copper and nickel are important. The mineral, *pyrolusite*, has been used since very early times to give color to glass; a smaller amount gives a weaker amethyst color which removes the greenish color due to iron and other impurities and makes colorless glass. Other compounds are the chloride, sulfate and permanganate, which is used as an antiseptic and in quantitative analysis because of its oxidizing power.

***Masurium** (Masurenland, in East Prussia), Ma; at. wt. 98, estimated; at. no. 43; m.p. 2300°C ; b.p.; sp. gr.; valence 2, 3, 4 or 6. Masurium is one of the eka-manganeses discovered by Noddack, Tacke (now Frau Noddack) and Berg in 1925 and occurs in the minerals *columbite*, *sperrylite*, *gadolinite* and *fergusonite*. These minerals were examined in a search for elements 43 and 75, the detection being made with the aid of the Röntgen spectrum. The quantity of masurium in these minerals and in the earth's crust, seems to be relatively very small.

Mercury (Planet Mercury), Hg (*hydrargyrum*, liquid silver); at. wt. 200.61; at. no. 80; m.p. -38.87°C ; b.p. 356.9°C ; sp. gr. 13.546 (20°C); valence 1 or 2. Known to ancient Chinese and Hindus; found in Egyptian tombs of 1500 B.C. Mercury, the only common metal liquid at ordinary temperatures, occurs free in nature, but the chief source is the sulfide (*cinnabar*, HgS), from which it may be obtained by heating in a current of air. It is a heavy silver-white, shining metal, a fair conductor of heat and electricity, having a regular coefficient of expansion. These properties make it generally useful in the laboratory for thermometers, barometers and many other instruments. It tarnishes but slightly in the air except when heated to near the boiling point, where it is slowly converted to the oxide (HgO), from which the oxygen is set free again at higher temperatures. Mercury forms alloys, called *amalgams*, with many metals. The most important salts are mercuric chloride (HgCl_2 , violent poison and antiseptic), mercurous chloride (HgCl , calomel laxative of medicine), mercury fulminate (Hg(ONC)_2 , a detonator widely used in explosives), and mercuric sulfide (HgS , vermilion, a high grade red paint). Organic mercury compounds are likewise important.

Molybdenum (Gr. *molybdos*, lead), Mo; at. wt. 95.95; at. no. 42; m.p. 2620°C ; b.p. 3700°C ; sp. gr. 10.2; valence 2, 3, 4, 5, or 6. Recognized by Scheele; prepared in an impure form in 1782 by Hjelm. Molybdenum does not occur native, being obtained from *molybdenite* (MoS_2) and from *wulfenite* (PbMoO_4). The metal is prepared by the reduction of the oxide with carbon, usually in the electric furnace. It is a very hard silver-white metal; it is widely used in the manufacture of certain grades of tool steel, boiler plate, rifle barrels and large cranks, as

* See element 43 at end of list.

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it increases toughness and tensile strength. Being softer and more ductile than tungsten it is invaluable for the filaments, grids and screens for radios.

Neodymium (Gr. *neos*, new and *didymos*, twin), Nd; at. wt. 144.27; at. no. 60; m.p. 840°C; b.p. ; sp. gr. 6.95; valence 3. In 1843 reported the supposed element didymium obtained from *cerite*. In 1885 von Welsbach separated didymium into two new elements, neodymium and praseodymium by repeated fractionation of ammonium didymium nitrate. Neodymium is a metallic element, belonging to the rare earths, forming a series of pink salts with a characteristic absorption spectrum.

***Neon** (Gr. *neos*, new), Ne; at. wt. 20.183; at. no. 10; m.p. -248.67°C; b.p. -245.9°C; density 0.8990 g/l (0°C); valence 0. Discovered by Ramsay and Travers in 1898. Neon is a gaseous element present in the atmosphere to the extent of 18 parts per million. It is obtained by liquefaction of air and separated from the other elements by fractional distillation. It is an inert element forming no compounds. Neon glows red-orange in a vacuum tube and is therefore widely used in electric signs and beacons. Its spectrum is marked by pronounced red and green lines.

Nickel (Sw. abbr. of *kopparnickel*, false copper), Ni; at. wt. 58.69; at. no. 28; m.p. 1455°C; b.p. 2900°C; sp. gr. 8.90 (20°C); valence 2 or 3. Discovered by Cronstedt in 1751. Nickel is obtained chiefly from the nickel bearing *pyrrhotite* of Ontario and the *garnierite* (hydrated silicate of nickel, iron and magnesium found in New Caledonia) by roasting to the oxide, which is then reduced with carbon or carbon monoxide, volatile nickel carbonyl being formed and then decomposed by heat. The metal is hard, malleable, ductile and tenacious, of a white color, somewhat magnetic, a fair conductor of heat and electricity; it belongs to the iron-cobalt group of metals. Nickel is chiefly valuable for the alloys it forms; coinage with 75% of copper, Monel metal with copper and iron, nickel steel for armor plates and burglar proof safes, invar, constantan, permalloy, nichrome, platinite and others. Nickel plate by electrodeposition is used as a protective coating for metals, and finely divided nickel as a catalyst in the hydrogenation of vegetable oils. The sulfate and the oxides, NiO and Ni₂O₃, are important compounds.

Niobium, see *Columbium*.

Nitrogen (L. niter forming), N; at. wt. 14.008; at. no. 7; m.p. -209.86°C; b.p. -195.8°C; density 1.2506 g/l; sp. gr. liquid 0.808 (-195.8°C) solid 1.026 (-252°C) valence 3 or 5. Discovered by Daniel Rutherford in 1772. Nitrogen makes up 78% of the air by volume, the estimated amount in the atmosphere being more than 4000 billion tons; from this inexhaustible source it can be obtained by liquefaction and fractional distillation. The element is so inert that Lavoisier named it *azote*, without life, yet its compounds are so active as to be most important in foods, poisons, fertilizers and explosives. It is also prepared easily by heating a water solution of ammonium nitrite (made from ammonium chloride and sodium nitrite).

* **Neptunium**, see end of list.

THE ELEMENTS (Continued)

Nitrogen is colorless, odorless and generally inert element. When heated it will combine directly with magnesium, lithium or calcium; when mixed with oxygen and subjected to electric sparks it forms first nitric oxide (NO) and then the peroxide (NO_2); when heated under pressure with a catalyst with hydrogen ammonia is formed (Haber process). The ammonia thus formed is of the utmost importance, and may be oxidized to nitric acid (Ostwald process). Sodium and potassium nitrates are formed by the decomposition of organic matter with compounds of the metals present; in certain dry areas these salt-peters are found in quantity. The chief compounds are ammonia, nitric acid, the nitrates, the five oxides (N_2O , NO, N_2O_3 , NO_2 , and N_2O_5) as well as very many organic substances.

Osmium (Gr. *osme*, odor) Os; at. wt. 190.2; at. no. 76; m.p. 2700°C ; b.p. above 5300°C ; sp. gr. 22.48 (20°C); valence 2, 3, 4, or 8. Discovered in 1803 by Tennant in the residue left when crude platinum is dissolved by *aqua regia*. Osmium occurs in *iridosime* and in platinum bearing river sands of the Urals, North America and South America. The metal is bluish-white, hard and crystalline, belonging to the platinum family. It is the heaviest known form of matter and is very infusible. When heated in air it is oxidized to OsO_4 with a pungent, irritating and poisonous vapor, which is easily reduced by organic matter. The oxide gives the element its name, and is useful in making microscopic slides. The metal has been used in making lamp filaments and with iridium forms the alloy osmiridium, which is very hard, suggesting its use for tipping gold pen points and for fine machine bearings.

Oxygen (Gr. *oxys*, acid, and *genes*, forming, acid former), O; at. wt. 16.0000; at. no. 8; m.p. -218.4°C ; b.p. -183.0°C ; density 1.429 g/l (0°C); sp. gr. liquid 1.14 (-183°C); valence 2. Discovered in 1774 by Priestley, who obtained it by heating mercuric oxide, using the sun's rays with a burning glass; independently by Scheele from other sources. Oxygen as a gaseous element forms 21% of the atmosphere by volume, from which it can be obtained by liquefaction and fractional distillation. Free and in compounds it makes up approximately one half of the total material on the surface of the earth, forming by weight more than one fifth of the air, about two-thirds of the human body and eight-ninths of the water, with a very high percentage in the minerals of the earth's crust. In the laboratory it is usually prepared by the electrolysis of water, or by heating potassium chlorate with manganese dioxide as a catalyst. The critical temperature and pressure are -118°C and 50 atmospheres. The gas is colorless, odorless, and tasteless; the liquid and solid forms are a pale blue color and are magnetic, but much less so than iron. Oxygen is very reactive, capable of combining with all the other elements except the inert gases in Group O and bromine. Its atomic weight is the standard of comparison for the atomic weight of each of the other elements. It is used with combustible gases in the oxy-hydrogen and oxy-acetylene flames. It is essential for respira-

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tion of all animals and for practically all combustion; in medicine it is used to aid respiration.

Palladium (Planetoid Pallas), Pd; at. wt. 106.7; at. no. 46; m.p. 1553°C; b.p. 2200°C; sp. gr. 12.16 (20°C); valence 2 or 4. Discovered in 1803 by Wollaston. Palladium occurs with platinum and is obtained by ignition of the precipitated cyanide. It is a steel-white metal of the platinum family; does not tarnish in air and has the property of taking up large volumes of hydrogen with the formation of the hydride. It is used in the construction of non-magnetic watches and parts of delicate balances and in surgical instruments. The most important compound is the chloride, PdCl₂.

Phosphorus (Gr. *phosphoros*, light bearing), P; at. wt. 30.98; at. no. 15; m.p. 44.1°C; b.p. 280°C; sp. gr. yellow 1.82, red 2.20; valence 3 or 5. Discovered in 1669 by Brand, who prepared it from urine. Phosphorus may be prepared in three allotropic forms; white or yellow, red, black. Never found free in nature, it is widely distributed in combination in minerals, the most important being the *apatites* (3Ca₃(PO₄)₂·CaF₂ and 3Ca₃(PO₄)₂·CaCl₂), which are the chief ingredients of commercial phosphates derived from South Carolina, Florida, Canada and Spain; it is an essential ingredient of all cell protoplasm, nervous tissue and bones. It may be obtained from phosphates by treatment with dilute sulfuric acid to form *o*-phosphoric acid, the concentrated solution of which is mixed with crushed charcoal or coke and dried; on heating this mixture in retorts, the phosphorus distills and is condensed. It is also prepared by heating crude phosphate with sand and coke in the electric furnace, the phosphorus distilling off. Ordinary phosphorus is a waxy solid, which is colorless when very pure, insoluble in water but soluble in carbon disulfide. It takes fire spontaneously in air, burning to the pentoxide; it is very poisonous. When heated in its own vapor to 250°C it is converted into the red variety, which does not glow in the air, does not ignite spontaneously, and is not poisonous. The production of phosphorus and its compounds has increased very rapidly in recent years; phosphoric acid is replacing sulfuric acid in the treatment of natural phosphates to make them soluble for use as fertilizers, since this causes a great increase in the percentage of P₂O₅ present and available. Organic compounds are increasing in number and in importance. Di- and tri-sodium phosphates are used as detergents in large quantities, while hexa-metaphosphate is in frequent use for the prevention of boiler scale and of corrosion in pipes and boiler tubes. Other important compounds are the phosphoric anhydride, used as a toxic smoke in warfare and made from burning phosphorus, and the chlorides, PCl₃ and PCl₅.

Platinum (Sp. *platina*, little silver), Pt; at. wt. 195.23; at. no. 78; m.p. 1773.5°C; b.p. 4300°C; sp. gr. 21.37 (20°C); valence 2 or 4. Discovered in South America by Ulloa in 1735 and by Wood in 1744. Platinum usually occurs native, accompanied by small quantities of iridium, osmium, ruthenium, rhodium and palladium, all belonging to the same group of metals.

THE ELEMENTS (Continued)

These are usually found in alluvial deposits in the Ural mountains, in Colombia and in certain western American states. Sperrylite (PtAs_2) occurring with nickel bearing deposits in Canada is the source of a considerable weight of the platinum metals, which are recovered as by-products in refining the nickel. The heavy nickel production offsets the fact that there is only one part of the platinum metals in two million parts of ore. Platinum is a tin-white metal of metallic luster, tenacious, malleable and ductile; it is welded at a red heat; has a coefficient of expansion approximately equal to that of glass. The metal does not oxidize in air at any temperature, but is corroded by halogens, cyanide, sulfur and caustic alkalies; it is insoluble in hydrochloric or nitric acids, but dissolves when they are mixed as *aqua regia*, forming chloroplatinic acid (H_2PtCl_6), a very important compound. The metal is extensively used in jewelry, in wire and vessels for laboratory use, as well as many valuable instruments; in finely divided state it is an excellent catalyst, having long been used in the contact process for sulfuric acid, of which it does not now have a monopoly. The price of platinum has varied widely, being used a century or more ago to adulterate South American gold; in 1920 it was nearly eight times as valuable as gold at its price then, while it now practically equals the new value assigned to gold.

***Polonium** (Poland, native country of Mme. Marie Curie), Po; at. wt. approximately 210; at. no. 84. First element discovered by Mme. Curie (1898) in seeking cause of radioactivity of pitchblende from Joachimisthal, Bohemia. The electroscope, claimed to be 500,000 times more sensitive than the spectroscope, showed it separating with the bismuth. Polonium is also called Radium F. (See Radioactive Elements.)

Potassium (English *potash*), K (L. *kalium*); at. wt. 39.096; at. no. 19; m.p. 62.3°C ; b.p. 760°C ; sp. gr. 0.87 (20°C); valence 1. Discovered in 1807 by Davy, who obtained it from caustic potash (KOH); this was the first metal isolated by the aid of the electric current. The metal occurs abundantly, being the eighth element in the earth's crust, of which it makes more than 2%; most of its minerals are insoluble and the metal is obtained from them with great difficulty. Under certain conditions the salts of potassium have been concentrated from ancient ocean beds; before World War I the principal source of potassium was the mines of Stassfurt in Prussian Saxony from such beds. During this war the United States suffered a severe shortage of potassium salts, which form an essential constituent of fertilizers. Before World War II began the American production was sufficient to meet all needs; this supply came from mines in New Mexico, ancient lake beds in California and Utah, as a by-product from cement plant dust and from distillery waste. Potassium is never found free but is obtained by the electrolysis of the hydroxide. On exposure to moist air it becomes coated with a film of the oxide, and so is preserved by immersion in kerosene or naphtha. It is a soft, bright, silvery metal belonging to the alkali group; dropped on water it evolves hydrogen which takes fire spontaneously, the flame being colored violet

* Plutonium, see end of list.

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by the potassium. In some cases its compounds are more readily purified by crystallization than those of sodium; important are the hydroxide, carbonate, nitrate, chloride, chlorate, bromide, iodide, cyanide, sulfate, chromate, dichromate and silicate.

Praseodymium (Gr. *prasios*, green, and *didymos*, twin), Pr; at. wt. 140.92; at. no. 59; m.p. 940°C ; b.p. ; sp. gr. 6.5 (20°C); valence 3, 4 or 5. In 1843 Mosander reported the rare earth didymia obtained from lanthana; in 1879 Lecoq de Boisbaudran isolated a new earth from didymia extracted from samarskite and called it samaria. Six years later Von Welsbach separated it into two earths which gave salts of different colors. Praseodymium is a metallic element from the cerium group of rare earths. It forms green salts with a characteristic absorption spectrum. The metal has been prepared by the electrolysis of the chloride.

Protoactinium (Gr. *protos*, first), Pa; at. wt. 231; at. no. 91. The first element of the actinium series of radioactive elements was discovered by Soddy and Cranston and independently by Hahn and Meitner, both in 1917. Later Grosse prepared the pure pentoxide and from this in 1934 the metal. Protoactinium has been called the "mother substance" or the "parent" of actinium, which it forms by the loss of an alpha particle, and the "patriarch" of the series; known also as ekatantalum and uranium X_2 . (See Radioactive Elements.)

Radium (L. *radius*, ray) Ra; at. wt. 226.05; at. no. 88; m.p. 960°C ; b.p. 1140°C ; sp. gr. 5 (?); valence 2. In the form of a salt (RaBr_2) it was first separated by M. and Mme. Curie in 1898 from the *pitchblende* in North Bohemia, in which it occurs in about one part in three million. Isolated in 1911 by Mme. Curie and Debierne by the electrolysis of a solution of pure radium chloride, employing a mercury cathode; on distillation in an atmosphere of hydrogen this amalgam yielded the pure metal. The *carnotite* sands of Colorado furnished some radium, but richer ores were found in the Belgian Congo and later in the Great Bear Lake region of Canada, which is now the principal source. Radium is obtained commercially as the bromide or chloride. The metal is brilliant white, shows luminescence, alters very rapidly in contact with the air, decomposes water, and is somewhat more volatile than barium. The primary uses of the compounds are in producing self-luminous paints and in the treatment of certain types of cancer and skin affections. One gram of radium produces about 0.1 cubic millimeter of emanation per day; this is pumped from the radium and sealed in minute tubes, which are then applied to the diseased parts. Radium loses about 1% of its activity in 25 years, being transformed into elements of lower atomic weights. Study of radium and its activity has decidedly changed our ideas of the structure of the atom. (See Radioactive Elements.)

Radon (from radium, called niton at first, L. *nitens*, shining), Rn; at. wt. 222; at. no. 86; valence 0; m.p. -110°C ; b.p. -61.8°C ; sp. gr. 9.73 g/l. Discovered in 1900 by Dorn and called radium emanation; isolated in 1908 by Ramsay and Gray,

THE ELEMENTS (Continued)

who named it niton. They determined its density, finding it to be the heaviest gas known. It occupies the last place in the zero group of gases in the Periodic Table. Since 1923 it has been called radon to show its origin from radium. Thoron and actinon are isotopes. (See Radioactive Elements.)

Rhenium (L. *Rhenus*, Rhine), Re; at. wt. 186.31; at. no. 75; m.p. 3000°C; b.p. ; sp. gr. 20.53 (20°C); valence 4, 5, 6, 7, 8. One of the eka-manganeses (dwi-manganese) discovered in 1925 by Noddack, Tacke and Berg in the minerals *columbite*, *tantalite* and *wolframite*. Rhenium was detected with the aid of the Röntgen spectrum; its arc spectrum has been carefully studied by Meggers. The metal can be hot forged or rolled; dissolved readily in nitric acid, slowly in sulfuric, hardly at all in hydrochloric. The price of \$10,000 per gram in 1928 dropped to \$3 in 1930, the production increasing a thousand fold. This has made possible the use of the element as a catalyst for dehydrogenation and in connection with other metals.

Rhodium (Gr. *rhodon*, rose), Rh; at. wt. 102.91; at. no. 45; m.p. 1985°C; b.p. above 2500°C; sp. gr. 12.5 (20°C); valence 3. Discovered in 1803 by Wollaston. Rhodium is a silver-white metal of the platinum family, occurring native with other members of this family in river sands in the Urals and in North and South America. The salts form red solutions. An alloy with platinum is used in connection with pure platinum to make thermojunctions in some forms of pyrometers. In electroplating it gives a surface unaffected by exposure to air or to strong acids or alkalies.

Rubidium (L. *rubidius*, dark red), Rb; at. wt. 85.48; at. no. 37; m.p. 38.5°C; b.p. 700°C; sp. gr. 1.53 (20°C); valence 1. Discovered in 1861 by Bunsen and Kirchhoff by the use of the spectroscope in the mineral *lepidolite*. Rubidium occurs in small quantities, also, in some mineral springs and in the rare minerals, *castor* and *pollux*, found in Elba. It is prepared by the electrolysis of the cyanide. Rubidium is a soft, white, rare, metallic element of the alkali group; it forms salts similar to those of potassium and colors the flame dark red, when held in a burner.

Ruthenium (Ruthenia, Ukraine), Ru; at. wt. 101.7; at. no. 44; m.p. 2450°C; b.p. above 2700°C; sp. gr. 12.2 (20°C); valence 3, 4, 6 or 8. Discovered in 1844 by Klaus more than a century after the discovery of platinum. Ruthenium, belonging to the platinum group, occurs native with the other members of this group. The metal is hard, gray, and brittle; it forms red or brown salts; ruthenous chloride (RuCl_3) gives a characteristic fine black precipitate with water.

Samarium (Samariski, a Russian), Sm; at. wt. 150.43; at. no. 62; m.p. above 1300°C; b.p. ; sp. gr. 7.7-7.8; valence 2 or 3. Discovered in 1879 by Lecoq de Boisbaudran in the mineral *samaraskite*, named in honor of a Russian mine official. Samarium is a metallic element belonging to the cerium group of the rare earths, occurring in very minute quantities in *samaraskite*, *cerite* and certain Scandinavian minerals.

THE ELEMENTS (Continued)

Scandium (Scandinavia), Sc. at. wt. 45.10; at. no. 21; m.p. 1200°C; b.p. 2400°C, calculated; sp. gr. 3.02 (10°C) — ?; valence 3. Predicted by Mendeleeff on the basis of the Periodic Law; discovered by Nilson in 1879. By some scandium is placed in the rare earth group. The metal has not been isolated; it forms colorless salts derived from the oxide Sc_2O_3 .

Selenium (Gr. *Selene*, moon), Se; wt. wt. 78.96; at. no. 34; m.p. of gray form 220°C; b.p. 688°C; sp. gr. gray 4.8 (20°C); valence 2, 4 or 6. Discovered in 1817 by Berzelius associated with tellurium, named for the earth, hence the name chosen. The principal source of selenium is the flue dust obtained in burning pyrites in the manufacture of sulfuric acid. It is prepared in red amorphous form by reduction of selenic acid, and this on melting and keeping somewhat below the melting point becomes gray and crystalline. It is in the sulfur family, which it resembles both in the various forms of the element and in its compounds. The conductivity of electricity of the gray form increases with the brightness of the light with which it is illuminated. For this reason it can be used in photo-electric cells; its chief use is in the glass and ceramic industries. Red glass may contain colloidal selenium. It occurs in some soils in amounts sufficient to produce serious effects on animals feeding on plants grown in such soils.

Silicon (L. *silex*, flint), Si; at. wt. 28.06; at. no. 14; m.p. 1420°C; b.p. 2600°C; sp. gr. 2.42 (20°C); valence 4. First prepared by Berzelius in 1823. Next to oxygen, the most abundant element; characteristic of all abundant and important rocks except carbonates. It makes up about one-fourth of the crust of the earth. Silicon is not found free, it occurs chiefly as the oxide, silica (SiO_2) (sand, quartz, rock crystal, amethyst, agate, flint, jasper, opal, etc.) both free and in combination with the metallic oxides as silicates (granite, hornblende, asbestos, feldspar, clay, mica, etc.). It is obtained as an amorphous brown powder on fusion of potassium fluosilicate with sodium or potassium; the crystalline form is obtained by passing silicon tetrachloride over melted aluminum in an atmosphere of hydrogen, or by heating potassium fluosilicate with zinc and sodium at a temperature just below the boiling point of zinc. Silicon is a non-metallic element resembling carbon in having several allotropic forms and in compounds formed. It is not attacked by acids except by a mixture of nitric and hydrofluoric acids; it is soluble in hot caustic potash or soda, evolving hydrogen and forming the corresponding silicate (K_2SiO_3 or Na_2SiO_3). Sodium silicate is of wide industrial importance. Glass, cement and clay working are called the silicate industries. An alloy of iron containing 14% of silicon is brittle, but extremely resistant to the action of acids, making it widely useful in the equipment of acid plants and in laboratory drains.

Silver (Anglo-Saxon, *soelfor*), Ag (L. *argentum*); at. wt. 107.880; at. no. 47; m.p. 960.5°C; b.p. 1950°C; sp. gr. 10.50 (20°C); valence 1. Known to ancients. Silver occurs native and in ores in combination with many non-metallic elements, as *argentite* (Ag_2S) and horn silver (AgCl); lead and copper ores

THE ELEMENTS (Continued)

yield considerable silver. It is obtained from its ores by smelting with lead or copper, by cyanidation, or by amalgamation with mercury. The metal is pure white having a brilliant luster, a little harder than gold and excelled only by that metal in malleability and ductility; it excels all other metals as a conductor of heat and electricity; it undergoes no change in water or pure air, but absorbs 22 times its volume of oxygen when melted, which is again expelled on cooling; it tarnishes in the vapors of sulfur compounds forming the black sulfide (Ag_2S). The most important compounds of silver are the nitrate (AgNO_3), or lunar caustic, the oxide (Ag_2O), and the halides (AgCl , AgBr), which darken on exposure to light, which is the basis of photography. A dilute solution of silver nitrate is used in medicine as an antiseptic. The metal is extensively used for coins, in jewelry and in tableware.

Sodium (English, *soda*), Na (L. *natrium*); at. wt. 22.997; at. no. 11; m.p. 97.5°C ; b.p. 880°C ; sp. gr. 0.971 (20°C); valence 1. Long recognized in compounds; first isolated by Davy in 1807 by electrolysis. Sodium is the most abundant of the alkali metals, being the seventh element in amount in the crust of the earth. Sodium chloride is the most common compound, but it occurs in many others. Never found free, it is obtained by the electrolysis of the chloride or hydroxide; it is a soft, bright, silvery metal. On exposure to moist air it becomes coated with a film of the oxide or hydroxide, and is preserved by immersing in kerosene or naphtha. It decomposes water with the formation of hydrogen and sodium hydroxide; it burns in air with the formation of the peroxide (Na_2O_2); it is used for the reduction of organic compounds, in the preparation of the peroxide and cyanide, and for keeping mercury clean and active in gold extraction. Soap is generally a sodium salt of certain fatty acids. Its compounds are of the widest industrial importance, being manufactured in hundreds of thousands of tons annually. Some of these are common salt (NaCl), soda ash (Na_2CO_3), baking soda (NaHCO_3), caustic soda (NaOH), Chile saltpeter (NaNO_3), di- and tri-sodium phosphates, sodium thiosulfate (hypo, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$), borate (borax, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$).

Strontium (Strontian, town in Scotland), Sr ; at. wt. 87.63; at. no. 38; m.p. 800°C ; b.p. 1150°C ; sp. gr. 2.54 (20°C); valence 2. Discovered by Crawford, a Scotchman in 1790; metal isolated by Davy by electrolysis in 1808. Strontium is found chiefly in *celestite* (SrSO_4) and *strontianite* (SrCO_3). Prepared by the electrolysis of the fused chloride, it resembles metallic calcium in its properties; it is a hard silver-white metal. The salts are generally soluble in water with the exception of the sulfate, phosphate and carbonate; they impart a brilliant, blood-red color to the flame, and are used in pyrotechny for red fire. Strontium salts are also used in beet sugar refining.

Sulfur (L. *sulfur*), S ; at. wt. 32.06; at. no. 16; m.p. rhombic 112.8°C , monoclinic 119.0°C ; b.p. 444.6°C ; sp. gr. rhombic 2.07, monoclinic 1.957 (20°C); valence 2, 4, or 6. Known to the ancients. Formerly obtained from the vicinity of volcanoes, active or extinct, since the beginning of this century the chief

THE ELEMENTS (Continued)

supply has come from wells sunk into the salt domes along the Gulf coast. The Frasch process of concentric pipes with great quantities of superheated water has been used to melt and raise the sulfur, giving a product of very high purity. Sulfur is widely distributed in nature in free form; in sulfides, as iron (*pyrites*), lead (*galena*), zinc (*blende*), mercury (*cinnabar*) and antimony (*stibnite*); in sulfates, as calcium (*gypsum*), magnesium (*Epsom salt*), strontium (*celestite*) and barium (*barite* or *heavy spar*). Sulfur is a pale yellow, odorless, brittle solid, which is insoluble in water, soluble in carbon disulfide. It occurs in two crystalline forms and an allotropic form known as plastic sulfur, which reverts to the crystalline form on standing; a finely divided form known as flowers of sulfur is obtained by sublimation. It readily forms compounds known as sulfides with many elements. Sulfur is a component of black gunpowder, is widely used in the vulcanization of rubber and as a fungicide. A tremendous tonnage is used after burning to form sulfur dioxide in the manufacture of sulfuric acid, the most important manufactured chemical, and in the processes for making wood pulp for paper; sulfur dioxide is also used in fumigation and in the bleaching of dried fruits. The element is a good electrical insulating agent, and organic compounds containing sulfur are very important.

Tantalum (Gr. *Tantalos*, mythological character) Ta; at. wt. 180.88; at. no. 73; m.p. 2996°C; b.p. above 4100°C; sp. gr. 16.6; valence 3 or 5. Discovered in 1802 by Ekeberg. Tantalum occurs principally in the mineral *tantalite* (FeTa_2O_6), very similar to columbite, and is prepared by the reduction of K_2TaF_7 with hydrogen followed by fusion in a vacuum. It can be drawn into a wire with a very high point of fusion and great tenacity, which has been used in the construction of filaments for incandescent lamps; it has been generally replaced by tungsten, but tantalum is still used when lamps have to resist more than ordinary vibration. It is also used to alloy with other metals. It is soluble in fused alkalis, insoluble in acids; especially suited for plant work with halogens, hydrochloric acid and *aqua regia*. The common oxide is Ta_2O_5 .

Tellurium (L. *tellus*, earth), Te; at. wt. 127.61; at. no. 52; m.p. 452°C; b.p. 1390°C; sp. gr. 6.24 (20°C); valence 2, 4, or 6. Discovered by Muller von Richenstein in 1782; named by Klaproth in 1798. Tellurium is found native and as the telluride of gold and other metals. It is obtained by reduction of telluric oxide and forms a powder of grayish-white, metallic appearance. It is a semi-metallic element of the sulfur group and forms tellurides with hydrogen and metals similar to the sulfides; the compounds H_2TeO_3 and H_2TeO_4 are only slightly acidic. The inhalation of the vapors of tellurium produces the very offensive "tellurium breath." It is used as a coloring agent in glass, giving a blue to brown color. Certain alloys give high electrical resistance. Addition of less than a tenth of one per cent to lead greatly increases its strength and hardness.

Terbium (Ytterby, village in Sweden), Tb; at. wt. 159.2; at. no. 65; m.p. ; b.p. ; sp. gr. ; valence 3.

THE ELEMENTS (Continued)

Discovered by Mosander in 1843 from *gadolinite*. Terbium is a metal of the rare earths; in order of discovery it falls in the Yttria group; the metal has not been isolated. It yields a white oxide Tb_2O_3 , and forms trivalent salts. Its name together with the names yttrium, ytterbium, and erbium, are all derived from the little Swedish town, Ytterby, where the rare earth minerals were first found.

Thallium (Gr. *thallos*, budding twig), Tl; at. wt. 204.39; at. no. 81; m.p. $303.5^{\circ}C$; b.p. $1650^{\circ}C$; sp. gr. 11.85 ($20^{\circ}C$); valence 1 or 3. Discovered by the use of the spectroscope in 1861 by Crookes, who isolated the metal in 1862. Lamy also isolated the metal in 1862. Thallium occurs in *pyrites* and is prepared from the flue dust of sulfuric acid works. The metal is obtained by heating thallium iodide with metallic sodium; it resembles lead, having a hardness of 1.2 compared with 1.5 for lead; the malleability is high and the tenacity is low; there are two allotropic forms with a transition temperature of $226^{\circ}C$; it is a poor conductor of electricity, tarnishes in air forming the oxide Tl_2O , or the hydroxide $TlOH$ in the presence of water. The element is displaced from solutions of its salts by zinc. Because of its resemblance to both the alkali metals and to the metals of Group III, thallium has been called the "paradoxical metal" and the "bird-beast metal." Its salts are poisonous, and are used in the control of rodents such as squirrels.

Thorium (*Thor*, Scandinavian god of war), Th; at. wt. 232.12; at. no. 90; m.p. $1845^{\circ}C$; b.p. above $3000^{\circ}C$; sp. gr. 11.3 ($20^{\circ}C$); valence 4. Discovered by Berzelius in 1828. Thorium occurs chiefly in *thorite* ($ThSiO_4$) and other rare minerals. In the U. S. it is obtained chiefly from *monazite*, which contains from 3 to 9% of ThO_2 . The free element has been prepared by heating the double chloride or fluoride of thorium and potassium with metallic sodium or potassium; it is a heavy, gray, difficulty fusible metal, belonging to the titanium group. It burns brightly in oxygen to form ThO_2 , which is also obtained on heating the nitrate, a reaction of which use is made in the manufacture of incandescent gas mantles. Thorium emits radiations similar to but not identical with those of radium. (See Radioactive Elements.)

Thulium (*Thule*, Northland), Tm; at. wt. 169.4; at. no. 69; m.p. ; b.p. ; sp. gr. ; valence 3. Discovered in 1879 by Cleve; pure thulia was prepared in 1911 by James. Thulium is in the yttrium group of the rare earth metals in order of discovery and belongs to the erbium family, which includes dysprosium, holmium and erbium also. They are obtained from certain rare minerals occurring in granite or pegmatite veins. These elements are characterized by their absorption spectra and the formation of highly colored salts; they form basic oxides of the type M_2O_3 with the following order of increasing basicity; thulium, erbium, holmium and dysprosium. The free elements have not been isolated.

Tin (Anglo-Saxon *tin*), Sn (L. *stannum*); at. wt. 118.70; at. no. 50; m.p. $231.89^{\circ}C$; b.p. $2260^{\circ}C$; sp. gr. gray 5.75, rhombic 6.55, tetragonal 7.31 ($20^{\circ}C$); valence 2 or 4. Known to the ancients.

THE ELEMENTS (Continued)

Tin is found chiefly in the mineral *cassiterite* (SnO_2), found in association with granitic rocks, almost none found in the U. S. It is obtained by roasting to remove sulfur and arsenic and smelting with powdered anthracite in a reverberatory furnace. Tin is found in several varieties; as ordinarily used it is a silver white metal, malleable and somewhat ductile with a low tenacity and highly crystalline structure. Due to a breaking of these crystals, the "tin cry" is heard when a bar is bent. Crystalline tin changes to gray tin at low temperatures, the speed of change reaching a maximum at -50°C . Ordinarily it takes a high polish and is used to coat other metals to prevent corrosion or other chemical action. Such tin plate over steel is used in the so called tin can for preserving food; enough is used in America each year to make a 100 foot wide belt around the earth at the equator. When heated in air, tin forms SnO_2 , which is feebly acid, forming stannate salts with basic oxides. The most important salt is the chloride ($\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$), which is used as a reducing agent and as a mordant in calico-printing. Alloys of the metal are very important, including solder, type metal, fusible metal, pewter, bronze and bell metal.

Titanium (L. *Titans*, the first sons of the Earth, myth.), Ti; at. wt. 47.90; at. no. 22; m.p. 1800°C ; b.p. above 3000°C ; sp. gr. 4.5 (20°C); valence 3 or 4. Discovered by Gregor in 1791; named by Klaproth in 1795; pure metal prepared in 1910 by Hunter by heating TiCl_4 with sodium in a steel bomb. Titanium is almost invariably present in igneous rocks and the sedimentary material derived from them, occurring as the oxide (TiO_2), in titanates and with many iron ores. The metal is prepared by heating the oxide with aluminum or by electrolysis of the oxide dissolved in fused calcium chloride. It is a lustrous white metal in the same group with tin; it burns in air and is the only element which burns in nitrogen. The most important compounds are the oxide (TiO_2), which is feebly acidic and from which the titanates are derived; the halides (TiX_4), some of which are volatile; and the nitrides (Ti_2N_2 , Ti_3N_4), metallic in appearance. The oxide is used in high grade white pigments of great opacity and covering power. The metal is used in steel alloys to increase strength.

Tungsten (Sw. heavy stone), W (G. *Wolfram*); at. wt. 183.92; at. no. 74; m.p. 3370°C ; b.p. 5900°C ; sp. gr. 19.3 (20°C); valence 2, 4, 5 or 6. Discovered by d'Elhujar brothers in 1783. Tungsten occurs in tungstates as *wolframite* (FeWO_4), *scheelite* (CaWO_4), *kübnerite* (MnWO_4). The metal is obtained by reduction of the oxide (WO_3) with hydrogen, carbon or aluminum. It is hard, brittle, nonmagnetic and forms the oxide when heated in the air. The only solvent for tungsten is a mixture of nitric and hydrofluoric acids. Because its melting point is higher than that of any other known element, its vapor pressure is extremely low. Thus it is useful for heating elements protected from air, targets of X-ray tubes, contacts, arcing points; its higher electrical efficiency causes its almost exclusive use in light filaments. About 90% of the world's production is used in steel manufacture, its various steel alloys being used in armor plate, projectiles and high speed cutting tools.

THE ELEMENTS (Continued)

Uranium (Planet Uranus), U; at. wt. 238.07; at. no. 92; m.p. about 1150°C; b.p. ; sp. gr. 18.68 (20°C); valence 3, 4 or 6. Discovered by Klaproth in *pitchblende* in 1789; metal first prepared in 1841 by Peligot by reducing the chloride with metallic potassium. This method is still used. The chief ore is *uraninite*, or *pitchblende*, uranous uranate, $U(VO_4)_2$; the metal is hard, white, heavy. Uranium is used chiefly in compounds which give a canary-yellow fluorescent glass and a black pigment for china painting; its compounds are used in photography. Of the generally recognized elements it has the highest atomic weight and is the last in the Periodic Table. Uranium compounds are radioactive. (See Radioactive Elements.)

Vanadium (Scandinavian goddess, *Vanadis*), V; at. wt. 50.95; at. no. 23; m.p. 1710°C; b.p. 3000°C; sp. gr. 5.96 (20°C); valence 2, 3, 4 or 5. Discovered by Sefstrom in 1830; isolated by Roscoe in 1869. Though relatively rare, vanadium is found in a variety of minerals; prominent among these are *vanadinite* ($3Pb_3(VO_4)_2 \cdot PbCl_2$) and *patronite* (possibly VS_4) occurring in Peru. Vanadium is obtained by reduction of the chloride in hydrogen, forming a gray and very infusible metal. The vanadates are employed in the preparation of aniline black and for coloring glass. Most of it is produced as ferro-vanadium and used in the manufacture of steel alloys, greatly increasing toughness, elasticity and tensile strength. V_2O_5 masses are used in the contact process for manufacture of sulfuric acid.

***Virginium** (State of Virginia), Vi; at. wt. about 224; at. no. 87; valence 1. Discovered in 1929 by Dr. Fred Allison and co-workers of Alabama Polytechnic Institute by the magneto optic method of analysis of *pollucite* and *lepidolite*. It has been found also in sea water, lake brine, Stassfurt deposits and certain other minerals. Virginium has the highest equivalent weight of any element. Named in honor of Virginia, where the discoverer was born. (Existence questioned Ed.)

Xenon (Gr. *xenon*, stranger), Xe; at. wt. 131.3; at. no. 54; m.p. -112°C; b.p. -107.1°C; density 5.85 g/l, sp. gr. liquid 3.52 (-109°C); valence 0. Discovered by Ramsay and Travers in 1898 in the residue left on evaporating liquid air. It is the rarest and heaviest of the gases of the argon family from the atmosphere, in which it is present to the extent of about one part in twenty million. It is inert and forms no compounds with other elements. Vacuum tubes containing it show a beautiful blue glow.

Ytterbium (Ytterby, village in Sweden), Yb; at. wt. 173.04; at. no. 70; m.p. 1800°C; b.p. ; sp. gr. ; valence 3. Separated by Marignac in 1878. In 1907 Urbain and in 1908 von Welsbach described a process by which this earth containing the metal, could be resolved into earths of two other metals—neo-ytterbium, or simply ytterbium, and lutecium. These elements occur in nearly all minerals which contain yttrium, but in very small amounts. The best sources are probably *gadolinite*, *xenotime*, *polycrase* and *blomstrandine*. The oxide, chloride and sulfate have been prepared.

■ See element 87 at end of list.

THE ELEMENTS (Continued)

Yttrium (Ytterby, village in Sweden), Y; at. wt. 88.92; at. no. 39; m.p. 1490°C; b.p. 2500°C; sp. gr. 5.51; valence 3. The rare earth yttria, which contained a new element, was discovered by Gadolin in 1794; in 1843 Mosander showed that yttria could be resolved into the earths of three other elements, the name yttria being reserved for the most basic one, the others being named erbia and terbia. Yttrium occurs in nearly all of the rare earths minerals. Wöhler obtained the free element by reduction of the chloride with potassium; it has also been obtained by the electrolysis of a mixture of the chloride and sodium chloride. The metal forms small scales with a metallic luster and an iron-gray color; it is readily oxidized in air and is converted to the hydroxide by boiling water.

Zinc (G. *Zink*), Zn; at. wt. 65.38; at. no. 30; m.p. 419.5°C; b.p. 907°C; sp. gr. 7.14 (20°C); valence 2. Its ores were used for making brass for centuries before it was recognized as a separate metal in 1746 by Marggraf, who obtained it by heating calamide with charcoal. The principal ores are *sphalerite* or *blende* (sulfide), *smithsonite* (carbonate) and *calamine* (silicate). The old method of heating the roasted ore with carbon in a retort is still used, being replaced to some extent by the electrolytic process. Zinc is a bluish-white metal, brittle at ordinary temperatures but malleable at 100°C, a fair conductor of electricity; it burns in air at high red heat with evolution of white clouds of the oxide; it is used to form numerous alloys with other metals, as brass with copper. Galvanizing is coating other metals, especially iron, with zinc to prevent corrosion; the coating is sometimes applied by dipping in molten zinc. It is used as the negative electrode in various types of electric batteries. Compounds are widely used in paints, the oxide being an important white pigment; its compounds have antiseptic properties and are used in medicine. Nearly a century ago Frankland showed the use of zinc in preparing organic compounds.

Zirconium (Arabic *zargun*, gold color), Zr; at. wt. 91.22; at. no. 40; m.p. 1900°C; b.p. above 2900°C; sp. gr. 6.4 (20°C); valence 4. Discovered in *zircon* by Klaproth in 1789; isolated by Berzelius in 1824. Rather widely diffused in igneous rocks, zirconium usually occurs in the silicate, ZrSiO_4 . The element is in the titanium family, its oxide being either base or acid forming. Prepared from the tetrachloride by heating with sodium in a bomb, the metal can be pressed into rods, drawn into wire, or burnished to a bright surface. A number of alloys have been made. Ferro-zirconium, made by aluminum reduction in an electric furnace, is used for desulfurizing and deoxidizing steel. Zircon, the silicate, is sometimes a gem. The oxide has been used in gas mantles, in paints as an opacifier, in lacquers in insulators and as an abrasive.

THE ELEMENTS (Continued)

Americium (The Americas), Am; at. no. 95. This name has been suggested for element number 95 by Seaborg, its co-discoverer, in 1945. It appears to belong to a series of elements of which actinium is the first member.

Astatine, At; at. no. 85. An isotope of atomic mass 211 was made by bombarding bismuth with high energy alpha particles. Its general behavior is that of a metal. Its properties were investigated by Corson, Mackenzie and Segré.

Curium (Pierre and Marie Curie), Cm; at. no. 96. Name suggested by Seaborg for element number 96, isotopes of which were identified in 1945. The element appears to belong to the "actinide" series.

Francium, Fa; at. no. 87. A radioactive form called actinium K has been discovered by Perey. It has a mass number of 223 and behaves like a heavy alkali metal. It disintegrates rapidly with negative beta particle emission.

Neptunium (Planet Neptune), Np; at. wt. 237; at. no. 93; three isotopes of mass numbers 237, 238 and 239 are known.

The two isotopes Np-238 and Np-239 were isolated in 1940 by McMillan and Abelson, both produced from uranium, the first by bombardment with deuterons. When uranium is bombarded with neutrons, an isotope of uranium of mass number 239 is first produced which by emission of a beta particle becomes Np-239. Both of these isotopes disintegrate to form plutonium.

Np-237 was discovered by Wahl and Seaborg in 1942 as a decay product of U-237. This isotope is relatively stable.

Plutonium (Planet Pluto), Pu; at. no. 94; valence 3, 4, 5, or 6; an artificially produced radioactive element having properties somewhat similar to uranium.

The element was discovered by Seaborg, McMillan, Wahl, and Kennedy in 1940. The isotope isolated was Pu-238 formed by deuteron bombardment of uranium which first produced Np-238. This decays to produce the plutonium isotope.

The isotope of mass number 239 is formed as a result of neutron capture by uranium-238 followed by two successive beta transformations. Both isotopes disintegrate slowly; Pu-239 has a half life of about 24,000 years, thus being essentially a stable element. This latter isotope is of tremendous importance because of being fissionable with slow neutrons, and has been used in the production of atomic bombs.

Promethium, Pm; at. no. 61. Radioactive forms were produced by Kurbatov and Pool and independently by Wu and Segré. The element belongs to the class of rare earths.

Technetium, Tc; at. no. 43. Radioactive isotopes were produced by the bombardment of molybdenum with deuterons. Perrier and Segré showed that the chemical properties resemble those of rhenium.

PERIODIC ARRANGEMENT OF THE ELEMENTS

Series	Period	ZERO GROUP	GROUP I R ₂ O	GROUP II RO	GROUP III R ₂ O ₃	GROUP IV RH ₄ RO ₂
0						
1			Hydrogen H = 1.0078 No. 1			
2	1	Helium He = 4.002 No. 2	Lithium Li = 6.940 No. 3	Beryllium Be = 9.02 No. 4	Boron B = 10.82 No. 5	Carbon C = 12.00 No. 6
3	2	Neon Ne = 20.183 No. 10	Sodium Na = 22.997 No. 11	Magnesium Mg = 24.32 No. 12	Aluminum Al = 26.97 No. 13	Silicon Si = 28.06 No. 14
4	3	Argon A = 39.944 No. 18	Potassium K = 39.10 No. 19	Calcium Ca = 40.08 No. 20	Scandium Sc = 45.10 No. 21	Titanium Ti = 47.90 No. 22
5			Copper Cu = 63.57 No. 29	Zinc Zn = 65.38 No. 30	Gallium Ga = 69.72 No. 31	Germanium Ge = 72.60 No. 32
6	4	Krypton Kr = 82.9 No. 36	Rubidium Rb = 85.44 No. 37	Strontium Sr = 87.63 No. 38	Yttrium Y = 88.92 No. 39	Zirconium Zr = 91.22 No. 40
7			Silver Ag = 107.880 No. 47	Cadmium Cd = 112.41 No. 48	Indium In = 114.8 No. 49	Tin Sn = 118.70 No. 50
8	5	Xenon Xe = 130.2 No. 54	Caesium Cs = 132.81 No. 55	Barium Ba = 137.36 No. 56	Lanthanum La = 138.90 No. 57	Cerium Ce = 140.13 No. 58
9						
10	6					Hafnium Hf = 178.6 No. 72
11			Gold Au = 197.2 No. 79	Mercury Hg = 200.61 No. 80	Thallium Tl = 204.39 No. 81	Lead Pb = 207.22 No. 82
12	7	Radon Rn = 222 No. 86	No. 87	Radium Ra = 225.97 No. 88	No. 89	Thorium Th = 232.12 No. 90

Elements not classified in the table above:

Praseodymium Pr = 140.92 No. 59	Neodymium Nd = 144.27 No. 60	Illinium Il = 146(?) No. 61	Samarium Sm = 150.43 No. 62	Europium Eu = 152.0 No. 63
	Gadolinium Gd = 157.3 No. 64	Terbium Tb = 159.2 No. 65	Dysprosium Dy = 162.46 No. 66	

MENDELEEFF'S

GROUP V RH ₃ R ₂ O ₅		GROUP VI RH ₂ RO ₂		GROUP VII RH R ₂ O ₇		GROUP VIII		
Nitrogen N =14.008 No. 7		Oxygen O =16.000 No. 8		Fluorine F =19.00 No. 9				
Phosphorus P =31.02 No. 15		Sulfur S =32.06 No. 16		Chlorine Cl =35.457 No. 17				
Vanadium V =50.95 No. 23		Chromium Cr =52.01 No. 24		Manganese Mn =54.93 No. 25		Iron Fe =55.84 No. 26	Cobalt Co =58.94 No. 27	Nickel Ni =58.69 No. 28
Arsenic As =74.93 No. 33		Selenium Se =79.2 No. 34		Bromine Br =79.916 No. 35				
Columbium Cb =93.3 No. 41		Molybdenum Mo =96.0 No. 42		Masurium Ma =? No. 43		Ruthenium Ru =101.7 No. 44	Rhodium Rh =102.91 No. 45	Palladium Pd =106.7 No. 46
Antimony Sb =121.76 No. 51		Tellurium Te =127.5 No. 52		Iodine I =126.932 No. 53				
Tantalum Ta =181.4 No. 73		Tungsten W =184.0 No. 74		Rhenium Re =186.31 No. 75		Osmium Os =190.8 No. 76	Iridium Ir =193.1 No. 77	Platinum Pt =195.23 No. 78
Bismuth Bi =209.00 No. 83		No. 84						
No. 91		Uranium U =238.14 No. 92		No. 93				
Holmium Ho =163.5 No. 67		Erbium Er =167.64 No. 68		Thulium Tm =169.4 No. 69		Ytterbium Yb =173.5 No. 70		Lutecium Lu =175.0 No. 71

ISOTOPES

Artificial and Natural Radioactive Isotopes and Stable Isotopes

The following table is taken from a comprehensive table of isotopes compiled by Glenn T. Seaborg, Department of Chemistry, University of California, and published in Reviews of Modern Physics, January 1944. All isotopes given in the original table are listed and all data included except information as to the nuclear reaction by which the isotope was produced. For this the reader is referred to the original publication. Information may usually be obtained from the literature cited in connection with data for the isotope.

The atomic number, Z , is given in the first column followed by the symbol of the isotope and the mass number A . The degree of certainty is shown in the third column by letters with the following significance:

A = isotope certain (mass number and element certain)

B = isotope probable, element certain

C = one of few isotopes, element certain

D = element certain

E = element probable

F = insufficient evidence

G = probably in error (e.g., impurity or inadequate half-life determination)

The percent abundance of the stable isotopes is listed in the fourth, and the type of radiation in the fifth column. The half-life of radioactive isotopes and the energy of radiation in mega-electron volts complete the table. Symbols in parenthesis throughout the table refer to the table of references at the end.

Table of Abbreviations

α = alpha-particles

β^- = negative beta-particles

β^+ = positive beta-particles (positrons)

γ = gamma-rays

e^- = internal-conversion electrons

Be- γ - n reaction = measurement of neutron energy from Be- γ - n reaction

D- γ - n reaction = measurement of neutron energy from D- γ - n reaction

abs. = absorption

calor. = calorimetric measurements

cl. ch. = cloud chamber (with magnetic field in case of beta-particles)

cl. ch. pair = positron-electron pairs in cloud chamber with magnetic field

cl. ch. recoil = secondary electrons in cloud chamber with magnetic field

coincid. = beta- and gamma-coincidence counters (Particles column)

coincid. = gamma-gamma-coincidence counters (γ -rays column)

ISOTOPES (Continued)

coincid. abs. = beta- and gamma-coincidence counters with absorbers (Particles column)

coincid. abs. = secondary electrons with coincidence counters and absorbers (γ -rays column)

d = deuteron

ion. ch. = measurement of pulse sizes in ionization chamber

I.T. = isomeric transition (transition from upper to lower isomeric state)

K = K -electron capture

K.U. = Konopinski-Uhlenbeck extrapolated value reported

n = neutron

p = proton

spect. = magnetic deflection (Particles column)

spect. = secondary electrons with magnetic spectrograph (γ -rays column)

spect. conv. = internal-conversion electrons with magnetic spectrograph

In the few cases where it is certain that no gamma-rays are emitted, this fact is expressed explicitly by the symbol "no γ ." Annihilation gamma-rays are not listed.

ISOTOPES (Continued)

TABLE OF ISOTOPES

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
1	H	A	99.98(H70)	β^-	31 yr.(O4)	0.015(O3, N6) abs., cl. ch.	
	H	...	0.02(H70)				
	H	A	...				
2	He	...	$\sim 10^{-5}$ (A7, A30)	β^-	0.8 sec.(B1)	3.7(B1, B2) cl. ch.	
	He	A	100(T20)				
	He	...	...		
3	Li	...	7.5(H71)	β^-, α K, γ	0.88 sec.(L1) 43 days(R13, A18)	12(β^-)(B4) cl. ch.	0.485(Z1) coincid. abs. < 0.5(M22) abs.
	Li	A	92.5(H71)				
	Li	...	...		
4	Be	A	100(N30)	β^-, γ	> 10^3 yr.(M22)	~ 0.5 (M22) abs.	
	Be	...	...		
	Be	A	...				
5	B	...	18.4(O20)	β^- β^+	0.022 sec.(C2, B22) 8.8 sec.(B27, D26) 20.5 min.(S8, T8)	12(B4) cl. ch. 3.4(D26) cl. ch. 0.95(D26) cl. ch.	
	B	A	81.6(O20)				
	B	...	...		
6	C	A	98.9(N31)	β^- β^+, γ	> 10^3 yr.(K24) 9.93 min.(W14, T8)	0.145(R21) abs. 0.92, 1.20(L22) spect.	No γ (R21) 0.28(R2) cl. ch. recoil
	C	...	1.1(N31)				
	C	A	...				
7	N	...	99.62(V20)	β^- β^+	8 sec.(C5, N1) 126 sec.(M3, B20)	6.0(?) (F1) cl. ch. 1.7(F1) cl. ch.	
	N	A	0.38(V20)				
	N	...	...		
8	O	A	99.76(S60)	β^-	31 sec.(N1)		
	O	...	0.041(M50)				
	O	A	0.20(S60)				

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
9	F	A	.....	β^+	70 sec.(N2)	2.1(K4) cl. ch.	
	F	A	.....	β^+	112 min.(S1)	0.7(Y2) cl. ch.	
	F	A	100(A30)				
	F	A	.....	β^- , γ (B50, C47)	12 sec.(C1)	5.0(F1, B50) cl. ch.	2.2(B50) cl. ch. recoil
10	Ne	A	.....	β^+	20.3 sec.(W7)	2.20(W7) cl. ch.	
	Ne	A	90.00(V20)				
	Ne	A	0.27(V20)				
	Ne	A	9.73(V20)				
11	Ne	A	.....	β^-	40 sec.(A1, B6)	4.1(P21) abs.	
	Na	B	.....	β^+ , γ	23 sec.(C27)	0.58(L3) cl. ch.	1.3(O2) spect.
	Na	A	.....		3.0 yr.(L3)		
	Na	A	100(S61)	β^- , γ	14.8 hr.(V1)	1.4(L21, S49) spect.	1.4, 2.8(E7, I2, E8) spect.; 2.87(G16) Be- γ -n reaction, D- γ -n reaction; 2.69, 3.22, 3.61(O10) cl. ch. pair 0.035(H54) abs. A1
12	Na	E	.....	β^- , γ	62 sec.(H54)	2.8(H54) abs. A1	
	Mg	A	.....	β^+	11.6 sec.(W7)	2.82(W7) cl. ch.	
	Mg	A	77.4(A31)				
	Mg	A	11.5(A12)				
13	Mg	A	11.1(A12)	β^- , γ	10.2 min.(H4)	1.8(C13) cl. ch.	0.64, 0.84, 1.02(I2) spect.
	Mg	A	.....	β^+	7.0 sec.(W7, F2)	2.99(W7) cl. ch.	
	Al	A	100(A31)	β^- , γ (W17)	2.4 min.(A1, M5, E2)	3.3(C6) cl. ch.	1.8(I2) spect.
	Al	A	.....	β^-	6.7 min.(B25)	2.5(B25) cl. ch. and abs.	

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
14	Si	A					
	27	A	.....	β^+	4.9 sec. (K10, C27)	3.74(M21) cl. ch.; 3.54(B8) cl. ch.	
	28	...	89.6(M51)				
	29	...	6.2(M51)				
	30	...	4.2(M51)				
	31	A	.....	β^-	170 min. (N3, A13)	1.8(K4) cl. ch.	No γ (N3)
15	Si	A	.....	β^-	4.6 sec. (W11)	3.63(W11) cl. ch.	
	29	A	.....	β^+	2.55 min. (R3, B49)	3.0(B48, B49) cl. ch.; 3.5(M26) spect.	
	30	A	.....	β^+			
	31	...	100(A31)	β^-	14.30 days (C8)	1.69(L5) spect.; 1.75(W29) spect.; 1.71(S49) spect.	No γ (K4)
	32	A	.....	β^+	3.2 sec. (W11, K10)	3.85(W11, E4) cl. ch.	
	33	A	.....	β^-	87.1 days (H53)	0.107(L6) spect.; 0.120(K13) abs. A1	
16	S	A	.....	β^-			
	31	A	.....	β^+	2.4 sec. (W11)	4.13(W11) cl. ch.	
	32	...	95.1(N32)	β^+	33 min. (S2, B21)	2.5(B21) abs.	
	33	...	0.74(N32)	β^+	$> 10^3$ yr. (G8, O5)	0.64(β^-) (G8) abs.	
	34	...	4.2(N32)	β^+	37 min. (V1)	1.1, 2.8, 5.0(W16, W17) spect., (W17) coincid. abs.	1.65, 2.15(C28, I2) spect.
	35	A	.....	β^-			
17	S	...	0.016(N32)	β^+			
	33	A	.....	β^+			
	34	A	.....	β^+			
	35	...	75.4(N33)	β^+ ; K; β^- (G8)			
	36	A	.....	β^+			
	37	...	24.6(N33)	β^- , γ			
17	Cl	A	.....	β^-			
	33	A	.....	β^-			
	34	A	.....	β^-			
	35	...	.....	β^-			
	36	A	.....	β^-			
	37	...	.....	β^-			
17	Cl	A	.....	β^-			
	33	A	.....	β^-			
	34	A	.....	β^-			
	35	...	.....	β^-			
	36	A	.....	β^-			
	37	...	.....	β^-			
17	Cl	A	.....	β^-			
	33	A	.....	β^-			
	34	A	.....	β^-			
	35	...	.....	β^-			
	36	A	.....	β^-			
	37	...	.....	β^-			

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
18	A						
	35	A	0.307(N34)	β^+	1.88 sec.(E4)	4.4(E4, W11) cl. ch.	
	36	...		.....	34 days(W18)		
	37	A	0.061(N34)	β^-	4 min.(P2)		
	38	...					
19	39	G	99.632(N34)	β^-	110 min.(S3)	1.5(K4) cl. ch. (K.U.)	1.37(R8) cl. ch. recoil
	40	A	.....	β^+	7.7 min.(H5, R3)	2.3(R3) abs.	
	41	A	.....	β^-, γ	1.42×10^9 yr	0.40(H83), 0.725(L6) spect.; 1.3(H87) abs.	2(K52) abs. Fe
	38	A	93.38(C51)	$\beta^-(T31, C61), \gamma(K52); K(75\%)(T30)$	(B71); 4×10^8 yr. (T30)		
	39	...	0.012(N34)				
	40	A					
	(H88, S62)						
	41	...	6.61(C51)	β^-	12.4 hr.(H5)	3.5(K4) cl. ch.	
	42	A	.....	β^-	18 min.(W1, W12)		
	43, 44	C	.....	β^+	4.5 min.(P2, W12)		
20	39	F	.....	.....	1.06 sec.(H44)		
	39	E	.....			
	40	...	96.96(N32)	$K, \gamma, e^-(W12)$	8.5 days(W12)	.....	1.1(W12) abs. Pb, abs. of e^-
	41	B	.....			
	42	...	0.64(N32)	β^-, γ	180 days(W12)	0.2, 0.9(W12) abs.	0.7(W12) abs. Pb
	43	...	0.15(N32)				
	44	...	2.06(N32)				
	45	A	.....			
	46	...	0.0033(N32)	β^-, γ	2.5 hr.(W12)	2.3(W12) abs.	0.8(W12) abs. Pb
	48	...	0.19(N32)		30 min.(W12)		
	49	A	.....			
	49	B	.....			

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
21	A						
	Sc 41	A	.....	β^+	0.87 sec.(K10)	4.94(E4) cl. ch.	
	Sc 42	F	.....	β^+	13.5 days(W10)	1.4(W10) abs.	1.0(W10) abs. Pb;
	Sc 43	A	.....	β^+ , γ	4 hr.(W10)	0.4, 1.4(W10) abs.; 1.13(H1)	1.65(H1)
	Sc 44	A	.....	I.T., e^- , γ (W10)	52 hr.(W10)	.....	0.27(H9, S19) spect. conv.; 0.28, 1.33(H1)
	Sc 44	A	.....	β^+ , γ	4.1 hr.(W10)	1.5(W10) abs., (S19) spect.; 1.33(H1)	1.80(H1)
	Sc 45	...	100(A31)				1.25(W10) abs. Pb
22	Sc 46	A	.....	β^- , γ , K(W5)	85 days(W5)	0.26, 1.5(β^-)(W10) abs.	
	Sc 47	F	.....	β^- , γ	63 hr.(W10)	1.1(W10) abs.	1.35(M2, M30) spect.;
	Sc 48	A	.....	β^- , γ (W10)	44 hr.(W10, M2)	0.64(S19) spect.; 0.57(H1)	1.33(H1) abs.
	Sc 49	A	.....	β^-	57 min.(W10)	1.8(W10) abs.	No γ (W10)
	Sc 49	F	.....	β^-	3.4 days(H1)	0.46(H1)	No γ (H1)
	Ti 45	A	.....	β^+	3.08 hr.(A17)	1.2(A17) cl. ch.	
	Ti 46	...	7.95(N32)				
23	Ti 47	...	7.75(N32)				
	Ti 48	...	73.45(N32)				
	Ti 49	...	5.51(N32)				
	Ti 50	...	5.34(N32)				
	Ti 51	A	.....	β^- , γ (W4)	2.9 min.(W4)	0.36(W5) abs.	1.0(W5) coincid. abs.
	Ti 51	A	.....	β^- , γ	72 days(W5)	1.9(W4, O7) abs.	
	V 47	B	.....	β^+ , K, γ (W5, H60)	33 min.(W4, O7) 16 days(W4)	1.0(W4) cl. ch.; 0.58(H60)	1.05(R4) cl. ch. recoil; 1.50(H60) abs. Pb
23	V 48	A	.....	β^+	600 days(W5)	No β^+ or e^- (W5)	No γ (W5)
	V 49	B	.....	K	3.7 hr.(W4)		
	V 50	A	.....	β^+			
	V 51	...	100(A31)				
23	V 52	A	.....	β^-	3.9 min.(W4)	2.05(D24) abs.	

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	γ-rays
	A					Particles	
24	Cr	A	.....	β^+ , γ	41.9 min.(O7)	1.45(O7) abs., cl. ch.	0.18, 1.55(O7) abs. Pb
	Cr	B	4.49(N35)	K , γ , e^- (W13)	26.5 days(W13)	.....	0.5, 1(W13) abs. Pb,
	Cr	..	.....	.....	.....	.....	abs. of e^-
	Cr	..	83.78(N35)	.....	1.6-2.3 hr.	.....	.....
	Cr	..	9.43(N35)	.....	(A14, D14)	.....	.....
	Cr	..	2.30(N35)	.....	46 min.(L7)	.....	.....
	Cr	B	.....	.....	21 min.(L7)	.....	.....
25	Mn	A	.....	β^+	6.5 days(L7)	2.0(L7) abs.	1.2(H6)
	Mn	A	.....	β^+ , γ	310 days(L7)	2.2(H6, H12) cl. ch.	1.0(H6)
	Mn	A	.....	β^+ , γ , K (H6, H12)	.....	0.77(H6, H12) cl. ch.	0.85(L7) abs. Pb;
	Mn	A	.....	K , γ (L7)	.....	.....	0.835(D35) spect.,
	Mn	..	100(S63)	β^- , γ	2.59 hr.(L7)	0.75, 1.05, 2.86(E12) spect., coincid.; 1.04, 2.88(T8) spect.	coincid.
	Mn	A	.....	.....	.....	.....	0.7, 1.7(B26, B14) cl.
	Mn	A	.....	.....	.....	.....	ch. recoil; 0.845, 1.81,
26	Fe	A	.....	β^+	8.9 min.(R3)	.....	2.13(E9, E12) spect.;
	Fe	..	6.04(N35)	K , e^-	~ 4 yr.(V4)	.....	0.800(G3) spect.
	Fe	A	.....	.....	.....	.....	.....
	Fe	..	91.57(N35)	.....	.....	.....	.....
	Fe	..	2.11(N35)	.....	.....	.....	.....
	Fe	..	0.28(N35)	.....	.....	.....	.....
	Fe	A	.....	β^- , γ	47 days(L20)	0.26, 0.46(D16) spect., coincid. abs.	1.10, 1.30(D16) spect.

TABLE OF ISOTOPES (Continued)

ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
27	A						
	Co 55	A	.....	β^+ , γ	18.2 hr. (D5)	1.50(L21) spect.	0.16, 0.21, 0.8, 1.2 (C20) cl. ch. recoil
	Cc 56	A	.....	β^+ , γ , K (E9)	72 days (L10)	1.2(L10) abs., (C17) cl. ch., coincid.; 1.50(E9, E12) spect., coincid.	1.7(C17) abs. Pb, coincid.; 1.05(L10) abs. Pb; 0.845, 1.26, 1.74, 2.01, 2.55, 3.25(E12) spect., coincid.
	Co 57	A	.....	K, γ , e^- ; β^+ (L10)	270 days (L10)	0.26(β^+) (L10)	0.117, 0.130, 0.202, 0.215(P3) spect.
	Co 58	A	.....	β^+ , γ , (10%) (D35); K, γ (90%) (D35)	72 days (L10)	0.4(L10) abs.; 0.470(E13, D35) spect.; (E13), coincid.	0.6(L10) abs. Pb; 0.805(D35) spect., coincid.
	Co 59 Co 60	A	100(M52)	β^- , γ	5.3 yr. (L10)	0.300(D17) spect., coincid. abs.	1.10, 1.30(D17) spect., coincid.
28	Co 60	A	.....	I.T., γ , e^- (L10, D17); β^- , γ (D17, N10)	10.7 min. (L10)	1.35(β^-) (N10) spect.	0.056(I.T.) (D17) spect. conv.; 1.5 (with β^-) (N10) abs. Pb
	Ni 57 Ni 58 Ni 60 Ni 61 Ni 62 Ni 63	A	..... 67.4(V21) 26.7(V21) 1.2(V21) 3.8(V21)	β^- , γ	36 hr. (L11)	0.67(L11) abs.	
	Ni 64 Cu 58, 60 Cu 61	C C B	0.88(V21)	β^+ β^+ β^+ ; K (A4)	2.6 hr. (L11) 81 sec. (D4) 7.9 min. (D4) 3.4 hr. (T1, R3)	1.9(L11) abs.	1.1(L11) abs. Pb; 0.280, 0.65, 0.93(G3) spect.
						0.9(R3) abs.	No γ (G2)
29							

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	γ -rays
	A					Particles	
29	Cu	A	70.13(E20)	β^+	10.5 min. (H8)	2.6(C13) cl. ch.	
	Cu	..A	..	$\beta^-; \beta^+; K$ (A4)	12.8 hr. (V2)	0.58(β^-); 0.66(β^+)(T6, T11, T8) spect.	No γ (T6)
	Cu	..A	29.87(E20)	β^-	5 min. (A1)	2.9(S5) cl. ch. (K.U.); 2.58(G15)	
	Cu	A	..	β^+	38 min. (D4, B20)	2.3(S18) abs., (T11, T8) spect.	
	Zn	..A	50.9(N34)	β^+, K, γ, e^-	250 days (L12)	0.4(β^+) (D9) cl. ch.	0.45, 0.65, 1.0(W15, I3) cl. ch. recoil; 1.14(D19, M34) spect.
30	Zn	..	27.3(N34)	I.T., γ (K11)	13.8 hr. (L12)	..	0.439(H9, G3) spect. conv.
	Zn	..	3.9(N34)		57 min. (L12)	1.0(L12) abs.	No γ (L12)
	Zn	..	17.4(N34)		48 min. (B13)	..	
	Zn	A	..		15 min. (A4, L10)	..	0.054, 0.117(D9) spect. conv.
	Zn	A	0.5(N34)		9.4 hr. (B13, R3)	3.1(M7) abs.	0.0925, 0.180, 0.297(H9) spect. conv., spect.; 0.292(G3) spect.; 0.094, 0.174, 0.187, 0.301(C21) spect.
31	Ga	A	..	β^-	83 hr. (A4)	..	
	Ga	..B	..	β^+	..	..
	Ga	A	..	K, e^-	..	..
	Ga	A	..	β^+	..	..
	Ga	A	..	K, γ, e^-	..	..

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
31	A	A	..... 61.2(S61)	β^+ β^-, γ β^-, γ β^- $K, e^-(?)$ (S30) β^+	68 min. (R3) 20 min. (B20, A1) 14.1 hr. (S6) 9 days (S29) ~ 195 days (M8) 11 days (S30) 40 hr. (S30)	1.9(R3, M7) abs. 1.68(S25) cl. ch. (K.U.) 1.71(S25) cl. ch. (K.U.) 0.8(S29)	1.17, 2.65(M30) spect. 0.6(S30) abs. of e
32	A	A	..... 21.2(A31)	β^+ β^-, γ (S30)	89 min. (S30)	1.1(S25, S29) cl. ch. (K.U.); 1.2(S30) abs. 1.9(S25, S29) cl. ch. (K.U.)	0.6(S30) abs. of e
33	A	A	..... 6.5(A31)	β^+ β^-, γ (S30)	12 hr. (S30)	1.1(S25, S29) cl. ch. (K.U.); 1.2(S30) abs. 1.9(S25, S29) cl. ch. (K.U.)	0.6(S30) abs. of e
34	A	A	..... 100(N30)	β^+ $K, e^-(E10)$ β^+ β^-, β^+, γ (S26)	26 hr. (V4) 90 days (S26) 50 hr. (S29) 16 days (S26)	0.6(S29) 1.3(β^-), 0.9(β^+) (S26) cl. ch. (K.U.)	0.052(E10) spect. conv. 0.582(D15) spect.
35	A	A	..... 100(N30)	β^+ $K, e^-(E10)$ β^+ β^-, β^+, γ (S26)	26.8 hr. (W9, W19)	1.1, 1.7, 2.7(β^-) (S23, W9, W19) cl. ch.; 0.7, 2.6(β^+) (S23) cl. ch.; coincid. (M35)	3.2, 2.2, 1.5(S23) cl. ch. pair; 1.94, 0.83(M6) spect.; coincid. (M35)
36	A	A	..... 100(N30)	β^+ $K, e^-(E10)$ β^+ β^-, β^+, γ (S26)	65 min. (S9)	1.4(S26) cl. ch. (K.U.)	0.27(S26) abs. Pb

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Particles	Energy of radiation in Mev
34	A						γ -rays
	74	B	0.9(A31)	K, γ , e^-	48 days(D9); 160 days(K30)	.....	0.50(D9) spect. conv. several < 0.3(K30) spect conv.
	75						
	76	...	9.5(A31)				
	77	...	8.3(A31)				
	78	...	24.0(A31)				
	79, 81	C	.....			
	79, 81	C	.....	I.T., $e^-(L30)$	57 min.(S9, L30) 19 min.(L30)	1.5(L30) abs.	0.099(H9) spect. conv
	80	...	48.0(A31)	β^-	30 min.(L30) Several hrs.(B15) Several days(B15)	.....
	82	A	9.3(A31)	β^-	6.4 min.(S9)	.....
35	78	D	.....	β^+ , e^-, γ	.....	2.3(β^+)(S9) abs.	0.046, 0.108(V7) spect. conv.
	79	A	50.6(B60)	I.T., e^-, γ (S10, V3, V7, G22)	4.4 hr (B13)	.....	0.049, 0.037 or 0.025(V7) spect conv.; 0.037(G22) abs. A1 < 0.5(B13, S9) abs.
	80	A	.....	β^-, γ	18 min.(S9, S10)	2.0(A2) spect	
	81	...	49.4(B60)	β^-, γ	34 hr.(S9)	0.465(R6, D21); (D23) coincid	0.547, 0.787, 1.35(R6, D15) spect; (D23) coincid.
	82	A	.....			1.05(L30) abs. 4.5(B30) abs.	No γ (S9)
	83	A	.....	β^-	140 min.(L30)		
	84	A	.....	β^-	30 min.(S35)		
	85	A	.....		3.0 min (S35, B29)		
	87	B	.....	50 sec.(S35)			
	> 82	F	.....		22 hr (B15)		

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Particles	Energy of radiation in Mev
36	A						
	Kr 78	C	0.35(N30)	$\beta^+(B41)$	34 hr. (B41)	C.4(C41) cl ch.	0.187(C41) spect. conv.
	Kr 79, 81	C	.....	I.T.(?), e^- , γ ; no $\beta^+(C41)$	13 sec (C41)	.....	0.127(C41) spect. conv.
	Kr 79, 81	C	.....	I.T.(?), e^- , γ ; no $\beta^+(C41)$	55 sec. (C41)	.....	.....
	Kr 80	...	2.01(N30)				
	Kr 82	...	11.53(N30)				
	Kr 83	...	11.53(N30)				
	Kr 83*	A	.....	I.T., e^- (L30)	113 min (L30)	.....	0.029, 0.046(H9) spect. conv
	Kr 84	...	57.11(N30)	β^-	4.0 hr. (C22)	0.85(B30) abs	
	Kr 85	A	17.47(N30)	β^-	74 min. (S9)	4(B30) abs	
37	Kr 86	B	.....	β^-	3 hr. (L27, H28)	2.5(W19) cl. ch (K. U)	
	Kr 88	A	.....	β^-	2.5 min. (H56)		
	Kr 89	B	.....	β^-	< 0.5 min. (H28)		
	Kr > 90	D	.....	.....	20 min. (H51)		
	Rb 82	B	.....	.....	6.5 hr. (H51)		
	Rb 84	B	.....	.....	
	Rb 85	B	72.8(N34)	.....	42 min. (H51)	1.56(H13) abs.;	
	Rb 86	A	.....	β^-	200 hr. (H51)	1.60(H32) spect	
	Rb 87	A	27.2(N34)	β^-	19.5 days (H13)	0.132(L6) spect.;	0.034, 0.053, 0.082,
	(H89, H84)	A	.....	γ (O30)	6.3×10^{10} yr. (S74)	0.25(K53); 0.13(O30) spect.	0.102, 0.129(O30) spect. conv
38	Rb 88	A	.....	β^-	17.5 min. (W19)	5.1(W19) cl. ch	
	Rb 89	B	.....	β^- , γ (G21)	15 min (G9, G21)	3.8(G21) abs.	
	Rb > 90	D	.....	β^-	80 sec. (H28)		

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
38	A						
	Sr 84	...	0.56(N36)	K, γ (D13)	65 days(D13)	...	0.8(D13, D25) abs. Pb
	Sr 85	A	...	I.T., e^- , γ (D25)	70 min.(D25)	...	0.170(D25) spect. conv.
	Sr 86	A	9.86(N36)	...	...	...	...
	Sr 87	...	7.02(N36)	...	...	...	...
	Sr 87*	A	...	I.T., e^- , γ (D11)	2.7 hr.(D11)	...	0.37(D11) spect. conv.; 0.386(H9) spect. conv.
	Sr 88	...	82.56(N36)	β^-	55 days(S24)	1.50(S24) cl. ch.; 1.32(H32) spect.	No γ (S24)
	Sr 89	A	...	...	...	...	...
	Sr 90	B	...	β^-	~ 5 yr.(H47)	...	...
	Sr 90	D	...	β^-	2.7 hr.(G13)	...	...
	Sr 90	D	...	β^-	7 min.(L26)	...	...
	Sr 91	B	...	β^-	10 hr.(H47)	...	...
39							
	Sr 90	D	...	I.T., e^- , γ (D25)	~ 2 min.(H47)	...	0.5(D25) abs. No γ (?) (D25)
	Sr 87	B	...	K(D13)	14 hr.(S24, D13)	...	0.95, 1.92(R12) cl. ch.; 0.908, 1.89(D28) spect., coincid.;
	Y 87	A	...	β^+	80 hr.(D25)	1.2(S11) cl. ch. (K.U.)	1.87(S32) Be- γ -n; 1.9, 2.8(G10) D- γ -n
	Y 88	A	...	K, γ (D25)	2.0 hr.(S24)	...	...
	Y 88	B	...	...	87 days(H33)	...	...
	Y 89	...	100(D4 ¹)	β^-	60 hr.(S11)	2.6(S11) cl. ch. (K.U.)	...
	Y 90	A	...	β^- , γ (H56)	3.5 hr.(H56)	3.6(B30) abs.	...
	Y 90	D	...	β^- , γ (B30)	57 days(H42, G13)	1.6(B30) abs.	...
	Y 91	B	...	...	50 min.(G13)	...	...
	Y 91	D	...	...	11.5 hr.(H47)	...	...
	Y 90	D	...	β^- , γ (H56)	20 min.(H47)	...	...

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Particles	Energy of radiation in Mev
	A						γ -rays
40	Zr 89	A	.....	β^+ (S12, D13)	78 hr.(D25)	1.0(β^+)(S12) cl. ch. (K.U.), (D25) abs.	No γ (D25)
	Zr 89	A	.....	e^- , γ , I.T. or K(D13, D25)	4.5 min.(D25)		
	Zr 90	...	48(A31)				
	Zr 91	...	11.5(A31)				
	Zr 92	...	22(A31)				
	Zr 93	D	.....	β^- , γ	63 days(S46)	0.25(S46) abs.; 0.57, 0.29(M33)	0.94(M33)
	Zr 94	...	17(A31)				
	Zr 95	D	.....	β^-	17.0 hr.(G18)	1(G18) abs.	
	Zr 96	...	1.5(A31)				
	Zr 97	E	.....	β^-	6 min.(S46)	~ 1.9 (S46) abs.	
	Zr 97	E	.....	β^-	18 min.(S46)		
	Zr 97	E	.....	β^-	90 min.(S12)	~ 1.5 (S46) abs.	
	Zr 97	E	.....	β^-	70 hr.(S46)	1.17(S46) cl. ch. (K.U.)	
	Cb 92	E	.....		4 min.		
	Cb 92	E	.....		12 min.		
	Cb 92	E	.....		38 min.		
	Cb 92	E	.....		21 hr.		
	Cb 92	E	.....		96 hr.		
	Cb 92	A	.....	β^- , γ	11 days(S42, S13)	1.38(S42) cl. ch. (K.U.); 0.59(M33)	1.0(M33)
	Cb 93	...	100(S63)				
	Cb 93*	D	.....	I.T., e^-	~ 55 days(S46)	~ 0.15 (S46, M33) abs. of e^- ; 0.94(M33)
	Cb 94	A	.....	β^- , γ (S42)	6.6 min.(S42)	1.4(S42) abs.	0.4(S42) abs, Pb
	Cb 95	D	.....	β^-	75 min.(G18)	1(G18) abs.	

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
42	Mo 92	\bar{F}	14.9(V22)	β^+	7 hr. (D9)		
	Mo 93	\bar{F}	.....		17 min. (B20, S12)	2.65(S46) cl. ch. (K.U.)	
	Mo 91, 93	\bar{C}	.....			
	Mo 94	..	9.4(V22)				
	Mo 95	...	16.1(V22)				
	Mo 96	...	16.6(V22)				
	Mo 97	...	9.65(V22)				
	Mo 98	...	24.1(V22)				
	Mo 99	\bar{B}	.....		67 hr. (S14)	1.5(S14) abs.	0.4(S14) abs.
	Mo 100	\bar{B}	9.25(V22)		14.6 min. (M25)	1.8(S40) cl. ch. (K.U.); 1.0, 2.2(M38)	0.3, 0.9(M38)
	Mo 101	\bar{B}	.....		12 min. (H41) ~ 60 days (H55)		
	Mo > 101	D	.....		2.7 hr. (D4)		
43	Mo 96	E	.....	β^-			
	43 96	B	.....	$\beta^-(?)$			
	43 99	B	.....	L.T., e^- , γ (S14)	6.6 hr. (S14)		
	43 101	B	.....	β^- , γ	14.0 min. (M25)	1.1(S40) cl. ch. (K.U.); 1.3(M38)	0.136(S14) spect. conv.; ~ 0.18 (S14) abs. 0.30(M38)
	43 > 101	D	.....	β^-	< 1 min. (H41)		0.097(H9) spect. conv.
	43 43	D	.....	K, e^-	90 days (C12)		
	43 43	D	.....	K, γ	62 days (C12)		
	43 43	D	.....	K(?) e^- , γ (E5)	110 hr. (E3)		
	43 43	E	.....	β^- , γ (E3)	55 min. (E5)		
	43 43	E	.....	β^-	36.5 hr. (D4)		
	43 43	E	.....	β^-	18 sec. (D9)		
	43 43	D	.....	K	~ 2 days (S14)	0.6(E3) 2.5(E5) abs.	0.05, 0.5(E5)
44	Ru 95	F	.....		20 min. (D7)		
	Ru 96	...	5.68(E20)				

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
44	Ru 98	...	2.22(E20)	β^-	4 hr. (D7, L13, N12)	1.5(B31) abs.	
	Ru 99	...	12.81(E20)	.....	11 days (L13)		
	Ru 100	...	12.70(E20)	.....	90 min. (K3)		
	Ru 101	...	16.98(E20)	β^-	4 min. (B31)	4(B31) abs.	
	Ru 102	...	31.34(E20)	.....	45 days (N15)	1.1(β^-)(M23) abs.	
	Ru 104	...	18.27(E20)	β^-, β^+, γ (M23)	210 days (M23)	.....
	Ru 105	B	.....	I.T., $e^-(P5)$	4.2 min. (P5)	.....
	Ru	G	.....			
	Ru	E	.....			
	Ru	D	.....			
45	Rh 102	A	100(C50)	β^-	44 sec. (P5, A1)	2.3(C13) cl. ch.	
	Rh 103	...	.....	.....	3 hr. (D9)		
	Rh 104	A	.....	β^-	10.7 hr. (D9)		
	Rh	E	.....	.....	3 days (D9)		
	Rh	E	.....	β^-	34 hr. (N12, N13)	0.5(N13) abs.	
46	Rh 105	B	.....	β^-	24 min. (B31)	1.2(B31) abs.	
	Rh	D	.....			
	Pd 102	...	0.8(S63)				
	Pd 104	...	9.3(S63)				
	Pd 105	...	22.6(S6)				
	Pd 106	...	27.2(S63)				
	Pd 107	...	.....		
	Pd 109	C	.....	β^-	13 hr. (K6)	1.03(K6) cl. ch.	
	Pd	...	26.8(S63)				
	Pd	...	.....		
							0.055-0.080(P5) abs. of e^- ; 0.069(O9) spect. conv.

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
46	Pd 110	A	13.5(S63)	β^-	26 min.(S33)	3.5(B31) abs.	
	Pd 111	A	.....	.....	17 hr.(S33, N14)		
	Pd 112	A	.....	.....	73 min.(E6)		
	Ag 102	E	.....	.....	16.3 min.(E6)		
	Ag 104	E	.....	.....	45 days(E6)		
47	Ag 105	E	.....	K, γ			0.29, 0.42, 0.50, 0.62(E6) spect.; 0.282, 0.345, 0.430, 0.650, > 1.0(D19) spect.
	Ag 106	A	.....	β^+	24.5 min.(P6, D2)	2.04(F5) abs.	No γ (F5)
	Ag 106	A	.....	K, e^-, γ (H50, P6, F5, A4)	8.2 days(P6, K6)	1.2(e^-)(F5) abs.	1.06, 0.69(E6) spect.; 1.63, 1.06, 0.72(?) (D19) spect.
	Ag 107	C	51.9(P44)	I.T., e^-	40 sec.(A12)		0.093(V7, A12, H9) spect conv.
	Ag 107*, 109*	A	.....	β^-	2.3 min.(A1, B20)	2.8(N4) cl. ch.	
48	Ag 108	A	48.1(P44)	β^-, γ (P6)	22 sec.(A1, P6)	2.8(G4) cl. ch. (K.U.)	0.650, 0.925, 1.51(D19) spect.; 0.6(K15) abs.
	Ag 109	A	.....	K, γ, e^- (K15, H59)	225 days(L14, R10)	.....	A1
	Ag 110	C	.....	β^-, γ	7.5 days(K6, P6)	~ 0.8(B30) abs.	No γ (K6, P6)
	Ag 108, 110	C	.....	β^-, γ	3.2 hr.(P6)	2.2(P6) cl. ch.	
	Ag 111	A	.....	K, γ (D4, V7, W11, A12)	6.7 hr.(D4, R5)	.....	0.53(V7) abs. Pb
48	Ag 112	A	1.4(N34)	K	158 days(H34)		
	Cd 106	C	.....			
	Cd 107	C	.....			
	Cd 109	C	.....			
	Cd 107, 109	C	.....			

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Particles	Energy of radiation in Mev
48	A						γ -rays
	Cd 108	E	1.0(N34)	β^+	33 min.(P2)	1.11(C14) spect.	0.55(L57) cl. ch. recoil; 0.65(M34) spect.
	Cd 109	...	12.8(N34)				
	Cd 110	...	13.0(N34)				
	Cd 111	...	24.2(N34)				
	Cd 112	...	12.3(N34)				
	Cd 113	...	28.0(N34)				
	Cd 114	A	...				
	Cd 115	A	...	β^-, γ	2.5 days(G5)	0.95(C14) cl. ch.	
	Cd 116	E	7.3(N34)	β^-, γ (C14)	40 days(C14)		
49	Cd 117	...	...	β^-	3.75 hr.(C14)		0.195(W30) abs. of e^-
	Cd*	A	...	I.T., e^-	48.7 min.(W30)		
	In 110	D	...	β^+	65 min.(B17)	1.6(B17) spect.	0.16(B17) spect. conv.
	In 111	D	...	β^+, γ, e^-	20 min.(B17)	1.7(β^+)(L57) cl. ch.	0.17, 0.25(B17, C14) spect. conv.
	In 112	D	...	K, $\gamma, e^-(L57)$	2.7 days(B17, C14)		0.120(S34) abs. of e^- 0.095(S34) abs. of e^-
	In 112	D	...	I.T., γ, e^-	16.5 min.(S34)		
	In 112	D	...	$\beta^+, \beta^-(?), \gamma, e^-(S34)$	17.5 min.(S34)	1.3(β^+)(S34) abs.; 0.47($\beta^- \tau$)(S34) abs.	
	In 113	...	4.5(S61)	I.T., $\gamma, e^-(B17)$	105 min.(B17)		0.39(B17, L57) spect. conv.
	In 113*	A	...	I.T., $e^-(L57, L48)$	48 days(B17)		0.19(B17, L57) spect. conv.
	In 114	A	...	β^-	72 sec.(L15, B17)	1.98(L32) cl. ch.	
	In 114	A	95.5(S61)	I.T., $e^-, \gamma(L57)$	4.1 hr.(G5, B18)		0.34(O57) spect. conv.
50	In 115*	A	...	β^-	13 sec.(A1, C14)	2.8(C14) cl. ch.	No γ (M11)
	In 116	A	...				

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope		Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
	In	A					Particles	γ -rays
49	In	116	A	.....	β^- , γ	54 min. (A1, L15)	0.85 (C14, C44) spect., cl. ch.	1.8, 1.4, 1.0, 0.6, 0.4, 0.2 (C44) cl. ch. recoil; 2.32, 1.31, 1.12, 0.428 (D19) spect.
50	In	117	A	.....	β^- , γ , e^-	117 min. (L32)	1.73 (β^-) (C14) spect.	
	Sn	112	...	1.1 (A32)	K, e^- , γ	70-105 days (L17, B17)	.....	0.085 (B17) spect. conv.
	Sn	113	A	.....			
	Sn	114	...	0.8 (A32)				
	Sn	115	...	0.4 (A32)				
	Sn	116	...	15.5 (A32)				
	Sn	117	...	9.1 (A32)				
	Sn	118	...	22.5 (A32)				
	Sn	119	E	.....	β^-	25 min. (L17)		
	Sn	119	E	.....	β^-	3 hr. (L17)		
	Sn	119	E	.....	β^-	13 days (L17)		
	Sn	120	...	9.8 (A32)				
	Sn	121	...	28.5 (A32)				
	Sn	122	...	5.5 (A32)				
	Sn	123	...	6.8 (A32)				
	Sn	124	...	.....		
	Sn	125	B	.....	β^-	9 min. (L17)		
	Sn	126	D	.....	β^-	40 min. (L17)		
	Sn	126	D	.....	β^-	26 hr. (L17)		
	Sn	126	D	.....	β^-	10 days (L17)		
	Sn	126	D	.....	β^-	~ 400 days (L17)		
	Sn	126	D	.....	β^-	~ 20 min. (H55)		
	Sn	125	D	.....	β^-	~ 80 hr. (H55);		
	Sn	125	D	.....	β^-	~ 60 hr. (N15)		
	Sn	125	D	.....	β^-	~ 70 min. (N15, H55)		
	Sn	125	D	.....	β^-	~ 11 days (H55)		
	Sn	125	D	.....	β^-	~ 4-5 hr. (H55)		
	Sn	125	F	.....	β^-			

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Particles	Energy of radiation in Mev	γ -rays
51	A							
	Sb 116,	E	.....	β^-	3.5 min. (D9)			
	Sb 118	E	.....	β^+	3.6 min. (R16)			
	Sb 120	A	.....	β^+	17 min. (H10, L18)	1.53(A10) cl. ch.		
	Sb 121	...	56(A31)		2.8 days (L28)	0.81, 1.64(A10, M35) cl. ch., abs.		0.96(M35) coincid. abs.; 0.80(M34) spect.
	Sb 122	A	.....	β^-, γ	60 days (L18)	1.53(M35) abs.; 0.74, 2.45(H35, H49) spect.		1.82(M35) coincid. abs.; 1.75(K16) Be- γ - n reaction
	Sb 123	...	44(A31)	β^-, γ				
	Sb 124	A	.....				
	Sb < 126	D	.....	β^-	3 hr. (L18)			
	Sb < 126	D	~ 45 days (L18)			
	Sb < 126	D	.....	β^-	~ 2 yr. (L18)			
	Sb > 125	D	.....	β^-	60 min. (N15)			
52	Sb 127	A	.....	β^-	80 hr. (A6)			
	Sb 129	A	.....	β^-	4.2 hr. (A6)			
	Sb 131	D	.....	β^-	< 10 min. (A6)			
	Sb 131	D	.....	β^-	5 min. (A6)			
	Sb 133	A	.....	β^-	< 10 min. (A6, W21)			
	Sb 133	A	< 1(A31)					
	Te 120	...	.....	K, e^- (S15, O8)	125 days (S15)			Coincid. (Y3)
	Te 121	A	.....				
	Te 122	...	2.9(A31)					
	Te 122, 122,	E	.....	L.T., e^- (?)	30 days (K17)			0.0820, 0.0883, 0.136, 0.1573, 0.2108, 0.615(K17) spect. conv.
	Te 124	...	.....			
	Te 123	...	1.6(A31)					
	Te 124	...	4.5(A31)					

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
52	A	...	6.0(A31)	I.T., e^- (S15) β^-	90 days(S15) 9.3 hr.(S15)	0.086(H9) spect. conv.
		A	19.0(A31)				
		A	I.T., e^- (S15) β^-	32 days(S15) 72 min.(S15, A6)	0.102(H9) spect. conv.
		A	32.8(A31)				
		A	I.T., e^- (S15) β^-	30 hr.(S15, A6) 25 min.(S15) 43 min.(A6)	0.177(H9) spect. conv.
		A	33.1(A31)				
		A	β^-	77 hr.(A6) 60 min.(A6, W21) < 1 min.-15 min. (W21, S21)	
		A	.....			
		A	β^-	~ 1 min.(H55) 4.0 days(L19, D9) 13.0 days(L19, T4)	
		A	.....			
		A	100(N30)	β^- , γ	24.99 min.(H36)	1.1(L19) abs.	0.5(L19) abs. Pb
		A	.....			
		A	β^- , γ	12.6 hr.(L19)	1.85(B14) cl. ch. or 1.05, 2.10(B14) cl. ch. (K, U.)	0.4(L19) abs. Pb
		A	.....			
		A	β^- , γ	8.0 days(L19)	0.61, 1.03(R23) spect., coincid.	0.417, 0.537, 0.667, 0.744(R23) spect. conv., spect. coincid.
		A	.....			
53	I	A	β^- , γ		0.687(T7) cl. ch.; 0.595(D28, D30, D31) spect., coincid.	0.4(L19) abs. Pb; 0.367, 0.080(D30, D31) spect., spect. conv. coincid.
		A	.....			
		A	.....			
		A	.....			
		A	.....			

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
53	I	A					
	> 131	D	.....	β^- , γ	2.4 hr. (A6)	~ 1.35(B30) abs.	0.85(B30) abs.
	> 131	D	.....	β^-	54 min. (A6)		
	I 133	A	.....	β^-	22 hr. (A6, W21)	1.1(P13) cl. ch.	
	I 135	A	.....	β^-	6.6 hr. (S21, D27, W21)		
54	I 137	E	.....	.....	30 sec. (S35)		
	I 137	E	.....	.....	1.8 min. (S35)		
	Xe 124	.....	0.094(N30)	.....		
	Xe 126	.....	0.088(N30)	.....		
	Xe 127	B	.....	I.T.(?), e^- , γ (C41)	75 sec. (C41)	.....	0.175, 0.125(C41) spect. conv.
	Xe 127	B	.....	e^- , γ (C41)	34 days (C41)	.....	0.9(C41) abs. of e^-
	Xe 128	.....	1.90(N30)	.....		
	Xe 129	.....	26.23(N30)	.....		
	Xe 130	.....	4.07(N30)	.....		
	Xe 131	.....	21.17(N30)	.....		
	Xe 132	.....	26.96(N30)	.....		
	Xe 133	A	.....	I.T., e^- (S27); β^- (S47)(?)	7.0 days(R22); 5.4 days(C22)	0.2-0.3(B30, S47) abs.	
	Xe 134	.....	10.54(N30)	.....		
	Xe 135	A	.....	β^- , γ (B30)	9.4 hr. (S21, W21)	0.95(B30) abs. A1; 0.9(S47) abs. A1	
	Xe 135	A	.....	β^- , γ (B30)	15.6 min. (R22)	0.7(B30) abs. A1; 0.6(S47) abs. A1	
	Xe 136	.....	8.95(N30)	.....		
	Xe 137	D	.....	.....	68 min. (C22)		
	Xe 137	D	.....	β^-	3.4 min. (R22)	4(B30) abs. A1	
	Xe 138	D	.....	β^-	17 min. (G21)		
	Xe 139	A	.....	β^-	< 0.5 min. (H28)		
	Xe 140	D	.....	β^-	< 0.5 min. (H28)		

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
55	Cs 133	...	100(N30)	β^- (K26)	3 hr. (K26)	1(K26) abs.	
	Cs 134	A	.....	β^- , γ (K26)	1.7 yr. (K26)	0.9(K26) abs.	
	Cs 134	A	.....	β^-	33 min. (H28)	2.6(G21) abs.	
	Cs 138	D	.....	β^-	7 min. (H28)	.....
	Cs 139	A	.....	β^-	40 sec. (H28)	.....
	Cs 140	D	.....	β^-	.....	.....
	Ba 130	...	0.101(N36)	I.T., e^- , γ (C30)	38.8 hr. (W28)	.....	0.30(D9) spect. conv.; 0.276(C30) spect. conv.
	Ba 132	...	0.097(N36)	.....	.....	.....
	Ba 133	A	.....	.....	.....	.....
	Ba 134	...	2.42(N36)	β^- , γ	86 min. (P8, H28)	1(K26) abs.; 2.3(B30) abs.	0.6(K26) abs. Pb, Cu
56	Ba 135	...	6.59(N36)	β^-	3 min. (A1, P2)	1.2(B30) abs.	
	Ba 136	...	7.81(N36)	β^-	\sim 300 hr. (H28, G21)	.....
	Ba 137	...	11.32(N36)	β^-	6 min. (H48)	.....
	Ba 138	...	71.66(N36)	β^-	18 min. (H48)	.....
	Ba 139	A	.....	β^-	$<$ 1 min. (H14)	.....
	Ba 140	D	.....	β^-	17.5 hr. (W23)	.....
	Ba 140	A	.....	β^-	2.2 hr. (P2)	.....	0.88(W23) abs. Pb
	Ba 140	D	.....	β^-	40.0 hr. (W23)	.....
	Ba 140	D	.....	β^-	.....	.....
	Ba 140	D	.....	β^-	.....	.....
57	Ba 140	E	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
57	Ba 140	F	100(A31)	β^- , γ	.....	1.41(W23) abs. A1 spect.	2.00(W23, M24) abs. Pb; 2.04(M27) spect.
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....
	Ba 140	F	.....	β^-	.....	.....

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
57	La > 140	D	.....	β^-	74 min. (H48)		
	La > 140	D	.....	β^-	3.5 hr. (H48)		
	La > 140	E	.....	β^-	< 30 min. (H14, H15)		
58	La > 140	F	.....	β^-	15 min. (H55)		
	Ce 136	F	.....	β^-	13 days (H55)		
	Ce 138	.....	< 1 (D41)				
	Ce 139	.....	< 1 (D41)				
	Ce 140	F	.....	β^+	2.1 min. (P9)		
	Ce 140*	B	89 (A31)				
59	Ce 141	A	.....	I.T., γ (P14)	140 days (P14)		0.21 (P14)
	Ce 141	A	.....	β^- , γ	30 days (P14)	0.65 (P14)	0.2 (P14)
	Ce 141	C	.....	.....	15 days (R11)	0.12 (R11) spect.	
	Ce 142	B	11 (A31)				
	Ce 142	D	.....	β^-	36 hr. (P14)		
	Ce 143	D	.....	β^-	310 days (B30, H55)		
60	Pr 140	D	.....	β^-	\leq 20 days (H55)		
	Pr 141	D	.....	β^-	\sim 15 min. (G19)		
	Pr 142	D	.....	β^-	\sim 4-5 hr. (H55)		
	Pr 143	D	.....	β^-	\sim 40 hr. (H55)		
	Pr 143	A	.....	β^+	3.5 min. (P9)	2.40 (D32) cl. ch.	
	Pr 143	A	100 (A31)	β^- , γ	19.3 hr. (D32)	2.14 (D32) spect.	1.9 (D32) abs. Pb
60	Nd 141	B	.....	β^-	13.5 days (P14)	0.95 (P14)	
	Nd 142	B	.....	β^-	25 min. (G19)		
	Nd 142	D	.....	β^-	17 min. (H55)	3.1 (B30, H55) abs.	
	Nd 142	E	25.95 (M53)	β^+	2.5 hr. (K19)	0.78 (K19)	

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope <i>A</i>	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
60	Nd 143	...	13.0(M53)	β^-	47 hr. (W25, L25)	0.95(W25) abs.	
	Nd 144	...	22.6(M53)				
	Nd 145	...	9.2(M53)				
	Nd 146	...	16.5(M53)				
	Nd 147, 149	<i>E</i>	.....			
61	Nd 148	...	6.8(M53)	β^- β^- <i>K</i> or I.T., γ (W25) β^- , γ β^- , γ β^- , γ	21 min. (P9) 12.5 hr. (P9) ~ 200 days (W25) 5.3 days (K20) 2.7 hr. (K20) 16 days (K20)	0.67(W25) abs.	
	Nd 150	<i>E</i>	5.95(M53)				
	Nd 151	<i>E</i>	.....			
	61	<i>E</i>	.....			
	61	<i>E</i>	.....			
62	61	<i>E</i>	α (H85, L74)	1.4 \times 10 ¹¹ yr. (H86); 1.7 \times 10 ¹¹ yr. (W40)	2.0(H86) cl. ch.	
	Sm 144	...	3(A33)				
	Sm 147	...	17(A33)				
	Sm 148	<i>A</i>	14(A33)				
	(W40)						
63	Sm 149	...	15(A33)	β^- I.T. (W25) β^+	21 min. (P9) 46 hr. (P9) 60 days (K19) 27 hr. (P9)	1.8(K19)	~ 0.6(M31) abs. of e^-
	Sm 150	...	5(A33)				
	Sm 152	...	26(A33)				
	Sm 154	...	20(A33)				
	Sm	<i>D</i>	.....			
63	Sm	<i>D</i>	β^+			
	Sm	<i>E</i>	.....			
	Sm	<i>E</i>	.....			
	Eu 150	<i>E</i>	.....			
	Eu 151	...	49.1(L60)				

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
63	Eu 152	B	.....	β^- , γ , $e^-(T6)$; $K(\beta)(R2)$	9.2 hr. (P9)	1.88(β^-)(T6) spect.	0.123, 0.163, 0.725(T6) spect. conv.
	Eu 153	B	50.9(L60)				
	Eu 154	E	.....	β^- , γ (R11, F7)	5-8 yr. (F11) 40 days (K20)	0.9(R11) spect.	
64	Eu 152	E	.....	.....	
	Gd 152	E	0.2(W41)				
	Gd 154	...	2.86(W41)				
	Gd 155	...	15.61(W41)				
	Gd 156	...	20.59(W41)				
	Gd 157	...	16.42(W41)				
	Gd 158	...	23.45(W41)				
	Gd 159,	E	.....	.....	8 hr. (A1, H17)		
	161		.....			
	Gd 160	F	20.87(W41)				
65	Gd 159	...	100(A33)	β^- , γ (F11)	155-170 days (F11)		
	Tb 160	A	.....			
	Tb 160	A	.....	β^- , γ (B33)	3.9 hr. (H16, M13) 72 days (B33)	0.70(B33) abs. A1	
66	Dy 158	...	0.1(D42)				
	Dy 160	...	1.5(D42)				
	Dy 161	...	22(A31)				
	Dy 162	...	24(A31)				
	Dy 163	...	24(A31)				
	Dy 164	...	28(A31)				
	Dy 165	A	.....	β^- , γ	2.5 hr. (H17, P9, M13)	1.20(C31) abs., coincid.; 1.18(D33) spect.; 1.40(E11) cl. ch.	1.1(C31) abs., coincid.
			.....	β^+	2.2 min. (P9)		
	Dy (?)	F	.....			
						

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
67	Ho 164	F	100(A33)	β^-	47 min.(P9)		
	Ho 165	B	.....	β^-	35 hr.(H17)	1.6(H120) abs.; 1.9(M31) abs.	
	Ho 166	.....	.....		
68	Er 162	.....	0.1(W42)	β^+	1.1 min.(P9)		
	Er 164	F	1.5(W42)				
	Er 165	.....	32.9(W42)				
	Er 166	.....	24.4(W42)				
	Er 167	.....	26.9(W42)				
	Er 168	C	.....		7 min.(M13)		
	Er 169, 171	C	.....	β^-	12 hr.(H17, P9)		
69	Er 170	.....	14.2(W42)				
	Tm 169	.....	100(A33)		105 days(H20)		
70	Tm 170	A	.....			
	Yb 168	.....	0.05(W43)				
	Yb 170	.....	4.21(W43)				
	Yb 171	.....	14.26(W43)				
	Yb 172	.....	21.49(W43)				
	Yb 173	.....	17.02(W43)				
	Yb 174	C	29.58(W43)		3.5 hr.(H17, M13)		
	Yb 175, 177	.....	.....		
	Yb 176	G	13.38(W43)		41 hr.(P9)		
	Lu (?)	.....	.....		
71	Lu 175	.....	97.5(M54)	β^- (H80, L70), γ (F16)	7.3×10^{10} yr.(L70)	0.215(L70) abs. A1, spect.; 0.40(F16)	0.260(F16)
	Lu 176	A	2.5(M54)				
	(H80, M54)						

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
71	Lu 176, 177	A	.....	β^-	3.4 hr. (F16)	1.150(F16) abs.	
	Lu 176, 177	C	.....	β^-	6.6 days (F16)	0.440(F16) abs.	
	Hf 174, 176, 177	...	0.18(M55) 5.30(M55) 18.47(M55) 27.13(M55) 13.85(M55) 35.14(M55)	β^-	55 days (H19) 14-21 min. (B11, O1) 8.2 hr. (O1)	< 0.5(e^-)(P)(O1) abs.	
73	Hf 179, 180, 181, 182	A	.....	K, e^-, γ (O1); $\beta^-(P)$	97 days (O1)	1.0(H37) abs.; 0.98, 0.32, 0.050(Z2)	1.6(Z2)
	Ta 180	A	.....	β^-, γ	77 days (M36)	0.55-0.65(F12) abs. A1; 0.64-0.72(F12) cl. ch.	
	Ta 181, 182	...	100(D40)	β^-, γ	24.1 hr. (F12)	1.4(F12) abs. A1, cl. ch. (C31) abs., coincid.	0.87(F12) abs. Pb; 0.90(C31) coincid. abs., coincid.; 0.94(M30) spect.; 0.135, 0.101, 0.086(V6) spect, conv.
74	W 180, 182, 183, 184, 185	B	~ 0.2(D43) 22.6(A31) 17.3(A31) 30.1(A31) ...	β^-, γ (M36)			
	W 186, 187	...	29.8(A31)	β^-, γ (M36)			
	W 186, 187	B	.....			

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
75	Re	A					
	184	E	.....	β^+ (C42)	30-55 min.(C32, D9)		
	185	E	.....	$K(?)$, γ	13 min.(C42)		0.85(F12)
	186	B	38.2(A31)		52 days(F12)		
	187	B	61.8(A31)	β^-	90 hr.(S16)	1.05(Y4) cl. ch.	No γ (C42)
76	Os	B	.....	β^- , γ	18 hr.(P2)	2.5(S16) cl. ch. (K.U.)	0.8(M34) spect.
	188	.....	0.018(N37)				
	186	.....	1.59(N37)				
	187	.....	1.64(N37)				
	188	.....	13.3(N37)				
	189	.....	16.1(N37)				
	190	.....	26.4(N37)				
	191	B	.....	β^- , γ (S36)	32 hr.(S36)	1.5(S36) abs. A1	
	192	B	41.0(N37)	β^- , γ (S36)	17 days(S36)	0.35(S36) abs. A1	
	193	.....	38.5(S63)	β^-	1.5 min.(M15)		
77	Ir	C	.....	β^- , γ (M34, W29)	19 hr.(M15, A1)	2.2(A2) spect.; 2.18(W29) spect; 2.11(W29) abs. A1	1.35(M34) spect.
	192	C	.....			
	194	C	.....			
	192	C	.....			
	194	C	.....			
78	Ir	C	.....	β^- , γ	60 days(M15, F6)		0.63(M34) spect.; 0.307, 0.467, 0.603(D34) spect.
	193	.....	61.5(S63)				
	Pt	.....	0.8(S63)				
	Pt	.....	30.2(S63)				
	Pt	.....	35.3(S63)				
	Pt	.....	26.6(S63)				

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
78	Pt 196*	D	.....	I.T., e^- (?) (S37)	80 min. (S37)	0.65 (S37) abs.; 0.72 (K27) abs.	
	Pt 197	B	.....	β^-	18 hr. (M15)		
79	Pt 197	B	.....	β^- , γ (K27)	3.3 days (M15)	1.8 (S37, K27) abs.	
	Pt 198	...	7.2 (S63)		31 min. (M15)		
	Pt 199	A	.....	β^-	13 hr. (M15)	0.36 (C43)	0.41 (C43)
	Pt 196	B	.....	β^-	4-5 days (M15); 5.6 days (L29, K27)		
	Au 196	B	.....	β^- , γ , e^- (K27)			
	Au 197	...	100 (D44)				
80	Au 197	A	.....	β^- , γ	2.7 days (M15, A1)	0.8 (M15, R2) abs. and cl. ch.; 0.78 (C31) abs., coincid. 1.01 (K27) abs. 2.5 (S37) abs.	0.28, 0.44, 2.5 (R2, S17) cl. ch. recoil, (C31) coincid. 0.45 (K27) abs.
	Au 198						
	Au 199	A	.....	β^- , γ (K27)	3.3 days (M15)		
	Au 200,	D	.....	β^-	48 min. (S37, M32)		
	Au 202						
	Hg 196	...	0.15 (N30)				
80	Hg 197	A	.....	K, γ , e^- (F13)	23 hr. (F13)		\sim 0.20 (F13) abs. of e^- ; 0.161, 0.130 (H38) spect. conv.; 0.125, 0.157 (V8) spect. conv. \sim 0.09 (F13) abs. of e^- ; 0.075 (H38) spect. conv.
	Hg 197	A	.....	K, γ , e^- (F13)	64 hr. (F13)		
80	Hg 197	A	.....	K, γ , e^- (F13)	64 hr. (F13)		
	Hg 198	...	10.1 (N30)				
	Hg 199	...	17.0 (N30)				
	Hg 199*, 201*, 204*	D	.....	I.T., e^- , γ (F13)	43 min. (H10, M15)		\sim 0.53 (F13) abs. of e^-

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	γ -rays
	A					Particles	
80	Hg 200	...	23.3(N30)	β^- , γ (F13)	51.5 days(F13)	0.46(F13) abs. A1	0.30(F13) abs. Pb
	Hg 201	...	13.2(N30)				
	Hg 202	...	29.6(N30)				
	Hg 203	C	...				
	Hg 205						
81	Hg 204	A	6.7(N30)	β^-	5.5 min.(K29, M32)	1.62(K29) abs. A1	1.0(K29) abs. Pb
	Tl 205	D	...	K (?), e^- , γ (K29)	10.5 hr.(K29)		
	Tl 200	D	...	K (?), e^- (K29)	44 hr.(K29)		
	Tl 200	F	...	...	4 min.(K3)		
	Tl 201	F	...	...	3.8 hr.(K3)		
	Tl 202	B	...	K (?), γ , e^- (K29, M32)	11.8 days(F14); 13 days(M32)		0.40(M32)
	Tl 203		29.1(N36)	β^-	4.23 min.(F17)	1.6(F17) abs.; 1.77(K29) abs. A1	No γ (F17)
	Tl 204	B	...				
	Tl 205	B	70.9(N36)	β^-	3.5 yr.(F14)	0.87(F14) cl. ch.	No γ (F14)
	Tl 206	A	...	β^- , γ (C60)	4.76 min.(C60, S70)	1.47(S71) abs. A1	
82	AcC'' 207	A	...	β^- , γ (C60)	3.1 min.(C60)	1.82(S72) abs. paper	2.62(R40)
	ThC'' 208	A	...	β^-	1.32 min.(C60)	1.80(L71) cl. ch.	
	RaC'' 210	A	...	β^-	10.25 min.(K29)	1.66(K29) abs. A1	
	Pb 203	B	...	I.T.(?) or K (?), e^- , γ (F14, K29, L33, M32)	52 hr.(F17, F14)		~ 0.45 (F17, F14, K29) abs. of e^- , (F14, M32, L33) abs. Pb, (L33) spect., (M32) spect. conv., 0.27(L33, M32) spect. conv., abs. Pb
	Pb 203	B	...				
	Pb 203	B	...				

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Particles	Energy of radiation in Mev
82	Pb 204	A	1.5(N38)	I.T.(P), γ , e^- (F14, M32)	68 min.(M32); 65 min.(F14)	.....	1.1(F14) abs. of e^- , abs. Pb; 0.90(M32)
	Pb 205	C	.....	.....	.....	.....	.....
	Pb 206	...	23.6(N38)	β^-	3.0 hr.(T5)	0.70(K29, F14) abs.; 0.750(M32)	.....
	Pb 207	...	22.6(N38)	β^- , γ (R40)	22 yr.(C60)	0.0255(L72) spect.	.....
	Pb 208	...	52.3(N38)	β^- , γ (S71)	36.1 min.(S70)	0.5, 1.40(S71) abs. A1	0.047(R40)
	Pb 209	A	.....	β^- , γ (R40)	10.6 hr.(C60)	0.36(S72) spect.	0.8(S71) abs.
	Rad 210	A	.....	β^- , γ (R40)	26.8 min.(C60)	0.65(S72) spect.	.....
	ThB 212	A	.....	I.T., e^-	1.6 min.(W27)	.....	.....
	Rad 214	D	.....	K(?), e^- , γ (L33)	6.4 days(K29)	.....	.....
	Pb* 207	A	.....	.....	.....	.....	.....
83	Bi 209	...	100(N36)	β^-	5.0 days(C60)	1.17(F30, N40, L76) spect.	.....
	Bi 210	A	.....	α (99.68%)(C60), γ (R40); β^- (0.32%)(C60), γ (C60)	2.16 min.(C60)	6.619(α)(H81) spect.	.....
	AcC 211	A	.....	α (33.7%)(K50), γ (R40); β^- (66.3%)(K50), γ (C60)	60.5 min.(C60)	6.054(α)(B70, H81) spect.; 2.20(β^-)(S72) spect.	.....
	ThC 212	A	.....	α (0.04%)(C60); β^- (99.96%)(C60), γ (R40)	19.7 min.(C60)	5.502(α)(L73) spect.; 3.15(β^-)(S72) abs. A1, spect.	1.8(R40)
	Rad 214	A	.....	.....	.....	.....	.....

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
84	Po	A	.....	α , γ (R40)	140 days(C60)	5.298(H81) spect.	
	AcC' 210	A	.....	α	5×10^{-3} sec.(C60)	7.434(L73) spect.	
	ThC' 212	A	.....	α	3×10^{-7} sec.(D50)	8.776(B70, H81) spect.	
	RaC' 214	A	.....	α	1.5×10^{-4} sec. (D50, R41, W50)	7.680(B70, H81) spect.	
	AcA 215	A	.....	α	1.83×10^{-3} sec. (W50)	7.365(L73) spect.	
	ThA 216	A	.....	α ($\sim 100\%$); β^- (0.014%) (K33)	1.58×10^{-1} sec. (W50)	6.774(α)(B70, H81) spect.	
85	RaA 218	A	.....	α (99.96%); β^- (0.04%)(K51)	3.05 min.(C60)	5.998(α)(B70, H81) spect.	
	85 211	A	.....	α (60%)(C46); K (40%)(C46)	7.5 hr.(C46, C23)	5.94(α)(C46) abs.	
	85 216	F	.....	α (K33)	Short (< 54 sec.) (K33)	7.64(K33) ion. ch.	
	85 218	F	.....	α (K51)	Several sec.(?) (K51)	6.63(K51) ion. ch.	
86	An 219	A	.....	α	3.92 sec.(C60)	6.824(H81, L73) spect.	
	Tn 220	A	.....	α	54.5 sec.(C60)	6.282(B70, H81) spect.	
	Rn 222	A	.....	α	3.825 days(C60)	5.486(B70, H81) spect.	
	87 223 (AcK)	E	.....	β^- , γ (P41, P43)	21 min.(P40, P43)	1.20(P42, P41) cl. ch.	> 3 (P41) cl. ch. pair
88	AcX 223	A	.....	α , γ (R40)	11.2 days(C60)	5.717(L73) spect.	
	ThX 224	A	.....	α	3.64 days(L71)	5.681(B70) spect.	
	Ra 226	A	.....	α , γ (C60)	1590 yr.(C60)	4.791(L73) spect.	0.19(R40)
	MsTh ₁ 228	A	.....	β^-	6.7 yr.(C60)	0.053(L72) spect., abs. A1	

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Particles	Energy of radiation in Mev	γ -rays
	A							
89	Ac 227	A	.....	α (1%) (P40); β^- (99%) (P40)	13.5 yr. (C60)	5.0 (α) (P40) abs air; 0.220 (β^-) (H82) spect.	No γ (P43)	
	MsTh ₂ 228	A	.....	β^- , γ (C60); α (G40)	6.13 hr. (C60)	1.55 (β^-) (L6) spect.; 4.5 (α) (G40) abs. air		
90	RdAc 227	A	.....	α , γ (C60)	18.9 days (C60)	6.049 (L73) spect		
	RdTh 228	A	.....	α , γ (C60)	1.90 yr. (C60)	5.418 (L73) spect.		
	Io 230	A	.....	α , γ (W53)	8.3×10^4 yr. (C60)	4.66 (G41) abs air; 4.81 (W51) calor. ~ 0.2 (E30) abs		
	UY 231	A	.....	β^-	24.6 hr. (C60), 24.0 hr. (G43)	4.20 (S73) ion ch.		
	Th 232	A	100 (D45)	α	1.39×10^{10} yr. (K50)	0.130, 0.300 (M61) cl. ch., 0.11, 0.20 (F40)	0.092 (M60) (1%) (F40)	
	Th 233	A	.....	β^-	23 min (G12)	abs. Al; 0.13 (S72)		
	UX ₁ 234	A	.....	β^- , γ (M60, F40)	24.5 days (C60), 24.1 days (S70)	abs. Al; spect. 5.049 (R42) spect.		
			.....	α , γ (C60)	3.2×10^4 yr. (G42)	0.4 (S38) abs Al; 0.23 (H40) spect.		e^- lines at 0.063, 0.077, 0.192, 0.293 (H40) spect.
91	Pa 231	A	.....	β^- , γ , e^- (H40)	27.4 days (G12)	0.56, 1.55 (F40) abs. Al	0.70 (F40) abs. Pb, W 0.802 (5%) (M61) spect conv.; 0.782, 0.822 (B32) spect conv.	
	Pa 233	A	.....	β^- , γ (F40)	6.7 hr. (C60)	2.32 (S72) abs. Al;		
	UZ 234	A	.....	β^- , γ (M61); I.T. (0.15%)	1.14 min. (C60)	1.52 (5%), 2.32 (95%) (M61) spect		
	UX ₂ 234	A	.....	(?) (F40)	4.71 (R43) cl. ch.;	4.78 (S75) abs air;		
92	Uir 234	A	0.066 (N39)	α	2.69×10^5 yr. (N41)	4.76 (S77) ion ch. 4.52 (W52) cl. ch.		
	AcU 235	A	0.71 (N39)	α	7.07×10^8 yr. (N41)			

ISOTOPES (Continued)

TABLE OF ISOTOPES (Continued)

Z	Isotope	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
						Particles	γ -rays
92	U 237	A	.....	β^- , γ (M37)	~ 7 days (M37, N8)	0.26 (M37) abs.	
	U 238	A	99.28 (N39)	α	4.51×10^9 yr. (N41)	4.15 (R43) el. ch.; 4.23 (S75) abs. air; 4.21 (S77) ion. ch.	
93	U 239	A	.....	β^-	23 min. (I1, S4)		
	*Np 237	A	.....	α	2.25×10^6 yr. (M62)		
93	Np 238	A	.....	β^-	2.0 days (S78)		
	Np 239	A	.....	β^- , γ	2.3 days (M28, M19)		
94	†Pu 238	A	α	50 yr. (S78)	0.47 (M28) abs.	0.22, 0.27 (H25) spect.
	Pu 239	A	α	24,000 yr. (C63)		conv., spect.

* Neptunium.
† Plutonium.

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Names and Symbols of Radioactive Elements

For convenience, the names, symbols, atomic numbers and mass numbers of radioactive elements and isotopes are arranged in alphabetical order. See also table of isotopes.

Name	Sym- bol	Atom- ic Num- ber	Mass Num- ber	Name	Sym- bol	Atom- ic Num- ber	Mass Num- ber
Actinium A.....	AcA	84	215	Radium D (Radio- lead).....	RaD	82	210
Actinium B.....	AcB	82	211	Radium E.....	RaE	83	210
Actinium C.....	AcC	83	211	Radon (Radium ema- nation, Niton)....	Rn	86	222
Actinium C'.....	AcC'	84	211	Thorium A.....	ThA	84	216
Actinium C''.....	AcC''	81	207	Thorium B.....	ThB	82	212
Actinium K.....	AcK	87	223	Thorium C.....	ThC	83	212
Actinium U.....	AcU	92	235	Thorium C'.....	ThC'	84	212
Actinium X.....	AcX	88	223	Thorium C''.....	ThC''	81	208
Actinon (Actinium emanation).....	An	86	219	Thorium X.....	ThX	88	224
Ionium.....	Io	90	230	Thoron (Thorium emanation).....	Tn	86	220
Mesothorium 1.....	MsTh ₁	88	228	Uranium I.....	UI	92	238
Mesothorium 2.....	MsTh ₂	89	228	Uranium II (Bre- vium).....	UII	92	234
Radioactinium.....	RdAc	90	227	Uranium X ₁	UX ₁	90	234
Radiothorium.....	RdTh	90	228	Uranium X ₂	UX ₂	91	234
Radium A.....	RaA	84	218	Uranium Y.....	UY	90	231
Radium B.....	RaB	82	214	Uranium Z.....	UZ	91	234
Radium C.....	RaC	83	214				
Radium C'.....	RaC'	84	214				
Radium C''.....	RaC''	81	210				

ISOTOPIC MASSES

The table below gives the masses of various isotopes, arranged according to the atomic and mass numbers, in atomic mass units ($sO^{16} = 16.000000$). Extensive data concerning isotopes and nuclear reactions, with complete references, will be found in Livingstone and Bethe; Review of Modern Physics 9, 245, 1937; and Mattauch Nuclear Physics Tables 1942.

Element	Atomic Number	Mass Number	Isotopic Mass	Element	Atomic Number	Mass Number	Isotopic Mass
	Z	0	a. m. u.		Z	0	a. m. u.
n	0	1	1.008941	Si	14	27	26.99711
(neutron)			1.008945(1)	Si	14	28	27.9866
			1.00893(2)	Si	14	29	28.98635
H	1	1	1.008130	Si	14	30	29.98399
H	1	2	2.014708	Si	14	31	30.9866
H	1	3	3.01700	P	15	29	28.99151
He	2	3	3.01699	P	15	30	29.9885
He	2	4	4.00390	P	15	31	30.98441
He	2	5	5.01543	P	15	32	31.98437
He	2	6	6.0209	S	16	31	30.98965
Li	3	6	6.01692	S	16	32	31.98252
Li	3	7	7.01816	S	16	33	32.98200
Li	3	8	8.02497	S	16	34	33.97981
Be	4	7	7.01909	Cl	17	33	32.9875
Be	4	8	8.00781	Cl	17	34	33.981
Be	4	9	9.01496	Cl	17	35	34.97867
Be	4	10	10.01662	Cl	17	36	35.9799
B	5	9	9.01610	Cl	17	37	36.97770
B	5	10	10.01617	Cl	17	38	37.97999
B	5	11	11.01290	A	18	35	34.9865
B	5	12	12.0168	A	18	36	35.9792
C	6	10	10.02086	A	18	38	37.97473
C	6	11	11.01502	A	18	40	39.97549
C	6	12	12.00388	A	18	41	40.97740
C	6	13	13.007581	K	19	39	38.976
C	6	14	14.00774	K	19	41	40.9731
N	7	13	13.00990	Ca	20	40	39.9753
N	7	14	14.00753	Ca	20	42	41.9711
N	7	15	15.004934	Ca	20	43	42.9723
N	7	16	16.00645	Ca	20	45	44.97075
O	8	15	15.0078	Sc	21	45	44.96977
O	8	16	16.000000	Sc	21	46	45.96909
O	8	17	17.00450	Ti	22	46	45.9661
O	8	18	18.00485	Ti	22	47	46.9647
F	9	17	17.00758	Ti	22	48	47.96580
F	9	18	18.00670	Ti	22	49	48.9646
F	9	19	19.00454	Ti	22	50	49.9621
F	9	20	20.00654	V	23	51	50.96035
Ne	10	19	19.00798	V	23	52	51.95857
Ne	10	20	19.99890	Cr	24	52	51.959
Ne	10	21	21.00002	Cr	24	53	52.956
Ne	10	22	21.99858	Mn	25	55	54.957
Na	11	22	22.00032	Fe	26	54	53.961
Na	11	23	22.99644	Fe	26	56	55.9571
Na	11	24	23.99774	Fe	26	57	56.957
Mg	12	23	23.00055	Ni	28	58	57.95971
Mg	12	24	23.99300	Ni	28	60	59.94981
Mg	12	25	24.99462	Ni	28	61	60.9540
Mg	12	26	25.99012	Ni	28	62	61.94959
Mg	12	27	26.99256	Ni	28	64	63.94744
Al	13	26	25.99446	Cu	29	63	62.957
Al	13	27	26.99069	Cu	29	65	64.955
Al	13	28	27.99077	Zn	30	64	63.957
Al	13	29	28.9890				

ISOTOPIC MASSES (Continued)

Element	Atom- ic Num- ber	Mass Num- ber	Isotopic Mass	Element	Atom- ic Num- ber	Mass Num- ber	Isotopic Mass
	Z	0	a. m. u.		Z	0	a. m. u.
Zn	30	66	65.953	Te	52	126	125.937(3)
Zn	30	68	67.955	Te	52	128	127.936(3)
Zn	30	70	69.954	I	53	127	126.932(3)
Ga	31	69	68.956	Xe	54	129	128.946
Ga	31	71	70.954	Xe	54	132	131.946
As	33	75	74.934	Xe	54	134	133.929(3)
Se	34	80	79.941	Cs	55	133	132.933(3)
Br	35	79	78.929(3)	Ba	56	138	137.916(3)
Br	35	81	80.926(3)	Nd	60	146	145.964
Kr	36	78	77.945	Nd	60	148	147.964
Kr	36	80	79.926(3)	Nd	60	150	149.970
Kr	36	82	81.938	Gd	64	155	154.977
Kr	36	83	82.927(3)	Gd	64	156	155.977
Kr	36	84	83.939	Gd	64	157	156.976
Kr	36	86	85.939	Gd	64	158	157.976
Cb	41	93	92.926(3)	Gd	64	160	159.976
Mo	42	94	93.945	Ta	73	181	180.927(3)
Mo	42	95	94.945	W	74	184	184.00(3)
Mo	42	96	95.946	Re	75	187	186.981(3)
Mo	42	97	96.945	Os	76	190	190.038
Mo	42	98	97.944	Os	76	192	191.981(3)
Mo	42	100	99.939	Ir	77	191	191.038
Ru	44	96	95.945	Ir	77	193	193.039
Ru	44	99	98.944	Pt	78	194	194.039
Rh	45	103	102.949	Pt	78	195	195.039
Pd	46	106	105.946	Pt	78	196	196.039
Pd	46	110	109.944	Pt	78	198	198.044
Ag	47	107	106.950	Au	79	197	197.039
Ag	47	109	108.949	Hg	80	200	200.016(3)
Sn	50	116	115.943	Tl	81	203	203.059
Sn	50	118	117.940	Tl	81	205	205.059
Sn	50	119	118.938	Pb	82	206	206.061
Sn	50	120	119.930	Pb	82	208	208.060
Sn	50	122	121.946	Bi	83	209	209.056
Sn	50	124	123.945				

- (1) Mattauch: Nuclear Physics Tables.
- (2) Semat: Introduction to Atomic Physics.
- (3) Aston.

**PHYSICAL CONSTANTS OF INORGANIC AND METAL-
ORGANIC COMPOUNDS**

PHYSICAL CONSTANTS OF INORGANIC AND METAL-ORGANIC COMPOUNDS

The names, formulas and order of entries for the inorganic compounds only have been in charge of

Janet D. Scott, S.M.,

Assistant Editor of Encyclopedia of Chemical Technology

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H. W. Adams, Ill. State Normal Univ.	O. C. Dermer, Okla. A. and M. College	L. R. Parks, Pa. State College
J. W. H. Aldred, Sheffield, Ala.	C. C. DeWitt, Mich. State Coll.	W. G. Parks, R. I. State College
A. L. Barker, Ripon College	W. C. Fernellus, Syracuse University	V. F. Payne, Long Branch, New Jersey
L. G. Bassett, Rensselaer Poly. Institute	L. S. Foster, Brown Univ.	P. P. Powell, Ala. Poly. Inst.
W. D. Bonner, Univ. of Utah	E. F. Furtsch, Va. Poly. Inst.	A. W. Ralston, Chemical Research Dept., Armour Co.
A. B. Burg, University of Southern California	C. A. Jacobson, W. Va. Univ.	F. W. Schwartz, Rensselaer Poly. Inst.
J. D. Capps, Ala. Poly. Inst.	Amy LeVesconte, Mary Hardin-Baylor College	M. C. Sneed, Univ. of Minnesota
R. K. Carleton, Boston College	Mary A. Magill, Chemical Abstracts, Ohio State Univ.	P. A. van der Meulen, Rutgers Univ.
L. L. Carrick, University of Michigan	C. A. Marlies, Coll. of City of N. Y.	A. A. Vernon, Northeastern Univ.
G. B. Cooke, Research Laboratories Crown Cork & Seal Co.	F. C. Mathers, Indiana Univ.	O. J. Walker, Univ. of Alberta
E. J. Cragoe, Baker Univ.	J. L. Maynard, Univ. of Minnesota	W. O. Walker, Research Director, Ansul Chemical Co.
J. L. Culbertson, State Coll. of Wash.	W. S. McGuire, Northeastern Univ.	J. W. Watson, Va. Poly. Inst.
Jane E. Davis, Institutum Divi Thomae	J. R. Morton, Ohio Univ.	S. Zuffanti, Northeastern Univ.
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EXPLANATION OF TABLE

The table presents data for about four thousand compounds. The first section includes inorganic compounds and the metallic salts of organic acids, and the second metal-organic compounds.

It is intended that the substances listed include the more important definite compounds for which data are available. Some are listed because of their theoretical importance, even when no constants can be given.

Nomenclature and Arrangement.—The names used for the compounds conform to the best current usage insofar as this could be ascertained, the Rules for Naming Inorganic Compounds adopted January 28-29, 1938, by the Committee for the Reform of Inorganic Chemical Nomenclature of the International Union for Chemistry being used as a guide to some extent. The compounds are listed under the names of the elements in alphabetical order, except that acids and a few other compounds (e.g. hydrazine, hydroxylamine, and sulfonyl, thionyl and uranyl compounds) have their own headings. Ferrous and ferric compounds are entered under iron, stannous and stannic, under tin, cuprous and cupric, under copper and aurous and auric, under gold. Acid salts (including hydrosulfides) and many basic salts are placed immediately after the normal salts. Names like bicarbonate and bisulfate have not been used for acid salts, but names like antimony oxychloride and uranyl nitrate have been used for some basic salts. Prefixes such as di-, tri-, ortho-, meta-, pyro-, hypo-, and per- are not alphabetized. Iso-, however, and prefixes like chloro- in chloroplatinic acid are alphabetized. For the naming of binary compounds of nonmetallic elements the order of decreasing electropositivity given in the Report of the German Commission for Nomenclature (Meyer, *Helvetica Chimica Acta* 20, 159-75 (1937)) has been followed: Sb, As, B, Si, C, P, Te, Se, S, I, Br, Cl, N, O, F, except in the case of fluorine oxides, nitrogen chlorides, nitrogen iodides, etc. Binary compounds of hydrogen (except ammonia and water) are listed under arsenic hydride (instead of arsine), hydrogen chloride, hydrogen phosphide (instead of phosphine), hydrogen sulfide and like names. Most amino compounds are grouped under headings like **Cobalt complexes** following the other compounds of the element in question, while complexes that have reasonably well-established names like chloroplatinate, cobaltinitrite, cyanoplatinite and fluoborate are listed under these names just like simpler salts. Double salts (including alums) are entered only once: (1) those with two cations are given with the more electropositive cation first in the order of the electromotive force series: Li, Rb, K, Na, NH_4 , Sr, Ba, Ca, Mg, Al, U, Mn, Zn, Cr, Ga, Fe^{++} , Cd, In, Tl, Co, Ni, Sn, Pb, Fe^{+++} , Sb, Bi, As, Cu, Ag, Hg, Pd, Pt, Au (e.g. sodium aluminum sulfate, ammonium magnesium phosphate); (2) those with two anions are given with the anions in alphabetical order (e.g., strontium chloride fluoride). The finding of compounds known also under names about as common as those listed is facilitated by a **Synonym Index**, which precedes the table. Organic names conform to those used in the Table of Physical Constants of Organic Compounds.

Molecular weights have been computed to the nearest hundredth, based on the **International Atomic Weights of 1933**.

The **Crystalline form and color** are stated in easily interpreted abbreviations. Other important characteristics are often added. **Indices of refraction** are given in the same column. For crystals with two or three indices, they are invariably given in the order ω , ϵ or α , β , γ . All indices are for sodium light ($\lambda = .5893\mu$) unless otherwise stated. The temperature is assumed to be normal room temperature unless otherwise indicated by a superior figure following the index. 1.536²⁵ (Li) would be interpreted as giving the value for the index of refraction of a substance for the red line of lithium at 25°C.

Specific gravity at 20°C, referred to water at 4°C, is normally given. Other temperatures are indicated by superior and inferior figures. For example: 2.64₁₅²⁰ indicates a specific gravity of 2.64 at 25°C, referred to water at 15°C. It should be noted that values of specific gravity referred to water at 4°C are numerically equivalent to density in grams per milliliter. The **density of gases** is given in grams per liter, indicated g/l.

Melting and boiling points are given in °C. The boiling point is stated at normal atmospheric pressure (760 mm of Hg) unless otherwise indicated by a superscript which is to be interpreted as the pressure in mm of Hg under which the compound boils at the temperature given. For example: 250⁷³² indicates a boiling point of 250°C under a pressure of 732 mm Hg; 426^{atm} indicates a boiling point of 426°C under a pressure of 2 atmospheres. Decomposition on heating is indicated by the abbreviation d. in melting or boiling point column. If decomposition occurs without change of state, the form d. 120 is used indicating the occurrence of decomposition at 120°C.

EXPLANATION OF TABLE

The form 120 d. would indicate a melting or boiling point of 120°C with decomposition. Loss of water of crystallization or oxygen is indicated by the form $-2\text{H}_2\text{O}$ or $-\text{O}$. The figures $-5\text{H}_2\text{O}$, 350 indicate the loss of five molecules of water of crystallization at 350°C.

Solubilities are stated for normal room temperatures, 20°C, unless otherwise indicated by ■ superior figure. 6.8²⁵ indicates a solubility of 6.8 grams of substance in 100 ml of the solvent at 25°C. The term insoluble (i.) must be usually understood to mean that a negligible quantity of the compound dissolves. A large proportion of salts commonly regarded as insoluble really dissolve to a very slight extent. The form s.d. indicates solubility with more or less decomposition. The abbreviation d. alone in the solubility column indicates that decomposition is the primary action occurring. Solubility in acids and alkalies is usually understood to be accompanied by decomposition.

ABBREVIATIONS

a.....	acid	fus.....	fused	prop.....	properties
abs.....	absolute	fxd.....	fixed	purp.....	purple
ac. a.....	acetic acid	gel., gelat.....	gelatinous	pyr.....	pyridine
acet.....	acetone	gl.....	glass	quad.....	quadrilateral
act.....	active	glac.....	glacial	quest.....	questioned
al.....	alcohol	glit.....	glittering	rect.....	rectangular
alk.....	alkali	glob.....	globular	redsh.....	reddish
amm.....	ammonium	glyc.....	glycerin	reg.....	regular
amor.....	amorphous	gran.....	granular	rhbdr.....	rhombobedral
anh.....	anhydrous	greas.....	greasy	rhomb.....	rhombic, ortho-
appr.....	approximately	grn.....	green		rhombic
aq.....	aqua, water	h.....	hot	s.....	soluble
aq. reg.....	aqua regia	hex.....	hexagonal	satd.....	saturated
asym.....	asymmetrical	ht.....	heat	sld.....	solid
atm.....	atmospheres	hyd.....	hydrolyzed	sensit.....	sensitive
bipyr.....	bipyramidal	hydx.....	hydroxides	sc.....	scales
bl.....	blue	hyg.....	hygroscopic	sec.....	secondary
blk.....	black	i.....	insoluble	silv.....	silver
boil.....	boiling	ign.....	ignites	sl.....	slightly
br., brn.....	brown	ind.....	indigo	sly.....	slowly
brnsh.....	brownish	indef.....	indefinite	sm.....	small
bz.....	benzene	infl., inflam.....	inflammable	sod.....	sodium
c.....	cold	infus.....	infusible	soln.....	solution
calc.....	calculated	irid.....	iridescent	solv.....	solvents
carb.....	carbon	leaf.....	leaflets	spont.....	spontaneous
caust.....	caustic	lem.....	lemon	st.....	steel
chl.....	chloroform	lgr.....	ligroin	stab.....	stable
choc.....	chocolate	lng.....	long	subl.....	sublimes
cit. a.....	citric acid	lq., liq.....	liquid	suffoc.....	suffocating
col.....	colorless	lt.....	light	sulfd.....	sulfides
coll.....	colloidal	lum.....	luminous	sulf.....	sulfur
com'l.....	commercial	lust.....	lustrous	sym.....	symmetrical
comp.....	compounds	me., meth.....	methyl	tabl.....	tablets
compl.....	completely	met.....	metal or metal-	tart. a.....	tartaric acid
conc.....	concentrated		lic	tetr.....	tetragonal
const.....	constant	micr.....	microscopic	tetrah.....	tetrahedral
cont.....	contains	min.....	mineral	tol.....	toluene
corros.....	corrosion	misc.....	miscible	trac.....	trace, traces
cr.....	crystalline	mixt.....	mixture	trans.....	transparent
cub.....	cubic	mod.....	modifications	translu.....	translucent
d., dec.....	decomposes	monbas.....	monobasic	tri., trig.....	trigonal
deliq.....	deliquescent	mon-H.....	monohydrogen	tribas.....	tribasic
deriv.....	derivative	monocl.....	monoclinic	tricl.....	triclinic
dibas.....	dibasic	near.....	nearly	trim.....	trimetric
di-H.....	dihydrogen	need.....	needles	tr. pt.....	transition point
dil.....	dilute	nit.....	nitrate	turp.....	turpentine
dimorph.....	dimorphous	oct.....	octahedral	unpleas.....	unpleasant
disg.....	disagreeable	odorl.....	odorless	unst.....	unstable
dk.....	dark	offen.....	offensive	v.....	very
doubt.....	doubtful	olv.....	olive	vac.....	vacuum
duct.....	ductile	opt.....	optical or	var.....	various
effl.....	efflorescent		optically	viol.....	violent,
em.....	emerald	or.....	orange		violence
eth.....	ether	ord.....	ordinary	visc.....	viscous
ev.....	evolves	org.....	organic	vitr.....	vitreous
evln.....	evolution	oxal.....	oxalate or	vlt.....	violet
ex.....	excess	oxalic.....	oxalic	volt., volat.....	volatizes
exist.....	existence	pa.....	pale	wh.....	white
exp.....	explodes	pet.....	petroleum	wh. lt.....	white light
extr.....	extreme(ly)	pl.....	plates	yel.....	yellow
f., fr.....	from	pois.....	poisonous	yelsh.....	yellowish
feath.....	feathery	polymorph.....	polymorphous	∞.....	soluble in all
fl.....	flakes	powd.....	powder		proportions
floc.....	flocculent	ppt.....	precipitate	>.....	above
fluo, fluores.....	fluorescent	pr.....	prisms	<.....	below
form.....	formic	press.....	pressure		
fum.....	fuming	prob.....	probably		

SYNONYM INDEX

Compound sought	Listed	Compound sought	Listed
Acanthite.....	Silver sulfide	Avogadrite.....	Potassium fluoborate
"Ajinomoto".....	Sodium <i>d</i> -glutamate	Azoimide.....	Hydrazoic acid
Alabandite.....	Manganese sulfide (ous)	Azurite.....	Copper carbonate, basic (ic)
Alamosite.....	Lead <i>metasilicate</i>	Baddeleyite.....	Zirconium oxide, di-
Albite.....	Sodium aluminum silicate	Baking soda.....	Sodium carbonate, acid
Alum, ammonium....	Ammonium aluminum sulfate	Barite.....	Barium sulfate
Alum, cesium.....	Cesium aluminum sulfate	Baryta.....	Barium oxide
Alum, ammonium chrome.....	Ammonium chromium sulfate	Benzylate.....	Benzyl oxide
Alum, ammonium gallium.....	Ammonium gallium sulfate	Berlin green.....	Iron ferricyanide (ic)
Alum, ammonium vanadium.....	Ammonium vanadium sulfate	Bertrandite.....	Beryllium <i>orthosilicate</i>
Alum, iron ammonium	Ammonium iron sulfate	Beryl.....	Beryllium aluminum silicate
Alum, iron potassium	Potassium iron sulfate	Bieberite.....	Cobalt sulfate (ous)
Alum, manganese potassium.....	Potassium manganese sulfate	Binoxalate.....	Oxalate, acid
Alum, potassium.....	Potassium aluminum sulfate	Bischofite.....	Magnesium chloride
Alum, potassium chrome.....	Potassium chromium sulfate	Bismite.....	Bismuth oxide, tri-
Alum, rubidium.....	Rubidium aluminum sulfate	Bismuthic acid, meta-	Bismuth oxide, tri-
Alum, sodium.....	Sodium aluminum sulfate	Bismuthine.....	Bismuth hydride
Alum, thallium.....	Aluminum thallium sulfate	Bismuthinite.....	Bismuth sulfide, tri-
Alumina.....	Aluminum oxide	Bismuthyl.....	Bismuth oxy-
Aluminic acid, meta-	Aluminum hydroxide, mono-	Bisulfate, -ite.....	Sulfate, -ite, acid
Alunogenite.....	Aluminum sulfate	Bleaching powder...	Calcium chloride hypochlorite
Amidophosphoric acid, tri-	Phosphoryl amide	Bloedite.....	Sodium magnesium sulfate
Amidosulfonic acid....	Sulfamic acid	Blue verdigris.....	Copper acetate, basic
Anatase.....	Titanium oxide, di-	Blue vitriol.....	Copper sulfate (ic)
Anglesite.....	Lead sulfate	Bobierrite.....	Magnesium <i>orthophosphate</i>
Anhydrite.....	Calcium sulfate	Boracic acid.....	Boric acid
Anhydrite, soluble....	Calcium sulfate	Borax.....	Sodium <i>tetraborate</i>
Anorthite.....	Calcium aluminosilicate	Boric anhydride.....	Boron oxide
Aquopentamminecobalt (III) chloride	under Cobalt complexes	Borobutane.....	Boron hydride
Aragonite.....	Calcium carbonate	Boroethane.....	Boron hydride
Arcanite.....	Potassium sulfate	Borofluoric acid.....	Fluoboric acid
Argentite.....	Silver sulfide	Borofluoride.....	Fluoborate
Arsenoferrite.....	Iron arsenide, di-	Bossingaultite.....	Ammonium magnesium sulfate
Arsenolite.....	Arsenic oxide, tri-	Bromellite.....	Beryllium oxide
Arsine.....	Arsenic hydride, tri-	Bromoazide.....	Bromine azide
Artinite.....	Magnesium carbonate, basic	Bromyrite.....	Silver bromide
Ascharite.....	Magnesium <i>pyroborate</i>	Brookite.....	Titanium oxide, di-
Atacamite.....	Copper oxychloride (ic)	Brucite.....	Magnesium hydroxide
Auricyanide.....	Cyanoaurate under Gold	Bunsenite.....	Nickel oxide, mono-
Auric salts.....	Cyanoaurite under Gold	Butter of antimony...	Antimony chloride, tri-
Aurocyanide.....		Butylate.....	Butoxide
Aurous salts.....		Calamine.....	Zinc silicate
		Calcite.....	Calcium carbonate
		Calomel.....	Mercury chloride (ous)
		Carbon oxybromide...	Carbonyl bromide
		Carbon oxychloride...	Carbonyl chloride
		Carbon oxysulfide...	Carbonyl sulfide
		Carnallite.....	Potassium magnesium chloride
		Caro's acid.....	Sulfuric acid, peroxy-mono-
		Cassel yellow.....	Lead oxychloride

SYNONYM INDEX (Continued)

Compound sought	Listed	Compound sought	Listed
Cassiopeum.....	Lutecium	Diamminepalladium	under Palladium
Cassiterite.....	Tin oxide (ic)	(II) hydroxide	complexes
Celestite.....	Strontium sulfate	Diaquotetrammine-	under Nickel com-
Cerargyrite.....	Silver chloride	nickel (II) nitrate	plexes
Cerussite.....	Lead carbonate	Diborane.....	Boron hydride
Cervantite.....	Antimony oxide,	Dichlorodiammine-	under Palladium
	tetra-	palladium (II) <i>trans</i> .	complexes
Chalcanthite.....	Copper sulfate (ic)	Digermene.....	Germanium hydride
Chalcocite.....	Copper sulfide (ous)	Dihydropentaborane.	Borane hydride
Chamber crystals.....	Nitrosylsulfuric acid	Dihydrotetraaborane.	Boron hydride
Chessylite.....	Copper carbonate,	Disilicane.....	Silicon hydride
	basic (ic)	Disilicoethane.....	Silicon hydride
Chloride of Millon's	Chloride (ic) aquo-	Disiloxane.....	Silicyle oxide
base	basic ammonobasic	Domeykite.....	Copper (tri) arsenide
Chlorinated lime.....	Calcium chloride	Dysprosia.....	Dyprosium oxide
	hypochlorite	Epsom salt.....	Magnesium sulfate
<i>cis</i> -Chloroquotetram-	under Cobalt com-	Erbia.....	Erbium oxide
mine cobalt (III)	plexes	Erythrite.....	Cobalt orthoarsenate
chloride			(ous)
Chlor(o)azide.....	Chlorine azide	Erythrosiderite.....	Potassium iron chlo-
Chlorocalcite.....	Potassium calcium		ride
	chloride	Ethylate.....	Ethoxide
Chloromanganokalite.	Potassium manga-	Ethylxanthate.....	Xanthate
	nese chloride (ous)	Euclase.....	Beryllium aluminum
Chloropentammine	under Chromium		silicate
chromium (III)	complexes	Eunatrol.....	Sodium oleate
chloride		Europa.....	Europium oxide
Chloropentammine-	under Cobalt com-	Ferric salts.....	under Iron
cobalt (III) chloride	plexes	Ferrous salts.....	under Iron
Chrome red.....	Lead chromate, basic	Fischer's salt.....	Potassium cobaltini-
Chrome yellow.....	Lead chromate		trite
Chromic anhydride.....	Chromium oxide, tri-	Fluellite.....	Aluminum fluoride
Chrysoberyl.....	Beryllium aluminate	Fluorite.....	Calcium fluoride
Cinnabar.....	Mercury sulfide (ic)	Gadolina.....	Gadolinium oxide
	(α -)	Gahnite.....	Zinc aluminate
Claudetite.....	Arsenic oxide, tri-	Galena.....	Lead sulfide
Clausthalite.....	Lead selenide	Germane.....	Germanium hydride,
Clinostatite.....	Magnesium silicate		tetra-
Columbic acid.....	Columbium oxide,	Germanium bromo-	
	pent-	form.....	Germane, tribromo-
Columbium hydroxide	Columbium oxide,	Germanium chloro-	
	pent-	form.....	Germane, trichloro-
Common salt.....	Sodium chloride	Gibbsite.....	Aluminum hydrox-
Coquimbite.....	Iron sulfate (ic)		ide, tri-
Corundum.....	Aluminum oxide	Glauber's salt.....	Sodium sulfate
Cotunnite.....	Lead chloride	Glucinum.....	Beryllium
Covellite.....	Copper sulfide (ic)	Goslarite.....	Zinc sulfate
Cream of tartar, solu-	Potassium borotar-	Greenockite.....	Cadmium sulfide
ble	trate	Guanajuatite.....	Bismuth selenide
Cristobalite.....	Silicon oxide, di-		tri-
Crocoite.....	Lead chromate	Guanite.....	Ammonium magne-
Cryolite.....	Sodium aluminum		sium phosphate
	fluoride	Gypsum.....	Calcium sulfate
Cryolithionite.....	Lithium sodium alu-	Hafnia.....	Hafnium oxide
	minum fluoride	Halite.....	Sodium chloride
Cuprammonium.....	under Copper com-	Hambergite.....	Beryllium orthobor-
	plexes		ate, basic
Cuprite.....	Copper oxide (ous)	Hauerite.....	Manganese sulfide
Decaborane.....	Boron hydride		(ic)
Dermatol.....	Bismuth gallate,	Hausmannite.....	Manganese oxide
	basic		(ous, ic)
Deuterioammonia, tri-	Ammonia- d_3	Heavy hydrogen.....	Deuterium
diamminecopper (II)	under Copper com-	Heavy water.....	Deuterium oxide
acetate	plexes	Hematite.....	Iron oxide (ic)

SYNONYM INDEX (Continued)

Compound sought	Listed	Compound sought	Listed
Hessite.....	Silver telluride	Lanarkite.....	Lead sulfate, basic
Hexamminechromium (III) chloride	under Chromium complexes	Langbeinite.....	Potassium magne- sium sulfate
Hexamminecobalt (III) chloride	under Cobalt com- plexes	Lansfordite.....	Magnesium carbon- ate
Hexamminecobalt (III) <i>perrhenate</i>	under Cobalt com- plexes	Lanthana.....	Lanthanum oxide
Hexaantipyrimetrium <i>perchlorate</i>	under Yttrium com- plexes	Laurionite.....	Lead oxychloride
Hexaantipyrimetrium iodide	under Yttrium com- plexes	Laurite.....	Ruthenium sulfide
Hexaborane.....	Boron hydride	Lautarite.....	Calcium iodate
Hexabromodisilico- ethane	Silicon (di-) bromide, hexa-	Lawrencite.....	Iron chloride (ous)
Hexabromoethane....	Carbon bromide, tri-	Lechatelierite.....	Silicon oxide, di-
Hexachlorodisilico- ethane	Silicon (di-) chloride hexa-	Leonite.....	Potassium magne- sium sulfate
Hexachloroethane....	Carbon chloride, tri-	Leukonin.....	Sodium <i>meta</i> antimo- nate
Hexaiododisilicoethane	Silicon (di-) iodide, hexa-	Lime.....	Calcium oxide
Hexaureachromium (III) fluosilicate	under Chromium complexes	Litharge.....	Lead oxide, mono-
Hexaureachromium (III) <i>perrhenate</i>	under Chromium complexes	Luminal.....	Sodium phenobar- bital
Hieratite.....	Potassium fluosili- cate	Magnesia.....	Magnesium oxide
Hoernesite.....	Magnesium <i>ortho</i> - arsenate	Magnesite.....	Magnesium carbon- ate
Hopeite, α -.....	Zinc <i>orthophosphate</i>	Magnetite.....	Iron oxide, ferroso- ferric
Hopeite, β -.....	Zinc <i>orthophosphate</i>	Malachite.....	Copper carbonate, basic (ic)
Hyacinth.....	Zinc <i>orthosilicate</i>	Manganite.....	Manganese hydrox- ide (ic)
Hydriodic acid.....	Hydrogen iodide	Manganolangbeinite..	Potassium manga- nese sulfate (ic)
Hydrobromic acid....	Hydrogen bromide	Manganosite.....	Manganese oxide, mon- (uso)
Hydrocerussite.....	Lead carbonate, basic	Marcasite.....	Iron sulfide, di-
Hydrochloric acid....	Hydrogen chloride	Marshite.....	Copper iodide (ous)
Hydrocyanic acid....	Hydrogen cyanide	Mascagnite.....	Ammonium sulfate
Hydrocyanite.....	Copper sulfate (ic)	Massicot.....	Lead oxide, mono-
Hydrofluosilicic acid..	Fluosilicic acid	Matlockite.....	Lead oxychloride
Hydromagnesite.....	Magnesium carbon- ate, basic	Medinal.....	Sodium barbitol
Hydrosulfite.....	Hyposulfite	Melanterite.....	Iron sulfate (ous)
Hydroxyplatinic acid	Platinum oxide, di- (ic)	Mendipite.....	Lead oxychloride
Hyposulfite.....	Thiosulfate	Mercallite.....	Potassium sulfate, acid
Iodide of Millon's base	Iodide (ic) aquobasic ammonobasic	Mercuric bromide, ammonobasic	under Mercury-ni- trogen compounds
Iodine hydroxide.....	Iodous acid, hypo-	Mercuric bromide, diammine	under Mercury-ni- trogen compounds
Iod(o)azide.....	Iodine azide	Mercuric chloride, ammonobasic	under Mercury-ni- trogen compounds
Iodyrite.....	Silver iodide	Mercuric chloride, aquobasic ammono- basic	under Mercury-ni- trogen compounds
Jaipurite.....	Cobaltsulfide, mono-	Mercuric chloride, diammine	under Mercury-ni- trogen compounds
Kainite.....	Potassium magne- sium chloride sul- fate	Mercuric iodide, am- monobasic	under Mercury-ni- trogen compounds
Kalinite.....	Potassium alumi- num sulfate	Mercuric iodide, aquo- basic ammonobasic	under Mercury-ni- trogen compounds
Kaluszite.....	Potassium calcium sulfate	Mercuric iodide, di- ammine	under Mercury-ni- trogen compounds
Kieserite.....	Magnesium sulfate	Metabisulfite.....	<i>Pyrosulfite</i>
Köttigite.....	Zinc <i>ortho</i> arsenate	Metacinnabarite.....	Mercury sulfide (ic) (β -)
Krausite.....	Potassium iron sul- fate (ic)	Metazirconic acid....	Zirconyl hydroxide
Krugite.....	Potassium calcium magnesium sulfate	Methylate.....	Methoxide

SYNONYM INDEX (Continued)

Compound sought	Listed	Compound sought	Listed
Millerite.....	Nickel sulfide, mono-	Phosgene.....	Carbonyl chloride
Minium.....	Lead oxide, red	Phosphine.....	Hydrogen phosphide
Mirabilite.....	Sodium sulfate	Phosphoric anhydride	Phosphorus oxide
Misenite.....	Potassium sulfate, acid	Phosphorus sulfobromide or thiobromide, etc	pent-Thiophosphoryl bromide, etc.
Molybdenite.....	Molybdenum sulfide, di-	Phosphoryl bromide, etc.	Phosphorus oxybromide, etc.
Molybdenum blue....	Molybdenum oxide, pent-	Picromerite.....	Potassium magnesium sulfate
Molybdic anhydride..	Molybdenum oxide, tri-	Pinnoite.....	Magnesium <i>metaborate</i>
Molybdite.....	Molybdenum oxide, tri-	Platinichloride.....	Chloroplatinate
Molysite.....	Iron chloride (ic)	Platinic hydroxide....	Platinum oxide, di-(ic)
Monazite.....	Cerium <i>orthophosphate</i>	Platinochloride.....	Chloroplatinite
Monodiaspore.....	Aluminum hydroxide	Platinocyanide.....	Cyanoplatinite
Montanite.....	Bismuth tellurate	Platinonitrite.....	Nitroplatinite
Montroydite.....	Mercury oxide (ic)	Plattnerite.....	Lead oxide, di-under Lead
Morenosite.....	Nickel sulfate	Plumbic.....	under Lead
Mosaic gold.....	Tin sulfide (ic)	Plumbous.....	Nickel sulfide (ous, ic)
Mullite.....	Aluminum silicate	Polydymite.....	Potassium calcium magnesium sulfate
Nantokite.....	Copper chloride (ous)	Polyhalite.....	Potassium amide
Nembutal.....	Sodium pentobarbital	Potassamide.....	Potassium diborane
Neodymia.....	Neodymium oxide	Potassium diboramide	Potassium <i>diborane</i>
Nesquehonite.....	Magnesium carbonate	Potassium pentaboranide	Potassium <i>pentaborane</i>
Neutral verdigris....	Copper acetate (ic)	Praseodymia.....	Praseodymium oxide, sequi-
Newberyite.....	Magnesium <i>orthophosphate</i>	Propylate.....	Propoxide
Niccolite.....	Nickel arsenide	Proustite.....	Silver thioarsenite
Niobium.....	Columbium	Prussian blue.....	Iron ferrocyanide (ic)
Niton.....	Radon	Prussian green.....	Iron ferricyanide (ous, ic)
Nitric anhydride.....	Nitrogen oxide, pent-	Prussiate of soda, yellow	Sodium ferrocyanide
Nitrobarite.....	Barium nitrate	Pseudocotunnite....	Potassium lead chloride
Nitrogen sulfide.....	Sulfur nitride	Pseudowallastonite..	Calcium <i>metasilicate</i> (α)
Nitrosoferricyanide..	Nitroprusside	Pyrargyrite.....	Silver thioantimonite
Nitrous anhydride....	Nitrogen (di-) oxide, tri-	Pyrite.....	Iron sulfide (di-)
Nitroxyl.....	Nitryl	Pyroborate.....	<i>Tetraborate</i>
Octahedrite.....	Titanium oxide, di-	Pyrochroite.....	Manganese hydroxide (ous)
Oldhamite.....	Calcium sulfide	Quartz.....	Silicon oxide, di-
Opal.....	Silicon oxide, di-	Racemate.....	<i>di-Tartrate</i>
Orpiment.....	Arsenic sulfide, tri-	Radium emanation...	Radon
Parahopeite.....	Zinc <i>orthophosphate</i>	Raspite.....	Lead tungstate
Paralaurionite.....	Lead oxychloride	Realgar.....	Arsenic sulfide, di-
Paramelaconite.....	Copper oxide (ic)	Reddingite.....	Manganese <i>orthophosphate</i>
Paris green.....	Copper acetate arsenite (ic)	Rhodanate, rhodanide	Thiocyanate
Peligo't's salt.....	Potassium chlorochromate	Rhodochrosite.....	Manganese carbonate (ous)
Pentaborane.....	Boron hydride	Rhodonite.....	Manganese <i>metasilicate</i> (ous)
Periclase.....	Magnesium oxide	Rinneite.....	Potassium iron chloride
Permonosulfuric acid.	Sulfuric acid, peroxymono-	Rochelle salt.....	Potassium sodium tartrate
Perovskite.....	Calcium titanate		
Per (di) sulfuric acid.	Sulfuric acid, peroxydi-		
Phenacite.....	Beryllium <i>orthosilicate</i>		
Phenolate.....	Phenoxide		

SYNONYM INDEX (Continued)

Compound sought	Listed	Compound sought	Listed
Roesslerite	Magnesium <i>orthoar</i> - senate	Tantalac acid, meta- . .	Tantalum hydroxide
Rutile	Titanium oxide, di-	Tarapacaite	Potassium chromate
Sal ammoniac	Ammonium chloride	Tartar emetic	Potassium antimony tartrate
Salt peter	Potassium nitrate	Tenorite	Copper oxide (ic)
Samaria	Samarium oxide	Tephroite	Manganese <i>orthosili</i> - cate (ous)
Scacchite	Manganese chloride, di-	Terbia	Terbium oxide
Scandia	Scandium oxide	Tetrabromoethylene . .	Carbon bromide, di-
Scheele's green	Copper <i>orthoarse</i> - nite, acid (?) (ic)	Tetrabromomethane . .	Carbon bromide, tetra-
Scheelite	Calcium tungstate	Tetrabromosilicane . .	Silicon bromide, tetra-
Schlippe's salt	Sodium thioantimo- nate	Tetrachlorodiammine- platinum (IV), <i>cis</i> -	under Platinum complexes
Schönite	Potassium magne- sium sulfate	Tetrachlorodiammine- platinum (IV), <i>trans</i> -	under Platinum complexes
Scorodite	Iron <i>orthoarsenate</i>	Tetrachloroethylene . .	Carbon chloride, di-
Seignette salt	Potassium sodium tartrate	Tetrachloromethane . .	Carbon chloride, tetra-
Sellaite	Magnesium fluoride	Tetradymite	Bismuth telluride, tri-
Senarmontite	Antimony oxide, tri-	Tetrafluoromethane . .	Carbon fluoride, tetra-
Siderite	Iron carbonate (ous)	Tetrafluorosilicane . .	Silicon fluoride, tetra-
Silanes	Silicon hydrides	Tetraiododisilico- ethylene	Silicon (di-) iodide, tetra-
Silica	Silicon oxide	Tetraiodomethane . . .	Carbon iodide, tetra-
Silicane	Silicon hydride	Tetraiodosilicane . . .	Silicon iodide, tetra-
Silicobromoform	Silicane, tribromo-	Tetramminecopper (II) sulfate	under Copper com- plexes
Silicochloroform	Silicane, trichloro-	Tetramminepalladium (II) chloride	under Palladium complexes
Silicofluoride	Fluosilicate	Tetrammine platinum (II) chloride	under Platinum complexes
Silicofluoroform	Silicane, trifluoro-	Tetrammine platinum (II) chloroplatinite	under Platinum complexes
Silicoidoform	Silicane, triiodo-	Tetramminezinc <i>per</i> - rhenate	under Zinc com- plexes
Smithsonite	Zinc carbonate	Tetrapyridinecopper (II) fluosilicate (ic)	under Copper com- plexes
Sodamide	Sodium amide	Tetrapyridinecopper <i>per</i> rhenate	under Copper com- plexes
Soda niter	Sodium nitrate	Tetrapyridinenickel (II) fluosilicate	under Nickel com- plexes
Sodium heptoate	Sodium enanthate	Tetrapyridinezinc fluosilicate	under Zinc com- plexes
Sodium phenolate	Sodium phenoxide	Tetrasilicane	Silicon hydride
Sperrylite	Platinum arsenide	Tetrasilicobutane . . .	Silicon hydride
Sphalerite	Zinc sulfide (β -)	Thenard's blue	Cobalt aluminate
Spherochalcite	Cobalt carbonate (ous)	Thenardite	Sodium sulfate
Spinel	Magnesium alumi- nate	Thermonatrite	Sodium carbonate
Stannane	Tin hydride	Thiophosgene	Thiocarbonyl chlo- ride
Stercorite	Sodium ammonium phosphate	Thoria	Thorium oxide, di-
Stibine	Antimony hydride	Thorite	Thorium <i>orthosilicate</i>
Stibnite	Antimony sulfide, tri-	Thulia	Thulium oxide
Stolzite	Lead tungstate	Tiemannite	Mercury selenide (ic)
Struvite	Ammonium magne- sium phosphate	Triamidophosphoric acid	Phosphoryl amide
Sulfocarbonate	Phenolsulfonate	Tridymite	Silicon oxide, di-
Sulfochloride	Chloride sulfide	Trigermane	Germanium hydride
Sulfocyanate, sulfo- cyanide	Thiocyanate	Trisilicane	Silicon hydride
Sulfur oxychlorides . .	Sulfuryl, pyro-, chlo- ride, sulfuryl chlo- ride, thionyl chlo- ride		
Sulfuryl amide	Sulfamide		
Sylvite	Potassium chloride		
Syngenite	Potassium calcium sulfate		
Szmkite	Manganese sulfate (ous)		

SYNONYM INDEX (Continued)

Compound sought	Listed	Compound sought	Listed
Trisilicopropane.....	Silicon hydride	Water glass.....	Sodium tetrasilicate
Troilite.....	Iron sulfide (ous)	White lead.....	Lead carbonate, basic
Uranium nitrate.....	Uranyl nitrate	Willamite.....	Zinc orthosilicate
Uranyl oxide.....	Uranium oxide, tri-	Winchite.....	Barium carbonate
Valerianite.....	Antimony oxide, tri-	Wulfenite.....	Lead molybdate
Vanadyl bromide, etc.	Vanadium oxybromide, etc.	Wurtzite.....	Zinc sulfide (α)
Verdigris.....	Copper acetate	Xanthogenate.....	Xanthate
Vermilion.....	Mercury sulfide (red)	Ytterbia.....	Ytterbium oxide
Williamite.....	Sodium fluoride	Yttria.....	Yttrium oxide
Violet blue.....	Copper sulfate (blue)	Zaratite.....	Nickel carbonate, basic
Vivianite.....	Iron orthophosphate (ous)	Zincite.....	Zinc oxide
Wollastonite.....	Calcium metasilicate (β)	Zinkosite.....	Zinc sulfate
Washing soda.....	Sodium carbonate	Zircon.....	Zirconium orthosilicate
		Zirconia.....	Zirconium oxide, di-
		Zirconic acid.....	Zirconium hydroxide

PHYSICAL CONSTANTS OF

Including Metallic Salts

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	Aluminum	Al	26.97	cub. silv. wh. duct. met.
2	acetate	$\text{Al}(\text{C}_2\text{H}_3\text{O}_2)_3$	204.10	known only in soln.
3	acetate, basic	$\text{Al}(\text{OH})(\text{C}_2\text{H}_3\text{O}_2) \cdot x\text{H}_2\text{O}$		wh. powd.
4	orthoarsenate	$\text{AlAsO}_4 \cdot 8\text{H}_2\text{O}$	310.01	wh. powd.
5	benzoate	$\text{Al}(\text{C}_7\text{H}_5\text{O}_2)_3$	390.30	wh. cr. powd.
6	benzyloxyde	$\text{Al}(\text{C}_7\text{H}_7\text{O})_3$	348.50	
7	bromate	$\text{Al}(\text{BrO}_3)_3 \cdot 9\text{H}_2\text{O}$	572.86	wh. cr. hyg.
8	bromide	AlBr_3	266.72	col. rhomb. deliq. pl.
9	"	$\text{AlBr}_3 \cdot 6\text{H}_2\text{O}$	374.82	col.-yelsh need., deliq.
10	"	$\text{AlBr}_3 \cdot 15\text{H}_2\text{O}$	536.96	need., col.
11	butoxide	$[\text{Al}(\text{C}_4\text{H}_9\text{O})_3]_4$	985.23	wh. cr.
12	carbide	Al_4C_3	143.91	hex., yel-grn.
13	chlorate	$\text{Al}(\text{ClO}_3)_3 \cdot 6\text{H}_2\text{O}$	385.44	rhbdr. col., deliq.
14	chloride	AlCl_3	133.34	hex., wh.-col.; odor HCl ; v. deliq.
15	"	$\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$	241.44	col. rhomb., deliq.; near. odorl. 1.6.
16	diethyl malonate deriv.	$\text{Al}(\text{C}_7\text{H}_{11}\text{O}_4)_3$	504.45	
17	ethoxide	$[\text{Al}(\text{C}_2\text{H}_5\text{O})_3]_4$	648.61	wh. cr.
18	α -ethylacetoacetatederiv.	$\text{Al}(\text{C}_8\text{H}_9\text{O}_3)_3$	414.37	wh. cr.
19	ferrocyanide	$\text{Al}_4[\text{Fe}(\text{CN})_6]_3 \cdot 17\text{H}_2\text{O}$	1050.00	br. powd.
20	fluoride	AlF_3	83.97	col. trans. tricl.
21	" (fluellite)	$\text{AlF}_3 \cdot \text{H}_2\text{O}$	101.99	rhomb., 1.473, 1.490, 1.511
22	"	$\text{AlF}_3 \cdot 3\frac{1}{2}\text{H}_2\text{O}$	147.03	wh. cr. powd.
23	fluosilicate	$\text{Al}_2(\text{SiF}_6)_3$	480.12	wh. powd.
24	hydroxide, mono- (diaspore)	$\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$	59.98 (119.96)	col. rhomb., 1.702, 1.722, 1.750
25	hydroxide, di-	$\text{Al}_2\text{O}(\text{OH})_4$ (or $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$)	137.97	amor.
26	" tri-(gibbsite)	$\text{Al}(\text{OH})_3$ (or $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$)	77.99 (155.99)	monocl. or amor. gelat. ppt., wh., 1.566, 1.566, 1.587
27	iodide	AlI_3	407.73	wh.-br. pl., cont. free I_2 , deliq.
28	"	$\text{AlI}_3 \cdot 6\text{H}_2\text{O}$	515.83	wh.-yel. cr.
29	isopropoxide	$[\text{Al}(\text{C}_3\text{H}_7\text{O})_3]_4$	816.92	wh. cr.
30	lactate	$\text{Al}(\text{C}_3\text{H}_5\text{O}_3)_3$	294.18	wh.-yelsh. powd.
31	nitrate	$\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	375.14	rhomb. col. deliq.
32	nitride	AlN	40.98	rhomb. yel.
33	oleate	$\text{Al}(\text{C}_{15}\text{H}_{33}\text{O}_2)_3$	871.31	wh. powd.; exist. doubted except as a basic salt
34	oxalate	$\text{Al}_2(\text{C}_2\text{O}_4)_3 \cdot 4\text{H}_2\text{O}$	390.06	wh. powd.
35	oxide	Al_2O_3	101.94	hex. col., 1.765
36	" (corundum)	Al_2O_3	101.94	trig. wh., 1.773
37	palmitate	$\text{Al}(\text{C}_{15}\text{H}_{31}\text{O}_2)_3 \cdot \text{H}_2\text{O}$	811.22	gran. yel. mass
38	2,4-pentanedione deriv. (acetylacetonate)	$\text{Al}(\text{C}_5\text{H}_7\text{O}_2)_3$	324.29	monocl. pr.
39	1-phenol-4-sulfonate	$\text{Al}(\text{C}_6\text{H}_4\text{SO}_3)_3$	546.45	redsh. wh. powd.
40	phenoxide	$\text{Al}(\text{C}_6\text{H}_5\text{O})_3$	306.27	grayish wh. cr. mass
41	orthophosphate	AlPO_4	121.99	rhomb. pl., 1.546, 1.556, 1.578
42	propoxide	$[\text{Al}(\text{C}_3\text{H}_7\text{O})_3]_4$	816.92	wh. cr.

INORGANIC COMPOUNDS

of Organic Acids

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc
1	2.702	659.7	1800	i.	i.	s. alk., HCl, H ₂ SO ₄ ; i. HNO ₃ , ac. a.
2	.....	d.	.....	s.	d.	.....
3	.....	d.	.....	i.	s.	s. a.; i. NH ₄ salts
4	3.011	-H ₂ O	.....	i.	i.	sl. s. a.
5	.....	.....	.....	v. sl. s.	.....	.....
6	.....	59-60	283-4 ^{9.5}	.....	.....	.....
7	.....	62.3	d. 100	s.	s.	sl. s. a.
8	3.01 ²⁵	97.5	263.3 ⁷⁴⁷	s. with viol.	d.	s. al., CS ₂ , acet.
9	2.54	93	d. > 100	s.	d.	s. al., amyl. al. sl. s. CS ₂
10	.....	-7.5	d. 7	s.	s.	s. al.
11	1.0251 ²⁰ ₀	101.5-102	284.5 ¹⁰	d.	d.	s. al.
12	2.36	stab. to 1400	d. at high temp.	d. to CH ₄	d.	d. dil. a.; i. acet.
13	.....	d.	.....	v.s.	v.s.	s. dil. HCl
14	2.44 ²⁵ ; lq. 1.31 ²⁰⁰	190 ^{2.5} atm.	182.7 ⁷⁵² ; subl. 177.8	69.9 ¹⁵ ; s. with viol.	s.d.	100 ^{12.5} abs. al., 072 ²⁵ chl.; s. CCl ₄ , eth.; sl. s. bz.
15	2.398-440	.....	d.	s.	v.s., ev. HCl	s. eth., 50 abs. al.
16	1.084 ¹⁰⁰	98	.....	i.	.....	s. org. solv.
17	1.142 ²⁰ ₀	134	205 ¹⁴	d.	s.	v. sl. s. al., eth.
18	1.101 ⁸⁰	78-9	190-200 ¹¹	d.	.....	s. lgr.
19	.....	.....	.....	sl. s.	sl. s.	s. dil. a.
20	3.07	1040	.....	s.	s.	i. a., al., alk., acet.
21	2.17	.....	.....	sl. s.	.....	.....
22	.....	-2H ₂ O, 100	-3H ₂ O, 250	i.	sl. s.	.....
23	.....	.....	.....	i.	.....	.....
24	3.3-3.5	d. 360	.....	0.00001 ²⁰	.....	v. sl. s. a., alk.
25	.....	.....	.....	i.	i.	i. a., alk.
26	2.423	-2H ₂ O, 300	.....	0.00015 ²⁰	.....	s. a., alk.; i. al.
27	3.98 ²⁵	191	360 (382)	s. d.	s.	s. al., eth., CS ₂
28	2.63	185 d.	d.	v. s.	v. s.	s. al., CS ₂
29	1.0346 ²⁰ ₀	118.5	140.5 ⁸	d.	.....	s. bz.
30	.....	.....	.....	v. s.	.....	.....
31	.....	70	d. 150	63.7 ²⁵	v. s. d.	100 al.; s. alk., acet., HNO ₃
32	3.05	2200 ⁴ atm.	d. > 2200	d. ev. NH ₃	d.	d. a., al.
33	.....	.....	.....	d.	d.	v. sl. s. bz.; i. al.
34	.....	.....	.....	i.	i.	s. a.; i. al.
35	3.5-9	2050	2250	.000098 ²⁹	i.	v. sl. s. a., alk.
36	4.00	2050	2250	.000098 ²⁹	i.	v. sl. s. a., alk.
37	.....	.....	.....	i.	.....	s. alk., pet., oil turp.
38	1.007 ¹⁹⁵	194	314-50	sl. s.	.....	s. al., eth., bz.
39	.....	.....	.....	s.	.....	s. al., glyc.
40	1.23	265 d.	.....	d.	.....	s. al., chl., eth.
41	2.566	> 1500	.....	i.	i.	s. a., alk.; i. al.
42	1.0578 ²⁰ ₀	106	248 ¹⁴	d.	d.	s. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Aluminum				
1	salicylate.	$\text{Al}(\text{C}_7\text{H}_5\text{O}_3)_3$	438.30	redsh.-wh. powd.
2	silicate (mullite)	$3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$	425.94	col. rhomb.
3	stearate.	$\text{Al}(\text{C}_{18}\text{H}_{35}\text{O}_2)_3$	877.36	wh.-yelsh. powd., exist. doubted except as basic salt
4	sulfate.	$\text{Al}_2(\text{SO}_4)_3$	342.12	wh. powd.
5	"	$\text{Al}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$	504.27	monocl. wh., 1.459
6	" (alunogenite)	$\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$	666.41	monocl. col., 1.474, 1.476, 1.483
7	sulfide	Al_2S_3	150.12	hex. yel., odor H_2S , d. moist air
8	thallium sulfate	$\text{AlTi}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	639.67	cub. oct. col., 1.4976
9	Ammonia	NH_3	17.03	col. gas., 1.325 ^{16.5} lq.
Ammonium				
10	acetate.	$\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$	77.08	wh. cr. hyg.
11	aluminum chloride.	$\text{NH}_4\text{Cl} \cdot \text{AlCl}_3$	186.84	wh. cr.
12	" sulfate.	$\text{NH}_4\text{Al}(\text{SO}_4)_2$	237.13	hex. col.
13	" "	$\text{NH}_4\text{Al}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	453.32	cub. col., 1.459
14	aminosulfamate.	$\text{NH}_3\text{NH}_2\text{SO}_3$	114.12	deliq.
15	metaantimonate.	$\text{NH}_4\text{SbO}_3 \cdot 2\text{H}_2\text{O}$	223.83	wh. cr.
16	antimony fluoride.	$2\text{NH}_4\text{F} \cdot \text{SbF}_3$	252.84	rhomb. col.
17	orthoarsenate.	$(\text{NH}_4)_3\text{AsO}_4 \cdot 3\text{H}_2\text{O}$	247.08	rhomb. cr.
18	orthoarsenate, mono-H.	$(\text{NH}_4)_2\text{HAsO}_4$	176.00	monocl. col., odor NH_3
19	orthoarsenate, di-H.	$\text{NH}_4\text{H}_2\text{AsO}_4$	158.97	tetr. col.
20	metaarsenite.	NH_4AsO_2	124.95	rhomb. pr., col.
21	azide.	NH_4N_3	60.06	col. pl.
22	benzenesulfonate.	$\text{NH}_4\text{C}_6\text{H}_5\text{O}_3\text{S}$	175.20	rhomb.
23	benzoate.	$\text{NH}_4\text{C}_7\text{H}_5\text{O}_2$	139.15	rhomb. col.
24	perborate.	NH_4BO_3 (or $\text{NH}_4\text{BO}_3 \cdot \frac{1}{2}\text{H}_2\text{O}$)	76.86 (85.87)	wh. cr.
25	tetraborate.	$(\text{NH}_4)_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$	263.43	
26	pentaborate (decaborate)	$\text{NH}_4\text{B}_5\text{O}_{10} \cdot 4\text{H}_2\text{O}$	271.21	
27	pentaborate (decaborate)	$(\text{NH}_4)_2\text{B}_{10}\text{O}_{16} \cdot 5\text{H}_2\text{O}$	490.36	monocl.
28	tetraborate, acid.	$\text{NH}_4\text{HB}_4\text{O}_7 \cdot 3\text{H}_2\text{O}$	228.38	col. cr., effl., $-\text{NH}_3$
29	bromate.	NH_4BrO_3	145.96	hex. col.
30	bromide.	NH_4Br	97.96	cub. col.; sl. hyg.; 1.712 ²⁵
31	bromoplatinate.	$(\text{NH}_4)_2\text{PtBr}_6$	710.81	cub. red-br.
32	bromoselenate.	$(\text{NH}_4)_2\text{SeBr}_6$	594.54	red oct. cr.
33	bromostannate.	$(\text{NH}_4)_2\text{SnBr}_6$	634.28	cub. col.
34	calcium arsenate.	$\text{NH}_4\text{CaAsO}_4 \cdot 6\text{H}_2\text{O}$	305.13	monocl. col.
35	" phosphate.	$\text{NH}_4\text{CaPO}_4 \cdot 7\text{H}_2\text{O}$	279.25	monocl. col.
36	carbamate.	$\text{NH}_4\text{CO}_2\text{NH}_2$	78.07	rhomb. col.
37	carbamate acid carbonate	$\text{NH}_4\text{CO}_2\text{NH}_2 \cdot \text{NH}_4\text{HCO}_3$	157.13	wh. cr.
38	carbonate.	$(\text{NH}_4)_2\text{CO}_3 \cdot \text{H}_2\text{O}$	114.11	cub. col.
39	carbonate, acid (bicarbonate)	NH_4HCO_3	79.06	rhomb. or monocl. col., 1.423, 1.536, 1.555
40	carbonate, sesqui-	$(\text{NH}_4)_4\text{H}_2(\text{CO}_3)_3 \cdot \text{H}_2\text{O}$	272.22	rhomb. pr.
41	cerium nitrate (ous)	$2\text{NH}_4\text{NO}_3 \cdot \text{Ce}(\text{NO}_3)_3 \cdot 4\text{H}_2\text{O}$	558.32	monocl.
42	" " (ic)	$2\text{NH}_4\text{NO}_3 \cdot \text{Ce}(\text{NO}_3)_4$	548.26	monocl. yel.-red

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				i.		s. dil. alk.; i. al.
2	3.15	d. 1810		v. sl. s.		
3				i.		s. oil. turp., pet., alk.; sl. s. al.
4	2.71	d. 770		31.3 ⁰	98.1 ¹⁰⁰	s. dil. a.; sl. s. al.
5	1.705 ²⁰ ₀	d.		s.	s.	s. a., alk.
6	1.69 ¹⁷	d. 86.5		s.	s.	i. al.
7	2.02 ¹³	1100	subl. 1550 (N ₂)	d.		s. a.; i. acet.
8	2.32	91		13 ²⁰	65.19 ⁶⁰	
9	7710 ⁰ g/l; lq. 0.817 ⁻⁷⁹	-77.7	-33.35	89.90; 52.0	7.4 ¹⁰⁰	13.2 ²⁰ al.; s. eth., org. solv.
10	1.073	114	d.	148 ¹	d.	s. al.; sl. s. acet.
11		304		s.		
12	2.039			s.		s. glyc.; i. al.
13	1.64	93.5	-10H ₂ O, 120 -12H ₂ O, 200	15 ²⁰	∞	s. dil. a.; i. al.
14				s.		i. al.
15		d.		i.		i. al.
16		subl., d.		108		
17		d.-loses NH ₃				
18	1.989	d.		s.	d.	
19	2.311 ⁹	d., -NH ₃ ³⁰⁰		33.74	122.4 ⁹⁰	
20				v. s.	d.	sl. s. NH ₄ OH; i. al., acet.
21	1.346	160	subl. 134; exp.	20.16/100 cc soln.	27.07 ⁹⁰ / 100 cc soln.	1.06 al.; s. NH ₃ ; i. eth.
22	1.342	271-5 d.		98	320	19 cold al; i. eth., bz.
23	1.260	198 d.	subl. 160	19.6 ^{14.5}	83.3 ¹⁰⁰	1.63 ²⁵ al.; i. eth.
24		d.		1.55 ^{17.5}	d.	
25				7.27 ¹⁸		
26				7.03 ¹⁸		
27				9.6		
28	2.38-95			s.		
29		exp.		v. s.	v. s.	sl. s. al.
30	2.429	subl. 542	235 vac.	59.8 ⁰	145.6 ¹⁰⁰	s. al., acet., eth., NH ₃
31	4.265 ²⁴	d. 145		0.40 ⁰ ; 0.59 ²⁰	0.36 ¹⁰⁰	
32	3.326			d.	d.	sl. s. eth.
33	3.50	d.		v. s.		
34	1.905 ¹⁵	d. 140		0.02	s.	s. NH ₄ Cl; i. NH ₄ OH
35	1.561 ¹⁵	d.		i.	d.	s. a.
36		subl. 60		v. s.	d.	v. s. NH ₄ OH; sl. s. al.; i. acet.
37		subl.		25 ¹⁵⁰	67 ⁶⁵⁰	
38		d. 58		100 ¹⁵	d.	i. al., CS ₂ , NH ₃
39	1.58	107.5, (d. 36-60)	subl.	11.9 ⁰	d.	i. al., acet.
40		d.		20 ¹⁵	d.	sl. s. al.
41		74		318 ²⁰	817.4 ⁹⁵	
42				142.6 ²⁵	232. ⁹⁰	sl. s. HNO ₃ ; s. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Ammonium				
1	cerium sulfate (ous)	$(\text{NH}_4)_2\text{SO}_4 \cdot \text{Ce}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	844.71	monocl.
2	chlorate	NH_4ClO_3	101.50	monocl. need. col.
3	perchlorate	NH_4ClO_4	117.50	rhomb. col., 1.482
4	chloride (sal ammoniac)	NH_4Cl	53.50	cub. col. 1.642
5	chloraurate	NH_4AuCl_4	357.07	rhomb. or monocl. yel.
6	"	$(\text{NH}_4\text{AuCl}_4)_4 \cdot 5\text{H}_2\text{O}$	1518.35	monocl. yel.
7	chlorogallate	NH_4GaCl_4	229.59	wh. cr.
8	chloroiridate	$(\text{NH}_4)_2\text{IrCl}_6$	441.92	cub. red-blk.
9	chloroiridite	$(\text{NH}_4)_3\text{IrCl}_6 \cdot 1\frac{1}{2}\text{H}_2\text{O}$	486.99	grn.-br.
10	chloropalladate	$(\text{NH}_4)_2\text{PdCl}_6$	355.52	cub. red-br.
11	chloropalladite	$(\text{NH}_4)_2\text{PdCl}_4$	284.61	tetr. olive grn.
12	chloroplatinate	$(\text{NH}_4)_2\text{PtCl}_6$	444.05	cub. yel.
13	chloroplatinite	$(\text{NH}_4)_2\text{PtCl}_4$	373.14	rhomb. red (tetr.)
14	chloroplumbate	$(\text{NH}_4)_2\text{PbCl}_6$	456.03	cub. yel.
15	chlorostannate	$(\text{NH}_4)_2\text{SnCl}_6$	367.52	cub. wh.
16	chromate	$(\text{NH}_4)_2\text{CrO}_4$	152.09	monocl. yel.
17	dichromate	$(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	252.10	monocl. or
18	perchromate	$(\text{NH}_4)_2\text{CrO}_8$	234.13	cub. red-br.
19	chromium sulfate (ic)	$(\text{NH}_4)_2\text{Cr}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	478.36	cub. grn. or vlt., 1.4842
20	citrate, tri- (tert.)	$(\text{NH}_4)_3\text{C}_6\text{H}_5\text{O}_7$	243.22	wh. cr., deliq.
21	" , di- (sec.)	$(\text{NH}_4)_2\text{HC}_6\text{H}_5\text{O}_7$	226.19	wh. gran. or powd.
22	cobalt chloride (ous)	$\text{NH}_4\text{Cl} \cdot \text{CoCl}_2 \cdot 6\text{H}_2\text{O}$	291.45	red., deliq.
23	cobalt orthophosphate (ous)	$\text{NH}_4\text{CoPO}_4 \cdot \text{H}_2\text{O}$	190.02	vlt. cr. powd.
24	cobalt sulfate (ous)	$(\text{NH}_4)_2\text{SO}_4 \cdot \text{CoSO}_4 \cdot 6\text{H}_2\text{O}$	395.24	monocl. ruby-red, 1.490, 1.495, 1.503
25	copper chloride (ic)	$2\text{NH}_4\text{Cl} \cdot \text{CuCl}_2 \cdot 2\text{H}_2\text{O}$	277.51	tetr. blue, 1.744, 1.724
26	" iodide (ous)	$\text{NH}_4\text{I} \cdot \text{CuI} \cdot \text{H}_2\text{O}$	353.47	rhomb. pl.
27	cyanate	NH_4CNO	60.06	wh. cr.
28	cyanide	NH_4CN	44.06	cub. col.
29	cynaoaurate	$\text{NH}_4\text{Au}(\text{CN})_4 \cdot \text{H}_2\text{O}$	337.33	col. pl.
30	cynaoaurite	$\text{NH}_4\text{Au}(\text{CN})_2$	267.28	cub. col.
31	cyanoplatinite	$(\text{NH}_4)_2\text{Pt}(\text{CN})_4 \cdot \text{H}_2\text{O}$	353.40	yel. cr.
32	ethyl sulfate	$\text{NH}_4\text{C}_2\text{H}_5\text{SO}_4$	143.16	col. to sl. yelsh. hyg. cr.
33	ferricyanide	$(\text{NH}_4)_3\text{Fe}(\text{CN})_6$	266.07	red. cr.
34	ferrocyanide	$(\text{NH}_4)_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$	338.16	monocl. yel., turns bl. in air
35	fluoborate	NH_4BF_4	104.86	rhomb. pr.
36	fluogallate	$(\text{NH}_4)_3\text{GaF}_6$	237.84	wh. oct. cr.
37	fluogermanate	$(\text{NH}_4)_2\text{GeF}_6$	222.14	col. hex. pr. and bipyr., 1.428, 1.425
38	fluometaphosphate	NH_4PF_6	163.06	col. pl.
39	" , di-	$\text{NH}_4\text{PO}_2\text{F}_2$	119.06	col., rhomb.
40	fluoride	NH_4F	37.04	hex. col., deliq., 1.315 ²⁵
41	fluoride, acid	NH_4HF_2	57.05	rhomb. or tetr., deliq.
42	fluosilicate (crypto-halite)	$(\text{NH}_4)_2\text{SiF}_6$	178.14	cub. or hex., col., 1.370
43	fluotitanate	$(\text{NH}_4)_2\text{TiF}_6$	197.98	hex. pr.
44	fluozirconate	$(\text{NH}_4)_2\text{ZrF}_6$	241.30	rhomb., hex.
45	"	$(\text{NH}_4)_3\text{ZrF}_7$	278.34	col. cub., 1.433
46	formate	NH_4CHO_2	63.06	monocl. wh., deliq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.523	-6H ₂ O, 100; -8H ₂ O, 150		anh. 5.33 ²² ; 3.29 ⁴⁰	1.05 ⁹⁰	
2		exp. 102		v. s.	v. s.	sl. s. al.
3	1.95	d.		10.74 ⁰	42.54 ⁸⁵	s. acet.; sl. s. al.
4	1.527	subl. 335		29.7 ⁰	75.8 ¹⁰⁰	0.6 ¹⁹ al.; s. NH ₃
5				s.		sl. s. al.
6		-5H ₂ O, 100		s.		s. al.
7		275		v. s.	v. s.	s. al.; i. pet. eth.
8	2.856	d.		.556 ⁹ ; .69 ¹⁴	4.38 ⁹⁰	s. HCl; i. al.
9				s.		
10	2.418	d.		sl. s.		
11	2.17	d.		s.		i. al.
12	3.065	d.		.290; 67 ²⁰	3.37 ¹⁰⁰	.005 al.; i. eth., c. HCl
13	2.936	d.		s.	s.	i. al.
14	2.925	d. 120		sl. s.	d.	s. a.
15	2.4	d.		33 ^{14.5}	v. s.	
16	1.91 ¹²	d.		40.5 ³⁰	d.	sl. s. NH ₃ , acet.; i. al.
17	2.15 ²⁵	d.		30.8 ¹⁵	89 ³⁰	s. al.; i. acet.
18		d. 40	exp. 50	sl. s.	d.	sl. s. NH ₃ ; i. al., eth.
19	1.72	94; -9H ₂ O, 100		21.2 ²⁵	32.8 ⁴⁰ ; grn. at 70	s. al., dil. a.
20		d.		v. s.	d.	i. al., eth., acet.
21				v. s.		sl. s. al.
22				v. s.	v. s.	
23				i.		s. a.
24	1.902			20.5 ²⁰	45.4 ⁸⁰	i. al.
25	1.993	d. 110		33.8 ⁰	99.3 ⁸⁰	s. a., al.; sl. s. NH ₃
26				d.	d.	s. NH ₄ I
27		d. 60		v. s.	d.	sl. s. al.; i. eth.
28	1.02 ¹⁰⁰ g/l	d. 36	subl. 40	v. s.	d.	v. s. al.
29		d. 200		v. s.		v. s. al.; i. eth.
30		d. 100		v. s.	v. s.	s. al.; i. eth.
31				s.		
32		99		s.		
33		d.		v. s.		
34		d.		s.	d.	i. al.
35	1.851 ¹⁷	subl.		25 ¹⁶	95 ¹⁰⁰	s. al.
36			d. > 250— GaF ₃	sl. s.		
37	2.564 ²⁵ / ₂₆			s.		i. al., meth. al.
38	2.180 ¹⁸	d.		s.	s.	s. al., acet.
39		213		s.	s.	s. al., acet.
40	1.315	subl.		v. s.	d.	s. al.; i. NH ₃
41	liq. 1.21 ¹² / ₁₂	subl.		v. s.	v. s.	sl. s. al.
42	2.01	subl.		18.6 ¹⁷	55.5 ¹⁰⁰	sl. s. al.; i. acet.
43		d.		s.	s.	i. al., eth.
44	1.154					
45				sl. s.		
46	1.266	116	d. 180	102 ⁰	531 ⁸⁰	s. al., NH ₃

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Ammonium				
1	gallium sulfate.....	$\text{NH}_4\text{Ga}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	496.07	cub. oct. col., 1.4684.....
2	hydroxide.....	NH_4OH	35.05	in soln. only at ord. temp.....
3	iodate.....	NH_4IO_3	192.96	rhomb. or monocl.....
4	metaperiodate.....	NH_4IO_4	208.96	tetr. col.....
5	iodide.....	NH_4I	144.96	cub. col. hyg., 1.701 ²⁵
6	iridium sulfate.....	$\text{NH}_4\text{Ir}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	619.46	yel. red.....
7	iron oxalate (ic).....	$(\text{NH}_4)_3\text{Fe}(\text{C}_2\text{O}_4)_3 \cdot 2\text{H}_2\text{O}$	.....	monocl. grn.....
8	" sulfate (ous).....	$(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	392.14	monocl. grn., 1.487, 1.492, 1.499.....
9	" " (ic).....	$\text{NH}_4\text{Fe}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	482.19	cub. oct., vlt.; effl., 1.4854.....
10	lactate.....	$\text{NH}_4\text{C}_3\text{H}_5\text{O}_3$	107.11	col.-yelsh. syrupy liq.....
11	laurate, acid.....	$\text{NH}_4\text{C}_{12}\text{H}_{23}\text{O}_2 \cdot \text{C}_{12}\text{H}_{24}\text{O}_2$	417.66	wh. sld.....
12	magnesium arsenate.....	$\text{NH}_4\text{MgAsO}_4 \cdot 6\text{H}_2\text{O}$	289.37	tetr. col., 1.608.....
13	" carbonate.....	$(\text{NH}_4)_2\text{CO}_3 \cdot \text{MgCO}_3 \cdot 4\text{H}_2\text{O}$	252.49	wh.....
14	" chloride.....	$\text{NH}_4\text{Cl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$	256.83	rhomb., doub. pyram. deliq.....
15	" chromate.....	$(\text{NH}_4)_2\text{CrO}_4 \cdot \text{MgCrO}_4 \cdot 6\text{H}_2\text{O}$	400.52	monocl. yel., 1.636, 1.637, 1.653.....
16	" phosphate (guanite, struvite).....	$\text{NH}_4\text{MgPO}_4 \cdot 6\text{H}_2\text{O}$	245.48	rhomb. col., 1.495, 1.496, 1.504; NH_3 on exposure
17	magnesium sulfate (boussingaultite).....	$(\text{NH}_4)_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 6\text{H}_2\text{O}$	360.62	monocl. col., 1.472, 1.473, 1.479.....
18	l-malate, acid.....	$\text{NH}_4\text{HC}_4\text{H}_4\text{O}_5$	151.12	rhomb. col.....
19	permanganate.....	NH_4MnO_4	136.97	rhomb.....
20	manganese phosphate(ic).....	$\text{NH}_4\text{MnPO}_4 \cdot \text{H}_2\text{O}$	186.01	wh. cr.....
21	" sulfate (ous).....	$(\text{NH}_4)_2\text{SO}_4 \cdot \text{MnSO}_4 \cdot 6\text{H}_2\text{O}$	391.23	monocl. pa. red, 1.480, 1.484, 1.491.....
22	molybdate.....	$(\text{NH}_4)_2\text{MoO}_4$	196.03	monocl. pr. col.....
23	molybdate (com'l).....	variable.....	.....	monocl. col.-yelsh.....
24	molybdenum oxychloride.....	$(\text{NH}_4)_2\text{MoOCl}_5$	325.32	rhomb. br.-red.....
25	molybdotellurate.....	$3(\text{NH}_4)_2\text{O} \cdot \text{TeO}_3 \cdot 6\text{MoO}_3 \cdot 7\text{H}_2\text{O}$	1321.67	col. rhomb.....
26	".....	$3(\text{NH}_4)_2\text{O} \cdot 2\text{TeO}_3 \cdot 6\text{MoO}_3 \cdot 10\text{H}_2\text{O}$	1551.32	col. monocl.....
27	myristate, acid.....	$\text{NH}_4\text{C}_{14}\text{H}_{27}\text{O}_2 \cdot \text{C}_{14}\text{H}_{28}\text{O}_2$	473.77	wh. sld.....
28	nickel chloride.....	$\text{NH}_4\text{Cl} \cdot \text{NiCl}_2 \cdot 6\text{H}_2\text{O}$	291.20	monocl. grn., deliq.....
29	nickel sulfate.....	$(\text{NH}_4)_2\text{SO}_4 \cdot \text{NiSO}_4 \cdot 6\text{H}_2\text{O}$	394.99	monocl. dk. bl.-grn, 1.495, 1.501. 1.508
30	nitrate.....	NH_4NO_3	80.05	rhomb. col. (monocl. > 32.1°).....
31	nitrite.....	NH_4NO_2	64.05	wh.-yelsh. cr.....
32	oleate, acid.....	$\text{NH}_4\text{C}_{18}\text{H}_{33}\text{O}_2 \cdot \text{C}_{18}\text{H}_{34}\text{O}_2$	581.94	wh. powd.....
33	oxalate.....	$(\text{NH}_4)_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$	142.12	rhomb. col., 1.439, 1.546, 1.594.....
34	oxalate, acid (binoxalate).....	$\text{NH}_4\text{HC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	125.08	rhomb. col.....
35	palmitate, acid.....	$\text{NH}_4\text{C}_{16}\text{H}_{31}\text{O}_2 \cdot \text{C}_{16}\text{H}_{32}\text{O}_2$	529.87	yelsh. soapy mass or yel. powd.....
36	hypophosphate.....	$(\text{NH}_4)_2\text{H}_2\text{P}_2\text{O}_6$	196.14	.....
37	orthophosphate, mono-H.....	$(\text{NH}_4)_2\text{HPO}_4$	132.11	monocl. col.....
38	" , di-H.....	$\text{NH}_4\text{H}_2\text{PO}_4$	115.08	tetr. col., 1.525, 1.479.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.777	.....	.....	30.9 ²⁵	.....	.00864 70% al.
2	.....	-77	.....	s.	.....	.....
3	3.309 ²¹	d. 150	.....	2.6 ¹⁵	14.5 ¹⁰⁰	.....
4	3.056 ¹⁸	exp.	.....	2.7 ¹⁶	.....	.....
5	2.514	subl 551	220 vac.	154.2 ⁰	250.3 ¹⁰⁰	v. s. al., acet., NH ₃ ; sl. s. eth.
6	.....	106	.....	s.	.....	.....
7	1.78	d. 165	.....	42.7 ⁰	345 ¹⁰⁰	.....
8	1.864	d.	.....	26.9 ²⁰	73.0 ⁶⁰	i. al.
9	1.71	230	-12H ₂ O, 230	124 ²⁵	400 ¹⁰⁰	s. dil. a.; i. al.
10	1.19-.21 ¹⁵	.....	.....	∞	.....	∞ al.
11	.....	75	d.	s.	s.	4.8 ⁷ al.; sl. s. eth., acet.
12	1.932 ¹⁵	d.	.....	0.038 ²⁰	0.024 ³⁰	s. a.; i. al.
13	.....	.....	.....	s.	v. s.	s. a.; i. al.
14	1.456	d.	.....	16.7	.....	.....
15	1.84	d.	.....	v. s.	v. s.	.....
16	1.711-.715	d.	.....	0.0231 ⁰ ; 0.052 ²⁰	0.0195 ³⁰	v. s. dil. a.; s. a.; i. al.
17	1.723	>120	.....	17.68 ⁰	130.58 ¹⁰⁰	.....
18	1.5	161	d.	32.2 ^{15.7}	.....	.....
19	2.208	exp.	.....	7.9 ¹⁵	d.	.....
20	.....	.....	.....	0.0031	0.05	i. al., NH ₄ salts
21	1.83	.....	.....	51.3 ²⁵	v. s.	.....
22	2.27	d.	.....	s. (d.)	d.	s. a.; i. al., NH ₃ , SO ₂ , acet.
23	2.498	d.	.....	40	d.	s. a., alk.
24	2.175 ¹¹⁸	.....	.....	s. d.	.....	.....
25	2.78	550 d.	d.	s.	s.	.....
26	.....	550 d.	d.	s.	s.	.....
27	.....	75-90	d.	sl. s.	s.	s. al.; i. e. eth.
28	1.645	.....	.....	v. s.	v. s.	.....
29	1.923	.....	.....	10.4 ²⁰	30 ³⁰	s. (NH ₄) ₂ SO ₄ ; i. al.
30	1.725 ²⁵	169.6	d. 210	118.3 ⁰	871 ¹⁰⁰	3.8 ²⁰ al., 17.1 ²⁰ meth. al.; s. acet., NH ₃
31	1.69	d.	.....	v. s.	d.	s. al.; i. eth.
32	.....	78 d.	.....	s.	s.	31 ⁰ , 80 ⁵⁰ , 47 ¹⁰ al., 13.3 ¹⁵ eth.
33	1.50	d.	.....	2.54 ⁰ ; 4.0 ^{16.8}	11.8 ⁵⁰ ; 34.8	i. NH ₃
34	1.556	d.	.....	s.	.....	i. eth., bz.
35	.....	>100 ⁰	d.	sl. s.	s.	5.0 ⁰ , 8.80 ⁵⁰ al.; 0.23 ¹³ eth.
36	.....	170	.....	.....	.....	.....
37	1.619	d.	d.	42.9 ⁰ ; 57.5 ¹⁰	106.0 ⁷⁰	i. al., acet.
38	1.803 ¹⁹	.....	.....	22.7 ⁰	173.2 ¹⁰⁰	i. acet.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Ammonium				
1	hypophosphate	$\text{NH}_4\text{H}_2\text{PO}_2$	83.08	rhomb. tabl.
2	orthophosphate, di-H.	$\text{NH}_4\text{H}_2\text{PO}_3$	99.08	monocl. col. pr.
3	phosphomolybdate (molybdiphosphate)	$(\text{NH}_4)_3[\text{P}(\text{MoO}_3\text{O}_{10})_4]$	1876.56	yel. powd.
4	phosphotungstate	$(\text{NH}_4)_3\text{PW}_{12}\text{O}_{40} \cdot 5\text{H}_2\text{O}$	3022.26	white
5	picramate	$\text{NH}_4\text{C}_6\text{H}_4\text{N}_3\text{O}_5$	216.16	redsh.-br. cr. powd.
6	picrate	$\text{NH}_4\text{C}_6\text{H}_2\text{N}_3\text{O}_7$	246.14	rhomb. red or yel.
7	praseodymium sulfate	$(\text{NH}_4)_3\text{SO}_4 \cdot \text{Pr}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	846.29	cr.
8	propionate	$\text{NH}_4\text{C}_3\text{H}_5\text{O}_2$	91.11	pr. deliq.
9	d-saccharate, acid	$\text{NH}_4\text{HC}_6\text{H}_5\text{O}_8$	227.17	need. or monocl. pr.
10	salicylate	$\text{NH}_4\text{C}_7\text{H}_5\text{O}_3$	155.15	monocl. col.
11	selenate	$(\text{NH}_4)_2\text{SeO}_4$	179.04	monocl. col., 1.561, 1.563, 1.585
12	selenide	$(\text{NH}_4)_2\text{Se}$	115.04	br.
13	stearate, acid	$\text{NH}_4\text{C}_{18}\text{H}_{35}\text{O}_2 \cdot \text{C}_{18}\text{H}_{37}\text{O}_2$	585.98	wh. cr.
14	succinate	$(\text{NH}_4)_2\text{C}_4\text{H}_4\text{O}_4$	152.15	col. cr.
15	sulfate (mascagnite)	$(\text{NH}_4)_2\text{SO}_4$	132.14	rhomb. col., 1.521, 1.523, 1.533
16	peroxydisulfate	$(\text{NH}_4)_2\text{S}_2\text{O}_8$	228.20	monocl. col., 1.498, 1.502, 1.587
17	sulfate, acid (bisulfate)	NH_4HSO_4	115.11	rhomb.
18	sulfide, mono-	$(\text{NH}_4)_2\text{S}$	68.14	col.-yel. cr., hyg.
19	sulfide, hydro-	NH_4HS	51.11	rhomb. wh.
20	sulfite	$(\text{NH}_4)_2\text{SO}_3 \cdot \text{H}_2\text{O}$	134.16	monocl. col.
21	sulfite, acid (bisulfite)	NH_4HSO_3	99.11	hex. pr.
22	dl-tartrate	$(\text{NH}_4)_2\text{C}_4\text{H}_4\text{O}_6$	184.15	monocl. col.; d, α 1.55, β 1.581
23	dl-tartrate, acid	$\text{NH}_4\text{HC}_4\text{H}_4\text{O}_6$	167.12	monocl. pr. col., 1.519, 1.561, 1.591
24	tellurate	$(\text{NH}_4)_2\text{TeO}_4$	227.69	wh. powd.
25	tellurite	$(\text{NH}_4)_2\text{TeO}_3$	211.69	need. in clusters.
26	thallium chloride	$3\text{NH}_4\text{Cl} \cdot \text{TiCl}_3 \cdot 2\text{H}_2\text{O}$	507.29	eol.
27	thioantimonate	$(\text{NH}_4)_3\text{SbS}_3 \cdot 4\text{H}_2\text{O}$	376.19	yel. pr.
28	thiocarbonate	$(\text{NH}_4)_2\text{CS}_3$	144.27	yel. cr.
29	thiocyanate	NH_4SCN	76.12	monocl. col., deliq.
30	dithionate	$(\text{NH}_4)_2\text{S}_2\text{O}_6 \cdot \frac{1}{2}\text{H}_2\text{O}$	205.21	monocl.
31	thiosulfate	$(\text{NH}_4)_2\text{S}_2\text{O}_3$	148.20	monocl. col.
32	titanium oxalate, basic	$(\text{NH}_4)_2\text{TiO}(\text{C}_2\text{O}_4)_2 \cdot \text{H}_2\text{O}$	294.04	wh. cr. mass.
33	uranyl carbonate	$2(\text{NH}_4)_2\text{CO}_3 \cdot \text{UO}_2 \cdot \text{CO}_3 \cdot 2\text{H}_2\text{O}$	558.29	monocl. yel.
34	valerate	$\text{NH}_4\text{C}_5\text{H}_9\text{O}_2$	119.16	col. or wh. cr.; disg. odor
35	metavanadate	NH_4VO_3	116.99	col. cr., wh.-yelsh.
36	vanadium sulfate	$\text{NH}_4\text{V}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	477.30	red to blue
37	zinc sulfate	$(\text{NH}_4)_2\text{SO}_4 \cdot \text{ZnSO}_4 \cdot 6\text{H}_2\text{O}$	401.68	monocl. wh., 1.489, 1.493, 1.499
38	Antimonious acid, ortho-	H_3SbO_4	188.78	wh. powd.
39	“ “ , pyro-	$\text{H}_5\text{Sb}_2\text{O}_7$	359.55	powd.
40	“ “ , meta-	HSbO_3	170.77	wh. powd.
41	Anti-			
42	monious acid, ortho-	H_3SbO_3	172.78	wh. amor.
43	“ “ , meta-	HSbO_2	154.77	
44	Antimony	Sb	121.76	hex. silv. wh. met.
45	bromide, tri-	SbBr_3	361.51	rhomb. col.
46	chloride, tri- (butter of Sb)	SbCl_3	228.13	rhomb. col., deliq.
47	chloride, penta-	SbCl_5	299.05	liq. or monocl. wh., 1.601 ¹⁴
48	fluoride, tri-	SbF_3	178.76	oct.
49	“ “ , penta-	SbF_5	216.76	oily, col. liq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.515	200	d. 240	s.	s.	s. al., NH ₃ ; i. acet.
2	.....	123	d. 145	171 ¹⁰	v. s.	i. al.
3	.....	d.	.....	sl. s.	sl. s.	s. alk.; i. al., HNO ₃
4	.....	.....	.....	sl. s.	sl. s.	.....
5	.....	.....	.....	s.	.....	s. al.
6	1.719	d.	exp. 423	1.1 ²⁰	s.	sl. s. al.
7	2.531 ^{18.5}	-8H ₂ O, 170	.....	sl. s.	.....	.....
8	1.108 ²⁶	45	.....	v. s.	.....	s. al., ac. a.
9	.....	.....	.....	1.22 ¹⁵	24.35 ¹⁰⁰	i. c. al.; s. h. al.
10	.....	.....	subl.	111 ²⁶	v. s.	28.8 ²⁸ al.
11	2.194	d.	d.	117 ⁷	197 ¹⁰⁰	i. al., NH ₃ , acet.
12	.....	.....	s.	s.	.....	.....
13	.....	110 d.	s.	v. s.	.....	0.3 ²⁵ al., 0.19 ²⁵ eth., 0.08 ²⁵ acet.
14	.....	.....	.....	s.	.....	s. al.
15	1.769	d. 100	.....	70.6 ⁹ ; 76	103.8 ¹⁰⁰	i. al., NH ₃ , acet.
16	1.982	d. 120	.....	58.2 ⁹	v. s.	.....
17	1.78	146.9	.....	100	v. s.	sl. s. al.; i. acet.
18	.....	d.	.....	v. s.	d.	v. s. NH ₃ ; s. al.
19	.....	118 ⁰ d.	subl.	128.1 ¹⁰	d.	s. al.
20	1.41 ²⁶	d.	subl. 150	32.4 ⁹	60.4 ¹⁰⁰ d.	sl. s. al.; i. acet.
21	.....	d.	.....	267 ⁰	620 ⁸⁰	.....
22	1.601	d.	.....	6.3 ¹⁵	d.	sl. s. al.
23	1.636	d.	.....	1 ²⁰	s.	s. a., alk.; i. al.
24	3.01 ²⁶ ; 3.024 ^{24.5}	d.	.....	s.	s.	i. al.; s. dil. a.
25	.....	.....	.....	i.	i.	s. alk., acids, al.
26	2.39	.....	.....	s.	.....	.....
27	.....	d.	.....	71.2 ⁰	d.	i. al.
28	.....	subl.	.....	v. s.	d.	sl. s. al., eth.
29	1.305	149.6	d. 170	128 ⁰ ; 165 ¹⁹	v. s.	s. al., NH ₃ , acet.
30	1.704	d. 130	.....	135 ⁰	v. s.	i. al.
31	.....	d. 150	.....	v. s.	.....	sl. s. acet.; i. al.
32	.....	.....	.....	v. s.	.....	.....
33	2.773	d. 100	.....	5.8 ¹⁹	d.	s. (NH ₄) ₂ CO ₃ , aq. SO ₂
34	.....	d.	.....	s.	.....	s. al., eth.
35	2.326	d.	.....	0.52 ¹⁵	6.95 ⁹⁰ d.	i. al., eth., NH ₄ Cl
36	1.687	49	.....	28.45 ²⁰	.....	.....
37	1.931	d.	.....	anh. 7 ⁰	anh. 42 ⁸⁰	.....
38	6.6	d. 100	.....	sl. s.	sl. s.	s. KOH
39	.....	-H ₂ O, 200	.....	sl. s.	sl. s.	s. alk.
40	6.6	d.	.....	sl. s.	sl. s.	s. a., KOH; i. acet.
41	.....	.....	.....	.....	.....	.....
42	.....	d.	.....	i.	i.	i. al.
43	6.684 ²⁵	630	1380	i.	i.	i. al.
44	4.148 ²³	96.6	280	d.	d.	s. h. conc. H ₂ SO ₄ , aq. reg.
45	3.140 ²⁵	73.4	223	601.6 ⁰	∞ ⁸⁰	s. HCl, HBr, CS ₂ , NH ₃ , al., acet.
46	liq. 2.336	2.8	140; 92 ³⁰	d.	d.	s. al., HCl, tart. a., CS ₂
47	4.379 ^{29.9}	292	subl.	384.7 ⁰	563.6 ³⁰	s. HCl, tart. a.
48	liq. 2.99 ²³	7.0	149.5	s.	.....	i. NH ₃
						s. KF

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Antimony				
1	hydride (stibine)	SbH_3	124.78	col. gas.
2	iodide, tri-	SbI_3	502.52	trig.; monoc. red; rhomb. yel
3	“ , penta-	SbI_5	756.36	br.
4	α -mercaptoacetamide (thioglycolamide)	$\text{Sb}(\text{C}_2\text{H}_4\text{NOS})_3$	392.12	wh. cr.
5	oxide, tri- (senarmontite)	Sb_2O_3	291.52	cub. wh., 2.087
6	“ , tri- (valentinite)	Sb_2O_3	291.52	rhomb. col., 2.18, 2.35, 2.35
7	“ , tetra- (cervantite)	Sb_2O_4	307.52	wh. powd. $n_D = 2.00$
8	“ , penta-	Sb_2O_5	323.52	yel. powd.
9	oxychloride (ous)	SbOCl	173.22	monoc. wh.
10	“ (ous)	$\text{Sb}_4\text{O}_5\text{Cl}_2$	637.95	col. mixt. SbOCl & Sb_2O_3
11	“ (ic)	SbOCl_3	244.13	yel., exist. doubtful
12	selenide, tri-	Sb_2Se_3	480.40	gray cr
13	sulfate (ous)	$\text{Sb}_2(\text{SO}_4)_3$	531.70	wh. powd., deliq.
14	sulfide, tri- (stibnite)	Sb_2S_3	339.70	rhomb. blk.-or. red, 3.194, 4.046, 4.303
15	“ , penta-	Sb_2S_5	403.82	or.-yel. powd.
16	d-tartrate	$\text{Sb}_2(\text{C}_4\text{H}_4\text{O}_6)_3 \cdot 6\text{H}_2\text{O}$	795.83	wh. cr. powd.
17	telluride, tri-	Sb_2Te_3	626.35	gray
18	Antimonyl sulfate	$(\text{SbO})_2\text{SO}_4$	371.58	wh.
19	“ “ , basic	$(\text{SbO})_2\text{SO}_4 \cdot \text{Sb}_2(\text{OH})_4$	683.13	wh.
20	Argon	A	39.944	col. inert gas
Arsenic				
21	Arsenic (black cryst.)	As_4	299.64	hex. silv. gray-blk. met.
22	“ (black amor.)	As_1	299.64	amor. blk.
23	“ (yellow)	As_4	299.64	cub. yel.
24	Arsenic acid , ortho-	$\text{H}_3\text{AsO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$	150.94	wh. translu. cr.; hyg.
25	“ “ , pyro-	$\text{H}_4\text{As}_2\text{O}_7$	265.85	col. cr.
26	“ “ , meta-	HAsO_3	123.92	wh. cr.
Arsenic				
27	bromide, tri-	AsBr_3	314.66	pr., col.-yelsh.; hyg.
28	chloride, tri-	AsCl_3	181.28	oily liq. or need. $n_D = 1.621^{14}$
29	chloride, penta-	AsCl_5	252.20	col. exist. quest.
30	fluoride, tri-	AsF_3	131.91	oily liq.
31	“ , penta-	AsF_5	169.91	gas, col.
32	hydride (solid)	As_2H_2	151.84	brown powd.
33	“ , tri- (arsine)	AsH_3	77.93	gas, col.
34	iodide, di-	AsI_2	328.75	red pr.
35	“ , tri-	AsI_3	455.67	hex., red.
36	“ , penta-	AsI_5	709.51	exist. quest.
37	oxide, tri- (arsenolite)	As_2O_3	197.82	col. cub. or fibrous, 1.755
38	“ , tri- (claudetite)	As_2O_3	197.82	monoc. col., 1.871, 1.92, 2.01
39	“ , tri- (amor. or vitreous)	As_2O_3	197.82	amor. or vitreous
40	oxide, penta-	As_2O_5	229.82	amor. wh.
41	oxychloride (ous)	AsOCl	126.37	brownish
42	phosphide, mono-	AsP	105.93	br. red powd.
43	selenide, tri-	As_2Se_3	386.70	br. cr.
44	sulfide, di- (or mono-) (realgar)	As_2S_2 (or AsS)	213.94 (106.97)	monoc. red-br., 2.46, 2.59, 2.61

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	liq. 2.26 ⁻²⁵ ; 5.30 ⁰ g/l	-88	-17	20 cm ³	4 cm ³	1500 cm ³ al., 2500 cm ³ CS ₂
2	mon. 4.768 ²²	167	401	d.	d.	s. HI, HCl, KI, al., acet., CS ₂
3	.....	.....	79	.....	.....	.....
4	.....	139	.....	200	.....	sl. s. al.; i. eth.
5	5.2	656	1550, subl.	v. sl. s.	sl. s.	s. HCl, KOH, tart. a., ac. a.
6	5.67	656	1550	v. sl. s.	sl. s.	s. HCl, KOH, tart. a., ac. a.
7	4.07	-O, 930	.....	i.	i.	s. HCl, HI, KOH
8	3.78	-O, 380	-2 O, 930	i.	i.	s. HCl, HI, KOH
9	.....	170 d.	.....	i.	d.	s. HCl, acet., CS ₂ ; i. al., NH ₃ , chl.
10	5.01	.....	.....	v. sl. s.	.....	.....
11	.....	d.	.....	i.	d.	s. al.
12	.....	611	.....	v. sl. s.	.....	.....
13	3.625 ⁴	d.	.....	i.	d.	s. a.
14	4.64	550	.....	0.000175 ¹⁸	d.	s. alk., NH ₄ HS, K ₂ S, HCl; i. ac. a.
15	4.120	d.	.....	i.	i.	s. alk., NH ₄ HS, HCl; i. al.
16	.....	.....	.....	s.	.....	.....
17	.....	629	.....	.....	.....	.....
18	4.89	.....	.....	d.	d.	.....
19	.....	.....	.....	i.	d.	5.15 ¹⁵ glyc.
20	1.784 ⁰ g/l; lq. 1.40 ⁻¹⁸⁶ ; cr. 1.65 ⁻²³³	-189.2	-185.7	5.6 ⁰ cm ³	3.01 ⁵⁰ cm ³	.....
21	5.727 ¹⁴	814 ³⁶ at m.	subl. 615	i.	i.	s. HNO ₃
22	4.7	.....	.....	i.	i.	s. HNO ₃ , aq. Cl ₂ , aq. reg., h. alk.
23	2.0 ³⁰	.....	.....	i.	.....	s. CS ₂
24	2.0-2.5	35.5	-H ₂ O, 160	16.7	50	s. alk., al., glyc.
25	.....	d. 206	.....	Forms orthoarsenic acid		
26	.....	d.	.....	Forms orthoarsenic acid		
27	3.54 ²⁵	32.8	221	d.	d.	s. HCl, HBr, CS ₂
28	liq. 2.163	-18	130.2 (122)	d.	d.	s. HBr, HCl, PCl ₃ , al., eth.
29	.....	ca. -40	.....	hydr.	.....	.....
30	liq. 2.666	-8.5	63 ⁷⁸²	d.	d.	s. al., eth., bz., NH ₄ OH
31	7.71 g/l	-80	-53	s.	.....	s. alk., al., eth., bz.
32	.....	d. 200	.....	i.	i.	s. KOH; i. al., eth., CS ₂
33	3.484 g/l	-113.5	-55; d. 230	20 cm ³	sl. s.	sl. s. al., alk.
34	.....	d. 136	.....	d.	.....	s. al., eth., chl., CS ₂
35	4.39 ¹³	146	403	sl. s. d.	30 d.	s. al., eth., chl., bz., CS ₂
36	3.93	76	.....	.....	.....	.....
37	3.865 ²⁵	subl. 193	.....	1.2 ² ; 2.04 ²⁵	11.46 ¹⁰⁰	s. al., alk., HCl
38	4.15	315; subl. 193	.....	1.2 ² ; 2.04 ²⁵	11.46 ¹⁰⁰	s. al., alk., HCl
39	3.738	.....	.....	3.7 ²⁰	10.14 ¹⁰⁰	s. alk., alk. carb., HCl
40	4.086	d. 315	.....	150 ¹⁶	v. s.	s. al., a., alk.
41	.....	.....	d.	d.	d.	.....
42	.....	subl. d.	.....	d.	d.	s. H ₂ SO ₄ , HCl; sl. s. CS ₂ ; i. al., eth., chl.
43	4.75	360	.....	i.	d.	s. alk.
44	α 3.506 ¹⁹ ; β 3.254 ¹⁹	tr. 267; β 307	565	i.	i.	s. K ₂ S, NaHCO ₃

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Arsenic			
1	sulfide, tri- (orpiment)	As_2S_3	246.00	monocl., yel or red $\beta > 2.72$ (Li)
2	" , penta-	As_2S_5	310.12	yellow
3	Auric or Aurous	See <i>Gold</i>		
4	Barium	Ba	137.36	yelsh.-silv. met.
5	acetate	$\text{Ba}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$	273.46	tricl. col., 1.500, 1.517, 1.525
6	arsenate	$\text{Ba}_3(\text{AsO}_4)_2$	689.90	blk.
7	" , acid	$\text{BaHAsO}_4 \cdot \text{H}_2\text{O}$	295.29	rhomb. or monocl. col.
8	azide	$\text{Ba}(\text{N}_3)_2$	221.41	monocl. pr.
9	"	$\text{Ba}(\text{N}_3)_2 \cdot \text{H}_2\text{O}$	239.42	cr. tricl., av. 1.7
10	benzoate	$\text{Ba}(\text{C}_6\text{H}_5\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	415.61	col. nacreous leaf
11	boride	BaB_6	202.28	cub. blk.
12	bromate	$\text{Ba}(\text{BrO}_3)_2 \cdot \text{H}_2\text{O}$	411.21	monocl. col.
13	bromide	BaBr_2	297.19	col. cr.
14	"	$\text{BaBr}_2 \cdot 2\text{H}_2\text{O}$	333.22	monocl. col., 1.713, 1.727, 1.744
15	" fluoride	$\text{BaBr}_2 \cdot \text{BaF}_2$	472.55	pl.
16	butyrate	$\text{Ba}(\text{C}_4\text{H}_7\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	347.59	
17	carbide	BaC_2	161.38	tetr. gray
18	carbonate (witherite)	BaCO_3	197.37	rhomb. wh., 1.529, 1.676, 1.677
19	" (α)	BaCO_3	197.37	hex. wh.
20	" (β)	BaCO_3	197.37	white
21	chlorate	$\text{Ba}(\text{ClO}_3)_2 \cdot \text{H}_2\text{O}$	322.29	monocl. col., 1.562, 1.577, 1.635
22	perchlorate	$\text{Ba}(\text{ClO}_4)_2$	336.27	hex. col.
23	chloride	BaCl_2	208.27	monocl. col.
24	"	BaCl_2	208.27	cub. col.
25	"	$\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$	244.31	rhomb. col., 1.635, 1.646, 1.660
26	" fluoride	$\text{BaCl}_2 \cdot \text{BaF}_2$	383.63	tetr.
27	chloroplatinate	$\text{BaPtCl}_6 \cdot 6\text{H}_2\text{O}$	653.43	rhomb. orange-yel
28	chloroplatinite	$\text{BaPtCl}_4 \cdot 3\text{H}_2\text{O}$	528.47	
29	chromate	BaCrO_4	253.37	rhomb. yel.
30	dichromate	BaCr_2O_7	353.38	monocl. red
31	"	$\text{BaCr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$	389.41	br. red-yel. need.
32	citrate	$\text{Ba}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 7\text{H}_2\text{O}$	916.39	wh. powd.
33	cyanide	$\text{Ba}(\text{CN})_2$	189.40	wh. cr. powd.
34	cyanoplatinite	$\text{BaPt}(\text{CN})_4 \cdot 4\text{H}_2\text{O}$	508.73	(a) monocl. yel., α 1.6704 (b) rhomb. grn.
35	ethylsulfate	$\text{Ba}(\text{C}_2\text{H}_5\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$	423.63	wh. lust. leaf
36	ferrocyanide	$\text{Ba}_2\text{Fe}(\text{CN})_6 \cdot 6\text{H}_2\text{O}$	594.77	monocl. yel.
37	fluoride	BaF_2	175.36	cub. col.
38	" iodide	$\text{BaF}_2 \cdot \text{BaI}_2$	566.56	pl.
39	fluosilicate	BaSiF_6	279.42	rhomb. need.
40	formate	$\text{Ba}(\text{CHO}_2)_2$	227.40	rhomb. col., 1.573, 1.597, 1.636
41	d-gluconate	$\text{Ba}(\text{C}_6\text{H}_{11}\text{O}_7)_2 \cdot 3\text{H}_2\text{O}$	581.71	pr. or rhomb. leaf
42	hydride	BaH_2	139.38	gray cr.
43	hydroxide	$\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$	315.51	monocl. col., 1.471, 1.502, 1.50
44	iodate	$\text{Ba}(\text{IO}_3)_2$	487.20	monocl.
45	"	$\text{Ba}(\text{IO}_3)_2 \cdot \text{H}_2\text{O}$	505.22	monocl. col.
46	iodide	$\text{BaI}_2 \cdot 2\text{H}_2\text{O}$	427.23	rhomb. col., deliq.
47	laurate	$\text{Ba}(\text{C}_{12}\text{H}_{23}\text{O}_2)_2$	535.97	wh. leaf. cr.
48	malate	$\text{BaC}_4\text{H}_4\text{O}_5$	269.43	
49	malonate	$\text{BaC}_3\text{H}_2\text{O}_4 \cdot \text{H}_2\text{O}$	257.42	
50	manganate	BaMnO_4	256.29	hex. gray-grn.
51	permanganate	$\text{Ba}(\text{MnO}_4)_2$	375.22	br.-vlt. cr.
52	methylsulfate	$\text{Ba}(\text{CH}_3\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$	395.58	col. effl. cr.
53	molybdate	BaMoO_4	297.31	wh. powd.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	3.43	300	707	0.00005 ¹⁸	sl. s.	s. al., alk., alk. carb.
2			subl.	i.	i.	s. alk., HNO ₃ , alk. sulf.
3						
4	3.5 ²⁰	850	1140	d. ev. H ₂	d.	s. al., a.; i. bz.
5	2.19, anh. 2.47	d.		76.4 ²⁶	74 ⁷⁰	sl. s. al.
6				0.055		s. a., NH ₄ Cl
7	3.93 ¹⁵	—H ₂ O, 150		sl. s.	d.	
8	2.936					
9		exp.		v. s.	v. s.	sl. s. al.; i. eth.
10		—2H ₂ O, 100		s.		sl. s. al.
11	4.36 ¹⁵			i.	i.	s. HNO ₃
12	3.99 ¹⁸	d. 260		0.8	5.67 ¹⁰⁰	i. al., acet.
13	4.781 ²⁴	847		98 ⁰	149 ¹⁰⁰	v. s. meth. al.
14	3.58 ²⁴	—H ₂ O, 75	—2H ₂ O, 120	151 ²⁰	204 ¹⁰⁰	v. s. meth. al.; s. al.
15	4.96 ¹⁸			d.	d.	s. conc. HCl, HNO ₃ ; i. al.
16				37.42 ⁹	42.12 ⁹⁰	
17	3.75			d. to C ₂ H ₂		d. a.
18	4.43	tr. 811 to α	d. 1450	0.0022 ¹⁸	0.0065 ¹⁰⁰	s. a., NH ₄ Cl; i. al.
19	4.43	tr. 982 to β	d.	0.002 ²⁰	0.006 ¹⁰⁰	s. a., NH ₄ Cl; i. al.
20		1740 ⁹⁰ atm.	d.	0.0022 ¹⁸	0.0065 ¹⁰⁰	s. a., NH ₄ Cl; i. al.
21	3.18	anh. 414	—H ₂ O, 120	27.4 ²⁵	111.2 ¹⁰⁰	sl. s. al., acet., HCl
22	(3H ₂ O) 2.74	505		198.5 ²⁵	v. s.	v. s. al.
23	3.856 ²⁴	tr. 925 to cub.	1560	31 ⁰	59 ¹⁰⁰	sl. s. HCl, HNO ₃ ; i. al.
24		962	1560			
25	3.097 ²⁴	—2H ₂ O, 113		35.7 ²⁰	58.7 ¹⁰⁰	sl. s. HCl, HNO ₃ ; i. al.
26	4.51 ¹⁸			d.	d.	s. conc. HCl, HNO ₃ ; i. al.
27	2.868	—5H ₂ O, 70		s.		d. a.; i. eth., meth. al.
28	2.868			s.		v. s. al.
29	4.498 ¹⁵			.00034 ¹⁵	.00044 ²⁸	s. min. a.
30				sl. s.		s. h. conc. H ₂ SO ₄
31				d.		s. conc. soln. CrO ₃
32				0.0406 ¹⁸		sl. s. al.
33				80 ¹⁴		18 ¹⁴ 70 % al.
34	(a) 2.076 (b) 2.085	—2H ₂ O, 100		sl. s.	s.	i. al.
35				s.		sl. s. al.
36				0.17 ¹⁵	0.9 ¹⁰⁰	
37	4.83	1280	2137	0.17 ¹⁰	sl. s.	s. a., NH ₄ Cl
38	5.21 ¹⁸			d.	d.	s. conc. HCl, HNO ₃ ; i. al.
39	4.29 ²¹			0.026 ¹⁷	0.09 ¹⁰⁰	sl. s. a., NH ₄ Cl; i. al.
40	3.21			27.76 ⁹	39.71 ⁸⁰	i. al., eth.
41		—3H ₂ O, 100; 120 d.		3.3 ^{15,5}		i. al.
42	4.21 ⁹	d. 675	1400	d. to Ba(OH) ₂ +H ₂		d. a.
43	2.18 ¹⁶ ; anh. 4.50	78	—8H ₂ O, 780	5.6 ¹⁵	94.7 ⁷⁸	sl. s. al.
44	4.998	d.		0.022	0.197	s. HNO ₃ , HCl
45	5.23	—H ₂ O, 130		v. sl. s.	sl. s.	s. HCl, HNO ₃ ; i. al., acet., H ₂ SO ₄
46	515; anh. 4.917	740 d.	—2H ₂ O, 539	200 ¹⁵	269 ¹⁰⁰	1.07 ¹⁵ al.; s. acet.
47		260		0.008 ^{15,3}	0.011 ⁵⁰	0.008 ²⁵ al., 0.006 ²⁵ eth.
48				0.883 ²⁰	1.044 ⁸⁰	
49				0.143 ⁹	0.326 ⁸⁰	
50	4.85			v. sl. s.		s. a.
51				62.5 ¹¹	75.4 ²⁵	
52				s.		s. al.
53				0.0058 ²³		sl. s. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Barium				
1	myristate.....	$\text{Ba}(\text{C}_{14}\text{H}_{27}\text{O}_2)_2$	592.08	wh. cr. powd.
2	nitrate (nitrobarite).....	$\text{Ba}(\text{NO}_3)_2$	261.38	cub. col., 1.572
3	nitrite.....	$\text{Ba}(\text{NO}_2)_2 \cdot \text{H}_2\text{O}$	247.39	hex. col.-yelsh.
4	oxalate.....	BaC_2O_4	225.38	cr.
5	oxide.....	BaO	153.36	cub. or hex., col.; wh.-yelsh. powd.
6	" , per-.....	BaO_2	169.36	wh.-gray powd.
7	" ".....	$\text{BaO}_2 \cdot 8\text{H}_2\text{O}$	313.49	hex. col.
8	palmitate.....	$\text{Ba}(\text{C}_{16}\text{H}_{31}\text{O}_2)_2$	648.18	wh. cr. powd.
9	hypophosphate.....	BaPO_3	216.38	need.
10	orthophosphate, tri-.....	$\text{Ba}_3(\text{PO}_4)_2$	602.12	cub. wh.
11	" , di-.....	BaHPO_4	233.39	rhomb. wh.
12	" , mono-.....	$\text{BaH}_4(\text{PO}_4)_2$	331.43	tricl.
13	pyrophosphate.....	$\text{Ba}_2\text{P}_2\text{O}_7$	448.76	rhomb. wh.
14	hypophosphite.....	$\text{Ba}(\text{H}_2\text{PO}_2)_2 \cdot \text{H}_2\text{O}$	285.45	monocl. wh.
15	propionate.....	$\text{Ba}(\text{C}_3\text{H}_5\text{O}_2)_2 \cdot \text{H}_2\text{O}$	301.52	rhomb., β 1.518
16	salicylate.....	$\text{Ba}(\text{C}_7\text{H}_5\text{O}_3)_2 \cdot \text{H}_2\text{O}$	429.60	wh. need.
17	selenate.....	BaSeO_4	280.32	rhomb.
18	metasilicate.....	BaSiO_3	213.42	rhomb. col., 1.673, 1.674, 1.678
19	".....	$\text{BaSiO}_3 \cdot 6\text{H}_2\text{O}$	321.52	rhomb., 1.542, 1.548, 1.548
20	stearate.....	$\text{Ba}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	704.29	wh. powd.
21	succinate.....	$\text{BaC}_4\text{H}_4\text{O}_4$	253.43	
22	sulfate (barite).....	BaSO_4	233.42	rhomb. wh. (monocl.), 1.637, 1.638, 1.649
23	peroxydisulfate.....	$\text{BaS}_2\text{O}_8 \cdot 4\text{H}_2\text{O}$	401.54	monocl. wh.
24	sulfide, mono-.....	BaS	169.42	cub. col.
25	" , tri-.....	BaS_3	233.54	yel.-grn.
26	" , tetra-.....	$\text{BaS}_4 \cdot 2\text{H}_2\text{O}$	301.63	rhomb.
27	" , hydro-.....	$\text{Ba}(\text{HS})_2 \cdot 4\text{H}_2\text{O}$	275.56	rhomb. yel.
28	sulfite.....	BaSO_3	217.42	cub. (hex.) col.
29	tartrate.....	$\text{BaC}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$	303.45	
30	tellurate.....	$\text{BaTeO}_4 \cdot 3\text{H}_2\text{O}$	353.02	voluminous wh.
31	pyrotellurate, acid.....	$\text{Ba}(\text{HTe}_2\text{O}_7)_2 \cdot \text{H}_2\text{O}$	891.83	voluminous ppt.; yel.-hot; wh.-cold.
32	thiocyanate.....	$\text{Ba}(\text{SCN})_2 \cdot 2\text{H}_2\text{O}$	289.55	need.
33	dithionate.....	$\text{BaS}_2\text{O}_6 \cdot 2\text{H}_2\text{O}$	333.51	rhomb., or monocl. col., 1.586, 1.595, 1.607
34	thiosulfate.....	BaS_2O_3	249.48	rhomb. wh.
35	".....	$\text{BaS}_2\text{O}_3 \cdot \text{H}_2\text{O}$	267.50	wh. cr. powd.
36	thiotellurite.....	Ba_3TeS_6	699.99	rect. pr. pa. yel.
37	tungstate.....	BaWO_4	385.28	tetr. col.
38	metatungstate.....	$\text{BaW}_4\text{O}_{13} \cdot 9\text{H}_2\text{O}$	1243.19	rhomb.
39	Beryllium (glucinum).....	$\text{Be}(\text{Gl})$	9.02	hex. gray met.
40	acetate.....	$\text{Be}(\text{C}_2\text{H}_3\text{O}_2)_2$	127.11	pl.
41	" basic.....	$\text{BeO} \cdot 3\text{Be}(\text{C}_2\text{H}_3\text{O}_2)_2$	406.35	oct.
42	" propionate, basic.....	$\text{BeO} \cdot 3\text{Be}(\text{C}_2\text{H}_3\text{O}_2)_2$ $(\text{C}_2\text{H}_5\text{O}_2)$	448.42	
43	aluminate (chrysoberyl).....	$\text{Be}(\text{AlO}_2)_2$	126.96	rhomb., 1.747, 1.748, 1.757
44	aluminum silicate (euclase).....	$2\text{BeO} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot \text{H}_2\text{O}$	290.12	monocl., 1.652, 1.655, 1.671
45	" " (beryl).....	$3\text{BeO} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$	537.36	hex. col., transp., 1.580, 1.574
46	benzenesulfonate.....	$\text{Be}(\text{C}_6\text{H}_5\text{SO}_3)_2$	323.34	monocl.
47	orthoborate, basic (hambergite).....	$\text{Be}_2(\text{OH})\text{BO}_3$	93.87	rhomb., 1.560, 1.591, 1.631
48	bromide.....	BeBr_2	168.85	wh. need., deliq.
49	butyrate, basic.....	$\text{BeO} \cdot 3\text{Be}(\text{C}_4\text{H}_7\text{O}_2)_2$	574.66	
50	carbide.....	Be_2C	30.05	hex. yel.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				0.007 ²⁵	0.010 ⁵⁰	0.009 ²⁵ al.; 0.003 ²⁵ eth.; 0.046 ¹⁵ meth. al.
2	3.24 ²³	592	d.	8.7 ²⁰	34.2 ¹⁰⁰	sl. s. a.; i. al.
3	3.173 ²⁹	d. 115		63 ²⁰	109.6 ⁸⁰	v. s. HCl; 1.6 al.; i. acet.
4	2.658			0.0093 ¹⁸	0.0228 ¹⁰⁰	s. a., NH ₄ Cl; i. al.
5	5.72; hex. 5.32	1923	ca. 2000	1.5 ⁰ d.	90.8 ⁵⁰	s. dil. a., al.; i. NH ₃ , acet.
6	4.96	450	-O, 800	v. sl. s.	d.	s. dil. a.; i. acet.
7		-8H ₂ O, 100		0.168	d.	s. dil. a.; i. al., eth., acet
8		d.		0.004 ¹⁵	0.007 ⁵⁰	0.001 ²⁵ eth.; 0.008 ^{16,5} al.
9				sl. s.		s. al.; v. sl. s. ac. a.
10	4.1 ¹⁶			i.	i.	s. a.
11	4.165 ¹⁵			0.01-0.02		s. a., NH ₄ Cl
12	2.9 ⁴			d.	d.	s. a.
13	3.9 ²⁰			0.01	sl. s.	s. a., NH ₄ salts
14	2.90 ¹⁷	d.		30 ¹⁵	33 ¹⁰⁰	i. al.
15		300 d.		48 ⁰	67.9 ³⁰	.08 al.
16				s.		
17	4.75	d.		0.0118	0.0138 ¹⁰⁰	s. HCl; i. HNO ₃
18	4.399	1604		s.	d.	s. HCl
19	2.59					
20				0.004 ¹⁵	0.006 ⁵⁰	0.005 ^{16,5} , 0.008 ²⁹ al.; 0.001 ²⁵ eth.
21				0.421 ⁰	0.237 ³⁰	sl. s. al.
22	4.50 ¹⁶	1580	tr. 1149-monocl.	.00023 ¹⁸	.00039 ¹⁰⁰	.006 3% HCl; sl. s. H ₂ SO ₄
23		d.		52.2 ⁰	d.	i. al.
24	4.25 ¹⁵			d.	d.	i. al.
25				s.	s.	
26	2.988	d. 300		41 ¹⁵	v. s.	i. al., CS ₂
27		d. 50		s.		i. al.
28			d.	0.02 ²⁰	0.002 ⁸⁰	v. s. HCl
29	2.980 ^{20,8}			0.026 ¹⁸	0.058 ⁹⁰	0.032 ¹⁸ al.
30	4.2, dried at 200	d. >200		sl. s.	sl. s.	s. HCl, HNO ₃
31				s.	s.	acids
32				43 ²⁰	s.	35 ²⁰ al.
33	4.536 ^{13,5}	d.		24.75 ¹⁸	90.9 ¹⁰⁰	sl. s. al.
34		d.		0.2		
35	3.5			v. sl. s.		
36				sl. s.	sl. s.	
37	5.04			sl. s.	sl. s.	d. a.
38	4.30			d.	v. s.	
39	1.85	1350	1530 ⁵	i.	sl. s. d.	s. dil. a., alk.; i. Hg
40		d. 300		i.		i. al., eth., CCl ₄
41	1.36 ⁴	234	331	sl. d.	d.	s. chl., ac. a.; sl. s. al., eth.
42		127	330			
43	3.76					i. a.
44	3.1					
45	2.66	1410 ± 100				i. a.
46				v. s.	v. s.	v. s. ac. a., al., acet.; i. CS ₂ , eth., bz., CCl ₄
47	2.35					
48	3.465 ²⁵	490 ± 10 subl.	520	s.	v. s.	s. al., eth.; i. bz.
49			239 ¹⁹			
50	1.90 ¹⁵	>2100 d.		d.	d.	s. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Beryllium				
1	carbonate	$\text{BeCO}_3 \cdot 4\text{H}_2\text{O}$	141.09	col.
2	chloride	BeCl_2	79.93	col. need., deliq.
3	"	$\text{BeCl}_2 \cdot 4\text{H}_2\text{O}$	152.00	monocl. wh., deliq.
4	fluoride	BeF_2	47.02	amor. col.
5	hydroxide	$\text{Be}(\text{OH})_2$	43.04	wh. amor. powd. or cr.
6	iodide	BeI_2	262.86	col. need.
7	nitrate	$\text{Be}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$	187.08	wh.-yelsh. cr., deliq.
8	nitride	Be_3N_2	55.08	cub., col.
9	oxalate	$\text{BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$	151.09	rhomb., β 1.487
10	oxide (bromellite)	BeO	25.02	hex. wh. or amor. powd., 1.719, 1.733
11	2,4-pentanedione deriv. (acetylacetonate)	$\text{Be}(\text{C}_5\text{H}_7\text{O}_2)_2$	207.23	monocl. wh.
12	orthophosphate	$\text{Be}_3(\text{PO}_4)_2 \cdot 3\text{H}_2\text{O}$	271.15	....
13	propionate, basic	$\text{BeO} \cdot 3\text{Be}(\text{C}_3\text{H}_5\text{O}_2)_2$	490.50	monocl.
14	selenate	$\text{BeSeO}_4 \cdot 4\text{H}_2\text{O}$	224.04	rhomb., 1.466, 1.501, 1.503
15	orthosilicate (phenacite)	Be_2SiO_4	110.10	tricl., 1.654, 1.670
16	" (bertrandite)	$2\text{Be}_2\text{SiO}_4 \cdot \text{H}_2\text{O}$	238.22	rhomb., 1.591, 1.605, 1.614
17	sulfate	BeSO_4	105.08	....
18	"	$\text{BeSO}_4 \cdot 4\text{H}_2\text{O}$	177.14	tetr. col., 1.472, 1.440
19	sulfide	BeS	41.08	....
20	Bismuth	Bi	209.00	hex. silv. wh. or redsh. met.
21	acetate	$\text{Bi}(\text{C}_2\text{H}_3\text{O}_2)_3$	386.13	wh. cr.
22	orthoarsenate	BiAsO_4	347.91	monocl., 2.14, 2.15, 2.18
23	benzoate	$\text{Bi}(\text{C}_7\text{H}_5\text{O}_2)_3$	572.33	wh. powd.
24	bromide, mono-	BiBr	288.92	....
25	" , tri-	BiBr_3	448.75	yel. cr. powd., deliq.
26	carbonate, basic (oxycarbonate, subcarbonate)	$\text{Bi}_2\text{O}_2\text{CO}_3$	510.01	wh. powd.
27	chloride, mono-	BiCl	244.46	....
28	" , di-	BiCl_2	279.91	blk. need (exist. quest.)
29	" , tri-	BiCl_3	315.37	wh. cr., deliq.
30	" , tetra-	BiCl_4	350.83	col. cr.
31	dichromate, basic	$(\text{BiO})_2\text{Cr}_2\text{O}_7$	666.02	yel.-or. red.
32	citrate	$\text{BiC}_6\text{H}_5\text{O}_7$	398.10	wh. cr.
33	fluoride, tri-	BiF_3	266.00	cub. gray cr.
34	gallate, basic (dermatol)	$\text{Bi}(\text{OH})_2\text{C}_2\text{H}_5\text{O}_5$ (approx.)	412.13	yel. cr.
35	hydride (bismuthine)	BiH_3	212.02	liq.
36	hydroxide	$\text{Bi}(\text{OH})_3$	260.02	wh. amor. powd.
37	iodate	$\text{Bi}(\text{IO}_3)_3$	733.76	wh.
38	iodide, tri-	BiI_3	589.76	hex. redsh. br.-gray bl.
39	dl-lactate	$\text{Bi}(\text{C}_6\text{H}_5\text{O}_6) \cdot 7\text{H}_2\text{O}$	512.25	pr. need.
40	nitrate	$\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$	485.11	tricl. col., sl. hyg.
41	" , basic (oxynitrate, subnitrate)	$\text{BiONO}_3 \cdot \text{H}_2\text{O}$	305.02	hex. pl. or wh. powd.
42	oxalate	$\text{Bi}_2(\text{C}_2\text{O}_4)_3$	682.06	....
43	oxide, di-	Bi_2O_3	241.00	....
44	" "	$\text{BiO}_2 \cdot 2\text{H}_2\text{O}$	277.03	br.-yel.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		-4H ₂ O, 100		0.36 ⁰		i. NH ₃
2	1.899 ²⁵	440 ± 10	520	v. s.	v. s. d.	v. s. al., eth., bz., pyr.; sl. s. chl., CS ₂ ; i. acet., NH ₃
3				v. s.	v. s.	s. al.
4	1.986 ²⁵	800		∞	∞	s. al., H ₂ SO ₄
5	1.909 (cr.)	d.		i.	i.	s. a., alk., (NH ₄) ₂ CO ₃
6	4.325 ²⁵	510 ± 10	590	d.	d.	s. al., eth., CS ₂
7		60	d. 100-200	v. s.	v. s.	v. s. al.
8		2200 ± 100	d. 2240	d.	d.	d. a., conc. alk.; i. al.
9		-2H ₂ O, 100, -3H ₂ O, 220	d. 350	38.22 ²⁵		
10	3.025	2570	ca. 3900	.00002 ²⁰		s. conc. H ₂ SO ₄ , fus. KOH; i. dil. a., alk.
11	1.168 ⁴	108	270	sl. s.	d.	s. a., al., eth.
12		-H ₂ O, 100		s.	s.	s. ac. a.
13		120				
14	2.03	-2H ₂ O, 100; -4H ₂ O, 300				
15	3.0					
16	2.6					
17	2.443	d. 540		i.	d. to BeS	O ₄ .4H ₂ O
18	1.713 ^{10.5}	-2H ₂ O, 100	-4H ₂ O, 250	42.5 ²⁵	100 ¹⁰⁰	sl. s. conc. H ₂ SO ₄
19	2.36			d.	d.	
20	9.80	271	1470 (1420-1560)	i.	i.	s. HNO ₃ , h. H ₂ SO ₄ , aq. reg.; sl. s. h. HCl
21		d.		i.	i.	s. ac. a.
22	7.14			i.		s. a.; i. eth.
23				i.		
24		287				
25	5.7	218	453	d. to BiOBr	d.	s. HCl, HBr, eth.; i. al.
26	6.86	d.		i.	i.	s. a.
27		320				
28	4.86	163	d. 300	d.		
29	4.75	230-2	447	d. to BiOCl	d.	m. a., al., eth., acet.
30		225		d.		
31				i.	i.	s. a.; i. alk.
32	3.458	d.		sl. s.	sl. s.	s. NH ₄ OH; sl. s. al.
33	8.75			i.		s. a., acet.; i. al.
34		d.		i.		i. al., eth.
35			22			
36	4.36	-H ₂ O, 100 d. 415	-1½H ₂ O, 400	0.00014	d.	s. a.; i. or sl. s. conc. alk.
37				i.	d.	sl. s. HNO ₃ ; s. HI, KI, 3.5 abs. al.
38	5.7	439 (408)	d. 500	i.	d.	s. HCl, HI, KI, 3.5 abs. al.
39				14.4 ²⁵		
40	2.83	d. 30	-5H ₂ O, 80	d.	d.	v. s. HNO ₃ ; s. a., 42 ¹⁹ acet.
41	4.928 ¹⁵	d. 260		i.	i.	s. a.; i. al.
42				i.	i.	s. a.
43	5.6					
44	5.6	-H ₂ O, 110	-2H ₂ O, 180; -O, 305	i.		s. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Bismuth				
1	oxide, tri-	Bi_2O_3	466.00	rhomb. yel.
2	" "	Bi_2O_3	466.00	cub. gray-blk.
3	" "	Bi_2O_3	466.00	rhomb., 1.91, av., wh. lt.
4	" " (bismite)	$\text{Bi}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$	520.05	rhomb., 2.01, 1.82
5	" pent-	Bi_2O_5	498.00	br. or dk. red.
6	" "	$\text{Bi}_2\text{O}_5 \cdot \text{H}_2\text{O}$ (or HBiO_3)	516.02 (258.01)	red.
7	oxybromide	BiOBr	304.92	col. cr. or wh. powd.
8	oxychloride	BiOCl	260.46	cr. or wh. powd.
9	oxyfluoride	BiOF	244.00	wh. cr. or powd.
10	oxyiodide	BiOI	351.92	rhomb. red cr.
11	orthophosphate	BiPO_4	304.02	monocl. wh.
12	propionate, basic	$\text{BiOC}_3\text{H}_5\text{O}_2$	298.07	wh. powd.; faint odor prop. acid.
13	salicylate	$\text{Bi}(\text{C}_7\text{H}_5\text{O}_3) \cdot 2\text{H}_2\text{O}$	382.14	wh. powd.
14	" basic (oxysalicylate) (subsalsicylate)	$\text{Bi}(\text{C}_7\text{H}_5\text{O}_3)_3 \cdot \text{Bi}_2\text{O}_3$	1086.33	wh. micro. cr.
15	selenide, tri- (guanajuatite)	Bi_2Se_3	654.88	rhomb. blk.
16	sulfate	$\text{Bi}_2(\text{SO}_4)_3$	706.18	wh. need.
17	sulfide, mono-	BiS	241.06	gray (exist. quest)
18	" tri- (bismuthinite)	Bi_2S_3	514.18	rhomb. br.-blk., 1.315, 1.900, 1.670.
19	tartrate	$\text{Bi}_2(\text{C}_4\text{H}_4\text{O}_6)_3 \cdot 6\text{H}_2\text{O}$	970.31	wh. powd.
20	telluride (montanite)	$\text{Bi}_2\text{Te}_6 \cdot 2\text{H}_2\text{O}$	677.64	biaxial, β 2.09
21	telluride, tri- (tetradymite)	Bi_2Te_3	800.83	rhbdr., gray
22	Boric acid , ortho- (boracic acid)	H_3BO_3	61.84	tricl. col., 1.340, 1.456, 1.459
23	" " tetra- (pyro-)	$\text{H}_2\text{B}_4\text{O}_7$	157.30	vitr. or wh. powd.
24	Borinetriamine , tri-	$\text{B}_3\text{N}_3\text{H}_6$	80.53	col. liq.
25	Borinoaminoborine	$\text{B}_2\text{H}_7\text{N}$	42.70	col. liq.
26	Boron	B	10.82	monocl. yel. or br. amor. powd., 2.5 lq. ($\lambda 579\mu$)
27	bromide	BBr_3	250.57	col. fum. liq., 1.553 ^{±.3} (F)
28	" (mono-) hydride,	$\text{B}_2\text{H}_5\text{Br}$	106.60	col. gas.
29	" penta-			
30	(mono-) iodide, di-	BBrI_2	344.58	col. liq.
31	" (di-) iodide	BBr_2I	297.57	col. liq.
32	carbide	B_4C	55.29	blk. cr.
33	chloride	BCl_3	117.19	col. fum. liq., 1.428 ^{±.7} (F)
34	chloride (mono-) hydride,	$\text{B}_2\text{H}_5\text{Cl}$	62.14	col. gas, highly unstable
35	penta-fluoride	BF_3	67.82	col. gas.
36	hydride (diborane, borocethane)	B_2H_6	27.69	col. gas; sickly sweet odor in low conc.
37	hydride (dihydrotetra-borane, borobutane)	B_4H_{10}	53.36	col. pois. gas, disg. odor.
38	hydride (pentaborane, stable)	B_5H_9	63.17	col. liq., pois., bad odor, spont. inflam.
39	hydride (pentaborane, unstable; dihydropentaborane)	B_5H_{11}	65.19	col. liq., turns yel. on standing.
40	hydride (hexaborane)	B_6H_{10}	75.00	col. liq. turns yel. on standing.
41	" (decaborane)	$\text{B}_{10}\text{H}_{14}$	122.31	col. need. rhomb.
42	iodide	BI_3	391.58	col. pl., hyg.
43	iodide (mono-) hydride,	$\text{B}_2\text{H}_5\text{I}$	153.60	col. mobile liq.
44	penta-nitride, mono-	BN	24.83	amor. wh.
45	" di-	BN_2	38.84	
46	oxide (boric anhydride)	B_2O_3	69.64	vitr. col., 1.464
47	phosphide	BP	41.84	maroon powd.
48	selenide, tri-	B_2Se_3	258.52	yel. gray powd.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	8.9	820	1890 (?)	i.	i.	s. a.
2	8.20	tr. 704		i.	i.	s. a.
3	8.5	860				sl. s. a.
4	4.36	d. 415				
5	5.10	O, 150	-2 O, 357	i.	i.	s. a., KOH
6	5.75	-H ₂ O, 120	-2 O, 300 (357)	i.	i.	s. a., KOH
7	8.08			i.		s. a.; i. al.
8	7.72	red ht.		i.	i.	s. a.; i. acet., tart. a., NH ₃
9	7.5	d.		i.		s. a.
10	7.92	d.		i.		s. a.; i. al., chl., KI
11	6.323 ¹⁵	d.		i.	i.	s. HCl; i. dil. HNO ₃ , al.
12				i.		v. s. dil. HCl; i. al.
13		135 d.		d.		
14				i.		s. a., alk.; i. al., eth.
15	6.82	710	d.	i.		i. alk.
16	5.08 ¹⁵	d.		d.	d.	s. a.
17	7.7	685		v. sl. s.		
18	7.39	685 d.		0.000018 ¹⁸		s. HNO ₃ ; i. dil. a.
19	2.595 ²³	-3H ₂ O, 105		i.	i.	s. a., alk.; i. al.
20	3.79					
21	7.7	573				
22	1.435 ¹⁵	185 d.	-1½H ₂ O, 300	1.95 ⁹ ; 5.15 ²¹	39.1 ¹⁰⁰	28 ²⁰ glyc., .0078 eth., 5.56 al.; sl. s. acet.
23				s.	s.	s. al.
24	0.824 ⁹ ; 0.898 ³⁷	-58	53	hyd.	hyd.	
25		-66.5	76.2			s. in triborine triamine
26	2.3; 1.73 (am.)	2300	2550	i.	i.	s. HNO ₃ , H ₂ SO ₄ ; i. al., eth., alk.
27	2.650 ⁹	-46	90.1 ⁷⁴⁰	d.	BO ₂ +	s. al., CCl ₄
28		-104	ca. 10	hyd. to H HBr + H ₂		
29			180	d.	d.	
30			125	d.	d.	
31	2.508-522	2350	>3500	i.	i.	s. fus. alk.; i. a.
32	1.434 ⁹	-107	12.5	d. to HCl	+ H ₃ BO ₃	d. al.
33			-78 ¹⁸	hyd.		
34	2.99 g/l	-127	-101	106 cm ³	d.	d. al.; s. conc. H ₂ SO ₄
35	lq. 0.447 ⁻¹¹² ; sld. 0.577 ⁻¹⁸³	-165.5	-92.5	sl. s. d. to H ₃ BO ₃ + H ₂		s. NH ₄ OH
36	lq. 0.59 ⁻⁷⁰ ; 0.56 ⁻³⁵	-120 (-112)	17.6-18.0	sl. s., hyd.		d. al.; s. bz.
37	0.61 ⁹	-46.6	0 ⁶⁶	hyd.		
38		-123.4	65	hyd.		
39		-65.1	07.2	hyd.		
40	0.94; liq. 0.78 ¹⁰⁰	99.7	100 ¹⁹ ; 156 ^{192.4} ; 213 extrap.	sl. s.	d.	v. s. CS ₂ ; s. al., eth., bz.
41	3.35 ⁶⁰	43	210	d.	d.	d. al.; v. s. CS ₂ , CCl ₄ , bz.
42	liq. 1.8 ⁻¹⁰⁸ ; sld. 2.0 ⁻¹¹²	-110	07 ⁷⁸	hyd. to H	BO ₂ + HI	+ H ₂
43	2.25	ca. 2730	subl. 1230 ^{9.4}	i.	i.	d. HCl, HF, H ₂ SO ₄
44						
45	1.844	ca. 577		d. 1.1 ⁹	15.7 ¹⁰⁰	s. a., al.
46		ign. 200		i.	i.	i. all solv.
47				d.	d.	

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Boron				
1	(tri-) silicide.....	B ₃ Si	60.52	rhomb. blk.
2	(hexa-) silicide.....	B ₆ Si	92.98	blk. cr.
3	sulfide, tri-.....	B ₂ S ₃	117.82	wh. cr. or vitr.
4	" , penta-.....	B ₂ S ₅	181.94	wh. cr. (exist quest.)
5	Borotungstic acid	H ₅ BW ₁₂ O ₄₀ ·30H ₂ O	3403.39	tetrag. col.
6	Bromic acid	HBrO ₃	128.92	known in soln. only, col. or yelsh
7	Bromine	Br ₂	159.83	rhomb. or dk. red liq., 1.661
8	azide (bromoazide).....	BrN ₃	121.94	or. red liq.
9	chloride.....	BrCl	115.37	red-yel. liq. or gas.
10	fluoride, tri-.....	BrF ₃	136.92	col.-gray yel. liq.
11	" , penta-.....	BrF ₅	174.92	col. liq.
12	hydrate.....	Br ₂ ·10H ₂ O	339.99	oct. red.
13	Bromoauric acid	HAuBr ₄ ·5H ₂ O	607.95	red-br. cr.
14	Bromoplatinic acid	H ₂ PtBr ₆ ·9H ₂ O	838.89	monocl. red, deliq.
15	Bromous acid, hypo-	HBrO	96.92	col.-yel.
16	Cadmium	Cd	112.41	hex. silv.-wh. malleable met., 1.13
17	acetate.....	Cd(C ₂ H ₃ O ₂) ₂ ·3H ₂ O	284.55	monocl. col.; odor ac. a.
18	amide.....	Cd(NH ₂) ₂	144.46	
19	benzoate.....	Cd(C ₇ H ₅ O ₂) ₂ ·2H ₂ O	390.66	
20	borotungstate.....	Cd ₅ (BW ₁₂ O ₄₀) ₂ ·xH ₂ O		yel. cr. tricl.
21	bromate.....	Cd(BrO ₃) ₂ ·H ₂ O	386.26	rhomb. wh.
22	bromide.....	CdBr ₂	272.24	yel. cr.
23	".....	CdBr ₂ ·4H ₂ O	344.31	sm. wh. need., effl.
24	carbonate.....	CdCO ₃	172.42	trig. wh.
25	chlorate.....	Cd(ClO ₃) ₂ ·2H ₂ O	315.36	col. pr., deliq.
26	chloride.....	CdCl ₂	183.32	hex. col.
27	".....	CdCl ₂ ·2H ₂ O	228.36	monocl. col., 1.6513
28	chloroacetate, tri-.....	Cd(C ₂ H ₃ O ₂) ₂ ·1½H ₂ O	464.22	rhomb.
29	" , di-.....	Cd(C ₂ HCl ₂ O ₂) ₂ ·H ₂ O	386.31	need.
30	" , mono-.....	Cd(C ₂ H ₂ ClO ₂) ₂ ·6H ₂ O	407.49	
31	cinnamate.....	Cd(C ₉ H ₇ O ₂) ₂	406.70	
32	cobaltinitrite.....	Cd ₃ Co(NO ₂) ₆ l ₂	1007.21	yellow
33	cyanide.....	Cd(CN) ₂	164.45	cr.
34	ferrocyanide.....	Cd ₅ Fe(CN) ₆ ·xH ₂ O		
35	fluoride.....	CdF ₂	150.41	cub. wh.
36	fluosilicate.....	CdSiF ₆ ·6H ₂ O	362.57	hex. col.
37	formate.....	Cd(CHO ₂) ₂ ·2H ₂ O	238.48	monocl.
38	fumarate.....	CdC ₄ H ₂ O ₄	226.47	
39	hydroxide.....	Cd(OH) ₂	146.43	trig. or amor. wh.
40	iodate.....	Cd(IO ₃) ₂	462.25	wh. cr.
41	iodate.....	Cd(IO ₃) ₂ ·H ₂ O	480.27	monocl., small cr.
42	iodide (α).....	CdI ₂	366.25	hex. brnsh.
43	" (β).....	CdI ₂	366.25	
44	lactate.....	Cd(C ₃ H ₅ O ₃) ₂	290.55	need.
45	maleate.....	CdC ₄ H ₂ O ₄ ·2H ₂ O	262.50	
46	permanganate.....	Cd(MnO ₄) ₂ ·6H ₂ O	458.37	
47	nitrate.....	Cd(NO ₃) ₂ ·4H ₂ O	308.49	prism. need. wh., hyg.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc
1	2.52			i.		d. H ₂ SO ₄ , KOH; sl. s. HNO ₃
2	2.47			i.		d. H ₂ SO ₄ ; s. HNO ₃ ; i. KOH
3	1.55	310		d.		d. al.; sl. s. PCl ₃ , SCl ₂
4	1.85	390		d.	d.	d. al.
5	3.0	45-51		s.		s. al., eth.
6		d. 100		v. s.	s. d.	
7	2.928 ⁶⁹ 3.12 ²⁰	-7.3	58.78	4.17 ⁷⁰ ; 3.58 ²⁰	3.52 ⁵⁰	v. s. al., chl., eth., CS ₂
8		ca. 45	exp.			s. eth., KI; sl. s. bz., lgr.
9			d. 10	s. d.		s. CS ₂ , eth.
10	2.49 ¹³⁵	(-2) 8.8	135	d. viol to HF, HB	O ₂ , HOBr, rO ₃	d. alk.
11	2.466 ²⁵	-61.3	40.5	d.	d.	
12		d. 6.8		s.		
13		27		v. s.		s. al.
14		<100 d.		v. s.	v. s.	
15		40 (vac.)		s.	s., d.	s. al., eth., chl.
16	8.642	320.9	767 ± 2	i.	i.	s. a., NH ₄ NO ₃ , h. H ₂ SO ₄
17	2.01	-H ₂ O, 130		v. s.	v. s.	v. s. al.
18	3.05 ²⁵	d. 120				
19				3.34 ²⁰		sl. s. al.
20		75		1250 ¹⁹	v. s.	
21	3.758	d.		125 ¹⁷		i. al.
22	5.192 ²⁵	567	963	57 ¹⁰	162 ¹⁰⁴	26.6 ¹⁵ al.; 0.4 ¹⁵ eth.; s. HCl
23		tr. 36		121 ¹⁰		25 al.; s. acet.; sl. s. eth.
24	4.258 ⁴	d. <500		i.	i.	s. a., KCN, NH ₄ salts; i. NH ₃
25	2.28 ¹⁸	80		298 ⁰	487 ⁸⁵	s. a., acet., al.
26	4.047 ²⁵	568	960	140 ²⁰	150 ¹⁰⁰	1.52 ¹⁵ al.; i. acet., eth.
27	3.327	tr. 34		168 ²⁰	180 ¹⁰⁰	2.05 ¹⁵ meth. al.; sl. s. al.
28	2.093 ²⁵					
29	2.132 ²⁵					
30	1.942 ²⁵					
31				0.7 ²⁶		
32		d. 175		sl. s.	v. s.	d. a., alk., org. solv.
33		d. >200		1.7 ¹⁵		s. a., KCN, NH ₄ OH
34				i.	i.	s. HCl
35	6.64	1100	1758	4.35 ²⁵		s. a., HF; i. al., NH ₃
36				s.	s.	s. 50% al.
37	2.44	d.		v. s.		
38				0.9 ³⁰		
39	4.79 ¹⁵	d. 300		0.00026 ²⁵		s. a., NH ₄ salts; i. alk.
40	6.43	d.		sl. s.	sl. s.	s. HNO ₃ , NH ₄ OH
41		-H ₂ O, 160		sl. s.	sl. s.	s. HNO ₃ , NH ₄ OH
42	5.670 ³⁰	388	713	79.8 ⁹ ; 85.2 ¹⁸	127.6 ¹⁰⁰	s. a., eth., al., NH ₄ OH; sl. s. NH ₃ , acet.
43	5.305 ³⁰			10	12.5	i. al.
44				0.66 ³⁰		
45				v. s.	v. s.	
46	2.81	d. 95		109.7 ⁰ ;	326 ^{59.5}	s. al., NH ₃ ; i. HNO ₃
47	2.455 ¹⁷	100 (60)	132	140.4 ³⁰		

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Cadmium				
1	oxalate.....	$\text{CdC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$	254.48	wh.
2	oxide, sub-.....	$\text{Cd}_2\text{O} (?)$	240.82	grn. amor.
3	".....	CdO	128.41	amor., br.
4	".....	CaO	128.41	cubic br.
5	orthophosphate.....	$\text{Cd}_3(\text{PO}_4)_2$	527.27	amor. col.
6	salicylate.....	$\text{Ca}(\text{C}_7\text{H}_5\text{O}_2)_2 \cdot \text{H}_2\text{O}$	404.65	need. wh.
7	selenate.....	$\text{CdSeO}_4 \cdot 2\text{H}_2\text{O}$	291.40	rhomb.
8	metasilicate.....	CdSiO_3	188.47	col. rhomb.
9	sulfate.....	CdSO_4	208.47	rhomb. wh.
10	".....	$\text{CdSO}_4 \cdot 4\text{H}_2\text{O}$	280.53	.....
11	".....	$3\text{CdSO}_4 \cdot 8\text{H}_2\text{O}$	769.54	monocl. wh., efft., 1.565
12	sulfide (greenockite).....	CdS	144.47	hex. yel.-or., 2.506, 2.529
13	sulfite.....	CdSO_3	192.47	cr.
14	tartrate.....	$\text{CdC}_4\text{H}_4\text{O}_6$	260.48	wh. cr. powd.
15	telluride.....	CdTe	240.02	blk. cub.
16	tungstate.....	CdWO_4	360.33	yel. cr.
Cadmium complexes:				
17	Tetramminecadmium perphenate.....	$[\text{Cd}(\text{NH}_3)_4](\text{ReO}_4)_2$	681.16	.....
18	Tetrapyridinecadmium fluosilicate.....	$[\text{Cd}(\text{C}_5\text{H}_5\text{N})_4]\text{SiF}_6$	570.86	tricl. wh.
Calcium				
19	acetate.....	Ca	40.08	cub. silv. wh. soft met.
20	".....	$\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$	158.17	col., 1.55, 1.56, 1.57.
21	".....	$\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$	176.18	col. need.
22	aluminate.....	CaAl_2O_4 (or $\text{CaO} \cdot \text{Al}_2\text{O}_3$).....	158.02	rhomb. or monocl. col., 1.643, 1.655, 1.663
23	".....	$\text{Ca}_3\text{Al}_2\text{O}_6$ (or $3\text{CaO} \cdot \text{Al}_2\text{O}_3$).....	270.18	cub., 1.710
24	aluminosilicate (anorthite).....	$\text{CaAl}_2\text{Si}_2\text{O}_8$	278.14	tricl.
25	orthoarsenate.....	$\text{Ca}_3(\text{AsO}_4)_2$	398.06	wh. amor. powd.
26	".....	$\text{Ca}_3(\text{AsO}_4)_2 \cdot 3\text{H}_2\text{O}$	452.11	col. or wh. powd.
27	arsenide.....	Ca_3As_2	270.06	red cr.
28	azide.....	$\text{Ca}(\text{N}_3)_2$	124.13	rhomb. col.
29	benzoate.....	$\text{Ca}(\text{C}_7\text{H}_5\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$	336.35	rhomb. col.
30	metaborate.....	$\text{Ca}(\text{BO}_2)_2$	125.72	col. long flat pl. rhomb., 1.540, 1.656, 1.682
31	".....	$\text{Ca}(\text{BO}_2)_2 \cdot 2\text{H}_2\text{O}$	161.75	cub.
32	".....	$\text{Ca}(\text{BO}_2)_2 \cdot 6\text{H}_2\text{O}$	233.82	col. hex.
33	tetraborate.....	CaB_4O_7	195.36	readily vitrified.
34	boride.....	CaB_6	105.00	cub. blk.
35	bromate.....	$\text{Ca}(\text{BrO}_3)_2 \cdot \text{H}_2\text{O}$	313.93	monocl.
36	bromide.....	CaBr_2	199.91	need., deliq.
37	".....	$\text{CaBr}_2 \cdot 3\text{H}_2\text{O}$	253.96	rhomb.
38	".....	$\text{CaBr}_2 \cdot 6\text{H}_2\text{O}$	308.01	hex. col.
39	butyrate.....	$\text{Ca}(\text{C}_4\text{H}_7\text{O}_2)_2 \cdot \text{H}_2\text{O}$	232.29	col.
40	cacodylate.....	$\text{Ca}[(\text{CH}_3)_2\text{AsO}_2]_2$	314.04	wh. gran., almost odorl. powd.
41	carbide.....	CaC_2	64.10	rhomb. gray
42	carbonate (aragonite).....	CaCO_3	100.09	rhomb. col., 1.530, 1.681, 1.685
43	" (calcite).....	CaCO_3	100.09	hex. col., 1.658, 1.486
44	".....	$\text{CaCO}_3 \cdot 6\text{H}_2\text{O}$	208.19	monocl., 1.460, 1.535, 1.545
45	chlorate.....	$\text{Ca}(\text{ClO}_3)_2 \cdot 2\text{H}_2\text{O}$	243.03	monocl. wh.-yelsh., deliq.
46	perchlorate.....	$\text{Ca}(\text{ClO}_4)_2 \cdot 2\text{H}_2\text{O}$	275.03	.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	anh 3.32 ¹⁸	d.		0.00337 ⁰	0.009	s. a., NH ₄ OH; i. al.
2	8.192 ¹⁸	d.				d. a., alk.
3	6.95	>1426	d. 900-1000	i.	i.	s. a., NH ₄ salts; i. alk.
4	8.15	d. 900		i.	i.	s. a., NH ₄ salts; i. alk.
5		1500		i.		s. a., NH ₄ salts
6				sl. s.	s	s. a., NH ₄ OH, al, eth, glycerol
7	3.632	-1 H ₂ O, 100		v. s.		
8	4.93	1242		v. sl. s.		
9	4.691	1000		75.5 ⁰	60.8 ¹⁰⁰	i. al., acet., NH ₃
10	3.05			140 ⁰	135.5 ¹⁰⁰	i. al.
11	3.09	tr. 41.5		114.2 ⁰	87 ¹⁰⁰	50 al.
12	4.82	1750 ¹⁰⁰ atm.	subl. in N ₂ 980	0.00013 ¹⁸	colloidal	v. sl. s. NH ₄ OH; s. a.
13		d.		sl. s.		s. a., NH ₄ OH; i. al.
14				sl. s.		s. a., NH ₄ OH
15	6.20 ¹⁵	1041		i.		d. HNO ₃ ; i. a
16				0.05		s. NH ₄ OH
17	3.714 ²⁵ ₄					0.037 conc. NH ₄ OH
18	2.282					
19	1.55	810	1240	d. to Ca(OH) ₂ + H ₂		s. a.; sl. s. al; i. bz, liq.
20		d.		37.4 ⁰	29.7 ¹⁰⁰	NH ₃ sl. s. al.
21		d.		43.6 ⁰	34.3 ¹⁰⁰	sl. s. al.
22	3.67	1600		d.		s. HCl; i. HNO ₃ , H ₂ SO ₄
23		1535 d.		i.		s. a.; not d. by KOH soln.
24	2.765	1551				
25				0.0048; .013 ²⁵		
26				i.	i.	s. a.
27	3.031 ²⁵	d.		d.	d.	d. a.; s. hot HNO ₃
28		exp. 144-56				.211 ¹⁶ al.; i. eth.
29	1.436	-3H ₂ O, 110		2.67 ⁰	8.3 ⁸⁰	
30		1154		sl. s.		s. a., NH ₄ salts; sl. s. ac. a
31		d.		.310 ⁸⁰	0.40 ⁸⁰	s. a., NH ₄ salts
32				0.25 ⁸⁰		
33		986				
34	2.33 ¹⁵ ; 2.3 ²⁰			i.	i.	s. HNO ₃ ; sl. s. conc. H ₂ SO ₄
35	3.329	-H ₂ O, 180		v. s.	v. s.	
36	3.353 ²⁵	765	806-812	125 ⁰	312 ¹⁰⁵	s. a., al., acet.; sl. s. NH ₃
37		80.5		240 ⁰	1850 ⁸⁰	s. a., al., acet.
38		38.2	149-50	594 ⁰	1360 ²⁵	s. a., al, acet.
39				22.0 ⁰	17.3 ¹⁰⁰	
40				v. s.		
41	2.22	2300		d to Ca(OH) ₂ + C ₂ H ₂		not d. by conc. H ₂ SO ₄
42	2.93	d. 825		.00153 ²⁵ (.146 ⁹)*	.00190 ⁷⁵ (.088 ³⁵)*	s. a., NH ₄ Cl
43	2.711 ²⁵ 2	1339 ¹⁰²⁵ atm.	subl. 898.6	.0014 ²⁵ (.13 ⁹)*	.0018 ⁷⁵ (.077 ³⁵)*	s. a., NH ₄ Cl
44	1.771 ⁰					
45	2.711	-H ₂ O, >100		177.7 ⁸	v. s.	s. al., acet.
46				188.6 ²⁵		s. al., acet.

* Solubility in water containing CO₂ (?)

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Calcium				
1	chloride	CaCl_2	110.99	cub. col., deliq., 1.52
2	"	$\text{CaCl}_2 \cdot \text{H}_2\text{O}$	129.01	col., deliq.
3	"	$\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$	147.03	col.
4	"	$\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$	219.09	trig. col., deliq., 1.417, 1.393
5	" hypochlorite (bleaching powder, chlorinated lime)	$\text{CaCl}(\text{OCl})$	126.99	wh. powd.; strong Cl odor; prob. a mixt.
6	chloride fluoride ortho- phosphate	$\text{CaClF} \cdot 3\text{Ca}_3(\text{PO}_4)_2$	1025.38	col., 1.634, 1.631
7	hypochlorite	$\text{Ca}(\text{ClO})_2 \cdot 4\text{H}_2\text{O}$	215.06	col. cr., deliq.
8	chromate	$\text{CaCrO}_4 \cdot 2\text{H}_2\text{O}$	192.12	monocl. pr., yel.
9	cinnamate	$\text{Ca}(\text{C}_9\text{H}_7\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$	388.42	col. cr.
10	citrate	$\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 4\text{H}_2\text{O}$	570.51	need. wh., 1.515, 1.530, 1.580
11	cyanamide	CaCN_2	80.11	hex. rhbdr. col.
12	cyanide	$\text{Ca}(\text{CN})_2$	92.12	rhbdr.
13	cyanoplatinite	$\text{CaPt}(\text{CN})_4 \cdot 5\text{H}_2\text{O}$	429.46	rhomb., yel., grn. fluores., 1.6226
14	ethylsulfate	$\text{Ca}(\text{C}_2\text{H}_5\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$	326.35	wh. cr.
15	ferricyanide	$\text{Ca}_3[\text{Fe}(\text{CN})_6]_2 \cdot 12\text{H}_2\text{O}$	760.33	red, need., deliq.
16	ferrocyanide	$\text{Ca}_2\text{Fe}(\text{CN})_6 \cdot 12\text{H}_2\text{O}$	508.30	tricl. yel., 1.570, 1.582, 1.596
17	fluoride (fluorite)	CaF_2	78.08	cub. col., lum. with heat., 1.434
18	fluosilicate	CaSiF_6	182.14	wh. cr. powd. tetr.
19	"	$\text{CaSiF}_6 \cdot 2\text{H}_2\text{O}$	218.17	tetr. col.
20	formate	$\text{Ca}(\text{CHO}_2)_2$	130.12	rhomb., col., 1.510, 1.514, 1.578
21	fumarate	$\text{CaC}_4\text{H}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$	208.18	rhomb. col.
22	d-gluconate	$\text{Ca}(\text{C}_6\text{H}_{11}\text{O}_7)_2 \cdot \text{H}_2\text{O}$	448.39	cr. powd., need.
23	glycerophosphate	$\text{CaC}_3\text{H}_5(\text{OH})_2\text{PO}_4$	210.19	wh. cr. hyg. powd.
24	hydride	CaH_2	42.10	gray-wh. cr. powd.
25	hydroxide	$\text{Ca}(\text{OH})_2$	74.10	rhomb. trig. col.
26	iodate (lautarite)	$\text{Ca}(\text{IO}_3)_2$	389.92	tricl.
27	"	$\text{Ca}(\text{IO}_3)_2 \cdot 6\text{H}_2\text{O}$	498.02	rhomb., 1.686, 1.644, 1.604
28	iodide	CaI_2	293.92	yelsh.-wh. pl., deliq.
29	"	$\text{CaI}_2 \cdot 6\text{H}_2\text{O}$	402.02	col.
30	isobutyrate	$\text{Ca}(\text{C}_4\text{H}_7\text{O}_2)_2 \cdot \text{H}_2\text{O}$	232.29	wh. powd.
31	lactate	$\text{Ca}(\text{C}_3\text{H}_5\text{O}_3)_2 \cdot 5\text{H}_2\text{O}$	308.30	wh. need., effl.
32	laurate	$\text{Ca}(\text{C}_{12}\text{H}_{23}\text{O}_2)_2 \cdot \text{H}_2\text{O}$	456.71	wh. amor. powd.
33	linoleate	$\text{Ca}(\text{C}_{18}\text{H}_{31}\text{O}_2)_2$	598.94	monocl. col. to pa. grn., 1.708, 1.711, 1.718
34	magnesium orthosilicate (merwinite)	$\text{Ca}_3\text{Mg}(\text{SiO}_4)_2$	328.68	rhomb. col., 1.545, 1.555, 1.575
35	dl-malate	$\text{CaC}_4\text{H}_4\text{O}_5 \cdot 3\text{H}_2\text{O}$	226.20	col.
36	l-malate	$\text{CaC}_4\text{H}_4\text{O}_5 \cdot 2\text{H}_2\text{O}$	208.18	rhomb. or wh. cr. powd., 1.493, 1.507, 1.545
37	malate, acid	$\text{Ca}(\text{HC}_4\text{H}_4\text{O}_6)_2 \cdot 6\text{H}_2\text{O}$	414.34	rhomb. col., 1.495, 1.575, 1.640
38	maleate	$\text{CaC}_4\text{H}_2\text{O}_4 \cdot \text{H}_2\text{O}$	172.15	214.19
39	malonate	$\text{CaC}_3\text{H}_2\text{O}_4 \cdot 4\text{H}_2\text{O}$	368.02	purp., pr.
40	permanganate	$\text{Ca}(\text{MnO}_4)_2 \cdot 5\text{H}_2\text{O}$	242.33	tetr. col., 1.967, 1.978
41	α -methylbutyrate (ethylmethylacetate)	$\text{Ca}(\text{C}_5\text{H}_9\text{O}_2)_2$	200.03	cub. col., hyg.
42	molybdate	CaMoO_4	164.10	218.14
43	nitrate	$\text{Ca}(\text{NO}_3)_2$	236.16	monocl. col., deliq., 1.465, 1.498, 1.504
44	"	$\text{Ca}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$		
45	"	$\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$		

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.512 ²⁵	772	>1600	59.5 ⁰	159 ¹⁰⁰	s. al., ac. a., acet.
2	.....	260	.....	76.8 ⁰	249 ¹⁰⁰	s. al.; i. acet.
3	.....	.....	.....	97.7 ⁰	326 ⁶⁰	s. al.
4	1.68 ¹⁷	29.92	-4H ₂ O, 30; -6H ₂ O, 200	279 ⁰	536 ²⁰	s. al.
5	.....	d.	.....	d. evln. Cl	.....	d. a.
6	3.14	1270	.....	v. sl. s.	.....	.....
7	.....	d.	.....	v. s.	d.	d. a.
8	.....	-2H ₂ O, 200	.....	22.4 ⁰ ; 16.3 ²⁰	18.2 ⁴⁵	s. a., al.
9	.....	.....	.....	0.22 ²	1.34 ¹⁰⁰	.....
10	.....	-2H ₂ O, 130	-4H ₂ O, 185	.25 ³⁰	.210 ⁸⁵	0.0065 ¹⁸ al.
11	.....	.....	1190	d. evln. NH ₃	d.	.....
12	.....	.....	.....	s.	d.	.....
13	.....	.....	.....	s.	.....	.....
14	.....	.....	.....	s.	.....	s. al.
15	.....	.....	.....	v. s.	v. s.	.....
16	1.68	d.	.....	86.8 ^{24.9}	115 ^{64.7}	.....
17	3.180	1360	.....	0.0016 ¹⁸	0.0017 ²⁶	s. soln. NH ₄ salts; sl. s. a.; i. acet.
18	2.662 ^{17.5}	.....	.....	sl. s.	.....	s. HF, HCl, al.
19	2.254	.....	.....	sl. s. d.	.....	s. HF, HCl; i. al.
20	2.015	d.	.....	16.2 ⁰	18.4 ¹⁰⁰	i. al.
21	.....	.....	.....	2.11 ³⁰	.....	.....
22	.....	-H ₂ O, 120	.....	3.3 ¹⁵	.....	v. sl. s. al.
23	.....	.....	.....	2 ²⁵	less s.	i. al.
24	1.7	814-6	.....	d. to Ca	(OH) ₂ +H ₂	d. a., no known solv.
25	2.343	-H ₂ O, 580	d.	0.185 ⁰	0.077 ¹⁰⁰	s. NH ₄ Cl soln., a.; i. al.
26	4.519 ¹⁵	d.	.....	0.10 ⁰	0.95 ¹⁰⁰	s. HNO ₃
27	.....	d.	.....	0.13 ⁰ ; 33 ²⁵	1.22 ¹⁰⁰	s. HNO ₃
28	3.956 ²⁵	575	718	66 ¹⁰	81 ¹⁰⁰	s. a., al., acet.
29	.....	42	160	757 ⁰	1680 ³⁰	s. a., acet., al.
30	.....	.....	.....	28.8 ⁰	37.6 ¹⁰⁰	.....
31	.....	-3H ₂ O, 100	.....	3.1 ⁰	7.9 ³⁰	sl. s. a.; i. al., eth.
32	.....	182-3	.....	0.004 ¹⁵	0.055 ¹⁰⁰	0.059 ¹⁵ al., 1.72 ⁷⁸ al.
33	.....	.....	.....	i.	.....	s. al., eth.
34	3.150	.....	.....	.....	.....	.....
35	.....	.....	.....	0.321 ⁰	0.451 ^{37.5}	i. al.
36	.....	.....	.....	0.812 ⁰	1.224 ^{37.5}	i. al.
37	.....	.....	.....	sl. s.	.....	.....
38	.....	.....	.....	2.89 ²⁵	3.21 ⁴⁰	.....
39	.....	.....	.....	0.44 ⁰	0.72 ¹⁰⁰	.....
40	2.4	d.	.....	331 ¹⁴	338 ²⁵	s. NH ₄ OH
41	.....	.....	.....	24.24 ⁰	25.65 ⁷⁰	.....
42	4.35	.....	.....	i.	.....	s. a.; i. al., eth.
43	2.36	561	.....	102.0 ⁰ ; 341 ²⁵	376 ¹⁵⁰	s. al., acet.
44	.....	51.1	.....	.....	.....	.....
45	1.82	α42.7; β39.7	d. 132	266 ⁰	660 ³⁰	s. al., acet.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Calcium				
1	nitride.....	Ca_3N_2	148.26	br. cr.
2	nitrite.....	$\text{Ca}(\text{NO}_2)_2 \cdot \text{H}_2\text{O}$	150.11	hex. col.-yelsh., deliq.
3	".....	$\text{Ca}(\text{NO}_2)_2 \cdot 4\text{H}_2\text{O}$	204.16	col.
4	oleate.....	$\text{Ca}(\text{C}_{18}\text{H}_{33}\text{O}_2)_2$	602.97	wh wax-like cr.
5	oxalate.....	CaC_2O_4	128.10	cub. col.
6	oxide (lime).....	CaO	56.08	cub. col. 1.838.....
7	" , per-.....	CaO_2	72.08	wh.
8	".....	$\text{CaO}_2 \cdot 8\text{H}_2\text{O}$	216.21	tetr., pearly.
9	palmitate.....	$\text{Ca}(\text{C}_{16}\text{H}_{31}\text{O}_2)_2$	550.90	wh. or yelsh.-wh. fatty powd.
10	1-phenol-4-sulfonate.....	$\text{Ca}(\text{C}_6\text{H}_4\text{SO}_3)_2 \cdot \text{H}_2\text{O}$...	404.42	wh. to pinkish powd.
11	phenoxide.....	$\text{Ca}(\text{OC}_6\text{H}_5)_2$	226.28	redsh. powd.
12	hypophosphate.....	$\text{Ca}_2\text{P}_2\text{O}_5 \cdot 2\text{H}_2\text{O}$	274.23	gel.
13	orthophosphate, tri (tert.).....	$\text{Ca}_3(\text{PO}_4)_2$	310.28	amor. wh. powd.
14	" , di- (sec., brushite).....	$\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$	172.14	monocl. wh., 1.5576, 1.5457, 1.5392..
15	" , mono- (prim.).....	$\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O}$..	252.17	tricl. col., deliq., 1.5292, 1.5176, 1.4932
16	pyrophosphate.....	$\text{Ca}_2\text{P}_2\text{O}_7$	254.20	biaxial, col.
17	".....	$\text{Ca}_3\text{P}_2\text{O}_7 \cdot 5\text{H}_2\text{O}$	344.28	monocl., 1.539, 1.545, 1.551.....
18	metaphosphate.....	$\text{Ca}(\text{PO}_3)_2$	198.12	col.
19	phosphide.....	Ca_3P_2	182.28	red cr.
20	hypophosphite.....	$\text{Ca}(\text{H}_2\text{PO}_2)_2$	170.15	monocl. wh.-gray.....
21	orthophosphite, di-.....	$2\text{CaHPO}_3 \cdot 3\text{H}_2\text{O}$	294.26	.....
22	orthoplumbate.....	Ca_2PbO_4	351.37	red-br. cr.
23	plumbite.....	CaPbO_2	279.29	cr.
24	propionate.....	$\text{Ca}(\text{C}_3\text{H}_5\text{O}_2)_2 \cdot \text{H}_2\text{O}$..	204.24	col. monocl. tabl.
25	l-quinate.....	$\text{Ca}(\text{C}_7\text{H}_{11}\text{O}_6)_2 \cdot 10\text{H}_2\text{O}$	602.56	rhomb. leaf.
26	salicylate.....	$\text{Ca}(\text{C}_7\text{H}_5\text{O}_3)_2 \cdot 2\text{H}_2\text{O}$..	350.33	oct.
27	".....	$\text{Ca}(\text{C}_7\text{H}_5\text{O}_3)_2 \cdot 3\text{H}_2\text{O}$..	368.35	monocl. wh.; $2\text{H}_2\text{O}$ oct.
28	selenate.....	CaSeO_4	183.04	col., ($2\text{H}_2\text{O}$, monocl.) ..
29	selenide.....	CaSe	119.04	simple cub., 2.274.....
30	metasilicate (α) (pseudo-wollastonite).....	CaSiO_3	116.14	monocl. col., 1.610, 1.611, 1.664.....
31	metasilicate (β) (wollastonite).....	CaSiO_3	116.14	monocl. col., 1.616, 1.629, 1.631.....
32	silicide.....	CaSi_2	96.20	.....
33	stearate.....	$\text{Ca}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	607.01	cr. powd.
34	succinate.....	$\text{CaC}_4\text{H}_4\text{O}_6 \cdot 3\text{H}_2\text{O}$	210.20	col., 1.460, 1.540, 1.610.....
35	sulfate (anhydrite).....	CaSO_4	136.14	rhomb. or monocl. col., 1.569, 1.575, 1.613
36	" (soluble anhydrite).....	CaSO_4	136.14	tricl. need.
37	" (gypsum).....	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	172.17	monocl. col., 1.521, 1.523, 1.530.....
38	sulfide (oldhamite).....	CaS	72.14	cub. col., 2.137.....
39	" , hydro-.....	$\text{Ca}(\text{HS})_2 \cdot 6\text{H}_2\text{O}$	214.31	pr. col.
40	sulfite.....	$\text{CaSO}_3 \cdot 2\text{H}_2\text{O}$	156.17	hex. col.
41	" , acid.	$\text{Ca}(\text{HSO}_3)_2$	202.22	yelsh. liq., strong SO_2 odor.....
42	d-tartrate.....	$\text{CaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$	260.22	rhomb., 1.525, 1.535, 1.550.....
43	dl-tartrate.....	$\text{CaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$	260.22	tricl., powd. or need.
44	mesotartrate.....	$\text{CaC}_4\text{H}_4\text{O}_6 \cdot 3\text{H}_2\text{O}$	242.20	monocl. or tricl. pr.
45	telluride.....	CaTe	167.69	simple cub., 2.51-58.....
46	tellurite.....	CaTeO_3	215.69	wh. flecks.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.63 ¹⁷	900	.....	75.5 d.	247 d.	s. dil. a.; i. abs. al.
2	2.23 ³⁴ ; anh. 2.53 ³⁰	—H ₂ O, 100	.....	45.9 ⁰	89.6 ⁹¹	sl. s. al.
3	1.674 ⁰ ₀	—2H ₂ O, 44	.....	74.9 ⁹	106 ⁴²	s. al.
4	.....	83–4	.....	0.04 ²⁵	0.03 ⁵⁰	sl. s. eth.
5	2.2 ⁴	d.	.....	0.00067 ¹³	0.0014 ⁹⁶	s. a.; i. ac. a.
6	3.40	2572	2850	.131 ¹⁰ d.	.07 ⁸⁰ d.	s. a.
7	.....	d. 275	.....	sl. s.	.....	s. a.
8	.....	—8H ₂ O, 100	d. 275, exp.	sl. s. ev. O	d.	s. a., NH ₄ salts; i. al., eth.
9	.....	.....	.....	0.003 ²⁵	.....	v. sl. s. al.; 0.008 ²⁵ eth.
10	.....	.....	.....	s.	.....	s. al.
11	.....	.....	.....	sl. s.	.....	sl. s. al.
12	.....	.....	.....	i.	.....	s. HCl, H ₄ P ₂ O ₆ , H ₂ P ₂ O ₆
13	3.14	1670	.....	0.002–3	d.	s. a.; i. al.
14	2.306 ¹⁶	d. 25	.....	0.02 ²⁵ ; 0.0316 ³⁹	0.075 ¹⁰⁰ d.	s. a.; i. al.
15	2.220 ¹⁶	—H ₂ O, 109	d. 203	i.	d.	s. a.
16	3.09	1230	.....	i.	.....	s. a.
17	2.25	.....	.....	sl. s.	.....	s. a.; i. NH ₄ Cl
18	2.82	975	.....	i.	i.	i. a.
19	2.238 ²⁵	>1600	.....	d. ev. PH ₃	.....	s. a.; i. al., eth., bz.
20	.....	d.	.....	15.4 ²⁶	12.5 ¹⁰⁰	i. al.
21	.....	.....	.....	sl. s.	d.	s. NH ₄ Cl
22	5.71	d.	.....	i.	d.	s. a.
23	.....	d.	.....	sl. s.	.....	.....
24	.....	.....	.....	49.0 ⁰	55.8 ¹⁰⁰	i. al.
25	.....	50; —10H ₂ O, 120	.....	16 ¹⁶	.....	i. al.
26	.....	.....	.....	s.	s.	s. al.
27	.....	.....	.....	2.70 ¹⁵	44.7 ¹⁰⁰	s. al.
28	2.93; (2H ₂ O) 2.68	.....	.....	7.9 ⁶	5.4 ⁶⁷	.....
29	7.593	.....	.....	.....	.....	.....
30	2.905	1540	.....	0.0095 ¹⁷	.....	s. HCl
31	2.915	tr. 1200	.....	.....	.....	.....
32	2.5	.....	.....	i.	d.	d. a., bases
33	.....	179–80	.....	0.004 ¹⁵	.....	i. al., eth.
34	.....	.....	.....	0.193 ¹⁰ ;	0.89 ⁸⁰	.....
35	2.96	monocl. 1450	tr. to rhomb. 1193	0.209 ³⁰	0.1619 ¹⁰⁰	s. a., Na ₂ S ₂ O ₃ , NH ₄ salts, glyc.
36	2.45	.....	.....	.....	.....	.....
37	2.32	—½H ₂ O, 128	—2H ₂ O, 163	0.241 ⁰	0.222 ¹⁰⁰	s. a., Na ₂ S ₂ O ₃ , NH ₄ salts, glyc.
38	2.18 ¹⁵	.....	d.	.0121 ¹⁵ d.	.4614 ¹⁰⁰ d.	d. a.
39	.....	d. 15–18	.....	v. s.	.....	s. al.
40	.....	—2H ₂ O, 100	.....	0.0043 ¹⁸	0.0011 ¹⁰⁰	s. H ₂ SO ₃
41	.....	.....	.....	s.	.....	s. a.
42	.....	d.	.....	0.0266 ⁰	0.0689 ^{37.5}	sl. s. al.
43	.....	—4H ₂ O, 200	.....	0.0032 ⁰	.0078 ^{37.5}	s. HCl; i. acet. a.
44	.....	—3H ₂ O < 170	.....	i.	0.16 ¹⁰⁰	.028 ¹⁸ , .085 ¹⁰⁰ acet. a
45	7.593	.....	.....	.....	.....	.....
46	.....	>960	.....	sl. s	s.	s. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Calcium				
1	thiocarbonate	CaCS_3	148.27	yel.
2	thiocyanate	$\text{Ca}_2\text{SCN}_2 \cdot 3\text{H}_2\text{O}$	210.28	wh. cr., deliq.
3	dithionate	$\text{CaS}_2\text{O}_6 \cdot 4\text{H}_2\text{O}$	272.26	trig. col., 1.5496
4	thiosulfate	$\text{CaS}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$	260.30	tricl.
5	metatitanate (perovskite)	CaTiO_3	135.98	rhomb., β 2.34
6	tungstate (scheelite)	CaWO_4	288.00	tetr. col. or wh. sc., 1.918, 1.934
7	metatungstate	$\text{CaW}_2\text{O}_{11} \cdot 10\text{H}_2\text{O}$	1163.92	col. tricl.
8	valerate	$\text{Ca}(\text{C}_5\text{H}_9\text{O}_2)_2$	242.33	
9	metazirconate	CaZrO_3	179.30	monocl.
10	Carbon amorphous	C	12.01	amor. blk.
11	graphite	C	12.01	cub. blk.
12	diamond	C	12.01	cub. col., 2.4173
13	bromide, di- (tetrabromomethylene)	C_2Br_4	343.68	
14	bromide, tri- (hexabromomethane)	C_2Br_6	503.52	rhomb. pr. 1.740, 1.847, 1.863
15	bromide, tetra- (tetrabromomethane)	CBr_4	331.67	col. monocl. tab.
16	chloride, di- (tetrachloromethylene)	C_2Cl_4	165.85	1.59998 ^{99.5} (He) col. liq., eth. odor, 1.5055
17	chloride, tri- (hexachloromethane)	C_2Cl_6	236.76	rhomb., tricl. or cub., col.
18	chloride, tetra- (tetrachloromethane)	CCl_4	153.84	col. liq., 1.46305 ¹⁵
19	fluoride, tetra- (tetrafluoromethane)	CF_4	88.01	col. gas
20	iodide, tetra- (tetraiodomethane)	CI_4	519.69	octahdr. red
21	oxide, sub-	C_3O_2	68.03	col. gas or liq., 1.4538 ⁹
22	" mono-	CO	28.01	col. odor. poisonous gas
23	" di-	CO_2	44.01	col. odorl. gas or col. liq.
24	selenide sulfide	CS_2S	123.03	yel. oily liq.
25	sulfide, sub-	C_2S_2	100.15	red liq.
26	" mono-	CS (or $(\text{CS})_2$)	44.07	red powd.
27	" di-	CS_2	76.13	inflam. col. liq., 1.62950 ¹⁵
28	" telluride	CSTe	171.68	yel.-red.
29	Carbonic acid	H_2CO_3	62.03	exists only in solution
30	Carbonyl bromide (carbon oxybromide)	COBr_2	187.84	
31	Carbonyl chloride (phosgene, carbon oxychloride)	COCl_2	98.92	col. pois. gas or col. volat. liq.
32	Carbonyl sulfide (carbon oxydisulfide)	COS	60.07	gas
33	Cerium	Ce	140.13	cub. or hex. steel gray met.
34	acetate (ous)	$\text{Ce}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot 1\frac{1}{2}\text{H}_2\text{O}$	344.29	wh.-redsh. cr. powd.
35	benzoate (ous)	$\text{Ce}(\text{C}_7\text{H}_5\text{O}_2)_3 \cdot 3\text{H}_2\text{O}$	557.51	wh. to redsh.-wh. powd.
36	bromate (ous)	$\text{Ce}(\text{BrO}_3)_3 \cdot 9\text{H}_2\text{O}$	686.02	hex. redsh. wh.
37	bromide (ous)	CeBr_3	379.88	wh. cr. powd., deliq.
38	" "	$\text{CeBr}_3 \cdot \text{H}_2\text{O}$	397.89	need., deliq.
39	carbide	CeC_2	164.15	hex. red.
40	carbonate (ous)	$\text{Ce}_2(\text{CO}_3)_3 \cdot 5\text{H}_2\text{O}$	550.37	micr. pr., wh.
41	chloride (ous)	CeCl_3	246.50	col. cr., deliq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				s.		s. al.
2				v. s.	v. s.	v. s. al.
3	2.176			160	360	
4	1.872	d.		100	d.	i. al.
5	4.10					
6	6.06			0.2		s. NH_4Cl ; i. a., al.
7		d.				d. a.
8				8.28	7.39	
9	4.75	2550				
10	1.8-2.1	subl. 3652-97	4200 (?)	i.	i.	i. a., alk.
11	2.25	subl. 3652-97	4200 (?)	i.	i.	s. liq. Fe ; i. a., alk.
12	3.51	>3500	4200 (?)	i.	i.	i. a., alk.
13		57.5	227			
14	3.823	148-9d	210	i.		s. CS_2 ; v. sl. s. al., eth.
15	3.42	α 48.4; 590.1	189.5	0.024		s. al., eth., chl.
16	1.6311 $\frac{15}{4}$	-22.4	120.8	i.		s. al., eth.
17	2.091	subl. 187		i.		s. al., eth., oils
18	1.595	-23.0	76.8	v. sl. s.		s. al. bz., chl., eth.
19	1.96-194	-184	-128	sl. s.		
20	4.32	171 d.		i.	d.	s. d. h. al., CS_2 , eth.
21	liq. 1.114 ³	-111.3	7	d.		
22	1.250 ³ g/l; liq. 0.793	-207	-190 (-192)	3.5 ³ cm ³	20 ²³ cm ³	s. al., Cu_2Cl_2 , bz., ac. a.
23	1.977 ³ g/l; liq. 1.101 ⁻²⁷ s. 1.56 ⁻⁷³	-56.6 ³ cm ³	-78.5 subl.	171.3 ³ cm ³ ; 348 ³⁰ g; .145 ²³ g	90.1 ²⁰ cm ³ ; .097 ⁴⁹ g; .058 ⁸⁰ g	31 ¹⁵ al. cm ³ ; s. acet.
24	1.9874	-85	84.5	i.	i.	s. CS_2 ; sl. s. al.
25	1.274	-0.5				
26	1.66	d.	260	i.		s. CS_2 , eth; i. al.
27	1.261 $\frac{17}{19}$	-108.6; frz. -111	46.3	0.22 ²²	.014 ⁵⁰	s. al., eth.
28	2.9 ⁻⁸¹	-54	d. > -54.0			s. CS_2 , bz.
29				s.		
30	2.44		64.5			
31	1.392	-104	8.3	d.		d. a., al.; v. s. bz., tol.; s. ac. a.
32	2.72 g/l; liq. 1.24 ⁻⁸⁷	-138	-48	133 ³ cm ³	49.3 ³⁰ cm ³	v. s. al., alk.
33	emb. 6.90; hex. 6.7	640	1400	i.	i.	s. dil. a.; i. al.
34		-14 H_2O , 115	d.	26.5 ¹⁵	16.2 ⁷⁵	
35		-3 H_2O , 100			sl. s.	sl. s. hot al.
36		49		s.		
37				s.		
38		d.		s.		s. al.
39	5.23			d.	d.	s. a.
40				v. sl. s.		s. dil. a., $(\text{NH}_4)_2\text{CO}_3$;
41	3.92 ³	848 (794-812)	d.	100	d.	30 al.; s. acet.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Cerium				
1	citrate (ous).....	$\text{Ce}(\text{C}_6\text{H}_5\text{O}_7) \cdot 3\frac{1}{2}\text{H}_2\text{O}$	392.29	wh. powd.....
2	cyanoplatinite (ous).....	$\text{Ce}_3[\text{Pt}(\text{CN})_4]_3 \cdot 18\text{H}_2\text{O}$	1502.46	monocl. yel. bl. lust.....
3	fluoride (ous).....	CeF_3	197.13	hex. wh.....
4	“ (ic).....	$\text{CeF}_3 \cdot \text{H}_2\text{O}$	234.15	wh. amor. powd.....
5	hexaantipyrine perchlorate (ous).....	$[\text{Ce}(\text{C}_{11}\text{H}_{12}\text{N}_2\text{O})_6]_3 \cdot (\text{ClO}_4)_3$	1567.84	col. hex. cr.....
6	hexaantipyrine iodide (ous).....	$[\text{Ce}(\text{C}_{11}\text{H}_{12}\text{N}_2\text{O})_6]\text{I}_3$	1650.23	large yel. cr.....
7	hydride (ous).....	CeH_3	143.15	amor. powd., dk. bl.....
8	hydroxide (ous).....	$\text{Ce}(\text{OH})_3$	191.15	wh. gelat. ppt.....
9	“ (ic).....	$\text{Ce}(\text{OH})_4$	208.16	yelsh. gelat. ppt.....
10	iodate (ic).....	$\text{Ce}(\text{IO}_3)_4$	839.81	col.....
11	iodide (ous).....	$\text{CeI}_3 \cdot 9\text{H}_2\text{O}$	683.04	redsh.-wh. cr.....
12	nitrate (ous).....	$\text{Ce}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$	434.25	col. or redsh. (trac. La, Di) cr., deliq.....
13	“ (ic), basic.....	$\text{Ce}(\text{OH})(\text{NO}_3)_3 \cdot 3\text{H}_2\text{O}$	397.21	long red need.....
14	oxalate (ous).....	$\text{Ce}_2(\text{C}_2\text{O}_4)_3 \cdot 9\text{H}_2\text{O}$	706.47	yel.-wh. cr.....
15	oxide (ous).....	Ce_2O_3	328.26	gray-grn. powd.....
16	“ (ic).....	CeO_2	172.13	cub. wh.-yel. or amor.....
17	oxychloride (ous).....	CeOCl	191.59	purp. leaf.....
18	2,4-pentanedione deriv. (ous) (acetylacetonate)	$\text{Ce}(\text{C}_5\text{H}_7\text{O}_2)_3 \cdot 3\text{H}_2\text{O}$	491.50	lt. yel. cr. ppt.....
19	orthophosphate (ous) (monazite)	CePO_4	235.15	monocl. red or rhomb. yel.....
20	metaphosphate (ous).....	$\text{Ce}(\text{PO}_3)_3$	377.19	mier. need.....
21	salicylate (ous).....	$\text{Ce}(\text{C}_7\text{H}_5\text{O}_3)_3$	551.46	wh. to redsh.-wh. powd.....
22	silicide.....	CeSi_2	196.25	.....
23	sulfate (ous).....	$\text{Ce}_2(\text{SO}_4)_3$	568.44	monocl. or rhomb. col.; grn. powd., hyg.....
24	“ “.....	$\text{Ce}_2(\text{SO}_4)_3 \cdot 4\text{H}_2\text{O}$	640.50	rhomb. asbestos like need. (5H ₂ O monocl.)
25	“ “.....	$\text{Ce}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	712.57	tricl. or monocl. sm. pink cr.....
26	“ “.....	$\text{Ce}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$	730.59	asbestos like need. hex. cr.....
27	“ (ic).....	$\text{Ce}(\text{SO}_4)_2$	332.25	deep yel. cr.....
28	“ “.....	$\text{Ce}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$	404.31	rhomb. sulf. yel.....
29	sulfide (ous).....	Ce_2S_3	376.44	red cr.; br.-dk. purp. powd.....
30	Cesium			
31	acetate.....	$\text{CsC}_2\text{H}_3\text{O}_2$	132.91	hex. silv.-wh. duct. met.....
32	aluminum sulfate.....	$\text{CsAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	191.95	deliq.....
33	benzoate.....	$\text{CsC}_7\text{H}_5\text{O}_2$	568.19	cub. col., 1.4587.....
34	bromate.....	CsBrO_3	254.02	.....
35	bromide, mono.....	CsBr	260.83	.....
36	“ tri.....	CsBr_3	212.83	cub. col., 1.6984.....
37	bromiodide, di.....	CsIBr_2	372.66	rhomb.....
38	bromodiodide.....	CsI_2Br	419.66	rhomb.....
39	carbonate.....	Cs_2CO_3	466.67	.....
40	“ , acid.....	CsHCO_3	325.83	col. cr., deliq.....
41	chlorate.....	CsClO_3	193.93	rhomb.....
42	perchlorate.....	CsClO_4	216.37	.....
43	chloride.....	CsCl	232.37	rhomb. col.....
			168.37	cub. col. deliq., 1.6418.....
44	chloroaurate.....	CsAuCl_4	471.94	monocl., yel.....
45	chlorodibromide.....	CsBr_2Cl	328.20	yellow.....
46	chlorobromide, di.....	CsBrCl_2	283.74	.....
47	chloroiodide, di.....	CsICl_2	330.74	rhomb. pa. or.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				i.		s. dil. min. a.
2	2.657					
3	6.16	1324		i.		
4		d.		i.		s. a.
5		295-300 d.		1.08 ²⁰		
6		268-70		15.10 ²⁰		
7		ign.		d.		
8						s. a., (NH ₄) ₂ CO ₃ ; i. alk.
9						s. a.; sl. s. alk. carb.; i. alk.
10				0.015 ²⁰		
11			d. ev. I ₂	v. s.		v. s. al.
12		-3H ₂ O, 150	d. 200	v. s.	v. s.	50 al.; s. acet.
13				s.		
14		d.		0.053 ²⁵		s. H ₂ SO ₄ , HCl; i. H ₂ C ₂ O ₄ , al., alk., eth.
15	6.9-7.0	ign. 200; 1692		i.	i.	s. H ₂ SO ₄ ; i. HCl
16	7.3	1950		i.	i.	s. H ₂ SO ₄ , HNO ₃ ; i. dil. a.
17				i.		s. dil. a.
18		131-2		d.		v. s. al.
19	5.22			i.	i.	s. a.; i. al.
20	3.272					i. a.
21				i.		
22	5.67 ¹⁷			i.		
23	3.912			10.1 ¹⁰	4.06 ⁸⁰ ; 2.25 ¹⁰⁰	
24	3.22 (5H ₂ O)			3.90 ⁵⁰	0.514 ¹⁰⁰	
25	2.886 ¹⁷	-8H ₂ O, 630		23.8 ⁰ ; 12 ²⁰	6 ⁵⁰	
26	2.831			11.87 ¹⁵ ; 9.42 ³⁰		
27	3.91 ¹⁸		d. 195	sl. d. to v. s., d.	form basic	salt
28				i.	d.	s. dil. H ₂ SO ₄
29	5.020 ¹¹	d.		d.	d.	s. dil. a.
30	1.90	28.5	670	d.	d.	s. a., d. al.
31		194		945.1 ^{-2.5}	1345.5 ^{88.5}	
32	1.97	117		0.34 ⁰	42.54 ¹⁰⁰	s. dil. a.; i. al.
33				294.5 ⁰	398.5 ¹⁰⁰	
34				4.53 ³⁰		
35	4.44; lq. 3.04 ⁷⁰⁰	636	1300	124.3 ²⁵		s. a.
36		180				
37		248	d. 320			
38		195.5		260.5 ^{15d.}		s. al.
39		d. 610		260.5 ¹⁵	v. s.	11 ¹⁹ al. s. eth.
40		-½CO ₂ , 175		209.3 ¹⁵	v. s.	s. al.
41	3.57				37.9 ¹⁰⁰	s. al.
42	3.327	d.		0.8 ⁰	30 ¹⁰⁰	i. abs. al.
43	3.97	646	1290 subl.	161.7 ⁰ ; 185.7 ²⁰	270.5 ¹⁰⁰	v. s. al.
44				0.5 ¹⁰	27.5 ¹⁰⁰	s. al.
45		191				
46		205				
47	3.86	230	d. 290			

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	Cesium chloroplatinate.....	Cs_2PtCl_6	673.79	cub. yel.....
2	chlorostannate.....	Cs_2SnCl_6	597.26	cub. wh.....
3	chromate.....	Cs_2CrO_4	381.83	α yel. pr.; β yel. rhomb.....
4	cyanide.....	CsCN	158.93	col. cr.....
5	fluogermanate.....	Cs_2GeF_6	452.42	isotropic cr., reg. octahedra.....
6	fluoride.....	CsF	151.91	cub. col.....
7	".....	$\text{CsF} \cdot 1\frac{1}{2}\text{H}_2\text{O}$	178.93	.....
8	fluosilicate.....	Cs_2SiF_6	407.88	cub. wh.....
9	fluotellurite.....	Cs_2TeF_6	355.52	col. need.....
10	formate.....	CsCHO_2	177.93	.....
11	".....	$\text{CsCHO}_2 \cdot \text{H}_2\text{O}$	195.94	.....
12	gallium selenate.....	$\text{CsGa}(\text{SeO}_4)_2 \cdot 12\text{H}_2\text{O}$	704.74	col. cr.....
13	" sulfate.....	$\text{CsGa}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	610.94	cub. col., 1.46495.....
14	hydride.....	CsH	133.92	wh. cr.....
15	hydroxide.....	CsOH	149.92	col.-yelsh., v. deliq.....
16	iodate.....	CsIO_3	307.83	monocl. wh.....
17	metaperiodate.....	CsIO_4	323.83	rhomb. wh. pl.....
18	iodide, mono-.....	CsI	259.83	cub. col., 1.7876.....
19	" , tri.....	CsI_3	513.67	rhomb. blk.....
20	" , penta-.....	CsI_5	767.51	tricl. blk.....
21	" , chlorobromo-.....	CsIBrCl	375.20	rhomb. yel.-red.....
22	permanganate.....	CsMnO_4	251.84	.....
23	mercury bromide (ic).....	$\text{CsBr} \cdot 2\text{HgBr}_2$	933.71	rhomb.....
24	mercury chloride (ic).....	$\text{CsCl} \cdot \text{HgCl}_2$	439.89	cub. or rhomb. col., 1.792.....
25	nitrate.....	CsNO_3	194.92	col. hex. or cub., glit.....
26	" , acid.....	$\text{CsNO}_3 \cdot \text{HNO}_3$	257.93	oct.....
27	" ".....	$\text{CsNO}_3 \cdot 2\text{HNO}_3$	320.95	col. pl.....
28	nitrite.....	CsNO_2	178.92	yel. cr.....
29	oxalate.....	$\text{Cs}_2\text{C}_2\text{O}_4$	353.84	.....
30	oxide, mon-.....	Cs_2O	281.82	or.-red cr.....
31	" , di-.....	Cs_2O_2	297.82	pa. yel. need.....
32	" , tri-.....	Cs_2O_3	313.82	choc. br. cr.....
33	" , tetr-.....	Cs_2O_4	329.82	yel. cr.....
34	phthalate, acid.....	$\text{CsHC}_2\text{H}_4\text{O}_4$	298.03	rhomb.....
35	rhodium sulfate.....	$\text{CsRh}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	644.13	yel. oct.....
36	salicylate.....	$\text{CsC}_7\text{H}_5\text{O}_3$	270.02	.....
37	silicotungstate.....	$4\text{Cs}_2\text{O} \cdot \text{SiO}_2 \cdot 12\text{WO}_3 \cdot x\text{H}_2\text{O}$	.....	wh. cr.....
38	sulfate.....	Cs_2SO_4	361.88	rhomb. or hex. col., 1.560, 1.564, 1.566.....
39	" , acid.....	CsHSO_4	229.98	rhomb. col. pr.....
40	sulfide.....	$\text{Cs}_2\text{S} \cdot 4\text{H}_2\text{O}$	369.94	wh. cr., deliq.....
41	" , di-.....	Cs_2S_2	329.94	amor., dk. red.....
42	" , ".....	$\text{Cs}_2\text{S}_2 \cdot \text{H}_2\text{O}$	347.96	tetr.....
43	" , tri-.....	Cs_2S_3	362.00	yel. leaf.....
44	" , tetra-.....	Cs_2S_4	394.06	yel.....
45	" , penta-.....	Cs_2S_5	426.12	.....
46	" , hexa-.....	Cs_2S_6	458.18	brown-red.....
47	tartrate, acid.....	$\text{CsHC}_4\text{H}_4\text{O}_6$	281.99	wh. rhomb. cr.....
48	" dihydroxy-.....	$\text{Cs}_2\text{C}_4\text{H}_4\text{O}_8 \cdot 2\text{H}_2\text{O}$	481.92	.....
49	Chloric acid	$\text{HClO}_3 \cdot 7\text{H}_2\text{O} (?)$	210.58	known only as col. soln.....
50	" " per-.....	HClO_4	100.47	col. unst. liq.....
51	" " ".....	$\text{HClO}_4 \cdot \text{H}_2\text{O}$	118.48	need., fairly stable.....
52	" " ".....	$\text{HClO}_4 \cdot 2\text{H}_2\text{O}$	136.50	stable, liq.....
53	Chlorine	Cl_2	70.91	grnsh.-yel. gas or liq. or rhomb. cr.; gas 1.000768, liq. 1.367.....
54	azide (chlor(o)azide).....	ClN_3	77.48	gas, exp.....

INORGANIC COMPOUNDS (Continued)

No	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d.		.024 ⁰ ; .135 ²⁰	0.377 ¹⁰⁰	i. al.
2	3.33					i. conc. HCl
3	4.237			71.4 ¹³	95.5 ³⁰	
4				s.		i. al.
5	4.10			sl. s.	v. s.	sl. s. a.
6	3.586	684	1250	v. s.		i. al.
7				366.5 ¹⁸		
8	3.372 ¹⁷			60 ¹⁷	less m.	i. al.
9				d.	d.	soln. HF
10		265			2012 ^{95.4}	
11		—H ₂ O, 41		369.9 ¹		
12				4.14 ²⁵		
13	2.113			1.51 ²⁵		.0035 ²⁸ 70% al.
14	2.7	d.		d.	d.	d. a.
15	3.675	272.3		395.5 ¹⁵		s. al.
16	4.85			2.6 ²⁴		
17	4.259			2.15 ¹⁵		
18	4.510	621	1280	44 ⁰	160 ⁶¹	s. al.
19		207.5		v. sl. s.		
20		73				
21		235	d. 290			
22	3.597	d.		0.097 ¹	1.27 ⁵⁹	
23				0.807 ¹⁷		sl. s. al.
24				1.44 ¹⁷		i. abs. al.
25	3.685; lq. 2.71 ⁸⁰⁰	414	d.	9.16 ⁰ ; 14.9 ¹⁰	196.8 ¹⁰⁰	s. acet.; sl. s. al.
26		100				
27		32-36				
28				v. s.	v. s.	
29				282.9 ²⁵		
30	4.36	d. 360-400		v. s.	d.	s. abs. al.
31	4.25	400	—O ₂ , 650	s.	d.	s. a.
32	4.25 ⁰	400		d.		s. a.
33	3.77 ¹⁹	600	d.	d. to CsOH	d.	s. a.
34	2.178					
35	2.238	110-111		sl. s.		
36				196.2 ⁰	1522 ¹⁰⁰	
37				0.005 ²⁰	0.5 ¹⁰⁰	sl. s. NH ₄ OH; i. HCl, al.
38	4.243	1010	tr. hex. 660	167 ⁰	220 ¹⁰⁰	i. al., acet.
39	3.352 ¹⁶	d.		s.		
40				v. s.	v. s.	
41		460	>800	hyg.		
42				s.		
43		217	780			
44		160 d.				
45	2.806 ¹⁶	210				
46		186				
47				9.7 ²⁵	98 ¹⁰⁰	
48				22.5 ⁰		
49	1.282 ^{14.2}	<—20	d. 40	v. s.		
50	1.764 ²²	—112	39 ⁵⁶	∞		
51	1.88; lq. 1.776 ⁶⁰	50	exp. 110	v. s.	v. s.	
52	1.65	—17.8	200	v. s.	v. s.	s. al.
53	3.214 ⁰ g/l; lq. 1.557 ^{—34} ; s. 1.9	—102	—33.7 (—34.6)	310 ¹⁰ cm ³ ; 1.46 ⁰ g sl. s.	177 ³⁰ cm ³ ; 0.57 ³⁰ g	s. alk.
54						d. alk.

PHYSICAL CONSTANTS OF

No	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Chlorine			
1	fluoride, mono-	ClF	54.46	nearly col. gas.
2	“ tri-	ClF_3	92.46	col. gas.
3	hydrate	$\text{Cl}_2 \cdot 6\text{H}_2\text{O}$ (?)	179.01	rhomb. lt. yel.
4	oxide, mon-	Cl_2O	86.91	yel.-red gas or red-br. liq.
5	“ di- (per-)	ClO_2	67.46	red-yel. gas or or.-red cr., exp.
6	“ tetr-	ClO_4	99.46	
7	oxide, hept-	Cl_2O_7	182.91	col. oil.
8	Chloroauric acid	$\text{HAuCl}_4 \cdot 4\text{H}_2\text{O}$	412.10	brt. yel. need., deliq.
9	Chloroplatinic acid	$\text{H}_2\text{PtCl}_6 \cdot 6\text{H}_2\text{O}$	518.09	red-br. pr., deliq.
10	Chlorostannic acid	$\text{H}_2\text{SnCl}_6 \cdot 6\text{H}_2\text{O}$	441.56	col. leaf.
11	Chlorosulfonic acid	ClSO_3H	116.53	col. fum. liq., 1.437 ¹⁴
12	Chromium	Cr	52.01	cub. steel gray v. hard met.
13	acetate (ous)	$\text{Cr}(\text{C}_2\text{H}_3\text{O}_2)_2$	170.10	red cr.
14	“ (ic)	$\text{Cr}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot \text{H}_2\text{O}$	247.16	gray-grn. powd. or bluish-grn., pasty mass
15	arsenide, mon-	CrAs	126.92	gray, hex.
16	boride, mono-	CrB	62.83	silv. cr.
17	bromide (ous)	CrBr_2	211.84	wh. cr.
18	“ (ic)	CrBr_3	291.76	hex. olv. grn.
19	“ “	$\text{CrBr}_3 \cdot 6\text{H}_2\text{O}$	399.86	hex. pl., grn., deliq.
20	(tri-) carbide, di-	Cr_3C_2	180.05	gray cr.
21	(penta-) carbide, di-	Cr_5C_2	284.07	silv. cr.
22	carbonate (ous)	CrCO_3	112.02	amor. gray bl.
23	chloride (ous)	CrCl_2	122.92	wh. need., deliq.
24	“ (ic)	CrCl_3	158.38	i. vit. pl. (or deliq. s. cr.)
25	“ “	$[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$	266.48	monocl. vlt
26	“ “	$[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$	266.48	grn. cr. powd.
27	“ “	$[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$	266.48	rhomb. grn.
28	“ “	$\text{CrCl}_3 \cdot 10\text{H}_2\text{O}$	338.54	grn. cr. powd.
29	fluoride (ous)	CrF_2	90.01	grn. cr.
30	“ (ic)	CrF_3	109.01	rhomb. grn.
31	“ “	$\text{CrF}_3 \cdot 4\text{H}_2\text{O}$	181.07	cub. oct. grn.
32	“ “	$\text{CrF}_3 \cdot 9\text{H}_2\text{O}$	271.16	vit. bl. gelat.
33	hydroxide (ous)	$\text{Cr}(\text{OH})_2$	86.03	yel. br.
34	“ (ic)	$\text{Cr}(\text{OH})_3$ (or $\text{Cr}_2\text{O}_3 \cdot x\text{H}_2\text{O}$)	103.03	bl.-gray grn. gel. or vlt. amor.
35	iodide (ous)	CrI_2	305.85	grayish powd.
36	nitrate (ic)	$\text{Cr}(\text{NO}_3)_3 \cdot 7\frac{1}{2}\text{H}_2\text{O}$	373.16	monocl. br.
37	“ “	$\text{Cr}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	400.18	monocl. purp
38	nitride, mono-	CrN	66.02	amor.
39	oxalate (ous)	$\text{CrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	158.05	yel. cr. powd.
40	oxide, mon- (ous)	CrO	68.01	black.
41	“ sesqui- (ic)	Cr_2O_3	152.02	hex., grn.
42	“ di-	CrO_2	84.01	br.-blk. powd.
43	“ tri- (chromic anhydride)	CrO_3	100.01	rhomb. red., deliq.
44	oxychloride	CrO_2Cl_2	154.92	dk. red liq.
45	2,4-pentanedione deriv. (acetylacetonate)	$\text{Cr}(\text{C}_5\text{H}_7\text{O}_2)_3$	349.33	
46	orthophosphate (ic)	$\text{Cr}(\text{PO}_4)_3 \cdot 2\text{H}_2\text{O}$	183.06	violet cr.
47	“ “	$\text{Cr}(\text{PO}_4)_3 \cdot 4\text{H}_2\text{O}$	219.09	grn. cr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.62 ¹⁰⁰	-154 ± 0.5	-100.8	d.	d.	.....
2	1.77 ¹³	-83	11.3	d.	d.	.....
3	1.23	d. 9.6	.....	v. s.	.....	s. alk.
4	3.89 ⁰ g/l	-20	3.87 ⁶⁶ ; exp.	200 cm ³	d. to HCl	exp. C. comp.; s. alk.
5	3.09 ¹¹ g/l	-59	9.97 ³¹ ; exp.	2000 ⁴	d. HClO ₃ .	exp. C. comp.; s. alk.,
6	.....	.....	100	cm ³	Cl ₂ , O ₂	H ₂ SO ₄
7	.....	-91.5	82; exp.	s. d.	.....	s. bz.
8	.....	.....	82	s. d.	.....	s. bz.
9	2.431	d.	.....	s.	v. s.	s. al., eth.
10	1.93	60	.....	v. s.	v. s.	s. al., eth.
11	1.766 ¹⁸	9	.....	s.	.....	.....
12	6.92	-80	158	d. to H ₂ S	O ₄ + HCl	d. al., a.; i. CS ₂
13	.....	1615	2200	i.	i.	s. HCl, dil. H ₂ SO ₄ ; i. HNO ₃
14	.....	.....	.....	sl. s.	s.	sl. s. al.
15	6.35 ¹⁶	.....	.....	s.	.....	i. al.
16	5.4 ¹⁷	.....	.....	i.	i.	i. a.
17	4.356	.....	.....	i.	.....	s. fus. Na ₂ O ₂
18	4.250	.....	subl.	(1) 200*	.....	s. al.
19	5.4 ¹⁷	.....	.....	(2) i.	i.	v. s. al.; d. alk.
20	6.68	1890	3800	200	.....	v. s. al.; s. fus. Na ₂ O ₂ ;
21	6.915 ²⁵	1665	.....	.....	i. eth.	s. dil. HCl
22	.....	.....	.....	v. sl. s.	.....	s. min. a.; i. eth., al.
23	2.75	.....	.....	v. s.	v. s.	sl. s. al.; i. eth.
24	2.76 ¹⁵	.....	1300 subl.	(1) i.	i.	} i. a., CS ₂ , acet., al.
25	2.76	95	.....	(2) 233 ²⁵	s.	
26	1.760 ²³	.....	.....	58.7 ²⁵	s.	s. al.; i. eth.
27	2.76	83	.....	58.5 ³⁵	s.	s. al.; i. eth.
28	.....	.....	.....	v. s.	.....	v. s. al.
29	4.11	1100	>1300	sl. s.	.....	s. h. HCl; i. al.
30	3.8	>1000	subl.	i.	.....	sl. s. a.; i. al., NH ₃
31	3.78	.....	.....	s.	s.	s. a.; i. al., NH ₃
32	.....	.....	.....	v. s.	.....	s. a., HCl, KOH; i. al
33	.....	.....	.....	d.	.....	s. a.
34	.....	.....	.....	i.	i.	s. a., alk.; sl. s. NH ₄ OH
35	5.196	.....	.....	v. s.	.....	.....
36	.....	100	.....	s.	s.	.....
37	.....	37	d. 125.5	s.	s.	s. a., al., alk., acet.
38	.....	d. 1500	.....	i.	.....	i. a., alk.
39	.....	.....	.....	.....	s.	.....
40	.....	.....	.....	i.	i.	i. dil. HNO ₃
41	5.21	1990	.....	i.	i.	i. a., al., alk.
42	.....	-O, 300	.....	i.	.....	s. HNO ₃
43	2.70	196	d.	166 ¹⁵	206.7 ¹⁰⁰	s. eth., al., H ₂ SO ₄
44	1.911	-96.5	117	d.	d.	d. al.; s. eth., ac. a.
45	.....	216	340	i.	.....	s. org. solvts. except lgr.
46	2.42 ^{32,5}	.....	.....	sl. s.	.....	s. a., alk.; i. ac. a.
47	2.10 ^{32,5}	.....	.....	sl. s.	.....	s. a.

* Several chromic salts exist in two forms, a soluble and an insoluble modification.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Chromium				
1	orthophosphate (ic).....	$\text{Cr}(\text{PO}_4) \cdot 6\text{H}_2\text{O}$	255.13	tricl. vlt.....
2	phosphide, mono.....	CrP	83.03	gray-blk. cr.....
3	silicide.....	Cr_3Si_2	212.15	tetr. pr.....
4	sulfate (ous).....	$\text{CrSO}_4 \cdot 7\text{H}_2\text{O}$	274.18	blue cr.....
5	" (ic).....	$\text{Cr}_2(\text{SO}_4)_3$	392.20	vlt. or red powd.....
6	" ".....	$\text{Cr}_2(\text{SO}_4)_3 \cdot 5\text{H}_2\text{O}$	482.28	green amor.....
7	" ".....	$\text{Cr}_2(\text{SO}_4)_3 \cdot 15\text{H}_2\text{O}$	662.44	violet amor. sc.....
8	" ".....	$\text{Cr}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$	716.49	cub. oct., bl.-vlt.....
9	sulfide, mono- (ous).....	CrS	84.07	blk. powd.....
10	" , sesqui- (ic).....	Cr_2S_3	200.20	br. blk. powd.....
11	(tri-) sulfide, tetra-.....	Cr_3S_4	284.27	gray-blk. powd.....
12	Chromium complexes: Chloropentamminechromium (III) chloride.....	$[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$	243.54	oct. red.....
13	Hexamminechromium (III) chloride.....	$[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3 \cdot \text{H}_2\text{O}$	278.59	yel. cr.....
14	Hexaureachromium (III) fluosilicate.....	$[\text{Cr}(\text{CON}_2\text{H}_4)_6]_2 \cdot [\text{SiF}_6]_3 \cdot 3\text{H}_2\text{O}$	1304.95	leaves, lt. grn.....
15	Hexaureachromium (III) perhenate.....	$[\text{Cr}(\text{CON}_2\text{H}_4)_6] \cdot (\text{ReO}_4)_3$	1163.29	grn. need.....
16	Cobalt.	Co	58.94	cub. silv. gray metal.....
17	acetate (ous).....	$\text{Co}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 4\text{H}_2\text{O}$	249.09	monocl. red-vlt., deliq.....
18	" (ic).....	$\text{Co}(\text{C}_2\text{H}_3\text{O}_2)_3$	236.07	oct., green.....
19	aluminate (approx. Thenard's blue).....	$\text{Co}(\text{AlO}_2)_2$	176.88	cub. blue.....
20	orthoarsenate (ous), (erythrite).....	$\text{Co}_3(\text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$	598.77	monocl. vlt.-red, 1.626, 1.661, 1.699.....
21	orthoarsenite, acid (ous).....	$\text{Co}_3\text{H}_6(\text{AsO}_3)_4 \cdot \text{H}_2\text{O}$	692.52	rose-red.....
22	benzoate (ous).....	$\text{Co}(\text{C}_7\text{H}_5\text{O}_2)_2 \cdot 4\text{H}_2\text{O}$	373.23	gray-red leaf.....
23	boride, mono.....	CoB	69.76	pr.....
24	bromate (ous).....	$\text{Co}(\text{BrO}_3)_2 \cdot 6\text{H}_2\text{O}$	422.87	oct. red.....
25	bromide (ous).....	CoBr_2	218.77	grn. cr., deliq.....
26	" ".....	$\text{CoBr}_2 \cdot 6\text{H}_2\text{O}$	326.87	pr. red-vlt., deliq.....
27	carbonate (ous) (spherocobaltite).....	CoCO_3	118.95	trig., red, 1.855, 1.60.....
28	" , basic (ous).....	$2\text{CoCO}_3 \cdot 3\text{Co}(\text{OH})_2 \cdot \text{H}_2\text{O}$	534.78	vlt.-red prisms.....
29	carbonyl, tri-.....	$\text{Co}(\text{CO})_3$ (or $[\text{Co}(\text{CO})_3]_4$).....	142.97 (571.88)	blk. cr.....
30	carbonyl, tetra-.....	$\text{Co}(\text{CO})_4$ (or $[\text{Co}(\text{CO})_4]_2$).....	170.98 (341.96)	or. cr.....
31	chlorate (ous).....	$\text{Co}(\text{ClO}_3)_2 \cdot 6\text{H}_2\text{O}$	333.95	cub. red, deliq.....
32	perchlorate (ous).....	$\text{Co}(\text{ClO}_4)_2$	257.85	red need.....
33	perchlorate (ous).....	$\text{Co}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$	365.95	hex., red 1.55.....
34	chloride (ous).....	CoCl_2	129.85	bl. cr.....
35	chloride (ous).....	$\text{CoCl}_2 \cdot 2\text{H}_2\text{O}$	165.89	.....
36	chloride (ous).....	$\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$	237.95	monocl. red.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.121	-3½H ₂ O, 100		sl. s.		s. a., alk.; i. ac. a.
2	5.7 ¹⁵			i.		s. HNO ₃ , HF; i. a.
3	5.5			i.	i.	s. HCl, HF; i. HNO ₃ , H ₂ SO ₄
4				12.35 ⁰		sl. s. al.
5	3.012			i.; s.*		s. al.; i. a.
6				s.		s. al., H ₂ SO ₄
7	1.867 ¹⁷	100	-10H ₂ O, 100	s.	s., d. ⁶⁷	i. al.
8	1.7 ²²	-12H ₂ O, 100		120 ²⁰	d.	s. al.
9	4.1			i.		v. s. a.
10	3.77 ¹⁹			i. d.	d.	d. al.; s. HNO ₃
11				i.		s. HNO ₃ ; i. HCl, dil. H ₂ SO ₄
12	1.696			.65 g. at 16		i. HCl
13	1.585			s.		
14				.522 ²⁰		i. al.
15	2.652 ²⁶ / ₄			1.786		.667 al.
16	8.9	1495	2900	i.	i.	s. a.
17	1.705 ¹⁹	-4H ₂ O, 140		s.	s.	s. a., al.
18				hyd. readily		s. glac. acet. a.
19				i.	i.	i. a.
20	2.948	d.		i.	i.	s. dil. a., NH ₄ OH
21		-H ₂ O, 100		i.		s. a., NH ₄ OH
22		-4H ₂ O, 115		v. s.		
23	7.25 ¹⁸			d.	d.	s. HNO ₃
24				45.5 ¹⁷		s. NH ₄ OH
25	4.909 ²⁵	d.		66.7 ⁵⁹	68.1 ⁹⁷	77.1 ²⁰ al.; s. eth.
26	2.46	47-8; -4H ₂ O, 100	-6H ₂ O, 130	s. red color	153.2 ⁹⁷	s. a., eth., al. bl. color
27	4.13	d.		i.	i.	s. a.; i. NH ₃
28				i.	d.	s. a., (NH ₄) ₂ CO ₃
29				sl. s.		d. with Br
30	1.73 ¹⁸	51	d. 52	i.	i.	s. al., CS ₂ , eth.
31	1.92	61	d. 100	558.3 ⁰	v. s.	s. al.
32	3.327			100 ⁰	115 ⁴⁵	s. al., acet.
33		143 (5H ₂ O)		5H ₂ O: 100 ⁰	115 ⁴⁵	s. al., acet.
34	3.356	subl.	1049	45 ⁷	105 ⁹⁶	54.4 al.; 8.6 acet.; 38.5 meth. al.
35	2.477 ²⁵ / ₂₅					
36	1.924 ²⁶ / ₂₅	86	-6H ₂ O, 110	76.7 ⁰ (red); 49.9 ²⁰	190.7 ¹⁰⁰	v. s. al. bl. color; 0.29 eth.; s. acet.

* Several chromic salts exist in two forms, a soluble and an insoluble modification.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Cobalt				
1	chloride (ous), diammine (α -)	$\text{CoCl}_2 \cdot 2\text{NH}_3$	163.92	rose...
2	chloride (ous), diammine (β -)	$\text{CoCl}_2 \cdot 2\text{NH}_3$	163.92	blue-violet...
3	chloride (ous), hexammine	$\text{CoCl}_2 \cdot 6\text{NH}_3$	232.05	rose-red oct.
4	chromate (ous)	CoCrO_4	174.95	gray-blk. cr.
5	citrate (ous)	$\text{Co}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 2\text{H}_2\text{O}$	591.05	rose-red
6	cyanide (ous)	$\text{Co}(\text{CN})_2 \cdot 2\text{H}_2\text{O}$	147.01	buff; anh. bl.-vlt. powd.
7	"	$\text{Co}(\text{CN})_2 \cdot 3\text{H}_2\text{O}$	165.02	amor. red-gray powd.
8	ferricyanide (ous)	$\text{Co}_3[\text{Fe}(\text{CN})_6]_2$	600.72	red. need.
9	ferrocyanide (ous)	$\text{Co}_2\text{Fe}(\text{CN})_6 \cdot 7\text{H}_2\text{O}$	455.94	gray-grn.
10	fluoride (ous)	$\text{CoF}_2 \cdot 2\text{H}_2\text{O}$	132.97	monocl. rose-red
11	"	$\text{CoF}_2 \cdot 4\text{H}_2\text{O}$	169.00	α rhomb. oct. red; β cr. powd. rose
12	" (ic)	$\text{Co}_2\text{F}_6 \cdot 7\text{H}_2\text{O}$	357.99	grn. powd.
13	" , acid (ous)	$\text{CoF}_2 \cdot 5\text{HF} \cdot 6\text{H}_2\text{O}$	305.08	trig., orange-red
14	" (ic)	CoF_3 (or Co_2F_6)	115.94	hex. brown
15	fluosilicate (ous)	$\text{CoSiF}_6 \cdot 6\text{H}_2\text{O}$	309.10	trig. pink, 1.382, 1.387
16	formate (ous)	$\text{Co}(\text{CHO}_2)_2 \cdot 2\text{H}_2\text{O}$	185.01	red cr.
17	hydroxide (ous)	$\text{Co}(\text{OH})_2$	92.96	rhomb. rose-red
18	" (ic)	$\text{Co}(\text{OH})_3$	109.96	blk.-br. powd.
19	iodate (ous)	$\text{Co}(\text{IO}_3)_2$	408.78	bl.-vlt. need.
20	"	$\text{Co}(\text{IO}_3)_2 \cdot 6\text{H}_2\text{O}$	516.88	red oct.
21	iodide (ous), (α -)(stable)	CoI_2	312.78	hexag. black
22	" " (β -)	CoI_2	312.78	yel. need., unst.
23	" " "	$\text{CoI}_2 \cdot 2\text{H}_2\text{O}$	348.81	grn., deliq.
24	" " "	$\text{CoI}_2 \cdot 6\text{H}_2\text{O}$	420.88	hex. br.-red
25	linoleate (ous)	$\text{Co}(\text{C}_{18}\text{H}_{33}\text{O}_2)_2$	617.80	brown amor.
26	nitrate (ous)	$\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	291.05	monocl. red, deliq.
27	oleate (ous)	$\text{Co}(\text{C}_{18}\text{H}_{33}\text{O}_2)_2$	621.83	br. amor. powd.
28	oxalate (ous)	CoC_2O_4	146.96	redsh. wh.
29	oxide (ous)	CoO	74.94	cub. grn.-br.
30	" " (ic)	Co_3O_4	240.82	cub. blk.
31	" (ic)	Co_2O_3	165.88	blk.-gray powd.
32	palmitate	$\text{Co}(\text{C}_{16}\text{H}_{31}\text{O}_2)_2$	569.76	
33	orthophosphate (ous)	$\text{Co}_3(\text{PO}_4)_2$	366.86	redsh. cr.
34	" " "	$\text{Co}_3(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$	402.89	pink powd.
35	" " "	$\text{Co}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$	510.99	redsh. powd.
36	phosphide	Co_2P	148.90	sm. need. gray
37	orthophosphite, di- (ous)	$\text{CoHPO}_3 \cdot 2\text{H}_2\text{O}$	175.00	redsh. need.
38	propionate (ous)	$\text{Co}(\text{C}_3\text{H}_5\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$	259.13	dk. red. cr.
39	perrhenate (ous)	$\text{Co}(\text{ReO}_4)_2 \cdot 5\text{H}_2\text{O}$	649.64	dk. pink
40	selenate (ous)	$\text{CoSeO}_4 \cdot 5\text{H}_2\text{O}$	291.98	tricl. ruby red
41	" " "	$\text{CoSeO}_4 \cdot 7\text{H}_2\text{O}$	328.01	monocl.
42	selenide, mono-	CoSe	137.90	hex. yel.
43	orthosilicate (ous)	Co_2SiO_4	209.94	vlt. cr.
44	silicide	CoSi	87.00	rhomb.
45	"	CoSi_2	115.06	cub. dk. bluish
46	"	Co_2Si	145.94	gray cr.
47	sulfate (ous)	CoSO_4	155.00	hex. and oct. red powd.
48	" " "	$\text{CoSO}_4 \cdot \text{H}_2\text{O}$	173.02	red cr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.097	273	.....	.....	.....	.....
2	2.073	210→ α	form	.....	.....	.....
3	1.497	.....	.....	.....	.....	s. NH_4OH ; i. al.
4	.....	d.	.....	i.	.....	s. a., NH_4OH
5	.....	-2 H_2O , 150	.....	0.8	.....	.....
6	anh. 1.872 ²⁵	-2 H_2O , 280	.....	i.	.....	s. KCN, HCl, NH_4OH
7	.....	-3 H_2O , 250	.....	i.	.....	s. KCN soln.
8	.....	.....	.....	i.	.....	s. NH_4OH ; i. HCl
9	.....	.....	.....	i.	.....	s. KCN; i. HCl
10	4.46	.....	.....	s.	d.	s. HF
11	2.192 ²⁵	.....	.....	.....	.....	.....
12	2.314 ²⁵	.....	.....	.....	.....	.....
13	2.045	.....	.....	.....	.....	.....
14	3.88	.....	.....	d. to $\text{Co}(\text{OH})_3$	.....	.....
15	2.113 ¹⁹	.....	.....	118.1 ^{21,5}	s.	.....
16	2.129 ²²	-2 H_2O , 140	anh. d. 175	5.03 ²⁰	.....	.....
17	3.597 ¹⁵	d.	.....	.00032	.....	s. a., NH_4 salts; i. alk.
18	.....	d.	-1 $\frac{1}{2}$ H_2O , 100	0.00032	.....	s. a.; i. al.
19	5.008 ¹⁸	.....	.....	0.4 ¹⁵	1.33 ¹⁰⁰	s. HCl, HNO_3
20	3.689 ²¹	61 d.; -4 H_2O , 135	.....	s.	.....	.....
21	5.68	.....	.....	159 ⁹	420 ¹⁰⁰	v. s. al., acet.
22	5.45 ²⁵	.....	.....	.....	.....	.....
23	.....	.....	.....	376.2 ⁴⁰	s.	.....
24	2.90	-6 H_2O , 130	.....	s.	s.	s. al., eth., chl.
25	.....	.....	.....	i.	.....	s. al., eth., acet.
26	1.87	<100	-3 H_2O , 55	133.8 ⁰	v. s.	100 ^{12,5} al.; s. acet.; sl. s NH_3
27	.....	.....	.....	i.	.....	s. al., eth., oils, bz.
28	3.021 ²⁵	.....	.....	i.	.....	s. a., NH_4OH
29	6.47 ¹⁸	1935	.....	i.	i.	s. a., NH_4OH ; i. al.
30	6.07	.....	.....	i.	i.	s. H_2SO_4 ; i. HCl, HNO_3 aq. reg.
31	5.18	d. 895	.....	i.	i.	s. a.; i. al.
32	.....	70.5	.....	.....	.....	s. pyridine, hot CS_2 , CCl_4 sl. s. eth., CS_2 ; i. meth al., acet.
33	2.587 ²⁵	.....	.....	i.	i.	s. H_3PO_4 , NH_4OH
34	.....	.....	.....	i.	.....	s. H_3PO_4
35	2.769 ²⁵	-8 H_2O , 200	.....	sl. s.	.....	s. min. a., H_3PO_4 ; i. al.
36	6.4 ¹⁵	1386	.....	i.	i.	s. HNO_3
37	.....	bl. at 250	.....	sl. s.	.....	.....
38	.....	ca. 250	.....	anh. 33.5 ¹¹	.....	v.s. al.
39	.....	d.	.....	d.	.....	.....
40	2.512	d.	.....	v. s.	.....	.....
41	2.135	.....	.....	.....	.....	.....
42	7.65	red ht.	.....	.....	.....	.....
43	4.63	.....	.....	i.	.....	s. dil. HCl
44	6.30 ²⁰	1395	.....	.....	.....	.....
45	5.3	1277	.....	.....	.....	.....
46	7.28	1327	.....	.....	.....	d. a.
47	3.71 ²⁵ 25	989	.....	36.2 ²⁰	83 ¹⁰⁰	1.04 ¹⁸ meth. al.; i. NH_3
48	3.075 ²⁵	d.	.....	s.	s.	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Cobalt				
1	sulfate (ous).....	$\text{CoSO}_4 \cdot 6\text{H}_2\text{O}$	263.10	monocl.....
2	“ “ (bieberite).....	$\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$	281.11	monocl. red-pink, 1.477, 1.483, 1.489
3	“ (ic).....	$\text{Co}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$...	730.35	bl.-green cr. powd.....
4	sulfide, mono- (jaipurite)	CoS	91.00	oct. reddish, silver-white
5	(tri-) sulfide, tetra- (ous, ic)	Co_3S_4	305.06	cub., dk. gray.....
6	sulfide, sesqui- (ic).....	Co_2S_3	214.06	blk. cryst.....
7	“ di-.....	CoS_2	123.06	cub. blk.....
8	sulfite (ous).....	$\text{CoSO}_3 \cdot 5\text{H}_2\text{O}$	229.08	red.....
9	tartrate (ous).....	$\text{CoC}_4\text{H}_4\text{O}_6$	207.01	monocl. redsh.....
10	thiocyanate (ous).....	$\text{Co}(\text{SCN})_2 \cdot 3\text{H}_2\text{O}$	229.14	rhomb. violet.....
11	orthotitanate.....	Co_2TiO_4	229.78	cub. grnsh. blk.....
12	tungstate (ous).....	CoWO_4	306.86	monocl., bl.-grn.....
Cobalt complexes:				
13	Aquopentamminecobalt (III) chloride (roseo)...	$[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]\text{Cl}_3$...	268.49	brick-red cr.....
14	cis-Chloroaquotetramminecobalt (III) chloride	$[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$	251.46	rhomb. violet.....
15	Chloropentamminecobalt (III) chloride (purpleo)	$[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$...	250.47	rhomb. dk. red-violet.....
16	Hexamminecobalt (III) chloride (luteo)	$[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$	267.50	monocl. or.....
17	Hexamminecobalt (III) perrenate	$[\text{Co}(\text{NH}_3)_6](\text{ReO}_4)_3 \cdot 2\text{H}_2\text{O}$	948.10	or.-yel. doubly refracting pr.....
18	Cobalticyanic acid ...	$[\text{H}_3\text{Co}(\text{CN})_6]_2 \cdot \text{H}_2\text{O}$ (or $\frac{1}{2}\text{H}_2\text{O}$)	454.16	col. need., deliq.....
19	Cobaltocyanic acid ...	$\text{H}_3\text{Co}(\text{CN})_6$	159.03	col.....
20	Columbium (niobium)	$\text{Cb}(\text{Nb})$	92.91	rhomb. steel gray lust. met., 1.80.....
21	bromide, penta-.....	CbBr_5	492.49	purp. red.....
22	chloride, penta-.....	CbCl_5	270.20	yel.-wh., deliq.....
23	fluoride, penta-.....	CbF_5	187.91	monocl. pr., col.....
24	hydride.....	CbH	93.92	gray powd.....
25	nitride, mono-.....	CbN	106.92	black.....
26	oxalate, acid.....	$\text{Cb}(\text{HC}_2\text{O}_4)_5$	583.05	monocl. col.....
27	oxide, mon- (or di-).....	CbO (or Cb_2O_3).....	108.91	cubic blk.....
28	“ di- (or tetr-).....	Cb_2O_3 (or Cb_2O_4).....	124.91	black.....
29	“ pent-.....	Cb_2O_5	265.82	rhomb. wh.....
30	“ “ (columbic acid, columbium hydroxide)	$\text{Cb}_2\text{O}_5 \cdot x\text{H}_2\text{O}$		wh. amor.....
31	oxybromide.....	CbOBr_3	348.66	yel. cryst.....
32	oxychloride.....	CbOCl_3	215.28	need. col.....
33	oxysulfide.....	Cb_2OS_3 (?).....	298.00	black.....
34	Copper	Cu	63.57	cub. redsh. metal.....
35	acetate (ic) (neutral verdigris)	$\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$...	199.67	dk. grn. powd., 1.545, 1.550.....
36	acetate, basic (blue verdigris)	$\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{CuO} \cdot 6\text{H}_2\text{O}$	369.33	grnsh.-bl. powd.....
37	acetate arsenite (ic) (Paris green)	Approx. $\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{CuO} \cdot \text{As}_2\text{O}_3$	1013.83	em. grn. powd.....
38	acetylide (ous).....	Cu_2C_2	151.16	amor. red exp.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.019 ¹⁶ / ₁₅	.....	.....	.....	.....	.....
2	1.948 ²⁵ / ₂₅	96.8	-7H ₂ O, 420	60.4 ³	67 ⁷⁰	2.5 ³ al.; s. meth. al.
3	.....	.....	.....	s. d.	.....	s. H ₂ SO ₄ ; i. pyr.
4	5.45	>1116	.....	0.00038 ¹⁹	.....	s. a., al.
5	4.86	.....	.....	.....	.....	.....
6	4.8	.....	.....	i.	.....	d. a.
7	4.269	.....	.....	i.	.....	s. HNO ₃ , aq. reg.
8	.....	.....	.....	i.	.....	s. H ₂ SO ₄
9	.....	.....	.....	sl. s.	.....	s. dil. a.
10	.....	-3H ₂ O, 105	.....	s.	.....	.....
11	5.07-12	.....	.....	.....	.....	s. conc. HCl; sl. s. dil. HCl
12	8.42	.....	.....	i.	.....	s. hot conc. acids; sl. s. cold dil. acids
13	1.7 ²⁵	d. 100	.....	16.12 ⁹ ; 24.87 ²⁵	24.87 ¹⁶	sl. s. HCl; i. al.
14	1.847	d.	.....	1.4 ⁹ ; 2.76 ²⁰	.....	s. a.; i. al.
15	1.819 ²⁵ / ₂₅	d.	.....	0.232 ⁹ ; 0.4 ²⁵	1.031 ^{16.5}	s. conc. H ₂ SO ₄ ; i. al.
16	1.702	.....	.....	4.26 ⁰	12.74 ^{16.5}	s. conc. HCl; i. al., NH ₄ OH
17	3.329 ²⁵	.....	.....	0.0469	.....	.....
18	.....	d <100	.....	s.	.....	s. al., HCl, dil. HNO ₃ , dil. H ₂ SO ₄
19	.....	.....	.....	s.	.....	i. abs. al., eth., chl.
20	8.55	2500	3700	i.	i.	s. h. H ₂ SO ₄ ; sl. s. HF; i. HCl, HNO ₃
21	.....	150	270	d.	.....	s. al., ethyl bromide
22	2.75	194	240.5	d.	.....	s. HCl, CCl ₄ , al.
23	3.293 ¹⁸	75.5	229	s. d.	.....	s. al.; sl. s. CS ₂ , chl., H ₂ SO ₄
24	6.6	infus.	.....	.....	.....	s. HF, conc. H ₂ SO ₄ ; i. HCl, HNO ₃ , alk.
25	8.4	2050 d.	.....	.....	.....	s. HF + HNO ₃ ; i. HNO ₃
26	.....	.....	.....	d.	d.	s. H ₂ C ₂ O ₄ ; d. al.
27	6.27	.....	.....	i.	.....	s. H ₂ SO ₄ ; sl. s. HF; i. HNO ₃
28	.....	.....	.....	i.	.....	sl. s. alk.; i. a.
29	4.47	1520	.....	i.	i.	s. H ₂ SO ₄ , HF, alk.
30	4.3 ?	.....	.....	i.	.....	s. KOH, HF, H ₂ SO ₄ ; i. NH ₃
31	.....	subl.	.....	d.	.....	s. a.
32	10.19 ⁴⁰⁰ g/l	subl. 400	.....	s. d.	d.	s. H ₂ SO ₄ , al.; i. HCl
33	.....	.....	.....	i.	.....	s. H ₂ SO ₄ ; sl. s. HF; i. HCl
34	8.92	1083	2310	i.	i.	s. HNO ₃ , h. H ₂ SO ₄ ; v. sl. s. HCl, NH ₄ OH
35	1.882	115	240 d.	7.2	20	7.14 al.; s. eth.
36	.....	.....	.....	sl. s.	.....	s. dil. a., NH ₄ OH; sl. s. s. al.
37	.....	.....	.....	i.	.....	s. a., NH ₄ OH; i. al.
38	.....	exp.	.....	v. sl. s.	.....	s. a., KCN

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Copper				
1	<i>ortho</i> arsenate (ic)	$\text{Cu}_3(\text{AsO}_4)_2 \cdot 4\text{H}_2\text{O}$	540.59	bluish-grn.
2	" , acid (ic)	$\text{Cu}_5\text{H}_2(\text{AsO}_4)_4 \cdot 2\text{H}_2\text{O}$	911.54	blue.
3	(tri-) arsenide (domey-kite)	Cu_3As	265.62	hex.
4	arsenide	Cu_5As_2	467.67	oct. bl.
5	<i>ortho</i> arsenite, acid (?) (ic) (Scheele's green)	CuHASO_3 (?)	187.49	green powd.
6	benzoate (ic)	$\text{Cu}(\text{C}_7\text{H}_5\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	341.82	lt.-bl. cr. powd.
7	metaborate (ic)	$\text{Cu}(\text{BO}_2)_2$	149.21	bluish-grn. cr. powd.
8	boride	Cu_3B_2	212.35	yellow.
9	bromate (ic)	$\text{Cu}(\text{BrO}_3)_2 \cdot 6\text{H}_2\text{O}$	427.50	cub. bl.-grn.
10	bromide (ous)	CuBr (or Cu_2Br_2)	143.49 (286.97)	cub., tetrah. wh.
11	" (ic)	CuBr_2	223.40	monocl. blk., deliq.
12	butyrate (ic)	$\text{Cu}(\text{C}_4\text{H}_7\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	273.80	dk.-grn. cr.; odor butyric a.
13	carbonate (ous)	Cu_2CO_3	187.15	yellow (exist. quest.)
14	" , basic (ic) (malachite)	$\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	221.17	monocl. dk. grn., 1.655, 1.875, 1.909.
15	" , basic (ic) (azurite, chessylite)	$2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	344.75	monocl. bl., 1.730, 1.758, 1.838.
16	chlorate (ic)	$\text{Cu}(\text{ClO}_3)_2 \cdot 6\text{H}_2\text{O}$	338.58	cub. green, deliq.
17	chloride (ous) (nan-tokite)	CuCl (or Cu_2Cl_2)	99.03 (198.05)	cub. wh., 1.93.
18	chloride (ic)	CuCl_2	134.48	br. yel. powd. hyg.
19	" "	$\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$	170.52	rhomb. grn., deliq., β 1.685.
20	chromate, basic (ic)	$\text{CuCrO}_4 \cdot 2\text{CuO} \cdot 2\text{H}_2\text{O}$	374.75	yel.-br.
21	dichromate (ic)	$\text{CuCr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$	315.62	blk. cryst., deliq.
22	citrate (ic)	$2\text{Cu}_2\text{C}_6\text{H}_4\text{O}_7 \cdot 5\text{H}_2\text{O}$	720.56	bluish-grn. powd.
23	cyanide (ous)	CuCN (or $\text{Cu}_3(\text{CN})_2$)	89.59	monocl. wh.
24	" (ic)	$\text{Cu}(\text{CN})_2$	115.61	yel. grn. powd.
25	ethylacetacetate (ic)	$\text{Cu}(\text{C}_6\text{H}_9\text{O}_3)_2$	321.84	grn. need.
26	ferricyanide (ous)	$\text{Cu}_3\text{Fe}(\text{CN})_6$	402.66	br.-red.
27	" (ic)	$\text{Cu}_3[\text{Fe}(\text{CN})_6]_2$	614.61	yel.-grn.
28	ferrocyanide (ous)	$\text{Cu}_4\text{Fe}(\text{CN})_6$	466.23	br.-red.
29	" (ic)	$\text{Cu}_2\text{Fe}(\text{CN})_6 \cdot 7\text{H}_2\text{O}$	465.20	red.-br.
30	fluoride (ous)	CuF (or Cu_2F_2)	82.57	red cryst.
31	" (ic)	$\text{CuF}_2 \cdot 2\text{H}_2\text{O}$	137.60	monocl. bl.
32	fluosilicate (ous)	Cu_2SiF_6	269.20	red powd.
33	" (ic)	$\text{CuSiF}_6 \cdot 4\text{H}_2\text{O}$	277.69	monocl. pr.
34	" (ic)	$\text{CuSiF}_6 \cdot 6\text{H}_2\text{O}$	313.73	rhomb. bl., deliq., 1.409, 1.408.
35	formate (ic)	$\text{Cu}(\text{CHO}_2)_2$	153.61	monocl. bl.
36	" "	$\text{Cu}(\text{CHO}_2)_2 \cdot 4\text{H}_2\text{O}$	225.67	blue cr.
37	glycine deriv. (ic)	$\text{Cu}(\text{C}_2\text{H}_4\text{NO}_2)_2 \cdot \text{H}_2\text{O}$	229.71	bl. need.
38	hydride	CuH (or Cu_2H_2)	64.58	red-br. (exist. quest.)
39	hydroxide (ous)	CuOH	80.58	yellow (exist. quest.)
40	" (ic)	$\text{Cu}(\text{OH})_2$	97.59	bl. gel. or amor. bl. powd.
41	iodate (ic)	$\text{Cu}(\text{IO}_3)_2$	413.41	monocl. grn.
42	" "	$\text{Cu}(\text{IO}_3)_2 \cdot \text{H}_2\text{O}$	431.43	tricl. blue.
43	" , basic (ic)	$\text{Cu}(\text{OH})\text{IO}_3$	255.50	rhomb. grn.
44	<i>paraperiodate</i> (ic)	Cu_2HIO_6	351.07	grn. powd. cr.
45	iodide (ous) (marshite)	CuI (or Cu_2I_2)	190.49	cub. wh., 2.346.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				i.	i.	s. a., NH ₄ OH
2				i.		s. a., NH ₄ OH
3	8.0	830				
4	7.56	d.		i.	i.	s. a., NH ₄ OH
5		d.		i.	i.	s. a., al., NH ₄ OH
6		-2H ₂ O, 110		sl. s.		s. dil. a.; sl. s. al.
7	3.859			s		
8	8.116					
9	2.583	d. 180	-6H ₂ O, 200	v. s.		s. NH ₄ OH
10	4.718	504	1345	v. sl. s.	d.	s. HBr, HCl, HNO ₃ , NH ₄ OH; i. acet.
11		498		v. s.		s. al., acet., NH ₃ , pyr.; i. bz.
12				v. sl. s.		s. al., eth., NH ₄ OH, dil. a.
13	4.40	d.		i.	i.	s. a., NH ₄ OH
14	4.0	d. 200		i.	d.	0.026 aq. CO ₂ ; s. a., NH ₄ OH, KCN; i. al.
15	3.88	d. 220		i.	d.	s. NH ₄ OH, h. aq. NaHCO ₃
16		65	d. 100			s. al., acet.
17	3.53	422	1366	207° 0.0062	v. s.	s. HCl, NH ₄ OH
18	3.054	498	d. to CuCl, 993	70.6°	107.9 ¹⁰⁰	53 ¹⁵ al.; 68 ¹⁵ meth. al.
19	2.38	-2H ₂ O, 110	d.	110.4°	192.4 ¹⁰⁰	s. al., NH ₄ Cl
20		-2H ₂ O, 260		i.		s. HNO ₃ , dil. a., NH ₄ OH; i. al.
21	2.283	-2H ₂ O, 100		v. s.	d.	s. a., al., NH ₄ OH
22				i.		s. a., NH ₄ OH
23	2.92	474.5	d.	i.	i.	s. HCl, NH ₄ OH, KCN, sl. s. NH ₃
24		d.		i.		s. a., alk., KCN, C ₆ H ₅ N, pyr.
25		192-3	subl.	i.		v. s. al., eth.; 10° bz.
26				i.		s. NH ₄ OH; i. HCl
27				i.		s. NH ₄ OH; i. HCl
28				i.		s. NH ₄ OH; i. NH ₄ Cl
29				i.	i.	s. NH ₄ OH; i. a., NH ₃
30		908	subl. 1100	i.		s. HCl, HF, HNO ₃ ; i. al.
31	2.93			sl. s.	d.	s. al., HCl, HNO ₃ , HF; i. acet., NH ₃
32			d. → SiF ₄		d., 100	
33	2.158			42.8		
34	2.207			232 ¹⁷		0.16 ²⁰ , 92% al.
35	1.831			12.5	d.	0.25 al.
36	1.81			6.2		
37		-H ₂ O, 130		0.57 ¹⁵		s. alk.
38		d. 60		d.		s. HCl d.
39	3.37	-½H ₂ O, 360		i.	i.	s. a., NH ₄ OH
40	3.368	d. -H ₂ O		i.	d.	s. a., NH ₄ OH, KCN
41	5.241 ¹⁵	d.		0.1364 ²⁵	1.	s. dil. HNO ₃ , H ₂ SO ₄
42	4.872	-H ₂ O, 240	d. 290	0.33 ¹⁵	0.65 ¹⁰⁰	s. NH ₄ OH, dil. H ₂ SO ₄ ; i. al., dil. HNO ₃
43	4.873	d. 290		i.	i.	s. dil. H ₂ SO ₄
44		d. 110		i.	i.	s. dil. HNO ₃
45	5.62	605	1290	0.0008 ¹⁸		s. KI, KCN, NH ₄ OH; i. a., al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Copper				
1	lactate (ic).....	$\text{Cu}(\text{C}_3\text{H}_5\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	277.74	monocl. dk. bl.....
2	laurate (ic).....	$\text{Cu}(\text{C}_{12}\text{H}_{23}\text{O}_2)_2$	462.18	lt. blue powd.....
3	nitrate (ic).....	$\text{Cu}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$	241.63	blue, deliq.....
4	“ “.....	$\text{Cu}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	295.68	bl. cr. deliq.....
5	nitride.....	Cu_3N	204.72	dk. gr. powd.....
6	nitrite, basic (ic).....	$\text{Cu}(\text{NO}_2)_2 \cdot 3\text{Cu}(\text{OH})_2$	448.34	grn. powd.....
7	nitroprusside (ic).....	$\text{CuFe}(\text{CN})_5\text{NO} \cdot 2\text{H}_2\text{O}$	315.54	wh.-grnsh. powd.....
8	oleate (ic).....	$\text{Cu}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	626.46	br. powd. or grn. bl. mass. pois.....
9	oxalate (ic).....	$\text{CuC}_2\text{O}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$	160.60	bl. wh.....
10	oxide, sub-	Cu_2O	270.28	olive grn.....
11	“ (ous) (cuprite).....	Cu_2O	143.14	oct., cub. red.....
12	oxide (ic) (paramelaconite).....	CuO	79.57	tetr. cub. blk. hyg.....
13	“ “ (tenorite).....	CuO	79.57	triocl. black, β 2.63.....
14	“ , per-	$\text{CuO}_2 \cdot \text{H}_2\text{O}$	113.59	br. or brownish-blk. cr.....
15	oxychloride (ic).....	$\text{CuCl}_2 \cdot 2\text{CuO} \cdot 4\text{H}_2\text{O}$	365.69	pa. bl.-grn.....
16	“ (atacamite).....	$\text{CuCl}_2 \cdot 3\text{CuO} \cdot 3\text{H}_2\text{O}$	427.24	orthorhomb grn.....
17	palmitate (ic).....	$\text{Cu}(\text{C}_{16}\text{H}_{31}\text{O}_2)_2$	574.39	grn.-bl. powd.....
18	2,4-pentanedione deriv. (acetylacetonate).....	$\text{Cu}(\text{C}_5\text{H}_7\text{O}_2)_2$	261.78	bl. cr.....
19	phenolsulfonate.....	$\text{Cu}(\text{C}_6\text{H}_5\text{O}_4\text{S})_2 \cdot 6\text{H}_2\text{O}$	517.99	bl.-grn. cr.....
20	orthophosphate (ic).....	$\text{Cu}_3(\text{PO}_4)_2 \cdot 3\text{H}_2\text{O}$	434.80	rhomb. bl.....
21	(tri-) phosphide.....	Cu_3P	221.73	gray blk.....
22	(tri-) phosphide, di-	Cu_3P_2	252.75	gray-blk. met. powd.....
23	orthophosphite, di-(ic).....	$\text{CuHPO}_3 \cdot 2\text{H}_2\text{O}$	179.63	blue cr.....
24	salicylate (ic).....	$\text{Cu}(\text{C}_7\text{H}_5\text{O}_3)_2 \cdot 4\text{H}_2\text{O}$	409.86	bl.-grn. need.....
25	selenate (ic).....	$\text{CuSeO}_4 \cdot 5\text{H}_2\text{O}$	296.61	triocl. bl.....
26	stearate (ic).....	$\text{Cu}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	630.50	lt. grn.-bl. amor. powd.....
27	sulfate (ous).....	Cu_2SO_4	223.20	gray powd.....
28	“ (ic) (hydrocyanite).....	CuSO_4	159.63	grn.-wh. rhomb.....
29	“ (ic) (blue vitriol or chalcantite).....	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	249.71	triocl. blue, 1.514, 1.537, 1.543.....
30	sulfide (ous) (chalcocite).....	Cu_2S	159.20	rhomb. blk.....
31	“ (ic).....	Cu_2S	159.20	cub. blk.....
32	sulfide (ic) (covellite).....	CuS	95.63	hex. or monocl. blk.....
33	sulfite (ous).....	$\text{Cu}_2\text{SO}_3 \cdot \text{H}_2\text{O}$	225.22	red pr.....
34	“ “.....	$\text{Cu}_2\text{SO}_3 \cdot \text{H}_2\text{O}$	225.22	hex. wh.....
35	tartrate (ic).....	$\text{CuC}_4\text{H}_4\text{O}_6$	211.64	lt.-bl. powd.....
36	“ “.....	$\text{CuC}_4\text{H}_4\text{O}_6 \cdot 3\text{H}_2\text{O}$	265.69	lt. gray bl. powd.....
37	tellurite.....	CuTeO_3	239.18	ppt. siskin grn.....
38	thiocyanate (ous).....	CuSCN	121.65	wh.....
39	“ (ic).....	$\text{Cu}(\text{SCN})_2$	179.73	black.....
40	tungstate (ic).....	$\text{CuWO}_4 \cdot 2\text{H}_2\text{O}$	347.52	oct. lt. grn.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				16.7	45 ¹⁰⁰	s. NH ₄ OH; sl. s. al.
2		111-13		sl. s.	sl. s.	
3	2.047 ^{2.9}	114.5	—HNO ₃ , 170	137.8 ⁹ ; 381 ⁴⁰	666 ⁸⁰ ; 1270 ¹⁰⁰	100 ^{12.5} al.
4	2.074	—3H ₂ O, 26.4		243.7 ⁰	∞	s. al.
5		d. 300		d.		d. a.
6				sl. s.		s. NH ₄ OH; sl. s. al.; d. dil. a.
7				i.		s. alk.; i. al.
8				i.	i.	s. eth.
9				.00253 ²⁵		s. NH ₄ OH; i. ac. a.
10		d.		i.		d. a.
11	6.0	1235	—O, 1800	i.	i.	s. HCl, NH ₄ Cl, NH ₄ OH; sl. s. HNO ₃ ; i. al.
12	6.40	d. 1026		i.	i.	s. a., NH ₄ Cl, KCN
13	6.45	d. 1026		i.	i.	s. a., NH ₄ Cl, KCN
14				i.		s. a. d.; i. al.
15		—3H ₂ O, 140		i.		s. a.
16	3.76-3.78					
17		120		i.		s. h. bz., CS ₂ , CCl ₄ ; sl. s. al., eth., chl., pyr.; i. meth. al., acet.
18		>230	subl.	i.		sl. s. al.; s. chl.
19				s.		s. al.
20				i.	sl. s.	s. a., NH ₄ OH, H ₃ PO ₄ ; i. NH ₃
21	6.4-6.8			i.		s. HNO ₃ ; i. HCl
22	6.67	d.		i.		s. HNO ₃ ; i. HCl
23		d.		i.	i.	
24				v. s.		v. s. al., NH ₄ OH
25	2.559			25.7 ¹⁵	d.	s. a., NH ₄ OH; i. al.
26		125		i.		s. eth., h. bz., chl., turp.; sl. s. pyr.; i. meth. al., acet., c. bz.
27		+O, 200		d.		s. conc. HCl, NH ₃ , glac. acet. a.
28	3.603	200	d. 650 to CuO	14.3 ⁰	75.4 ¹⁰⁰	1.04 ¹⁸ meth. al.; i. al.
29	2.284	—4H ₂ O, 110	—5H ₂ O, 150	31.6 ⁰	203.3 ¹⁰⁰	15.6 ¹⁸ meth. al.; i. al.
30	5.6	1100		1×10 ⁻¹⁴		s. HNO ₃ , NH ₄ OH; i. acet.
31	5.78	1130		1×10 ⁻¹⁴		s. HNO ₃ , NH ₄ OH; i. acet.
32	4.6	tr. 103	d. 220	0.000033 ¹⁸		s. HNO ₃ , KCN, h. conc. HCl, H ₂ SO ₄ ; i. al., alk.
33	4.46 ¹⁵			sl. s.		s. NH ₄ OH, HCl; i. al., eth.
34	3.83 ¹⁵	d.		v. sl. s.		s. a., alk.
35				0.02 ¹⁵	0.14 ⁸⁵	s. a., alk.
36		d.		i.	i.	
37				0.0005 ¹⁸		s. NH ₄ OH, conc. a., eth.; i. al.
38	2.843	1084		d.	d.	s. a., NH ₄ OH
39		d. 100		0.1 ¹⁵		s. NH ₄ OH; sl. s. ac. a.; i. al.; d. min. a.
40		red ht.				

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	Copper xanthate (ethylxantho- genate)	$\text{Cu}(\text{C}_2\text{H}_5\text{OS}_2)_2$	305.95	yellow ppt.
2	Copper complexes: Diamminecopper (II) acetate	$\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{NH}_3$	215.72	vlt.-bl. cr.
3	Tetramminecopper (II) sulfate	$[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$	245.77	rhomb. bl.
4	Tetrapyridinecopper (II) fluosilicate	$[\text{Cu}(\text{C}_5\text{H}_5\text{N})_4]\text{SiF}_6$	522.02	rhomb. purplish-blue.
5	Tetrapyridinecopper (II) perrhenate	$[\text{Cu}(\text{C}_5\text{H}_5\text{N})_4](\text{ReO}_4)_2$	880.58	bl. monoc. cr.
6	Cyanic acid	HOCN	43.03	
7	Cyanoauric acid	$\text{HAu}(\text{CN})_4 \cdot 3\text{H}_2\text{O}$	356.33	tab.
8	Cyanogen	C_2N_2	52.04	col. gas. pungent odor. v. pois.
9	Cyanogen com- pounds	See <i>Organic Tables</i> .		
10	Dysprosium	Dy	162.46	
11	acetate	$\text{Dy}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot 4\text{H}_2\text{O}$	411.66	yel. need.
12	bromate	$\text{Dy}(\text{BrO}_3)_3 \cdot 9\text{H}_2\text{O}$	708.35	yel. hex. need.
13	carbonate	$\text{Dy}_2(\text{CO}_3)_3 \cdot 4\text{H}_2\text{O}$	577.01	
14	chloride	DyCl_3	268.83	shining yel. pl.
15	chromate	$\text{Dy}_2(\text{CrO}_4)_3 \cdot 10\text{H}_2\text{O}$	853.11	yel. cr.
16	nitrate	$\text{Dy}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$	438.57	yel. cryst.
17	oxalate	$\text{Dy}_2(\text{C}_2\text{O}_4)_3 \cdot 10\text{H}_2\text{O}$	769.14	pr.
18	oxide (dysprosia)	Dy_2O_3	372.92	wh. powd.
19	orthophosphate	$\text{DyPO}_4 \cdot 5\text{H}_2\text{O}$	347.56	yellowish-white powd.
20	selenate	$\text{Dy}_2(\text{SeO}_4)_3 \cdot 8\text{H}_2\text{O}$	897.93	yel. need.
21	sulfate	$\text{Dy}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	757.23	brill. yel. cr.
22	Erbium	Er	167.20	dk. gray powd.
23	acetate	$\text{Er}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot 4\text{H}_2\text{O}$	416.40	triclinic.
24	chloride	$\text{ErCl}_3 \cdot 6\text{H}_2\text{O}$	381.67	deliq.
25	nitrate	$\text{Er}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$	443.31	redsh. cr.
26	oxalate	$\text{Er}_2(\text{C}_2\text{O}_4)_3 \cdot 10\text{H}_2\text{O}$	778.62	redsh. micr. powd.
27	oxide (erbia)	Er_2O_3	382.40	rose-red powd.
28	sulfate	$\text{Er}_2(\text{SO}_4)_3$	622.58	
29	"	$\text{Er}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	766.71	monocl. rose-red.
30	Europium	Eu	152.00	st. gray.
31	chloride	EuCl_3	258.37	fine yel. need.
32	oxide (europia)	Eu_2O_3	352.00	pa. rose powd.
33	sulfate	$\text{Eu}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	736.31	pa. rose cr.
34	Ferric or Ferrous See <i>Iron</i>			
35	Ferricyanic acid	$\text{H}_3\text{Fe}(\text{CN})_6$	214.97	grn.-br. need., deliq.
36	Ferrocyanic acid	$\text{H}_4\text{Fe}(\text{CN})_6$	215.98	wh. need., bl. in moist air.
37	Fluoboric acid	HBF_4	87.83	col. liq.
38	Fluorine	F_2	38.00	grn. yel. gas, pois., 1.000195.
39	oxide	F_2O	54.00	col. gas unst.
40	Fluosilicic acid	H_2SiF_6	144.08	col. liq. fum. corros.
41	Gadolinium	Gd	156.90	
42	acetate	$\text{Gd}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot 4\text{H}_2\text{O}$	406.10	tricl.
43	bromide	$\text{GdBr}_3 \cdot 6\text{H}_2\text{O}$	504.75	rhomb. pl.
44	chloride	GdCl_3	263.27	monocl. pr. eol.
45	chloride	$\text{GdCl}_3 \cdot 6\text{H}_2\text{O}$	371.37	wh. pr., deliq.
46	cyanoplatinite	$\text{Gd}_2\text{Pt}_3(\text{CN})_{12} \cdot 21\text{H}_2\text{O}$	1590.05	rhomb.
47	fluoride	GdF_3	213.90	wh. gelat.
48	nitrate	$\text{Gd}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$	433.01	prisms.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d.		i.		s. NH_4OH ; v. sl. s. al.; i. CS_2
2		d. ca. 175		s., d.		s. ac. a., NH_4OH ; i. al.
3	1.81	d. 150		18.5 ^{21,5}	d.	i. al.
4	2.108					
5	2.338			.5555		
6	1.140 ^c ₀			d.		
7		50	d.	s.		s. al., eth.
8	2.335 g/l; 0.87	-34.4	-20.7	450 ²⁰ cm ³		230 cm ³ al.; 500 cm ³ eth.
9						
10						
11		d. 120		s.		v. sl. s. al.
12		78	-6H ₂ O, 110	v. s.		sl. s. al.
13		-3H ₂ O, 15		i.		
14	3.67 ^o	680		s.		
15		-3½H ₂ O, 150	d.	1.002 ²⁶		
16		88.6		s.		
17				i.		s. dil. a.
18	7.81 ²⁷					s. a. grn. soln.
19		-5H ₂ O, >200		i.		s. dil. a., ac. a.
20		-8H ₂ O, 200		v. s.		i. al.
21		stab. 110	-8H ₂ O, 360	s.		
22	4.77 ¹⁵ (?)					
23	2.114					
24				s.	s.	s. al.
25				s.		s. al., eth., acet.
26	2.64 (?)	d. 575				
27	8.640	infus.		0.00049 ²⁹		sly. s. min. a.
28	3.678	d. 630		43 ^o		
29	3.217	-8H ₂ O, 400		16 ²⁰	6.53 ⁴⁰	
30				i.	i.	
31		623 ± 2				
32	7.42 fr. oxal.; 6.55 fr. nit.					
33		-8H ₂ O, 375		2.563 ²⁰	1.93 ⁴⁰	
34		d.		s.	s.	s. al.
35		d.		s.	s.	s. al.; i. eth.
36			d. 130	∞	s.	∞ al.
37	1.69 ¹⁵ g/l; lq. 1.108 ⁻¹⁸⁷	-223	-187	d. to O ₃ + HF	d.	
38	lq. 1.90 ^{-223,8}	-223.8	-144.8	sl. s., d.	i.	sl. s. a., alk.
39	1.29-31 ¹⁵		d.	s.	s.	sl. s. alk.
40						
41	1.611			11.6 ²⁵		
42	2.844 ¹⁵			s.	s.	s. HBr
43	4.52 ^o	628		s.	s.	
44	2.424 ^o			s.	s.	
45	2.563					
46				i.		sl. s. hot HF
47	2.406 ¹⁵	92		v. s.	v. s.	v. sl. s. conc. HNO_3

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Gadolinium				
1	nitrate.....	$Gd(NO_3)_3 \cdot 6H_2O$	451.02	tricl.....
2	oxalate.....	$Gd_2(C_2O_4)_3 \cdot 10H_2O$	758.02	monocl.....
3	oxide (gadolinia).....	Gd_2O_3	361.80	wh. amor. powd., hyg.....
4	selenate.....	$Gd_2(SeO_4)_3 \cdot 8H_2O$	886.81	monocl. pearly.....
5	sulfate.....	$Gd_2(SO_4)_3$	601.98	col.....
6	".....	$Gd_2(SO_4)_3 \cdot 8H_2O$	746.11	monocl.....
7	sulfide.....	Gd_2S_3	409.98	yel. hyg. mass.....
8	Gallium	Ga	69.72	rhomb. pseudotetr. gray-bl.....
9	acetate, basic.....	$4Ga(C_2H_3O_2)_3 \cdot 2Ga_2O_3 \cdot 5H_2O$	1452.37	micr. cr., wh.....
10	bomide, tri-.....	$GaBr_3$	309.47	col. cr., deliq.....
11	" tri-, mon- ammine.....	$GaBr_3 \cdot NH_3$	326.50	wh. powd.....
12	" " hexammine.....	$GaBr_3 \cdot 6NH_3$	411.66	wh. powd.....
13	chloride, di-.....	$GaCl_2$	140.63	col. cr., deliq.....
14	" tri-.....	$GaCl_3$	176.09	col. cryst., deliq.....
15	" " monammine.....	$GaCl_3 \cdot NH_3$	193.12	wh. powd.....
16	" " hexammine.....	$GaCl_3 \cdot 6NH_3$	278.28	wh. powd.....
17	ferrocyanide.....	$Ga_4[Fe(CN)_6]_3$	914.72	gel. wh. ppt.....
18	fluoride, tri-.....	GaF_3	126.72	white powd.....
19	" ".....	$GaF_3 \cdot 3H_2O$	180.77	wh. powd.....
20	hydroxide.....	$Ga(OH)_3$	120.74	amor. wh.....
21	" (hydrated gal- lium oxide).....	$Ga_2O_3 \cdot xH_2O$	.....	gel. ppt., indef. composition.....
22	hydroxyquinoline deriv.....	$Ga(C_9H_6NO)_3$	502.16	grn.-yel. cr.....
23	iodide, tri-.....	GaI_3	450.48	col.-lem. yel. (need.) hyg.....
24	" " monammine.....	$GaI_3 \cdot NH_3$	467.51	wh. powd.....
25	" " hexammine.....	$GaI_3 \cdot 6NH_3$	552.67	wh. powd.....
26	nitrate.....	$Ga(NO_3)_3 \cdot xH_2O$	.....	wh. cr., deliq.....
27	nitride.....	GaN	83.73	dk. gray powd. hex.....
28	oxalate.....	$Ga_2(C_2O_4)_3$	403.50	white powder.....
29	".....	$Ga_2(C_2O_4)_3 \cdot 4H_2O$	475.56	micr. powd. wh., hyg.....
30	oxide, sub-.....	Ga_2O	155.44	br.-blk. powd.....
31	" sesqui-.....	Ga_2O_3	187.44	wh. powd.; α trig., β monocl.....
32	" ".....	$Ga_2O_3 \cdot H_2O$	205.46	white powd.....
33	oxychloride.....	$6GaOCl \cdot 14H_2O$	979.29	oct.....
34	2,4-pentanedione deriv. (acetylacetonate)	$Ga(C_8H_7O_2)_3$	367.04	α monocl. or. plates, β rhomb. or. pyramids, γ rhomb. pyramids
35	selenate.....	$Ga_2(SeO_4)_3 \cdot 16H_2O$	856.58	col. cr.....
36	".....	$Ga_2(SeO_4)_3 \cdot 22H_2O$	964.68	cr. monocl. or tricl., col.....
37	selenide, sub-.....	Ga_2Se	218.40	.....
38	" mono-.....	$GaSe$	148.68	dk. red-br. greas. leaf.....
39	" sesqui-.....	Ga_2Se_3	376.32	rdsh. blk., hard, brittle.....
40	sulfate.....	$Ga_2(SO_4)_3$	427.62	wh. powd.....
41	".....	$Ga_2(SO_4)_3 \cdot 18H_2O$	751.91	col. cr.....
42	sulfide, sub-.....	Ga_2S	171.50	grn. cr. or blk. powd.....
43	" mono-.....	GaS	101.78	sublimate, lt. yel.....
44	" sesqui-.....	Ga_2S_3	235.62	yel. cr. or wh. amor.....
45	telluride, mono-.....	$GaTe$	197.33	soft, blk. greasy leaves.....
46	" sesqui-.....	Ga_2Te_3	522.27	hard, blk., brittle cr.....
Germane				
47	bromo-.....	GeH_3Br	155.54	col. liq.....
48	chloro-.....	GeH_3Cl	111.08	col. liq.....
49	chlorotrifluoro-.....	GeF_3Cl	165.06	colorless gas.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.332	91	.....	v. s.	v. m.	s. HNO ₃ ; sl. s. a.; 0.11
2	.....	—6H ₂ O, 110	.....	i.	.....	n—H ₂ SO ₄ s. a.
3	7.407 ¹⁵	.....	.....	v. sl. s.	.....	.....
4	3.309	—8H ₂ O, 130	.....	s.	s.	.....
5	4.139 ^{14,5}	.....	.....	3.98 ⁹	2.26 ^{34,4}	.....
6	3.010 ^{14,6}	.....	.....	3.28 ²⁰	2.54 ⁴⁰	.....
7	3.8	.....	.....	d.	.....	d. a.
8	5.903 ²⁵ ; 6.093 ^{32,38}	29.78	2000 ± 150	i.	i.	s. a., alk.; sl. s. Hg
9	.....	d. > 160	.....	s.	d.	i. ac. a.
10	3.69 ²⁵	121.5 ± 0.6	278.8	s.	s.	sl. s. NH ₃
11	3.112 ²⁵	124	.....	d.	d.	sl. s. NH ₃
12	.....	.....	.....	d.	d.	sl. s. NH ₃
13	.....	164(175)	535	v. s.	d.	.....
14	2.47 ²⁵ ; lq. 2.36 ⁸⁰ / ₈₀	77.9 ± 0.2	201.2	v. s.	v. s.	s. NH ₃ ; sl. s. pet. eth.
15	2.189 ²⁵	124	.....	d.	d.	s. NH ₃
16	.....	.....	d.	d.	d.	s. NH ₃
17	.....	.....	s.	s.	s.	i. conc. HCl
18	4.47	> 1000	subl. ca. 950	.002	.....	s. H ₂ P ₂ ; i. dil. HCl
19	.....	> 140	d.	i.	sl. s.	s. dil. HCl; sl. s. 50% HF
20	.....	d. to Ga ₂ O ₃ + H ₂ O	.....	i.	i.	s. a., alk.
21	.....	.....	.....	.00010	.....	.0032 4.6% NH ₄ OH; s. a., NaOH
22	.....	> 150	subl. vac.	.0001	.0012	s. a., alk.; sl. s. al.
23	4.15 ²⁵	212 ± 1	345, subl.	.....	d.	.....
24	3.635 ²⁵	140	.....	d.	d.	.....
25	.....	.....	.....	d.	d.	.....
26	.....	d. 110	→ Ga ₂ O ₃ , 200	v. s.	v. s.	s. abs. al.; i. eth.
27	.....	.....	subl. > 800	i.	i.	d. h. a., alk.
28	.....	.....	d. 195—CO ₂	.....	.....	.....
29	.....	d. 195	d. > 160—H ₂ O	0.4	.....	.....
30	4.77	> 660	subl. > 500 d. > 800	i.	i.	s. a., alk.
31	α6.44; β5.88	1900	.....	i.	i.	s. h. a., alk.
32	.....	.....	.....	sl. s.	.....	.....
33	.....	.....	.....	i.	.....	v. s. KOH; i. dil. HNO ₃
34	α1.42; β1.41	194–5	subl. 140 ¹⁹	s.	s.	s. acet.
35	.....	.....	.....	v. s.	v. s.	.....
36	.....	.....	.....	57.4 ²⁵	v. s.	.....
37	5.02	.....	.....	.....	.....	.....
38	5.03	960	.....	.....	.....	.....
39	4.92	1020	.....	.....	.....	.....
40	.....	d. > 600	d. > 520	v. s.	v. s.	s. al.; i. eth.
41	.....	.....	.....	v. s.	v. s.	s. 60% al.; i. al., eth.
42	4.18 ²⁵	d. > 800	.....	d.	d.	s. a., alk.
43	3.86 ²⁵	965 ± 10	.....	i.	d.	s. a., alk.
44	3.65 ²⁵	1255 ± 10	.....	d.	d.	s. a., alk.
45	5.44	824	.....	.....	.....	.....
46	5.57	790	.....	.....	.....	.....
47	2.34 ^{29,5}	—32.0	52.0	d.	d.	reacts like CeH ₂ Br ₂ ; d. alk.; i. al.
48	1.75 ^{—52}	—52.0	28.0	d.	d.	d. alk.; i. al.
49	.....	—66.2	—20.3	d.	.....	s. abs. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Germane				
1	dibromo-.....	GeH_2Br_2	234.45	col. liq.
2	dichloro-.....	GeH_2Cl_2	145.53	col. liq.
3	dichlorodifluoro-.....	GeCl_2F_2	181.51	col. gas.
4	tribromo- (germanium bromoform).....	GeHBr_3	313.36	col. liq.
5	trichloro- (germanium chloroform).....	GeHCl_3	179.98	col. liq.
6	trichlorodifluoro-.....	GeCl_3F	197.97	col. liq.
7	Germanium	Ge	72.60	cub. gray-wh. met.
7	bromide, di-.....	GeBr_2	232.43	col. need. or pl.
9	" , tetra-.....	GeBr_4	392.26	gray-wh. oct.
10	chloride, di-.....	GeCl_2	143.51	wh. powd.
11	" , tetra-.....	GeCl_4	214.43	col. liq., 1.464
12	fluoride, di-.....	GeF_2	110.60	wh. cr., hyg.
13	" , tetra-.....	GeF_4	145.90	col. gas or solid, not liq. at atm. press.
14	" , tri-.....	$\text{GeF}_3 \cdot 3\text{H}_2\text{O}$	202.65	wh. cr., deliq.
15	hydride, mono-.....	GeH	73.61	br. powd.
16	" , tetra- germane.....	GeH_4	76.63	col. gas.
17	" digermane.....	Ge_2H_6	151.25	liq.
18	" trigermane.....	Ge_3H_8	225.86	col. liq.
19	hydride, gas.....	$\text{GeO} \cdot x\text{H}_2\text{O}$		yel. to red.
20	imide.....	GeNH	102.63	wh. amor. powd.
21	iodide, di-.....	GeI_2	326.44	yel. hex.
22	" , tetra-.....	GeI_4	580.28	cub. yel.
23	tri- nitride, di-.....	Ge_2N_2	245.52	blk. cr.
24	" , tetra-.....	Ge_3N_4	273.83	wh.-lt. br. powd.
25	oxide, mono-.....	GeO	88.60	blk. cr. powd.
26	" , di- (soluble).....	GeO_2	104.60	hex., col.
27	" " (insoluble).....	GeO_2	104.60	tetr.
28	oxychloride.....	GeOCl_2	159.51	col. liq.
29	sulfide, mono-.....	GeS	104.66	yel.-red amor. or rhomb. bipyram. blk.
30	" , di-.....	GeS_2	136.72	wh. powd. orthorhombic, white.
31	Glucinum	See Beryllium		
32	Gold	Au	197.20	cub. yel. duct. met., coll. bl. vit.
33	bromide (ous).....	AuBr	277.12	yelsh.-gray mass or cr. powd.
34	" (auroauric).....	Au_2Br_3	714.06	blk. (exist. quest.)
35	" (ic).....	AuBr_3 or Au_2Br_4	436.95	gray powd., cr. brown.
36	chloride (ous).....	AuCl	232.66	yel. cr.
37	" (auroauric).....	Au_2Cl_3	536.23	dk. red (exist. quest.)

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.89 ²⁰	-15.0	89.0	d.	d.	d. alk.; i. al.
2	1.90 ²⁰	-68.0	99.5	d.	d.	d. alk.; i. al.
3		-51.8	-2.8	d.		s. abs. al.
4		-24.0	d.	d.	d.	d. alk.
5	1.83 ²⁰	-71.0	75.2	d.	d.	d. alk.
6		-49.8	37.5	d.		s. abs. al.
7	5.35 ¹⁸ ₂₅	255.5	2700	i.	i.	s. h. H ₂ SO ₄ , aq. reg.; i. alk.
8		122.0	d.	d.	d.	s. a., GeBr ₄ , al.; i. bz.
9	3.132 ²² ₂₅	26.1	189.5	d.	d.	s. abs. al., eth., bz.; i. conc. H ₂ SO ₄
10		d. to Ge	-GeCl ₄	d.	d.	s. GeCl ₄ ; i. al., chl.
11	1.874 ¹⁸ ₂₅	-49.5	83.1	d.	d.	v. s. dil. HCl; s. al., eth.; i. conc. H ₂ SO ₄ , conc. HCl
12		d. > 350	subl.	s.	v. s.	
13	6.65 g/l	subl.		s. i. to G	eO ₂ + H ₂	GeF ₄
14		d.		s.	s.	
15		d. 165	sl. exp.	i.	i.	s. HNO ₃ , H ₂ O ₂ ; i. NaOH.
16	3.43 g/l; lq. 1.532 ²⁰	-165.0	-90.0 (-126)	i.	i.	s. NaOCl; sl. s. h. HCl
17	g. 6.74 ²⁰ g/l; lq. 1.95 ²⁰	-104	29	d.		
18	2.2	-105.6	110.5	i.		s. CCl ₄
19		d.		i.		v. s. HCl; sl. s. NaOH
20		d. 150		d. to NH ₃	-GeO ₂	
21		subl., i.		s.	d.	s. dil. a., conc. HI; sl. s. chl., CCl ₄
22	4.822 ¹⁸ ₂₅	144.0	d.	s. with slow hydrolysis	d.	s. CS ₂ , CCl ₄ , bz.; sl. s. conc. HCl, KOH
23			subl. > 650	i.	i.	i. a., alk.
24		d. 450		i.	i.	s. Cl ₂ water or H ₂ O ₂ with NH ₄ OH; i. a., alk.
25		subl. 710				s. a., alk.; one form i. H ₂ O, HCl, HF, NaOH, NH ₄ OH
26	4.708 ²⁰	1115.0		0.447 ²⁵	1.0 ²⁰	sl. s. NaOH; i. HF, HCl
27	6.239	1085 ± 5		i.		i. all solv.
28		-56.0	d. > 90	d.	d.	s. HCl, alk., or alk. sulfid.; sl. s. NH ₄ OH
29	(am.) 3.31; rhomb. 4.01 ²⁴ ₂₅	530	subl. > 430	i.	i.	
30	2.64 ²⁴	ca. 900	subl. > 900	sl. s.; d. sty.	d. to GeO ₂ + H ₂ S	s. alk., alk. sulfid.; i. a., al., eth., etc.
31						
32	19.3; lq. 17.9 ²⁰	1062.4	2600	i.	i.	s. KCN, aq. reg., h. H ₂ SeO ₄ ; i. a.
33	7.9	d. 115		i.	i.	d. a.
34		d. 115		d.		
35		-Br ₂ , 160		sl. s.		s. eth.
36	7.4	d. to AlCl ₃ , 170	d. 299.5	d., v. sl.	d.	s. HCl, HBr
37	5.1	d. 250		s.		
				d.		

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Gold				
1	chloride (ic).....	AuCl ₃	303.57	claret red, pr. cr.
2	" ".....	AuCl ₃ ·2H ₂ O	339.60	orange cr.
3	cyanide (ous).....	AuCN	223.22	lt. yel. cr. powd.
4	" (ic).....	Au(CN) ₃ ·6H ₂ O (or 3H ₂ O)	383.35 (329.30)	col. hyg. pl.
5	hydroxide (ous).....	AuOH	214.21	dk. vlt.
6	" (ic).....	Au(OH) ₃	248.22	yel.-br. powd.
7	iodide (ous).....	AuI	324.12	grnsh.-yel. powd.
8	" (ic).....	AuI ₃	577.96	dk. grn.
9	nitrate, acid, (ic).....	AuH(NO ₃) ₄ ·3H ₂ O	500.29	tricl. oct. yel.
10	oxide (ous).....	Au ₂ O	410.40	gray-violet
11	" (auroauric).....	Au ₂ O ₂	426.40	olive br. powd.
12	" (ic).....	Au ₂ O ₃	442.40	br.-blk. powd.
13	phosphide.....	Au ₂ P ₃	487.46	gray
14	selenide.....	Au ₂ Se ₃	631.28	
15	sulfate (ic).....	Au ₂ O ₃ ·2SO ₃ ·H ₂ O	620.54	yel. deliq. (exist. quest.)
16	sulfide (ous).....	Au ₂ S	426.46	br.-blk. powd.
17	" (auroauric).....	Au ₂ S ₂ (or AuS)	458.52	blk.
18	" (ic).....	Au ₂ S ₃	490.58	br.-blk. powd.
19	telluride.....	Au ₂ Te	522.01	tricl. (exist. quest.)
20	".....	AuTe ₂	452.42	(1) rhomb. (2) monocl. (3) tricl. yel., earthy to massive.
21	Hafnium	Hf	178.60	gray
22	carbide.....	HfC	190.61	
23	oxide (hafnia).....	HfO ₂	210.60	wh. monocl.
24	oxychloride.....	HfOCl ₂ ·8H ₂ O	409.64	col.
25	Helium	He	4.003	col. gas, inert, odorl.
26	Holmium	Ho	164.94	salts yellow
27	Hydrazine	NH ₂ NH ₂	32.05	col. liq. or wh. cr., 1.470 ²²
28	azide.....	N ₂ H ₄ ·HN ₃	75.08	deliq.
29	fluogermanate.....	2N ₂ H ₄ ·H ₂ GeF ₆	252.71	monocl. pr., 1.452, 1.460, 1.464
30	fluosilicate.....	N ₂ H ₄ ·H ₂ SiF ₆	176.12	cryst.
31	formate.....	N ₂ H ₄ ·2CH ₂ O ₂	124.10	cub.
32	hydrate.....	N ₂ H ₄ ·H ₂ O	50.06	col. fum. liq. or cub. cr.
33	hydrochloride, mono-.....	N ₂ H ₄ ·HCl	68.51	wh. need.
34	" di-.....	N ₂ H ₄ ·2HCl	104.98	cub. col.
35	nitrate, mono-.....	N ₂ H ₄ ·HNO ₃	95.06	col. dimorph. need.
36	" di-.....	N ₂ H ₄ ·2HNO ₃	158.08	col. cr.
37	oxalate.....	2N ₂ H ₄ ·H ₂ C ₂ O ₄	154.13	wh. need.
38	hypophosphate.....	N ₂ H ₄ ·2H ₂ PO ₃	194.12	
39	orthophosphate.....	N ₂ H ₄ ·H ₃ PO ₄	130.09	
40	orthophosphite.....	N ₂ H ₄ ·H ₃ PO ₃	114.09	
41	orthophosphite.....	N ₂ H ₄ ·2H ₃ PO ₃	196.14	
42	picrate.....	N ₂ H ₄ ·HC ₆ H ₂ N ₃ O ₇ · ½H ₂ O	270.16	
43	selenate.....	N ₂ H ₄ ·H ₂ SeO ₄	177.02	col. cr. powd.
44	sulfate.....	2N ₂ H ₄ ·H ₂ SO ₄	162.17	col. cr.
45	".....	N ₂ H ₄ ·H ₂ SO ₄	130.12	rhomb. col.
46	Hydrazole acid (azoimide)	HN ₃	43.03	col. liq.
47	Hydrogen	H ₂	2.0162	col. gas, cub. solid
48	bromide (hydrobromic acid)	HBr	80.92	col. gas or pa. yel. liq., 1.325 liq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	3.9	254 d.	subl. 265	68	v. s.	s. al., eth.; sl. s. NH_3 ; i. CS_2
2	.....	d.	.....	s.	s.	s. HCl , al., eth.; sl. s. NH_3
3	7.12	d.	.....	v. sl. s.	.....	s. KCN , NH_4OH ; i. al., eth.
4	.....	d. 50	.....	v. s.	d. v. s.	s. al., eth.
5	.....	$-\text{H}_2\text{O}$, 200	.....	s.	.....	s. d. alk.
6	.....	$-\frac{1}{2}\text{H}_2\text{O}$, 250	.....	5.7×10^{-11} at 25	.....	s. HCl , NaCN , conc. HNO_3
7	8.25	d. 120	.....	v. sl. s.	sl. s. d.	s. KI
8	.....	.....	.....	i.	d.	s. iodides
9	2.84	72 d.	.....	s. d.	.....	s. HNO_3
10	3.6	$-\text{O}$, 205	.....	i.	i.	s. HCl ; sl. s. KOH ; i. H_2SO_4 , HNO_3 , al.
11	.....	d. 180	.....	i.	.....	.....
12	.....	$-\text{O}$, 160	-3 O, 250	i.	i.	s. HCl
13	6.67	d.	.....	.....	.....	i. HCl , dil. HNO_3
14	4.65 ²²	.....	.....	.....	.....	.....
15	.....	.....	.....	s.	d.	s. HCl , H_2SO_4
16	.....	d. 240	.....	i.; fresh soln.	ppt. coll.	i. a.; s. KCN , aq. reg.
17	.....	d. 140	.....	i.	i.	s. $(\text{NH}_4)_2\text{S}$; i. a.
18	8.754	d. 197	.....	i.	.....	s. Na_2S ; i. a., eth.
19	9.04	.....	.....	.....	.....	.....
20	8.2-9.3	472, d.	.....	i.	i.	.....
21	13.3	2207 (1700?)	>3200	i.	.....	.....
22	.....	3887	.....	.....	.....	.....
23	9.68	2812	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....
25	0.1785 ⁰ g/l; lq. 0.147-270.8	-272.2^{28} atm.	-268.9	0.94 ⁰ cm ³ ; 0.94 ²⁵ cm ³	1.05 ⁵⁰ cm ³ ; 1.21 ⁷⁵ cm ³	abs. by Pt; i. al.
26	.....	.....	.....	.....	.....	.....
27	lq. 1.011 ¹⁶	1.4	115.5	v. s.	.....	s. al.
28	.....	75.4	.....	v. s.	v. s.	v. s. al.
29	2.406 ²⁵ ₂₅	.....	.....	s.	.....	.....
30	.....	d. 186	.....	v. s.	.....	sl. s. al.
31	.....	128	.....	s.	.....	.....
32	1.03 ²¹	< -40	118.5 ⁷⁴⁰	∞	∞	s. al.; i. eth., chl.
33	.....	89	.....	v. s.	.....	sl. s. al.
34	1.42	198	.....	270.4 ²³	v. s.	sl. s. al.
35	.....	70.7	subl. 140	v. s.	.....	sl. s. al.
36	.....	104 d.	.....	v. s.	.....	.....
37	.....	148	.....	200 ³⁵	.....	.0003 ²² al; i. eth.
38	.....	152	.....	.....	.....	.....
39	.....	82	.....	.....	.....	.....
40	.....	36	.....	.....	.....	.....
41	.....	82	.....	.....	.....	.....
42	.....	201.3	.....	s.	s.	.....
43	.....	.....	.....	v. sl. s.	v. s.	.....
44	.....	85	.....	v. s.	.....	i. al.
45	1.37	254	.....	3.05 ³²	v. s.	i. al.
46	.....	-80	37	∞	∞	s. al., alk.
47	.0899 g/l; lq. .070	-259.18	-252.8	2.14 ⁰ cm ³ ; 1.91 ²⁵ cm ³	0.85 ⁵⁰ cm ³ ; 1.89 ⁵⁰ cm ³	6.925 ⁰ cm ³ al.
48	3.50 ⁰ g/l; lq. 2.77-67	-88.5	-67.0	221 ¹⁰	130 ¹⁰⁰	s. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Hydrogen				
1	bromide	HBr·H ₂ O	98.94	col. liq.
2	" (const.-boiling mixt.)	HBr (47%) + H ₂ O		col. liq.
3	bromide	HBr·2H ₂ O	116.96	wh. cr. col. liq.
4	chloride (hydrochloric acid)	HCl	36.47	col. gas or col. pois. fum. liq.; 1.256 liq.
5	" (const.-boiling mixt.)	HCl(20.24%) + H ₂ O		col. liq.
6	"	HCl·H ₂ O	54.48	col. liq.
7	"	HCl·2H ₂ O	72.50	col. liq.
8	"	HCl·3H ₂ O	90.51	col. liq.
9	cyanide (hydrocyanic acid)	HCN	27.03	col. liq. or gas, pois., 1.2675 ¹⁰ liq.
10	fluoride	HF (or H ₂ F ₂)	20.01	col. fum. corros. liq. or gas.
11	" (const.-boiling mixt.)	HF(35.35%) + H ₂ O		col. liq.
12	iodide (hydriodic acid)	HI	127.93	col. gas or pa. yel. liq., 1.466 liq.
13	" (const.-boiling mixt.)	HI(57%) + H ₂ O		col. or pa. yel., fum. liq.
14	"	HI·2H ₂ O	163.96	col. liq.
15	"	HI·3H ₂ O	181.98	col. liq.
16	"	HI·4H ₂ O	199.99	col. liq.
17	oxide (water)	H ₂ O (or (H ₂ O) _x)	18.02	col. liq. or hex. col. cr., liq. 1.333, slt. 1.309, 1.313
18	" ,per-	H ₂ O ₂	34.02	col. liq., 1.414 ²² liq.
19	phosphide (phosphine)	H ₃ P	34.04	col. pois. spon. infl. gas or col. liq., 1.317 liq.
20	"	H ₄ P ₂	66.07	col. liq.
21	"	(H ₂ P ₄) ₃	378.29	yel. solid
22	selenide	H ₂ Se	80.98	col. gas.
23	sulfide	H ₂ S	34.08	col. infl. gas, offen. odor 1.374 liq.
24	" ,di-	H ₂ S ₂	66.14	yel. oil, 1.885
25	" ,tri-	H ₂ S ₃	98.20	bright yel. liq.
26	" ,penta-	H ₂ S ₅	162.32	clear yel. oil
27	telluride	H ₂ Te	129.63	col. gas or yel. need.
28	Hydroxylamine	NH ₂ OH	33.03	wh. need. or col. liq., 1.440 ^{23.5} (liq.), deliq.
29	fluogermanate	2NH ₂ OH·H ₂ GeF ₆	254.68	monocl. pr. 1.418, 1.438, 1.433
30	fluosilicate	2NH ₂ OH·H ₂ SiF ₆ ·2H ₂ O	246.17	scales
31	hydrochloride	NH ₂ OH·HCl	69.50	monocl. col.
32	nitrate	NH ₂ OH·HNO ₃	96.05	wh.
33	sulfate	2NH ₂ OH·H ₂ SO ₄	164.14	monocl. col.
34	Illinium	Il	146?	
35	Indium	In	114.76	tetr. silv. wh. soft metal
36	bromide, mono-	InBr	194.68	red-br. solid
37	" ,di-	InBr ₂	274.59	pa. yel. solid
38	" ,tri-	InBr ₃	354.51	wh. to yel. need., deliq.
39	perchlorate	In(ClO ₄) ₃ ·8H ₂ O	557.26	col. deliq. cr.
40	chloride, mono-	InCl	150.22	(1) yel. or (2) dk. red, deliq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.78	Stable	-3.3 to -15	5 bet. 1 and 2.5 at m.		
2	1.49	-11	126			
3	2.11 ⁻¹⁵	-11				
4	1.639 ⁹ g/l; lq.	-112	-83.7	s.	s.	
5	1.194 ⁻⁸⁶			82.3 ⁹ g	56.1 ⁶⁰ g	327 cm ³ al.; s. eth., bz.
6			110			
7	1.48	-15.35				
8	lq. 1.46 ^{18.3}	-17.7	d.	∞	■	s. al.
9	.901 g/l; .699 ²⁰ ;	-24.4	d.	∞		s. al.
10	0.6884 lq.	-14	26	∞	∞	s. al.
11	.921 g/l; lq.	-92.3	19.4	∞	v. s.	∞ al., s. eth.
12	.987		120			
13	5.66 ⁰ g/l; lq.	-50.8	-35.38 ⁴ atm.	42.500 ¹⁰ cm ³	v. s.	s. al.
14	2.85 ^{-4.7}		127 ⁷⁴			
15	1.70 ¹⁵	-43		∞		
16		-48		∞		
17	1.006 ⁴ ;	-36.5		■		
18	s. .9168 ⁰	0	100			∞ al.
19	1.4649 ⁰	-89	152.1	∞		s. al., eth.; i. pet. ethi
20	1.529 ⁰ g/l, lq.	-133.5	-87.4	26 ¹⁷ cm ³	i.	s. al., eth., Cu ₂ Cl ₂
21	.746 ⁻⁹⁰					
22	1.012	< -10	57.5 ⁷³⁵	i.	i.	s. al., turp.
23	1.83 ¹⁹	ign. 160	d.	i.	i.	i. al.; s. P, P ₂ H ₄
24	3.614 g/l; lq.	-64	-42	377 ⁴	270 ^{22.5}	s. CS ₂ , COCl ₂
25	2.12 ⁻⁴²			cm ³	cm ³	
26	1.539 ⁰ g/l; lq.	-82.9	-61.80	437 ⁰	186 ⁴⁰	9.54 ²⁰ cm ³ al.; s. CS ₂
27	96			cm ³	cm ³	
28	1.376	-88	74.5	d.		s. bz., CS ₂ ; i. al.
29	1.496 ¹⁵	-52	d. 90			
30	1.67 ¹⁶	d.				
31	5.81 g/l; lq.	-51	-4; 0	s. (unst.)		s. al., alk.
32	2.57 ⁻²⁰	33.05	56.5 ²²	s.	d.	s. a., al., meth. al.; v. sl. s. eth., chl., bz., CS ₂
33	1.204					
34	2 229 ²⁵ / ₂₅			s.		s. abs. al.
35				v. s.		i. al.
36	1.67 ¹⁷	151	d.	83 ¹⁷	v. s.	s. al., meth. al., glyo.; i. eth.
37		48	d. < 100	v. s.	d.	v. s. al.
38		170	d.	32.9 ⁰	68.5 ⁹⁰	s. eth.; sl. s. al.
39						
40	7.362	155	1450	i.	i.	s. a.; v. sl. s. NaOH
41	4.96 ²⁵	220	662, subl.	d.		s. a.
42	4.22 ²⁵	235	632, subl.	d.		s. a.
43	4.74 ²⁵	436 ± 2	subl. easily	v. s.		
44		ca. 80	d. 200	v. s.	d.	s. abs. al.; sl. s. eth.
45	4.19 ²⁵ (yel.);	225 ± 1	550 (608)	d.	d.	s. a.
46	4.18 ²⁵ (red)					

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Indium			
1	chloride, di-	InCl_2	185.67	wh. cr., deliq.
2	“ , tri-	InCl_3	221.13	wh. pl., deliq.
3	cyanide	$\text{In}(\text{CN})_3$	192.81	wh. ppt.
4	fluoride	InF_3	171.76	
5	“	$\text{InF}_3 \cdot 3\text{H}_2\text{O}$	225.81	cr.
6	“	$\text{InF}_3 \cdot 9\text{H}_2\text{O}$	333.91	wh. need.
7	hydroxide	$\text{In}(\text{OH})_3$	165.78	wh. ppt.
8	iodate	$\text{In}(\text{IO}_3)_3$	639.52	wh. cr.
9	iodide, mono-	InI	241.68	br.-red solid.
10	“ , di-	InI_2	368.60	
11	“ , tri-	InI_3	495.52	yel. cr. deliq.
12	nitrate	$\text{In}(\text{NO}_3)_3 \cdot 3\text{H}_2\text{O}$	354.83	deliq. pl.
13	“	$\text{In}(\text{NO}_3)_3 \cdot 4\frac{1}{2}\text{H}_2\text{O}$	381.86	need., deliq.
14	oxide, sub-	In_2O	245.52	blk. cr.
15	“ , mon-	InO	130.76	wh.-gray
16	“ , sesqui-	In_2O_3	277.52	red-br., hot; pa. yel., cold; amor. and trig.
17	selenate	$\text{In}_2(\text{SeO}_4)_3 \cdot 10\text{H}_2\text{O}$	838.56	deliq. cr.
18	sulfate	$\text{In}_2(\text{SO}_4)_3$	517.70	wh.-gray powd. monoc. pr., hyg.
19	“	$\text{In}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$	679.85	
20	“ , acid	$\text{In}_2(\text{SO}_4)_3 \cdot \text{H}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$	741.89	rhomb.
21	sulfide, sub-	In_2S	261.58	yel. to blk. need.
22	“ , mono-	InS	146.82	dk.
23	“ , sesqui-	In_2S_3	325.70	red cr. or yel. ppt.
24	sulfite, basic	$2\text{In}_2\text{O}_3 \cdot 3\text{SO}_2 \cdot 8\text{H}_2\text{O}$	891.35	cr.
25	Iodic acid	HIO_3	175.93	rhomb. col. or pa. yel. cr. powd.
26	“ “ , metaper-	HIO_4	191.93	col.
27	“ “ , paraper-	H_5IO_6 (or $\text{HIO}_4 \cdot 2\text{H}_2\text{O}$)	227.96	monoc. wh., deliq.
28	Iodine	I_2	253.84	rhomb. vit.-blk., met. lust., 3.34
29	azide (iod(o)azide)	IN_3	168.94	yellow, exp.
30	bromide, mono-	IBr	206.84	dk. gray cr.
31	“ , tri-	IBr_3	366.67	dk. br. liq.
32	chloride, mono- α -	ICl	162.38	cub. need. dk. red; oily red-br. liq.
33	chloride, mono- β -	ICl	162.38	rhomb., 6 sided pl., brn.-red.
34	“ , tri-	ICl_3	233.29	rhomb. yel.-br. red, deliq.
35	cyanide	ICN	152.94	wh. cr.
36	fluoride, penta-	IF_5	221.92	col. liq.
37	“ , hepta-	IF_7	259.92	col. cr. or liq.
38	oxide, di- (or tetr-)	IO_2 (or I_2O_4)	158.92	lem. yel. cr.
39	“ , pent-	I_2O_5	333.84	trim. wh.
40	Iodoplatinic acid	$\text{H}_2\text{PtI}_6 \cdot 9\text{H}_2\text{O}$	1120.91	monoc. blk., deliq.
41	Iodous acid , hypo- (iodine hydroxide)	HOI	143.93	only in soln., yel. to grnsh.
42	Iridium	Ir	193.10	cub., silv. wh. met.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	3.655 ²⁵	235	550-70	d.	d.	.....
2	4. (3.46)	586; subl. <400	volat. 600	v. s.	v. s.	sl. s. al., eth.
3	.....	.....	.....	unst.	.....	s. HCN; v. sl. s. NaOH; i. dil. a.
4	4.39 ²⁵ ± 0.01	1170 ± 10	>1200	.....	.....	.....
5	.....	-3H ₂ O, 100	.....	86.4	.....	s. a.; i. al., eth.
6	.....	d.	.....	sl. s.	d.	s. HCl, HNO ₃ ; i. al., eth.
7	.....	-H ₂ O, <150	.....	i.	.....	s. a.; v. sl. s. NaOH; i. NH ₄ OH
8	.....	.....	d.	0.067 ²⁰	.....	s. dil. H ₂ SO ₄ , HNO ₃
9	5.31	351	711-15	.....	slowly d.	s. dil. a.; i. al., eth., chl.
10	4.71 ²⁵	212	.....	.....	.....	s. a.
11	4.69	210 ± 2 (199)	.....	s. unst.	s.	s. a., chl., bz., xylene
12	.....	-2H ₂ O, 100	d.	v. s.	.....	s. al.
13	.....	-4½H ₂ O, 100	d.	v. s.	s.	s. al.
14	6.99 ²⁵	subl. in vac. 6.56-700	.....	.....	.....	s. HCl
15	.....	.....	.....	i.	.....	s. a.
16	7.179	d. 850	volat.	i.	.....	amor. s. a.; cr. i. a.
17	.....	.....	.....	v. s.	.....	.....
18	3.438	.....	.....	s.	v. s.	.....
19	.....	.....	d. 250	v. s.	.....	.....
20	.....	-H ₂ SO ₄ + 7H ₂ O ca. 250	.....	s.	.....	.....
21	5.87 ²⁵	653 ± 5	.....	.....	.....	.....
22	5.18 ²⁵	692 ± 5	subl. in vac. 850	.....	.....	s. HCl, HNO ₃
23	4.90	1050	subl. ca. 850 in high vac.	i.	.....	s. a.; sl. s. Na ₂ S
24	.....	-3H ₂ O, 100	-8H ₂ O, 260	i.	.....	s. a.
25	4.629 ⁰	110	.....	286 ⁰	472 ²⁰	v. s. 87% al.; sl. s. HNO ₃ ; i. abs. al., eth., chl.
26	.....	.....	subl. 110	v. s.	.....	.....
27	.....	d. 140	.....	v. s.	v. s.	s. al., eth.
28	4.93	114	183	0.029 ²⁰	0.073 ⁵⁰	20.5 ¹⁵ al., 20.6 ¹⁷ eth.; s. chl., glyc., KI, CS ₂
29	.....	.....	.....	s. d.	.....	s. Na ₂ S ₂ O ₃
30	4.4157 ⁰	(42); subl. 50	116	s. d.	.....	s. al., eth., chl., CS ₂
31	.....	.....	.....	s.	.....	s. al.
32	3.182 ²⁰	27.2	97.4	d. to HIO ₃ ± Cl	.....	s. HCl, al., eth., CS ₂
33	lq. 3.24 ³⁴	13.92	97.4	d.	.....	s. HCl, al., eth.
34	3.117 ¹⁵	101 ¹⁶ atm.	77 d.	s. d.	.....	s. bz., CCl ₄ , al., eth., ac. a.
35	.....	.....	.....	sl. s.	sl. s.	s. al., eth.
36	3.5	-8	97	d.	d.	d. a., alk.
37	liq. 2.8 ⁹	5.5	4.5 subl.	v. s., d.	d.	d. a., alk.
38	4.2 ¹⁰ / ₁₀	d. sly. 75; rap. 130	.....	d. to HIO ₃ ± I ₂	.....	s. H ₂ SO ₄ ; sl. s. acet.; i. al., eth.
39	4.799 ²⁵	d. 300-50	.....	187.4 ¹³	.....	sl. s. dil. al.; i. abs. al., eth., chl., CS ₂
40	.....	<100	.....	v. s. d.	.....	.....
41	.....	.....	.....	.....	.....	.....
42	22.421	2440 ± 15	4400	i.	i.	amor. s. aq. reg.; i. a., aq. reg.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Iridium				
1	bromide, tri-	$\text{IrBr}_3 \cdot 4\text{H}_2\text{O}$	504.91	olv. grn. cryst.
2	" , tetra-	IrBr_4	512.76	bl., deliq.
3	chloride, di-	IrCl_2	264.01	blk.-grn. cryst. (exist. quest.)
4	" , tri-	IrCl_3	299.47	olive grn.
5	" , tetra-	IrCl_4	334.93	dk. brn.-amor., hyg.
6	fluoride, hexa-	IrF_6	307.10	yel. glass or tetr.
7	hydroxide	$\text{Ir}(\text{OH})_3 \cdot \text{H}_2\text{O}$ (or $\text{Ir}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$)	262.14 (524.28)	olive-grn.
8	" , tetra-	$\text{Ir}(\text{OH})_4$	261.13	indigo-bl.
9	iodide, tri-	IrI_3	573.86	grn.
10	" , tetra-	IrI_4	700.78	blk.
11	oxide, sesqui-	Ir_2O_3	434.20	bl.-blk. (exist. quest.)
12	" , di-	IrO_2	225.10	tetr. blk.
13	sulfate	$\text{Ir}_2(\text{SO}_4)_3 \cdot 2\text{H}_2\text{O}$		yel. pr.
14	sulfide, mono-	IrS	225.16	bl. blk.
15	" , sesqui-	Ir_2S_3	482.38	br. blk.
16	" , di-	IrS_2	257.22	br.
17	" , hydro-	$\text{Ir}(\text{HS})_3 \cdot 2\text{H}_2\text{O}$	328.34	choc. br.
18	Iron , pure (See under Alloys)	Fe	55.84	cub. silv. metal
19	acetate (ous)	$\text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 4\text{H}_2\text{O}$	245.99	need.
20	" , basic (ic)	$\text{FeOH}(\text{C}_2\text{H}_3\text{O}_2)_2$	190.94	br.-red powd.
21	orthoarsenate (ous)	$\text{Fe}_3(\text{AsO}_4)_2 \cdot 6\text{H}_2\text{O}$	553.44	grn. amor. powd.
22	" (ic) (scorodite)	$\text{FeAsO}_4 \cdot 2\text{H}_2\text{O}$	230.78	rhomb. grn. 1.765, 1.774, 1.797
23	arsenide	FeAs	130.75	wh.
24	" , di- (arsenoferrite)	FeAs_2	205.66	cub. silv. gray
25	orthoarsenite, basic (ic)	$2\text{FeAsO}_3 \cdot \text{Fe}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$	607.26	br.-yel. powd.
26	pyroarsenite (ous)	$\text{Fe}_2\text{As}_2\text{O}_6$	341.50	grn.-wh.
27	benzoate (ic)	$\text{Fe}(\text{C}_7\text{H}_5\text{O}_2)_3$	838.34	br. powd.
28	boride	FeB	66.66	gray cryst.
29	bromide (ous)	FeBr_2	215.67	hex. grn.-yel.
30	" (ic)	FeBr_3	295.59	dk. red-br., deliq.
31	" "	$\text{FeBr}_3 \cdot 6\text{H}_2\text{O}$	403.69	red.
32	cacodylate (ic)	$\text{Fe}[\text{C}_2\text{H}_3\text{AsO}_2]_3$	466.78	yelsh. amor. powd.
33	carbide	Fe_3C	179.53	cub. gray
34	carbonate (ous) (siderite)	FeCO_3	115.85	trig. gray, 1.875, 1.633
35	" (ous)	$\text{FeCO}_3 \cdot \text{H}_2\text{O}$	133.87	amor.
36	carbonyl, tetra-	$\text{Fe}(\text{CO})_4$	167.88	dk. grn. lust. cr.
37	" "	$\text{Fe}_2(\text{CO})_9$	363.77	or. hex. cryst.
38	" , penta-	$\text{Fe}(\text{CO})_5$	195.89	visc. yel. liq.
39	perchlorate (ous)	$\text{Fe}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$	362.85	grn.
40	chloride (ous) (lawrencite)	FeCl_2	126.75	hex. grn. to yel., deliq.
41	" "	$\text{FeCl}_2 \cdot 2\text{H}_2\text{O}$	162.79	
42	" "	$\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$	198.82	monocl. bl.-grn., deliq.
43	" (ferrosoferric)	$\text{FeCl}_2 \cdot 2\text{FeCl}_3 \cdot 18\text{H}_2\text{O}$	775.47	yel. deliq.
44	" (ic) (molysite)	FeCl_3	162.21	hex. blk.-br.
45	" "	$\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$	270.31	br.-yel. v. deliq., cr. mass.
46	chloroplatinate (ous)	$\text{FePtCl}_6 \cdot 6\text{H}_2\text{O}$	571.91	yel. hex.
47	dichromate (ic)	$\text{Fe}_2(\text{Cr}_2\text{O}_7)_3$	759.74	red-br. gran.
48	citrate (ic)	$\text{FeC}_6\text{H}_5\text{O}_7 \cdot 3\text{H}_2\text{O} (?)$	298.99	red.-br. scales.
49	ferricyanide (ous)	$\text{Fe}_3[\text{Fe}(\text{CN})_6]_2$	591.42	deep bl.
50	" (" , ic)	$\text{Fe}^{II}_4\text{Fe}^{III}_3[\text{Fe}(\text{CN})_6]_6$	1662.57	grn.
51	(Prussian green) ferricyanide (ic) (Berlin green)	$\text{Fe}[\text{Fe}(\text{CN})_6]$	267.79	cub.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		-3H ₂ O, 100		v. s.		i. al.
2		d.		s. d.		s. al.
3		d. 773		s.		i. a., alk.
4	5.30	d. 763		i.		i. a., alk.
5		d.		s.	d.	s. al., dil. HCl
6	6.0	44.4 (30)	53	d.	d.	
7		d.		i.		s. a., alk.
8		-2H ₂ O, 350		i.	i.	s. HCl
9				sl. s.	s.	sl. s. al.
10		d. 100		i.	i.	s. KI; i. al.
11		-O, 400		i.		s. H ₂ SO ₄ , h. HCl; i. alk.
12	3.15	d.		i.	i.	i. a., alk.
13		d.		s.		
14		d.		i.		s. K ₂ S; i. a.
15		d.		sl. s.		s. HNO ₃ , K ₂ S
16		d. 300		i.		s. aq. reg.; i. a.
17		d.		i.		s. HNO ₂
18	7.86	1535	3000	i.	i.	s. a.; i. al., alk., eth.
19		d.		v. s.		
20				i.		s. a., al.
21		d.		i.	i.	s. dil. HCl; sl. s. NH ₄ OH
22	3.18	d.		i.	i.	s. HCl; i. HNO ₃
23	7.83	1020		v. sl. s.		
24	7.4	990		i.		sl. s. HNO ₃ ; i. HCl
25		d.		sl. s.		s. a., alk.
26				i.		s. NH ₄ OH
27				i.		s. h. eth., al.
28	7.15 ¹⁸			i.		s. HNO ₃ , h. conc. H ₂ SO ₄
29	4.636 ²⁵	d.		109 ¹⁰	170 ⁹⁶	s. al.
30		subl. d.		s.		s. al., eth.; sl. s. NH ₃
31		27		v. s.	v. s.	
32				6.67		sl. s. al.
33	7.4	1837		i.	i.	s. a.
34	3.8	d.		0.0067 ²⁵		s. CO ₂ soln.
35		d.		sl. s.		s. a., CO ₂ soln.
36	1.996 ¹⁸	d. 140-50		i.		s. org. solv.
37	2.085 ¹⁸	d. 100				
38	lq. 1.457	-21	102.8 ⁷⁴⁹	i.		s. conc. H ₂ SO ₄ , alk., al., eth., bz.
39		d. >100		97.8 ⁹	116.1 ⁶⁰	86.5 ²⁰ al.; s. HClO ₄
40	2.98	670-4	subl.	64.4 ¹⁰	105.7 ¹⁰⁰	100 al.; s. acet.; i. eth.
41	2.358					
42	1.93			160.1 ¹⁰	415.5 ¹⁰⁰	s. al.
43		d. 50				
44	2.804 ¹¹	282	315	74.4 ⁹	535.7 ¹⁰⁰	v. s. al., eth., 63 ¹⁵ acet.
45		37	280-5	91.9 ²⁰	∞	s. al., eth.
46	2.714	d.		v. s.	v. s.	
47				s.		s. a.
48				s.	s.	i. al.
49		d.		i.		i. al., dil. a.
50		d. 180		i.		s. h. HCl
51						

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Iron				
1	ferrocyanide (ous).....	$\text{Fe}_2\text{Fe}(\text{CN})_6$	323.63	amor. bl.-wh.....
2	" (ic) (Prussian blue)	$\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$	859.20	dk. bl. cryst.....
3	fluoride (ous).....	FeF_2	93.84	.....
4	" ".....	$\text{FeF}_2 \cdot 4\text{H}_2\text{O}$	165.90	.....
5	" ".....	$\text{FeF}_2 \cdot 8\text{H}_2\text{O}$	237.97	grn.-bl.....
6	" (ic).....	FeF_3	112.84	rhomb. grn.....
7	" ".....	$\text{FeF}_3 \cdot 4\frac{1}{2}\text{H}_2\text{O}$	193.91	yel. cryst.....
8	fluosilicate (ous).....	$\text{FeSiF}_6 \cdot 6\text{H}_2\text{O}$	306.00	trig. col., 1.364, 1.385.....
9	" (ic).....	$\text{Fe}_2(\text{SiF}_6)_3$	537.86	gel., flesh color.....
10	formate (ic).....	$\text{Fe}(\text{CHO}_2)_3$	190.89	cr., red powd.....
11	glycerophosphate (ic).....	$\text{Fe}_2(\text{C}_3\text{H}_5(\text{OH})_2\text{OPO}_3)_3$	622.00	yelsh.-grn. scales or powd.....
12	hydroxide (ous).....	$\text{Fe}(\text{OH})_2$	89.86	hex. pa. grn. or wh. amor.....
13	" (ic).....	$\text{Fe}(\text{OH})_3$ (or $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$).....	106.86	red.-br.....
14	iodide (ous).....	FeI_2	309.68	hex. gray.....
15	" ".....	$\text{FeI}_2 \cdot 4\text{H}_2\text{O}$	381.74	gray-blk. cr., deliq.....
16	lactate (ous).....	$\text{Fe}(\text{C}_3\text{H}_5\text{O}_3)_2 \cdot 3\text{H}_2\text{O}$	288.03	grn.-wh. cr. or powd.....
17	" (ic).....	$\text{Fe}(\text{C}_3\text{H}_5\text{O}_3)_3$	323.05	br. amor., deliq.....
18	malate (ic).....	$\text{Fe}_2(\text{C}_4\text{H}_4\text{O}_6)_3$	509.90	br. hyg. scales.....
19	methanearsonate(ic).....	$\text{Fe}_2(\text{CH}_3\text{AsO}_3)_3$	525.51	redsh.-br. lust. scales.....
20	nitrate (ous).....	$\text{Fe}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	287.95	rhomb. grn.....
21	" (ic).....	$\text{Fe}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$	349.96	cub.....
22	" ".....	$\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	404.01	monocl. col.-pa. vlt., deliq.....
23	nitride.....	Fe_3N (or Fe_4N_2).....	125.69	gray.....
24	" ".....	Fe_4N_3	237.37	.....
25	oleate (ic).....	$\text{Fe}(\text{C}_{18}\text{H}_{33}\text{O}_2)_3$	900.18	br.-red fatty lumps.....
26	oxalate (ous).....	$\text{Fe}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$	179.89	rhomb. pa. yel.....
27	" (ic).....	$\text{Fe}_2(\text{C}_2\text{O}_4)_3$	375.74	amor.....
28	oxide (ous).....	FeO	71.84	blk.....
29	" (ferrosoferric).....	Fe_3O_4	231.52	cub. blk.; red-blk. powd.....
30	" " (magnetite).....	$\text{Fe}_3\text{O}_4 \cdot x\text{H}_2\text{O}$.....	.....	blk.....
31	" (ic) (hematite).....	Fe_2O_3	159.68	hex. red br. to blk., 3.01, 2.94 (Li).....
32	2,4-pentanedione deriv. (ic) (acetylacetonate).....	$\text{Fe}(\text{C}_5\text{H}_7\text{O}_2)_3$	353.16	deep red rhomb.....
33	orthophosphate (ous) (vivianite).....	$\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$	501.69	monocl. wh.-bl., 1.579, 1.603, 1.633.....
34	orthophosphate (ic).....	$\text{FePO}_4 \cdot 2\text{H}_2\text{O}$	186.89	yel.-wh., dimorph.....
35	pyrophosphate (ic).....	$\text{Fe}_4(\text{P}_2\text{O}_7)_3 \cdot 9\text{H}_2\text{O}$	907.63	yel.-wh. powd.....
36	phosphide, mono-.....	FeP	86.86	rhomb.....
37	(di-) phosphide.....	Fe_2P	142.70	bl.-gray cr. or powd.....
38	(tri-) phosphide.....	Fe_3P	198.54	gray.....
39	hypophosphite (ic).....	$\text{Fe}(\text{H}_2\text{PO}_2)_3$	250.95	wh. or gray-wh. powd.....
40	sulfate (ous).....	$\text{FeSO}_4 \cdot \text{H}_2\text{O}$	169.92	monocl.....
41	" ".....	$\text{FeSO}_4 \cdot 4\text{H}_2\text{O}$	223.96	grn. monocl. pr.....
42	" " (melanterite).....	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	278.01	monocl. bl.-grn., 1.471, 1.478, 1.486.....
43	" (ic).....	$\text{Fe}_2(\text{SO}_4)_3$	399.86	rhomb. yel.....
44	" " (coquimbite).....	$\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$	562.01	rhomb., deliq., 1.552, 1.558.....
45	sulfide (ous) (troilite).....	FeS	87.90	hex. blk.-br.....
46	" (ferrosoferric).....	Fe_3S_4	295.76	hex., (exist. quest.).....
47	" (ic).....	Fe_2S_3	207.86	yel., grn.....
48	" , di- (marcasite).....	FeS_2	119.96	rhomb. yel.....
49	" " (pyrite).....	FeS_2	119.96	cub. yel.....
50	sulfite (ous).....	$\text{FeSO}_3 \cdot 3\text{H}_2\text{O}$	189.95	grnsh. or wh. cr.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				i.		
2		d.		i.	i.	s. HCl, H ₂ SO ₄ ; i. al., eth.
3	3.95-4.33	>1000 (?)		sl. s.		i. al., eth.
4	2.095					
5		-8H ₂ O, 100		sl. s.	s.	s. a., HF; i. al., eth.
6	3.18			sl. s.	s.	s. a.; i. al., eth.
7		-3H ₂ O, 100	d.	sl. s.	s.	i. al.
8	1.961			128.2		
9				s.	s. d.	
10				s.		v. sl. s. al.
11				50 ²⁵		i. al.
12	3.4	d.		0.00067		s. a., NH ₄ Cl; i. alk.
13	3.4-3.9	-1½H ₂ O, 500		i.	i.	s. a.; i. al., eth.
14	5.315	177		s.		
15	2.87	90-8		v. s.	d.	s. al., eth.
16		d.		2.1 ¹⁰	8.5 ¹⁰⁰	s. alk. citrate; v. sl. s. al.
17				s.	v. s.	i. eth.
18				s.		s. al.
19				50		i. al., eth.
20		60.5 d.		70.90; 83.5 ²⁰	166.7 ⁶¹	
21		35		s.		
22	1.684	47.2	d.	s.	s.	s. al., acet.; sl. s. HNO ₃
23	6.35	d. 200		i.		s. HCl, H ₂ SO ₄
24	6.57 (?)					
25				i.		s. a., al., eth.
26	2.28	d. 160		0.022	0.026	s. a.
27		d. 100		v. s.	v. s.	s. a.; i. al.
28	5.7	1420		i.	i.	s. a.; i. al., alk.
29	5.18	1538 d.		i.	i.	sl. s. a.; i. al., eth.
30		d.		i.	i.	s. a.
31	5.24	1565		i.		s. HCl
32		184		i.		s. al., bz., chl.; sl. s. eth.
33	2.58			i.	i.	s. a.; i. ac. a.
34	2.87	d.		v. sl. s.	0.67 ¹⁰⁰	s. HCl, H ₂ SO ₄
35				i.		s. a., alk. citrates
36	6.07 (5.2 ²⁹)					
37	6.56	1290		i.	i.	s. aq. reg., HNO ₃ + HF; i. dil. a.
38	6.74	1100		i.		
39		d.		0.043 ²⁵	0.083 ¹⁰⁰	s. alk. citrate
40	2.99-3.08					
41	2.23-29					
42	1.898	64; -6H ₂ O, 100	-7H ₂ O, 300	15.65	48.6 ⁵⁰	i. al.
43	3.097 ¹⁸	d. 480		sl. s.	d.	i. H ₂ SO ₄ , NH ₃
44	2.1	d.		440	d.	s. abs. al.
45	4.84	1193	d.	.00062 ¹⁸		s. a., ev. H ₂ S; i. NH ₃
46	4.55			i.		s. a.
47	4.3	d.		v. sl. s., d.	to FeS + S	d. a.
48	4.87	tr. 450	d.	0.00049		s. HNO ₃ ; i. dil. a.
49	5.00	1171	d.	0.00049		s. HNO ₃ ; i. dil. a.
50		d. 250		v. sl. s.		s. SO ₂ soln.; i. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Iron				
1	<i>d</i> -tartrate (ous).....	$\text{FeC}_4\text{H}_4\text{O}_6$	203.91	cr.....
2	thiocyanate (ous).....	$\text{Fe}(\text{SCN})_2 \cdot 3\text{H}_2\text{O}$	226.04	rhomb. grn.....
3	(ic).....	$\text{Fe}(\text{SCN})_3$ (or $\text{Fe}_2(\text{SCN})_6$) (.....)	230.07 (460.15)	cub. blk.-red. deliq.....
4	thiosulfate (ous).....	$\text{FeS}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$	258.04	grn. cr. deliq.....
5	metavanadate (ic).....	$\text{Fe}(\text{VO}_3)_3$	352.69	grayish-br. powd.....
6	Krypton	Kr.....	83.70	col. inert gas.....
Lanthanum				
7		La.....	138.92	lead-gray met.....
8	acetate.....	$\text{La}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot 1\frac{1}{2}\text{H}_2\text{O}$	343.08	
9	bromate.....	$\text{La}(\text{BrO}_3)_3 \cdot 9\text{H}_2\text{O}$	684.81	hex. pr.....
10	bromide.....	$\text{LaBr}_3 \cdot 7\text{H}_2\text{O}$	504.78	col. cr.....
11	carbide.....	LaC_2	162.94	yel. cryst.....
12	carbonate.....	$\text{La}_2(\text{CO}_3)_3 \cdot 3\text{H}_2\text{O}$	511.92	trimet. wh.....
13	chloride.....	LaCl_3	245.29	wh. deliq. cryst.....
14	“.....	$\text{LaCl}_3 \cdot 7\text{H}_2\text{O}$	371.40	tri-cl. wh., hyg.....
15	hexaantipyrine perchlorate.....	$[\text{La}(\text{C}_{11}\text{H}_{12}\text{N}_2\text{O})_6] \cdot (\text{ClO}_4)_3$	1566.63	col. hex. cr.....
16	hydroxide.....	$\text{La}(\text{OH})_3$	189.94	wh. powd.....
17	iodate.....	$\text{La}(\text{IO}_3)_3$	663.68	col.....
18	iodide.....	LaI_3	519.68	
19	molybdate.....	$\text{La}_2(\text{MoO}_4)_3$	757.69	tetr.....
20	nitrate.....	$\text{La}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$	433.04	col. deliq.....
21	oxalate.....	$\text{La}_2(\text{C}_2\text{O}_4)_3 \cdot 9\text{H}_2\text{O}$	704.05	wh.....
22	oxide (lanthana).....	La_2O_3	325.84	amor. or rhomb. wh.....
23	sulfate.....	$\text{La}_2(\text{SO}_4)_3$	566.02	wh. powd., hyg.....
24	“.....	$\text{La}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$	728.17	hex. col.....
25	sulfide.....	La_2S_3	374.02	red-yel. cr.....
Lead				
26		Pb.....	207.21	cub. silv. bl.-wh. soft met.....
27	acetate.....	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$	379.35	monocl. wh., β 1.576.....
28	“.....	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 10\text{H}_2\text{O}$	505.46	rhomb. cr.....
29	“ , basic.....	$\text{Pb}_2\text{OH}(\text{C}_2\text{H}_3\text{O}_2)_3$	608.56	wh.....
30	“.....	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{Pb}(\text{OH})_2 \cdot \text{H}_2\text{O}$	584.54	monocl. wh.....
31	“.....	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{Pb}(\text{OH})_2$	807.75	wh. micr. need.....
32	“ , tetra-.....	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_4$	443.39	monocl.....
33	orthoantimonate.....	$\text{Pb}_3(\text{SbO}_4)_2$	993.15	or.-yel. powd., v. pois.....
34	pyroantimonate.....	$\text{Pb}_2\text{Sb}_2\text{O}_7$	769.94	dk. yel. powd.....
35	orthoarsenate.....	$\text{Pb}_3(\text{AsO}_4)_2$	899.45	wh. cr.; v. pois.....
36	“ , di-.....	PbHAsO_4	347.13	monocl. leaf, α 1.90, γ 1.97.....
37	“ , mono-.....	$\text{Pb}(\text{H}_2\text{AsO}_4)_2$	489.06	tri-cl., 1.74, 1.82.....
38	pyroarsenate.....	$\text{Pb}_2\text{As}_2\text{O}_7$	676.24	rhomb., β 2.03.....
39	metaarsenate.....	$\text{Pb}(\text{AsO}_3)_2$	453.03	hex. tabl.....
40	metaarsenite.....	$\text{Pb}(\text{AsO}_2)_2$	421.03	wh. powd.....
41	azide.....	$\text{Pb}(\text{N}_3)_2$	291.26	col. need.....
42	benzoate.....	$\text{Pb}(\text{C}_7\text{H}_5\text{O}_2)_2 \cdot \text{H}_2\text{O}$	467.45	wh. cr. powd.....
43	metaborate.....	$\text{Pb}(\text{BO}_2)_2 \cdot \text{H}_2\text{O}$	310.87	cr. wh. powd.....
44	bromate.....	$\text{Pb}(\text{BrO}_3)_2 \cdot \text{H}_2\text{O}$	481.06	monocl. col.....
45	bromide.....	PbBr_2	367.04	rhomb. wh.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				0.877 ¹⁶		
2		d.		v. s.		s. al., eth., acet.
3		d.		s.	v. s.	s. al., eth.
4				v. s.	d.	v. s. al.
5				i.		s. a.; i. al
6	3.708 ⁹ g/l; lq. 2.155 ^{-152.9}	-157	-152.9	11.0 ⁰ cm ³ 6.0 ²⁶ cm ³	4.67 ⁵⁰ cm ³	
7	6.15	826	1800	d. to La (OH) ₃	d.	s. a.
8				16.88 ²⁵		
9		37.5	-7H ₂ O, 100	28.5 ¹⁵		i. al.
10	5.057 ²⁵ anh.	anh. 783 ± 3		v. s.		v. s. al.; i. eth.
11	5.02			d.	d.	s. H ₂ SO ₄ ; i. conc. HNO ₃
12				i.		s. dil. a.; sl. s. aq. CO ₂ i. acet.
13	3.842 ²⁵	872(860)		v. s.	d.	v. s. al., pyr.; i. eth., bz.
14		d. 91		v. s.	v. s.	v. s. al.
15		290-5 d.		1.50 ²⁰		
16		d.		i.		s. a.
17				1.7 ²⁵		
18	5.057 ²⁵	761 ± 2				
19	4.77 ¹⁶	1181		sl. s.		
20		40	d. 126	151.1 ¹²⁵	v. s.	v. s. al.; s. acet.
21		d.		.00008 ²⁵		
22	6.51	2315	4200	0.0004 ²⁹	d.	s. a., NH ₄ Cl; i. acet.
23	3.60 ¹⁵	d. 1150		3.0	0.69 ¹⁰⁰	sl. s. al.; i. acet.
24	2.821	d.		3.8 ⁰	0.87 ¹⁰⁰	sl. s. HCl, al.
25	4.997 ⁰ ; 4.911 ¹¹	2100-2150 vac.		d.	d.	s. a.
26	11.3437 ¹⁶ 11.288 ²⁰ Ra Pb 11.2960 ¹⁸ U Pb	327.43	1613	i.	i.	s. HNO ₃ , h. conc. H ₂ SO ₄
27	2.55	75, anh. 280		45.61 ¹⁵	200 ¹⁰⁰	i. al.
28	1.69	22		s.		i. al.
29				v. s.		sl. s. al.
30				v. s.		v. s. al.
31				5.55	18.2	s. al.
32	2.228 ¹⁷	175		d.		d. al.; s. chl., hot ac. a.
33				i.		
34	6.72			i.	i.	v. sl. s. HCl
35	7.30	1042; sl. d. 1000		v. sl. s.		s. HNO ₃
36	5.79	d. > 200	-H ₂ O, 280	i.	sl. s.	s. HNO ₃ , caust. alk.
37	4.46 ¹⁵	d. 140		d.		s. HNO ₃
38	6.85	802		i.	d.	s. HCl, HNO ₃ ; i. ac. a.
39	6.42 ¹⁵			d.	d.	s. HNO ₃
40	5.85			i.		s. HNO ₃
41		exp. 350		0.023 ¹⁸	0.09 ⁷⁰	v. s. ac. a.; i. NH ₄ OH
42		-H ₂ O, 100		0.16 ²⁰	0.31 ^{49.5}	
43	5.598 anh.		-H ₂ O, 160	i.	i.	s. a.; i. alk.
44	5.53	d. 180		1.38 ²⁰		
45	6.66	373	916	0.4554 ⁰ ; 0.8441 ²⁰	4.71 ¹⁰⁰	s. a., KBr; sl. s. NH ₃ ; i. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Lead				
1	caprate.....	$\text{Pb}(\text{C}_{10}\text{H}_{19}\text{O}_2)_2$	549.72	.....
2	caproate.....	$\text{Pb}(\text{C}_6\text{H}_{11}\text{O}_2)_2$	437.51	.....
3	caprylate.....	$\text{Pb}(\text{C}_8\text{H}_{15}\text{O}_2)_2$	493.61	wh. leaf.....
4	carbonate (cerussite).....	PbCO_3	267.22	rhomb. col., 1.804, 2.076, 2.078.....
5	“ , basic (white lead, hydrocerussite)	$2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$	775.67	wh. hex. or amor. powd., 2.09, 1.94.....
6	cerotate.....	$\text{Pb}(\text{C}_{26}\text{H}_{51}\text{O}_2)_2$	998.56	wh. need. fr. bz.....
7	chlorate.....	$\text{Pb}(\text{ClO}_3)_2$	374.12	monocl. wh.....
8	“.....	$\text{Pb}(\text{ClO}_3)_2 \cdot \text{H}_2\text{O}$	392.14	monocl. wh., deliq.....
9	perchlorate.....	$\text{Pb}(\text{ClO}_4)_2 \cdot 3\text{H}_2\text{O}$	460.17	rhomb.....
10	chloride (cotunnite).....	PbCl_2	278.12	rhomb. wh., 2.199, 2.217, 2.260.....
11	“ , tetra-.....	PbCl_4	349.04	yel. oily liq.....
12	“ sulfide.....	$\text{PbCl}_2 \cdot 3\text{PbS}$	995.93	red.....
13	chlorite.....	$\text{Pb}(\text{ClO}_2)_2$	342.12	monocl. yel.....
14	chromate (crocoite, chrome yellow)	PbCrO_4	323.22	monocl. yel., 2.31, 2.37 (Li), 2.66.....
15	chromate, basic.....	$\text{Pb}_2(\text{OH})_2\text{CrO}_4$	564.45	red, amor. or cr.....
16	“ , “ (chrome red)	$\text{PbCrO}_4 \cdot \text{PbO}$	546.43	red cr. powd.....
17	dichromate.....	PbCr_2O_7	423.23	red cr.....
18	citrate.....	$\text{Pb}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 3\text{H}_2\text{O}$	1053.88	wh. cr. powd.....
19	cyanate.....	$\text{Pb}(\text{OCN})_2$	291.25	wh. need.....
20	cyanide.....	$\text{Pb}(\text{CN})_2$	259.25	yelsh.-wh. pois. powd.....
21	enantate.....	$\text{Pb}(\text{C}_7\text{H}_{13}\text{O}_2)_2$	465.56	wh. leaf.....
22	ferricyanide.....	$\text{Pb}_3[\text{Fe}(\text{CN})_6]_2 \cdot 5\text{H}_2\text{O}$ (or $6\text{H}_2\text{O}$)	1135.61 (1153.62)	blk.-brn. to red, monocl. pr.....
23	ferrite.....	$\text{Pb}(\text{FeO}_2)_2$	382.89	hexag.....
24	ferrocyanide.....	$\text{Pb}_2\text{Fe}(\text{CN})_6 \cdot x\text{H}_2\text{O}$	.....	yelsh.-wh. powd.....
25	fluoride.....	PbF_2	245.21	col.....
26	fluosilicate.....	$\text{PbSiF}_6 \cdot 2\text{H}_2\text{O}$	385.30	monocl. col.....
27	“.....	$\text{PbSiF}_6 \cdot 4\text{H}_2\text{O}$	421.33	monocl.....
28	formate.....	$\text{Pb}(\text{CHO}_2)_2$	297.25	rhomb. wh. lust., 1.789, 1.852, 1.877.....
29	hydroxide.....	$\text{Pb}(\text{OH})_2$	241.23	wh. amor.....
30	“.....	$\text{Pb}_2\text{O}(\text{OH})_2$ (or $2\text{PbO} \cdot \text{H}_2\text{O}$)	464.44	cub. or wh. amor. powd.....
31	iodate.....	$\text{Pb}(\text{IO}_3)_2$	557.05	wh.....
32	paraperiodate.....	PbHIO_6	415.14	cryst.....
33	“.....	$\text{PbHIO}_6 \cdot \text{H}_2\text{O}$	433.15	amor.....
34	iodide, mono-.....	PbI	334.13	pa. yel.....
35	“ , di-.....	PbI_2	461.05	hex. yel. powd.....
36	isobutyrate.....	$\text{Pb}(\text{C}_4\text{H}_7\text{O}_2)_2$	381.40	wh. pr.....
37	laurate.....	$\text{Pb}(\text{C}_{12}\text{H}_{23}\text{O}_2)_2$	605.82	chalky white powd.....
38	lignocerate.....	$\text{Pb}(\text{C}_{24}\text{H}_{47}\text{O}_2)_2$	942.45	wh. powd.....
39	melissate.....	$\text{Pb}(\text{C}_{31}\text{H}_{61}\text{O}_2)_2$	1138.82	wh. powd.....
40	molybdate (wulfenite).....	PbMoO_4	367.16	yel.-wh. powd. or pl., oct.....
41	myristate.....	$\text{Pb}(\text{C}_{14}\text{H}_{27}\text{O}_2)_2$	661.93	wh. powd.....
42	2-naphthalenesulfonate.....	$\text{Pb}(\text{C}_{10}\text{H}_7\text{SO}_3)_2$	621.64	wh. cr. powd., pois.....
43	nitrate.....	$\text{Pb}(\text{NO}_3)_2$	331.23	cub. or monocl. col., 1.782.....
44	“ , basic.....	$\text{Pb}(\text{OH})\text{NO}_3$	286.23	rhomb. cr.....
45	oleate.....	$\text{Pb}(\text{C}_{18}\text{H}_{33}\text{O}_2)_2$	770.10	wh. powd.....
46	oxalate.....	PbC_2O_4	295.23	heavy, wh. powd.....
47	oxide, sub-.....	Pb_2O	430.42	amor. blk.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		103-4		i.	i.	0.00290 ²⁰ eth.
2		73-4				1.09 ²⁵ eth.
3		83.5-84.5		i.	i.	s. al.; 0.0938 ²⁰ eth.
4	6.6	d. 315		0.00011 ²⁰	d.	s. a., alk.; i. al., NH ₃
5	6.14	d. 400		i.	i.	sl. s. aq. CO ₂
6		112.5-3.5		i.		i. al., eth.
7	3.89	d.		v. s.		s. al.
8	4.037	d. 110		151.3 ¹⁸	171 ⁸⁰	s. al.
9	2.6	d. 100		499.7 ²⁵		s. al.
10	5.85	501	950	0.673 ⁰ ; 0.99 ²⁰	3.34 ¹⁰⁰	sl. s. dil. HCl, NH ₃ ; i. al
11	3.18 ⁰	-15	exp. 105	d. ev. Cl ₂	d.	s. conc. HCl
12				i.	d.	d. a., alk.; i. dil. a.
13		exp. 126		0.095 ²⁰	0.42 ¹⁰⁰	s. KOH
14	6.3 (6.12 ¹⁵)	844	d.	.0000058 ²⁵	i.	s. a., alk.; i. ac. a., NH ₃
15		920		i.		1.019 100 ml. 2 N KOH
16				i.	i.	s. a., alk.
17				d.		s. a., alk.
18				s.		
19		d.		i.	sl. s.	
20				sl. s.	s.	s. KCN
21		79-80			sl. s.	i. al.
22	1.037 ⁰ (satd.-soln.)	-H ₂ O, 110-120, d.		sl. s.	s., d. 100	s. HNO ₃ , alk.
23		1530; d. > 725				
24		-H ₂ O, 100		i.		sl. s. H ₂ SO ₄
25	8.24	855	1290	0.064 ²⁰		s. HNO ₃ ; i. acet., NH ₃
26		d.		s.	v. s.	
27		<100, d.				
28	4.63	d. 190		1.6 ¹⁸	20 ¹⁰⁰	i. al.
29		d. 145		0.0155 ²⁰	sl. s.	s. a., alk.; i. acet.
30	7.592	d. 145		.014	sl. s.	s. HNO ₃ , alk., ac. a.
31		d. 300		0.0012 ²	0.003 ²⁵	sl. s. HNO ₃ ; i. NH ₃
32		d. 130		i.	i.	s. dil. HNO ₃
33		-H ₂ O, 110		i.	i.	sl. s. dil. HNO ₃
34		d. 300		.01		
35	6.16	402 (393)	954 (900)	.044 ⁰ ; 0.063 ²⁰	0.41 ¹⁰⁰	s. alk., KI; i. al.
36		<100		9.1 ¹⁸		
37		104.7		0.009 ³⁵		0.008 ²⁵ al.; 0.007 ^{14.5} eth.
38		117		i.		v. s. boil. bz.; sl. s. al.; i. eth.
39		115-16		i.	i.	s. boil. tol., ac. a.; sl. s. h. bz., chl.; i. al., eth.
40				i.		d. conc. H ₂ SO ₄ ; s. a., KOH; i. al.
41		107		0.005 ³⁵	0.006 ⁵⁰	0.004 ²⁵ al.; 0.010 ^{14.5} eth.
42				i.		s. al.
43	4.53 ²⁰	d. 470		37.65 ⁰ ; 56.5 ²⁰	127 ¹⁰⁰	8.7 ¹²² 43 % al.; s. NH ₃ , alk.
44	5.93	180 d.		19.4 ^{19.2}	s.	s. a.
45				i.		6.46 ²⁰ eth.; s. pet. eth.; sl. s. al.
46	5.28	d. 300		0.00016 ¹⁸		s. HNO ₃ ; i. al.
47	8.342	d.		i.	i.	s. a., alk.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Lead				
1	oxide, mono- (litharge) . .	PbO	223.21	tetr. yel., 2.665 (Li), 2.535 (Li)
2	“ “ (massicot)	PbO	223.21	rhomb. yel., 2.51, 2.61 (Li), 2.71
3	“ , red (minium)	Pb ₃ O ₄	685.63	cr. sc. or red amor. powd.
4	“ , sesqui-	Pb ₂ O ₃	462.42	amor. or-yel. powd.
5	“ , di- (plattnerite)	PbO ₂	239.21	tetr. br., ω 2.3 (Li)
6	oxychloride (matlockite) . .	PbCl ₂ ·PbO	501.33	tetr. wh., 2.04, 2.15, 2.15
7	“ (laurionite)	PbCl ₂ ·PbO·H ₂ O	519.35	rhomb.
8	“ (paralaurionite)	PbCl ₂ ·PbO·H ₂ O	519.35	monocl., pr., col. to wh., 2.146
9	“ (mendipite)	PbCl ₂ ·2PbO	724.54	rhomb. yel., 2.24, 2.27, 2.31
10	“	PbCl ₂ ·3PbO	947.75	yel.
11	“ (Cassel yel-low)	PbCl ₂ ·7PbO	1840.59	yel. cr., or powd
12	palmitate	Pb(C ₁₅ H ₃₁ O ₂) ₂	718.03	chalky wh. powd
13	orthophosphate	Pb ₃ (PO ₄) ₂	811.67	hex. col. or wh. powd., 1.970, 1.936 . .
14	orthophosphate, di-	PbHPO ₄	303.24	rhomb. monocl. (?)
15	“ , mono-	Pb(H ₂ PO ₄) ₂	401.28	need
16	pyrophosphate	Pb ₂ P ₂ O ₇	588.46	rhomb. wh.
17	“	Pb ₂ P ₂ O ₇ ·H ₂ O	606.48	rhomb.
18	metaphosphate	Pb(PO ₃) ₂	365.25	col. cr
19	orthophosphate	PbHPO ₃	287.24	wh. powd
20	picrate	Pb(C ₆ H ₂ N ₃ O ₇) ₂ ·H ₂ O	681.43	yel. need
21	selenide (clausthalite)	PbSe	286.17	cub.
22	metasilicate (alamosite) . . .	PbSiO ₃	283.27	monocl. col. or wh
23	sulfate (anglesite)	PbSO ₄	303.27	monocl. or rhomb. wh., 1.877, 1.882, 1.894
24	“ , basic (lanarkite)	PbSO ₄ ·PbO	526.48	monocl. wh., 1.93, 1.99, 2.02
25	peroxydisulfate	PbS ₂ O ₈ ·3H ₂ O	453.38	deliq.
26	sulfate, acid	Pb(HSO ₄) ₂ ·H ₂ O	419.36	cryst.
27	sulfide (galena)	PbS	239.27	cub. bl. metallic, 3.912
28	sulfite	PbSO ₃	287.27	wh. powd
29	stearate	Pb(C ₁₈ H ₃₅ O ₂) ₂	774.14	wh. powd
30	tartrate	PbC ₄ H ₄ O ₆	355.28	wh. cr. powd
31	thiocyanate	Pb(SCN) ₂	323.37	monocl. wh.
32	dithionate	PbS ₂ O ₆ ·4H ₂ O	439.39	trig., 1.635, 1.653
33	thiosulfate	PbS ₂ O ₃	319.33	wh. cr
34	metatitanate	PbTiO ₃	303.11	yel. rhomb. pyr
35	tungstate (raspite)	PbWO ₄	455.13	monocl. col., 2.27, 2.27, 2.30
36	“ (stolzite)	PbWO ₄	455.13	tetr., 2.269, 2.182
37	metavanadate	Pb(VO ₃) ₂	405.11	yel. powd
38	Lithium	Li	6.94	cub. silv. wh. soft met., μ_c 3.16
39	acetate	LiC ₂ H ₃ O ₂ ·2H ₂ O	102.02	rhomb. wh., α 1.40, β 1.50
40	acetylsalicylate	LiC ₉ H ₇ O ₄	186.09	sl. hyg. powd.; d. in moist air
41	amide	LiNH ₂	22.96	cub. col
42	orthoarsenate	Li ₃ AsO ₄	159.73	wh. powd. rhomb.
43	benzoate	LiC ₇ H ₅ O ₂	128.05	wh. cr. or powd
44	metaborate	LiBO ₂	49.76	wh. powd., tricl
45	“	LiBO ₂ ·8H ₂ O	193.89	trig
46	tetraborate	Li ₂ B ₄ O ₇ ·5H ₂ O	259.24	. . . . .
47	bromide	LiBr	86.86	cub. wh., deliq.
48	carbide	Li ₂ C ₂	37.90	cr. or wh. powd
49	carbonate	Li ₂ CO ₃	73.89	monocl. col., 1.428, 1.567, 1.572
50	“ , acid (bicarbonate)	LiHCO ₃	67.96	wh.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	9.53	888	.....	0.0017 ²⁰	.....	s. HNO ₃ , alk., lead acet., NH ₄ Cl, CaCl ₂ , SrCl ₂
2	8.0	.....	.....	0.0023 ²²	i.	s. alk.
3	9.1	d. 500	.....	i.	i.	s. ac. a., h. HCl; i. al.
4	.....	d. 370	.....	i.	d.	d. a. to Pb salts + PbO ₂
5	9.375	d. 290	.....	i.	i.	s. dil. HCl; sl. s. ac. a.; i. al.
6	7.21	d. 524	.....	0.0095 ¹⁸	.....	s. alk.
7	6.24	d. 142	.....	.....	.....	.....
8	6.05 ¹⁵	d. 150	.....	.....	.....	.....
9	7.08	693	.....	i.	i.	s. alk.
10	.....	.....	.....	0.0056 ¹⁸	0.07 ⁷⁴	.....
11	.....	.....	.....	i.	.....	.....
12	.....	112.3	.....	0.005 ³⁵	0.007 ⁵⁰	s. al., 0.148 ²⁰ eth.
13	6.9-7.3	1014	.....	0.000014 ²⁰	i.	s. HNO ₃ , alk.; i. ac. a.
14	5.661 ¹⁵	d.	.....	.....	.....	s. HNO ₃ , KOH, NaOH, NH ₄ Cl
15	.....	.....	.....	.....	.....	s. KOH, NaOH, dil. HNO ₃ , h. conc. HCl; i. 50% acet. a.
16	5.8	824	.....	i.	i.	s. HNO ₃ , KOH
17	.....	806 anh.	.....	i.	d.	s. HNO ₃ , KOH, Na ₄ P ₂ O ₇
18	.....	800 (?)	.....	v. sl. s.	.....	.....
19	.....	d.	.....	i.	i.	s. HNO ₃
20	2.831 ²⁰	-H ₂ O, 130	expl.	0.88 ¹⁵	.....	s. HNO ₃
21	8.10 ¹⁵	1065	.....	i.	.....	d. a.
22	6.49	766	.....	i.	.....	s. NH ₄ salts; sl. s. conc. H ₂ SO ₄ ; i. al.
23	6.2	d. 1000	.....	0.00425 ²⁵	0.0056 ⁴⁰	sl. s. H ₂ SO ₄
24	6.92	977	.....	0.0044 ⁹	v. sl. s.	.....
25	.....	.....	.....	v. s.	.....	sl. s. H ₂ SO ₄
26	.....	d.	.....	0.0001 ¹⁸ d.	.....	s. a., i. KOH, al.
27	7.5	1114	.....	0.000086	.....	s. HNO ₃
28	.....	.....	.....	i.	i.	0.005 ^{14.5} eth.; i. al.
29	.....	115.7	.....	0.005 ³⁵	0.006 ⁵⁰	s. HNO ₃ , KOH; i. al., ac. a., amm. acetate
30	2.53 ¹⁹	.....	.....	0.0025 ²⁰	0.0074 ¹⁰⁰	s. KCNS, HNO ₃
31	3.82	.....	.....	0.05 ²⁰	d.	s. a., Na ₂ S ₂ O ₃
32	3.22	d.	.....	115.0 ^{20.5}	.....	.....
33	5.18	d.	.....	0.03	.....	d. a.; i. al.
34	7.52	.....	.....	i.	i.	s. KOH; i. HNO ₃
35	.....	1123	.....	0.03	.....	d. HCl, s. dil. HNO ₃
36	8.23	.....	.....	i.	.....	d. al.; s. a.
37	.....	.....	.....	sl. s.	OH + H ₂	21.5 al.
38	0.534	186	1609 ± 5	d to Li	v. s.	25 al.
39	.....	70	d.	300 ¹⁵	.....	s. dil. ac.; i. pyr.
40	.....	373-375	430	100	d.	7.7 ²⁵ , 10 ⁷⁸ al.
41	1.178	.....	.....	d.	.....	.....
42	3.07 ¹⁵	.....	.....	v. sl. s.	.....	.....
43	.....	.....	.....	33 ²⁵	40 ¹⁰⁰	.....
44	.....	840-5	.....	sl. s.	.....	.....
45	1.38 ^{14.7}	47	.....	.....	.....	.....
46	.....	-2H ₂ O, 200	.....	v. s.	.....	i. al.
47	3.464 ²⁵	547	1265	142.7 ⁰	243.6 ⁸²	s. al., eth.
48	1.65 ¹⁸	.....	.....	d.	d.	s. a.
49	2.111 ^{17.5}	618	d.	1.54 ⁰ , 1.33 ²⁰	0.72 ¹⁰⁰	s. a.; i. acet., NH ₃ , al.
50	.....	.....	.....	5.5 ¹³	.....	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Lithium				
1	chlorate.....	LiClO_3	90.40	rhomb. need.....
2	“.....	$\text{LiClO}_3 \cdot \frac{1}{2} \text{H}_2\text{O}$ (or $\frac{1}{3} \text{H}_2\text{O}$).....	99.41 (96.40)	tetr., deliq.....
3	perchlorate.....	LiClO_4	106.40	col. deliq.....
4	“.....	$\text{LiClO}_4 \cdot 3\text{H}_2\text{O}$	160.45	hex. col.....
5	chloride.....	LiCl	42.40	cub. wh., deliq.....
6	“.....	$\text{LiCl} \cdot \text{H}_2\text{O}$	60.41	hex. or red, deliq.....
7	chloroplatinate.....	$\text{Li}_2\text{PtCl}_6 \cdot 6\text{H}_2\text{O}$	529.95	rhomb. or.-yel., deliq.....
8	chromate.....	$\text{Li}_2\text{CrO}_4 \cdot 2\text{H}_2\text{O}$	165.92	blk.-br., deliq.....
9	dichromate.....	$\text{Li}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$	265.93	col. cr. or wh. powd., deliq.....
10	citrate.....	$\text{Li}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 4\text{H}_2\text{O}$	281.99	cub. col.....
11	fluoride.....	LiF	25.94	monocl. wh., 1.300, 1.296.....
12	fluosilicate.....	$\text{Li}_2\text{SiF}_6 \cdot 2\text{H}_2\text{O}$	191.97	rhomb. col.....
13	formate.....	$\text{LiCHO}_2 \cdot \text{H}_2\text{O}$	69.97	monocl., 1.7.....
14	metagermanate.....	Li_2GeO_3	134.48	col.....
15	hydride.....	LiH	7.95	wh. cr. or powd. tetr.....
16	hydroxide.....	LiOH	23.95	monocl. col.....
17	“.....	$\text{LiOH} \cdot \text{H}_2\text{O}$	41.96	hex. wh.....
18	iodate.....	LiIO_3	181.86	cub. wh., deliq.....
19	iodide.....	LiI	133.86	hex. col.-yelish.....
20	“.....	$\text{LiI} \cdot 3\text{H}_2\text{O}$	187.91	wh. powd.....
21	laurate.....	$\text{LiC}_{12}\text{H}_{23}\text{O}_2$	206.25	cub.....
22	permanganate.....	$\text{LiMnO}_4 \cdot 3\text{H}_2\text{O}$	179.92	trig.....
23	molybdate.....	Li_2MoO_4	173.83	trig.....
24	myristate.....	$\text{LiC}_{14}\text{H}_{27}\text{O}_2$	234.30	trig. col. deliq., 1.735, 1.435.....
25	nitrate.....	LiNO_3	68.95	col.....
26	“.....	$\text{LiNO}_3 \cdot 3\text{H}_2\text{O}$	123.00	red.-brn. amor. or blk. to gray cub. cr.....
27	nitride.....	Li_3N	34.83	flat need.....
28	nitrite.....	$\text{LiNO}_2 \cdot \text{H}_2\text{O}$	70.96	col. cr.....
29	oxalate.....	$\text{Li}_2\text{C}_2\text{O}_4$	101.90	col. cr.....
30	“ , acid.....	$\text{LiHC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	113.98	wh. powd., deliq.....
31	oxide.....	Li_2O	29.88	rhomb., col. deliq.....
32	palmitate.....	$\text{LiC}_{16}\text{H}_{31}\text{O}_2$	262.35	rhomb. col., α 1.594, γ 1.614.....
33	orthophosphate.....	Li_3PO_4	115.84	rhomb. col., lq. 1.548 ²⁵ , α 1.584, γ 1.604.....
34	“.....	$2\text{Li}_3\text{PO}_4 \cdot \text{H}_2\text{O}$	249.70	bl. cr., hyg.....
35	potassium <i>dl</i> -tartrate.....	$\text{LiKC}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$	212.12	cub. cr. 1.3395.....
36	salicylate.....	$\text{LiC}_7\text{H}_5\text{O}_3$	144.05	wh. cr. 1.3395.....
37	selenide.....	$\text{Li}_2\text{Se} \cdot 9\text{H}_2\text{O}$	254.99	wh. cr. 1.3395.....
38	orthosilicate.....	Li_4SiO_4	119.82	wh. cr. 1.3395.....
39	metasilicate.....	Li_2SiO_3	89.94	wh. cr. 1.3395.....
40	silicide.....	Li_6Si_2	97.76	wh. cr. 1.3395.....
41	sodium aluminum fluoride (cryolithionite).....	$3\text{LiF} \cdot 3\text{NaF} \cdot 2\text{AlF}_3$	371.75	wh. cr. 1.3395.....
42	stearate.....	$\text{LiC}_{18}\text{H}_{35}\text{O}_2$	290.40	wh. cr. 1.3395.....
43	sulfate.....	Li_2SO_4	109.94	col. α monocl., β hex. or rhomb. \rightarrow γ cub. 500° C; β 1.465.....
44	“.....	$\text{Li}_2\text{SO}_4 \cdot \text{H}_2\text{O}$	127.96	monocl. col., 1.460, 1.477, 1.488.....
45	“ , acid.....	LiHSO_4	104.01	pr.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		124-9	d. 270	313.5 ¹⁸	v. s.	
2		(50) 65	- $\frac{1}{2}$ H ₂ O, 90; d. 290	313.5 ¹⁸	∞	v. s. al.
3	2.429	236	d. 380	59.7 ²⁵		s. al.
4	1.841	95	-2H ₂ O, 100; -3H ₂ O, 150	s.	s.	v. s. al.
5	2.068 ²⁵	613	1353	45.4 ²⁵	127.5 ¹⁰⁰	3.80 ²⁰ al., 43.8 ²⁰ meth. al.; 3.94 ²⁵ acet.; s. eth.
6	1.78	-H ₂ O, >98	-6H ₂ O, 180	s.	s.	s. al.; i. eth.
7			-2H ₂ O, 150	141 ¹⁸	128 ³⁰	
8			d.	151 ³⁰		
9		-2H ₂ O, 130	d.	74.5 ²⁵	66.7 ¹⁰⁰	sl. s. al., eth.
10		d.		0.27 ¹⁸		s. a., HF; i. al., acet.
11	2.601	870	1676	52.6 ¹⁷		s. al.; i. eth., acet.
12	2.33 ¹²	-2H ₂ O, 100	d.	24.4 ²⁰	57.64 ¹⁰⁴	s. form. a.
13	1.46	d.		0.85 ²⁵		s. a.
14	3.53 ²¹	1239		d. to LiO	H + H ₂	
15	0.82	680		12.7 ⁹	17.5 ¹⁰⁰	sl. s. al.
16	1.43	450	d.	22.3 ¹⁰	26.8 ⁸⁰	sl. s. al.
17				125 ¹⁵		
18				s.	s.	251 ²⁵ al.; v. s. NH ₃
19	4.061 ²⁵	446	1190	151 ⁹	201.2 ⁶⁰	s. abs. al., acet.
20	3.48	73; -H ₂ O, 73	-2H ₂ O, 80; -3H ₂ O, 300			
21		229.2-8		0.154 ^{16.3} ; 0.187 ²⁵		0.322 ²⁵ al.; 0.008 ^{15.8} eth.; 0.240 ¹⁵ acet.
22	2.06	d. 190				
23		705		0.027 ^{16.3} ; 0.036 ²⁵	0.062 ⁵⁰	0.010 ^{15.8} eth; 0.331 ¹⁵ acet; 0.155 ²⁰ al.
24		223.6-4.2		52.2	66.170.9	s. al., acet.
25	2.38	255		34.8 ^{0.1}	57.48 ^{29.6}	
26		29.88; -2 $\frac{1}{2}$ H ₂ O, 29.9	-3H ₂ O, 61.1			
27		840-5				
28	1.615 ⁰	<100	d.	125 ⁰	459 ⁶⁰	v. s. abs. al.
29	2.121 ^{17.5}	d.		819.5		
30		d.		817		
31	2.013 ^{25.2}	>1700		6.67 ⁰ d.	10.02 ¹⁰⁰	
32		224.5		0.01 ¹⁸	0.015 ³⁵	0.347 ¹⁵ acet., 0.077 ²⁰ al., 0.005 ^{15.8} eth.
33	2.537 ^{17.5}	837		0.039 ¹⁸		s. a., NH ₄ OH; i. acet.
34	2.41			0.04		s. a.
35	1.610			s.		
36		d.		133.3		50 al.
37				d.		
38	2.28	1256		i.	d.	
39	2.52 ²⁵	1201		i.	s. d.	s. dil. HCl
40	ca 1.12	d.		d.	d.	d. a.; i. NH ₃ , turp.
41	2.774-8	710		0.074 ¹⁸		
42		220.5-1.5		0.010 ¹⁸		0.010 ²⁵ al., 0.040 ¹⁸ eth., 0.457 ¹⁵ acet.
43	2.221	860		26.1 ¹⁰	23 ¹⁰⁰	i. abs. al., acet.
44	2.06	-H ₂ O, 130		34.6 ²⁰	29.5 ¹⁰⁰	i. abs. al.
45	2.123 ¹³	120	d.	d.		

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Lithium				
1	sulfide.....	Li_2S	45.94	cub. wh.-yel.
2	" , hydro-	LiHS	40.01	wh. powd. hyg.
3	sulfite.....	$\text{Li}_2\text{SO}_3 \cdot \text{H}_2\text{O}$	111.96	need.
4	tartrate.....	$\text{Li}_2\text{C}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$	179.97	wh. cr. powd.
5	thallium <i>dl</i> -tartrate.....	$\text{LiTlC}_4\text{H}_4\text{O}_6 \cdot 2\text{H}_2\text{O}$	395.43	tri-cr.
6	thiocyanate.....	LiSCN	65.02	deliq., wh. cr.
7	tungstate.....	Li_2WO_4	261.80	trig. col.
8	urate, acid.....	$\text{LiHC}_5\text{H}_2\text{N}_4\text{O}_3$	174.05	wh. powd.
9	metavanadate.....	$\text{LiVO}_3 \cdot 2\text{H}_2\text{O}$	141.92	yelsh. powd.
10	Lutecium (cassiopeium)	Lu	175.00	
Magnesium				
11		Mg	24.32	hex. silv. wh. met.
12	acetate.....	$\text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 4\text{H}_2\text{O}$	214.47	monocl. col., β 1.491
13	aluminate (spinel).....	MgAl_2O_4	142.26	cub. col., 1.723
14	antimonide.....	Mg_3Sb_2	316.48	metallic
15	orthoarsenate (hoernesite).....	$\text{Mg}_3(\text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$	494.91	monocl. wh.
16	"	$\text{Mg}_3(\text{AsO}_4)_2 \cdot 22\text{H}_2\text{O}$	747.14	
17	" mono-H (roesslerite).....	$\text{MgHAsO}_4 \cdot 7\text{H}_2\text{O}$	290.35	monocl.
18	orthoarsenite.....	$\text{Mg}_3(\text{AsO}_3)_2$	318.78	
19	benzoate.....	$\text{Mg}(\text{C}_7\text{H}_5\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$	320.59	wh. powd.
20	orthoborate.....	$\text{Mg}_3(\text{BO}_3)_2$	190.60	rhomb. col.
21	pyroborate (ascharite).....	$\text{Mg}_2\text{B}_2\text{O}_5 \cdot \text{H}_2\text{O}$	168.30	orthorhomb.
22	metaborate (pinnoite).....	$\text{MgB}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$	164.01	yel. tetr. pyram. 1.565, 1.575
23	"	$\text{MgB}_2\text{O}_4 \cdot 8\text{H}_2\text{O}$	254.09	tetr., 1.565, 1.575
24	bromate.....	$\text{Mg}(\text{BrO}_3)_2 \cdot 6\text{H}_2\text{O}$	388.25	cub. col., 1.514
25	bromide.....	MgBr_2	184.15	lg. lust. wh. cr., deliq.
26	"	$\text{MgBr}_2 \cdot 6\text{H}_2\text{O}$	292.25	hex. col. pr. & need., fluo. in X-Rays.
27	bromoplatinate.....	$\text{MgPtBr}_6 \cdot 12\text{H}_2\text{O}$	915.24	trig.
28	carbonate (magnesite).....	MgCO_3	84.33	trig. wh., 1.717, 1.515
29	" (nesquehonite).....	$\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$	138.38	rhomb. col. need., 1.495, 1.501, 1.526
30	" (lansfordite).....	$\text{MgCO}_3 \cdot 5\text{H}_2\text{O}$	174.41	monocl. 1.456, 1.468, 1.507
31	" , basic (artinite).....	$\text{MgCO}_3 \cdot \text{Mg}(\text{OH})_2 \cdot 3\text{H}_2\text{O}$	196.71	rhomb., 1.489, 1.534, 1.557
32	" " (hydro-magnesite).....	$3\text{MgCO}_3 \cdot \text{Mg}(\text{OH})_2 \cdot 3\text{H}_2\text{O}$	365.37	rhomb. wh., 1.527, 1.530, 1.540
33	chlorate.....	$\text{Mg}(\text{ClO}_3)_2 \cdot 6\text{H}_2\text{O}$	299.33	wh. cr. or powd. deliq.
34	perchlorate.....	$\text{Mg}(\text{ClO}_4)_2$	223.23	
35	"	$\text{Mg}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$	331.33	
36	chloride.....	MgCl_2	95.23	wh. lust. hex. cr., 1.675, 1.59
37	" (bischofite).....	$\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$	203.33	monocl. col. deliq., 1.495, 1.507, 1.528
38	chloropalladate.....	$\text{MgPdCl}_6 \cdot 6\text{H}_2\text{O}$	451.86	hex.
39	chloroplatinate.....	$\text{MgPtCl}_6 \cdot 6\text{H}_2\text{O}$	540.39	trig.
40	chlorostannate.....	$\text{MgSnCl}_6 \cdot 6\text{H}_2\text{O}$	463.86	tri.
41	chromate.....	$\text{MgCrO}_4 \cdot 7\text{H}_2\text{O}$	266.44	rhomb. yel., 1.521, 1.550, 1.568
42	citrate.....	$\text{Mg}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 14\text{H}_2\text{O}$	703.39	wh. gran. powd.
43	ferrite (magnesioferrite).....	MgFe_2O_4	200.00	oct. blk., 2.35
44	ferrocyanide.....	$\text{Mg}_2\text{Fe}(\text{CN})_6 \cdot 12\text{H}_2\text{O}$	476.78	pa. yel. cr.
45	fluoride (sellaite).....	MgF_2	62.32	tetr. col. faint vlt. lumin., 1.378, 1.390

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.66	.....	.....	v. s.	v. s.	v. s. al.
2	.....	.....	.....	s.	s.	s. al.
3	.....	455 sl. d.	-H ₂ O, 180-200	s.	s.	i. al.
4	.....	.....	.....	s.	.....	.....
5	3.144	.....	.....	v. s.	.....	s. methyl acetate
6	.....	.....	.....	v. s.	v. s.	d. a.; i. al.
7	.....	742	.....	27 ²⁰	2.5 ¹⁰⁰	sl. s. al.
8	.....	.....	.....	s.	.....	.....
9	.....	.....	.....	.....	.....	.....
10	.....	.....	.....	.....	.....	.....
11	1.74 ⁵	651	1100-1120	i.	sl. s. d. to Mg(OH) ₂	s. min. a. except CrO ₃ d. a.; i. al.
12	1.454	d.	.....	36.2 ⁰ ; 61.1 ¹⁵	66.4 ⁶⁸	conc. HF, NH ₄ salts; i. alk. v. s. al.
13	3.6	2135	.....	.....	.....	v. sl. s. dil. HCl; i. dil. HNO ₃
14	.....	961	.....	i.	.....	.....
15	2.60-.61	.....	.....	.....	.....	.....
16	1.788	.....	.....	i.	i.	s. a., NH ₄ Cl
17	3.155 ¹⁵	-5H ₂ O, 100	.....	d.	.....	.....
18	.....	.....	.....	s.	v. s.	s. a., NH ₄ Cl; i. NH ₄ OH
19	.....	d. 200 (?); -3H ₂ O, 110	.....	6.16 ¹⁵	19.6 ¹⁰⁰	s. al.
20	2.99 ²¹	.....	.....	s.	s.	s. min. a.; i. ac. a.
21	2.60-.70	.....	.....	.....	.....	.....
22	2.27-.30	.....	.....	.....	.....	.....
23	2.30	.....	.....	i.	i. (v. sl. s.)	s. a.
24	2.29	-6H ₂ O, 200	d.	42 ¹⁵	v. s.	i. al.
25	3.72	700 (695)	.....	47.9 ⁰ ; 49.1 ²⁰	53.2 ²⁰ ; 54.6 ¹⁰⁰	6.9 ⁰ al.; 21.8 ²⁰ meth. al.
26	2.00?	165 d.	.....	316 ⁰	v. s.	s. al., acet.; sl. s. NH ₃
27	2.802	.....	.....	.....	.....	.....
28	3.037	d. 350	-CO ₂ , 900	0.0106	.....	s. a., aq. CO ₂ ; i. acet., NH ₃
29	1.850	165	.....	0.129 ²⁵	d.	s. a.; 1.4 aq. CO ₂
30	1.69-.73	.....	.....	.....	.....	.....
31	2.02 ²⁰	.....	.....	.....	.....	.....
32	2.16	d.	.....	0.04	0.011	s. a., NH ₄ salts
33	1.80 ²⁵	35	d. 120	56.5 ¹⁸	73.7 ⁹³	s. al.
34	2.60 ²⁵	251 d.	.....	49.90 ²⁵	v. s.	.....
35	1.970 ²⁵	147	.....	.....	.....	.....
36	2.316	708	1412	35.3 ²⁰	42.2 ¹⁰⁰	50 al.
37	1.56	d. 116-8	d.	167	367	50 al.
38	2.12	d.	.....	.....	.....	.....
39	2.437	d.	.....	.....	.....	.....
40	2.08	d. 100	.....	.....	.....	.....
41	1.695	.....	.....	211.5 ¹⁸	v. s.	.....
42	.....	.....	.....	sl. s.	.....	s. a.
43	4.44-60	1750 ± 25	.....	.....	.....	s. conc. HCl; i. h. HNO ₃ al., dil. a.
44	.....	d. ca. 200	.....	33	.....	.....
45	2.9-3.2	1396	2239	.0076 ¹⁸	i.	s. HNO ₃ ; sl. s. a.; i. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Magnesium				
1	fluosilicate	$MgSiF_6$	166.38	wh. cr. or powd.
2	"	$MgSiF_6 \cdot 6H_2O$	274.48	trig. wh.
3	formate	$Mg(CHO_2)_2 \cdot 2H_2O$	150.39	rhomb. col.
4	orthogermanate	Mg_2GeO_4	185.24	wh. ppt.
5	hydroxide (brucite)	$Mg(OH)_2$	58.34	trig. col., 1.559, 1.580.
6	iodate	$Mg(IO_3)_2 \cdot 4H_2O$	446.22	monocl.
7	iodide	MgI_2	278.16	wh. cr., deliq.
8	"	$MgI_2 \cdot 8H_2O$	422.29	wh. deliq. powd.
9	lactate	$Mg(C_3H_5O_3)_2 \cdot 3H_2O$	256.51	wh. cr. powd.; v. bitter taste.
10	laurate	$Mg(C_{12}H_{23}O_2)_2 \cdot 2H_2O$	458.97	wh. lumps.
11	permanganate	$Mg(MnO_4)_2 \cdot 6H_2O$	370.28	dk. purp. need. deliq.
12	myristate	$Mg(C_{14}H_{27}O_2)_2$	479.04	wh. powd.
13	nitrate	$Mg(NO_3)_2 \cdot 2H_2O$	184.37	pr
14	"	$Mg(NO_3)_2 \cdot 6H_2O$	256.43	monocl. col. deliq.
15	nitride	Mg_3N_2	100.98	grn. yel. cr.
16	oleate	$Mg(C_{18}H_{33}O_2)_2$	587.21	yellow powd. or mass.
17	oxalate	$MgC_2O_4 \cdot 2H_2O$	148.37	wh. powd.
18	oxide (periclase)	MgO	40.32	cub. col., 1.736.
19	" , per-	MgO_2	56.32	wh. powd.
20	palmitate	$Mg(C_{16}H_{31}O_2)_2$	535.14	cr. need. or wh. lumps.
21	orthophosphate	$Mg_3(PO_4)_2 \cdot 4H_2O$	335.06	monocl.
22	" (bobierite)	$Mg_3(PO_4)_2 \cdot 8H_2O$	407.13	monocl. pl., 1.510, 1.520, 1.543.
23	" , mono-H (newberyite)	$MgHPO_4 \cdot 3H_2O$	174.40	rhomb. wh., 1.514, 1.518, 1.533.
24	" , mono-H	$MgHPO_4 \cdot 7H_2O$	246.46	hex.
25	pyrophosphate	$Mg_2P_2O_7$	222.68	tabular monocl. col., 1.602, 1.604, 1.615
26	"	$Mg_2P_2O_7 \cdot 3H_2O$	276.73	wh. amor.
27	hypophosphate	$Mg(H_2PO_3)_2 \cdot 6H_2O$	262.49	wh. cr.
28	orthophosphate	$MgHPO_3 \cdot 3H_2O$	158.40	wh. cr. powd.
29	salicylate	$Mg(C_7H_5O_3)_2 \cdot 4H_2O$	370.61	col. or sl. redsh. effl. cr. powd.
30	selenate	$MgSeO_4 \cdot 6H_2O$	275.38	monocl. col., 1.486, 1.489, 1.491.
31	silicate (clinoenstatite)	$MgSiO_3$	100.38	monocl.
32	(di-) silicide	Mg_2Si	76.70	oct.
33	(penta-) silicide, tri-	Mg_5Si_3	205.78	
34	stearate	$Mg(C_{18}H_{35}O_2)_2$	591.25	wh. powd. or lumps.
35	sulfate	$MgSO_4$	120.38	col. cr.
36	" (kieserite)	$MgSO_4 \cdot H_2O$	138.40	monocl. col. pr., 1.523, 1.535, 1.586.
37	" (Epsom salt, ep-somite)	$MgSO_4 \cdot 7H_2O$	246.49	rhomb. (monocl.) col., 1.433, 1.455, 1.461
38	sulfide	MgS	56.38	cub. pa. red-redsh.-br., phos.
39	sulfite	$MgSO_3 \cdot 6H_2O$	212.48	wh. cr. powd.
40	d-tartrate	$MgC_4H_4O_6 \cdot 5H_2O$	262.47	monocl.
41	" , acid	$Mg(HC_4H_4O_6)_2 \cdot 4H_2O$	394.55	rhomb.
42	thiosulfate	$MgS_2O_3 \cdot 6H_2O$	244.54	col. pr.
43	thiotellurite	Mg_3TeS_5	360.87	cr. mass pale yel.
44	tungstate	$MgWO_4$	272.24	col. monocl.
45	Manganese	Mn	54.93	cub. or tetr. gray-pink met.
46	acetate (ous)	$Mn(C_2H_3O_2)_2 \cdot 4H_2O$	245.08	monocl. pa. red.
47	arsenide, mono-	$MnAs$	129.84	blk. hex.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				65		
2	1.788					
3				7.7		i. al., eth.
4				0.0016 ²⁸		s. a.; i. alk.
5	2.38-39	-H ₂ O, 350	d.	0.0009 ¹⁸	0.004 ¹⁰⁰	s. a., NH ₄ salts
6	3.3 ^{13.5}	-4H ₂ O, 210		10.2 ²⁰	19.3 ¹⁰⁰	
7	4.244	>700 d.		100 ⁰ ; 148 ¹⁸	164.9 ¹¹⁰	s. al., eth., NH ₃ , methyl l.
8		d. 41		81 ²⁰	90.3 ⁹⁰	s. al., eth.
9				3.3	16.7 ¹⁰⁰	i. al., eth.
10		150.4		0.007 ²⁵	0.041 ¹⁰⁰	0.415 ¹⁵ al., 0.012 ²⁵ eth.
11	2.18 ?	d.		v. s.	d.	s. ac. a., meth. al.
12		131.6		0.006 ¹⁵	0.014 ⁵⁰	0.189 ²⁵ al., 0.126 ¹⁵ al. 0.007 ²⁵ eth.
13	2.0256 ²⁵	129.0-5				
14	1.464	95	-5H ₂ O, 330	42.33 ¹⁸	57.81 ⁹⁰	s. al., liq. NH ₃
15		d. 1500		i.	d.	s. a.; d. al.
16				0.024 ²⁵		6.64 ²⁰ al.; s. linseed oil sl. s., eth.
17	2.45 ($2\frac{1}{2}$ H ₂ O)	d.		0.07 ¹⁶	0.08 ¹⁰⁰	s. a., alk. oxal.
18	3.65-75	2500-800		0.00062	0.0086 ³⁰ sl. d.	s. a., NH ₄ salts; i. al.
19				i.	i.	s. a.
20		121.5		0.008 ²⁵	0.009 ⁵⁰	0.003 ²⁵ eth.; 0.047 ²⁵ al.
21	1.64 ¹⁵			0.0205		s. a.; i. NH ₄ salts, NH ₃
22	2.41					s. NH ₄ citrate
23	2.10			sl. s.		s. a.
24		-4H ₂ O, 100		0.3	0.2	s. a.; i. al.
25	2.559	1383		i.	i.	s. a.; i. al.
26	2.56	d. 150		i.	sl. s.	s. a.; i. al.
27				20		i. al., eth.
28				0.25		s. a.
29				s.		s. al.
30	1.928			v. s.	v. s.	
31	3.28	1557 d.				
32		1102		i.	d.	s. a., NH ₄ Cl, HCl
33		1102		i.	d.	s. a., NH ₄ Cl
34		88.5		0.003 ¹⁵ ; 0.004 ²⁵	0.008 ⁵⁰	0.020 ²⁵ al., 0.003 ²⁵ eth.
35	2.66	1124 d.		26 ⁰	73.8 ¹⁰⁰	s. al., glyc., 1.16 ¹⁸ eth., i. acet.
36	2.517 (2.57)				68.4 ¹⁰⁰	
37	1.636 (1.68)	-6H ₂ O, 150	-7H ₂ O, 200	71 ²⁰	91 ⁴⁰	s. al., glyc.
38	2.79-85	d.		d.	d.	s. a., PCl ₃
39	1.725	-6H ₂ O, 200	d.	1.25	0.83	i. al. NH ₃
40	1.67	d.	d.	0.8 ¹³	1.44 ⁹⁰	i. al., NH ₃
41	1.72					
42	1.818 ²⁴	-3H ₂ O, 170	d.	v. s.	v. s.	s. al.
43				s.	s.	s. al.
44	5.66			i.		d. a.; i. al.
45	7.20	1260	1900	d.	d.	s. dil. a.
46	1.589			s.		s. al.
47	6.17-20 (5.55)	d. 400		i.	i.	s. HCl, aq. reg.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Manganese				
1	(di-) arsenide	Mn_2As	184.77	(exist. quest.)
2	(tri-) arsenide, di-	Mn_3As_2	314.61	magnetic (exist. quest.)
3	orthoarsenite, acid (ous)	$Mn_3H_6(AsO_3)_4 \cdot 2H_2O$	698.51	rose-red.
4	benzoate (ous)	$Mn(C_7H_5O_2)_2 \cdot 3H_2O$	351.20	flat pr.
5	boride, mono-	MnB	65.75	cr. powd.
6	" di-	MnB_2	76.57	gray-vlt. cr.
7	bromide, di-	$MnBr_2$	214.76	rose-red.
8	" "	$MnBr_2 \cdot 4H_2O$	286.83	α stable, monoc. rose-red, deliq. β - or labile, col., rhomb.
9	carbide	Mn_3C	176.80	tetrah.
10	carbonate (ous) (rhodochrosite)	$MnCO_3$	114.94	rhbdr. or trig. rose pink or amor. lt. br. powd., 1.817, 1.597
11	chloride, di- (scacchite)	$MnCl_2$	125.84	cub. pink, deliq.
12	" "	$MnCl_2 \cdot 4H_2O$	197.91	monoc. rose, deliq.
13	" , tri-	$MnCl_3$	161.30	grnsh. blk. solid or brn. cr.
14	" , tetra-	$MnCl_4$	196.76	rdsh.-brn. sld. (exist. quest.)
15	chromite (ous)	$Mn(CrO_2)_2$	222.95	oct. gray
16	citrate (ous)	$Mn_3(C_6H_5O_7)_2$	542.99	wh.-redsh. powd.
17	ferrocyanide (ous)	$Mn_2Fe(CN)_6 \cdot 7H_2O$	447.92	grnsh-wh. powd.
18	fluoride, di-	MnF_2	92.93	red tetrag. or redsh. powd.
19	" , tri-	MnF_3	111.93	red cr.
20	fluosilicate (ous)	$MnSiF_6 \cdot 6H_2O$	305.09	hex. pr., rose red, 1.357, 1.374
21	formate (ous)	$Mn(CHO_2)_2 \cdot 2H_2O$	181.00	rhomb.
22	glycerophosphate (ous)	$Mn_3H_7O_6P$	225.04	wh. or sl. redsh. odorl. powd.
23	hydroxide (ous) (pyrochroite)	$Mn(OH)_2$	88.95	trig. wh.-pink, 1.723, 1.681
24	" (ic)	$MnO(OH)$ (or $Mn_2O_3 \cdot H_2O$)	87.94 (175.88)	br.
25	" " (manganite)	$MnO(OH)$ (or $Mn_2O_3 \cdot H_2O$)	87.94 (175.88)	rhomb. br.-blk., 2.24, 2.24 (Li) 2.53.
26	" "	$MnO(OH)_2$	104.95	blk.-br. amor. (exist. quest.)
27	iodide, di-	MnI_2	308.77	yelsh.-br. or pink, deliq., cr. mass or wh. powd.
28	" "	$MnI_2 \cdot 4H_2O$	380.83	monoc. rose-red, deliq.
29	lactate (ous)	$Mn(C_3H_5O_3)_2 \cdot 3H_2O$	287.12	monoc. pa. red.
30	nitrate (ous)	$Mn(NO_3)_2 \cdot 6H_2O$	287.04	monoc. rose-wh. or col.
31	oxalate (ous)	MnC_2O_4	142.95	rhomb.
32	" "	$MnC_2O_4 \cdot 2H_2O$	178.98	redsh.-wh. cr. powd., oct.
33	" "	$MnC_2O_4 \cdot 3H_2O$	197.00	prismatic, pink
34	oxide, mon- (ous) (manganosite)	MnO	70.93	cub. grn., 2.16
35	" (ous, ic), (hausmannite)	Mn_2O_4	228.79	tetr. (rhomb.) blk., 2.46 (Li), 2.15 (Li)
36	" , sesqui- (ic)	Mn_2O_3	157.86	cub. (tetr.) blk.
37	" , di-	MnO_2	86.93	rhomb. blk. or br.-blk. powd.
38	" , tri-	MnO_3	102.93	redsh., deliq.
39	" , hept-	Mn_2O_7	221.86	dk. red oil
40	orthophosphate (ous) (reddingite)	$Mn_3(PO_4)_2 \cdot 3H_2O$	408.88	rhomb., also gran. pa. rose-pink or yish. wh., 1.651, 1.656, 1.683
41	" (ous)	$Mn_3(PO_4)_2 \cdot 7H_2O$	480.94	wh.-redsh. amor. powd.
42	" , mono-H (ous)	$MnHPO_4 \cdot 3H_2O$	205.01	rhomb. red or pink powd.
43	" , di-H (ous)	$Mn(H_2PO_4)_2 \cdot 2H_2O$	285.03	pr.
44	orthophosphate (ic)	$MnPO_4 \cdot H_2O$	167.97	grnsh.-gray cr. powd.
45	pyrophosphate (ous)	$Mn_2P_2O_7$	283.90	monoc. br.-pink, 1.695, 1.704, 1.710.
46	" "	$Mn_2P_2O_7 \cdot 3H_2O$	337.95	amor. wh. powd.
47	metaphosphate (ic)	$Mn_2(PO_3)_6 \cdot 2H_2O$	620.01	pink
48	phosphide, mono-	MnP	85.95	dk. gray.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		1400		i.	i.	s. aq. reg.
2				i.	i.	s. aq. reg.
3				i.		s. a.
4				6.55 ¹⁵		
5	6.2 ¹⁵					
6	6.9			d.	d.	s. a.
7	4.385 ²⁵	d.		127.3 ⁰	228 ¹⁰⁰	i. NH ₃
8		64.3 d.	d.	296.7 ⁰		
9	6.89 ¹⁷			d.	d.	s. a.
10	3.125	d.		.0065 ²⁵		s. dil. a., .026 aq. CO ₂ ; i. NH ₃ , al.
11	2.977 ²⁵	650	1190	62.2 ¹⁰	123.8 ¹⁰⁰	s. al.; i. eth., NH ₃
12	2.01	58; -H ₂ O, 106	-4H ₂ O, 198	151 ⁸	656 ¹⁰⁰	s. al.; i. eth.
13		d. sl.				s. abs. al.
14				s.	s.	s. al., eth.
15	3.87					
16				v. sl. s.		s. soln. sod. cit., dil. a.
17				i.		s. HCl; i. NH ₄ salts
18	3.98	856		i.	d.	s. a.; i. al., eth.
19	3.54	d.		d.	d.	s. a.
20	1.903	d.		140 ¹⁸	v. s.	s. al.
21	1.953	d.		s.	s.	
22				sl. s.		s. a., cit. a.; i. al.
23	3.258 ¹³	d.		.0002 ¹⁸		s. a., NH ₄ salts; i. alk.
24	3.26	d.		v. sl. s.		
25	4.2-4.4	d.		i.	i.	s. h. H ₂ SO ₄ , HCl
26	2.58			v. sl. s.		v. sl. s. al.
27	5.01	d. ca. 80		s.		
28		d.		s.	v. s.	
29		d.		s.	v. s.	s. al.
30	1.82	25.8	129.4	426.4 ⁰	∞	v. s. al.
31	2.43 ^{21,7}	d.		i.	i.	s. a., NH ₄ Cl
32		-2H ₂ O, 100	d.	0.0312 ²⁵	0.037 ³⁶	
33		-H ₂ O, 25				
34	5.43-.46 (3.7-3.9)	1650		i.	i.	s. a., NH ₄ Cl
35	4.856	1705		i.	i.	s. HCl
36	4.50	-O, 1080		i.	i.	s. a.; i. ac. a.
37	5.026	-O, 535		i.	i.	s. HCl; i. HNO ₃ , acet.
38		d.		s.	d.	s. H ₂ SO ₄ , alk.
39	>1.84	<-20	exp. 70	v. s.	d.	s. H ₂ SO ₄
40	3.102					
41				v. sl. s.		s. a., ac. a.; i. al.
42				sl. s.	d.	s. a.; i. al.
43		-H ₂ O>100		s.		i. al.
44						s. boil. conc. H ₂ SO ₄ , conc. HCl, molten H ₃ PO ₄
45	3.707 ²⁵	(1196)		i.		s. a.
46				i.		s. aq. K ₄ P ₂ O ₇ , H ₂ SO ₃ ; i. acet.
47				sl. s.	s.	
48	5.39 ²¹	1190		i.	i.	sl. s. HNO ₃

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Manganese				
1	(tri-) phosphide, di-	Mn_3P_2	226.83	dk. gray
2	hypophosphite (ous)	$Mn(H_2PO_3)_2 \cdot H_2O$	203.02	rose-red cr. or powd.
3	orthophosphite (ous)	$MnHPO_3 \cdot H_2O$	152.97	redsh.
4	selenate	$MnSeO_4 \cdot 2H_2O$	233.92	rhomb.
5	"	$MnSeO_4 \cdot 5H_2O$	287.97	
6	selenide	$MnSe$	133.89	gray, cubic.
7	selenite (ous)	$MnSeO_3 \cdot 2H_2O$	217.92	cr.
8	orthosilicate (ous) (tephroite)	Mn_2SiO_4	201.92	rhomb. flesh-red to gray, 1.759, 1.786, 1.797
9	metasilicate (ous) (rhodonite)	$MnSiO_3$	130.99	tricl. red., 1.733, 1.740, 1.744
10	(di-) silicide	Mn_2Si	137.92	quad. pr.
11	silicide, mono-	$MnSi$	82.99	tetrah.
12	" , di-	$MnSi_2$	111.05	gray oct.
13	sulfate (ous)	$MnSO_4$	150.99	reddish
14	" " (szmikite)	$MnSO_4 \cdot H_2O$	169.01	monocl. pa. pink, 1.562, 1.595, 1.632
15	" " "	$MnSO_4 \cdot 2H_2O$	187.02	(exist. quest.)
16	" " "	$MnSO_4 \cdot 3H_2O$	205.04	(exist. quest.)
17	" " (common form)	$MnSO_4 \cdot 4H_2O$	223.05	monocl. or rhomb. pink effl.
18	" " "	$MnSO_4 \cdot 5H_2O$	241.07	tricl. rose.
19	" " "	$MnSO_4 \cdot 6H_2O$	259.09	(exist. quest.)
20	" " "	$MnSO_4 \cdot 7H_2O$	277.10	rhomb. or monocl. red.
21	" (ic)	$Mn_2(SO_4)_3$	398.04	grn. cr., deliq.
22	sulfide (ous) (alabandite)	MnS	86.99	cub. grn. or amor. pink, 2.70 (Li)
23	" " "	$3MnS \cdot H_2O$	278.99	gray-pink
24	" (ic) (hauerite)	MnS_2	119.05	cub. blk., 2.69 (Li)
25	tartrate (ous)	$MnC_4H_4O_6$	203.00	wh. powd.
26	thiocyanate (ous)	$Mn(SCN)_2 \cdot 3H_2O$	225.13	deliq.
27	dithionate (ous)	MnS_2O_6	215.95	tricl.
28	valerate	$Mn(C_5H_5O_2)_2 \cdot 2H_2O$	293.21	br. powd.
29	Manganic acid, per-		119.94	in soln. only
30	Manganocyanic acid		215.07	
31	Masurium			
32	Mercury		200.61	silv. liq., hex. met.
33	acetate (ous)	$HgC_2H_3O_2$	259.65	micaceous scales
34	" (ic)	$Hg(C_2H_3O_2)_2$	318.70	wh. sc. or powd.
35	acetylide (ic)	$3HgC_2 \cdot H_2O$	691.91	wh. powd.
36	orthoarsenate (ous)	Hg_3AsO_4	740.74	dk. red
37	" , mono-H (ous)	Hg_2HASO_4	541.14	yel.-red.
38	" (ic)	$Hg_3(AsO_4)_2$	879.65	yel.
39	azide (ous)	HgN_3	242.63	wh. cr.
40	benzoate (ic)	$Hg(C_7H_5O_2)_2$	442.83	wh. cr. powd.
41	bromate (ous)	$HgBrO_3$	328.53	cr.
42	" (ic)	$Hg(BrO_3)_2 \cdot 2H_2O$	492.47	cr.
43	bromide (ous)	$HgBr$	280.53	tetr. wh.-yel.
44	" (ic)	$HgBr_2$	360.44	rhomb. col.
45	" iodide (ic)	$HgBrI$	407.45	rhomb. yel.
46	carbonate (ous)	Hg_2CO_3	461.23	yel.-br.
47	" , basic (ic)	$HgCO_3 \cdot 2HgO$	693.84	br.-red.
48	chlorate (ous)	$HgClO_3$	284.07	rhomb. wh.
49	" (ic)	$Hg(ClO_3)_2$	367.52	need.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	5.12 ¹⁸	1095		i.	i.	sl. s. dil. HNO ₃
2		-H ₂ O > 150		12.5	16.7	i. al.
3		-H ₂ O, 200		sl. s.		s. MnCl ₂ , MnSO ₄
4	2.95-3.01			s.	s.	
5	2.33-39					
6	5.59 ¹⁵			i.	i.	d. dil. a.
7				v. sl. s.	v. sl. s.	
8	4.043 ²⁵	1300				
9	3.72 ²⁵	1323		i.	i.	i. HCl
10	6.20 ¹⁵	1316		i.	i.	s. HCl, NaOH; i. HNO ₃
11	5.90 ¹⁵	1280		i.	i.	s. HF; v. sl. s. a.
12	5.24 ¹³			i.	i.	s. HF, alk.; i. HNO ₃ , H ₂ SO ₄
13	3.25	700	d. 850	52 ⁵	70 ⁷⁰	s. al.; i. eth.
14	2.95	stab. 57-117		98.47 ⁴⁸	79.8 ¹⁰⁰	
15	2.526 ¹⁵	stab. 40-57		85.27 ³⁵	106.8 ⁵⁵	
16	2.356 ¹⁵	stab. 30-40		74.22 ⁵	99.31 ⁵⁷	
17	2.107	stab. 18-30		105.3 ⁰	111.2 ⁵⁴	i. al.
18	2.103	stab. 8-18		124 ⁰	142 ⁵⁴	
19		stab. -5 to +8		147.4 ⁰	134.5 ³⁸	
20	2.092	-7H ₂ O, 280	stab. -10 to -5	172 ⁰	118 ¹³	i. al.
21		d. 160		d.	d.	s. HCl, dil. H ₂ SO ₄ ; i. conc. H ₂ SO ₄ , HNO ₃
22	3.99	d.		.00047 ¹⁸		s. dil. a., al.; i. (NH ₄) ₂ S
23		d.		0.0006	i.	s. dil. a.; i. (NH ₄) ₂ S
24	3.463	d.		i.	i.	d. HCl
25				v. sl. s.		
26		-3H ₂ O, 160-70		s.	v. s.	v. s. al.
27	1.757			s.	v. s.	
28				s.		
29				v. s.	d.	
30		d.		i.		v. s. al.; i. eth.
31		2300				
32	13.546	-38.89	356.9	i.	i.	s. HNO ₃ ; i. dil. HCl, HBr.
33		d.		0.75 ¹²		HI
34	3.270	d.		25 ¹⁰	100 ¹⁰⁰	s. H ₂ SO ₄ , HNO ₃
35	5.3	exp.		i.	i.	s. al., ac. a.
36		d.		i.		i. al.
37		d.		i.		s. HNO ₃ ; i. ac. a.
38						s. HNO ₃ ; i. NH ₄ OH, ac. a.
39		exp. d. by hg ht		v. sl. s.		s. HCl, HNO ₃
40		165		0.025		
41		d.		1.2 ¹⁵	2.5 ¹⁰⁰	s. al., NaCl, NH ₄ C ₇ H ₅ O ₂
42		d. 130-40		d.		sl. s. HNO ₃
43	7.307	subl. 345		0.15	1.6	s. HNO ₃ , HCl, Hg(NO ₃) ₂
44	6.109 ²⁵ ; l. 5.12 ²⁴⁰	236	322	.000004 ²⁵		s. a.; i. al., acet.
45				.61 ²⁵	20-25 ¹⁰⁰	15 ⁰ al.; s. meth. al.; v. sl. s. eth.
46	5.07 ²¹⁸ g/l	229	369	.0000045	d.	s. al., eth.
47		d. 130				s. NH ₄ Cl; i. al.
48	6.409	d. 250		s.	d.	s. H ₂ CO ₃ , NH ₄ Cl
49	4.998	d.		25		s. al., ac. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Mercury				
1	chloride (ous) (calomel).	HgCl.....	236.07	tetr. wh., 1.973, 2.656.....
2	chloride (ic) (corrosive sublimite)	HgCl ₂	271.52	rhomb. col. or wh. powd., pois.....
3	“ iodide (ic)	HgI.....	362.99	rhomb. red.....
4	chromate (ous).....	Hg ₂ CrO ₄	517.23	red need. or powd.....
5	“ (ic).....	HgCrO ₄	316.62	rhomb. red.....
6	citrate (ous).....	Hg ₃ C ₆ H ₅ O ₇	790.93	wh. powd.....
7	cyanide (ic).....	Hg(CN) ₂	252.65	tetr. col. or wh. powd., pois.....
8	fluoride (ous).....	HgF.....	219.61	cub. yel.....
9	“ (ic).....	HgF ₂	238.61	cub.....
10	fluosilicate (ous).....	Hg ₂ SiF ₆ ·2H ₂ O.....	579.31	col. pr.....
11	“ (ic).....	HgSiF ₆ ·6H ₂ O.....	450.77	rhbdr. col.....
12	“ , basic (ic).....	HgSiF ₆ ·HgO·3H ₂ O.....	613.33	yel. need.....
13	formate (ous).....	HgCHO ₂	245.63	glist. scales.....
14	fulminate (ic).....	HgC ₂ N ₂ O ₂	254.65	cub. wh.....
15	hydroxide (ic).....	Hg(OH) ₂	234.63	.....
16	iodate (ous).....	HgIO ₃	375.53	yelsh.....
17	“ (ic).....	Hg(IO ₃) ₂	550.45	wh. amor. powd.....
18	iodide (ous).....	HgI.....	327.53	tetr. or amor. powd., yel.....
19	“ (ic).....	HgI ₂	454.45	rhomb. yel., cr. or powd.....
20	“ “.....	HgI ₂	454.45	tetr. red., cr. or powd.....
21	nitrate (ous).....	HgNO ₃ ·H ₂ O.....	280.63	monocl. col. effl.....
22	“ (ic).....	Hg(NO ₃) ₂ ·½H ₂ O.....	333.63	wh.-yel. deliq. powd. or tr. cr.....
23	“ “.....	Hg(NO ₃) ₂ ·H ₂ O.....	342.64	col. cr. or wh. deliq. powd., pois.....
24	nitride.....	Hg ₃ N ₂	629.85	br. powd.....
25	oxalate (ous).....	Hg ₂ C ₂ O ₄	489.24	.....
26	“ (ic).....	HgC ₂ O ₄	288.63	.....
27	oxide (ous).....	Hg ₂ O.....	417.22	blk.-brush. powd.....
28	“ (ic) (montroydite).	HgO.....	216.61	rhomb. yel. or red, 2.37, 2.5, 2.65...
29	oxybromide (ic).....	HgBr ₂ ·3HgO.....	1010.27	yel. cr.....
30	oxychloride (ic).....	HgCl ₂ ·2HgO.....	704.74	hex. red or monocl. blk.....
31	“ “.....	HgCl ₂ ·3HgO.....	921.35	hex. yel.....
32	oxycyanide (ic).....	Hg(CN) ₂ ·HgO.....	469.26	need. or wh. cr. powd.....
33	oxyfluoride (ic).....	HgF ₂ ·HgO·H ₂ O.....	473.24	yel. cr.....
34	oxyiodide (ic).....	HgI ₂ ·3HgO.....	1104.28	yel. br.....
35	orthophosphate (ous).....	Hg ₃ PO ₄	696.85	col.....
36	“ (ic).....	Hg ₃ (PO ₄) ₂	791.87	wh.-yelsh. powd.....
37	selenide (ic) (tiemannite).	HgSe.....	279.57	gray plates.....
38	sulfate (ous).....	HgSO ₄	497.28	monocl. col., wh.-yelsh. powd.....
39	“ (ic).....	HgSO ₄	296.67	rhomb. col. or wh. powd.....
40	“ , basic (ic).....	HgSO ₄ ·2HgO.....	729.89	lem. yel. powd.....
41	sulfide (ous).....	HgS.....	433.28	blk.....
42	sulfide (ic) (α-) (cinna- bar, vermilion)	HgS.....	232.67	hex. red cr. or powd., 2.854, 3.201...

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	7.150	302	383.7	.00021 ¹⁸ ; .00020 ²⁵	.0014 ³	s. Hg(NO ₃) ₂ , aq. reg.; sl. s. h. HNO ₃ , HCl; i. al., eth.
2	5.440 ²⁵ ; 1.444 ²⁸⁰	276	302	3.6 ⁰ ; 6.9 ²⁰	61.3 ¹⁰⁰	33 ²⁵ al., 25 eth.; s. ac. a., pyr.
3	.....	153	315	i.	sl. s.	s. al.
4	.....	d.	.....	v. sl. s.	sl. s.	s. HNO ₃ , KCN; i. al., acet.
5	.....	d.	.....	sl. s. d.	d.	d. a.; s. NH ₄ Cl; i. acet.
6	.....	.....	.....	v. sl. s.	.....	.....
7	3.996	d.	.....	9.3 ¹⁴	53.9 ¹⁰⁰	10 ²⁰ al.; 44.1 ^{19.5} meth. al.; s. NH ₃ , glyc.; i. bz.
8	8.73	570	.....	s. d. to Hg ₂ O	.....	.....
9	8.95 ¹⁵	645 d.	650	d.	.....	s. dil. HNO ₃ , HF
10	.....	.....	.....	sl. s.	.....	i. HCl
11	.....	.....	.....	d. easily	.....	.....
12	.....	.....	.....	d.	.....	.....
13	.....	d.	.....	0.4 ¹⁷	d.	.....
14	4.42	exp.	.....	sl. s.	s.	s. al., NH ₄ OH
15	.....	-H ₂ O, 175	.....	i.	i.	s. a.
16	.....	d.	.....	i.	i.	s. dil. HCl; i. cold HNO ₃
17	.....	.....	.....	i.	.....	s. HCl, NH ₄ Cl, NaCl, KI; i. HNO ₃
18	7.70	subl. 140; 290 d.	310 d.	v. sl. s.	.....	s. KI, NH ₄ OH; i. al., eth.
19	6.271; 1.524 ²⁵⁵	259	354	v. sl. s.	sl. s.	v. sl. s. al.; s. eth., Na ₂ S ₂ O ₃ , KI
20	6.283	tr. 126-7; 259	354	.00610 ²⁵	sl. s.	1.8 ²⁵ abs. al.; s. eth., acet., Na ₂ S ₂ O ₃ , alk. salts
21	4.79 ⁴	70	.....	d.	s. d.	s. dil. HNO ₃ ; i. NH ₄ OH
22	4.39	79	d.	v. s.	d.	s. HNO ₃ , NH ₃ , acet.; i. al.
23	.....	.....	.....	s.	.....	s. HNO ₃ ; i. al.
24	.....	exp.	.....	d.	.....	d. a.; s. NH ₄ OH, NH ₄ salts
25	.....	.....	.....	i.	i.	sl. s. HNO ₃
26	.....	d.	.....	.0107 ²⁰	.....	s. HCl; sl. s. HNO ₃
27	9.8	d. 100	.....	.00513	.....	s. H ₂ SO ₄ , HNO ₃ , h. ac. a.; i. dil. HCl, alk., NH ₃ , al., eth.
28	11.14	d. 500	.....	.0052 ⁵	.0395 ¹⁰⁰	s. a.; i. al., eth., acet., alk., NH ₃
29	.....	.....	.....	i.	sl. s.	v. s. al.
30	red 8.16-.43; blk. 8.53	.....	.....	.....	.....	.....
31	7.93	d. 260	.....	i.	d.	.....
32	4.437 ¹⁹	exp.	.....	1.25	s.	.....
33	.....	d. 100	.....	d.	.....	s. dil. HNO ₃
34	.....	.....	.....	d.	.....	s. HI
35	.....	.....	.....	i.	d.	s. HNO ₃ , aq. HgNO ₃ ; i. H ₃ PO ₄
36	.....	.....	.....	i.	sl. s.	s. a., NH ₄ Cl; i. al.
37	7.1-8.9	subl.	.....	i.	.....	s. aq. reg.
38	7.56	d.	d.	.06 ²⁵	.09 ¹⁰⁰	s. H ₂ SO ₄ , HNO ₃
39	6.47	d.	.....	d.	.....	s. a., NaCl; i. al., acet., NH ₃
40	6.44	.....	volat.	.003 ¹⁶	sl. s.	s. a.; i. al.
41	.....	d. 0	.....	i.	.....	i. a., (NH ₄) ₂ S
42	8.10	subl. 583.5	.....	.000001 ¹⁸	.....	s. Na ₂ S, aq. reg.; i. HNO ₃ , al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Mercury				
1	sulfide (ic) (β -) (meta-cinnabarite)	HgS.....	232.67	cub. blk. or amor. powd.....
2	tartrate (ous).....	Hg ₂ C ₄ H ₄ O ₆	549.29	yelsh.-wh. cr. powd.....
3	orthotellurate (ic).....	Hg ₃ TeO ₆	825.44	cubic dodecahedron trans. amber.....
4	metatellurate (ic).....	HgTeO ₄ ·2H ₂ O.....	428.25	ortho. rhmb., trans., flocc.....
5	thiocyanate (ous).....	HgSCN.....	258.69	wh. powd. pois.....
6	" (ic).....	Hg(SCN) ₂	316.77	wh. powd. pois.....
7	tungstate (ous).....	Hg ₂ WO ₄	649.14	yel. amor.....
8	" (ic).....	HgWO ₄	448.53	yel.....
Mercury-nitrogen compounds:				
Mercury				
9	bromide (ic), ammono-basic	Hg(NH ₂)Br.....	296.55	wh. powd.....
10	bromide (ic), ammono-basic	Hg ₂ NBr.....	495.14	yel.....
11	" " , diammine.	HgBr ₂ ·2NH ₃	394.51	wh. powd.....
12	chloride (ic), ammono-basic (infusible white ppt.)	Hg(NH ₂)Cl.....	252.09	wh. powd. or sm. pr.....
13	chloride (ic), ammono-basic	Hg ₂ NCl.....	450.69	yel.....
14	" " , aquobasic ammonobasic (chloride of Millon's base)	HOHgNHHgCl....	468.70	pa. yel. or wh. powd.....
15	chloride (ic), diammine (fusible white ppt.)	HgCl ₂ ·2NH ₃	305.59	rhbdr.....
16	iodide (ic), ammono-basic	Hg(NH ₂)I.....	343.55	dirty wh. cr.....
17	" " "	Hg ₂ NI.....	542.15	.....
18	" " , aquobasic ammonobasic (iodide of Millon's base)	HOHgNHHgI.....	560.16	yel. to br.....
19	iodide (ic), diammine.....	HgI ₂ ·2NH ₃	488.51	col. or pa. yel. powd. or need.....
20	Millon's base	Hg ₂ NOH·xH ₂ O.....	.....	.....
21	Molybdenum	Mo.....	95.95	cub. silv.-wh. met. or gray-blk. powd.....
22	bromide, di-.....	MoBr ₂ (or Mo ₃ Br ₆).....	255.78	yel.-red.....
23	" , tri-.....	MoBr ₃	335.70	dk. grn. need.....
24	" , tetra-.....	MoBr ₄	415.61	blk. need., deliq.....
25	carbide, mono-.....	MoC.....	107.96	dk. gray cr. powd.....
26	(di-) carbide.....	Mo ₂ C.....	203.91	pr. wh.....
27	carbide, di-.....	MoC ₂	119.97	wh. pr.....
28	carbonyl.....	Mo(CO) ₆	264.01	cr. diamagnetic.....
29	chloride, di-.....	MoCl ₂ (or Mo ₃ Cl ₆).....	166.86	amor. yel.....
30	" , tri-.....	MoCl ₃	202.32	dk. red need. or powd.....
31	" , tetra-.....	MoCl ₄	237.78	br. cr. or powd., deliq.....
32	" , penta-.....	MoCl ₅	273.24	gr.-blk. cr., deliq.....
33	fluoride, hexa-.....	MoF ₆	209.95	col. cr.....
34	hydroxide.....	Mo(OH) ₃ (or Mo ₂ O ₃ ·H ₂ O).....	146.97	blk. powd.....
35	".....	MoO(OH) ₃ (or Mo ₂ O ₃ ·3H ₂ O).....	162.97 (325.95)	light br. amor.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	7.73	583.5	.....	i.	.....	s. Na ₂ S, aq. reg. alk.; i. HNO ₃ , al.
2	.....	.....	.....	i.	.....	i. a.
3	.....	unalt. at 140	.....	i.	i.	s. HNO ₃ , HCl
4	.....	d. 20	.....	slow d.	rapid d.	.....
5	.....	d.	.....	i.	.....	s. HCl, KCNS
6	.....	d.	.....	.07 ²⁵	s.	s. NH ₄ salts, NH ₃ , HCl KCN; sl. s. al., eth.
7	.....	d.	.....	i.	i.	d. a.; i. al.
8	.....	d.	.....	i.	d.	d. a.; i. al.
9	.....	d.	.....	i.-d.	.....	i. al.; sl. s. NH ₄ OH
10	.....	d.	.....	i.	.....	s. HCl, KI
11	.....	180	.....	d.	.....	s. NH ₄ Br, NH ₄ Cl, NH ₄ I
12	5.70	infus.	.....	0.14	d. ¹⁰⁰	d. a.; i. al.
13	.....	d. 300	.....	i.	i.	s. a., KI
14	.....	d. >120	.....	sl. s.	.....	s. HCl, HNO ₃
15	.....	300	.....	i.	d.	s. a., KI
16	.....	.....	.....	.....	.....	i. eth.
17	.....	.....	.....	i.	.....	s. HCl; d. KI
18	.....	>128	exp.	i.	.....	s. d. HCl, KI soln.
19	.....	.....	.....	d.	.....	s. NH ₄ OH
20	4.083 ¹⁸	.....	.....	.....	.....	.....
21	10.2	2620 ± 10	3700	i.	i.	s. h. conc. HNO ₃ , H ₂ SO ₄ ; i. HCl, HF, dil. H ₂ SO ₄ , NH ₃
22	4.88 ^{17.5}	.....	.....	i.	i.	s. alk.; i. a., aq. reg.
23	.....	d.	.....	i.	i.	d. alk., NH ₃ ; i. a.
24	.....	d.	volat.	v. s.	.....	d. alk.
25	8.40	2570	.....	i.	i.	sl. s. HNO ₃ , HF, h. H ₂ SO ₄ , HCl; i. alk. hyd.
26	8.9	2380	.....	.....	.....	.....
27	8.9	.....	4500	.....	.....	.....
28	1.96	d. 150	.....	.....	.....	.....
29	3.714 ²⁵	d.	.....	i.	i.	s. HCl, H ₂ SO ₄ , NH ₄ OH, al., eth.
30	3.578 ²⁵	d.	.....	i.	d. sly.	d. alk.; s. conc. H ₂ SO ₄ , HNO ₃ ; v. sl. s. al., eth.; i. HCl
31	.....	d.	.....	d.	d.	d. al., eth.; s. conc. HNO ₃ , H ₂ SO ₄ , HCl
32	2.928	194	268	d.	d.	s. d. al., eth.; s. CCl ₄ , chl; s. conc. HCl, conc. H ₂ SO ₄ , HNO ₃
33	lq. 2.55	17	35	s. d.	d.	d. NH ₃ ; s. NH ₄ OH, alk.
34	.....	d.	.....	.....	.....	sl. s. H ₂ SO ₄ , HCl; s. 30% H ₂ O ₂
35	.....	.....	.....	0.2 (coll.)	.....	sl. s. alk. carb., NH ₃ , HCl, H ₂ SO ₄

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Molybdenum				
1	hydroxytetrabromide, di-	$\text{Mo}_3\text{Br}_4(\text{OH})_2$	641.53	red powd.
2	“	$\text{Mo}_3\text{Br}_4(\text{OH})_2 \cdot 8\text{H}_2\text{O}$	785.66	golden-yel. cr.
3	hydroxytetrachloride, di-	$\text{Mo}_3\text{Cl}_4(\text{OH})_2 \cdot 2\text{H}_2\text{O}$	499.73	amor. pa. yel.
4	iodide, di-	MoI_2	349.79	amor. br.
5	oxide, sesqui-	Mo_2O_3	239.90	blk. opaque.
6	“ , di-	MoO_2	127.95	tetr. vlt.-red.
7	“ , tri- (molybdic anhydride, molybdite)	MoO_3	143.95	rhomb. wh.-yelsh. or col.
8	oxide, pent-	Mo_2O_5	271.90	violet-bl. powd.
9	“ (“molyb. blue”)	$\text{Mo}_2\text{O}_5 \cdot x\text{MoO}_3$		dk. blue coll.
10	oxydibromide, di-	MoO_2Br_2	287.78	tabl. yel.-red, deliq.
11	oxytetrachloride	MoOCl_4	253.78	grn. cr., deliq.
12	oxydichloride, di-	MoO_2Cl_2	198.86	yelsh. wh. scaly cr.
13	oxytrichloride, tri-	$\text{Mo}_2\text{O}_3\text{Cl}_3$	417.19	dk. br.-blk. cr., deliq.
14	oxyhexachloride, tri-	$\text{Mo}_2\text{O}_3\text{Cl}_6$	452.64	ruby-red cr. or dp. vlt.
15	oxytetrafluoride	MoOF_4	187.95	col.-wh. deliq.
16	phosphide	MoP (or Mo_2P_2)	126.97	gray-grn. cr. powd.
17	“	MoP_2	157.99	blk. powd.
18	sulfide, sesqui-	Mo_2S_3	288.08	steel gray need.
19	“ , di- (molybdenite)	MoS_2	160.07	hex. blk. luster.
20	“ , tri-	MoS_3	192.13	red dk.-br.
21	“ , tetra-	MoS_4	224.19	brown powd.
22	thiocyanate, basic	$\text{Mo}(\text{OH})_2(\text{SCN})_3(?)$	304.20	red in aq.
23	Molybdic acid	H_2MoO_4 (or $\text{MoO}_3 \cdot \text{H}_2\text{O}$)	161.97	hex.-wh. or sl. yelsh.
24	“	$\text{H}_2\text{MoO}_4 \cdot \text{H}_2\text{O}$ (or $\text{MoO}_3 \cdot 2\text{H}_2\text{O}$)	179.98	monocl. yel.
25	Neodymium	Nd	144.27	yelsh. met.
26	acetate	$\text{Nd}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot \text{H}_2\text{O}$	339.42	
27	bromate	$\text{Nd}(\text{BrO}_3)_3 \cdot 9\text{H}_2\text{O}$	690.16	hex. red.
28	bromide	NdBr_3	384.02	grn. cr.
29	carbide	NdC_2	168.29	hex. leaf. yel.
30	chloride	NdCl_3	250.64	rose-vlt. pr.
31	“	$\text{NdCl}_3 \cdot 6\text{H}_2\text{O}$	358.74	rhomb. red.
32	hexaantipyrine perchlorate	$[\text{Nd}(\text{C}_{11}\text{H}_{12}\text{N}_2\text{O})_6] \cdot (\text{ClO}_4)_3$	1571.98	rose hex. cr.
33	iodide	NdI_3	525.03	blk. cr. powd.
34	molybdate	$\text{Nd}_2(\text{MoO}_4)_3$	768.39	tetr., 2.005.
35	nitrate	$\text{Nd}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$	438.39	tri-cr.
36	nitride	NdN	158.28	blk. powd.
37	oxalate	$\text{Nd}_2(\text{C}_2\text{O}_4)_3 \cdot 10\text{H}_2\text{O}$	732.76	rose cr.
38	oxide (neodymia)	Nd_2O_3	336.54	lt. bl. powd. red fluores.
39	sulfate	$\text{Nd}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	720.85	monocl. red, 1.541, 1.551, 1.562.
40	sulfide	Nd_2S_3	384.72	olive grn. powd.
41	Neon	Ne	20.18	col., wholly inert gas.
42	Nickel	Ni	58.69	cub. silvery metal.
43	acetate	$\text{Ni}(\text{C}_2\text{H}_3\text{O}_2)_2$	176.78	grn. pr.
44	orthoarsenate	$\text{Ni}_3(\text{AsO}_4)_2$	453.89	yelsh-grn. powd.
45	arsenide (niccolite)	NiAs	133.60	hex.
46	orthoarsenite, acid	$\text{Ni}_3\text{H}_6(\text{AsO}_3)_4 \cdot \text{H}_2\text{O}$	691.77	grn.-wh.
47	benzenesulfonate	$\text{Ni}(\text{C}_6\text{H}_5\text{O}_2\text{S})_2 \cdot 6\text{H}_2\text{O}$	481.11	green monocl.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1						s. alk.
2		d.	d.			d. HNO ₃ , alk.; s. HCl
3				i.		s. conc. a.; i. al.
4	4.3	d.		sl. s. d.	d.	d. KOH; i. al.
5				i.	i.	i. a., alk., NH ₄ OH
6	4.516 ^{19,5}			i.	i.	sl. s. h. conc. H ₂ SO ₄ ; i. KHC ₄ H ₄ O ₆ ; i. alk., HCl, HF
7	4.50 ^{19,5}	795	subl.	0.1066 ¹⁸	2.055 ⁷⁰	s. a., NH ₄ OH, alk. sulf.
8						s. h. H ₂ SO ₄ , HCl
9				s.		s. a., CH ₃ OH; i. (CH ₃) ₂ O, chl., C ₆ H ₆ , CS ₂ , acetone
10				s.		
11		subl.		s.		
12	3.31 ¹⁷	subl.		s.	s.	s. al., eth.
13		melts eas.	subl.	s.	s.	
14		d.		d.		s. eth.
15	3.0	98	180	s.		s. CCl ₄ , al., eth.; s. d. H ₂ SO ₄
16	6.167					s. h. HNO ₃
17	5.35 ²⁵					s. HNO ₃ , h. conc. H ₂ SO ₄ , aq. reg.; i. conc. HCl
18	5.91 ¹⁵	d. 1100	volat. 1290			i. conc. HCl
19	4.80 ¹⁴	1185	d. in air	i.	i.	s. h. H ₂ SO ₄ , aq. reg., HNO ₃ ; i. dil. a., c. H ₂ SO ₄
20		d.	d.	sl. s.	s.	s. alk. sulfd., conc. KOH
21		d.		i.	i.	s. alk. sulfd., h. H ₂ SO ₄ ; i. a.
22				s.	s.	s. eth.
23	3.112	d. 115		sl. s.	sl. s.	s. alk., NH ₄ OH, H ₂ SO ₄ ; i. NH ₃
24	3.124 ¹⁵	—H ₂ O, 70	d.	0.133 ¹⁸	2.568 ⁷⁰	s. alk. hydxx., alk. carb.; sl. s. acids
25	6.9	840		d.		
26				26.2		
27		66.7	—9H ₂ O, 150	151 ²⁵		
28				sl. s.		
29	5.15	d.		d.	d.	s. dil. a., H ₂ SO ₄ ; i. conc. HNO ₃
30	4.134 ²⁵	784		96.7 ¹³	140 ¹⁰⁰	44.5 al.; i. eth., chl.
31	2.282 ^{16,5}	124	—6H ₂ O, 160	246 ¹³	511 ¹⁰⁰	v. s. al.
32		285–9 d.		0.99 ²⁰		
33		775 ± 3				
34	5.14 ¹³	1176				
35				152.9 ²⁵		s. al., acet.
36				d.		
37				.000074 ²⁵		
38	7.24			.00019 ²⁹		s. a.
39	2.85			8. ²⁰	5.4 ⁴⁰	
40	5.179 ¹¹	d.		i.	d.	s. dil. a.
41	.9002 ⁹ g/l; lq. 1.204 ^{—245.9}	—248.67	—245.9	1.23 ⁰ cm ³ ; 1.16 ²⁵ cm ³	1.08 ⁵⁰ cm ³	s. liq. O ₂
42	8.90	1455	2900	i.	i.	s. dil. HNO ₃ ; sl. s. HCl, H ₂ SO ₄ ; i. NH ₃
43	1.798	d.		16.6		i. al.
44	4.98			i.		s. a.
45	7.57 ⁹	968		i.	i.	s. aq. reg.
46		d.		i.		s. a., alk.
47	1.628 ⁵	—H ₂ O	d.	14.3 ¹⁸	51.5 ⁸²	5.9 al.; 4.5 eth.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Nickel				
1	boride.....	NiB.....	69.51	pr.....
2	bromate.....	Ni(BrO ₃) ₂ ·6H ₂ O.....	422.62	monocl.....
3	bromide.....	NiBr ₂	218.52	yel.-br., deliq.....
4	".....	NiBr ₂ ·3H ₂ O.....	272.57	yelsh-grn. need., deliq.....
5	" , hexammine.....	NiBr ₂ ·6NH ₃	320.72	violet powd.....
6	carbide.....	Ni ₃ C.....	188.08	.....
7	carbonate.....	NiCO ₃	118.70	rhomb. lt. grn.....
8	" , basic (zaratite).....	NiCO ₃ ·2Ni(OH) ₂ ·4H ₂ O(?).....	376.18	cub. emerald grn., 1.56-1.61.....
9	" , basic.....	2NiCO ₃ ·3Ni(OH) ₂ ·4H ₂ O.....	587.58	lt. grn. cr. or br. powd.....
10	carbonyl.....	Ni(CO) ₄	170.73	col. volat. inflam. liq. or need.....
11	chlorate.....	Ni(ClO ₃) ₂ ·6H ₂ O.....	333.70	dk. red.....
12	" , hexammine.....	Ni(ClO ₃) ₂ ·6NH ₃	327.80	.....
13	perchlorate.....	Ni(ClO ₄) ₂ ·6H ₂ O.....	365.70	hex. need. grn., 1.55 av.....
14	chloride.....	NiCl ₂	129.60	yel. sc., deliq.....
15	".....	NiCl ₂ ·6H ₂ O.....	237.70	monocl. grn., deliq.....
16	" , hexammine.....	NiCl ₂ ·6NH ₃	231.80	cub. bluish.....
17	cyanide.....	Ni(CN) ₂	110.73	.....
18	cyanide.....	Ni(CN) ₂ ·4H ₂ O.....	182.79	lt. grn. pl. or powd., pois.....
19	dimethylglyoxime deriv., acid.....	Ni(HC ₄ H ₆ N ₂ O ₂) ₂	288.92	scarlet-red cr.....
20	ferrocyanide.....	Ni ₂ Fe(CN) ₆ ·xH ₂ O.....	.....	grn.-wh.....
21	fluoride.....	NiF ₂	96.69	grn. quad.....
22	" , acid.....	NiF ₂ ·5HF·6H ₂ O.....	304.83	trig. blue-grn.....
23	fluosilicate.....	NiSiF ₆ ·6H ₂ O.....	308.85	trig. grn., 1.391, 1.407.....
24	formate.....	Ni(CHO ₂) ₂ ·2H ₂ O.....	184.76	grn. cr.....
25	hydroxide (ous).....	Ni(OH) ₂	92.71	grn. amor. or cr.....
26	".....	4Ni(OH) ₂ ·H ₂ O.....	388.84	lt. grn. amor. or cr.....
27	" (ie).....	Ni(OH) ₃	109.71	blk. amor. powd.....
28	iodide.....	NiI ₂	312.53	blk., deliq.....
29	" , hexammine.....	NiI ₂ ·6NH ₃	414.72	cub. pa. blue.....
30	nitrate.....	Ni(NO ₃) ₂ ·6H ₂ O.....	290.80	monocl. grn., deliq.....
31	" , tetrammine.....	Ni(NO ₃) ₂ ·4NH ₃ ·2H ₂ O.....	286.87	octahedra blue.....
32	" , hexammine.....	Ni(NO ₃) ₂ ·6NH ₃	284.90	oct. or cub. bl.....
33	oleate.....	Ni(C ₁₈ H ₃₃ O ₂) ₂	621.58	green oil.....
34	oxalate.....	NiC ₂ O ₄ ·2H ₂ O.....	182.74	lt.-grn. powd.....
35	oxide, mon- (bunsenite).....	NiO.....	74.69	cub. grn.-blk., 2.18 (red).....
36	" (ous, ic).....	Ni ₃ O ₄	240.07	cub. or amor. gray-blk.....
37	" , sesqui-.....	Ni ₂ O ₃	165.38	gray-blk. powd.....
38	oxyiodide.....	NiI ₂ ·9NiO·15H ₂ O.....	1254.98	rdsh.-brn. powd. (exist. quest.).....
39	orthophosphate.....	Ni ₃ (PO ₄) ₂ ·8H ₂ O.....	510.24	apple grn. pl. or emerald cr. granules.....
40	pyrophosphate.....	Ni ₂ P ₂ O ₇ ·xH ₂ O.....	.....	grn.....
41	(di-) phosphide.....	Ni ₂ P.....	148.40	gray cr.....
42	(tri-) phosphide, di-.....	Ni ₃ P ₂	238.11	dk. grn.-blk.....
43	(penta-) ".....	Ni ₅ P ₂	355.49	need. or tabular cr.....
44	hypophosphite.....	Ni(H ₂ PO ₂) ₂ ·6H ₂ O.....	296.86	grn.....
45	selenide.....	NiSe.....	137.65	cub. wh. or gray.....
46	stearate.....	Ni(C ₁₈ H ₃₅ O ₂) ₂	625.62	green powd.....
47	sulfate.....	NiSO ₄	154.75	cub. yel.....
48	".....	NiSO ₄ ·6H ₂ O.....	262.85	α, tetr. blue; β, monocl. grn., 1.611, 1.487.....
49	" (morenosite).....	NiSO ₄ ·7H ₂ O.....	280.86	rhomb. grn., 1.467, 1.489, 1.492.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	7.39 ¹⁸			d.	d.	s. HNO ₃ , aq. reg.
2	2.575	d.		28		
3	4.64 ²³	d.		112.8 ⁰	155.1 ¹⁰⁰	s. al., eth., NH ₄ OH
4		-3H ₂ O, 200		199 ⁰	315.7 ¹⁰⁰	s. al., eth., NH ₄ OH
5	1.837			v. s.	d.	
6	7.957 ²⁵					
7		d.		0.0093 ²⁵	i.	s. a.
8	2.6					s. h. dil. HCl
9		d.		i.	d.	s. a., NH ₃ salts
10	1.32 ¹⁷	-25	43	.018 ^{9,8}		s. HNO ₃ , aq. reg., al., eth., chl., bz.; i. dil. a., alk.
11	2.07	d. 80		0.9 ²⁷		
12	1.52	180		giv.		
13		149		Ni(NH ₃) ₄		
14	3.55	subl.	973	222.5 ⁰	273.7 ⁴⁵	s. al., acet.; i. chl.
15				64.2 ²⁰	87.6 ¹⁰⁰	s. al., NH ₄ OH; i. NH ₃
16	1.468 ²⁵			254 ²⁰	599 ¹⁰⁰	v. s. al.
17				s.	d.	s. NH ₄ OH; i. al.
18		-4H ₂ O, 200	d.	i.	i.	s. KCN
19		subl. 250		i.	i.	s. KCN, NH ₄ OH, alk.; sl. s. dil. a.
20	1.892 (?)			i.		s. abs. al., a.; i. ac. a., NH ₄ OH
21	4.63			0.02		s. NH ₄ OH, KCN; i. HCl
22	2.132			s.		i. a., al., eth., NH ₃
23	2.134	d.		v. s.		s. dil. a.
24	2.154	d.		s.		
25	4.1			0.0013		s. a., NH ₄ OH
26	4.36	d.		i.	i.	s. a., NH ₄ OH; i. alk.
27		d.		i.	i.	s. a., NH ₄ OH, NH ₄ Cl
28	5.834	subl.		124.2 ⁰	188.2 ¹⁰⁰	s. al.
29	2.101	d.		d.		s. NH ₄ OH
30	2.05	56.7	136.7	238.5 ⁰	∞	s. al., NH ₄ OH
31		d.		v. s.		sl. s. dil. al.
32				4.46		
33		18-20				
34				i.		s. a., NH ₃ salts; v. sl. s. h. oxal. a.
35	7.45	2090	to Ni ₂ O ₃ , 400	i.	i.	s. a., NH ₄ OH
36				i.	i.	s. a.
37	4.83	-O ₂ , 600		i.	i.	s. a., NH ₄ OH, KCN
38		d.		i.		s. HNO ₃ ; i. NH ₄ OH
39		d.		i.	i.	s. a., NH ₄ salts; i. methyl and ethyl acetates
40	anh. 3.93 ²⁵			i.		s. a., NH ₄ OH
41	6.31 ¹⁵	1112		i.		s. HNO ₃ + HF; i. a.
42	5.99			i.	i.	s. HNO ₃ ; i. HCl
43		1185				
44	1.82 ^{19,8}	d. 100		s.		
45	8.46			i.		s. HNO ₃ , aq. reg.; i. HCl
46		100		i.		s. CCl ₄ , pyr. sl. s. acet; i. CH ₃ OH, eth.
47	3.68	-SO ₃ , 840		29.3 ⁰	83.7 ¹⁰⁰	i. al., eth., acet.
48	2.07	tr. 53.3	-6H ₂ O, 280	62.52 ⁰	340.7 ¹⁰⁰	v. s. al., NH ₄ OH; 12.5 meth. al.
49	1.948	-H ₂ O, 31.5; 99	-6H ₂ O, 103	75.6 ^{15,5}	475.8 ¹⁰⁰	s. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Nickel			
1	sulfide, sub-	Ni ₂ S	149.44	yel. cr.
2	" , mono- (millerite)	NiS	90.75	trig. or amor. blk.
3	" (ous, ic) (polydymite)	Ni ₃ S ₄	304.31	cub. gray-blk.
4	sulfite.	NiSO ₃ ·6H ₂ O	246.85	tetrah. grn.
5	Nickel complexes: Diaquotetrammine-nickel (II) nitrate	[Ni(NH ₃) ₄ (H ₂ O) ₂](NO ₃) ₂	286.87	grn. cr.
6	Tetrapyridinenickel (II) fluosilicate	[Ni(C ₅ H ₅ N) ₄]SiF ₆	517.14	rhomb. bl.-grn.
7	Niobium	See <i>Columbium</i>		
8	Nitric acid	HNO ₃	63.02	col. corros. pois. liq., 1.397 ^{16.4}
9	Nitrogen	N ₂	28.02	col. gas; col. liq. or cub. cr. at low temp.
10	chloride, tri-	NCl ₃	120.38	yel. oil or rhomb. cr.
11	fluoride, tri-	NF ₃	71.01	col. gas
12	iodide, tri-	NI ₃	394.77	blk.
13	" " , monoammine	NI ₃ ·NH ₃	411.80	rhomb. dk. red.
14	oxide (ous)	N ₂ O	44.02	col. gas. or liq. or cub. cr., 1.193 ¹⁶ lq.
15	" (ic)	NO	30.01	col. gas; blue liq. and solid, liq. 1.330 ⁻⁹⁰
16	(di-) oxide, tri- (nitrous anhydride)	N ₂ O ₃	76.02	red br. gas; bl. solid or liq.
17	oxide, di- or tetr-	NO ₂ (or N ₂ O ₄)	46.01 (92.02)	col. solid (N ₂ O ₄), yel. liq. or red-br. gas
18	" , pent- (nitric anhydride)	N ₂ O ₅	108.02	hex. (rhomb.) wh.
19	" , tri- or per-	NO ₃	62.01	bluish gas or sld.
20	Nitrosyl bromide	NOBr	109.92	br. gas or dk. br. liq.
21	chloride	NOCl	65.47	yel. gas or yel.-red liq. or cr.
22	fluoride	NOF	49.01	col. gas.
23	Nitrosylsulfuric acid (chamber crystals)	SO ₂ (OH)ONO	127.08	rhomb. col.
24	Nitrosylsulfuric anhydride	(SO ₂ ONO) ₂ O	236.14	tetr.
25	Nitrous acid	HNO ₂	47.02	known only in solution (pa. blue)
26	" " , hypo-	H ₂ N ₂ O ₂	62.03	wh. sld.
27	Nitryl chloride	NO ₂ Cl	81.47	pa. yel. br. gas
28	fluoride	NO ₂ F	65.01	col. gas and solid.
29	Osmium	Os	190.20	hex. gray-bl. met.
30	chloride, di-	OsCl ₂	261.11	dk. br., deliq.
31	" , tri-	OsCl ₃	296.57	cub. br.
32	" " "	OsCl ₃ ·3H ₂ O	350.62	dk. grn. cr.
33	" , tetra-	OsCl ₄	332.03	red br. need.
34	fluoride, tetra-	OsF ₄	266.20	br. powd.
35	" , hexa-	OsF ₆	304.20	grn. cr.
36	" , octa-	OsF ₈	342.20	citron yel. cr.
37	oxide, mon-	OsO	206.20	blk.
38	" , sesqui-	Os ₂ O ₃	428.40	dk. br.
39	" , di-	OsO ₂	222.20	cub. or hex. red-br.
40	" , tetra-	OsO ₄	254.20	(a) monocl. col. (b) yel. mass.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	5.52			i.		s. HNO_3
2	5.3-5.65	797		.00036 ¹⁸	d.	s. HNO_3 , KHS, aq. reg.; sl. s. a.
3	4.7			i.		s. HNO_3
4				i.		s. HCl , H_2SO_4
5				s.		i. al.
6	2.307					
7						
8	1.502	-42	86	∞	∞	d. al. viol.; s. eth.
9	1.2506 ⁹ g/l; lq. 0.808 ^{-196.8} ; s. 1.026 ^{-252.5}	-209.86	-195.8	2.33 ⁰ cm ³	1.42 ⁴⁰ cm ³ ; 1.32 ⁶⁰ cm ³	sl. s. al.
10	1.653	<-40	<71, exp. 95	i.	d.	s. chl., bz., CCl_4 , CS_2 , PCl_3
11	lq. 1.537 ⁻¹²⁹	-216.6	-120	v. sl. s.		
12		exp.	subl. vac.	i.	d.	s. $\text{Na}_2\text{S}_2\text{O}_3$, KCNS
13	3.5	d. >20	exp.	i.	d.	s. HCl , KCN, $\text{Na}_2\text{S}_2\text{O}_3$; i. abs. al.
14	1.977 g/l; lq. 1.226 ⁻⁸⁹	-102.4	-88.49	130.0 ⁰ cm ³ ; 87.4 ¹⁰ cm ³	56.7 ²⁵ cm ³	s. al., eth., H_2SO_4
15	1.3402 g/l; lq. [1.269 ^{-150.2}	-163.6	-151.8	7.34 ⁰ cm ³	2.37 ⁶⁰ cm ³	3.5 cm ³ H_2SO_4 , 26.6 cm ³ al.; s. FeSO_4 , CS_2
16	1.447 ²	-102	3.5 d.	s.	d.	s. alk., a., eth.
17	1.491 ⁰	-9.3	21.3 d.	s. d.		s. alk., CS_2 , chl.
18	1.642 ¹⁸	30	47 d.	s.	d. to HNO_3	s. chl.
19		d. slly. at ord.	temp.			s. eth.
20	>1.0	-55.5	-2	i. d.	d.	s. alk.
21	2.99 g/l; lq. 1.417 ⁻¹²	-64.5	-5.5	d.	d.	s. fuming H_2SO_4
22	2.176 g/l	-134	-56	s. d. to H	$\text{NO}_2 + \text{HF}$	
23		73		d.		s. H_2SO_4
24		217	360	d.		s. H_2SO_4
25						
26		exp.		s.		
27	2.57 g/l; lq. 1.32 ¹⁴	<-31	5	d.		
28	2.90 g/l	-139	-63.5	d.		d. al., eth., chl.
29	22.48	2700	>5300	i.	i.	sl. s. HNO_3 , aq. reg.; i. NH_3
30		d.		i.	sl. d.	s. al., eth., HNO_3 ; sl. s. alk.
31		d. 560-600		v. s.		s. a., alk., al.; sl. s. eth.
32		d.		v. s.		s. al.
33		subl.		sl. s. d.		i. al.
34				d.	d.	
35		>50	205	d.	d.	
36		34.4	47.3	s. d.	s. d.	s. KF aq.
37				i.	i.	i. a.
38		d.		i.	i.	i. a.
39	7.91 ²²	d. 650		i.	i.	i. a.
40	4.906 ²²	(a) 39.5 (b) 41	130	5.07 ⁰	6.23 ²⁵	v. s. CCl_4 ; s. al., eth., NH_4OH , POCl_3

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Osmium			
1	sulfide, di-.....	OsS ₂	254.32	cub. blk.
2	" , tetra-.....	OsS ₄	318.44	br. blk.
3	sulfite.....	OsSO ₃	270.26	bl. blk.
4	Oxygen	O ₂	32.00	col. gas or liq. or hex. cr.
5	Ozone	O ₃	48.00	col. gas or dk. bl. liq.
6	Palladium	Pd	106.70	cub. silv.-wh. met.
7	bromide.....	PdBr ₂	266.53	red-br.
8	chloride.....	PdCl ₂	177.61	cub. need., dk. red, deliq.
9	".....	PdCl ₂ ·2H ₂ O	213.65	br. prisms, deliq.
10	cyanide.....	Pd(CN) ₂	158.74	yelsh.-wh.
11	fluoride, di-.....	PdF ₂	144.70	br.
12	" , tri-.....	PdF ₃	163.70	rhomb. blk.
13	hydride.....	Pd ₂ H (or Pd ₄ H ₂)	428.82	silv. metallic (exist. quest.).....
14	iodide.....	PdI ₂	360.54	blk. powd.
15	nitrate.....	Pd(NO ₃) ₂	230.72	rhomb. br.-yel., deliq.
16	oxide, sub-.....	Pd ₂ O	229.40	blk.
17	" , mon-.....	PdO	122.70	blk.-grn. or amber mass or blk. powd.
18	oxide, mon-.....	PdO·xH ₂ O		ycl. to br.
19	" , di-.....	PdO ₂	138.70	blk.
20	" , ".....	PdO ₂ ·xH ₂ O		dull red.
21	sulfate.....	PdSO ₄ ·2H ₂ O	238.79	red-br. cr., deliq.
22	sulfide, sub-.....	Pd ₂ S	245.43	grn.-gray
23	" , mono-.....	PdS	138.76	br.-blk.
24	" , di-.....	PdS ₂	170.82	dk.-br.
25	Palladium com- plexes: Diamminepal- ladium (II) hydroxide	[Pd(NH ₃) ₂ (OH) ₂]	174.78	micr.-cr. yel.
26	Dichlorodiamminepal- ladium (II), <i>trans</i> - (or α-)	[Pd(NH ₃) ₂ Cl ₂]	211.68	tetr. yel.
27	Tetramminepalladium (II) chloride	[Pd(NH ₃) ₄]Cl ₂ ·H ₂ O	263.76	tetrag. col.
28	Phospham	PN ₂ H	60.04	wh. amor.
29	Phosphomolybdic acid	H ₃ PMO ₁₂ O ₄₀ ·xH ₂ O		yelsh. cr.
30	" ".....	H ₃ PMO ₁₂ O ₄₀ ·29H ₂ O	2347.91	oct. yel.
31	Phosphonium bro- mide	PH ₃ Br	114.97	cub. col.
32	chloride.....	PH ₃ Cl	70.51	cub. col.
33	iodide.....	PH ₃ I	161.97	tetr. col. deliq.
34	sulfate.....	(PH ₃) ₂ SO ₄	166.16	cr. col. deliq.
35	Phosphoric acid, ortho-.....	H ₃ PO ₄	98.04	col. liq. or rhomb. cr., deliq.
36	" " ".....	2H ₃ PO ₄ ·H ₂ O	214.10	hex. pointed pr. col., deliq.
37	" " , pyro-.....	H ₄ P ₂ O ₇	178.07	col. need. or liq. hyg.
38	" " , meta-.....	HPO ₃	89.03	vitreous col., deliq.
39	" " , hypo-.....	H ₄ P ₂ O ₆	162.07	cryst.
40	Phosphorous acid, ortho-.....	H ₂ (HPO ₃)	82.04	col.-yel., deliq. cr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d.		i.	i.	i. alk.
2		d.		i.		s. dil. HNO_3 ; i. $(\text{NH}_4)_2\text{S}$
3		d.		i.		s. dil. HCl , alk.
4	1.429 ⁰ g/l; lq. 1.14 ⁻¹⁸³ ; s. 1.426 ^{-252.5}	-218.4	-183.0	4.89 ⁰ cm ³ ; 3.16 ²⁵ cm ³	2.46 ⁵⁰ cm ³ ; 2.30 ¹⁰⁰ cm ³	2.78 ²⁵ cm ³ al.; s. fus. Ag.
5	2.144 g/l; lq. 1.71 ⁻¹⁸³	-251	-112	49 ⁰ cm ³		s. alk. solns., oils
6	11.97 ⁰ ; 11.40 ^{22.5}	1549.4	ca. 2540	i.	i.	s. aq. reg., h. HNO_3 , H_2SO_4 ; sl. s. HCl
7		d.		i.	i.	s. HBr
8		500 d.		s.	s.	s. HCl , acet.
9		d.		v. s.	v. s.	s. HCl , acet.
10		d.		i.	i.	s. KCN , NH_4OH ; i. dil. a.
11		volat.	d. red heat	sl. s.		s. HF
12	5.06	d.	d.	d.	d.	s. HF
13	10.76	d.				
14		d. 350		i.	i.	s. KI ; i. al., eth., dil. HCl
15		d.		s. d.		s. HNO_3
16		d.		i.		i. a.
17	8.31	d. 750		i.	i.	sl. s. h. a.
18		d.		i.	i.	s. a., NH_3 , NH_4Cl
19		-O, 200		v. sl. s.		sl. s. a.
20		d. - H_2O , -O		i.	i.	s. a., alk.
21		d.		v. s.	d.	
22	7.303 ¹⁵	d. 800		i.	i.	sl. s. a., aq. reg.
23		950 d.		i.	i.	s. HNO_3 , aq. reg.; i. HCl , $(\text{NH}_4)_2\text{S}$
24		d.		i.	i.	s. aq. reg., $(\text{NH}_4)_2\text{S}$
25		> 105		v. s.	d.	
26	2.5	d.		0.304 ¹⁶	s. d.	s. a. (dec.), NH_4OH
27	1.91 ¹⁸	d. 120		v. s.		
28		infus.		i.	d.	s. conc. H_2SO_4 ; i. a., alk.
29				s.		s. al., eth.
30		- H_2O , 104; 78				
31	g. 2.464 g/l		38.87 ⁹⁴ ; subl. ca. 30	d.	d.	
32		28 ⁴⁶ atm.	subl.	d.		
33	2.86	subl. 61.8	80	d.		s. d. a., alk.
34				d.		
35	1.834 ¹⁸	42.35	- $\frac{1}{2}\text{H}_2\text{O}$, 213	548	v. s.	s. al.
36		29.32	d.	v. s.		
37		61		709 ²³	d. to H_3PO_4	v. s. al., eth.
38	2.2-5	subl.		d. to H_3PO_4	d.	s. al.; i. liq. CO_2
39		55	d. 100	s.; d. sly. to H_3PO_3 + HPO_3	d. > 30	
40	1.651 ^{21.2}	73.6	d. 200	309 ⁰	694 ⁴⁰	s. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Phosphorous acid,			
1	pyro...	$H_4P_2O_5$	146.07	need.....
2	" " meta-	HPO_2	64.03	feather like cr.....
3	" " hypo-	$H(H_2PO_2)$	66.04	col. oily liq. or deliq. cr.....
4	Phosphorus, yellow...	P_4	124.08	cub. col.-yelsh. wax-like solid, 2.144.
5	" , red.....	P_4	124.08	cub. redsh.-br. or amor. red br. powd. (mixt. of col. and violet?)
6	" , violet....	P_4	124.08	monocl. vlt.....
7	" , black....	P_4	124.08	blk. incombust.....
8	bromide, tri-	PBr_3	270.77	col. fum. liq., 1.697 ^{26.6} .
9	" , penta-	PBr_5	430.60	rhomb. yel.....
10	bromide (mono-) chlo-	$PBrCl_4$	252.76	yel. cr.....
11	ride, tetra-			
12	bromide (di-) chloride, tri-	PBr_2Cl_3	297.22	or. cr.....
13	bromide (hepta-) chlo-	PBr_7Cl_2	661.35	pr.....
14	ride, di-			
15	bromide (octa-) chlo-	PBr_8Cl_3	776.72	br. need.....
16	ride, tri-			
17	bromide (di-) fluoride,	PBr_2F_3	247.85	pa. yel.....
18	tri-			
19	" " nitride....	$(PNBr_2)_3$	614.58	rhomb. col.....
20	" sulfide.....	$P_2S_3Br_4$	477.88	yel. oil.....
21	chloride, di-	PCl_2 (or P_2Cl_4).....	101.93	col.....
22	" , tri-	PCl_3	137.39	col. fum. liq., 1.516 ¹⁴ .
23	" , penta-	PCl_5	208.31	tetr. yelsh.-wh., fum.....
24	chloride (di-) fluoride, tri-	PCl_2F_3	158.93	.....
25	chloride (tri-) iodide, di-	PCl_3I_2	391.23	hex. red.....
26	" (di-) nitride....	$(PNCl_2)_3$	347.83	rhomb.....
27	" " ".....	$(PNCl_2)_4$	463.77	.....
28	" " ".....	$(PNCl_2)_5$	579.71	.....
29	" " ".....	$(PNCl_2)_6$	695.65	.....
30	chloride nitride....	$P_6N_7Cl_9$	603.29	tr. rhomb. pr.....
31	cyanide.....	$P(CN)_3$	109.07	wh. need.....
32	fluoride, tri-	PF_3	88.02	col. gas.....
33	" , penta-	PF_5	126.02	col. gas.....
34	iodide, di-	P_2I_4	569.72	triol. orange.....
35	iodide, tri-	PI_3	411.78	hex. red., deliq.....
36	" sulfide.....	P_2I_2S	347.94	or. sld.....
37	nitride.....	P_2N_5	163.10	amor. wh.....
38	oxide, tri-	P_2O_3 (or P_4O_6).....	110.04	monocl. col. or wh. powd., deliq.....
39	" , tetra-	P_2O_4	126.04	rhomb. col., deliq.....
40	" , pent- (phosphoric anhydride)	P_2O_5 (or P_4O_{10}).....	142.04	monocl. or wh. powd., v. deliq.....
41	oxybromide.....	$POBr_3$	286.77	col. pl.....
42	" chloride, di-	$POBrCl_2$	197.85	tabl. or liq.....
43	oxychloride.....	$POCl_3$	153.39	col. fum. liq., 1.460 ^{25.1} .
44	" ".....	$P_2O_3Cl_4$	251.87	col. fuming liq.....
45	oxydibromide chloride..	$POBr_2Cl$	242.31	.....
46	oxyfluoride.....	POF_3	104.02	col. gas.....
47	oxyiodide.....	P_3OI_6	982.58	red cr.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		38	d. 130	d.	.....	.....
2				d.	.....	.....
3	1.493 ¹⁹	26.5	d.	s.	v. s.	v. s. al., eth.
4	1.82	44.1; ign. 34	280	.0003 ¹⁵	sl. s.	0.3 al., 880 ¹⁰ CS ₂ , s. bz., NH ₃ , alk., eth., chl.
5	2.20	590 ⁴³ atm.	ign. > 200; 280	i. (v. sl. s.)	i.	s. abs. al.; i. CS ₂ , eth., NH ₃
6	2.36	593	.....	i.	.....	i. a., org. solv.
7	2.70		.....	.....	.....	i. CS ₂ , c. H ₂ SO ₄
8	2.852 ¹⁵	-40	172.9	d.	.....	d. al.; s. eth., chl., CS ₂ , CCl ₄
9		< 100 d.	106 d.	d.	.....	s. CS ₂ , CCl ₄ , bz.
10				d.	.....	.....
11		35 d.		d.	.....	.....
12				d.	.....	s. PCl ₃ , PCl ₅
13		25		d.	.....	.....
14		-20	d. 15	d.	.....	d. glass
15		190	subl. 150 vac.	i.	.....	s. eth.; sl. s. CS ₂ , chl.
16	lq. 2.262 ¹⁷		d.	d.	.....	s. CS ₂ , eth.
17		-28	180	hydr.	.....	.....
18	1.574 ²¹	-91, (-111.8)	75.5 ⁷⁴⁹	d.	d.	s. eth., bz., chl., CS ₂ , CCl ₄
19	g. 4.65 ²⁹⁶ g/l	166.8 (press) sl. d.	subl. 162	d.	.....	d. a.; s. CCl ₄ , CS ₂
20			-8; d. 200	.....	.....	.....
21				d.	.....	s. CS ₂
22	1.98	114	256.5	i.	d.	s. al., eth., chl., CS ₂ , bz., ac. a.
23	2.18 ²⁴ / ₂₄	123.5	328.5	.....	.....	.....
24		41	224 ¹³ ; polymer. > 250	.....	.....	.....
25		90	262 ¹³ ; polymer. > 250	.....	.....	.....
26		237.5	251-261 ¹³	.....	.....	.....
27		subl. 130	.....	d.	.....	v. s. eth.; sl. s. h. bz.
28	3.907 g/l	-160	-95	d.	.....	d. alk.; s. al.
29	5.805 g/l	-93.7	-84.5	d.	.....	.....
30		124.5	d.	d.	.....	s. CS ₂
31		61	d.	d.	d.	v. s. CS ₂
32		75	d.	.....	.....	s. CS ₂
33	2.51 ¹⁸		d. 800	i.	v. sl. s. d.	i. any solv.
34	2.135 ²¹	23.8	173	d. to H ₃ PO ₃	d.	s. CS ₂ , eth., chl., bz.
35	2.54 ²³	> 100	subl. 180	v. s. to H ₃ PO ₃	d.	.....
36	2.39	563	subl. 347	d. to H ₃ PO ₄	d.	s. H ₂ SO ₄ ; i. acet., NH ₃
37	2.822	56	193	d.	.....	s. H ₂ SO ₄ , CS ₂ , eth., bz., chl.
38	lq. 2104 ¹⁴	13	137.6	d.	.....	.....
39	1.675	2	105.3	d.	d.	d. al., a.
40	lq. 1.58 ⁷	< -50	212	d.	.....	.....
41	lq. 2.45 ⁵⁰	30	165	d.	.....	d. al.
42	4.69 g/l	-68	-39.8	d.	.....	.....
43		140	d.	s.	.....	s. al., eth.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Phosphorus				
1	oxynitride.....	PON.....	61.03	amor. wh.....
2	oxysulfide.....	P ₄ O ₆ S ₄	348.32	tetr., deliq.....
3	selenide, sub.....	P ₄ Se.....	203.04	dk. yel. liq. (exist. quest.).....
4	" , mono.....	P ₂ Se.....	141.00	red.....
5	" , tri.....	P ₄ Se ₃	360.96	or-red cr.....
6	" , penta.....	P ₂ Se ₃	298.92	dk. red.....
7	sulfide, tri.....	P ₂ Se ₅	456.84	dk. red-blk. need.....
8	" , tri.....	P ₄ S ₃	220.26	rhomb. yel.....
9	" , hepta.....	P ₄ S ₆ (or P ₂ S ₃).....	316.44	gray-yel. cr.....
10	" , di.....	P ₄ S ₇	348.50	lt. yel. cr.....
11	" , penta.....	P ₂ S ₅ (or PS ₂).....	285.42	yel. need.....
12	thiocyanate.....	P ₂ S ₅ (or P ₄ S ₁₀).....	222.34	gray-yel. cr. deliq.....
13	amide (triamidophosphoric acid)	P(SCN) ₃	205.25	liq.....
14	Phosphoryl amide (triamidophosphoric acid)	PO(NH ₂) ₃	95.09	amor., wh.....
15	Phosphotungstic acid	H ₃ PW ₁₂ O ₄₀ ·14H ₂ O.....	3133.31	tri-cr. yel.-grn. cr.....
16	" " "	H ₃ PW ₁₂ O ₄₀ ·24H ₂ O.....	3313.47	trig.....
17	Platinum	Pt.....	195.23	cub. silv. metal.....
18	arsenide (sperrylite).....	PtAs ₂	345.05	cub. tin wh.....
19	bromide, di- (ous).....	PtBr ₂	355.06	br.....
20	" , tetra- (ic).....	PtBr ₄	514.89	dk. br.....
21	chloride, di- (ous).....	PtCl ₂	266.14	olive-grn.....
22	" , tri.....	PtCl ₃	301.60	grnsh.-blk.....
23	" , tetra- (ic).....	PtCl ₄	337.06	br.-red cr.....
24	" " ".....	PtCl ₄ ·5H ₂ O.....	427.14	monocr. red.....
25	cyanide (ous).....	Pt(CN) ₂	247.27	yel. br. cr.....
26	fluoride, di- (ous).....	PtF ₂	233.23	yelsh.-grn.....
27	" , tetra- (ic).....	PtF ₄	271.23	deep red, fused mass or yel.-lt. br cr., deliq.....
28	hydroxide (ous).....	Pt(OH) ₂	229.25	blk.....
29	" " ".....	Pt(OH) ₂ ·2H ₂ O.....	265.28	blk.....
30	iodide, di- (ous).....	PtI ₂	449.07	blk.....
31	" , tetra- (ic).....	PtI ₄	702.91	amor. br. or blk. cr.....
32	oxide, mon- (ous).....	PtO.....	211.23	vlt. blk.....
33	" " ".....	PtO·2H ₂ O.....	247.26	blk.....
34	" (ous, ic).....	Pt ₃ O ₄	649.69	blk.....
35	" , sesqui.....	Pt ₂ O ₃ ·xH ₂ O.....	227.23	br.....
36	" , di- (ic).....	PtO ₂	227.23	blk.....
37	" " ".....	PtO ₂ ·H ₂ O.....	245.25	blk.....
38	" " " (platinitic hydroxide).....	PtO ₂ ·2H ₂ O (or Pt(OH) ₄).....	263.26	yel.-br.-rose.....
39	oxide, di- (ic).....	PtO ₂ ·3H ₂ O.....	281.28	ochre.....
40	" " " (hydroxyplatinitic acid).....	PtO ₂ ·4H ₂ O (or H ₂ Pt(OH) ₆).....	299.29	yel. need.....
41	oxide, tri.....	PtO ₃	243.23	rdsh.-brn. powd.....
42	pyrophosphate.....	PtP ₂ O ₇	369.27	grn.-yel.....
43	sulfate.....	Pt(SO ₄) ₂ ·4H ₂ O.....	459.41	yel. pl.....
44	sulfide, mono- (ous).....	PtS.....	227.29	blk.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		red heat		i.	i.	i. a., alk.
2		102	295	d.		50 CS ₂
3		-12	ign.	d.		s. CS ₂ ; i. al., eth.
4				d.		v. s. CS ₂ ; sl. s. eth.; i. al.
5	1.31	242	360-400			
6					d.	s. KOH; i. CS ₂
7		d.		d.		s. CCl ₄ ; i. CS ₂
8	2.03	172.5	407.5	i.	d.	60 CS ₂ ; s. bz., PCl ₃ , HNO ₃ ; i. HCl, H ₂ SO ₄
9		290	490	d.		s. al., eth.; alk.; v. sl. s. CS ₂
10	2.19 ¹⁷	310	523			sl. s. CS ₂ ; i. most solv.
11		298	337 ^{10.5}			v. sl. s. CS ₂
12	2.03	276	514	d.		0.22 CS ₂ ; s. alk.
13	1.625 ¹⁸	ca. -4	265	d.		s. al., eth., CS ₂ , bz.
14		d.		i.	i.	s. al.; i. a.
15				s.		s. al., eth.
16		89		s.		
17	21.45	1773.5	4300	i.	i.	s. aq. reg., fus. alk.
18	10.602	>800 d.		i.		i.
19	6.65	d. 250		i. (v. sl. s.)	i.	s. HBr, KBr, Br aq.
20	5.69	d. 180		0.41 ²⁰	sl. s.	v. s. al., eth., HBr
21	5.87 ¹¹ (6.05)	d. 581		i. (v. sl. s.)	i.	s. HCl, NH ₄ OH; sl. s. NH ₃ ; i. al., eth.
22	5.256 ²⁵	435		sl. s.	s.	v. sl. s. conc. HCl; s. h. HCl
23		d. 370		v. s.	v. s.	s. acet.; sl. s. al., NH ₃ ; i. eth.
24	2.43 (8H ₂ O)	-H ₂ O, 100		v. s.	v. s.	s. al., eth.
25				i.	i.	s. KCN; i. a., alk., al.
26				i.	i.	
27		d.		s. d.	v. s.	s. a., alk.
28		d.		i.	i.	s. HCl, HBr, alk.; i. H ₂ SO ₄ , dil. HNO ₃
29		-2H ₂ O, 100		i.	i.	s. conc. a.
30	6.4	d. 300-350		i.	i.	s. HI; sl. s. Na ₂ SO ₃ ; i. a.
31	6.064 ²⁵	d. 370		s. d.		s. al., alk., acet., HI, KI, NH ₃
32	14.9 ¹⁵	d. 550		i.	i.	s. HCl, H ₂ SO ₃ ; i. a., aq. reg.
33						s. conc. HCl, H ₂ SO ₄ , HNO ₃
34		d.		i.		i. a., aq. reg.
35				i.	i.	s. conc. H ₂ SO ₄ , caust. alk.
36		450		i.	i.	i. a., aq. reg.
37				i.	i.	sl. s. NaOH; i. ac. a., aq. reg., HCl
38		-2H ₂ O, 100		i.	i.	s. HCl, aq. reg., KOH
39		d.		i.	i.	i. HCl, aq. reg.
40		-2H ₂ O, 100; -3H ₂ O, 120		i.	i.	s. a., dil. caust. alk.
41						s. HCl, H ₂ SO ₃ ; sl. s. HNO ₃ , H ₂ SO ₄
42	4.85	d. 600		v. sl. s.		
43				s.	d.	s. a., al., eth.
44	8.847	d.		i.	i.	s. (NH ₄) ₂ S; i. a., alk.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Platinum			
1	sulfide, sesqui-	Pt_2S_3	486.64	gray.....
2	" , di- (ic).....	PtS_2	259.35	blk.-br. powd.....
	Platinum com- plexes:			
3	Tetrammineplatinum (II) chloride	$[\text{Pt}(\text{NH}_3)_4]\text{Cl}_2 \cdot \text{H}_2\text{O}$	352.29	tetrag. col., 1.672, 1.667.....
4	Tetrammineplatinum (II) chloroplatinite (Magnus' salt)	$[\text{Pt}(\text{NH}_3)_4]\text{PtCl}_4 \dots$	600.42	tetrag. grn. or red.....
5	Tetrachlorodiammine- platinum (IV), <i>cis</i> -	$[\text{Pt}(\text{NH}_3)_2\text{Cl}_4] \dots$	371.12	rhomb. or hex. pl. or need. or-yel...
6	Tetrachlorodiammine- platinum (IV), <i>trans</i> -	$[\text{Pt}(\text{NH}_3)_2\text{Cl}_4] \dots$	371.12	oct. or quad. yel. pl.....
7	Plumbous, Plumbic	See <i>Lead</i>		
8	Potassium	K	39.10	cub. silv. metal.....
9	acetate.....	$\text{KC}_2\text{H}_3\text{O}_2$	98.14	lust. wh. powd., deliq.....
10	" , acid.....	$\text{KC}_2\text{H}_3\text{O}_2 \cdot \text{HC}_2\text{H}_3\text{O}_2$	158.19	need. or pl.....
11	acetylsalicylate.....	$\text{KC}_9\text{H}_7\text{O}_4 \cdot 2\text{H}_2\text{O}$	254.28	
12	aluminate.....	$\text{KAlO}_2 \cdot 1\frac{1}{2}\text{H}_2\text{O}$	125.09	col. cr.....
13	aluminum borate, basic	$\text{K}(\text{AlO})_2(\text{BO}_2)_3 \dots$	253.50	cub. wh., 1.6935.....
14	" sulfate (kali- nite)	$\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	474.38	cub. or monoc. col., 1.4562; 1.430, 1.452, 1.458
15	amide (potassamide)	KNH_2	55.12	col.-wh. or yel.-grn.....
16	ammonium tartrate	$\text{KNH}_4\text{C}_4\text{H}_4\text{O}_6$	205.21	wh. cr. powd.....
17	pyroantimonate, di-H.	$\text{K}_2\text{H}_2\text{Sb}_2\text{O}_7 \cdot 4\text{H}_2\text{O}$	507.79	gran., wh. cr. powd.....
18	metaantimonate	$\text{KSbO}_3 \cdot x\text{H}_2\text{O}$		wh. powd.....
19	antimony tartrate (tar- tar emetic)	$\text{KSbC}_4\text{H}_4\text{O}_7 \cdot \frac{1}{2}\text{H}_2\text{O}$	333.94	rhomb. col., 1.620, 1.636, 1.638.....
20	argentocyanide.....	$\text{KAg}(\text{CN})_2$	199.01	cub. col.....
21	orthoarsenate.....	K_3AsO_4	256.20	col. deliq. need.....
22	" , mono-H.	K_2HAsO_4	218.11	col. cr.....
23	" , di-H	KH_2AsO_4	180.02	tetr. col., 1.567, 1.518.....
24	orthoarsenite.....	K_3AsO_3	240.20	col. need.....
25	metaarsenite.....	KAsO_2	146.01	wh. powd., hyg.....
26	" , acid	$\text{KH}(\text{AsO}_2)_2 \cdot \text{H}_2\text{O}$	271.94	
27	aurate.....	$\text{KAuO}_2 \cdot 3\text{H}_2\text{O}$ (or $2\text{H}_2\text{O}$)	322.34	lt. yel. need.....
28	azide.....	KN_3	81.12	col.....
29	benzoate.....	$\text{KC}_7\text{H}_5\text{O}_2 \cdot 3\text{H}_2\text{O}$	214.26	wh. cr. powd.....
30	diborane (diboramide)	$\text{K}_2\text{B}_2\text{H}_6$	105.88	wh. cubical cr., 1.493.....
31	" dihydroxy-	$\text{K}_2\text{B}_2\text{H}_6\text{O}_2$	137.88	col. cubical cr.....
32	pentaborane (penta- boramide)	$\text{K}_2\text{B}_5\text{H}_9$	141.36	wh. powd.....
33	metaborate.....	KBO_2 (or $\text{K}_2\text{B}_2\text{O}_4$)	81.92	monocl. col.....
34	tetraborate.....	$\text{K}_2\text{B}_4\text{O}_7 \cdot 5\text{H}_2\text{O}$	323.55	monocl. or hex. pr.....
35	pentaborate.....	KB_5O_8	221.20	col.....
36	perborate.....	$\text{KBO}_3 \cdot \frac{1}{2}\text{H}_2\text{O}$	106.92	wh.....
37	borotartrate (sol. cream of tartar)	$\text{KC}_4\text{H}_4\text{BO}_7(?)$	213.99	wh. cr. powd.....
38	bromate.....	KBrO_3	167.01	trig. col.....
39	bromide.....	KBr	119.01	cub. col. sl. hyg., 1.559.....
40	bromoaurate.....	KAuBr_4	555.96	rhomb. red-br.
41	"	$\text{KAuBr}_4 \cdot 2\text{H}_2\text{O}$	591.99	vlt. cr. monocl.....
42	bromiodide, di-	KIBr_2	325.85	rhomb.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	5.52	d.	.....	i.	i.	slowly s. aq. reg.; i. a.
2	7.22	d. 225-250	.....	i.	i.	s. HCl, HNO ₃ ; i. (NH ₄) ₂ S
3	2.737	250; -H ₂ O, 100	.....	.....	.....	.....
4	<4.1	d.	.....	sl. s.	sl. s.	.....
5	.....	240	.....	.....	.....	.....
6	3.3	200-216	.....	.....	.....	.....
7	.....	.....	.....	.....	.....	.....
8	0.86 ²⁰ ; 0.83 ⁶²	62.3	760	d. to KOH+ H ₂	d.	d. al.; s. a., Hg, NH ₃
9	1.8	292 ¹	.....	253 ²⁰ ; 286.3 ³¹	492 ⁶²	33 al.; i. eth.
10	.....	148	d. 200	d.	d.	s. al., acet.
11	.....	65	.....	.....	.....	.....
12	.....	.....	.....	v. s., d.	v. s., d.	s. alk.; i. al.
13	3.415	<1800	.....	i.	i.	sl. s. HCl
14	1.75	92 (84.5)	-9H ₂ O, 64.5	11.4 ²⁰	∞	s. dil. a.; i. al.
15	.....	335	subl. 400	d.	d.	d. al.
16	.....	.....	.....	v. s.	.....	.....
17	.....	.....	.....	2.82 ²⁰	s.	.....
18	.....	.....	.....	i.	sl. s.	s. h. KOH; i. al., CS ₂
19	2.607	-½H ₂ O, 100	.....	5.26 ^{5,7}	35.7 ¹⁰⁰	i. al.; 6.67 ²⁵ glyc.
20	2.36	.....	.....	25 ²⁰	100	4, 85% al.; i. a.
21	.....	.....	.....	18.87	v. s.	4 al.
22	.....	.....	.....	18.86 ⁶	s.	i. al.
23	2.867	288	.....	19 ⁶	v. s.	i. al.
24	.....	.....	.....	v. s.	.....	s. al.
25	.....	.....	.....	s.	s.	sl. s. al.
26	.....	.....	.....	s.	.....	sl. s. al.
27	.....	d.	.....	s.	d.	s. al.
28	2.04	350	.....	s.	s.	s. al.; i. eth.
29	.....	-3H ₂ O, 110	d.	52 ²⁵	112 ¹⁰⁰	s. al.
30	1.18	.....	300 ¹ d.	d.	.....	.....
31	1.39	d.→K	.....	s.	.....	s. al.
32	.....	d.<180	.....	d.	d.	.....
33	.....	947-50	.....	71 ³⁰	v. s.	.....
34	(anh.) 1.74	d.	.....	26.7 ³⁰	v. s.	.....
35	.....	780	.....	.007 ⁰	v. s.	.....
36	.....	.....	.....	1.22 ⁰ ; 2.15 ¹⁵	.....	i. al., eth.
37	1.832	.....	.....	v. s.	.....	i. al., eth., chl.
38	3.27 ^{17,5}	434; d. 370	.....	3.1 ⁰ ; 13.3 ⁴⁰	49.75 ¹⁰⁰	sl. s. al.; i. acet.
39	2.75 ²⁵	730	1380 (1435)	53.49 ⁰	102 ¹⁰⁰	0.5 al.; s. glyc.; sl. s. eth.
40	.....	d.	.....	sl. s.	.....	s. al.
41	.....	.....	.....	19.5 ¹³	204 ⁶⁷	d. eth.; sl. al., KBr
42	.....	60	d. 180	d.	.....	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Potassium				
1	bromoplatinate.....	K_2PtBr_6	752.92	cub. dk. red-br.
2	bromoplatinite.....	K_2PtBr_4	593.09	rhomb. br.
3	.....	$K_2PtBr_4 \cdot 2H_2O$	629.12	rhomb. blk.
4	cacodylate.....	$KAsC_2H_5O_2 \cdot H_2O$	194.09	wh. cr.
5	cadmicyanide.....	$K_2Cd(CN)_4$	294.67	cub. col.
6	cadmium iodide.....	$2KI \cdot CdI_2 \cdot 2H_2O$	734.31	wh.-yelsh. cr. powd., deliq.
7	calcium chloride (chloro-calcite)	$KCl \cdot CaCl_2$	185.55	cub. β 1.52
8	“ magnesium sulfate (krugite)	$K_2CaMg(SO_4)_6 \cdot 2H_2O$	875.22	gray
9	“ magnesium sulfate (polyhalite)	$K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$	602.94	tri., wh., 1.548, 1.562, 1.567
10	“ sulfate (kalus-zite, syngenite)	$K_2Ca(SO_4)_2 \cdot H_2O$	328.41	monocl., 1.500, 1.517, 1.518
11	d-camphorate.....	$K_2C_{10}H_{14}O_4 \cdot 5H_2O$	366.49	need. clusters, hydr.
12	carbonate.....	K_2CO_3	138.20	monocl. col., hyg.
13	“.....	$K_2CO_3 \cdot 2H_2O$	174.23	rhomb.
14	carbonate.....	$2K_2CO_3 \cdot 3H_2O$	330.45	monocl. col.
15	carbonate, acid.....	$KHCO_3$	100.11	monocl. col.
16	peroxycarbonate.....	$K_2C_2O_6$	198.21	bl.
17	carbonyl.....	$(KCO)_6$	402.64	gray-red
18	chlorate.....	$KClO_3$	122.55	monocl. col., 1.409, 1.517, 1.524
19	perchlorate.....	$KClO_4$	138.55	rhomb. col.
20	chloride (sylvite).....	KCl	74.55	cub. col., 1.490
21	hypochlorite.....	$KClO$	90.55	in soln. only
22	chloroauroruthenite, penta-	$K_2Ru(H_2O)Cl_5$	375.19	rose prisms
23	chloroaurate.....	$KAuCl_4$	378.12	monocl. yel.
24	“.....	$KAuCl_4 \cdot 2H_2O$	414.16	rhomb. pl., yel.
25	chlorochromate (Peligot's salt)	$KClCrO_3$	174.56	monocl. red.
26	chlorohydroxyruthenate, penta-	$K_2Ru(OH)Cl_5$	374.19	brn.-red cr.
27	chloroiodite.....	$KICl_4$	307.84	rhomb. yel.
28	chloroiridate.....	K_2IrCl_6	484.03	cubic, blk.
29	chloronitrosoruthenate, penta-	$K_2Ru(NO)Cl_5$	387.19	rhomb. dk. red
30	chloroosmate.....	K_2OsCl_6	481.13	cub. red
31	chloroosmite.....	$K_3OsCl_6 \cdot 3H_2O$	574.28	cr. dk. red
32	chloropalladate.....	K_2PdCl_6	397.63	cub. red.
33	chloropalladite.....	K_2PdCl_4	326.72	tetr. red-br. (cub. yel.)
34	chloroplatinate.....	K_2PtCl_6	486.16	cub. yel.
35	chloroplatinite.....	K_2PtCl_4	415.25	tetr. red-br.
36	chlororhodite, penta-	K_2RhCl_5	358.39	rhomb. red
37	“ , hexa-	$K_3RhCl_6 \cdot 3H_2O$	486.99	tricl. red
38	chlororuthenate.....	K_2RuCl_6	392.63	cub. blk.
39	chlorostannate.....	K_2SnCl_6	409.63	cub. col., 1.657
40	chlorotellurate.....	K_2TeCl_6	418.64	pale yel. octahedral
41	chromate (tarapacaita)	K_2CrO_4	194.20	rhomb. yel., β 1.74
42	dichromate.....	$K_2Cr_2O_7$	294.21	monocl. or tricl. red
43	peroxychromate.....	K_3CrO_8	297.30	cub. br.-red
44	chromicyanide.....	$K_3Cr(CN)_6$	325.41	rhomb. yel.
45	chromium chromate, basic	$K_2CrO_4 \cdot 2Cr(OH) \cdot CrO_4$	564.26	vlt.-br. amor. powd.
46	chromium sulfate (ic)	$KCr(SO_4)_2 \cdot 12H_2O$	499.42	cub. oct., red or grn., 1.4814
47	citrate.....	$K_3C_6H_5O_7 \cdot H_2O$	324.40	col.
48	“ , monobasic.....	$KH_2C_6H_5O_7$	230.21	wh. cr. powd.
49	cobalt carbonate, acid (ous)	$KHCO_3 \cdot CoCO_3 \cdot 4H_2O$	291.13	rose need.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	4.66 ²⁴	d. >400	.....	2.02 ²⁰	10 ¹⁰⁰	i. al.
2	.....	.....	.....	v. s.	v. s.	.....
3	.....	-H ₂ O vac.	.....	v. s.	v. s.	.....
4	.....	.....	.....	s.	.....	sl. s. al.; i. eth.
5	1.85	.....	.....	33	100 ¹⁰⁰	sl. s. al.
6	3.359	.....	.....	137 ¹⁵	.....	s. a., al., eth.
7	.....	754	.....	s.	.....	.....
8	2.801	.....	.....	.....	.....	.....
9	2.775	.....	.....	.....	.....	.....
10	2.60	1004	.....	0.25	d.	s. a.; i. al.
11	.....	-5H ₂ O, 110	.....	260 ¹⁴	.....	s. al.
12	2.428 ¹⁹	891	d.	112 ²⁰	156 ¹⁰⁰	i. al., acet.
13	.....	.....	.....	146.9	331 ¹⁰⁰	.....
14	2.043	.....	.....	129.4	268.3 ¹⁰⁰	i. conc. NH ₄ OH, al.
15	2.17	d. 100-200	.....	22.4	60 ⁶⁰	i. al.
16	.....	200-300	.....	s.	.....	.....
17	.....	exp.	.....	exp.	.....	d. al.
18	2.32	368.4	d. 400	7.1 ²⁰	57 ¹⁰⁰	0.83 al.; s. alk.
19	2.52 ¹⁰	610 ± 10; (525-30)	.....	0.75 ⁰	21.8 ¹⁰⁰	i. al., eth.
20	1.984	776	subl. 1500	34.7 ²⁰	56.7 ¹⁰⁰	sl. s. al.; s. alk., eth., glyc.
21	.....	d.	.....	v. s.	v. s.	.....
22	.....	-H ₂ O, 200	.....	s.	s.	sl. s. al.
23	.....	d. 357	.....	61.8 ²⁰	80.2 ⁶⁰	s. a.; 25 al.
24	.....	.....	.....	s.	s.	s. al., eth.
25	2.497	d.	.....	s. d.	.....	s. a.
26	.....	d.	.....	s. d.	d.	i. al.
27	1.76 ⁴⁵	d.	.....	d.	.....	d. eth.
28	3.546	d.	.....	1.25 ¹⁹	6.67	i. al., KCl, NH ₄ OH
29	.....	d.	.....	12 ²⁵	80 ⁶⁰	i. al.
30	.....	d.	.....	sl. s.	s.	s. dil. HCl; i. al.
31	.....	-3H ₂ O, 150	.....	v. s.	.....	s. al.; i. eth.
32	2.738	d.	.....	sl. s. d.	d.	sl. s. HCl; i. al.
33	2.67	d. 105	.....	s.	v. s.	s. KCl, NH ₄ OH; i. al.
34	3.499 ²⁴	d. 250	.....	0.481 ²	5.22 ¹⁰⁰	i. al., eth.
35	3.30	d.	.....	0.93 ¹⁶	5.3 ¹⁰⁰	i. al.
36	.....	d.	.....	sl. s.	d.	i. al.
37	3.291	d.	.....	d.	.....	sl. s. al., KCl
38	.....	d.	.....	s. d.	.....	i. al.
39	2.71	.....	.....	s.	s.	.....
40	.....	.....	.....	d.	d.	s. HCl
41	2.732 ¹⁸	968.3	.....	62.9 ²⁰	79.2 ¹⁰⁰	i. al.
42	2.69	tr. 2.36; 398	d. 500	4.9 ⁰	102 ¹⁰⁰	i. al.
43	.....	d. 170	.....	sl. s.	.....	i. al., eth.
44	1.71	.....	.....	30.9 ²⁰	.....	i. al.
45	2.28 ¹⁴	300	.....	i.	.....	i. al., acet. a.
46	1.83	89	-12H ₂ O, 400	24.39 ²⁵	50	s. dil. a.; i. al.
47	1.98	d. 230	.....	167 ¹⁵	199.7 ³¹	s. glyc.; sl. s. al.
48	.....	.....	.....	s.	.....	.....
49	.....	.....	.....	d.	.....	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Potassium				
1	cobaltcyanide.....	$K_3Co(CN)_6$	332.34	monocl. yel.....
2	cobaltinitrite (Fischer's salt)	$K_3Co(NO_2)_6$	452.28	pr. yel.....
3	cobaltinitrite.....	$K_3Co(NO_2)_6 \cdot H_2O$..	470.29	yel. cr. powd.....
4	".....	$K_3Co(NO_2)_6 \cdot 1\frac{1}{2}H_2O$	479.30	tetr. yel.....
5	cobalt malonate (ous)...	$K_2Co(C_3H_2O_4)_2$	341.22	
6	cobaltocyanide.....	$K_4Co(CN)_6$	371.43	vlt. need.....
7	cobalt sulfate (ous).....	$K_2SO_4 \cdot CoSO_4 \cdot 6H_2O$	437.35	monocl. pr. red, 1.481, 1.487, 1.500..
8	copper chloride.....	$KCl \cdot CuCl_2$	209.04	red need.....
9	cuprocyanide.....	$K_3Cu(CN)_4$	284.93	rhbdr. col.....
10	cyanate.....	KOCN.....	81.11	need. col.....
11	cyanide.....	KCN.....	65.11	cub. col., wh. gran., deliq., extr. pois.
12	cycanoaurate (auri-cyanide)	$KAu(CN)_4 \cdot 1\frac{1}{2}H_2O$..	367.39	col. tabl.....
13	cycanoaurite (auro-cyanide)	$KAu(CN)_2$	288.33	col. rhomb.....
14	cycanoösmite.....	$K_4Os(CN)_6 \cdot 3H_2O$..	556.74	monocl. col.-yel., β 1.607.
15	cycanoplatinite.....	$K_2Pt(CN)_4 \cdot 3H_2O$..	431.54	rhomb. col. yel., blue fluores., deliq.
16	ethylsulfate.....	$K_2C_2H_5O_4S$	164.22	monocl. wh.....
17	ferricyanide.....	$K_3Fe(CN)_6$	329.24	monocl. red., 1.566, 1.569, 1.583.
18	ferrocyanide.....	$K_4Fe(CN)_6 \cdot 3H_2O$..	422.38	monocl. lem. yel., β 1.577.
19	fluoberyllate.....	K_2BeF_4	163.21	rhomb. col.....
20	fluoborate (avogadrite)...	KBF_4	125.92	rhomb. or cub. col.....
21	fluocolumbate, penta...	$K_2C_2O_7 \cdot H_2O$	300.12	monocl. leaf. col.....
22	fluogermanate.....	K_2GeF_6	264.79	hex. wh.....
23	fluomanganite.....	K_2MnF_6	247.12	hex. tab., yel.....
24	fluorescein deriv.....	$K_2C_{20}H_{10}O_5$	408.47	yellowish-red powd.....
25	fluoride.....	KF.....	58.10	cub. col., deliq.....
26	".....	$KF \cdot 2H_2O$	94.13	monocl. pr., deliq.....
27	" , acid.....	KHF ₂	78.10	cub. col.....
28	fluosilicate (hieratite)...	K_2SiF_6	220.25	hex. or cub. col.....
29	fluostannate.....	$K_2SnF_6 \cdot H_2O$	328.91	monocl. pr.....
30	fluosulfonate.....	$KFSO_3$	138.16	short, thick pr.....
31	fluotellurate, di.....	$K_2TeO_3F_2 \cdot 3H_2O$..	345.85	micros., oct., monocl.....
32	fluotitanate.....	$K_2TiF_6 \cdot H_2O$	258.11	col. monocl. sm. lust. leaf.....
33	fluozirconate.....	K_2ZrF_6	283.41	monocl. col., 1.466, 1.455.
34	formate.....	KCHO ₂	84.11	rhomb. col., deliq.....
35	gadolinium sulfate.....	$K_2SO_4 \cdot Gd_2(SO_4)_3 \cdot 2H_2O$	812.26	cryst.....
36	gallium sulfate.....	$KGa(SO_4)_2 \cdot 12H_2O$..	517.13	col. cr., 1.46528.....
37	metagermanate.....	K_2GeO_3	198.79	wh. cryst.....
38	germanate.....	$K_2Ge_2O_5$	303.39	wh. cryst.....
39	tetragermanate.....	$K_2Ge_4O_9$	512.59	wh. cryst.....
40	glycerophosphate.....	$K_2C_3H_7PO_5$	248.30	col. to sl. yelsh. mass, hyg.....
41	hydride.....	KH.....	40.10	wh. need.....
42	hydroxide.....	KOH.....	56.10	rhomb. deliq., wh.....
43	iodate.....	KIO ₃	214.02	monocl. col.....
44	iodate, acid.....	KIO ₃ · HIO ₃	389.94	monocl.....
45	" ".....	KIO ₃ · 2HIO ₃	565.87	col. tricl.....
46	metaperiodate.....	KIO ₄	230.02	tetr. col.....
47	iodide.....	KI.....	166.02	cub. col. or wh. gran., 1.677.....
48	" , tri.....	KI ₃	419.86	monocl. dk. bl., deliq.....
49	iodocaurate.....	KAuI ₄	743.98	lust. blk. cr.....
50	iodoiridite.....	K ₂ IrI ₆	1071.91	grn. cr.....
51	iodoplatinate.....	K ₂ PtI ₆	1034.94	blk. rect.....
52	iron chloride (ic) (erythrosiderite)	$2KCl \cdot FeCl_3 \cdot H_2O$..	329.33	orthorhomb. red.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.906	d.		s.	s.	i. al.
2				sl. s.	sl. s.	i. al.
3				i.	s. d.	s. min. a.; sl. s. ac. a.; i. al., eth.
4		d. 200		0.089 ¹⁷	sl. s.	i. al., eth.
5	2.234					
6				s.	s.	i. al., eth.
7	2.218			25.5 ⁰	108.4 ⁴⁰	
8	2.86					
9		d.		v. s.		
10	2.048 ¹⁶ ; 2.056 ²⁰	d. 700-900		s.	s.	i. al.
11	1.52 ¹⁶	634.5; (601-621) d. 200		v. s.	v. s.	s. glyc., meth. al.; sl. s. al.
12				s.	v. s.	s. al.
13	3.45			14.3	200	sl. s. al.; i. eth.
14		d.		sl. s.	s.	i. al., eth.
15	2.455 ¹⁶	d. 400-600		sl. s.	v. s.	s. al., eth., H ₂ SO ₄
16	1.843			s.		s. al.
17	1.894 ¹⁷	d.		33 ⁴	77.5 ¹⁰⁰	s. acet.; i. al.
18	1.85 ¹⁷	-3H ₂ O, 70	d.	27.8 ¹²	90.6 ^{96.3}	s. acet.; i. al., NH ₃
19		red ht.		22 ⁰	5.26 ¹⁰⁰	
20	2.498	530		44 ²⁰	6.27 ¹⁰⁰	s. al.; sl. s. eth.
21				7.69		
22		730	ca. 835	542 ¹³	2.58 ¹⁰⁰	
23		d.		d.	d.	s. c. HCl
24				s.		
25	2.48	880	1500	92.3 ¹⁸	v. s.	s. HF, NH ₃ ; i. al.
26	2.454	41		349.3 ¹⁸	v. s.	s. HF; i. al.
27		d.		41.2 ¹	v. s.	s. K ₂ H ₃ O ₂ ; i. al.
28	hex. 3.08; cub. 2.665 ¹⁷	d.		0.12 ^{17.5}	0.954 ¹⁰⁰	s. HCl; i. NH ₃ , al.
29	3.053			3.7 ¹⁸	33.3 ¹⁰⁰	i. al., NH ₃
30		311		6.9 ¹⁹		
31		d.		sl. s.	sl. s.	s. HF
32		-H ₂ O, 32; 780	d.	556 ⁰ ; 1.3 ²⁰	1.27 ²¹	s. min. a.; i. NH ₃
33	3.48			.781 ²	25 ¹⁰⁰	i. NH ₃
34	1.91	167.5	d.	331 ¹⁸	657 ⁹⁰	s. al.; i. eth.
35	3.503 ¹⁶			s.	s.	s. K ₂ SO ₄
36	1.895			s.		
37	3.40 ^{21.5}	823		s.		s. a.
38	4.31 ^{21.5}	> 83		s.		s. a.
39	4.12 ^{21.5}	1033		s.		s. a.
40				v. s.	v. s.	s. al.
41	1.43-.47	d.		d.	d.	i. CS ₂ , eth., bz.
42	2.044	360.4 ± 7	1320-4	97 ⁰ ; 107 ¹⁵	178 ¹⁰⁰	v. s. al., eth.; i. NH ₃ ,
43	3.89	560	d. > 100	4.74 ⁰	32.3 ¹⁰⁰	s. KI; i. al., NH ₃
44				1.33 ¹⁵		
45				4 ¹⁶		
46	3.618 ¹⁵	582	-O, 300	0.66 ¹³	s.	v. sl. s. KOH
47	3.13	723	1420 (1330)	127.5 ⁰	208 ¹⁰⁰	14.3 al.; s. NH ₃ ; sl. s. eth
48	3.498	31 (45)	d. 225	v. s.		s. al., KI
49				s., d.		s. dil. soln. KI
50		d.		v. s. (i.)		i. al.
51	5.176 (4.96- 5.03)			s.	s. d.	i. al.
52	2.320					

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Potassium				
1	iron oxalate (ous)	$K_2Fe(C_2O_4)_2 \cdot 2H_2O$	346.10	gold need.
2	“ “ (ic)	$KFe(C_2O_4)_2 \cdot 2\frac{1}{2}H_2O$	316.02	br. cr.
3	“ “	$K_2Fe(C_2O_4)_3 \cdot 3H_2O$	491.24	monocl. grn.
4	“ sulfate (ous)	$K_2SO_4 \cdot FeSO_4 \cdot 6H_2O$	434.25	grn. monocl. pr.
5	“ “ (ic)	$K_2SO_4 \cdot Fe_2(SO_4)_3 \cdot 2H_2O$	610.14	monocl., pale yel. grn.
6	“ “ “ (krausite)	$KFe(SO_4)_2 \cdot 12H_2O$	503.25	cub. oct. col. or vlt., 1.482
7	“ sulfide (ic)	$KFeS_2$	159.06	purp., hex.
8	lactate	$KC_3H_5O_3 \cdot xH_2O$	. . . . .	col. to yelsh. syrupy liq.
9	laurate	$KC_{12}H_{23}O_2$	238.40	amor.
10	“ , acid	$KC_{12}H_{23}O_2 \cdot C_{12}H_{24}O_2$	438.72	wh. wax-like solid.
11	lead chloride (pseudo-cotunnite)	$2KCl \cdot PbCl_2$	427.23	yel.
12	magnesium carbonate, acid	$KHCO_3 \cdot MgCO_3 \cdot 4H_2O$	256.51	tricl. or rhombic col.
13	“ chloride (carnallite)	$KCl \cdot MgCl_2 \cdot 6H_2O$	277.88	rhomb. col., deliq., 1.466, 1.475, 1.494
14	“ chloride sulfate (kainite)	$K_2SO_4 \cdot MgSO_4 \cdot MgCl_2 \cdot 6H_2O$ (or $KMgClSO_4 \cdot 3H_2O$)	497.96 (248.98)	col. monocl.
15	magnesium chromate	$K_2CrO_4 \cdot MgCrO_4 \cdot 2H_2O$	370.56	tric.
16	magnesium sulfate (langbeinite)	$K_2SO_4 \cdot 2MgSO_4$	415.01	tetrah., 1.5329
17	“ sulfate (leonite)	$K_2SO_4 \cdot MgSO_4 \cdot 4H_2O$	366.70	col., monocl., 1.483, 1.487, 1.490
18	“ “ (picromerite, schönite)	$K_2SO_4 \cdot MgSO_4 \cdot 6H_2O$	402.73	monocl. col., 1.461, 1.463, 1.476
19	malate	$K_2C_4H_4O_5$	210.26	col., viscid mass.
20	manganate	K_2MnO_4	197.12	rhomb. grn.
21	permanganate	$KMnO_4$	158.03	rhomb. purple, ω 1.59
22	manganese chloride (ous) (chloromanganokalite)	$4KCl \cdot MnCl_2$	424.06	trig., 1.59
23	manganese sulfate (ic)	$KMn(SO_4)_2 \cdot 12H_2O$	502.34	cub. (oct.), vlt.
24	“ “ (manganolangbeinite)	$K_2SO_4 \cdot 2MnSO_4$	476.23	tetrah., rose-red, 1.572
25	manganicyanide	$K_3Mn(CN)_6$	328.33	rhomb. red, 1.553, 1.555 (Li), 1.571
26	manganocyanide	$K_4Mn(CN)_6 \cdot 3H_2O$	421.47	tetr. deep blue
27	mercuricyanide	$K_2Hg(CN)_4$	382.87	col. cr. pois.
28	mercury iodide (ic)	$KI \cdot HgI_2$	620.47	yel., deliq. pr.
29	“ tartrate (ous)	$KHgC_4H_4O_6$	387.78	wh. cr. powd
30	methionate (methane-disulfonate)	$K_2CH_2O_6S_2$	252.34	monocl., β 1.539
31	methylsulfate	$2KCH_3O_4S \cdot H_2O$	318.40	wh. cr.
32	molybdate	K_2MoO_4	238.14	wh. deliq. powd.
33	“	$K_2MoO_4 \cdot 5H_2O$	328.22	wh. deliq. powd.
34	myristate, acid	$KC_{14}H_{27}O_2 \cdot C_{14}H_{25}O_2$	494.82	wh. wax-like solid.
35	naphthalene-1,5-disulfonate	$K_2C_{10}H_6O_6S_2 \cdot 2H_2O$	400.49	monocl., 1.485, 1.699, 1.697
36	nickelocyanide	$K_2Ni(CN)_4 \cdot H_2O$	258.97	monocl. cr. or powd., red-yel.
37	nickel sulfate	$K_2SO_4 \cdot NiSO_4 \cdot 6H_2O$	437.10	monocl. bl., 1.484, 1.492, 1.505
38	nitrate (saltpeter)	KNO_3	101.10	rhomb. or trig. col., 1.335, 1.5056, 1.5064
39	nitride	K_3N	131.30	grnsh. blk.
40	nitrite	KNO_2	85.10	col. prism, deliq.
41	nitroplatinite	$K_2Pt(NO_2)_4$	457.45	monocl. col.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d.		s.	s.	
2		d.		92 ²¹	d.	i. al.
3		-3H ₂ O, 100	d. 230	4.7 ⁰	117.7 ¹⁰⁰	s. acet.; i. al., NH ₃
4	2.169					
5	2.840					
6	1.83	33		20 ^{12.5}	v. s.	i. al.
7	2.563			d.		
8				s.		s. al.; i. eth.
9						4.5 ¹⁵ al.
10		160				0.904 ^{13.5} al.
11		490		s.		
12	2.98			s. d. gives	MgCO ₃ ·3 H ₂ O	
13	1.61	265		64.5 ¹⁹ d.	d.	d. al.
14	2.131			79.56 ¹⁸		i. eth., al.
15	2.59					
16	2.829	927				
17	2.201 ²⁰			v.s.		
18	2.15	d. 72		19.26 ⁰ ; 25 ²⁰	59.8 ⁷⁵	
19				s.		
20		d. 190		d.	d.	s. KOH
21	2.703	d. < 240		2.83 ⁰ ; 6.38 ²⁰	25 ⁶⁵	d. al.; s. H ₂ SO ₄ ; v. s. meth. al., acet.
22	2.31			s.	s.	
23				d.		
24	3.02	850				
25				s.		
26				s.	d.	
27				s.		s. al.
28				d.		s. al., eth., KI, ac. a.
29				i.		i. al.
30	2.376			s.		
31				s.		s. al.
32	lq. 2.342 ⁹⁶⁴	919		184.6 ²⁵	v. s.	i. al.
33				s.		
34		153				453 ^{13.5} al.
35	1.797			s.		
36	1.875 ¹¹	-H ₂ O, 100		s.		d. a.
37	2.124	d. < 100		7 ⁰	60.8 ⁷⁵	
38	2.109 ¹⁶	tr.-trig. 129 m.p. 334	d. 400	13.3 ⁰ ; 31.6 ²⁹	247 ¹⁰⁰	i. al., eth.
39		d.		d.		
40	1.915	387(419)		281 ⁰ ; 313 ²⁵	413 ¹⁰⁰	v. s. NH ₃ ; sl. s. al.; l. 94% al.
41		d.		3.8 ¹⁵	s.	

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Potassium				
1	<i>m</i> -nitrophenoxide.....	$\text{KOC}_6\text{H}_4\text{NO}_2 \cdot 2\text{H}_2\text{O}$	213.23	flat or. need.....
2	<i>p</i> -nitrophenoxide.....	$\text{KOC}_6\text{H}_4\text{NO}_2 \cdot 2\text{H}_2\text{O}$	213.23	yel. leaf.....
3	nitroprusside.....	$\text{K}_2(\text{NO})\text{Fe}(\text{CN})_5 \cdot 2\text{H}_2\text{O}$	330.16	monocl. red hyg.....
4	oleate.....	$\text{KC}_{18}\text{H}_{33}\text{O}_2$	320.54	cr. or yelsh. or brnsh. soft mass, α 1.452, γ 1.465
5	" , acid.....	$\text{KC}_{18}\text{H}_{33}\text{O}_2 \cdot \text{C}_{18}\text{H}_{34}\text{O}_2$	603.00	white wax-like solid.....
6	osmate.....	$\text{K}_2\text{OsO}_4 \cdot 2\text{H}_2\text{O}$	368.42	cub. vlt., hyg.....
7	oxalate.....	$\text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$	184.23	monocl. wh., 1.440, 1.485, 1.550.
8	" , acid.....	KHC_2O_4	128.12	monocl. col., 1.415, 1.545.
9	" ".....	$\text{KHC}_2\text{O}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$	137.13	trim.....
10	" ".....	$\text{KHC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	146.14	rhomb.....
11	" , tetr.....	$\text{KHC}_2\text{O}_4 \cdot \text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$	254.19	tricl. col.....
12	oxide, mon.....	K_2O	94.19	cub. col.-gray.....
13	" , di.....	K_2O_2	110.19	wh.....
14	" , tri.....	K_2O_3	126.19	red.....
15	" , per.....	KO_2	71.10	yel. leaf.....
16	palmitate, acid.....	$\text{KC}_{16}\text{H}_{31}\text{O}_2 \cdot \text{C}_{16}\text{H}_{32}\text{O}_2$	550.93	wh. fatty solid.....
17	1-phenol-2-sulfonate (<i>o</i> -)	$\text{KC}_6\text{H}_5\text{O}_4\text{S} \cdot \text{H}_2\text{O}$	230.27	rhomb., 1.527, 1.568, 1.647.....
18	" -4- " (<i>p</i> -)	$\text{KC}_6\text{H}_5\text{O}_4\text{S}$	212.26	rhomb., 1.571, 1.608, 1.694.....
19	phenyl sulfate.....	$\text{KC}_6\text{H}_5\text{SO}_4$	212.26	rhomb. leaf.....
20	orthophosphate.....	K_3PO_4	212.31	rhomb. col., deliq.....
21	" , mono-H.....	K_2HPO_4	174.22	amor. wh., deliq.....
22	" , di-H.....	KH_2PO_4	136.13	tetr. col., deliq., 1.510, 1.4684.....
23	pyrophosphate.....	$\text{K}_4\text{P}_2\text{O}_7 \cdot 3\text{H}_2\text{O}$	384.47	col. deliq.....
24	metaphosphate.....	KPO_3	118.076	col., 1.458, 1.487.....
25	orthophosphite, mono-H.....	K_2HPO_3	158.22	wh. powd. deliq.....
26	" , di-H.....	KH_2PO_3	120.13	deliq. wh.....
27	hypophosphite.....	KH_2PO_2	104.13	hex. wh., deliq.....
28	phthalate, acid.....	$\text{KHC}_8\text{H}_4\text{O}_4$	204.22	rhomb. col.....
29	picrate.....	$\text{KC}_6\text{H}_3\text{N}_3\text{O}_7$	267.20	yel. redsh. or grnsh. rhomb., 1.527, 1.903, 1.952.....
30	piperate.....	$\text{KC}_{12}\text{H}_5\text{O}_4$	256.29	lt.-yel. cr. powd.....
31	platinate.....	$\text{K}_2\text{PtO}_3 \cdot 3\text{H}_2\text{O}$	375.47	rhomb. yel.....
32	platinum (tri-) thio-platinate (ous)	$\text{K}_2\text{Pt}_3(\text{PtS}_6)$	1051.47	bl. gray cr.....
33	metaplumbate.....	$\text{K}_2\text{PbO}_3 \cdot 3\text{H}_2\text{O}$	387.45	rhomb. col.....
34	praseodymium sulfate.....	$3\text{K}_2\text{SO}_4 \cdot \text{Pr}_2(\text{SO}_4)_3 \cdot \text{H}_2\text{O}$	1110.79	cr.....
35	propionate.....	$\text{KC}_3\text{H}_5\text{O}_2 \cdot \text{H}_2\text{O}$	130.18	wh. hyg. cr., leaf., deliq.....
36	propyl sulfate.....	$\text{KC}_3\text{H}_7\text{O}_4\text{S}$	178.24	wh. cr. powd.....
37	rhodium sulfate.....	$\text{KRh}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	550.32	yel. cub.....
38	ruthenate.....	$\text{K}_2\text{RuO}_4 \cdot \text{H}_2\text{O}$	261.91	tetr. blk.....
39	perruthenate.....	KRuO_4	204.80	tetr. blk.....
40	<i>d</i> -saccharate, acid.....	$\text{KHC}_6\text{H}_5\text{O}_8$	248.23	rhomb. need.....
41	salicylate.....	$\text{KC}_7\text{H}_5\text{O}_3$	176.21	wh. powd.....
42	santoninate.....	$\text{KC}_{16}\text{H}_{13}\text{O}_4$	302.40	wh. deliq. cr. powd.....
43	selenate.....	K_2SeO_4	221.15	rhomb. col., 1.535, 1.539, 1.545.....
44	selenide.....	K_2Se	157.15	wh., cr. reddens on exposure to air.....
45	selenite.....	K_2SeO_3	205.15	wh. deliq.....
46	selenocyanate.....	KSeCN	144.07	need., deliq.....
47	metasilicate.....	K_2SiO_3	154.25	amor. col.....
48	isilicate.....	$\text{K}_2\text{Si}_2\text{O}_6$	214.31	β , 1.500.....
49	" , hydrogen.....	KHSi_2O_5	176.22	rhomb.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.691 ²⁰	-2H ₂ O, 130	d.	16.3 ¹⁵	..	s. al.
2	1.652 ²⁰	-2H ₂ O 130	d.	7.5 ¹⁵	.....	sl. s. al.
3	.....	.....	.....	100 ¹⁵	.....	s. al.
4	.....	.....	.....	25	s.	s. 4.315 ^{13,6} , 100 ⁵⁰ al.; 3.5 ^{3b} eth.
5	.....	95	.....	s.	s.	5.2 ^{13,6} al.
6	.....	-H ₂ O, > 100	.....	sl. s.	s. d.	i. al., eth.
7	2.127 ³⁹ ; 2.08	d.	.....	33 ¹⁶	.....	.....
8	2.0	d.	.....	2.5	16.7 ¹⁰⁰	sl. s. al.
9	.....	d.	.....	2.2	51.5 ¹⁰⁰	.....
10	2.044	.....	.....	.....	.....	.....
11	1.836	d.	.....	1.8 ¹³	.....	.....
12	2.32 ⁰	.....	.....	v. s.	v. s.	s. al., eth.
13	.....	490	.....	.....	.....	.....
14	.....	430	.....	.....	.....	.....
15	.....	ca. 400	d.	v. s. d.	.....	d. al.
16	.....	138	.....	.....	.....	0.198 ¹³ al.
17	1.734	400	.....	s.	.....	s. al.
18	1.87	> 260	.....	.....	.....	.....
19	.....	150-60 d.	d.	14 ¹⁵	.....	v. sl. s. al.
20	D ¹⁷ = 2.584	1340	.....	sl. s.	s.	i. al.
21	.....	d.	.....	v. s.	v. s.	v. s. al.
22	2.338	252.6	.....	33 ²⁵	s.	i. al.
23	2.33	-2H ₂ O, 180	-3H ₂ O, 300	s.	v. s.	i. al.
24	2.393 ²⁵	807	.....	i.	i.	.....
25	.....	d.	.....	v. s.	v. s.	i. al.
26	.....	d.	.....	v. s.	v. s.	i. al.
27	.....	d.	.....	v. s.	v. s.	11.1 ²⁵ chl.; v. sl. s. abs. al. NH ₃ ; i. eth.
28	1.636	.....	.....	10 ²⁵	33 ¹⁰⁰	.....
29	1.852	.....	exp. 310	0.5 ¹⁵	25 ¹⁰⁰	0.184 ²⁵ al.
30	.....	.....	.....	sl. s.	v. s.	.....
31	.....	d.	.....	s.	.....	i. al.
32	6.44 ¹⁵	d. ign.	.....	i.	.....	d. HCl
33	.....	.....	.....	d.	d.	s. KOH
34	3.275 ¹⁵	.....	.....	sl. s.	.....	s. HNO ₃ , HCl
35	.....	-H ₂ O, 120	.....	207 ¹⁵	359	22.2 ¹³ 95% al.
36	.....	.....	.....	v. s.	.....	.....
37	2.23	.....	.....	s.	.....	.....
38	.....	-H ₂ O, 200	d. 400 ^{vac.}	v. s.	d.	d. a., al.
39	.....	d. 440	.....	sl. s.	s. d.	.....
40	.....	.....	.....	1.1 ⁶	s.	.....
41	.....	.....	.....	s.	.....	s. al.
42	.....	.....	.....	s.	.....	s. al.
43	3.066	.....	.....	110.5 ⁰	122.2 ¹⁰⁰	.....
44	2.851 ¹⁵	.....	.....	s. d.	s.	.....
45	.....	.....	.....	s.	.....	sl. s. al.
46	2.347	d. 100	.....	s.	s.	d. a.; s. al.
47	.....	976	.....	s.	s.	i. al.
48	2.456 ^{$\frac{25}{4}$}	1015 ± 10	.....	.....	.....	.....
49	2.417 ^{$\frac{15}{4}$}	515	.....	.....	.....	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Potassium				
1	tetrasilicate.....	$K_2Si_4O_9 \cdot H_2O$	352.45	rhomb., α 1.495, β 1.535.
2	silicotungstate (normal).	$K_4SiW_{12}O_{40} \cdot 18H_2O$	3355.78	col. hex.
3	silver carbonate.....	$KAgCO_3$	206.99	rect. pl.
4	" nitrate.....	$KNO_3 \cdot AgNO_3$	270.99	monocl.
5	sodium antimony tartrate	$KNaSbC_4H_4O_7$	346.92	wh. scales or powd.
6	" carbonate.....	$KNaCO_3 \cdot 6H_2O$	230.20	monocl. hyg. efflor.
7	" cobaltinitrite.....	$K_2NaCo(NO_2)_6 \cdot H_2O$	454.19	yel. cr.
8	" ironchloride (ous) (rinneite)	$3KCl \cdot NaCl \cdot FeCl_2$	408.87	rhbdr., 1.589, 1.590.
9	" sulfate.....	$3K_2SO_4 \cdot Na_2SO_4$	664.81	rhbdr.
10	sodium tartrate (Rochelle salt, Seignette salt)	$KNaC_4H_4O_6 \cdot 4H_2O$	282.23	rhomb. col., 1.492, 1.493, 1.496.
11	stannate.....	$K_2SnO_3 \cdot 3H_2O$	298.94	trig. col.
12	stearate.....	$KC_{18}H_{35}O_2$	322.56	wh. cr. powd.
13	" , acid.....	$KC_{18}H_{35}O_2 \cdot C_{18}H_{35}O_2$	607.03	wh. powd.
14	strontium chromium oxalate (ic)	$KSrCr(C_2O_4)_3 \cdot 6H_2O$	550.89	grnsh.-blk.
15	stypnate.....	$KC_6H_2N_3O_8 \cdot H_2O$	301.21	yel. monocl. pr.
16	succinate.....	$K_2C_4H_4O_4 \cdot 3H_2O$	248.31	rhomb.
17	" , acid.....	$KHC_4H_4O_4$	156.18	monocl.
18	" ".....	$KHC_4H_4O_4 \cdot 2H_2O$	192.21	rhomb., 1.417, 1.530, 1.533.
19	" ".....	$KHC_4H_4O_4 \cdot C_6H_6O_4$	274.27	monocl.
20	sulfate (arcanite).....	K_2SO_4	174.25	rhomb. or hex. col., 1.494, 1.495, 1.497
21	" , acid (mercallite, misenite)	$KHSO_4$	136.16	monocl. or rhomb. col., deliq.
22	pyrosulfate.....	$K_2S_2O_7$	254.31	col. need.
23	peroxydisulfate.....	$K_2S_2O_8$	270.31	tricl. col., 1.461, 1.467, 1.566.
24	sulfide, mono.....	K_2S	110.25	yel-br., deliq.
25	" ".....	$K_2S \cdot 5H_2O$	200.33	rhomb. col.
26	" , hydro.....	KHS	72.16	rhomb. yel. deliq.
27	" , di.....	K_2S_2	142.31	red yel. cr.
28	" ".....	$K_2S_2 \cdot 3H_2O$	196.36	yel.
29	" , tri.....	K_2S_3	174.37	br. yel. cr.
30	" , tetra.....	K_2S_4	206.43	red-br. cr.
31	" ".....	$K_2S_4 \cdot 2H_2O$	242.46	yel.
32	" , penta.....	K_2S_5	238.49	orange cr.
33	sulfite.....	$K_2SO_3 \cdot 2H_2O$	94.28	monocl. wh.-yelsh.
34	" , acid.....	$KHSO_3$	120.16	col. cr.
35	pyrosulfite (metabisulfite)	$K_2S_2O_5$	222.31	monocl. pl.
36	tantalum fluoride.....	K_2TaF_7	392.07	rhomb. col.
37	d-tartrate.....	$K_2C_4H_4O_6 \cdot \frac{1}{2}H_2O$	235.27	monocl. col., β 1.526.
38	dl-tartrate.....	$K_2C_4H_4O_6$	226.26	monocl. col.
39	d- " , acid.....	$KHC_4H_4O_6$	188.18	rhomb. col.
40	dl- " ".....	$KHC_4H_4O_6$	188.18	monocl. col.
41	tellurate.....	K_2TeO_4	269.80	soft, glutinous mass.
42	" ".....	$K_2TeO_4 \cdot 5H_2O$	359.88	rhomb. col., deliq.
43	telluride.....	K_2Te	205.80	col.
44	tellurite.....	K_2TeO_3	253.80	wh. deliq. cr.
45	thioantimonate.....	$2KSbS_4 \cdot 9H_2O$	896.72	yel. cr.
46	thioarsenate.....	K_3AsS_4	320.44	dliq. cr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.417; anh. 2.335 ²⁵	d. 400; anh. 770		s.	s.	i. al.
2		-17H ₂ O, 100		33.3 ²⁰	v. s.	v. s. acet.; s. meth. al.; sl. s. al.; i. eth., bz.
3	3.769	d.		d.	d.	
4	3.219	125		v. s.	v. s.	
5				s.		
6	1.61-1.63 ¹⁴	-6H ₂ O, 100		185.2 ¹⁵		
7	1.633	135		0.07 ²⁵		i. al.
8	2.3					
9	2.7			s.	s.	
10	1.790	70-80	-4H ₂ O, 215	26 ⁰	66 ²⁶	v. sl. s. al.
11	3.197			85 ¹⁰	110.5 ²⁰	sl. s. KOH; i. al., acet.
12					s.	0.145 ^{13.5} al.; i. eth., CS ₂ , chl.
13		153		s.	s.	0.091 ^{13.5} al.
14	2.155 ¹³					
15		-H ₂ O, 120	expl.	1.54 ³⁰		v. sl. s. al.
16	1.564					
17	1.767	242 d.				
18	1.616			s.		s. al.
19	1.56	162				
20	2.662	tr. 588; 1076		6.85 ⁰ ; 12 ²⁵	24.1 ¹⁰⁰	i. al., acet., CS ₂
21	2.24-2.61	210	d.	36.3 ⁰	121.6 ¹⁰⁰	i. al., acet.
22	2.27	>300	d.	s.	d.	
23	2.477	d. <100		1.75 ⁰	5.3 ²⁰	i. al.
24	1.805 ¹⁴	471		s.	v. s.	s. al., glyc.; i. eth.
25		60	-3H ₂ O, 150	s.		s. al., glyc.; i. eth.
26	2.0 (1.68-70)	455		d.	d.	s. al.
27		470		s.	d.	s. al.
28				v. s.	v. s.	s. al.
29		252		s.	d.	s. al.
30		145	d. 850	s.		s. al.
31				s.	s.	sl. s. al.
32		206		v. s.	v. s.	sl. s. al.
33		d.		100	<100	sl. s. al.; i. NH ₃
34		d. 190		s.	s.	i. al.
35	2.3	d.		sl. s.		sl. s. al.; i. eth.
36	4.56; 5.24			sl. s., d.		sl. s. HF
37	1.97			150 ¹⁴	278 ¹⁰⁰	sl. s. al.
38	1.984					
39	1.956			0.37	6.1 ¹⁰⁰	s. a., alk.; i. al., ac. a.
40	1.954			.42 ²⁵		s. min. a.; i. al.
41		200 d.		hydrolyzes		
42				sl. s.	s.	sl. s. KOH; i. al.
43	2.51			s.	s.	
44		460-470 d.		v. s.	v. s.	s. h. K ₂ CO ₃ , KOH
45				s.		i. al.
46		d.		v. s.		i. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Potassium				
1	thioarsenite.....	K_3AsS_3	288.38	
2	thiocarbonate.....	K_2CS_3	186.38	yel.-red-br. cr., deliq.
3	thiocyanate.....	$KSCN$	97.17	col. prisms, deliq.
4	dithionate.....	$K_2S_2O_6$	238.31	trig. col., 1.455, 1.515.
5	trithionate.....	$K_2S_3O_6$	270.37	rhomb., 1.475, 1.480, 1.487.
6	tetrathionate.....	$K_2S_4O_6$	302.43	monocl.
7	pentathionate.....	$2K_2S_5O_6 \cdot 3H_2O$	723.03	rhomb. col.
8	thiostannate.....	$K_2SnS_3 \cdot 3H_2O$	347.12	dk. br. oil
9	thiosulfate.....	$3K_2S_2O_3 \cdot H_2O$	588.95	monocl. deliq.
10	"	$3K_2S_2O_3 \cdot 5H_2O$	661.02	col. rhomb.
11	thorium fluoride.....	$K_2ThF_6 \cdot 4H_2O$	496.38	col.
12	orthotungstate.....	$K_2WO_4 \cdot 2H_2O$	362.14	monocl. col., deliq.
13	paratungstate.....	$K_6W_7O_{24} \cdot 6H_2O$	2014.11	rhomb.
14	metatungstate.....	$K_2W_4O_{13} \cdot 8H_2O$	1166.00	cubic.
15	metauranate.....	$K_2UO_4 \cdot xH_2O$	380.26	or.-yel., rhomb.
16	peruranate.....	$K_2UO_6 \cdot xH_2O$		orange-yel cr.
17	uranium oxalate.....	$K_4U(C_2O_4)_4 \cdot 5H_2O$	836.62	monocl. yel.
18	uranyl acetate.....	$KUO_2(C_2H_3O_2)_3 \cdot H_2O$	504.32	tetr.
19	" carbonate.....	$2K_2CO_3 \cdot UO_2CO_3$	606.48	hex. yel.
20	" sulfate.....	$K_2SO_4 \cdot UO_2SO_4 \cdot 2H_2O$	576.41	monocl. yel.
21	urate, acid.....	$KHC_5H_2N_4O_3$	206.20	wh. powd.
22	metavanadate.....	KVO_3	138.05	col. cr.
23	ethylxanthate.....	$KC_3H_5OS_2$	160.29	col.-lt. yel. pr.
24	Praseodymium	Pr.....	140.92	pa. yel. met.
25	acetate.....	$Pr(C_2H_3O_2)_3 \cdot 3H_2O$	372.10	grn. need.
26	bromate.....	$Pr(BrO_3)_3 \cdot 9H_2O$	686.81	hex. grn.
27	bromide.....	$PrBr_3$	380.67	grn. cr. powd.
28	carbide.....	PrC_2	164.94	yel. cr.
29	carbonate.....	$Pr_2(CO_3)_3 \cdot 8H_2O$	606.00	grn. silky pl.
30	chloride.....	$PrCl_3$	247.29	bl. grn. need.
31	"	$PrCl_3 \cdot 7H_2O$	373.40	triocl. grn.
32	hexaantipyrine perchlorate.....	$[Pr(C_{11}H_{12}N_2O)_6]_3(ClO_4)_3$	1568.63	grn. hex. leaf.
33	oxalate.....	$Pr_2(C_2O_4)_3 \cdot 10H_2O$	726.06	lt. grn. cr.
34	oxide, sesqui- (praseodymia)	Pr_2O_3	329.84	yel.-grn. amor.
35	oxide, di-.....	PrO_2	172.92	br.-bl. powd.
36	" , tetr-.....	PrO_4	204.92	blk.
37	2, 4-pentanedione deriv. (acetylacetonate)	$Pr(C_5H_7O_2)_3$	438.24	cr. ppt.
38	sulfate.....	$Pr_2(SO_4)_3$	570.02	lt. grn. powd.
39	"	$Pr_2(SO_4)_3 \cdot 5H_2O$	660.10	monocl. pr.
40	"	$Pr_2(SO_4)_3 \cdot 8H_2O$	714.15	monocl. grn., 1.540, 1.549, 1.561.
41	sulfide.....	Pr_2S_7	378.02	br. powd.
42	Radium	Ra.....	226.05	silv.-wh. met.
43	bromide.....	$RaBr_2$	385.88	monocl. col.-yelsh.
44	"	$RaBr_2 \cdot 2H_2O$	421.91	
45	carbonate.....	$RaCO_3$	286.06	wh. or sl. brnsh.
46	chloride.....	$RaCl_2$	296.96	monocl. col.-yelsh.
47	"	$RaCl_2 \cdot 2H_2O$	333.00	
48	iodate.....	$Ra(IO_3)_2$	575.89	
49	sulfate.....	$RaSO_4$	322.11	col.
50	Radon (niton) (radium emanation)	Rn.....	222.00	col. gas, opaque cr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d.		s.		i. al.
2		d.		v. s.	s.	s. NH ₃ ; sl. s. al.; i. eth.
3	1.886	173.2	d. 500	177.2 ²⁰	217 ²⁰	s. al., 20.75 ²² acet.; 0.18 ¹³ amyl. al.
4	2.278	d.		6	66 ¹⁰⁰	i. al.
5	2.304			v. s.	d.	i. al.
6	2.296			v. s.		i. al.
7	2.112	d.		50	d.	i. al.
8	1.847 ¹⁸	-3H ₂ O, 100		s.		i. al.
9	2.23; (anh.) 2.590	-H ₂ O, 180	d.	96.1 ⁰	312 ⁹⁰	i. al.
10		d.		150.2 ^{17.2}		
11				6 × 10 ⁻⁵ (25°)		
12	3.113	tr. 388; 921		51.5	151.5	d. a.; i. al.
13		d.		2.15	6.6	d. a.; i. al.
14		ca. 930		s.	v. s.	d. a.
15				i.	v. s. a.	v. s. a.
16		d. 100		d.	d.	d. HCl
17	2.563					
18	2.396 ¹⁵ ($\frac{1}{2}$ H ₂ O)	-H ₂ O, 275		s.		
19		-CO ₂ , 300		7.4 ¹⁵	d.	s. aq. K ₂ CO ₃ ; i. al.
20	3.363 ^{19.1}	-2H ₂ O, 120		s.		
21				sl. s.		
22				sl. s.	s.	sl. s. KOH; i. al.
23	1.558 ^{21.5}	d. > 200		v. s.	d.	20 al.; i. eth.
24	6.5	940		d.		s. a.
25				v. s.		
26		56.5	-7H ₂ O, 100	196 ²⁵		
27				sl. s. d.		
28	5.10	d.		d.	d.	s. dil. a.
29		-6H ₂ O, 100		i.		s. a.
30	4.02 ²⁵	818 (769-82)	> 1000	103.9 ¹³	∞ ¹⁰⁰	v. s. al.; 2.4 pyr.; i. eth., chl.
31	2.25 ¹⁷	115		334 ¹³	∞ ¹⁰⁰	s. al., HCl
32		286-91 d.				
33				i.		s. a.; 0.098 ²⁵ n-H ₂ SO ₄
34	6.88	d.		.000020 ²⁹		s. a.
35						
36	5.978					
37		146				s. CS ₂
38	3.72 ¹⁵			23.7 ⁰ ; 17.7 ²⁰	1.02 ⁹⁵	
39	3.176 ¹⁶				1.85 ³⁵	
40	2.827 ^{13.3}			17.4 ²⁰	sl. s.	
41	5.042 ¹¹	d.		i.	d.	s. dil. a.
42	5?	960	1140	d. ev. H ₂		d. a.
43	5.79	728		s.	s.	s. al.
44		-2H ₂ O, 100				
45				i.		d. a.
46	4.91	1000		s.	s.	s. al.
47		-2H ₂ O, 100				
48				.0175 ⁰	.170 ¹⁰⁰	
49				.000002 ²⁵	.000005 ⁴⁵	i. a.
50	9.73 g/l; lq. 4.4 ⁻⁶² ; sl. d. 4	-71	-61.8	51.0 ⁰ cm ³ ; 22.4 ²⁵ cm ³	13.0 ⁵⁰ cm ³	

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	Rhenium	Re	186.31	hex. met. lust.
2	chloride, tri-	ReCl ₃	292.68	hex. dk. red.
3	" , tetra-	ReCl ₄	328.14	blk. (exist. quest.)
4	" , hexa-	ReCl ₆	399.05	yelsh. red (exist. quest.)
5	fluoride, tetra-	ReF ₄	262.31	
6	" , hexa-	ReF ₆	300.31	pa. yel.
7	oxide, hept-	Re ₂ O ₇	484.62	br.-yel. pl. or powd.
8	" , di-	Re ₂ O ₅	218.31	blk.
9	oxybromide	ReO ₂ Br	314.23	wh.
10	oxychloride	ReO ₂ Cl	344.14	
11	"	ReO ₂ Cl ₂	324.68	br. cryst. slt.
12	"	ReO ₂ Cl	299.77	yel. liq.
13	oxyfluoride	ReOF ₃	278.31	col.
14	"	ReO ₂ F ₂	256.31	col.
15	Rhodium	Rh	102.91	cub. gray-wh.
16	chloride, tri-	RhCl ₃ ·xH ₂ O	209.28	br. red. powd. deliq.
17	fluoride, tri-	RhF ₃	159.91	dk. red.
18	hydroxide, tri-	Rh(OH) ₃	153.93	rhomb. red.
20	nitrate	Rh(NO ₃) ₃	288.93	yel. gel.
21	"	Rh(NO ₃) ₃ ·2H ₂ O	324.97	br.-yel.
22	oxide, mon-	RhO	118.91	red. deliq.
23	" , sesqui-	Rh ₂ O ₃	253.82	gray (exist. quest.)
24	" , di-	Rh ₂ O ₄	134.91	gray cr. or amor.
25	" , di-	Rh ₂ O ₃ ·xH ₂ O		br.
26	" , tri-	Rh ₂ O ₃	150.91	olive-grn.
27	sulfate	Rh ₂ (SO ₄) ₃ ·4H ₂ O	556.06	bl.
28	"	Rh ₂ (SO ₄) ₃ ·12H ₂ O	710.19	red.
29	"	Rh ₂ (SO ₄) ₃ ·15H ₂ O	764.24	lt. yel. cr.
30	sulfide, mono-	Rh ₂ S	134.97	pa. yel. cr.
31	" , sesqui-	Rh ₂ S ₃	302.00	gray-blk. cr.
32	" , hydro-	Rh ₂ HS	202.11	blk.
33	sulfite	Rh ₂ (SO ₃) ₃ ·6H ₂ O	554.10	yel. cr.
34	Rubidium	Rb	85.48	soft, silv.-wh. met.
35	acetate	RbC ₂ H ₃ O ₂	144.52	col. nacreous leaf.
36	aluminum sulfate	RbAl(SO ₄) ₂ ·12H ₂ O	520.76	cub. oct. col., 1.457, 1.45232, 1.46618
37	bromate	RbBrO ₃	213.40	
38	bromide	RbBr	165.40	cub. col., 1.5530
39	" , tri-	RbBr ₃	325.23	rhomb.
40	bromochloriodide	RbIBrCl	327.77	rhomb.
41	bromiodide, di-	RbIBr ₂	372.23	rhomb.
42	chlorobromide, di-	RbBrCl ₂	236.31	rhomb.
43	chlorodibromide	RbBr ₂ Cl	280.77	rhomb.
44	carbonate	Rb ₂ CO ₃	230.97	cel. cr., deliq.
45	" , acid	RbHCO ₃	146.50	rhomb.
46	chlorate	RbClO ₃	168.94	trim.
47	perchlorate	RbClO ₄	184.94	rhomb.
48	chloride	RbCl	120.94	cub. col., 1.493
49	chloriodide, di-	RbICl ₂	283.31	rhomb.
50	chloroplatinate	Rb ₂ PtCl ₆	578.93	cub. yel.
51	chromate	Rb ₂ CrO ₄	286.97	rhomb. yel.
52	dichromate	Rb ₂ Cr ₂ O ₇	386.98	tricl. or monoc.
53	chromium sulfate	RbCr(SO ₄) ₂ ·12H ₂ O	545.80	cub., vlt., 1.482

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	20.53	2157 ± 60				s. conc. HNO_3 , H_2O_2
2			>550	s.	s.	s. s. alk.
3			500	s. d.	s. d.	s. HCl
4			<40	s. d.	s. d.	s. HCl
5		124.5				
6	lq. 6.1573; s.d. 4.251	25.6	47.6	s. d.	s. d.	
7	8.2	ca. 220	450 subl.	v. s.	v. s.	v. s. al.; s. a. alk.
8				l.	l.	s. conc. HCl , H_2O_2
9		39.5	163			
10		28	223			
11	3.357 ^m	23.9 ± 0.2				
12		4.5	131			
13	lq. 5.314; s.d. 4.032	39.7	42.7			
14		156				
15	12.1	1966	>2500	l.	l.	s. H_2SO_4 + HCl , h. conc. H_2SO_4 ; s. s. a. aq. reg.
16		d. 450-500	subl. 800	l.	l.	i. a. aq. reg.
17		d.		v. s.		s. al. HCl ; i. eth.
18	5.2		>600 subl.	l.	l.	i. a. alk.
19		d.				s. a. alk.
20		d.		v. s.	s.	i. al.
21				s.	s.	i. al.
22				l.	l.	i. a.
23		d. 1100-1150		l.	l.	i. a. aq. reg., KOH
24				l.	l.	s. a. alk.
25		d.				s. HCl
26						s. alk., HCl
27		d.		s.	s.	
28				v. s.	d.	i. al.
29		d.		v. s.	d.	i. al., eth.
30		d.		l.	l.	i. a. aq. reg.
31		d.		l.	l.	i. a. aq. reg., aq. Br
32		d.		l.	d.	s. aq. reg., aq. Br; i. Na_2S
33		d.		s.		i. al.
34	1.532; lq. 1.475 ^m	38.5	700	d.	d.	s. a.; d. al.
35		246		s.		
36	1.867 ^m	99		2.56 ^m	48.35 ^m	
37	3.68	430		2.96 ^m	5.08 ^m	
38	3.35; lq. 2.78 ^m	682	1340	96 ^m	205.2 ^m	d. s. acct.; i. al.
39		d. 140				
40		205	d. 200			
41		225	d. 365			
42		d. 110				
43		76				
44		837	d. 740	450 ^m	s.	0.7 abs. al.
45		d. 175		v. s.		s. al.
46	3.14			5 ^m	62.3 ^m	
47	2.9	fus.	d.	0.5 ^m	18 ^m	i. al.
48	2.76; lq. 2.688 ^m	715	1390	77 ^m	183.9 ^m	0.08 ^m al.; v. s. s. NH_3
49		190-200	d. 265	91.2 ^m		i. al.
50	3.64 ^m	d.		184 ^m	164 ^m	i. al.
51	3.518			141 ^m		
52	3.02-13		tri-cr.	62 ^m	95.7 ^m	
			mon-cr.	4.96 ^m	77.5 ^m	
53	1.944	107		5.42 ^m	28.1 ^m	

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Rubidium				
1	copper sulfate.....	$\text{Rb}_2\text{SO}_4 \cdot \text{CuSO}_4 \cdot 6\text{H}_2\text{O}$	534.75	monocl., 1.489, 1.491, 1.504.....
2	fluogermanate.....	Rb_2GeF_6	357.56	wh. cr.....
3	fluoride.....	RbF	104.48	col.....
4	fluosilicate.....	Rb_2SiF_6	313.02	cub. oct.....
5	fluosulfonate.....	RbFSO_3	184.54	need.....
6	gallium sulfate.....	$\text{RbGa}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	563.51	col. cr., 1.46579.....
7	hydride.....	RbH	86.49	col. need.....
8	hydroxide.....	RbOH	102.49	gray-wh., deliq.....
9	iodate.....	RbIO_3	260.40	monocl. or cub.....
10	periodate.....	RbIO_4	276.40	tetr.....
11	iodide.....	RbI	212.40	cub. col., 1.6474.....
12	" , tri-.....	RbI_3	466.24	rhomb. blk.....
13	" , compd. with SO_2	$\text{RbI} \cdot 4\text{SO}_2$	468.64	lemon-yel.....
14	iron selenate (ous).....	$\text{Rb}_2\text{SeO}_4 \cdot \text{FeSeO}_4 \cdot 6\text{H}_2\text{O}$	620.82	bl.-grn. monocl. pr.....
15	" " (ic).....	$\text{RbFe}(\text{SeO}_4)_2 \cdot 12\text{H}_2\text{O}$	643.43	cub., 1.507 ¹⁸
16	" sulfate (ous).....	$\text{Rb}_2\text{SO}_4 \cdot \text{FeSO}_4 \cdot 6\text{H}_2\text{O}$	527.02	grn. monocl. pr., 1.4815, 1.4874, 1.4977.....
17	" " (ic).....	$\text{RbFe}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	549.63	cub., 1.4823.....
18	permanganate.....	RbMnO_4	234.41	cryst.....
19	neodymium nitrate.....	$2(?)\text{RbNO}_3 \cdot \text{Nd}(\text{NO}_3)_3 \cdot 4\text{H}_2\text{O}$	697.33	redsh. vit. pl.....
20	nitrate.....	RbNO_3	147.49	hex. cub. rhomb. or tricl. col., 1.51, 1.52, 1.524.....
21	" , acid.....	$\text{RbNO}_3 \cdot \text{HNO}_3$	210.50	tetr.....
22	" ".....	$\text{RbNO}_3 \cdot 2\text{HNO}_3$	273.52	col. need.....
23	oxide, mon-.....	Rb_2O	186.96	cub. col.-yel.....
24	" , di- (per-).....	Rb_2O_2	232.96	cub. yel.....
25	" , tri-.....	Rb_2O_3	218.96	blk.....
26	" , tetr-.....	Rb_2O_4	234.96	yel.....
27	praseodymium nitrate.....	$2\text{RbNO}_3 \cdot \text{Pr}(\text{NO}_3)_3 \cdot 4\text{H}_2\text{O}$	693.98	grnsh. monocl. need., hyg.....
28	sulfate.....	Rb_2SO_4	267.02	rhomb. hex. col., 1.513, 1.513, 1.514.....
29	" , acid.....	RbHSO_4	182.55	rhomb.....
30	sulfide, mono-.....	Rb_2S	203.02	col.....
31	" ".....	$\text{Rb}_2\text{S} \cdot 4\text{H}_2\text{O}$	275.08	cr., deliq.....
32	" , di-.....	Rb_2S_2	235.08	dk. red.....
33	" , tri-.....	Rb_2S_3	267.14	redsh. yel.....
34	" , penta-.....	Rb_2S_5	331.26	rhomb. red, deliq.....
35	" , hexa-.....	Rb_2S_6	363.32	brown-red.....
36	dl-tartrate, acid.....	$\text{RbHC}_4\text{H}_4\text{O}_6$	234.56	trim. pr.....
37	Ruthenium	Ru	101.70	blk. porous.....
38	".....	Ru	101.70	hex. gray-wh. brittle met.....
39	chloride, di-.....	$(\text{RuCl}_2)_x$	172.61 _x	br.-blk. cr.....
40	" , tri-.....	RuCl_3	208.07	cr. br., deliq.....
41	" , tetra-.....	$\text{RuCl}_4 \cdot 5\text{H}_2\text{O}$	333.61	rdsh.-brn. cr. hygro.....
42	fluoride, penta-.....	RuF_5	196.70	dk.-grn. cr.....
43	hydroxide.....	$\text{Ru}(\text{OH})_3$	152.72	blk. powd.....
44	oxide, sesqui-.....	Ru_2O_3	251.40	bl.-blk. (exist. quest.).....
45	" ".....	$\text{Ru}_2\text{O}_3 \cdot x\text{H}_2\text{O}$		yel.....
46	" , di-.....	RuO_2	133.70	tetr. dk. bl.....
47	" ".....	$\text{RuO}_2 \cdot x\text{H}_2\text{O}$		blk.....
48	" , non-.....	Ru_3O_8	550.80	blk. cr. (exist. quest.).....
49	" , pent-.....	Ru_2O_5	283.40	blk. cr. (exist. quest.).....
50	" , tetr-.....	RuO_4	165.70	rhomb. yel.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		2.57		10.28 ²⁵		
2						
3	lq. 2.88 ⁸²⁰	760	1410	sl. s.	v. s.	s. dil. HF; i. al., eth., NH ₃
4	3.332			130.6 ¹⁸	1.35 ¹⁰⁰	s. a.; i. al.
5		304		0.16 ²⁰		
6	1.962			s.		
7	2.0	d. 300		d.	d.	d. a.
8	3.203 ¹¹	300		180 ¹⁵	v. s.	s. al.
9	4.33 ^{19.5}	d.		2.1 ²³		v. s. HCl
10	3.918 ¹⁶			0.65 ¹³		
11	3.55; lq. 2.87 ⁸²⁵	642	1300	152 ¹⁷	v. s.	0.674 ²⁶ acet.
12	4.03	190		s.		
13		13.5				
14	2.819					
15	2.131 ¹⁵	45				
16	2.516					
17	1.91-.95	48-53				
18	3.235 ^{10.4}			0.5 ⁰	4.7 ⁸⁰	
19	2.56	47	-4H ₂ O, 60			
20	3.11; lq. 2.39 ⁵⁴⁰⁰	tr.-cub. 161.4, m.p. 130	tr.-rhomb. 219	34.8 ²⁰	452 ¹⁰⁰	v. s. HNO ₃ ; s. acet.
21		62				
22		45				
23	3.72	d. 400		s. d.	s. d.	
24	3.65 ⁰	600		d. to RbO	H + H ₂ O ₂	
25	3.53	<500		s. d.		
26	3.05 ⁰	280		d. to RbO	H + H ₂ O ₂	+ O ₂
27	2.50	63.5	-4H ₂ O, 60			
28	3.613; lq. 2.53 ¹¹⁰⁰	1060; tr. 653		42.4 ¹⁰	81.8 ¹⁰⁰	
29	2.892 ¹⁶	<red heat				
30	2.912			v. s.	v. s.	
31				v. s.	v. s.	
32		420	volat. >850			
33		213				
34	2.618 ¹⁵	225		d.		s. 70% al.; i. eth., chl.
35		201				
36	2.282	d.		1.18 ²⁶	11.7 ¹⁰⁰	
37	8.6	>1950		i.		sl. s. a., aq. reg.; i. al., eth.
38	12.063	2450	4150	i.	i.	s. fus. alk.; sl. s. aq. reg.; i. a.
39				i.		s. dil. al. (bl.); i. a., alk.
40	3.11	d. >500		i.	d.	s. HCl; sl. s. al.; i. CS ₂
41				s.		s. al.
42	2.963 ^{16.5}	101	270	d.	d.	
43				v. sl. s.		s. a.; i. alk.
44				i.	i.	i. a., alk.
45		d.		i.	i.	s. a., alk.
46	6.97	d.		i.	i.	i. a.; s. fus. alk.
47		d.		i.	i.	s. a.; i. alk.
48		-O, 440				
49		-O, 360				
50	3.29 ²¹	25.5	ca. 100 d.	i.		s. HCl
				2.033 ²⁰	2.249 ⁷⁴	s. a., alk., al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Ruthenium				
1	silicide.....	RuSi	129.76	met. pr.....
2	sulfide (laurite).....	RuS_2	165.82	cub. gray-blk.....
3	Samarium	Sm (or Sa)	150.43	hex. gray-wh. met.....
4	acetate.....	$\text{Sm}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot 3\text{H}_2\text{O}$	381.61	
5	bromate.....	$\text{Sm}(\text{BrO}_3)_3 \cdot 9\text{H}_2\text{O}$	696.32	hex. yel.....
6	bromide.....	$\text{SmBr}_3 \cdot 6\text{H}_2\text{O}$	498.28	yel. cr., deliq.....
7	carbide.....	SmC_2	174.45	hex. yel.....
8	chloride (ous).....	SmCl_2	221.34	red-br. cr.....
9	".....	SmCl_3	256.80	yelsh.-wh. cr., hyg.....
10	".....	$\text{SmCl}_3 \cdot 6\text{H}_2\text{O}$	364.90	tricl. grn.-yel., deliq.....
11	hydroxide.....	$\text{Sm}(\text{OH})_3$	201.45	pa. yel. powd.....
12	iodide.....	SmI_3	531.19	or.-yel. cr.....
13	nitrate.....	$\text{Sm}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$	444.55	tricl. pa. yel.....
14	oxalate.....	$\text{Sm}_2(\text{C}_2\text{O}_4)_3 \cdot 10\text{H}_2\text{O}$	745.08	cryst.....
15	oxide (samaria).....	Sm_2O_3	348.86	wh.-yelsh. powd.....
16	2,4-pentanedione deriv. (acetylacetonate)	$\text{Sm}(\text{C}_5\text{H}_7\text{O}_2)_3$	447.75	cr. mass.....
17	sulfate.....	$\text{Sm}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	733.17	monocl. lt. yel., 1.543, 1.552, 1.563..
18	" , basic.....	$\text{Sm}_2\text{O}_3\text{SO}_4$	428.92	yel. powd.....
19	sulfide.....	Sm_2S_3	397.04	yelsh.-pink.....
20	Scandium	Sc	45.10	silv.....
21	bromide.....	ScBr_3	284.85	
22	chloride.....	ScCl_3	151.47	col. cr.....
23	hydroxide.....	$\text{Sc}(\text{OH})_3$	96.12	col. amor.....
24	nitrate.....	$\text{Sc}(\text{NO}_3)_3$	231.12	col.....
25	".....	$\text{Sc}(\text{NO}_3)_3 \cdot 4\text{H}_2\text{O}$	303.19	pr., deliq.....
26	oxalate.....	$\text{Sc}_2(\text{C}_2\text{O}_4)_3 \cdot 5\text{H}_2\text{O}$	444.34	cr.....
27	oxide (scandia).....	Sc_2O_3	138.20	wh. powd.....
28	2,4-pentanedione deriv. (acetylacetonate)	$\text{Sc}(\text{C}_5\text{H}_7\text{O}_2)_3$	342.42	col. pl.....
29	sulfate.....	$\text{Sc}_2(\text{SO}_4)_3$	378.38	col. cr.....
30	".....	$\text{Sc}_2(\text{SO}_4)_3 \cdot 5\text{H}_2\text{O}$	468.46	
31	".....	$\text{Sc}_2(\text{SO}_4)_3 \cdot 6\text{H}_2\text{O}$	456.48	
32	Selenic acid	H_2SeO_4	144.98	col. hex. pr.....
33	" ".....	$\text{H}_2\text{SeO}_4 \cdot \text{H}_2\text{O}$	162.99	col. liq. or need. or rect. pl.....
34	" ".....	$\text{H}_2\text{SeO}_4 \cdot 4\text{H}_2\text{O}$	217.04	col. liq.....
35	Selenious acid	H_2SeO_3	128.98	hex. col.....
36	Selenium	Se_8	631.68	amor. red powd.....
37	".....	Se_8	631.68	colloidal dk. red powd.....
38	".....	Se_8	631.68	vitreous, dk. brnsh. blk.....
39	".....	Se_8	631.68	monocl. red, 2.9 ²²⁰ lq.....
40	".....	$\text{Se}_8 < 500$ (Se_2 at 900)	631.68	trig. gray met.....
41	bromide, mono.....	Se_2Br_2	317.75	dk. red liq.....
42	" , tetra.....	SeBr_4	398.62	or. red-br. cr.....
43	" (mono-) chloride, tri.....	SeBrCl_3	265.25	yel. br. cr.....
44	" (tri-) chloride.....	SeBr_3Cl	354.17	orange cr., hyg.....
45	" (mono-) nitride.....	$\text{Se}_2\text{N}_2\text{Br}$	265.85	
46	di-chloride, mono.....	Se_2Cl_2	228.83	br.-red liq., 1.596.....
47	" , tetra.....	SeCl_4	220.79	cub. wh.-yel., deliq., 1.807.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	5.40 ⁴			i.	i.	s. HNO ₃ + HF
2	6.99			i.	i.	s. fus. alk.; i. a.
3	7.7	1300-1400				
4	4H ₂ O, 1.94			15 ²⁵		
5		75	-9H ₂ O, 150	114 ²⁵		v. sl. s. al.
6	2.971 ²²					
7	5.86			d.	d.	s. a. d.
8	3.687 ²²	740		s. d.		i. al., CS ₂
9	4.46 ¹³	678 ± 2		92.4 ¹⁰	99.9 ⁵⁰	v. s. al.; 6.4 ²⁵ pyr.
10	2.383	-5H ₂ O, 110				
11				i.		s. a.; i. alk.
12		816-24	d. 800			
13	2.375	78-9		v. s.		
14				0.000054		s. H ₂ SO ₄
15	7.43			i.		v. s. a.
16		146-7		i.		
17	2.930	-8H ₂ O, 450		2.67 ²⁰ ; 4.4 ²⁵	1.99 ⁴⁰	
18			d. 1100	i.		i. dil. H ₂ SO ₄
19	5.729	1900			d.	d. dil. a.
20	2.5	1200	2400	d. ev. H ₂		
21	3.914	subl. > 1000				
22		939	subl. 800-50	v. s.	v. s.	i. abs. al.
23				i.		s. dil. a.
24		150		s.		
25		-4H ₂ O, 100		v. s.		
26		-4H ₂ O, 140				
27	3.86			i.	i.	s. h. a.
28		187.5	subl. 210-15	i.		s. al., bz., chl.
29	2.579	d.		10.3 ²⁵	v. s.	
30				39.9 ²⁵		
31		-4H ₂ O, 100; -6H ₂ O, 250		v. s.		
32	sl. d. 2.951 ¹⁵ ; lq. 2.608 ¹⁵	58; eas. undercools	260 d.	v. s.	v. s.	s. H ₂ SO ₄ ; i. NH ₃ ; d. al. & org. solv.
33	2.627 ¹⁵ ; lq. 2.356 ¹⁵	25-6; eas. undercools	205	v. s.	v. s.	d. org. solv., v. s. al.; i. NH ₃
34		-51.7; eas. undercools	172 ²⁵ ; -H ₂ O	∞		d. org. solv.; s. H ₂ SO ₄
35	3.004 ¹⁵	d.	-H ₂ O	167 ²⁰	v. s.	v. s. al.; i. NH ₃
36	4.26	tr.-vit. 40-50; -met. 200	688	i.	i.	s. H ₂ SO ₄ , CS ₂ , bz.; i. al.
37				s.		s. CS ₂
38	4.28 (4.14 ²²)	indef.	688	i.	i.	s. H ₂ SO ₄ , HNO ₃ , CS ₂
39	4.46 ²⁵ (4.50)	170-180	688	i.	i.	s. H ₂ SO ₄ , HNO ₃ , CS ₂
40	4.79 ¹⁵	217	688	i.	i.	s. H ₂ SO ₄ , HNO ₃ ; i. CS ₂
41	3.604 ¹⁵		227 d.	d.	d.	d. al.; s. CS ₂ , chl., C ₂ H ₅ Br
42		d. 75		d.	d.	s. CS ₂ , chl., C ₂ H ₅ Br, HCl
43		190				i. CS ₂
44		d.				v. sl. s. CS ₂
45				i.	d.	
46	2.91 ¹⁷ ; 2.77 ²³	-85	130 d.	d.	d.	d. al., eth.; s. CS ₂ CCl ₄ , chl., bz.
47	3.78-.85 ³⁶⁰	305; subl. 170-196	d. 288	d.	d.	d. a., alk.; s. POCl ₃ ; v. sl. s. CS ₂

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Selenium				
1	fluoride, tetra.....	SeF ₄	154.96	col. liq. or wh. cr.....
2	" , hexa.....	SeF ₆	192.96	gas, col., 1.895.....
3	iodide, mono.....	Se ₂ I ₂	411.76	steel gray cr. (exist. quest.).....
4	" , tetra.....	SeI ₄	586.64	dk. gray cr. (exist. quest.).....
5	nitride.....	Se ₃ N ₄	371.87	amor. or.-yel. to brk. red hyg.....
6	oxide, di.....	SeO ₂	110.96	wh. monoc. (tetr.) col.....
7	" , tri.....	SeO ₃	126.96	amor. pa. yel. hyg.....
8	oxybromide.....	SeOBr ₂	254.79	red-yel. cr.....
9	oxychloride.....	SeOCl ₂	165.87	col.-yel. liq., 1.651 ²⁰
10	oxyfluoride.....	SeOF ₂	132.96	col. liq.....
11	sulfide, mono.....	SeS.....	111.02	or. yel. tabl. or powd.....
12	" di.....	SeS ₂	143.08	br. red-yel.....
13	sulfur oxide.....	SeSO ₃	159.02	grn. pr. or yel. powd.....
14	sulfur oxytetrachloride...	SeSO ₃ Cl ₄	300.85	hex. pr.....
15	Silicane , bromo.....	SiH ₃ Br.....	111.00	.....
16	" , bromotrichloro.....	SiBrCl ₃	214.35	col. liq.....
17	" , chloro.....	SiH ₃ Cl.....	66.54	.....
18	" , dibromo.....	SiH ₂ Br ₂	189.91	.....
19	" , dibromodichloro.....	SiBr ₂ Cl ₂	258.81	col. liq.....
20	" , dichloro.....	SiH ₂ Cl ₂	100.99	.....
21	" , tribromo- (silico-bromoform)	SiHBr ₃	268.82	col. liq.....
22	" , tribromochloro.....	SiBr ₃ Cl.....	303.27	col. liq.....
23	" , trichloro- (silico-chloroform)	SiHCl ₃	135.44	col. liq.....
24	" , trichloroiodo.....	SiCl ₃ I.....	261.35	col. liq.....
25	" , trifluoro- (silico-fluoroform)	SiHF ₃	86.07	col. gas.....
26	" , triiodo- (silico-iodoform)	SiHI ₃	409.83	red liq.....
27	Silicic acid , ortho.....	H ₄ SiO ₄	96.09	amor. col. (exist. quest.).....
28	" , meta.....	H ₂ SiO ₃	78.08	amor. col. (exist. quest.).....
29	Silicon , adamantine.....	Si.....	28.06	cub. steel gray.....
30	" amorphous.....	Si.....	28.06	amor. br.....
31	" graphitoidal.....	Si.....	28.06	blk. pl.....
32	acetate, tetra.....	Si(C ₂ H ₃ O ₂) ₄	264.24	hyg. cr.....
33	(di-) bromide, hexa- (hexabromodisilicoethane)	Si ₂ Br ₆	535.62	rhomb. wh.....
34	bromide (di-) sulfide....	SiSBr ₂	219.95	col. pl.....
35	" , tetra- (tetra-bromosilicane)	SiBr ₄	347.72	col. fum. liq., 1.579 ¹⁶ (F).....
36	carbide.....	SiC.....	40.07	hex. col. or blk., 2.654. 2.697.....
37	(di-) chloride, hexa- (hexachlorodisilicoethane)	Si ₂ Cl ₆	268.86	col. liq.....
38	chloride (di-) sulfide....	SiSCl ₂	131.03	col. pr.....
39	chloride, tetra.....	SiCl ₄	169.89	col. fum. liq., 1.412 (C).....
40	" (tri-) sulfide, hydro-	SiCl ₃ HS.....	167.50	col. liq.....
41	fluoride, tetra- (tetra-fluorosilicane)	SiF ₄	104.06	col. gas.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	.....	m.p. -13.5; frz. -90	>100 (93)	d.	d.	.....
2	3.25 ⁻²⁸ g/l	-39; subl. -46.6	-34.5	s. d.	.....	.....
3	.....	68-70	d. 100	d.	d.	.....
4	.....	75-80	-4 I, 100	d.	d.	.....
5	.....	exp. 160-200	d.	i.	i.	v. sl. s. bz., ac. a., CS ₂ ; i. al., eth.
6	3.95 ¹⁵ ₁₅	340-350	subl. 315-7	38.4 ¹⁴	82.5 ¹⁵	6.67 ¹⁴ al., 4.35 ^{15,3} acet.; 1.11 ^{12,9} ac. a.; s. bz.
7	3.6	d. 120	.....	v. s. d.	v. s. d.	s. al., conc. H ₂ SO ₄ ; i. eth., bz., chl., CCl ₄
8	lq. 3.38 ⁵⁰	41.6	217 ⁷⁴⁰ d.	d.	.....	s. CS ₂ , CCl ₄ , chl., H ₂ SO ₄ , bz.
9	2.42 ²²	8.5 (10.9)	176.4	d.	.....	s. CS ₂ , CCl ₄ , chl., bz.
10	2.67	4.6	124	d.	.....	s. al., CCl ₄
11	3.056 ⁹	d. 118-9	.....	i.	i.	s. CS ₂ ; i. eth.
12	.....	<100	d.	i.	.....	d. aq. reg., HNO ₃ ; s. (NH ₄) ₂ S
13	.....	-SO ₂ , 40	.....	d.	.....	s. H ₂ SO ₄ ; i. SO ₂
14	.....	165	183	d.	.....	.....
15	1.72 ⁻⁹⁹ ; 1.533 ²⁰	-94	1.9	.....	.....	.....
16	.....	<-60	80	d.	d.	.....
17	1.145 ⁻¹¹³	-118.1	-30.4	.....	.....	.....
18	2.17 ⁹	-77	66	.....	.....	.....
19	.....	<-60	104	d.	d.	.....
20	1.42 ⁻¹²²	-122	8.3	.....	.....	.....
21	2.7 ¹⁷	<-60	169	d.	d.	d. NH ₃
22	2.434	-39	140.5	d.	d.	.....
23	1.34	-134	33	d.	d.	s. CS ₂ , CCl ₄ , chl., bz.
24	.....	<-60	113.5	d.	.....	.....
25	3.86 ⁹ g/l	ca. -110	-80.2	d.	d.	d. alk., al., eth.; s. tol.
26	3.314	8	220	d.	d.	s. CS ₂ , bz.
27	1.57 ¹⁷	.....	.....	sl. s.	sl. s.	s. alk.; i. NH ₄ Cl
28	2.1-3	.....	.....	i.	i.	s. alk.; i. NH ₄ Cl
29	2.4	1420	2600	i.	i.	s. HF + HNO ₃ ; i. a., HF
30	2.00	.....	2600	i.	i.	s. HF, KOH
31	ca. 2.4	.....	2600	i.	i.	s. HF + HNO ₃ ; i. HF
32	.....	110, subl.	148	.....	d. 160- 170	d. al.
33	.....	95	240	d.	d.	d. KOH; s. CS ₂
34	.....	93	150 ^{13,3}	d.	d.	s. bz., CS ₂
35	2.814	5	153	d.	d.	d. H ₂ SO ₄
36	3.17	>2700	subl. >2000 d. 2210	i.	i.	d. fused KOH; i. a.
37	lq. 1.58 ⁹	-1	139 (145)	d.	d.	d. al.
38	.....	75	92 ^{22,5}	d.	d.	s. CCl ₄ , CS ₂
39	1.483	-70	57.57	d.	d.	d. al.
40	1.45	.....	96-100	d.	d.	d. al.
41	4.67 g/l	-77 (-97)	-65 ¹⁸¹	d.	d.	s. abs. al., eth., HF

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Silicon				
1	hydride (silicane, silane)	SiH ₄	32.09	col. gas
2	“ (disilicoethane, disilicane)	Si ₂ H ₆	62.17	col. gas
3	“ (trisilicopropane, trisilicane)	Si ₃ H ₈	92.24	col. liq.
4	“ (tetrasilicobutane, tetrasilicane)	Si ₄ H ₁₀	122.32	col. liq.
5	iodide, tetra- (tetraiodosilicane)	SiI ₄	535.74	cub. col.
6	(di-) iodide, tetra- (tetraiododisilicoethylene)	Si ₂ I ₄	563.80	orange-red
7	(di) iodide, hexa- (hexaiododisilicoethane)	Si ₂ I ₆	817.64	hex. col.
8	nitride.....	Si ₃ N ₄	140.21	amor. grayish-wh. powd.
9	oxide, di- (cristobalite)	SiO ₂	60.06	cub. or tetr. col., 1.487, 1.484
10	“ “ (lechatelierite)	SiO ₂	60.06	col., 1.46
11	“ “ (quartz)	SiO ₂	60.06	hex. col., 1.544, 1.553
12	“ “ (tridymite)	SiO ₂	60.06	rhomb. col., 1.469, 1.470, 1.471
13	“ “ (amor., opal)	SiO ₂ (+ xH ₂ O).....		col. amor., 1.41-1.46
14	oxychloride.....	Si ₂ OCl ₆	284.86	col. liq.
15	sulfide, mono-.....	SiS.....	60.12	yel. need. or blk. sld.
16	“ , di-.....	SiS ₂	92.18	wh. need.
17	thiocyanate, tetra-.....	Si(SCN) ₄	260.37	small trim. pr.
18	Silicotungstic acid , normal	H ₈ SiW ₁₂ O ₄₀ ·24H ₂ O	3311.52	trig. col.
19	Silicotungstic acid ..	H ₈ SiW ₁₂ O ₄₀ ·30H ₂ O	3419.62	col. or yelsh. tetrag.
20	Silicelyamine , tri-.....	(SiH ₃) ₃ N.....	107.26	inflam. liq.
21	Silicelyl oxide (disiloxane)	(SiH ₃) ₂ O.....	78.17	col. gas
22	Silver	Ag.....	107.88	cub. wh. met., 0.54
23	acetate.....	AgC ₂ H ₃ O ₂	166.92	wh. pl.
24	acetylide.....	Ag ₂ C ₂	239.78	wh. ppt.
25	orthoarsenate.....	Ag ₃ AsO ₄	462.55	cub. dk. red.
26	orthoarsenite.....	Ag ₃ AsO ₃	446.55	yel. powd.
27	azide.....	AgN ₃	149.90	wh. prisms
28	benzoate.....	AgC ₇ H ₅ O ₂	228.99	wh. powd.
29	tetraborate.....	Ag ₂ B ₄ O ₇ ·2H ₂ O.....	407.07	white
30	bromate.....	AgBrO ₃	235.80	tetr. col., 1.847, 1.920
31	bromide (bromyrite)....	AgBr.....	187.80	cub. pa. yel., 2.253
32	carbonate.....	Ag ₂ CO ₃	275.77	yel. powd.
33	chlorate.....	AgClO ₃	191.34	tetr. wh.
34	perchlorate.....	AgClO ₄	207.34	wh. cr., deliq.
35	chloride (cerargyrite)...	AgCl.....	143.34	cub. wh., 2.071
36	chromate.....	Ag ₂ CrO ₄	331.77	monocl. red.
37	dichromate.....	Ag ₂ Cr ₂ O ₇	431.78	tricl. red.
38	citrate.....	Ag ₃ C ₆ H ₅ O ₇	512.74	wh. need.
39	cyanate.....	AgOCN.....	149.90	col.
40	cyanide.....	AgCN.....	133.90	hex. wh.
41	ferricyanide.....	Ag ₃ Fe(CN) ₆	535.59	orange

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	lq. 0.68 ⁻¹⁸⁵ ; 1.44 g/l	-185	-111.8	i.	.....	d. KOH
2	lq. 0.686 ⁻²⁵	-132.5	-14.5	slow d., sl. s.	.....	s. bz., al., CS ₂
3	.725; 0.743 ⁰	-117.4	52.9	d.	d.	d. CCl ₄
4	0.79 ⁰	-93.5	80	d.	.....	.....
5	.....	120.5	290	d.	.....	2.2 ²⁷ CS ₂
6	.....	.....	.....	d.	.....	i. CS ₂ , chl., bz.
7	.....	250	d.	d.	d.	19 ¹⁹ CS ₂
8	3.44	1900 press.; subl.	.....	.....	.....	s. HF
9	2.32	1710	2230 (2590)	i.	i.	s. HF; v. sl. s. alk.
10	2.20	.....	2230 (2590)	i.	i.	s. HF; v. sl. s. alk.
11	2.653-2.660	<1470	2230 (2590)	i.	i.	s. HF; v. sl. s. alk.
12	2.28-2.33	1670	2230 (2590)	i.	i.	s. HF; v. sl. s. alk.
13	2.1-2.3	>1600	.....	i.	i.	s. HF, hot alk.
14	.....	-33	137	d.	d.	d. al.; ∞ CS ₂ , CCl ₄ , chl., eth.
15	1.853 ¹⁵	.....	subl. 940 ²⁰	d.	d.	d. alk., al.
16	.....	subl.	white heat	d.	.....	d. al.; m. dil. alk.; i. bz.
17	.....	143.8	314.2	.....	.....	s. bz.; sl. s. CS ₂ , chl.
18	.....	-18H ₂ O, 100	.....	v. s.	v. s.	v. s. al., eth.
19	.....	-6H ₂ O ca. 28.5; 36-53	.....	v. s.	.....	s. al.
20	0.895 ⁻¹⁰⁶	-105.6	52	.....	.....	.....
21	0.881 ⁻⁸⁰	-144	-15.2	v. sl. s.	sl. d.	.....
22	10.5	960.5	1950	i.	i.	s. HNO ₃ , h. H ₂ SO ₄ , KCN; i. alk.
23	3.259 ¹⁵	d.	.....	0.72 ⁰ ; 1.02 ²⁰	2.52 ⁸⁰	.....
24	.....	exp.	.....	i.	.....	s. a.; sl. s. al.
25	6.657 ²⁵	.....	.....	0.00085 ²⁰	.....	s. ac. a., NH ₄ OH
26	.....	150 d.	.....	0.00115 ²⁰	i.	s. ac. a., NH ₄ OH, HNO ₃ ; i. al.
27	.....	exp. 252	.....	i.	0.01 ¹⁰⁰	s. KCN, dil. HNO ₃ ; sl. s. NH ₄ OH
28	.....	.....	.....	0.262 ²⁵	s.	.017 al.
29	.....	.....	.....	sl. s.	.....	s. a.
30	5.206	d.	.....	.196 ²⁵	1.33 ⁹⁰	s. NH ₄ OH; sl. s. HNO ₃
31	6.473 ²⁵	434	d. 700	8.4×10 ⁻⁶	.00037 ¹⁰⁰	s. KCN, Na ₂ S ₂ O ₃ ; sl. s. NH ₄ OH; i. al.
32	6.077	218 d.	.....	0.0032 ²⁰	0.05 ¹⁰⁰	s. NH ₄ OH, Na ₂ S ₂ O ₃ ; i. al.
33	4.430	230	d. 270	10 ¹⁵	50 ⁸⁰	sl. s. al.
34	2.806 ²⁵	d. 486	.....	525 ²⁵	s.	s. al., tol.
35	5.56	455	1550	.000089 ¹⁰	.0021 ¹⁰⁰	s. NH ₄ OH, Na ₂ S ₂ O ₃ , KCN
36	5.625	.....	.....	0.0014 ⁰	0.008 ⁷⁰	s. a., NH ₄ OH, KCN
37	4.770	d.	.....	0.0083 ¹⁵	d.	s. a., NH ₄ OH, KCN
38	.....	d.	.....	0.028 ¹⁸	.....	s. a., NH ₄ OH, KCN, Na ₂ S ₂ O ₃
39	4.00	d.	.....	sl. s.	s.	s. HNO ₃ , NH ₄ OH, KCN
40	3.95	320 d.	.....	.000023 ²⁰	.....	s. HNO ₃ , NH ₄ OH, KCN, Na ₂ S ₂ O ₃
41	.....	.....	.....	.000066 ²⁰	.....	s. NH ₄ OH, h. (NH ₄) ₂ CO ₃ ; i. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Silver				
1	ferrocyanide	$\text{Ag}_3\text{Fe}(\text{CN})_6$	643.47	yel.
2	fluoride, sub.	Ag_2F	234.76	hex. yel.
3	"	AgF	126.88	cub. yel., deliq.
4	fluosilicate	$\text{Ag}_2\text{SiF}_6 \cdot 4\text{H}_2\text{O}$	429.88	col. cr. or wh. powd., deliq.
5	fulminate	$\text{Ag}_2\text{C}_2\text{N}_2\text{O}_2$	299.80	sm. need.
6	iodate	AgIO_3	282.80	rhomb. col.
7	iodide (iodyrite)	AgI	234.80	hex. yel., 2.21, 2.22
8	lactate	$\text{AgC}_3\text{H}_5\text{O}_3 \cdot \text{H}_2\text{O}$	214.97	wh. or sl. gray cr. powd.
9	laurate	$\text{AgC}_{12}\text{H}_{23}\text{O}_2$	307.19	wh. greasy powd.
10	levulinate	$\text{AgC}_6\text{H}_7\text{O}_5$	222.99	leaf.
11	permanganate	AgMnO_4	226.81	monocl. dk. vlt.
12	mercury iodide (ic)	$2\text{AgI} \cdot \text{HgI}_2$	924.05	deep-yel. powd.
13	myristate	$\text{AgC}_{14}\text{H}_{27}\text{O}_2$	335.24	
14	nitrate	AgNO_3	169.89	rhomb. col., α 1.729, γ 1.788
15	nitrite	AgNO_2	153.89	rhomb. wh.
16	nitroprusside	$\text{Ag}_2\text{Fe}(\text{CN})_5\text{NO}$	431.70	lt. pink.
17	oxalate	$\text{Ag}_2\text{C}_2\text{O}_4$	303.78	col. cr.
18	oxide	Ag_2O	231.76	cub. br.-blk.
19	" , per-	Ag_2O_2 (or AgO)	247.76	cub. gray-blk.
20	palmitate	$\text{AgC}_{16}\text{H}_{31}\text{O}_2$	363.29	wh. greasy powd.
21	orthophosphate	Ag_3PO_4	418.66	cub. yel.
22	pyrophosphate	$\text{Ag}_4\text{P}_2\text{O}_7$	605.56	wh.
23	metaphosphate	AgPO_3	186.90	wh. amor.
24	propionate	$\text{AgC}_3\text{H}_5\text{O}_2$	180.95	wh. leaf. or need.
25	salicylate	$\text{AgC}_7\text{H}_5\text{O}_3$	244.99	wh. to redsh. wh. cr.
26	selenide	Ag_2Se	294.72	cub. thin gray pl.
27	stearate	$\text{AgC}_{17}\text{H}_{35}\text{O}_2$	391.34	wh. powd., amor.
28	sulfate	Ag_2SO_4	311.82	rhomb. wh.
29	sulfide (acanthite)	Ag_2S	247.82	rhomb. gray-blk.
30	" (argentite)	Ag_2S	247.82	cub. blk.
31	sulfite	Ag_2SO_3	295.82	wh. cr.
32	d-tartrate	$\text{Ag}_2\text{C}_4\text{H}_4\text{O}_6$	363.83	scales
33	orthotellurate, tetra-H	$\text{Ag}_2\text{H}_4\text{TeO}_6$	443.40	rhomb. bipyr. straw yel.
34	telluride (hessite)	Ag_2Te	343.37	cub. gray
35	tellurite	Ag_2TeO_3	391.37	yel. wh. ppt.
36	thioantimonite (pyrargyrite)	Ag_3SbS_3 (or $3\text{Ag}_2\text{S} \cdot \text{Sb}_2\text{S}_3$)	541.58	trig., 3.084, 2.881 (Li)
37	thioarsenite (proustite)	Ag_3AsS_3 (or $3\text{Ag}_2\text{S} \cdot \text{As}_2\text{S}_3$)	494.73	trig., 3.088, 2.792
38	thiocyanate	AgSCN	165.96	col. cr. or wh. curd
39	thiosulfate	$\text{Ag}_2\text{S}_2\text{O}_3$	327.88	wh.
40	tungstate	Ag_2WO_4	463.68	pa.-yel. cr.
41	Silver complex: Diamminesilver pererrhenate	$[\text{Ag}(\text{NH}_3)_2]\text{ReO}_4$	392.25	col. monocl. cr.
42	Sodium	Na	22.997	cub. silv. met., 4.22
43	acetate	$\text{NaC}_2\text{H}_3\text{O}_2$	82.04	wh.-gr. powd.
44	"	$\text{NaC}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$	136.09	monocl. pr. col., effl., β 1.464
45	aluminate	NaAlO_2	81.97	amor. wh. powd. hyg.
46	aluminum chloride	$\text{NaCl} \cdot \text{AlCl}_3$	191.80	wh.-yelsh. cr. powd., deliq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				i.	i.	s. NH_4OH , KCN; i. a.
2	8.57	90 d.		d.		
3	5.852 ¹⁵ 5	435		182 ^{15,5}	205 ¹⁰⁵	sl. s. NH_4OH
4		<100	d.	v. s.		
5		exp.		0.075 ¹³	s.	v. s. NH_4OH ; i. HNO_3
6	5.525	>200	d.	0.003 ¹⁰	0.019 ⁶⁰	s. NH_4OH , HNO_3 , KI
7	5.67	d. 552		3×10^{-7}	3×10^{-6}	s. KCN, $\text{Na}_2\text{S}_2\text{O}_3$; sl. s. NH_4OH
8				ca. 7.7		
9		212.5				0.007 ²⁵ al., 0.008 ¹⁵ eth.
10				0.67 ¹⁷	d.	
11		d.		0.55 ⁰	1.69 ^{28,5}	d. al.
12				i.		s. KI, KCN; i. dil. a.
13		211		0.007 ²⁵		0.006 ²⁵ al., 0.007 ¹⁵ eth.
14	4.352 ¹⁹	212	444 d.	122 ⁰	952 ¹⁰⁰	s. eth., glyc.; v. sl. s. abs. al.
15	4.453 ²⁶	d. 140		0.155 ⁰	1.363 ⁶⁰	s. ac. a., NH_4OH ; i. al.
16				i.		s. NH_4OH ; i. al., HNO_3
17	5.029 ⁴	exp. 140		0.00339 ¹⁸		s. a., NH_4OH , KCN
18	7.143 ¹⁶ 6	d. 300		0.0013 ²⁰	0.0053 ³⁰	s. a., NH_4OH , KCN; i. al.
19	7.44	d. >100		i.		s. H_2SO_4 , conc. HNO_3 , NH_4OH
20		209		0.0012 ²⁰ ; 0.004 ³⁵	0.006 ⁶⁰	0.007 ¹⁵ eth.; 0.006 ²⁵ al.
21	6.370 ²⁵	849		.00065 ^{19,5}		s. a., NH_4OH , KCN; i. NH_3
22	5.306 ⁷ 5	585		i.	i.	s. a., NH_4OH , KCN; i. ac. a.
23	6.37	ca. 482		i.		s. HNO_3 , NH_4OH
24	2.687 ²⁵ / ₄			0.842 ²⁰	2.03 ³⁰	
25				s.		s. al.
26	8.0	880	d.	i.		s. h. HNO_3 , NH_4OH
27		205		0.006 ²⁰		0.006 ²⁵ al.; 0.006 ²⁵ eth.
28	5.45 ²⁹ 2	652	d. 1085	0.57 ⁰	1.41 ¹⁰⁰	s. a., NH_4OH ; i. al.
29	7.326	tr. 175	d.	.00002		s. HNO_3 , KCN, conc. H_2SO_4
30	7.317	825	d.	.000014 ²⁰		s. a., KCN
31		d. 100		v. sl. s.		s. a., NH_4OH , KCN; i. HNO_3
32	3.432 ¹⁵	d.		0.2 ¹⁵	0.203 ²⁵	s. a., NH_4OH , KCN
33		d. >200		i.	i.	s. NH_4OH , KCN
34	8.5	955		i.		s. HNO_3 , KCN
35		250-bl.; 450-pa. yel.		i.	i.	s. NH_3 , KCN
36	5.76	>175		i.	i.	s. HNO_3
37	5.49	>175		i.	i.	s. HNO_3
38		d.		.000021 ²⁵	.00064 ¹⁰⁰	s. NH_4OH ; i. a.
39		d.		sl. s.		s. NH_4OH , $\text{Na}_2\text{S}_2\text{O}_3$
40				0.05 ¹⁵		s. HNO_3 , NH_4OH , KCN
41	3.901					1.618 conc. NH_4OH
42	0.97	97.5	880	d. to NaOH	H + H_2	d. al.; i. bz., eth.
43	1.528	324		119 ⁹⁰	170.15 ¹⁰⁰	2.1 ¹⁵ al.
44	1.45	58; 78	123	76.2 ⁹⁰	138.8 ⁶⁰	2.1 ¹⁵ al.; s. eth.
45		1650		s.	v. s.	i. al.
46		185		s.	s.	

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Sodium				
1	aluminum fluoride (cryolite)	$3\text{NaF} \cdot \text{AlF}_3$	209.96	monocl., col., β 1.364.....
2	" trisilicate (albite)	$\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$..	524.29	tri. col., 1.525, 1.529, 1.536.....
3	" sulfate.....	$\text{NaAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$..	458.28	cub. oct. col., 1.4388.....
4	amide (sodamide).....	NaNH_2	39.02	olive grn. fr. impurities, or wh. conchoidal fract.
5	ammonium phosphate (microcosmic salt; stercorite)	$\text{NaNH}_4\text{HPO}_4 \cdot 4\text{H}_2\text{O}$	209.13	monocl. col., 1.439, 1.441, 1.469.....
6	pyroantimonate, di-H...	$\text{Na}_2\text{H}_2\text{Sb}_2\text{O}_7 \cdot \text{H}_2\text{O}$..	421.55	tetr. col.....
7	metaantimonate (Leukonin)	$2\text{NaSbO}_3 \cdot 7\text{H}_2\text{O}$	511.63	cub. col.....
8	orthoarsenate.....	$\text{Na}_3\text{AsO}_4 \cdot 12\text{H}_2\text{O}$	424.10	trig. col., 1.457, 1.466, hex. pr.
9	" , mono-H...	$\text{Na}_2\text{HAsO}_4 \cdot 7\text{H}_2\text{O}$	312.03	monocl. col., 1.462, 1.466, 1.478.....
10	" " " ".....	$\text{Na}_2\text{HAsO}_4 \cdot 12\text{H}_2\text{O}$	402.11	monocl. col. eff., 1.445, 1.450, 1.451.
11	" , di-H...	$\text{NaH}_2\text{AsO}_4 \cdot \text{H}_2\text{O}$	181.94	rhomb. or monocl. col., 1.5382, 1.5535, 1.5607
12	metaarsenate.....	NaAsO_3	145.91	rhomb. eff., 1.479, 1.502, 1.5265....
13	orthoarsenite, mono-H...	Na_2HAsO_3	169.91	col. (exist. quest.).....
14	auride.....	NaAu_2	417.40	cub. yel.....
15	azide.....	NaN_3	65.02	col. hex.....
16	barbital (medinal).....	$\text{NaC}_8\text{H}_{11}\text{N}_2\text{O}_3$	206.18	wh. powd.....
17	benzenesulfonate.....	$\text{NaC}_6\text{H}_5\text{O}_3\text{S}$	180.16	wh. cr.....
18	benzoate.....	$\text{NaC}_7\text{H}_5\text{O}_2$	144.11	col. cr. or wh. amor., or gran. powd.
19	tetraborane deriv.....	$\text{Na}_2\text{B}_4\text{H}_{10}$	99.36	wh. cr. powd.....
20	metaborate.....	NaBO_2 (or $\text{Na}_2\text{B}_2\text{O}_4$)	65.82	hex. pr., col.....
21	".....	$\text{NaBO}_2 \cdot 2\text{H}_2\text{O}$ (or $\text{NaH}_2\text{BO}_3 \cdot \text{H}_2\text{O}$)	101.85	monocl. col.....
22	tetraborate.....	$\text{Na}_2\text{B}_4\text{O}_7$	201.27	.....
23	".....	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 5\text{H}_2\text{O}$	291.36	cub. or hex., deliq.....
24	" (borax).....	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$	381.44	monocl. col., 1.447, 1.469, 1.472, eff
25	perborate.....	$\text{NaBO}_3 \cdot \text{H}_2\text{O}$ (or $\text{NaBO}_2 \cdot \text{H}_2\text{O}_2$)	99.83	.....
26	".....	$\text{NaBO}_3 \cdot 4\text{H}_2\text{O}$ (or $\text{NaBO}_2 \cdot \text{H}_2\text{O}_2 \cdot 3\text{H}_2\text{O}$)	153.88	monocl. col.....
27	bromate.....	NaBrO_3	150.91	cub. col., 1.594.....
28	bromide.....	NaBr	102.91	cub. col.....
29	".....	$\text{NaBr} \cdot 2\text{H}_2\text{O}$	138.95	monocl. col. pr.....
30	bromoaurate.....	$\text{NaAuBr}_4 \cdot 2\text{H}_2\text{O}$	575.89	br.-blk. cr.....
31	bromoiridite.....	$\text{Na}_3\text{IrBr}_6 \cdot 12\text{H}_2\text{O}$	957.78	olive gr. rhomb. eff.....
32	bromoplatinate.....	$\text{Na}_2\text{PtBr}_6 \cdot 6\text{H}_2\text{O}$	828.82	tricl. dk. red.....
33	cacodylate.....	$\text{NaAsC}_2\text{H}_5\text{O}_2 \cdot 3\text{H}_2\text{O}$...	214.02	wh amor. powd. pois.....
34	calcium sulfate.....	$\text{Na}_2\text{Ca}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$...	314.23	monocl. need.....
35	d-camphorate.....	$\text{Na}_2\text{C}_{10}\text{H}_{14}\text{O}_4 \cdot 3\text{H}_2\text{O}$...	298.26	hygr. need.....
36	carbide.....	Na_2C_2	70.01	wh. powd.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.90	1000	.....	sl. s.	.....	d. alk.; i. HCl
2	2.61	1100	.....	.....	.....	.....
3	1.675	61	.....	anh. 110 ¹⁵	anh. 146.3 ³⁰ ; d > 30	s. dil. a.; i. al.
4	.....	210	400	d.	d.	d. hot al.; s. 0.1 g in liq. NH ₃
5	1.554	79 d.	.....	16.7	100	i. al.
6	.....	.....	.....	.03 ^{12.3}	0.3 ¹⁰⁰	sl. s. al.
7	.....	-2H ₂ O, 200	.....	0.031 ^{12.3}	.....	sl. s. al., NH ₄ salts; i. ac. a.
8	1.762-1.804	86.3	.....	38.9 ^{15.5}	.....	1.67 al.
9	1.88	120-130	-H ₂ O, 180	5.46 ⁹	35.09 ³⁴ ; 100 ¹⁰⁰	sl. s. al.
10	1.736-59	28	-12H ₂ O, 100	17.2 ²⁰ ; 56 ¹⁴	140.7 ³⁰	sl. s. al.; i. liq. Cl
11	2.53; 2.67	-H ₂ O, 100-130	d. 200-280	s.	.....	.....
12	2.301	.....	.....	.....	.....	.....
13	1.87	.....	.....	v. s.	v. s.	sl. s. al.
14	.....	d. 700	.....	.....	.....	.....
15	1.846	.....	d. in vac.	40.16 ¹⁰ ; 41.7 ¹⁷	.....	0.314 ¹⁶ al.; s. liq. NH ₃ ; i. eth.
16	.....	.....	.....	20 ²⁵	40 ¹⁰⁰	sl. s. al.; i. eth.
17	.....	.....	.....	35.8 ³⁰	v. s.	.....
18	.....	.....	.....	62.8 ⁵⁰ ; 66 ²⁰	74.2 ¹⁰⁰	.81 ¹⁵ , 1.64 ²⁵ , 8.37 ⁸ al.
19	.....	d. < 180 → Na	B ₂ H ₃	d.	d.	.....
20	2.464	966	1434	s.	v. s.	.....
21	.....	57	-H ₂ O, 120	v. s.	v. s.	.....
22	2.367	741	1575 d.	1.49 ⁰	8.79 ⁴⁰	i. al.
23	1.815	120, H ₂ O	.....	22 ⁶⁵ anh.	52.3 ¹⁰⁰ anh.	.....
24	1.73	75; -8H ₂ O, 60	-10H ₂ O, 200	1.3 ⁰ ; 1.6 ¹⁰	22 ⁵² ; 14.2 ⁵⁵ ; 201 ¹⁰⁰	s. glyc.; v. sl. s. al.; i. a.
25	.....	d. 40	.....	sl. s.	d.	s. glyc., alk.
26	.....	63	-H ₂ O, 130-150	2.55 ¹⁵	3.78 ³²	s. a., al., glyc.
27	3.339 ^{17.5}	381	.....	27.5 ⁰	90.9 ¹⁰⁰	i. al.
28	3.203 ²⁵	755	1390	79.5 ⁰ ; 110 ⁵⁰	121 ¹⁰⁰	sl. s. al.
29	2.176	-2H ₂ O, 51	.....	79.5 ⁰	116 ⁵⁰ ; 118.6 ^{90.5}	sl. s. al.
30	.....	.....	.....	s.	.....	.....
31	.....	100	-H ₂ O, 150	.....	.....	s. NH ₄ OH
32	3.323	d. 150	.....	v. s.	v. s.	v. s. al.
33	.....	ca. 60	.....	200 ¹⁵⁻²⁰ ; ca. 20 ²⁵	.....	ca. 40 ²⁵ al.; 100 ¹⁵⁻²⁰ 90% al.
34	2.64	-2H ₂ O, 80	.....	d.	d.	.....
35	.....	-3H ₂ O, 100	.....	122 ¹⁴	.....	s. al.
36	1.575 ¹⁵	.....	700	d.	d.	d. al.; s. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Sodium				
1	carbonate.....	Na_2CO_3	106.00	wh. powd., hyg.....
2	“ (crystal carbonate, thermonatrite)	$\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$	124.02	rhomb. col. deliq.....
3	carbonate.....	$\text{Na}_2\text{CO}_3 \cdot 7\text{H}_2\text{O}$	232.12	rhomb., bipyr. effl.....
4	“ (washing soda)	$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	286.17	monocl. wh., 1.405, 1.425, 1.440
5	“ , sesqui-.....	$\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$	226.05	monocl. 1.5073.....
6	“ , acid (baking soda)	NaHCO_3	84.02	monocl. wh. pr.....
7	cerium carbonate.....	$\text{Na}_6\text{Ce}(\text{CO}_3)_5 \cdot 12\text{H}_2\text{O}$	794.36	.....
8	chlorate.....	NaClO_3	106.45	cub. or trig. col., 1.513.....
9	perchlorate.....	NaClO_4	122.45	rhomb., deliq.....
10	“.....	$\text{NaClO}_4 \cdot \text{H}_2\text{O}$	140.47	rhbdr. col., deliq.....
11	chloride (common salt, halite)	NaCl	58.45	cub., col., 1.5442.....
12	hypochlorite.....	NaClO	74.45	in solution only.....
13	“.....	$\text{NaClO} \cdot 2\frac{1}{2}\text{H}_2\text{O}$	119.49	col. hyg.....
14	“.....	$\text{NaClO} \cdot 5\text{H}_2\text{O}$	164.54	col.....
15	chloroaurate.....	$\text{NaAuCl}_4 \cdot 2\text{H}_2\text{O}$	398.06	rhomb. yel.....
16	chloroiridate.....	$\text{Na}_2\text{IrCl}_6 \cdot 6\text{H}_2\text{O}$	559.93	tricl. dull red-blk.....
17	chloroiridite.....	$\text{Na}_3\text{IrCl}_6 \cdot 12\text{H}_2\text{O}$	691.03	dk. grn. cr.....
18	chloroosmate.....	$\text{Na}_2\text{OsCl}_6 \cdot 2\text{H}_2\text{O}$	484.97	or. red rhomb. pr.....
19	chloropalladite.....	$\text{Na}_2\text{PdCl}_4 \cdot 3\text{H}_2\text{O}$	348.57	br.-red cr., deliq.....
20	chloroplatinate.....	Na_2PtCl_6	453.97	or. yel. powd.....
21	“.....	$\text{Na}_2\text{PtCl}_6 \cdot 6\text{H}_2\text{O}$	562.06	tricl. yel.-red.....
22	chloroplatinite.....	$\text{Na}_2\text{PtCl}_4 \cdot 4\text{H}_2\text{O}$	455.12	red pr.....
23	chlororhodite.....	Na_3RhCl_6	384.64	tricl. red.....
24	“.....	$\text{Na}_3\text{RhCl}_6 \cdot 18\text{H}_2\text{O}$	708.93	oct. garnet-red effl.....
25	chromate.....	Na_2CrO_4	162.00	yel. rhomb. bipyr.....
26	“.....	$\text{Na}_2\text{CrO}_4 \cdot 10\text{H}_2\text{O}$	342.17	monocl. yel., deliq.....
27	dichromate.....	$\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$	298.05	monocl. pr. red, deliq., 1.661, 1.699, 1.751.....
28	peroxychromate.....	Na_3CrO_8	249.00	or. pl.....
29	cinnamate.....	$\text{NaC}_6\text{H}_7\text{O}_2$	170.14	wh. cr. powd.....
30	citrate.....	$\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 5$ (or $5\frac{1}{2}$) H_2O	348.17	rhomb. wh.....
31	metacolumbate.....	$\text{Na}_2\text{Cb}_2\text{O}_6 \cdot 7\text{H}_2\text{O}$	453.93	pseudo-cub.....
32	cuprocyanide.....	$\text{NaCu}(\text{CN})_2$	138.60	col.....
33	cyanate.....	NaOCN	65.02	.....
34	cyanide.....	NaCN	49.02	cub. col., deliq.....
35	cyanoaurite (aurocyanide)	$\text{NaAu}(\text{CN})_2$	272.23	wh. cr. powd.....
36	enantate (heptoate).....	$\text{NaC}_7\text{H}_{13}\text{O}_2$	152.17	wh. cr. powd. or leaf.....
37	ethylacetoacetate deriv.....	$\text{NaC}_6\text{H}_9\text{O}_3$	152.13	need.....
38	ethylsulfate.....	$\text{NaC}_2\text{H}_5\text{SO}_4 \cdot \text{H}_2\text{O}$	166.13	wh., hex. plates, deliq.....
39	ferricyanide.....	$\text{Na}_3\text{Fe}(\text{CN})_6 \cdot \text{H}_2\text{O}$	298.96	red, deliq.....
40	ferrite.....	$\text{Na}_2\text{Fe}_2\text{O}_4$	221.67	br. hex. pl. or need.....
41	ferricyanide (yellow prussiate of soda)	$\text{Na}_4\text{Fe}(\text{CN})_6 \cdot 10\text{H}_2\text{O}$	484.10	monocl. pa. yel., 1.519, 1.530, 1.544
42	fluoantimonate.....	NaSbF_6	258.76	.....
43	fluoberyllate.....	Na_2BeF_4	131.01	rhomb. or monocl. wh.....
44	fluophosphate.....	$\text{NaPF}_6 \cdot \text{H}_2\text{O}$	186.03	.....
45	fluoride (villiaumite).....	NaF	42.00	tetr. or cub. col., 1.336.....
46	“ , acid.....	$\text{NaF} \cdot \text{HF}$	62.01	rhbdr. col. or wh. cr. powd.....
47	“ orthophosphate.....	$\text{NaF} \cdot \text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$	422.20	.....
48	fluosilicate.....	Na_2SiF_6	188.05	hex. col., 1.312, 1.309.....
49	formaldehydesulfoxylate.....	$\text{NaHSO}_2 \cdot \text{CH}_2\text{O} \cdot 2\text{H}_2\text{O}$	154.12	rhomb. pr. hygr.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.509 ⁰	851	d.	7.1 ⁰	45.5 ¹⁰⁰	sl. s. abs. al.; i. acet.
2	2.25	—H ₂ O, 100	.....	33	33.56 ¹⁰⁰	14 ²⁵ glyc.; i. al., eth.
3	1.51	—H ₂ O, 32	.....	16.90	33.9 ³⁵	.....
4	1.44 ¹⁸	32.5–34.5	—H ₂ O, 33.5	21.52 ⁰	421 ¹⁰⁴	i. al.
5	1.777 (2.112)	d.	.....	13 ⁰	42 ¹⁰⁰	.....
6	2.159–2.22	—CO ₂ , 270	.....	6.9 ⁰	16.4 ⁶⁰	sl. s. al.
7	1.47	—H ₂ O, 100	d. 200	d.	d.	s. ac. a., Na ₂ CO ₃ soln.
8	2.490 ¹⁵	248–261	d.	79 ⁰	230 ¹⁰⁰	s. al., glyc.
9	.....	482 d.	d.	s.	v. s.	s. al.
10	2.02	130	.....	209 ¹⁵	284 ⁵⁰	s. al.
11	2.165	801	1413 (1490)	35.7 ⁰	39.12 ¹⁰⁰	s. glyc.; sl. s. al., liq. NH ₃ ; i. HCl
12	.....	d.	d.	s.	d.	.....
13	.....	57.5	.....	v. s.	.....	.....
14	.....	24.5	.....	29.3 ⁰	94.2 ²³	.....
15	.....	d.	.....	150 ¹⁰	990 ⁶⁰	v. s. al., eth.
16	.....	d. 600	.....	v. s.	v. s.	sl. s. al.
17	.....	—H ₂ O, 50	.....	31.46 ¹⁵	307.26 ³⁵	.....
18	.....	.....	.....	v. s.	.....	s. al.
19	.....	.....	.....	v. s.	.....	s. al.
20	.....	tr. 150–160	.....	s.	v. s.	s. al.
21	2.50	—6H ₂ O, 100	.....	66 ¹⁵	v. s.	11.9 al.; s. aq. Cl; i. eth.
22	.....	100, d.	.....	s.	.....	s. al.
23	.....	d. > 650	.....	v. s.	.....	.....
24	.....	904 d. effl.	.....	v. s.	.....	i. al.
25	2.710–36	.....	.....	87.3 ³⁰	.....	s. meth. al.; sl. s. al.
26	1.483	19.92	.....	31.7 ⁰ ; 50 ¹⁰	126 ¹⁰⁰	sl. s. al.; i. ac. a.
27	2.52 ¹³	—2H ₂ O, 100; anh. 320	d. 400	238 ⁰ ; anh. 180 ²⁰	508 ⁶⁰ ; anh. 433 ⁹⁸	i. al.
28	.....	d. 115	.....	sl. s.	.....	i. al., eth.
29	.....	.....	.....	9.1	5 ¹⁰⁰	s. glyc.; 0.625 90% al.
30	1.857 ^{23.5}	—5H ₂ O, 150	d.	92.6 ²⁵	250 ¹⁰⁰	sl. s. al.
31	4.512–59	—H ₂ O, 100	.....	s.	.....	.....
32	1.013 ²⁰	d. 100	.....	s.	.....	.....
33	.....	.....	.....	s.	s.	i. al., eth.
34	.....	563.7	1496	s.	v. s.	sl. s. al.; s. NH ₃
35	.....	.....	.....	s.	.....	.....
36	.....	240–350	.....	s.	.....	s. al.
37	.....	d.	.....	d.	.....	s. eth.
38	.....	.....	d.	164 ¹⁷	.....	d. alk., H ₂ SO ₄ ; 142 al.
39	.....	.....	.....	18.9 ⁰	67 ¹⁰⁰	i. al.
40	.....	.....	.....	d.	.....	v. s. dil. HCl
41	1.458	.....	.....	31.85 ²⁰	156.5 ³⁸	i. al.
42	3.375	.....	.....	128.6 ²⁰	.....	s. al., acet.
43	.....	d.	.....	1.47 ¹⁸	2.94 ¹⁰⁰	.....
44	2.369 ¹⁹	.....	.....	103.2 ⁰	.....	.....
45	2.79; 2.558 ⁴¹	980–997 (1040)	1700	4.22 ¹⁸	.....	s. HF; v. sl. s. al.
46	.....	.....	.....	s.	s.	.....
47	2.2165	.....	.....	12 ²⁵	57.5 ⁷⁰	.....
48	2.679	d.	.....	0.652 ¹⁷	2.46 ¹⁰⁰	i. al.
49	.....	64	d.	v. s.	.....	d. a.; s. al., alk.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Sodium				
1	formate.....	NaCHO_2	68.02	monocl. col., deliq. wh.
2	2-furanacrylate.....	$\text{NaC}_7\text{H}_5\text{O}_3$	160.11	lt. br. powd.
3	metagermanate.....	Na_2GeO_3	166.59	monocl., wh., deliq., 1.59
4	".....	$\text{Na}_2\text{GeO}_3 \cdot 7\text{H}_2\text{O}$	292.71	rhombic col.
5	d-glutamate ("Ajino-moto").....	$\text{NaC}_5\text{H}_7\text{NO}_4$	169.12	wh. cr., not deliq.
6	glycerophosphate.....	$\text{Na}_2\text{C}_3\text{H}_7\text{O}_5\text{P} \cdot \text{H}_2\text{O}$	234.12	yelsh., viscid liq.; wh. cr. or powd.
7	".....	$\text{Na}_2\text{C}_3\text{H}_7\text{O}_5\text{P} \cdot 5\frac{1}{2}\text{H}_2\text{O}$	315.19	wh. odorl. pl., sc., or powd.
8	gold sulfide.....	$\text{NaAuS} \cdot 4\text{H}_2\text{O}$	324.32	monocl. col.
9	" thiosulfate.....	$\text{Na}_3\text{Au}(\text{S}_2\text{O}_3)_2 \cdot 2\text{H}_2\text{O}$	526.46	wh. odorl. cr.
10	hydride.....	NaH	24.01	silv. need.
11	hydroxide.....	NaOH	40.01	wh., deliq., 1.3576
12	iodate.....	NaIO_3	197.92	rhomb. wh.
13	metaperiodate.....	NaIO_4	213.92	tetr.
14	".....	$\text{NaIO}_4 \cdot 3\text{H}_2\text{O}$	267.97	trig. effl.
15	iodide.....	NaI	149.92	cub. col.
16	".....	$\text{NaI} \cdot 2\text{H}_2\text{O}$	185.95	monocl. col. cr.
17	iodoplatinate.....	$\text{Na}_2\text{PtI}_6 \cdot 6\text{H}_2\text{O}$	1110.84	tri.
18	iron oxalate (ic).....	$\text{Na}_3\text{Fe}(\text{C}_2\text{O}_4)_3 \cdot 5\text{H}_2\text{O}$	478.97	monocl. grn
19	isocyanate.....	NaNCO	65.02	col. need.
20	lactate.....	$\text{NaC}_3\text{H}_5\text{O}_3$	112.07	col. or yelsh. liq. very hyg.
21	magnesium sulfate (bloodite).....	$\text{Na}_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 4\text{H}_2\text{O}$	334.50	monocl. col., 1.486, 1.488, 1.489
22	" tartrate.....	$\text{Na}_2\text{Mg}(\text{C}_4\text{H}_4\text{O}_6)_2 \cdot 10\text{H}_2\text{O}$	546.62	wh. powd. or monocl. pr.
23	manganate.....	$\text{Na}_2\text{MnO}_4 \cdot 10\text{H}_2\text{O}$	345.09	monocl. grn
24	permanganate.....	NaMnO_4	141.93	red.
25	".....	$\text{NaMnO}_4 \cdot 3\text{H}_2\text{O}$	195.98	purp. deliq., cr.
26	methanearsonate (methyl arsenate).....	$\text{Na}_2\text{AsCH}_3\text{O}_3 \cdot 6\text{H}_2\text{O}$	292.04	wh. cr. powd.
27	methoxide.....	$\text{CH}_3\text{ONa} \cdot 2\text{CH}_3\text{OH}$	118.12	wh. powd.
28	methylsulfate.....	$\text{NaCH}_3\text{SO}_4 \cdot \text{H}_2\text{O}$	152.11	col. hyg. cr.
29	molybdate.....	Na_2MoO_4	205.94	opaque wh.
30	".....	$\text{Na}_2\text{MoO}_4 \cdot 2\text{H}_2\text{O}$	241.98	rhbdr. wh.
31	dimolybdate.....	$\text{Na}_2\text{Mo}_2\text{O}_7$	349.89	need. wh.
32	trimolybdate.....	$\text{Na}_2\text{Mo}_3\text{O}_{10} \cdot 7\text{H}_2\text{O}$	619.96	need. acicular.
33	tetramolybdate.....	$\text{Na}_2\text{Mo}_4\text{O}_{13} \cdot 6\text{H}_2\text{O}$	745.89	need; yel. soln.
34	paramolybdate.....	$\text{Na}_6\text{Mo}_7\text{O}_{24} \cdot 22\text{H}_2\text{O}$	1589.99	monocl. col., effl.
35	octamolybdate.....	$\text{Na}_2\text{Mo}_8\text{O}_{25} \cdot 17\text{H}_2\text{O}$	1519.87	monocl. cr.
36	decamolybdate.....	$\text{Na}_2\text{Mo}_{10}\text{O}_{31} \cdot 21\text{H}_2\text{O}$	1879.83	wh. pr.
37	permolybdate.....	$\text{Na}_2\text{Mo}_6\text{O}_{19} \cdot x\text{H}_2\text{O}$		red. br. cr.
38	nitrate (soda niter).....	NaNO_3	85.01	trig. or rhbdr. col., 1.587, 1.336
39	nitride.....	Na_3N	83.00	dk. gray
40	hyponitrite.....	$\text{Na}_2\text{N}_2\text{O}_2$	106.01	
41	nitrite.....	NaNO_2	69.01	rhomb. col.-yel. pr. hyg.
42	nitroplatinitite.....	$\text{Na}_2\text{Pt}(\text{NO}_2)_4$	425.26	pa. yel. rhomb. or monocl. pr., effl.
43	p-nitrophenoxide.....	$\text{NaOC}_6\text{H}_4\text{NO}_2 \cdot 4\text{H}_2\text{O}$	233.16	yel. monocl. pr.
44	nitroprusside.....	$\text{Na}_2(\text{NO})\text{Fe}(\text{CN})_5 \cdot 2\text{H}_2\text{O}$	297.96	rhomb. red.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.92 ²⁰	253		44 ⁰ ; 97.2 ²⁰	160 ¹⁰⁰	s. al.; i. eth.
2	1.919	d.		s.	s.	sl. s. al.; i. eth.
3	3.31 ²²	1083			d.	s. a.
4		83		24.6 ⁰ ; 45.5 ²⁵		s. a.
5		d.		v. s.		
6				s.		s. al.
7			d. > 130	v. s.		i. al.
8		d.		s.		s. al.
9				50		i. al.
10	0.92	800 m.p. d.		d.	d.	s. molten metals; i. CS ₂ , CCl ₄ , bz., NH ₃
11	2.130	318.4	1390	42 ⁰	347 ¹⁰⁰	v. s. al., glyc.; i. acet. eth.
12	4.277 ^{17.5}	d.		2.5 ⁰	34 ¹⁰⁰	s. ac. a.; i. al.
13	3.865 ¹⁵	d. 300		s.		s. H ₂ SO ₄ , HNO ₃ , ac. a.
14	3.219 ²³	d. 175		8		
15	3.667	651	1300	158.7 ⁰	256.8 ²⁰⁰	v. s. al.; s. glyc.
16	3.677 ⁰ ; 2.448 ^{20.5}	752		317.9 ⁰	1550 ¹⁰⁰	v. s. NH ₃
17	2.5			s.		s. al.
18	1.973 ^{17.5}	-4H ₂ O, 100	-10H ₂ O, 200	32.5	182 ¹⁰⁰	
19	1.937 ²⁰			s.	s.	
20		17, d. 149		v. s.		s. al.; i. eth.
21	2.23			s.		
22				s.	s.	
23		17		s.	d.	
24		d.		deliq.	v. s.	
25	2.47	d. 170		v. s.	v. s.	d. alk.; s. NH ₃
26		130-140		ca. 100		sl. s. al.; i. bz., eth., pet. eth., oils
27		d. -CH ₂ OH		s. d.		s. CH ₂ OH
28				s.		s. al.
29	lq. 2.50	687		s.	84 ¹⁰⁰	
30	3.28	687		56.2 ⁰	115.5 ¹²⁰	i. meth. acetate
31		612		sl. s.	sl. s.	
32		528; -6H ₂ C, 100-120		3.879 ²⁰	13.7 ¹⁰⁰	
33				39.8 ²¹	v. s.	
34		700; -H ₂ O 120-200		117.9 ³⁰		
35		-H ₂ O, 20		v. s.	v. s.	
36				sl. s.	0.842 ¹⁰⁰	
37		d.	exp. 100			
38	2.261	306.8	d. 350	73 ⁰	180 ¹⁰⁰	v. s. NH ₃ ; sl. s. glyc., 0.036 ²⁵ ; v. sl. s. acet.
39		d. 300		d.		i. al.
40	2.466 ⁴ ; 1.728 ²⁵	d. 300		d.		3 ²⁰ eth.; 4.4 ²⁰ meth. al.;
41	2.168	271	d. 320	72 ⁰ ; 81.5 ¹⁵	163 ¹⁰⁰	3 abs. al.; v. s. NH ₃
42		-H ₂ O, 100		s.	s.	
43		-2H ₂ O, 36; -4H ₂ O, 120	d.	5.97 ²⁵		sl. s. al.
44	1.72			40 ¹⁵		s. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Sodium				
1	oleate (Eunatrol).....	$\text{NaC}_{18}\text{H}_{33}\text{O}_2$	304.44	wh. cr. or yel. amor. gran.
2	oxalate.....	$\text{Na}_2\text{C}_2\text{O}_4$	134.01	col. cr.: wh. powd.
3	" , acid.....	$\text{NaHC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	130.04	monocl. wh.
4	oxide, mon-.....	Na_2O	61.99	wh.-gray, deliq.
5	" , di- (per-).....	Na_2O_2	77.99	yel.-wh. powd.
6	" " ".....	$\text{Na}_2\text{O}_2 \cdot 8\text{H}_2\text{O}$	222.12	hex.
7	palmitate.....	$\text{NaC}_{16}\text{H}_{31}\text{O}_2$	278.41	cr.
8	" , acid.....	$2\text{NaC}_{16}\text{H}_{31}\text{O}_2 \cdot \text{C}_{16}\text{H}_{32}\text{O}_2$	813.24	
9	pentobarbital (nem-butal)	$\text{NaC}_{11}\text{H}_{17}\text{N}_2\text{O}_3$	248.26	
10	phenobarbital (luminal)	$\text{NaC}_{12}\text{H}_{11}\text{N}_2\text{O}_3$	254.22	wh.
11	1-phenol-4-sulfonate (p)	$\text{NaC}_6\text{H}_5\text{O}_4\text{S} \cdot 2\text{H}_2\text{O}$	232.19	col. monocl., or gran., sl. eff.
12	phenoxide (phenolate).....	NaOC_6H_5	116.10	wh. deliq. cr. need.
13	hypophosphate.....	$\text{Na}_4\text{P}_2\text{O}_6 \cdot 10\text{H}_2\text{O}$	430.19	monocl., 1.477, 1.482, 1.504
14	" , di-H.....	$\text{Na}_2\text{H}_2\text{P}_2\text{O}_6 \cdot 6\text{H}_2\text{O}$	314.15	monocl. col., 1.486, 1.490, 1.504
15	orthophosphate.....	$\text{Na}_3\text{PO}_4 \cdot 10\text{H}_2\text{O}$	344.17	col. oct.
16	" " ".....	$\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$	380.21	trig. col., 1.446, 1.452
17	" , mono-H.....	$\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$	178.05	rhombic-bi-sphenoidal, 1.4629
18	" " ".....	$\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$	268.14	monocl. pr., 1.4424
19	" " ".....	$\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$	358.22	rhomb. or monocl. col. effl., wh. powd., 1.432, 1.436, 1.437
20	" di-H.....	$\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$	138.05	rhomb. col., 1.456, 1.485, 1.487
21	pyrophosphate.....	$\text{Na}_4\text{P}_2\text{O}_7$	266.03	wh. cr., 1.425
22	" " ".....	$\text{Na}_4\text{P}_2\text{O}_7 \cdot 10\text{H}_2\text{O}$	446.19	monocl. col., 1.450, 1.453, 1.460
23	" , di-H.....	$\text{Na}_2\text{H}_2\text{P}_2\text{O}_7 \cdot 6\text{H}_2\text{O}$	330.15	monocl. 1.460, 1.465, 1.465
24	metaphosphate (glass)	NaPO_3	101.98	col., hyg., amor., 1.485
	metaphosphate (sol.).....	NaPO_3	101.98	col., 1.474 1.478, 1.480
	metaphosphate (insol)	NaPO_3	101.98	col., 1.498, 1.510, 1.529
25	phosphide.....	Na_3P	100.01	red.
26	hypophosphite.....	$\text{NaH}_2\text{PO}_2 \cdot \text{H}_2\text{O}$	106.05	monocl. col., deliq.
27	orthophosphite, mono-H.....	$\text{Na}_2\text{HPO}_3 \cdot 5\text{H}_2\text{O}$	216.10	rhomb. wh., deliq., β 1.443
28	" , di-H.....	$\text{NaH}_2\text{PO}_3 \cdot 2\frac{1}{2}\text{H}_2\text{O}$	149.07	monocl., 1.419, 1.431, 1.449
29	phthalate.....	$\text{Na}_2\text{C}_8\text{H}_4\text{O}_4$	210.11	wh. powd. pearly pl.
30	picrate.....	$\text{NaC}_6\text{H}_2\text{N}_3\text{O}_7 \cdot \text{H}_2\text{O}$	269.11	yel. need.
31	platinate.....	$\text{Na}_2\text{PtO}_3 \cdot 3\text{H}_2\text{O}$	343.27	hex. red-br. or yel.
32	metaplumbate.....	$\text{Na}_2\text{PbO}_3 \cdot 3\text{H}_2\text{O}$	355.25	lt. yel.-wh. fused, hyg. lumps
33	propionate.....	$\text{NaC}_3\text{H}_5\text{O}_2$	96.07	wh. gran. powd.
34	pyrohypophenate.....	$\text{Na}_4\text{Re}_2\text{O}_7 \cdot \text{H}_2\text{O}$	594.62	sandy yel. cr.
35	perrhenate.....	NaReO_4	273.31	col. hex. pl.
36	perruthenate.....	$\text{NaRuO}_4 \cdot \text{H}_2\text{O}$	206.71	blk. cr. lamellar
37	salicylate.....	$\text{NaC}_7\text{H}_5\text{O}_3$	160.11	wh. cr. powd.
38	selenate.....	Na_2SeO_4	188.95	rhomb. col.
39	" " ".....	$\text{Na}_2\text{SeO}_4 \cdot 10\text{H}_2\text{O}$	369.12	monocl. col.
40	selenide.....	Na_2Se	124.95	wh. to red, deliq. cr.
41	selenite.....	$\text{Na}_2\text{SeO}_3 \cdot 5\text{H}_2\text{O}$	263.04	wh. cr., tetrag.
42	metasilicate.....	Na_2SiO_3	122.05	monocl. col., α 1.518, γ 1.527
43	" " ".....	$\text{Na}_2\text{SiO}_3 \cdot 9\text{H}_2\text{O}$	284.20	effl. rhomb. bipyramids
44	disilicate.....	$\text{Na}_2\text{Si}_2\text{O}_5$	182.11	rhomb. pearly luster, 1.500, 1.510, 1.515
45	tetrasilicate (water glass) (?)	$\text{Na}_2\text{Si}_4\text{O}_9(?)$	302.23	amor. col., deliq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		232-5		10 ¹²		10 ³² al; sl. s. eth.
2	2.34			3.7 ²⁰	6.33 ¹⁰⁰	
3				1.7 ¹⁵	21 ¹⁰⁰	
4	2.27		1275 subl.	d.	d.	d. al.
5	2.805	460 d.	d. 657	s.	d.	d. al, NH ₃ ; s. dil. a.; i. alk.
6		d. 30	d.	s.	d.	i. al.
7		270				
8		115-17		i.	i.	s. h. eth.
9				s.	s. d.	s. al.
10				v. s.		s. al.; i. eth., chl.
11			d.	23.8 ²⁵	125 ¹⁰⁰	0.71 ²⁵ , 7.4 ¹⁰⁰ al., 20 ²⁵ glye.
12				v. s.		d. a.; s. al., acet.
13	1.823	d.		1.49 ²⁵	5.46 ⁵⁰	
14	1.849	250	-6H ₂ O, 100	2.25	25	s. dil. H ₂ SO ₄ , NH ₄ OH; i. al.
15	2.536 ^{17.5} anh.	100				
16	1.645 ⁴ ; 1.62 ²⁰	73.3-76.7 d.	-12H ₂ O, 100	1.5 ⁹ ; 25.8 ²⁰	157 ⁷⁰	i. CS ₂
17	2.066 ¹⁵	-H ₂ O, 92.5		82.5 ⁵⁰	96.6 ⁵⁰	
18	1.6789	-5H ₂ O, 48		63.9 ⁴⁰		
19	1.52	34-41	-H ₂ O, 36.4; -12H ₂ O, 100	4.15	87.4 ³⁴	i. al.
20	2.040	-H ₂ O, 100; d. 204	-2H ₂ O, 200	59.9 ⁹ ; 110.3 ²⁰	427 ¹⁰⁰	v. sl. s. chl., tol., eth.; i. al.
21	2.534	880		3.16 ⁹	40.26 ¹⁰⁰	
22	1.815-36	880; -H ₂ O, 93.8		5.41 ⁹	93.11 ¹⁰⁰	i. al., NH ₃
23	1.85	-H ₂ O, 220		s. d.	d.	
24	2.484 ²⁰ 2.476	cr. 300 627.6 tr. 500		v. s. 21 i.	v. s. i.	i. i. i.
25		d.		d. ev. PH ₃		
26		d. viol.		100	667 ¹⁰⁰	v. s. al.; s. glyc.; sl. s. NH ₃ , NH ₄ OH
27		53	200-250 d.	s.	v. s.	i. al., NH ₄ OH
28		42	-5H ₂ O, 100	56 ⁹	193 ⁴²	
29				v. s.		
30		-H ₂ O, 150	expl. 310	5.58 ³⁰		sl. s. al.
31		-3H ₂ O, 150-70	d.	s.		sl. s. HCl; i. al.
32				d. to PbO ₂		d. acids; s. alk.; hyd. al.
33				s.		s. al.
34				.004		
35		300 in O ₂		25 ²⁰		s. al.
36		d. 440 ^{vac.}		v. s.	d.	
37				111 ¹⁵	125 ²⁵	17 ¹⁵ al.; 25 glye.
38	3.098			84 ³⁵	72.8 ¹⁰⁰	
39	1.603-1.620	ca 32 trans.		43.5 ²⁰	78.7 ³⁰	
40	2.625 ¹⁰	>875		d.		i. NH ₃
41				s.	s.	i. al.
42	2.4	1088		s.	s. d.	i. al., Na and K salts
43		40-48	-6H ₂ O, 100	v. s.	v. s.	29 ¹⁸ N/2 NaOH; i. al., a.
44		874		s.	s.	
45				s.	s.	i. al., Na and K salts

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Sodium				
1	silicotungstate (normal)	$\text{Na}_4\text{SiW}_{12}\text{O}_{40} \cdot 20\text{H}_2\text{O} (?)$	3327.41	col. tricl.
2	silver thiosulfate	$2\text{Na}_2\text{S}_2\text{O}_3 \cdot \text{Ag}_2\text{S}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$	680.14	wh. to gray cr. powd.
3	stannate	$\text{Na}_2\text{SnO}_3 \cdot 3\text{H}_2\text{O}$ (or $\text{Na}_2\text{Sn}(\text{OH})_6$)	266.74	hex. col. trig. wh. powd. or lumps...
4	metastannate	$\text{Na}_2\text{Sn}_3\text{O}_{11} \cdot 4\text{H}_2\text{O}$	887.56	wh. cr. powd.
5	stearate	$\text{NaC}_{18}\text{H}_{35}\text{O}_2$	306.46	wh. powd., fatty odor
6	succinate	$\text{Na}_2\text{C}_4\text{H}_4\text{O}_4 \cdot 6\text{H}_2\text{O}$	270.16	wh. gran. or powd.
7	" , tetrahydroxy- (dihydroxytartrate)	$\text{Na}_2\text{C}_4\text{H}_4\text{O}_5 \cdot 3\text{H}_2\text{O}$	280.12	wh. ppt.
8	sulfanilate	$\text{NaC}_6\text{H}_6\text{NO}_3\text{S} \cdot 2\text{H}_2\text{O}$	231.21	wh., lust. cr. leaf
9	sulfate (thenardite)	Na_2SO_4	142.05	rhomb., 1.464, 1.474, 1.485
10	"	Na_2SO_4	142.05	monocl. col.
11	"	Na_2SO_4	142.05	hex. col. (> 500)
12	"	$\text{Na}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$	268.17	rhomb. or tetr. wh.
13	" (Glauber's salt, mirabilite)	$\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$	322.22	monocl. col. effl., 1.394, 1.396, 1.398
14	sulfate, acid	NaHSO_4	120.07	tricl. col.
15	"	$\text{NaHSO}_4 \cdot \text{H}_2\text{O}$	138.08	monocl. col., deliq.
16	pyrosulfate	$\text{Na}_2\text{S}_2\text{O}_7$	222.11	wh. transluc. cr., deliq.
17	peroxydisulfate	$\text{Na}_2\text{S}_2\text{O}_8$	238.11	wh. cr. powd.
18	sulfide, mono-	Na_2S	78.05	amor. yel.-pink or wh., deliq.
19	"	$\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$	240.20	tetr. col., deliq.
20	" , hydro-	NaHS	56.07	rhomb. col. or wh. gran. cr.
21	"	$\text{NaHS} \cdot 2\text{H}_2\text{O}$	92.10	col. need., deliq.
22	"	$\text{NaHS} \cdot 3\text{H}_2\text{O}$	110.11	col. lust. rhomb. cr.
23	" , tetra-	Na_2S_4	174.23	yel. cub. hyg. cr.
24	" , penta-	Na_2S_5	206.29	yel. (exist. quest.)
25	hyposulfite	$\text{Na}_2\text{S}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$	210.15	monocl. (?) col. cr. or yel.-wh. powd.
26	sulfite	Na_2SO_3	126.05	hex. pr. or wh. powd.
27	"	$\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$	252.17	monocl. col., efflor.
28	" , acid	NaHSO_3	104.07	monocl. wh., yel. in soln.
29	pyrosulfite (metabisulfite)	$\text{Na}_2\text{S}_2\text{O}_5$	190.11	col. pr., wh.
30	d (& l)-tartrate	$\text{Na}_2\text{C}_4\text{H}_4\text{O}_6 \cdot 2\text{H}_2\text{O}$	230.10	rhomb. col.
31	d-tartrate, acid	$\text{NaHC}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$	190.09	wh. cr. powd., rhomb.
32	dl-tartrate, acid	$\text{NaHC}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$	190.09	monocl. or tricl.
33	tellurate	$\text{Na}_2\text{TeO}_4 \cdot 2\text{H}_2\text{O}$	273.64	hex. pl.
34	tellurite	Na_2TeO_3	221.60	wh. rhomb. pr.
35	thioantimonate (Schlippe's salt)	$\text{Na}_3\text{SbS}_4 \cdot 9\text{H}_2\text{O}$	481.14	cub. pa. yel.
36	thioarsenate	$\text{Na}_3\text{AsS}_4 \cdot 8\text{H}_2\text{O}$	416.27	monocl. yel., β 1.6802
37	thiocarbonate	$\text{Na}_2\text{CS}_3 \cdot \text{H}_2\text{O}$	172.20	yel. need., deliq.
38	thiocyanate	NaSCN	81.08	rhomb. col. pois., deliq.
39	dithionate	$\text{Na}_2\text{S}_2\text{O}_6 \cdot 2\text{H}_2\text{O}$	242.15	clear, rhomb., 1.482, 1.495, 1.519
40	thiosulfate (hypo)	$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$	248.20	monocl. col., effl., 1.489, 1.508, 1.536
41	trititanate	$\text{Na}_2\text{Ti}_3\text{O}_7$	301.69	wh. need.
42	tungstate	Na_2WO_4	293.91	wh. rhomb.
43	"	$\text{Na}_2\text{WO}_4 \cdot 2\text{H}_2\text{O}$	329.95	rhomb. col., pl.
44	paratungstate	$\text{Na}_6\text{W}_7\text{O}_{24} \cdot 16\text{H}_2\text{O}$	2097.68	col. tricl.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	.....	-7H ₂ O, 100	d.	v. s.	v. s.	s. a.; sl. s. al.
2	.....	.....	.....	s.	.....	.....
3	.....	-3H ₂ O, 140	.....	61.3 ^{15.5}	50 ¹⁰⁰	i. al., acet.
4	.....	d. 60	.....	sl. s.	d.	i. al., alk., NaOH
5	.....	.....	.....	s.	s.	s. h. al.
6	.....	.....	.....	21.45 ⁰	86.63 ⁷⁵	v. sl. s. al.
7	.....	d.	.....	0.032 ⁰	d.	d. min. a.; i. al., eth.
8	.....	.....	.....	s.	.....	.....
9	2.698	884, tr. -mcl. 100	.....	4.76 ⁰	42.7 ¹⁰⁰	s. glyc.; i. al.
10	.....	tr.-hex. 500; 884	.....	48.8 ⁴⁰	42.5 ¹⁰⁰	d. HI
11	.....	884	.....	s.	s.	.....
12	.....	tr. to anh. 24.4	.....	19.5 ⁰	44 ²⁰	i. al.
13	1.464	d. 32.4	.....	11 ⁰	92.7 ³⁰	i. al.
14	2.435 ¹³ ; 2.742	>315; d. 240-50	d. to Na ₂ S ₂ O ₇	28.6 ²⁵	100 ¹⁰⁰	d. al.; sl. s. al.; i. NH ₃
15	.....	58.54 ± .05	.....	ca. 67, d.	v. s. d.	i. al.
16	2.658 ²⁵	400.9	d. 460	s.	.....	s. fum. H ₂ SO ₄
17	.....	.....	.....	s. d.	.....	i. al.
18	1.856 ¹⁴	ca. 920	.....	15.4 ¹⁰	57.2 ⁹⁰	d. a.; sl. s. al.; i. eth.
19	2.471	920 d.	.....	47.5 ¹⁰	96.7 ⁵⁰	d. a.; sl. s. al.
20	.....	350	.....	v. s.	.....	s. al.
21	.....	d.	.....	s.	s.	d. a.; s. al.
22	.....	22	d.	s.	s.	s. al.
23	.....	275	d.	s.	.....	s. al.
24	.....	251.8	.....	s.	s.	s. al.
25	.....	d. 52	.....	25.4 ²⁰	d.	d. a.; s. alk.; i. al.
26	2.633 ^{15.4}	.....	d.	12.54 ⁰	28.3 ⁸⁰	sl. s. al.; i. liq. Cl ₂ , NH ₃
27	1.561; 1.539 ¹⁵	-7H ₂ O, 150	d.	32.8 ⁰	196 ⁴⁰	sl. s. al.
28	1.48	d.	.....	v. s.	v. s.	sl. s. al.
29	1.48	d. >150	.....	54 ²⁰	81.7 ¹⁰⁰	i. al.
30	1.818	.....	.....	29 ⁶	66 ⁴³	i. al.
31	.....	-H ₂ O, 100	d. 234	6.7 ¹⁸	9.2 ³⁰	.....
32	.....	-H ₂ O, 100	d. 219	8.9 ¹⁹	.....	i. al.
33	.....	d.	d.	0.77 ¹⁸	2 ¹⁰⁰	s. h. dil. HNO ₃ ; i. NaOH soln.
34	.....	.....	.....	sl. s.	s.	.....
35	1.839	d.	.....	20.15 ⁰ ; 33	100	i. al.
36	.....	d.	.....	v. s.	d.	i. al.
37	.....	d.	.....	s.	d.	s. al.; i. bz., eth.
38	.....	287	.....	139.3 ^{21.3}	v. s.	v. s. al.
39	2.189	-H ₂ O, 110; -SO ₂ , 267	.....	6.05 ⁰ ; 47.6 ¹⁶	90.9 ¹⁰⁰	i. al., HCl
40	1.729 ¹⁷ (1.685)	45-50; d. 48.0	.....	79.4 ⁰	291.1 ⁴⁵ ; 301.5 ⁶⁰	s. NH ₃ ; i. al.
41	3.35-3.50	.....	.....	i.	.....	i. h. HCl
42	4.179	698	.....	.....	.....	.....
43	3.23-.25	-2H ₂ O, 100, anh. 698	.....	41 ⁰ ; 82.5 ²⁰	123.5 ¹⁰⁰	sl. s. NH ₃ ; i. a., al.
44	3.987	-12H ₂ O, 100 -16H ₂ O, 300	.....	8	d.	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Sodium				
1	metauranate.....	Na_2UO_4	348.06	gr. yel. or red pl. or rhomb. pr., or powd.
2	peruranate.....	$\text{Na}_4\text{UO}_8 \cdot x\text{H}_2\text{O}$		yel. cr. powd.....
3	uranyl acetate.....	$\text{Na}_2\text{UO}_2(\text{C}_2\text{H}_3\text{O}_2)_3$	470.20	tetr. yel. cr., 1.501.....
4	" carbonate.....	$2\text{Na}_2\text{CO}_3 \cdot \text{UO}_2\text{CO}_3$	542.09	yel. cr.....
5	urate.....	$\text{Na}_2\text{C}_5\text{H}_2\text{N}_4\text{O}_3 \cdot \text{H}_2\text{O}$	230.11	hard, cr. nodules or wh. gran. powd.
6	" acid.....	$\text{NaHC}_5\text{H}_2\text{N}_4\text{O}_3$	190.10	wh. gran. powd.....
7	valerate.....	$\text{NaC}_5\text{H}_5\text{O}_2$	124.12	col. cr. or wh. deliq. mass.....
8	orthovanadate.....	Na_3VO_4	183.94	col. hex. pr.....
9	".....	$\text{Na}_3\text{VO}_4 \cdot 10\text{H}_2\text{O}$	364.10	wh. cubic or hex. cr. 1.5305; ω 1.5398, ϵ 1.5475
10	".....	$\text{Na}_3\text{VO}_4 \cdot 16\text{H}_2\text{O}$	472.20	cr. col. need.....
11	pyrovanadate.....	$\text{Na}_4\text{V}_2\text{O}_7$	305.89	hex.....
12	metavanadate.....	NaVO_3	121.95	col. monoc. pr.....
13	xanthate.....	$\text{NaC}_3\text{H}_5\text{OS}_2$	144.19	yelsh. powd.....
14	zinc uranyl acetate.....	$\text{Na}_2\text{Zn}(\text{UO}_2)_3(\text{C}_2\text{H}_3\text{O}_2)_9 \cdot 9\text{H}_2\text{O}$	1592.13	tab. monoc. cr. α 1.475, γ 1.480.....
15	zirconium fluoride.....	$5\text{NaF} \cdot 2\text{ZrF}_4$	544.43	monoc. pr.....
16	Stannous and Stannic			
17	Strontium			
18	acetate.....	$\text{Sr}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \frac{1}{2}\text{H}_2\text{O}$	214.73	wh. cr. powd.....
19	orthoarsenate, acid.....	$\text{SrHAsO}_4 \cdot \text{H}_2\text{O}$	245.56	rhomb. need.....
20	orthoarsenite.....	$\text{Sr}_3(\text{AsO}_3)_2 \cdot 4\text{H}_2\text{O}$	580.77	cr. or wh. powd.....
21	tetraborate.....	$\text{SrB}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$	314.97	
22	boride.....	SrB_6	152.55	blk. cr.....
23	bromate.....	$\text{Sr}(\text{BrO}_3)_2 \cdot \text{H}_2\text{O}$	361.48	monoc. col.-yelsh. hyg.....
24	bromide.....	SrBr_2	247.46	wh. need., hyg.....
25	".....	$\text{SrBr}_2 \cdot 6\text{H}_2\text{O}$	355.56	hex. col., hyg.....
26	carbide.....	SrC_2	111.65	tetr. blk.....
27	carbonate.....	SrCO_3	147.64	rhomb. col. or wh. powd., 1.516, 1.664, 1.666.....
28	chlorate.....	$\text{Sr}(\text{ClO}_3)_2$	254.54	rhomb. col. or wh. powd., 1.567, 1.605, 1.626.....
29	".....	$\text{Sr}(\text{ClO}_3)_2 \cdot 8\text{H}_2\text{O}$	398.67	wh. need.....
30	chloride.....	SrCl_2	158.54	cub. col., <1.6.....
31	".....	$\text{SrCl}_2 \cdot 2\text{H}_2\text{O}$	194.58	transp. leaf.....
32	".....	$\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$	266.64	trig. col., 1.536, 1.487.....
33	fluoride.....	$\text{SrCl}_2 \cdot \text{SrF}_2$	284.17	tetr. 1.651, 1.627.....
34	chromate.....	SrCrO_4	203.64	monoc. yel.....
35	cyanide.....	$\text{Sr}(\text{CN})_2 \cdot 4\text{H}_2\text{O}$	211.73	wh. rhomb., deliq.....
36	ferrocyanide.....	$\text{Sr}_2\text{Fe}(\text{CN})_6 \cdot 15\text{H}_2\text{O}$	657.45	monoc. yel.....
37	fluoride.....	SrF_2	125.63	cub. col. or wh. powd.....
38	fluosilicate.....	$\text{SrSiF}_6 \cdot 2\text{H}_2\text{O}$	265.72	monoc.....
39	formate.....	$\text{Sr}(\text{CHO}_2)_2$	177.67	rhomb., 1.559, 1.574, 1.598.....
40	".....	$\text{Sr}(\text{CHO}_2)_2 \cdot 2\text{H}_2\text{O}$	213.70	rhomb. col., 1.484, 1.521, 1.538.....
41	glycerophosphate.....	$\text{SrC}_3\text{H}_7\text{O}_8\text{P}$	257.74	wh. powd.....
42	hydroxide.....	$\text{Sr}(\text{OH})_2$	121.65	wh. deliq.....
43	".....	$\text{Sr}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$	265.78	tetr. col., deliq., 1.499, 1.476.....
44	iodide.....	SrI_2	341.47	col. pl.....
45	".....	$\text{SrI}_2 \cdot 6\text{H}_2\text{O}$	449.57	hex. col.-yelsh., deliq.....
46	lactate.....	$\text{Sr}(\text{C}_3\text{H}_5\text{O}_3)_2 \cdot 3\text{H}_2\text{O}$	319.82	wh. cr. or gran. powd.....
47	permanganate.....	$\text{Sr}(\text{MnO}_4)_2 \cdot 3\text{H}_2\text{O}$	379.54	cub. purp.....
48	molybdate.....	SrMoO_4	247.58	tetr.....
49	nitrate.....	$\text{Sr}(\text{NO}_3)_2$	211.65	cub. col., 1.567.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				i.	i.	s. dil. a., alk. carb.
2				sl. s.	d.	d. HCl, H ₂ SO ₄ , ac. a.
3	2.56					
4		d. 400		sl. s.		i. al.
5					1.3 ¹⁰⁰	v. sl. s. 90% al.
6				0.083	0.8 ¹⁰⁰	
7		140		s.		s. al.
8		850-66		s.		i. al.
9				s.	s.	
10		866 (anh.)		v. s.	d.	i. al.
11		632-54		s.	s.	i. al.
12		630		21.1 ²⁵	38.8 ⁷⁵	
13				s.		m. al.
14				i.		
15				.387 ¹⁸	1.67 ¹⁰⁰	
16						
17	2.6	752 (800)	1150	d.	d.	s. a., al., liq. NH ₃
18	anh. 2.099			s.		sl. s. al.
19	3.606 ¹⁵ ; anh. 4.035	-H ₂ O, 125		0.284 ^{15.5}	d.	s. a.
20				sl. s.		s. a.; sl. s. al.
21					77 ¹⁰⁰	s. HNO ₃ , NH ₄ salts
22	3.3			i.	i.	s. HNO ₃
23	3.773	-H ₂ O, 120	d. 240	33 ¹⁶		
24	4.216 ²⁴	643	d.	85.2 ⁰	222.5 ¹⁰⁰	s. al., amyl. al.
25	2.358 ¹⁸	d. 20	-6H ₂ O, >180	204.2 ⁰	∞	s. al.; i. eth.
26	3.2			d.	d.	d. a.
27	3.70	1497 ⁸⁰ atm.	-CO ₂ , 1340	0.0011 ¹⁸	0.065 ¹⁰⁰	0.12 aq. CO ₂ ; s. a., NH ₄ salts
28	3.152	120 d.		174.9 ¹⁸	v. s.	s. al.; i. abs. al.
29				s.	v. s.	s. al.
30	3.052	873		43.5 ⁰	100.8 ¹⁰⁰	v. sl. s. abs. al., acet.; i. NH ₃
31	2.6715 ²⁵					
32	1.93	-4H ₂ O, 60	-6H ₂ O, 100	106.2 ⁰	205.8 ⁴⁰	3.8 ⁸ al.
33	4.18	962		d.	d.	s. conc. HCl, HNO ₃ ; i. al.
34	3.895 ¹⁵			0.12 ¹⁵	3 ¹⁰⁰	s. ac. a., HCl, HNO ₃ , NH ₄ salts
35		d.		v. s.		
36				50	100	
37	4.24	1190		0.011 ⁰	0.012 ²⁷	s. h. HCl; i. HF
38	2.99 ^{17.5} d.	d.		3.2 ¹⁵	v. s.	.065 ¹⁵ 50% al.; s. HCl
39	2.69	71.9		s.	s.	
40	2.695	d.		s.	s.	
41				sl. s.		i. al.
42	3.625	375		0.41 ⁰	21.83 ¹⁰⁰	s. a., NH ₄ Cl
43	1.90	-8H ₂ O, 100		0.90 ⁰	47.71 ¹⁰⁰	s. a., NH ₄ Cl; i. acet.
44	4.549 ²⁵	402	d.	165.3 ⁰	383 ¹⁰⁰	3.1 ⁴⁰ , 4.3 ³⁹⁰ abs. al.
45	4.415			448.9 ⁰	∞	s. al.; i. eth.
46				25	200 ¹⁰⁰	sl. s. al.
47	2.75	d. 175		270 ⁰	291 ¹⁸	
48	4.145			0.0104 ¹⁷		s. a.
49	2.986	570		40.1 ⁰	100 ⁹⁰	.012 abs. al.; v. s. NH ₃ ; sl. s. acet.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Strontium				
1	nitrate.....	$\text{Sr}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$	283.71	monocl. wh.
2	nitrite.....	$\text{Sr}(\text{NO}_2)_2 \cdot \text{H}_2\text{O}$	197.66	hex.
3	oxalate.....	$\text{SrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	193.67	col.
4	oxide.....	SrO	103.63	cub. gray-wh.
5	" , per-.....	SrO_2	119.63	wh. powd.
6	" , ".....	$\text{SrO}_2 \cdot 8\text{H}_2\text{O}$	263.76	col. cr.
7	orthophosphate, di-.....	SrHPO_4	183.66	rhomb. col.
8	salicylate.....	$\text{Sr}(\text{C}_6\text{H}_5\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	397.88	col. cr.
9	selenate.....	SrSeO_4	230.59	rhomb.
10	metasilicate.....	SrSiO_3	163.69	col. pr., 1.618.
11	sulfate (celestite).....	SrSO_4	183.69	rhomb. col., 1.622, 1.624, 1.631.
12	" , acid.....	$\text{Sr}(\text{HSO}_4)_2$	281.77	col.
13	sulfide, mono-.....	SrS	119.69	cub. lt. gray
14	" , hydro-.....	$\text{Sr}(\text{HS})_2$	153.77	cryst
15	" , tetra-.....	$\text{SrS}_2 \cdot 6\text{H}_2\text{O}$	323.97	redsh. cr.
16	sulfite.....	SrSO_3	167.69	col. cr.
17	tartrate.....	$\text{SrC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$	307.77	monocl.
18	thiocyanate.....	$\text{Sr}(\text{SCN})_2 \cdot 3\text{H}_2\text{O}$	257.83	deliq.
19	dithionate.....	$\text{SrS}_2\text{O}_6 \cdot 4\text{H}_2\text{O}$	319.81	trig., 1.530, 1.525
20	thiosulfate.....	$\text{SrS}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$	289.83	monocl. need.
21	tungstate.....	SrWO_4	335.55	tetr.
22	Sulfamic acid (amido-sulfonic acid)	$\text{H}_2\text{NSO}_2\text{H}$	97.09	col. rhomb.
23	Sulfamide (sulfuryl amide)	$\text{SO}_2(\text{NH}_2)_2$	96.11	rhomb. pl.
24	Sulfur , rhombic (α).....	S_8	256.48	rhomb. yel., 1.957.
25	" , monoclinic (β).....	S_8	256.48	monocl. pa. yel., 2.038.
26	" , amorphous (γ).....	S_8	256.48	pa. yel. amor.
27	bromide, mono-.....	S_2Br_2 (or SBr)	223.95	red liq., 1.736.
28	chloride, mono-.....	S_2Cl_2 (or SCl)	135.03	yelsh. red liq., 1.666 ¹⁴ .
29	" , di-.....	SCl_2	102.97	dk. red liq., 1.557 ¹¹ .
30	" , tetra-.....	SCl_4	173.89	yel. br. liq.
31	fluoride, mono-.....	S_2F_2	102.12	col. gas.
32	" , tetra-.....	SF_4	108.06	gas (exist. quest.)
33	" , hexa-.....	SF_6	146.06	col. gas.
34	iodide, mono-.....	S_2I_2	317.96	brittle gray-blk., met. lust. (exist. quest.)
35	" , hexa-.....	SI_6	793.58	gray-blk. cr. (exist. quest.)
36	(penta-) nitride, di-.....	S_5N_2	188.32	red liq. or gray solid.
37	(tetra-) " , tetra-.....	S_4N_4	184.27	monocl. or-red.
38	oxide, sesqui-.....	S_2O_3	112.12	bl.-grn. cr.
39	" , di-.....	SO_2	64.06	col. gas or liq., suffoc. odor, 1.410 lq.
40	" , tri- (α -).....	SO_3	80.06	trim. col. cr. or liq., 1.4097.
41	" , " (β -).....	$(\text{SO}_3)_2$	160.12	silky, fibrous need.
42	" , hept-.....	S_2O_7	176.12	visc. liq. or need. (exist. quest.)
43	" , tetra-.....	SO_4	96.06	wh. solid.
44	oxytetrachloride, mono-.....	S_2OCl_4	221.95	dk. red liq.
45	" , tri-.....	$\text{S}_2\text{O}_3\text{Cl}_4$	253.95	rhomb. need. or pl., wh
46	Sulfuric acid	H_2SO_4	98.08	col. oily liq. or hex. cr., 1.429.
47	" ".....	$\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$	116.09	col. liq. or monocl. pr., 1.438.
48	" ".....	$\text{H}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$	134.11	col. liq., 1.405.
49	" ".....	$\text{H}_2\text{SO}_4 \cdot 4\text{H}_2\text{O}$	170.14	
50	" " , peroxy-mono- (permono-Caro's acid)	H_2SO_5	114.08	wh. cr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.2			60.43 ⁹⁰	206.5 ¹⁰⁰	v. sl. s. abs. al.; i. HNO ₃
2	2.408 ⁰ ₀	—H ₂ O, >100	d. 240	58.9 ⁹⁰	182 ¹⁰⁰	.42 ²⁰ 90% al.
3		—H ₂ O, 150		0.0051 ¹⁸	5 ¹⁰⁰	s. HCl, HNO ₃
4	4.7	2430		d. Sr(OH) ₂		sl. s. al.; i. eth., acet.
5	4.56	d.		0.008 ²⁰	d.	v. s. al., NH ₄ Cl; i. acet.
6	1.951	—8H ₂ O, 100	d.	0.018 ²⁰	d.	s. al., NH ₄ Cl; i. NH ₄ OH
7	3.544 ¹⁵			i.	i.	s. a., NH ₃ salts
8		d.		5.6 ²⁵	28.6 ¹⁰⁰	1.5 ²⁵ , 9.5 ⁷⁸ al.
9	4.23			i.	i.	s. h. HCl; i. HNO ₃
10	3.65	1580		i.	i.	
11	3.96	1580 d.	d.	0.0113 ⁹⁰	0.0114 ³⁰	sl. s. a.; i. dil. H ₂ SO ₄ , al.
12		d.		d.		14 ⁷⁰ H ₂ SO ₄
13	3.70 ¹⁵			s. d.		s. a., al.; i. acet.
14		d.		s.	d.	
15		25		s.		s. al.
16		d.		0.0033 ¹⁷		v. s. H ₂ SO ₃ ; s. a.
17	1.966			0.112 ⁹	0.755 ⁶⁵	
18		—3H ₂ O, 100	d. 160–70	v. s.		v. s. al.
19	2.373	—4H ₂ O, 78		22 ¹⁶	67 ¹⁰⁰	i. al.
20	2.17 ¹⁷	—4H ₂ O, 100		25 ¹³	57 ¹⁰⁰	i. al.
21	6.187	d.		0.14		d. a.; i. al.
22	2.03 ¹²	200 d.		d.		
23		91.5	d. 250	s.		s. al.
24	2.07; liq. 1.803	112.8; tr. mcl. 95.5	444.6	i.	i.	23 ⁰ CS ₂ ; s. tol.; sl. s. al., bz., eth.
25	1.96	119.25	444.6	i.	i.	70 CS ₂ ; s. al., bz.
26	1.92; 1.9556 ⁰	ca. 120	444.6	i.	i.	i. CS ₂
27	2.635	—40	54 ^{0.2}	d.	d.	s. CS ₂
28	1.678	—80	135.6	d.	d.	s. CS ₂ , bz., eth.
29	1.621 ¹⁵ ₁₅	—78	59	d.	d.	d. al., eth.; s. bz., CCl ₄
30		—30	d. —15	d.	d.	
31	liq. 1.5 ^{—100}	—105.5	—99	d.	d.	d. KOH
32		—124	—40	d.	d.	
33	6.50 g/l; liq. 1.91	—56	—63.8 subl.	v. sl. s.	sl. s.	s. KOH; sl. s. al.
34						s. CS ₂ ; sl. s. glyc.
35					d.	s. CS ₂
36	1.901 ¹⁸	11	d.	i.		s. eth.; sl. s. al., CS ₂
37	2.22 ¹⁵	179 subl.	exp. 160	d.		s. CS ₂ , chl., bz., NH ₃ ; sl. s. al., eth.
38		d. 70–95		d.	d.	s. fum. H ₂ SO ₄
39	2.927 g/l; liq. 1.434	—72.7	—10.0	22.8 ⁹⁰	0.58 ⁹⁰	s. al., H ₂ SO ₄ , ac. a.
40	2.75; liq. 1.925 ¹³	16.83	44.8	d.	d.	Forms fuming sulfuric acid with H ₂ SO ₄
41	liq. 1.97	62.2; 32.2 ³⁹⁸	44.6; (subl. 50)	d.	d.	
42		0	subl. 10	d.	d.	s. H ₂ SO ₄
43		0–3 d.		s. d.		d. dil. H ₂ SO ₄
44	1.656 ⁹		60–1	d.	d.	d. viol. al.
45		57 d.		d.	d.	d. al.
46	1.834	10.49	330 (98.3%) d.	∞ ev. ht.	∞	d. al.; misc. org. solv.
47	1.788	8.62	290	∞	∞	d. al.
48	1.650 ⁹	—38.9	167	∞	∞	d. al., eth.
49		—24.5		∞	∞	d. al., eth.
50		45 d.		d.	d.	s. H ₃ PO ₄

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	Sulfuric acid , peroxydi-(per(di)sulfur-ic)	$H_2S_2O_8$	194.14	hyg. cr.
2	Sulfuric acid , pyro...	H_2SO_7	178.14	col. cr., hyg.
3	Sulfurous acid	H_2SO_3	82.08	in solution only
4	" " , hypo-	$H_2S_2O_4$	130.14	in solution only
5	Sulfuryl chloride	SO_2Cl_2	134.97	col. liq., 1.444
6	" " , pyro-, chloride.	$S_2O_5Cl_2$	215.03	col. liq., 1.449 ¹⁹
7	fluoride	SO_2F_2	102.06	col. gas.
8	See also under Thio .			
9	Tantallic acid , meta-(tantalum hydroxide)	$HTaO_3$	229.89	col. cr.
10	Tantalum	Ta	180.88	cub. gray-blk. met. or blk. powd.
11	bromide	$TaBr_5$	580.46	yel. cr.
12	carbide	TaC	192.89	
13	chloride	$TaCl_5$	358.17	lt.-yel. cr. powd.
14	fluoride	TaF_5	275.88	tetr. col.
15	hydroxide	$Ta(OH)_5$	265.92	wh. amor. or cr.
16	nitride	TaN	194.89	hex. blk.
17	(tri-) nitride, di-	Ta_3N_5	612.68	amor. yel.-red
18	oxide, tetr-	Ta_2O_4 (or TaO_2)	425.76	dk.-gray powd.
19	" " , pent-	Ta_2O_5	441.76	rhomb. col.
20	sulfide	Ta_2S_4 (or TaS_2)	490.00	amor. or cr.
21	Telluric acid , ortho-	$H_6TeO_6 \cdot 4H_2O$ (or $H_2TeO_4 \cdot 6H_2O$)	301.72	hex. need.
22	" " "	H_6TeO_6 (or $H_2TeO_4 \cdot 2H_2O$)	229.66	cub. or monoc. col.
23	" " , allo-	$(H_2TeO_4)_x$		wh. powd.
24	Tellurium	Te_2	255.22	rhbdr. sil.-wh. met., 1.0025
25	"	Te_2	255.22	amor. br.-blk., 1.0025
26	bromide, di-	$TeBr_2$	287.44	steel gray-grn. need., unst.
27	" " , tetra-	$TeBr_4$	447.27	or. cr.
28	" " , acid	$TeBr_4 \cdot HBr \cdot 5H_2O$	618.28	need. or.-red
29	chloride, di-	$TeCl_2$	198.52	blk. cr. or amor., unst.
30	" " , tetra-	$TeCl_4$	269.44	wh. to yel. cr., deliq.
31	ethoxide	$Te(OC_2H_5)_4$	307.85	
32	fluoride, tetra-	TeF_4	203.61	cr. wh.
33	" " , hexa-	TeF_6	241.61	col. gas, unpleas. odor, 1.0009
34	iodide, di-	TeI_2	381.45	blk. cr.
35	" " , tetra-	TeI_4	635.29	gray cr.
36	" " , acid	$TeI_4 \cdot HI \cdot 8$ (or 9) - H_2O	907.35	rect. pr. met. luster
37	methoxide	$Te(OCH_3)_4$	251.75	solid
38	nitrate, basic	$Te_2O_3(OH)NO_3$	382.24	rhomb. col.
39	oxide, mon-	TeO	143.61	amor., blk.
40	" " , di- (tellurite)	TeO_2	159.61	tetr. or rhomb. wh., 2.00, 2.18 (Li), 2.35
41	" " , tri-	TeO_3	175.61	or. cr.
42	sulfate, basic	$Te_2O_3SO_4$	399.28	rhomb. col.
43	sulfide	TeS_2	191.73	red-blk. amor. powd. (exist. quest.)
44	sulfur oxide	$TeSO_3$	207.67	amor. deep red solid

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	.....	65 d.	d.	d.	d.	s. al., eth., H ₂ SO ₄
2	1.9	35	d.	d.	d.	d. al.
3	.....	.....	.....	s.	.....	s. al., eth., ac. a.
4	.....	.....	.....	s.	.....	.....
5	1.6674	-54.1	69.1	d.	d.	s. ac. a., bz.
6	g. 9.6 g/l; lq. 1.818 ¹¹ / ₄	-39 to -37	140	d.	d.	d. a.
7	3.72 g/l	-120	-52	10 ⁹	.....	s. al.; sl. s. alk.
8	.....	.....	.....	.....	.....	.....
9	.....	.....	.....	i.	.....	s.
10	met. 16.6; powd. 14.491	2996	ca. 4100	i.	i.	s. HF, fused alk.; i. a.
11	4.67	240	320	d.	d.	s. abs. al., eth.
12	.....	3877	5500	i.	i.	sl. s. H ₂ SO ₄ , HF
13	3.68 ²⁷	221	242	d.	.....	s. abs. al., H ₂ SO ₄
14	4.74	96.8	229.5	s.	.....	s. HF
15	.....	.....	.....	i.	.....	s. alk.; i. a.
16	.....	3360	.....	i.	.....	.....
17	.....	ign.	.....	i.	.....	s. HNO ₃ + Hf; i. a.
18	.....	oxidizes	.....	i.	.....	i. a.
19	8.735 ^{61.2}	1470 d.	.....	i.	i.	s. fus. KHSO ₄ ; i. a.
20	.....	d. > 1300	.....	i.	i.	sl. s. HF + HNO ₃ ; i. HCl
21	.....	-4H ₂ O, 10	.....	13.92 ⁰	.....	s. alk., dil. a.; sl. s. strong a.; i. al.
22	cub. 3.05; mcl. 5.09	-2H ₂ O, 140	.....	19.7 ⁰	258.5 ¹⁰⁰	s. a., alk.; i. al.
23	3.44 ^{19.2}	d. > 160	.....	sl. s.	s.	s. al.; sl. s. KOH
24	6.25	452	1390	i.	i.	s. H ₂ SO ₄ , HNO ₃ , aq. reg., KCN, KOH; i. HCl, CS ₂
25	6.00	452	1390	i.	i.	s. H ₂ SO ₄ , HNO ₃ , aq. reg., KCN, KOH; i. HCl, CS ₂
26	.....	210 (280)	339	d.	.....	d. NaOH; sl. s. min. a., tart. a.
27	4.31 ¹⁶ / ₄	380 ± 6	421	sl. s. d.	d.	s. min. a., tart. a., NaOH
28	.....	20	.....	d.	d.	.....
29	7.05	209 ± 5(175)	327	d.	d.	d. NaOH; sl. s. min. a., tart. a.
30	3.26; lq. 2.559 ²³²	224 (214)	414	s. d.	s. d.	s. HCl, bz., al., chl., CCl ₄ ; i. CS ₂
31	.....	20	107-107.5 ^{5.6}	.....	.....	.....
32	.....	subl.	.....	d.	d.	.....
33	3.025 ^{-36.5}	-36	-35.5	d.	d.	d. a., alk.
34	.....	subl.	.....	i.	i.	.....
35	8.403 ¹⁵	259	d.	sl. s.	d.	s. Hl, alk., aq. NH ₃
36	.....	-55	.....	d.	d.	.....
37	.....	.....	123-4	.....	.....	.....
38	.....	-NO ₂ , 190	d.	sl. d.	d.	s. NaOH, a.
39	.....	d.	d.	i.	i.	s. HCl, dil. a., H ₂ SO ₄ , NaOH
40	tetr. 5.67 ¹⁵ ; rhomb. 5.91 ⁰	dull red	subl. 450	0.00067	.....	s. HCl, HNO ₃ , alk.; i. NH ₄ OH
41	5.08 ^{10.5}	d.	.....	i.	i.	d. conc. HCl; s. h. KOH; i. a., al.
42	4.7	d. 500	.....	d.	.....	s. HCl, HNO ₃
43	.....	.....	.....	i.	.....	s. alk., sulfides; i. a.
44	.....	soft. 30 d.	d.	d.	rapid d.	s. H ₂ SO ₄

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	Tellurous acid	H_2TeO_3	177.63	rhomb. or monoc. col.
2	Terbium	Tb	159.20	.....
3	chloride	TbCl_3	265.57	wh. need.
4	"	$\text{TbCl}_3 \cdot 6\text{H}_2\text{O}$	373.67	col. cr., hyg.
5	nitrate	$\text{Tb}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$	453.32	monoc. need. col.
6	oxide (terbia)	Tb_2O_3	366.40	wh. cr.
7	" , per-	Tb_4O_7 (?)	748.80	dk. br. or blk.
8	sulfate	$\text{Tb}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	750.71	cryst.
9	Thallium	Tl	204.39	tetr. bl. wh. mct.
10	acetate	$\text{TlC}_2\text{H}_3\text{O}_2$	263.43	silk wh. cr., deliq.
11	azide	TlN_3	246.41	yel.
12	bromate	TlBrO_3	332.31	col.
13	bromide, mono-	TlBr	284.31	cub. yelsh. wh.
14	" , di-	TlBr_2	364.22	yel. need.
15	" , tri-	TlBr_3	444.14	yel., deliq. (exist. quest.)
16	"	$\text{TlBr}_3 \cdot 4\text{H}_2\text{O}$	516.20	lt.-yel. need.
17	carbonate	Tl_2CO_3	468.79	monoc. col.
18	chlorate	TlClO_3	287.85	.....
19	perchlorate	TlClO_4	303.85	col.
20	chloride, mono-	TlCl	239.85	cub. col. or wh. powd.
21	" , sesqui-	Tl_2Cl_3 (or Tl_4Cl_6)	515.15	hex. yel. or yel. powd.
22	" , tri-	TlCl_3	310.76	hex. pl.
23	"	$\text{TlCl}_3 \cdot \text{H}_2\text{O}$	328.78	.....
24	"	$\text{TlCl}_3 \cdot 4\text{H}_2\text{O}$	382.83	col. need.
25	chloroplatinate	Tl_2PtCl_6	816.75	pa. orange cr.
26	chromate	Tl_2CrO_4	524.79	yel.
27	dichromate	$\text{Tl}_2\text{Cr}_2\text{O}_7$	624.80	red cr.
28	cyanide	TlCN	230.41	tabl.
29	ethoxide	$[\text{TiOC}_2\text{H}_5]_4$	997.80	col. liq.
30	ferrocyanide	$\text{Ti}_4\text{Fe}(\text{CN})_6 \cdot 2\text{H}_2\text{O}$	1065.54	triol. yel.
31	fluoride, mono-	TiF	223.39	cub. oct. col.
32	" , tri-	TiF_3	261.39	olive grn.
33	fluosilicate	$\text{Ti}_2\text{SiF}_6 \cdot 2\text{H}_2\text{O}$	586.87	hex. pl.
34	hydroxide (ous)	TiOH	221.40	pa. yel. need.
35	" , ortho- (ic)	$\text{Ti}(\text{OH})_3$	255.41	hex. br.
36	" , meta- "	TiOOH	237.40	yel. cr. or red br. amor.
37	iodide, mono-	TiI	331.31	cub. red; rhomb. yel.
38	" , sesqui-	Ti_2I_3	789.54	blk. need.
39	" , tri-	TiI_3	585.15	br. need.
40	methoxide	TiOCH_3	235.42	wh. cr. powd.
41	myristate	$\text{TiC}_{14}\text{H}_{27}\text{O}_2$	431.75	wh. powd.
42	nitrate (ous) (α)	TiNO_3	266.40	cubic.
43	" " (β)	TiNO_3	266.40	trig.
44	" " (γ)	TiNO_3	266.40	rhomb., α 1.817.
45	" , (ic)	$\text{Ti}(\text{NO}_3)_3$	390.41	cryst.
46	" "	$\text{Ti}(\text{NO}_3)_3 \cdot 3\text{H}_2\text{O}$	444.46	rhomb. col., deliq.
47	oleate	$\text{TiC}_{18}\text{H}_{35}\text{O}_2$	485.84	wh. cr. clusters.
48	oxalate	$\text{Ti}_2\text{C}_2\text{O}_4$	496.80	monoc. pr.
49	oxide (ous)	Ti_2O	424.78	blk., deliq.
50	" (ic)	Ti_2O_3	456.78	hex. blk., amor. br.
51	palmitate	$\text{TiC}_{16}\text{H}_{31}\text{O}_2$	459.80	cr. need.
52	phenoxide	$[\text{TiOC}_6\text{H}_5]_3$	892.47	wh. cr.
53	orthophosphate	Ti_3PO_4	708.19	col. need.
54	" , di-H	TiH_2PO_4	301.43	monoc.
55	pyrophosphate	$\text{Ti}_4\text{P}_2\text{O}_7$	991.60	monoc. pr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d. 40		0.00067	d.	s. NaOH, a.; sl. s. NH ₄ OH; i. al.
2						
3	4.35	588		s.		s. al.
4				v. s.		
5		89.3		s.		
6						
7						s. dil. a.
8		-8H ₂ O, 360				s. min. m.
9	11.85	302	1457 ± 10	3.561 ²⁰	2.51 ⁴⁰	m. HNO ₃ , H ₂ SO ₄ ; sl. s. HCl
10	3.68	110		i.	i.	v. s. al.
11		334		v. s.		
12				v. sl. s.		
13	7.557 ^{17.3}	460	815	0.35 ²⁰		
14				.05 ²⁵	.25 ⁶⁸	s. al.; i. HBr, acet.
15		d.		d.	d.	
16				s.	v. s.	v. s. al.
17	7.11	273		v. s.		s. al.
18	5.047 ⁹			4.03 ^{15.5}	27.2 ¹⁰⁰	i. abs. al., eth., acet.
19	4.89	501	d.	20 ²⁰	57.31 ¹⁰⁰	
20	7.00	430	720 (806)	20.5 ³⁰	167 ¹⁰⁰	sl. s. al.
				0.32 ²⁰	1.97 ¹⁰⁰	sl. s. HCl; i. a., NH ₄ OH, al.
21	5.9	400-500	d.	0.26 ¹⁵	1.9 ¹⁰⁰	
22		25	d.	v. s.		
23		-H ₂ O, 60	d. 100	v. s.	d.	
24		37		86.2 ¹⁷	d.	s. al., eth.
25	5.76 ¹⁷			0.0064 ¹⁵	0.05 ¹⁰⁰	
26				0.03 ⁶⁰	0.2 ¹⁰⁰	sl. s. a., alk.; i. ac. m.
27				i.		d. a.
28		d.		16.8 ^{28.5}		
29	3.522	-3	d. 80	s. d.		9.11 ²⁵ al.; s. bz; i. liq. NH ₃
30	4.641			0.37 ¹⁸	3.93 ¹⁰¹	
31			300	78.6 ¹⁵	v. s.	sl. s. al.
32				d.		i. c. HCl
33				v. s.		
34			d. 139	25.9 ⁹	52 ⁴⁰ ; 148 ¹⁰⁰	s. al.
35		>340		i.		v. s. dil. a.
36		-H ₂ O, 115		i.		s. a., NH ₄ salts, al.; i. alk.
37	7.09	440	824	.0064 ²⁰	0.120 ¹⁰⁰	s. HNO ₃ . aq. reg.; sl. s. al.; i. KI
38				i.		sl. s. al.
39						s. al., eth.
40		d. >120		s. d.		1.70 ²⁵ CH ₃ OH; 3.16 ²⁵ bz.
41		120-3				0.52 ²⁵ 50% al.
42		206	430	9.55 ²⁰	413 ¹⁰⁰	s. acet.; i. al.
43		tr. 145 -α				
44	5.556 ^{21.4}	tr. 75 -β		3.91 ⁹	414 ¹⁰⁰	s. acet.; i. al.
45				s.		
46		d. 100		d.	d.	
47		131-2		0.05 ¹⁵	0.3 ³⁰	1.75 ¹⁵ , 3.0 ²⁵ al.
48	6.31			1.48 ¹⁵	9.02 ¹⁰⁰	
49		300	1080 ⁶⁰⁰ ; -O, 1865	v. s., d. t	o TIOH	s. a., al.
50	amor. 9.65 ²¹ ; hex. 10.19 ²²	717 ± 5	-2O, 875	i.	i.	s. a.; i. alk.
51		115-7		0.01 ¹⁵	0.07 ⁶⁰	0.20 ¹⁵ , 1.04 ⁴⁵ al.
52		233-5		d.		s. h. bz., pyr.; sl. s. lgr.
53	6.89			0.5 ¹⁵	0.67 ¹⁰⁰	s. NH ₄ salts; i. al.
54	4.723	ca. 190		sl. s.	sl. s.	i. al.
55	6.786 ²⁰	>120		40		

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Thallium				
1	picrate.....	$\text{TlC}_6\text{H}_2\text{N}_3\text{O}_7$	432.49	red monoc. or yel. tricl.....
2	selenate.....	Tl_2SeO_4	551.74	rhomb. need., 1.949, 1.959, 1.964...
3	selenide.....	Tl_2Se	487.74	gray leaf.....
4	silver nitrate.....	$\text{TlNO}_3 \cdot \text{AgNO}_3$	436.29	wh. cr. powd.....
5	stearate.....	$\text{TlC}_{18}\text{H}_{35}\text{O}_2$	487.85	need.....
6	sulfate (ous).....	Tl_2SO_4	504.84	rhomb. col., 1.860, 1.867, 1.885....
7	" " , acid.....	THSO_4	301.46	
8	sulfate (ic).....	$\text{Tl}_2(\text{SO}_4)_3 \cdot 7\text{H}_2\text{O}$	823.07	col. leaf.....
9	sulfide (ous).....	Tl_2S	440.84	tetr. bl.-blk.....
10	" (ic).....	Tl_2S_3	504.96	blk. amor.....
11	sulfite.....	Tl_2SO_3	488.84	cryst.....
12	tellurate.....	Tl_2TeO_4	600.39	heavy ppt. wh.....
13	thiocyanate.....	TlSCN	262.47	tetr. col.....
Thio compounds:				
14	Thiocarbonyl chloride (thiophosgene)	CSCl_2	114.98	red-yel. liq., 1.5442.....
15	Thiocarbonyl chloride, tetra-	CSCl_4	185.90	yel.....
16	Thiocyanic acid.....	HSCN	59.09	col. gas.....
17	Thionyl bromide.....	SOBr_2	207.89	or.-yel. liq.....
18	" " chloride.....	SOBrCl	163.43	yel.....
19	" " chloride.....	SOCl_2	118.97	col. yel. liq., 1.527 ¹⁰
20	" " fluoride.....	SOF_2	86.06	col. gas.....
21	Triphosphoric acid.....	$\text{PS}(\text{OH})_3$	114.10	
22	Thiophosphoryl amide.....	$\text{PS}(\text{NH}_2)_3$	111.15	amor. yel.-wh.....
23	" " bromide.....	PSBr_3	302.83	cub. yel.....
24	" " ".....	$\text{PSBr}_3 \cdot \text{H}_2\text{O}$	320.84	yel. cr.....
25	" " ".....	PSBrCl_2	213.91	yel. liq.....
26	(mono-) chloride, di-Thiophosphoryl bromide (di-) chloride	PSBr_2Cl	258.37	pale gr. fum. liq.....
27	Thiophosphoryl chloride	PSCl_3	169.45	col. liq. 1.563 (C).....
28	" " fluoride	PSF_3	120.08	gas.....
29	Thiosulfuric acid.....	$\text{H}_2\text{S}_2\text{O}_3$	114.14	in soln. only.....
30	Thorium	Th	232.12	cub. gray, radioactive.....
31	boride, tetra-	ThB_4	275.40	pr.....
32	" " , hexa-	ThB_6	297.04	amor., violet.....
33	bromide.....	ThBr_4	551.78	col. cr.....
34	carbide.....	ThC_2	256.14	tetrag. yel.....
35	carbonate.....	$\text{Th}(\text{CO}_3)_2$	352.14	(exist. quest.).....
36	chloride.....	ThCl_4	373.95	rhomb. wh., deliq.....
37	cyanoplatinite.....	$\text{Th}(\text{Pt}(\text{CN})_4)_2 \cdot 16\text{H}_2\text{O}$	1118.98	rhomb. yel. grn.....
38	fluoride.....	ThF_4	308.12	wh. powd., cub.....
39	fluoride.....	$\text{ThF}_4 \cdot 4\text{H}_2\text{O}$	380.18	cr.....
40	hydroxide.....	$\text{Th}(\text{OH})_4$	300.15	wh. gelat.....
41	iodide.....	ThI_4	739.80	
42	nitrate.....	$\text{Th}(\text{NO}_3)_4$	480.15	plates, deliq.....
43	" " ".....	$\text{Th}(\text{NO}_3)_4 \cdot 4\text{H}_2\text{O}$	552.22	col.....
44	" " ".....	$\text{Th}(\text{NO}_3)_4 \cdot 12\text{H}_2\text{O}$	696.35	col. leaf, deliq.....
45	oxalate.....	$\text{Th}(\text{C}_2\text{O}_4)_2$	408.16	wh. cr.....
46	" " ".....	$\text{Th}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$	516.26	wh. amor. powd.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	red 3.164 ¹⁷ ; yel. 2.993 ¹⁷	exp. 273-5	.....	0.135 ⁵⁰	2.43 ⁷⁰	0.40 CH ₃ OH
2	6.875	>400	.....	2.13 ¹⁰	8.5 ⁸⁰	i. al., eth.
3	.....	340	.....	i. ....	.....	i. a.
4	.....	75	.....	s. ....	.....	.....
5	.....	119	.....	0.005 ¹⁵	0.095 ⁷⁵	0.18 ¹⁸ , 0.60 ⁶⁰ al.
6	6.77	632	d.	4.87 ²⁰	15.57 ^{99.7}	.....
7	.....	120 d.	.....	.....	.....	v. sl. s. aq. H ₂ SO ₄
8	.....	-6H ₂ O, 220	d.	d.	.....	s. dil. H ₂ SO ₄
9	8.0	443	d.	0.02 ²⁰	sl. s.	s. a.; i. alk., acet.
10	.....	soft. 12; 260	d.	i.	i.	s. h. H ₂ SO ₄
11	6.427	.....	.....	3.34 ¹⁵	v. s.	i. al.
12	5.712; 6.760 ^{17.6}	red heat	.....	sl. s.	sl. s.	.....
13	.....	.....	.....	0.315 ²⁰	0.727 ⁴⁰	i. al.
14	1.509 ¹⁵	.....	73.5	d.	.....	d. al.; s. eth.
15	1.712 ¹³	.....	146-7	.....	d.	.....
16	.....	>-10 d.	.....	v. s.	.....	v. s. al., eth., bz.
17	2.68 ¹⁸	-52 to -50	138 ⁷⁷³ ; 684 ⁴⁰	d.	d.	s. bz., chl., CS ₂ , CCl ₄
18	lq. 2.31 ¹⁰	.....	115 d.	d.	.....	.....
19	1.655 ^{10.4}	-105	78.8 ⁷⁴⁶	d.	d.	d. a., al., alk.; s. bz., chl.
20	2.93	-110	-30	d.	d.	s. eth., bz., chl. acet., AsCl ₃
21	.....	.....	.....	s.	d.	s. al.
22	1.7 ¹³	d. 200	.....	sl. s.	d.	.....
23	2.85 ¹⁷	38	d. 175	d.	.....	s. CS ₂ , eth., PCl ₃
24	2.794 ¹⁸	35	.....	.....	.....	.....
25	lq. 2.12 ²⁰	-30	150 d.	d.	.....	.....
26	lq. 2.48 ⁵⁰	-60	95 ⁶⁰	d.	.....	.....
27	lq. 1.635	-35	125	d.	.....	s. CS ₂ , CCl ₄ , bz.
28	.....	3.87 ^{6atm.}	d.	sl. sol., sl. d.	.....	s. eth.; i. CS ₂ , bz.
29	.....	.....	.....	s.	.....	.....
30	11.2	1845	>3000	i.	i.	s. HCl, H ₂ SO ₄ , aq. reg.; sl. s. HNO ₃
31	7.5 ¹⁵	.....	.....	i.	i.	s. HNO ₃ , HCl, h. H ₂ SO ₄
32	6.4 ¹⁵	.....	.....	i.	i.	s. HNO ₃ ; i. H ₂ SO ₄ , HCl, HF, aq. alk.
33	5.67	.....	subl. 610	s.	s.	.....
34	8.96	2773; ign.	5000	d.	.....	v. sl. s. conc. a.
35	.....	.....	.....	i.	d.	s. conc. Na ₂ CO ₃ ; i. aq. CO ₂
36	4.59	820; subl. 720-50	d. 1100	v. s.	v. s.	s. KCl, al., eth., a.
37	2.460	.....	.....	sl. s.	s.	.....
38	.....	red ht.	.....	.....	.....	sl. d. dil. H ₂ SO ₄ , HCl; i. conc. H ₂ SO ₄
39	.....	-H ₂ O, 100	-2H ₂ O, 140-200	.017 ²⁵,	.....	i. HF
40	.....	d.	.....	i.	i.	s. a.; i. alk., H ₂ C ₂ O ₄ , HF
41	.....	d.	.....	s.	.....	.....
42	.....	d. 500	.....	v. s.	.....	s. al.
43	.....	swells	.....	v. s.	.....	v. s. al.
44	.....	d.	.....	v. s.	.....	v. s. al., a.
45	4.637 ¹⁶	d.	.....	i.	i.	s. h. aq. (NH ₄) ₂ C ₂ O ₄ ; sl. s. a.
46	.....	.....	.....	i.	.....	s. Na ₂ CO ₃ , (NH ₄) ₂ C ₂ O ₄ soln.; i. HNO ₃

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Thorium				
1	oxide, di- (thoria).....	ThO ₂	264.12	cubic, white, 2.20 (lq.).....
2	oxysulfide.....	ThOS.....	280.18	yel. cr.....
3	2,4-pentanedione deriv. (acetylacetonate)	Th(C ₅ H ₇ O ₂) ₄	628.55	col. cr.....
4	orthophosphate.....	Th ₃ (PO ₄) ₄ ·4H ₂ O.....	1148.50	gelat. wh.....
5	metaphosphate.....	Th(PO ₃) ₄	548.20	col., rhomb. pl.....
6	hypophosphate.....	ThP ₂ O ₆ ·11H ₂ O.....	588.34	amor. wh. ppt.....
7	picrate.....	Th(C ₆ H ₂ N ₃ O ₇) ₄ ·10H ₂ O.....	1324.68	.....
8	orthosilicate (thorite)....	ThSiO ₄	324.18	col. tetr.....
9	sulfate.....	Th(SO ₄) ₂	424.24	wh., cryst.....
10	".....	Th(SO ₄) ₂ ·4H ₂ O.....	496.30	need. or wh. cr. powd.....
11	".....	Th(SO ₄) ₂ ·6H ₂ O.....	532.34	.....
12	".....	Th(SO ₄) ₂ ·8H ₂ O.....	568.37	monocl. pr.....
13	".....	Th(SO ₄) ₂ ·9H ₂ O.....	586.39	monocl. wh.....
14	sulfide.....	ThS ₂	296.24	yel-br. cryst.....
15	pyrovanadate.....	Th ₂ O·6H ₂ O.....	554.12	yellow.....
16	Thulium	Tm.....	169.40	.....
17	chloride.....	TmCl ₃ ·7H ₂ O.....	401.88	grn. cr.....
18	oxalate.....	Tm ₂ (C ₂ O ₄) ₃ ·6H ₂ O.....	710.96	grnsh. wh. ppt.....
19	oxide (thulia).....	Tm ₂ O ₃	386.80	grnsh. wh. powd.....
20	Tin gray (α-).....	Sn.....	118.70	cubic, gray.....
21	" , ordinary (β-).....	Sn.....	118.70	tetr. wh. met.....
22	" , brittle (γ-).....	Sn.....	118.70	rhomb. wh.....
Tin, acids of:				
23	Stannic acid, ortho-.....	H ₄ SnO ₄	186.73	wh. gel. (exist. quest.).....
24	" " , meta-(α-acid)	H ₂ SnO ₃	168.72	amor. or coll. ppt., wh. (exist. quest.)
25	" " , meta-(β-acid)	H ₁₀ Sn ₅ O ₁₅	843.58	amor. or gel. wh. (exist. quest.).....
26	Tin acetate (ous).....	Sn(C ₂ H ₃ O ₂) ₂	236.79	yelsh. powd.....
27	pyroarsenate (ous).....	Sn ₂ As ₂ O ₇	499.22	flocculent ppt.....
28	bromide (ous).....	SnBr ₂	278.53	rhomb. pa. yel.....
29	" (ic).....	SnBr ₄	438.36	rhomb. pyramids, col., deliq.....
30	bromide (tri-) chloride.....	SnBr ₃ Cl.....	393.91	liq.....
31	bromide (di-) chloride, di-.....	SnBr ₂ Cl ₂	349.45	.....
32	bromide chloride, tri-.....	SnBrCl ₃	304.99	col. liq.....
33	bromide (di-) iodide, di-.....	SnBr ₂ I ₂	532.37	or-red hex. pl.....
34	chloride (ous).....	SnCl ₂	189.61	rhomb. wh.....
35	" ".....	SnCl ₂ ·2H ₂ O.....	225.65	wh. monocl.....
36	" (ic).....	SnCl ₄	260.53	col. liq.....
37	" ".....	SnCl ₄ ·3H ₂ O.....	314.58	monocl. cr.....
38	" ".....	SnCl ₄ ·4H ₂ O.....	332.59	opaque.....
39	" ".....	SnCl ₄ ·5H ₂ O.....	350.61	monocl. cr.....
40	" , basic (ic).....	SnOCl ₂	205.61	wh.....
41	" , diammine (ic).....	SnCl ₄ ·2NH ₃	294.59	cr.....
42	chloride (di-) iodide, di-.....	SnCl ₂ I ₂	443.45	red mobile liq.....
43	chromate (ic).....	Sn(CrO ₄) ₂	350.72	br.-yel. cr. powd.....
44	ferricyanide (ous).....	Sn ₃ (Fe(CN) ₆) ₂	780.00	wh.....
45	ferrocyanide (ous).....	Sn ₂ Fe(CN) ₆	449.35	wh. gel.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	9.69	>2800	4400	i.	i.	s. h. H ₂ SO ₄ ; i. alk., dil. a.
2	6.44 ⁹	d.		i.	.....	s. aq. reg.; sl. s. HNO ₃
3	.....	171; subl. 160 ¹⁰	260-270 ¹⁰	sl. s.	.....	v. s. al., chl.; s. eth.
4	.....			i.	i.	s. 30 % HCl; i. a.
5	4.08 ^{16,4}			.....	.....	.....
6	.....			i.	i.	i. a., alk.
7	.....			0.305 ²⁵	.....	.....
8	5.3			v. sl. s.	.....	.....
9	4.225 ¹⁷			v. s.	s.	v. s. NH ₄ C ₃ H ₃ O ₂
10	.....			9.41 ¹⁷ (anh.)	2.54 ³⁰ (anh.)	.....
11	.....			1.5 ⁹ ; 1.63 ¹⁵	3.85 ⁴⁵ ; 6.64 ⁸⁰	.....
12	.....	-4H ₂ O, 42		1 ⁹ ; 1.85 ²⁵	3.71 ⁴⁴	.....
13	2.77	-9H ₂ O, 400		.74 ⁹ ; 1.57 ²⁰	6.76 ⁶⁵	s. HCl, HNO ₃
14	6.80	d.		i.	i.	s. h. aq. reg.; sl. s. a.
15	.....			i.	i.	s. conc. a.
16	.....			i.	i.	.....
17	.....			v. s.	.....	v. s. al.
18	.....			.....	.....	s. soln. alk. oxal.
19	.....			.....	.....	s. min. a.
20	5.75	231.9, stab. <18	2270	i.	i.	d. HCl, H ₂ SO ₄ , dil. HNO ₃
21	7.28	231.9 stab. 18-170	2270	i.	i.	aq. reg., h. KOH, NaOH
22	6.52-.56	231.9 stab. >161	2270	i.	i.	d. HCl, H ₂ SO ₄ , dil. HNO ₃
23	.....			s.	.....	aq. reg., h. KOH, NaOH
24	.....			i.	i.	d. HCl, H ₂ SO ₄ , dil. HNO ₃
25	.....			i.	i.	aq. reg., h. KOH, NaOH
26	.....	182	240	d.	.....	d. KOH, NaOH, a.
27	.....	d. As ₂ O ₃ +	SnO ₂	i.	i.	d. KOH, NaOH; i. a.
28	5.117 ¹⁷	215.5	620	85.2 ⁹	222.5 ¹⁰⁰	d. KOH, NaOH; i. a.
29	lq. 3.340 ³⁵	31	202. ³⁴	s. d.	d.	d. KOH, NaOH; i. a.
30	3.12 ¹³	1	73 ³⁰	.....	d.	d. KOH, NaOH; i. a.
31	2.82 ¹³	-20	65 ³⁰ ; d. 191	d. ⁶	d.	d. KOH, NaOH; i. a.
32	2.51 ¹³	-1	50 ³⁰	.....	d.	d. KOH, NaOH; i. a.
33	3.631 ¹⁵	d. 50	.....	s.	d. <80	d. KOH, NaOH; i. a.
34	lq. 3.393 ²⁴⁵	246.0	623	83.9 ⁹ d.	269.8 ¹⁵ d.	d. KOH, NaOH; i. a.
35	2.710 ^{15,5}	37.7	d.	118.7 d.	∞ d.	d. KOH, NaOH; i. a.
36	2.232	-33	114.1	s.	d.	d. KOH, NaOH; i. a.
37	.....	80	stab. 64-83	s.	.....	d. KOH, NaOH; i. a.
38	.....	.....	stab. 56-63	s.	.....	d. KOH, NaOH; i. a.
39	.....	.....	stab. 19-56	s.	.....	d. KOH, NaOH; i. a.
40	1.8	.....	.....	s.	.....	d. KOH, NaOH; i. a.
41	.....	.....	.....	s.	.....	d. KOH, NaOH; i. a.
42	3.287 ¹⁵	.....	297	s. conc. sol.	d. dil. sol	d. KOH, NaOH; i. a.
43	.....	d.	.....	s.	.....	d. KOH, NaOH; i. a.
44	.....	d.	.....	i.	.....	d. KOH, NaOH; i. a.
45	.....	.....	.....	i.	i.	d. KOH, NaOH; i. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Tin				
1	ferrocyanide (ic)	$\text{SnFe}(\text{CN})_6$	390.65	grish. wh. gel.
2	fluoride (ous)	SnF_2	156.70	wh. monocl. cr.
3	" (ic)	SnF_4	194.70	wh. cr. mass, hyg.
4	hydride (stannane)	SnH_4	122.73	gas
5	hydroxide (ous)	$\text{SnO} \cdot x\text{H}_2\text{O}$		wh. powd. or yelsh-br. cr.
6	iodide (ous)	SnI_2	372.54	monocl. yel-red.
7	" (ic)	SnI_4	625.38	cub. yel.
8	nitrate (ous)	$\text{Sn}(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$	503.04	col. leaf.
9	" basic (ous)	$\text{SnO} \cdot \text{Sn}(\text{NO}_3)_2$	377.42	wh. cr. mass.
10	" (ic)	$\text{Sn}(\text{NO}_3)_4$	366.75	silky need.
11	oxalate (ous)	SnC_2O_4	266.72	wh. cr. or heavy wh. powd.
12	oxide (ous)	SnO	154.70	tetr. habit, blk.
13	" (ic) (castnerite)	SnO_2	156.70	tetr. wh. 1.967, 2.003
14	orthophosphate (ous)	$\text{Sn}_2\text{P}_2\text{O}_7$	546.14	wh. amor. solid
15	" mono-H	Sn_2HPO_6	214.73	cr.
16	" di-H	$\text{Sn}_2\text{H}_2\text{P}_2\text{O}_7$	612.77	rhomb. cr.
17	" basic	$\text{Sn}_2\text{O} \cdot \text{PO}_3$	448.44	oct. cr.
18	" basic (ic)	$\text{Sn}_2\text{O} \cdot \text{PO}_3 \cdot x\text{H}_2\text{O}$	429.60	
19	pyrophosphate (ous)	$\text{Sn}_2\text{P}_2\text{O}_6$	411.44	amor. powd.
20	metaphosphate (ous)	$\text{Sn}_2\text{P}_2\text{O}_7$	274.74	amor. mass.
21	phosphate, mono-	SnP	146.72	silv-wh.
22	" tri-	SnP_3	211.73	cr.
23	(tetra-) phosphide, tri-	Sn_3P_4	567.56	wh. cr.
24	phosphorus chloride (ic)	$\text{SnCl}_2 \cdot \text{PCl}_3$	498.87	cr.
25	phosphoryl chloride (ic)	$\text{SnCl}_2 \cdot \text{POCl}_3$	413.82	cr.
26	sesquide (ous)	Sn_2Se_3	197.87	steel-gray cr.
27	" (ic)	Sn_2Se_3	274.80	cr.
28	sulfate (ous)	SnSO_4	314.74	wh.-yelsh. cr. powd.
29	" (ic)	$\text{Sn}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	346.85	hex. pr. deliq.
30	" basic (ic)	$\text{Sn}(\text{OH})_2 \cdot \text{SO}_4$	348.74	slender wh. need.
31	sulfide (ous)	SnS	156.75	rhomb. gray-blk.
32	" (ic) (mosaic prod.)	SnS_2	189.82	hex. gold-yel.
33	sulfur chloride (ic)	$\text{SnCl}_2 \cdot 2\text{SCl}_2$	667.56	yel. cr.
34	tartrate (ous)	$\text{SnC}_4\text{H}_6\text{O}_6$	366.77	heavy wh. powd.
35	telluride (ous)	SnTe	346.81	gray cr.
36	" (ic)	SnTe_2	678.92	blk. fine. ppt.
37	Titanic acid, ortho-	H_2TiO_3	118.95	wh.
38	" meta-	H_2TiO_4	97.92	wh. amor. powd.
39	Titanium	Ti	47.90	α hex., tr. β cub. 800° C., silv. gray.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	.....	.....	.....	i.	i.	d. h. HCl
2	.....	.....	.....	s.	.....	.....
3	4.780 ¹⁹	.....	705	v. s.	d. to SnO ₂	.....
4	.....	-150; d.	-52	.....	.....	s. AgNO ₃ , HgCl ₂ , conc. H ₂ SO ₄ , conc. alk.
5	.....	.....	.....	.....	d. to SnO	d. a., alk.; s. alk. carb.; i. NH ₄ OH
6	5.28 ²⁵	320	720	1.32 ^{20,8}	3.55 ^{28,5}	d. KOH, HCl; s. HF, CS ₂
7	4.696 ¹¹	143.5	341; sub. 180	d.	d.	145 ¹⁵ CS ₂ ; s. al., eth., chl., bz.
8	.....	-20	.....	d.	d.	d. HNO ₃
9	.....	d. < 100 exp.	.....	d.	d.	.....
10	.....	d. compl. 50	.....	d.	.....	.....
11	3.56 ¹⁸	.....	.....	.....	.....	d. HCl; sl.s. NH ₄ Cl, (NH ₄) ₂ C ₂ O ₄
12	6.446 ⁹	d. 700-950	.....	i.	i.	d. a., fixed alk. hydx.; sl.s. NH ₄ Cl
13	6.95	1127 d.	.....	i.	i.	d. KOH, NaOH; i. aq. a.
14	3.823 ¹⁷	.....	.....	i.	i.	d. a., alk. hydx.
15	3.476 ^{15,5}	stab. < 100	d.	i.	i.	.....
16	3.167 ^{22,8}	.....	.....	.....	.....	.....
17	3.98	.....	.....	i.	i.	sl. s. HNO ₃
18	.....	.....	.....	i.	i.	i. HNO ₃
19	4.009 ^{16,4}	.....	.....	.....	.....	.....
20	3.380 ^{22,8}	.....	.....	.....	.....	.....
21	6.56	.....	.....	i.	.....	s. HCl; i. HNO ₃
22	4.10 ⁰	d. < 415 to Sn ₄ P ₃	.....	i.	i.	d. HNO ₃ ; i. HCl
23	5.181	d. < 480	.....	i.	i.	d. HCl, fixed alk. hydx.
24	.....	subl. 200	.....	d.	d.	.....
25	.....	58	180	d.	d.	.....
26	6.179 ⁹	861	.....	i.	i.	d. HCl, HNO ₃ , aq. reg., alk. sulfd.
27	5.133	650	.....	i.	i.	d. h. conc. a.; i. dil. a.
28	.....	d. < 360 to SO ₂	.....	33 ²⁵	.....	s. H ₂ SO ₄
29	.....	.....	.....	v. s.	d.	s. eth., dil. H ₂ SO ₄ ; reacts with HCl
30	.....	.....	.....	s. d.	d.	.....
31	5.080 ⁹	882	1230	.000002 ¹⁸	.....	d. HCl, alk., (NH ₄) ₂ S _x
32	4.5	d.	.....	0.00002 ¹⁸	.....	d. alk. sulf., aq. reg., PCl ₅ , SnCl ₂ , alk. hydx.; i. HCl, HNO ₃
33	.....	37	d. < 40	d.	d.	d. HNO ₃ ; s. CS ₂ , eth., bz., ethyl acetate
34	.....	.....	.....	s.	.....	v. s. dil. HCl
35	6.48	780	.....	i.	i.	d. alk. sulfd.
36	.....	.....	.....	i.	i.	d. dil. a., alk. hydx., (NH ₄) ₂ S _x
37	.....	d.	.....	v. sl. s.; sl. d.	.....	s. dil. HCl, H ₂ SO ₄
38	.....	.....	.....	i.	i.	s. conc. H ₂ SO ₄ , alk.; i. other a., al.
39	4.5 ²⁰	1800	> 3000	i.	d.	s. dil. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Titanium				
1	bromide, di-	TiBr ₂	207.73	blk. powd.
2	" , tetra-	TiBr ₄	367.56	or.-yel., deliq.
3	carbide	TiC	59.91	cubic, metallic
4	chloride, di-	TiCl ₂	118.81	lt. brn.-blk., deliq.
5	" , tri-	TiCl ₃	154.27	dk.-vlt., deliq.
6	" , tetra-	TiCl ₄	189.73	col.-lt. yel. liq., 1.61
7	fluoride, tri-	TiF ₃	104.90	purp.-red or violet
8	" , tetra-	TiF ₄	123.90	wh. powd.
9	iodide, di-	TiI ₂	301.74	blk. hyg.
10	" , tetra-	TiI ₄	555.58	cub. red.
11	nitride	TiN	61.91	bronze red cr.
12	(tri-) nitride, tetra-	Ti ₃ N ₄	199.73	br.
13	oxalate	Ti ₂ (C ₂ O ₄) ₃ ·10H ₂ O	540.02	yel. pr.
14	oxide, mon-	TiO	63.90	pr. blk.
15	" , sesqui-	Ti ₂ O ₃	143.80	trig., vlt. blk.
16	" , di- (brookite)	TiO ₂	79.90	rhomb., 2.583, 2.586, 2.741
17	" " (octahedrite, anatase)	TiO ₂	79.90	br.-blk., tetr., 2.554, 2.493
18	" " (rutile)	TiO ₂	79.90	tetr. bl., 2.616, 2.903
19	" , tri- (or per-)	TiO ₃ (?)	95.90	yel.
20	sulfate	Ti ₂ (SO ₄) ₃	383.98	cr. grn., deliq.
21	" , basic	TiOSO ₄	159.96	wh. or sl. yelsh. powd.
22	sulfide, mono-	TiS	79.96	redsh. sld.
23	" , sesqui-	Ti ₂ S ₃	191.98	grayish blk. cr.
24	" , di-	TiS ₂	112.02	yel. scales
25	Tungsten	W	183.92	cub. gray-blk.
26	bromide, di-	WBr ₂	343.75	bl.-blk., need.
27	" , penta-	WBr ₅	583.50	vlt.-br., need.
28	" , hexa-	WBr ₆	663.42	bl.-blk., need.
29	carbide	WC	195.93	gray
30	"	W ₂ C	379.85	grn.
31	chloride, di-	WCl ₂	254.83	gray, amor.
32	" , tetra-	WCl ₄	325.75	gray, deliq.
33	" , penta-	WCl ₅	361.21	blk., deliq.
34	" , hexa-	WCl ₆	396.66	cub. dk. bl.
35	fluoride, hexa-	WF ₆	297.92	lt. yel. liq., or col. gas.
36	iodide, di-	WI ₂	437.76	br.-grn. amor.
37	" , tetra-	WI ₄	691.60	blk. cr.
38	oxide, di-	WO ₂	215.92	cub. br.
39	" , tri-	WO ₃	231.92	rhomb. yel. or yel.-or. powd.
40	oxytetrabromide	WOBr ₄	519.58	blk., deliq.
41	oxydibromide, di-	WO ₂ Br ₂	375.75	red pr.
42	oxytetrachloride	WOCl ₄	341.75	red need.
43	oxydichloride, di-	WO ₂ Cl ₂	286.83	lt. yel. tabl.
44	oxytetrafluoride	WOF ₄	275.92	col. pl., hyg.
45	phosphide	WP	214.94	gray pr.
46	"	WP ₂	245.96	blk. cr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d. > 500		s. ev. H ₂		
2	2.6	39	230	d.		s. abs. al., abs. eth.
3	4.25	3140	4300	i.	i.	s. HNO ₃ , HNO ₃ + HCl
4		subl. in H ₂		d.		s. al.; i. eth., chl., CS ₂
5		d. 440		s.	s.	v. s. al.; s. HCl; i. eth.
6	lq. 1.726	-30	136.4	s.	d.	s. dil. HCl, al.
7				red s.; vlt. i.		
8	2.798 ^{20.5}		284	s., d.		s. H ₂ SO ₄ , al., C ₃ H ₅ N; i. eth.
9	4.3 ²⁰			d.		d. alk.; s. conc. HF, HCl
10		150	> 360	v. s.	d.	
11	5.29	3220		i.		i. a.
12		d.		d.		
13				s.	s.	i. al., eth.
14	4.93	1750				s. dil. H ₂ SO ₄ ; i. HNO ₃
15	4.6	2130; d.		i.	i.	s. H ₂ SO ₄ ; i. HCl, HNO ₃
16	4.17			i.	i.	s. H ₂ SO ₄ , alk.; i. a.
17	3.84			i.	i.	s. H ₂ SO ₄ , alk.; i. a.
18	4.26	1640 d.		i.	i.	s. H ₂ SO ₄ , alk.; i. a.
19						s. a.
20				i.	i.	s. dil. a.; i. al., eth., conc. H ₂ SO ₄
21				d.		
22				i.		s. conc. H ₂ SO ₄ ; i. HCl, HF, dil. H ₂ SO ₄
23				i.	i.	s. conc. H ₂ SO ₄ , HNO ₃ ; i. dil. HCl, dil. H ₂ SO ₄
24				hyd. sly.	d. in steam	d. HCl; s. dil. HNO ₃ , H ₂ SO ₄
25	19.3	3370	5900	i.	i.	s. h. conc. KOH; sl. s. HNO ₃ , aq. reg.
26		d. 400		d.		
27		276	333	d.		s. alk., abs. al., chl., eth.
28	6.9			i.	d.	s. NH ₄ OH
29	15.7 ¹⁸	2777	6000	i.		
30	16.06 ¹⁹	2857 d.	6000	i.		s. HNO ₃ ; sl. s. HCl, H ₂ SO ₄
31	5.436			d.		
32	4.624	d.	d.	d.		
33	3.875	248	275.6	d. to W ₂ O ₅		v. sl. s. CS ₂
34	3.52	275	346.7		d. ⁶⁰	v. s. CS ₂ , POCl ₃ ; s. al., eth., bz.
35	g. 12.9 g/l; lq. 3.44	2.5	19.5	d.	d.	s. alk.
36	6.9			i.	d.	s. KOH, alk.; i. CS ₂ , al.
37	5.2 ¹⁸	d.	d.	i.	d.	s. abs. al.; i. eth., chl., turp.
38	12.11			i.	i.	s. a., KOH
39	7.16	1473		i.	i.	s. h. alk., HF; i. a.
40		277	327	d.	d.	
41		d.	d.			
42		211	227.5	d.	d.	s. CS ₂ , S ₂ Cl ₂ , bz.
43		266		s.	d.	s. alk., NH ₄ OH; i. al.
44		110	187.5	d.		sl. s. CS ₂ ; i. CCl ₄
45	8.5			i.		s. HNO ₃ + HF; i. alk., HCl
46	5.8	d.		i.	i.	s. HNO ₃ + HF, aq. reg. i. al., eth.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	Tungsten phosphide.....	W_4P_2 (or W_2P)	797.72	dk. gray pr.
2	sulfide, di.....	WS_2	248.04	dk. gray cr.
3	“ , tri.....	WS_3	280.10	choc.-br. powd.
4	Tungstic acid	H_2WO_4	249.94	yel.
5	“ , tri.....	$H_2WO_4 \cdot H_2O$	267.95	wh.
6	“ , meta.....	$H_2W_2O_{13} \cdot xH_2O$		cub. yel.
7	Uranic acid, meta-	H_2UO_4	304.09	rhomb. or yel. powd.
8	Uranium	U	238.07	cub. silv. wh. or blk. radioact.
9	bromide, tri.....	UBr_3	477.82	dk.-br. need., hyg.
10	“ , tetra.....	UBr_4	557.73	br. leaf., deliq.
11	carbide.....	UC_2	262.09	gray cr.
12	chloride, tri.....	UCl_3	344.44	need. dk. red, hyg.
13	“ , tetra.....	UCl_4	379.90	cub. oct. dk. grn.-gray, deliq.
14	“ , penta.....	UCl_5	415.36	dk. grn.-gray need., red by trans. light, deliq.
15	fluoride, tetra.....	UF_4	314.07	grn. amor. powd.
16	“ , hexa.....	UF_6	352.07	monocl. col.-pa. yel., deliq.
17	iodide, tetra.....	UI_4	745.75	blk. need.
18	nitride.....	U_3N_4	770.24	brn.-blk.
19	oxide, di.....	UO_2	270.07	rhomb. or cub., br.-blk.
20	“	U_3O_8	842.21	olive-grn.
21	“ , tri- (uranyl oxide).....	UO_3	286.07	yel.-red powd.
22	“ , per.....	$UO_4 \cdot 2H_2O$	338.10	pa.-yel. cr., hyg.
23	sulfate (ous).....	$U(SO_4)_2 \cdot 4H_2O$	502.25	rhomb. grn.
24	“	$U(SO_4)_2 \cdot 8H_2O$	574.32	monocl. grn.
25	sulfide, sesqui.....	U_2S_3	572.32	gray-blk. need.
26	“ , di.....	US_2	302.19	tetr. gray-blk.
27	Uranyl acetate.....	$UO_2(C_2H_3O_2)_2 \cdot 2H_2O$	424.19	rhomb. yel.
28	benzoate.....	$UO_2(C_7H_5O_2)_2$	512.29	yel. powd.
29	bromide.....	$UO_2Br_2(7H_2O)?$	556.02	grn.-yel. need.
30	perchlorate.....	$UO_2(ClO_4)_2 \cdot 4H_2O$	509.04	
31	chloride.....	UO_2Cl_2	340.98	yel., deliq.
32	formate.....	$UO_2(CHO_2)_2 \cdot H_2O$	378.12	oct. yel.
33	iodate.....	$UO_2(IO_3)_2$	619.91	rhomb. yel.
34	“	$UO_2(IO_3)_2 \cdot H_2O$	637.93	α prismatic, stable; β pyramidal
35	iodide.....	UO_2I_2	523.91	red, deliq.
36	nitrate.....	$UO_2(NO_3)_2 \cdot 6H_2O$	502.18	rhomb. yel., deliq., β 1.4967
37	oxalate.....	$UO_2C_2O_4 \cdot 3H_2O$	412.14	yel. cr.
38	phosphate, mono-H.....	$UO_2HPO_4 \cdot 4H_2O$	438.16	tetr. yel. pl.
39	sulfate.....	$UO_2SO_4 \cdot 3H_2O$	420.18	yel.-grn. cr.
40	“	$2UO_2SO_4 \cdot 7H_2O$	858.37	yel.
41	sulfide.....	UO_2S	302.13	br.-blk. tetr.
42	sulfite.....	$UO_2SO_3 \cdot 4H_2O$	422.19	pa. grn. cr.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	5.21					s. fus. $\text{Na}_2\text{CO}_3 + \text{NaNO}_3$;
2	7.5 ¹⁰			i.		i. a., aq. reg.
3				sl. s.	s.	s. $\text{HNO}_3 + \text{HF}$, fus, alk.; i.
4	5.5	$-\frac{1}{2}\text{H}_2\text{O}$, 100		i.	sl. s.	al.
5		H_2WO_7 at 100		sl. s.		s. alk.
6				s.		s. alk., HF, NH_3
7	5.926	$-\text{H}_2\text{O}$, 250-300		i.	i.	s. alk.
8	18.7	ca. 1150	ign.	i.	i.	s. a., alk. carb.; i. alk.
9			volat.	s.		s. a.; i. alk., al.
10	4.84 ^{$\frac{21}{4}$}		volat.	s.	s.	s. acet.; i. al., eth.
11	11.28 ¹⁸	2260	4100	d.	d.	s. a.
12	5.44 ^{$\frac{25}{4}$}			v. s.	d.	s. HCl , NH_4Cl , acet. a.
13	4.725 ^{$\frac{25}{4}$}	subl.	618	v. s.	d.	s. al., acet., $\text{C}_6\text{H}_5\text{COOH}$, ac. a., NH_4Cl ; i. eth.
14		d. 120		d.		s. abs. al., ac. a., acet., NH_4Cl ; i. eth., bz.
15		ca. 1000		i.		s. conc. a., alk.; i. dil. a., alk.
16	4.68 ^{20.7}	69.2 ^{atm.}	56.2 ^{764.5}	s.		d. al., eth.; v. s. $\text{C}_2\text{H}_2\text{Cl}_4$;
17	5.6 ¹⁵	500		s.	s., d.	s. CCl_4 , chl.; i. CS_2
18	10.09			d.		s. HNO_3 ; i. conc. HCl , H_2SO_4
19	10.9	2176		i.	i.	s. HNO_3 , conc. H_2SO_4
20	7.31	d.		i.	i.	s. HNO_3 , H_2SO_4
21	7.29	d.		i.		s. min. a.; i. $\text{K}_2\text{C}_4\text{H}_4\text{O}_6$
22		d. 115		.0006 ²⁰	.008 ⁹⁰	d. HCl
23		$-\text{H}_2\text{O}$, 300		d.		s. dil. a.
24		d. 90		s. d.		s. dil. a.; i. al.
25		ign.				+O aq. reg., conc. HNO_3 ;
26		>1100	oxidizes	sly. d.		i. dil. a.
27	2.893 ¹⁵	$-\text{H}_2\text{O}$, 110	d. 275	7.694 ¹⁵	d.	d. HNO_3 ; s. conc. HCl
28				sl. s.		v. s. al.
29				s.		sl. s. al.
30		d. 110				s. al., eth.
31		<red ht.	d.	320 ¹⁸	v. s.	m. al., eth., amyl. al.
32	3.695 ¹⁹	$-\text{H}_2\text{O}$, 110		420 ¹⁵		sl. s. form. a.
33	5.2	d. 250				i. HNO_3
34	α 5.220 ¹⁸ ; β 5.052 ¹⁸			α .1049 ¹⁸ ; β .1214 ¹⁸		sl. s. dil. HNO_3
35		d. in air				s. al., eth., bz.
36	2.807 ¹³	60.2 d. 100	118	170.3 ⁹	∞ ⁶⁰	v. s. al., eth., ac. a., acet., meth. al.
37		$-\text{H}_2\text{O}$, 110		0.8 ¹⁴	3.3 ¹⁰⁰	s. min. a., alk. oxal.
38				i.	i.	s. aq. Na_2CO_3 , HNO_3 ; i. ac. a.
39	3.28 ^{16.5}	d. 100		20.5 ^{15.5}	22.2 ¹⁰⁰	4 al.; s. H_2SO_4
40		anh. 300		v. s.	v. s.	s. H_2SO_4
41		d. 40-50		sl. s.		s. dil. a., al., $(\text{NH}_4)_2\text{CO}_3$;
42				i.		i. abs. al.
						s. H_2SO_3

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	Vanadic acid , pyro..	$H_4V_2O_7$	217.93	amor., br.
2	“ “ , meta-..	HVO_3	99.96	yel. sc.
3	Vanadium	V	50.95	cub. lt. gray met., 3.03
4	bromide, tri-..	VBr_3	290.70	grn. blk., deliq.
5	carbide.....	VC	62.96	gray, cr. mass.
6	chloride, di-..	VCl_2	121.86	hex. grn., deliq.
7	“ “ , tri-..	VCl_3	157.32	pink, deliq. cr.
8	“ “ , tetra-..	VCl_4	192.78	red-br., liq.
9	fluoride, tri-..	VF_3	107.95	rhomb. grn.
10	“ “ “	$VF_3 \cdot 3H_2O$	162.00	rhomb.
11	“ “ , tetra-..	VF_4	126.95	br.-yel.
12	“ “ , penta-..	VF_5	145.95	
13	iodide.....	$VI_3 \cdot 6H_2O$	539.81	grn. cr., deliq.
14	nitride.....	VN	64.96	grn.-br.
15	oxide, di- (or mono-)	V_2O_2 (or VO)	133.90	lt.-gray cr.
16	“ “ , sesqui- (or tri-)	V_2O_3	149.90	blk. cr.
17	“ “ , tetr- (or di-)	V_2O_4 (or VO_2)	165.90	bl. cr.
18	“ “ , pent-..	V_2O_5	181.90	rhomb. yel.-red.
19	oxybromide.....	$VOBr$	146.87	oct., vlt.,
20	oxydibromide.....	$VOBr_2$	226.78	br., deliq., powd.
21	oxytribromide.....	$VOBr_3$	306.70	red liq.
22	oxychloride.....	$VOCl$	102.41	yel.-brn. powd.
23	oxydichloride.....	$VOCl_2$	137.86	grn., deliq.
24	oxytrichloride.....	$VOCl_3$	173.82	yel. liq., deliq.
25	oxymonochloride, di-	V_2O_2Cl (or $(VO)_2Cl$)	169.36	yel.-brn. cr.
26	oxydifluoride.....	VOF_2	104.95	yel. solid.
27	oxytrifluoride.....	VOF_3	123.95	yel.-wh., hyg.
28	silicide.....	VSi_2	107.07	met., prisms
29	(di-) silicide.....	V_2Si	129.96	silv. wh. pr.
30	sulfate (hypovanadous)	$VSO_4 \cdot 7H_2O$	273.12	monocl. vlt.
31	sulfide, di- (or mono-)	V_2S_2 (or VS)	166.02	blk., pl.
32	“ “ , sesqui- (or tri-)	V_2S_3	198.08	grn.-blk. pl. or powd.
33	“ “ , penta-..	V_2S_5	262.20	blk.-grn. powd.
34	Vanadyl sulfate	$VOSO_4$	163.01	bl.
35	“ “ (di-) sulfate, tri-	$(VO)_2(SO_4)_3$	422.08	red, deliq.
36	Water	H_2O	18.02	col. liq. or hex. col. cr., lq. 1.333, slt 1.309, 1.313
37	Xenon	Xe	131.30	col. inert. gas.
38	Ytterbium	Yb	173.04	
39	acetate.....	$Yb(C_2H_3O_2)_3 \cdot 4H_2O$	422.24	hex. pl.
40	chloride.....	$YbCl_3 \cdot 6H_2O$	387.51	rhomb. grn., deliq.
41	oxalate.....	$Yb_2(C_2O_4)_3 \cdot 10H_2O$	790.30	col. cr.
42	oxide (ytterbia).....	Yb_2O_3	394.08	col.
43	selenate.....	$Yb_2(SeO_4)_3 \cdot 8H_2O$	919.09	hex. pl.
44	selenite.....	$Yb_2(SeO_3)_3$	726.96	
45	sulfate.....	$Yb_2(SO_4)_3$	634.26	col.
46	“ “ “	$Yb_2(SO_4)_3 \cdot 8H_2O$	778.39	prisms.
47	Yttrium	Y	88.92	hex. gray-blk. met.
48	acetate.....	$Y(C_2H_3O_2)_3 \cdot 4H_2O$	338.12	col. tricl.
49	bromate.....	$Y(BrO_3)_3 \cdot 9H_2O$	634.81	hex. pr.
50	bromide.....	YBr_3	328.67	deliq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	.....	.....	.....	i.	.....	s. a., alk., NH_4OH
2	.....	.....	.....	i.	.....	s. a., alk.; i. NH_3
3	5.866 ¹⁵	1720 ± 20	3000	i.	i.	s. HNO_3 , H_2SO_4 , HF, aq. reg.; i. HCl, alk.
4	.....	d.	.....	s.	.....	s. al., eth.; i. HBr
5	5.4	2810	3900	i.	.....	s. HNO_3 , fus. KNO_3 ; i. HCl, H_2SO_4
6	3.23 ¹⁸	.....	.....	s. d.	s. d.	s. al., eth.
7	3.00 ¹⁸	d.	.....	s. d.	s. d.	s. abs. al., eth.
8	1.816 ³⁰	-28 ± 2	148.5 ⁷⁵⁵	s. d.	.....	s. abs. al., eth., chl., ac. a.
9	3.363 ¹⁹	>800	subl.	i.	.....	i. al., chl., CS_2
10	.....	-3 H_2O , 130	.....	s.	v. s. d.	i. abs. al.
11	2.975 ²³	d. 325	.....	s.	.....	s. acet.; sl. s. al., chl.
12	2.177 ¹⁹	.....	111.2	s.	.....	s. al., chl.; i. CS_2
13	.....	.....	.....	.....	.....	s. al.
14	5.63	ca. 2320	.....	i.	.....	.....
15	5.758 ¹⁴	ign.	.....	i.	i.	s. a.
16	4.87 ¹⁸	1970	.....	sl. s.	s.	s. HNO_3 , HF, alk.
17	4.339	1967	.....	i.	i.	s. a., alk.
18	3.357 ¹⁸	690	d. 1750	0.8 ²⁰	.....	s. a., alk.; i. abs. al.
19	4.00 ¹⁸	d. 480	.....	v. sl. s.	.....	s. acet. anhyd., eth. ac., acet.
20	.....	d. 180	.....	s.	.....	.....
21	2.933 ^{14,5}	d. 180	130 ¹⁰⁰	s.	.....	.....
22	2.824; 3.64 ²⁰	.....	127	i.	.....	v. s. HNO_3
23	2.88 ¹³	.....	.....	d.	.....	s. dil. HNO_3
24	1.829	-77 ± 2	126.7	s. d.	.....	s. al., eth., ac. a.
25	3.64	.....	.....	i.	.....	s. HNO_3
26	3.396 ¹⁹	d.	.....	.....	.....	sl. s. acet.
27	2.459 ¹⁹	300	480	.....	.....	.....
28	4.42	.....	.....	i.	i.	s. HF; i. a., al., eth.
29	5.48 ¹⁷	.....	.....	i.	i.	s. HF; i. a., al., eth.
30	.....	d. in air	.....	.....	.....	.....
31	4.20	d.	.....	.....	.....	s. h. H_2SO_4 , HNO_3 ; sl. s. KSH; i. alk., HCl
32	4.7 ²¹	d.	.....	i.	.....	s. alk. sulf.; sl. s. alk., HCl, HNO_3 , H_2SO_4
33	3.00	d.	.....	i.	.....	s. dil. HNO_3 , alk. sulf., alk
34	.....	.....	.....	v. s.	.....	.....
35	.....	.....	.....	v. s.	d.	s. al.
36	lq. 1.000 ⁴ ; s. 9168 ⁹	0	100	.....	.....	∞ al.
37	5.851 g/l; lq. 3.06 ⁻¹⁰⁹ ; s. 2.7 ⁻¹⁴⁰	-112	-107.1	24.1 ⁰ cm ³ ; 11.9 ²⁵ cm ³	8.4 ⁵⁰ cm ³ ; 7.12 ⁵⁰ cm ³	.....
38	.....	1800	.....	d. ev. H_2	.....	.....
39	2.09	-4 H_2O , 100	.....	v. s.	v. s.	.....
40	2.575	150-5	-6 H_2O , 180	v. s.	v. s.	s. abs. al.
41	2.644	.....	.....	.000033 ²⁵	.....	sl. s. dil. a.
42	9.17	.....	.....	i.	i.	s. h. dil. a.
43	3.30	.....	.....	s. d.	s.	.....
44	.....	.....	.....	i.	.....	.....
45	3.793	d. 900	.....	44.2 ⁹	4.7 ¹⁰⁰	.....
46	3.286	.....	.....	35.0 ²⁰	21.1 ⁴⁰	.....
47	5.51	1490	2500 d.	sl. d.	d.	v. s. dil. a., h. KOH
48	.....	.....	.....	9.03 ²⁵	.....	.....
49	.....	74	-6 H_2O , 100	168 ²⁵	.....	sl. s. al.; l. eth.
50	.....	.....	.....	v. s.	.....	s. al.; i. eth.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Yttrium				
1	bromide.....	$\text{YBr}_3 \cdot 9\text{H}_2\text{O}$	490.81	col. tabl., deliq.
2	carbide.....	YC_2	112.94	micro-cr. yel.
3	carbonate.....	$\text{Y}_2(\text{CO}_3)_3 \cdot 3\text{H}_2\text{O}$	411.92	wh.-redsh. powd.
4	chloride.....	YCl_3	195.29	shin. wh. leaf.
5	".....	$\text{YCl}_3 \cdot \text{H}_2\text{O}$	213.31	col.
6	".....	$\text{YCl}_3 \cdot 6\text{H}_2\text{O}$	303.39	rhomb. redsh.-wh., deliq.
7	fluoride.....	$\text{YF}_3 \cdot \frac{1}{2}\text{H}_2\text{O}$	154.93	gelat.
8	hydroxide.....	$\text{Y}(\text{OH})_3$	139.94	wh.-yel., gelat. or powd.
9	iodide.....	YI_3	469.68	deliq.
10	nitrate.....	$\text{Y}(\text{NO}_3)_3 \cdot 4\text{H}_2\text{O}$	347.01	redsh. wh. pr.
11	".....	$\text{Y}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$	383.04	redsh.-col., deliq. cr.
12	oxalate.....	$\text{Y}_2(\text{C}_2\text{O}_4)_3 \cdot 9\text{H}_2\text{O}$	604.05	wh. cr. powd.
13	oxide (yttria).....	Y_2O_3	225.84	col.-yelsh. cr. or powd.
14	sulfate.....	$\text{Y}_2(\text{SO}_4)_3$	466.02	wh. powd.
15	".....	$\text{Y}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	610.15	monocl. col.-redsh., 1.543, 1.549, 1.576
16	sulfide.....	Y_2S_3	274.02	yel.-gray powd.
Yttrium complexes:				
17	Hexaantipyrineyttrium perchlorate.....	$[\text{Y}(\text{C}_{11}\text{H}_{12}\text{N}_2\text{O})_6]-(\text{ClO}_4)_3$	1516.63	col. hex. cr.
18	Hexaantipyrineyttrium iodide.....	$[\text{Y}(\text{C}_{11}\text{H}_{12}\text{N}_2\text{O})_6]\text{I}_3$	1599.02	col. cr.
Zinc				
19	acetate.....	Zn	65.38	hex. bluish-wh. met.
20	".....	$\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2$	183.47	monocl.
21	".....	$\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	219.50	monocl. col. β 1.494
22	aluminate (gahnite).....	ZnAl_2O_4	183.32	1.78
23	amide.....	$\text{Zn}(\text{NH}_2)_2$	97.43	amor., wh. powd.
24	orthoarsenate (köttigite).....	$\text{Zn}_3(\text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$	618.09	monocl. 1.662, 1.683, 1.717
25	benzoate.....	$\text{Zn}(\text{C}_6\text{H}_5\text{O}_2)_2$	307.60	wh. powd.
26	borate.....	$3\text{ZnO} \cdot 2\text{B}_2\text{O}_3$	383.42	wh. amor. powd., or tricl. cr.
27	bromate.....	$\text{Zn}(\text{BrO}_3)_2 \cdot 6\text{H}_2\text{O}$	429.31	cub. wh.
28	bromide.....	ZnBr_2	225.21	rhomb. col., hyg.
29	butyrate.....	$\text{Zn}(\text{C}_4\text{H}_7\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	275.61	wh. pr.
30	caproate.....	$\text{Zn}(\text{C}_6\text{H}_{11}\text{O}_2)_2$	295.68	wh. need.
31	carbonate (smithsonite).....	ZnCO_3	125.39	trig. col., 1.818, 1.618
32	chlorate.....	$\text{Zn}(\text{ClO}_3)_2 \cdot 4\text{H}_2\text{O}$	304.36	cub. col.-yelsh., deliq.
33	chloride.....	ZnCl_2	136.29	cubic wh., deliq.
34	" , diammine.....	$\text{ZnCl}_2 \cdot 2\text{NH}_3$	170.36	col.
35	chromate.....	ZnCrO_4	181.39	lem. yel., pr.
36	dichromate.....	$\text{ZnCr}_2\text{O}_7 \cdot 3\text{H}_2\text{O}$	335.45	or.-yel. powd., or redsh. br. cr., hyg
37	citrate.....	$\text{Zn}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 2\text{H}_2\text{O}$	610.37	wh. amor. powd.
38	cyanide.....	$\text{Zn}(\text{CN})_2$	117.42	rhomb. col.
39	ferrite.....	ZnFe_2O_4	241.06	oct. blk.
40	ferrocyanide.....	$\text{Zn}_2\text{Fe}(\text{CN})_6$	342.71	wh. powd.
41	".....	$\text{Zn}_2\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$	396.76	wh. powd.
42	fluoride.....	ZnF_2	103.38	col., monocl. or tricl.
43	".....	$\text{ZnF}_2 \cdot 4\text{H}_2\text{O}$	175.44	rhomb.
44	fluosilicate.....	$\text{ZnSiF}_6 \cdot 6\text{H}_2\text{O}$	315.54	hex. pr., col.
45	formaldehydesulfoxylate.....	$\text{Zn}(\text{HSO}_2 \cdot \text{CH}_2\text{O})_2$	255.57	rhomb. pr.
46	" , basic.....	$\text{Zn}(\text{OH})\text{HSO}_2 \cdot \text{CH}_2\text{O}$	177.48	rhomb. pr.
47	formate.....	$\text{Zn}(\text{CHO}_2)_2$	155.42	
48	".....	$\text{Zn}(\text{CHO}_2)_2 \cdot 2\text{H}_2\text{O}$	191.45	monocl. wh., 1.513, 1.526, 1.566

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				v. s.		sl. s. al.; i. eth.
2	4.13 ¹⁸			d.		
3				i.		sl. s. aq. CO ₂ ; s. (NH ₄) ₂ CO ₃ , dil. min. a.; i. al., eth.
4	2.8 ¹⁸	680		78 ¹⁰	82 ⁵⁰	60.1 ¹⁵ al., 60.6 ¹⁵ pyr.
5		—H ₂ O, 160		v. s.		
6	2.18 ¹⁸	—5H ₂ O, 100		217 ²⁰	233 ⁵⁰	s. al.; i. eth.
7				i.		v. sl. s. dil. a.
8		d.		i.	i.	s. a., NH ₄ Cl; i. alk.
9				v. s.		s. al.; sl. s. eth.
10	2.682			s.		s. al., HNO ₃
11	2.68	—3H ₂ O, 100		134.7 ^{22.5}		v. s. al., eth., HNO ₃
12		d.		0.0001		sl. s. HCl
13	4.84; 5.046	2410		.00018 ²⁹		s. a.; i. alk.
14	2.52	d. 1000		5.38 ²⁵	s.	s. satd. aq. K ₂ SO ₄
15	2.558	—8H ₂ O, 120	d. 700	9.763 ²⁰	4.90 ¹⁰	s. conc. H ₂ SO ₄ ; i. al., alk.
16				d.		d. a.
17		293–6 d.		0.55 ²⁰		
18		280–2		4.65 ²⁰		
19	7.14	419.4	907	i.	i.	s. a., alk., ac. a.
20	1.84	242	subl. vac.	30 ²⁰	44.6 ¹⁰⁰	2.8 ²⁵ , 166 ⁷⁹ al.
21	1.735	237	—2H ₂ O, 100	31.1 ²⁰	66.6 ¹⁰⁰	2 al.
22	4.58			i.	i.	sl. s. alk.; i. a.
23	2.13 ²⁵	d. 200		d.	d.	i. eth., al.
24	3.309 ¹⁵	d. 100		i.	i.	s. HNO ₃ , H ₃ AsO ₄ , alk.
25				2.61 ^{15.9} ; 2.46 ²⁰	1.44 ⁶⁰	
26	amor. 3.64; cr. 4.22	980		s.		amor. s. HCl; cr. i. HCl
27	2.566	100	—6H ₂ O, 200	100	v. s.	
28	4.219 ⁴	394	650	447 ²⁰ ; 471 ²⁵	675 ¹⁰⁰	v. s. al., eth., NH ₄ OH
29				10.7 ¹⁶	d.	
30				1.03 ^{24.5}		
31	4.44	—CO ₂ , 300		0.001 ¹⁵		s. a., alk., NH ₄ salts; i. NH ₃ , acet., pyr.
32	2.15	d. 60	d.	262 ²⁰	v. s.	167 al.; s. glyc., eth.
33	2.91 ²⁵	262	732	432 ²⁵	615 ¹⁰⁰	100 ^{12.5} al.; v. s. eth.; i. NH ₃
34		210.8	d. 271	d.		
35				i.	d.	s. a.; i. acet., liq. NH ₃
36				v. s.	d.	s. a.; i. al., eth.
37				sl. s.		
38		d. 800		0.0005 ²⁰		s. alk., KCN, NH ₃ ; i. al.
39	5.33 ²⁰	1590				s. conc. HCl; i. alk., dil. a.
40				i.		s. excess alk; i. dil. a.
41		d.		i.	i.	d. NaOH; s. NH ₄ OH; v. sl. s. NH ₃ ; i. HCl, al.
42	4.84 ¹⁵	872		sl. s.	s.	s. h. a., NH ₄ OH; i. al., NH ₃
43	2.535 ¹²	—4H ₂ O, 100		1.6 ¹⁸	s.	s. NH ₄ OH, a., alk.
44	2.104			v. s.		
45		d.		v. s.	v. s.	d. a.; trans. by alk.; i. al.
46		d.		i.	i.	d. a.; trans. by alk.; i. al.
47	2.36		d.			
48	2.207 ²⁰		d.	5.2 ²⁰	38 ¹⁰⁰	i. al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Zinc				
1	gallate.....	ZnGa_2O_4	268.82	fine wh. cr., 1.74.....
2	glycerophosphate.....	$\text{ZnC}_3\text{H}_7\text{O}_6\text{P}$	235.49	wh. amor. powd.....
3	hydroxide.....	$\text{Zn}(\text{OH})_2$	99.40	rhomb. col.....
4	iodate.....	$\text{Zn}(\text{IO}_3)_2$	415.22	wh. cr. powd.....
5	".....	$\text{Zn}(\text{IO}_3)_2 \cdot 2\text{H}_2\text{O}$	451.25	.....
6	iodide.....	ZnI_2	319.22	cub. col. or wh. powd., deliq.....
7	<i>dl</i> -lactate.....	$\text{Zn}(\text{C}_3\text{H}_5\text{O}_3)_2 \cdot 3\text{H}_2\text{O}$	297.57	wh. rhomb. cr.....
8	<i>d</i> -lactate.....	$\text{Zn}(\text{C}_3\text{H}_5\text{O}_3)_2 \cdot 3\text{H}_2\text{O}$	297.57	wh. need.....
9	laurate.....	$\text{Zn}(\text{C}_{12}\text{H}_{23}\text{O}_2)_2$	463.99	wh. powd.....
10	permanganate.....	$\text{Zn}(\text{MnO}_4)_2 \cdot 6\text{H}_2\text{O}$	411.34	vlt. br. or blk., deliq.....
11	nitrate.....	$\text{Zn}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$	243.44	need.....
12	".....	$\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	297.49	tetr. col.....
13	nitride.....	Zn_3N_2	224.16	gray.....
14	oleate.....	$\text{Zn}(\text{C}_{18}\text{H}_{33}\text{O}_2)_2$	628.27	wax-like solid.....
15	oxalate.....	$\text{ZnC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$	189.43	wh. powd.....
16	oxide.....	ZnO	81.38	wh. or yelsh., amor. powd.....
17	" (zincite).....	ZnO	81.38	hex. wh., 2.008, 2.029.....
18	" , per-.....	ZnO_2	97.38	wh.-yel. powd.....
19	2,4-pentanedione deriv. (acetylacetonate).....	$\text{Zn}(\text{C}_5\text{H}_7\text{O}_2)_2$	263.59	need.....
20	1-phenol-4-sulfonate (<i>p</i>).....	$\text{Zn}(\text{C}_6\text{H}_5\text{O}_4\text{S})_2 \cdot 8\text{H}_2\text{O}$	555.83	clear, col. cr. or fine wh. powd., effl.....
21	orthophosphate.....	$\text{Zn}_3(\text{PO}_4)_2$	386.18	rhomb. col.....
22	orthophosphate (α -hopeite).....	$\text{Zn}_3(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$	458.24	rhomb. col., 1.572, 1.591, 1.59.....
23	orthophosphate (β -hopeite).....	$\text{Zn}_3(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$	458.24	rhomb. col., 1.574, 1.582, 1.582.....
24	orthophosphate (parahopeite).....	$\text{Zn}_3(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$	458.24	tricl. col., 1.614, 1.625, 1.665.....
25	orthophosphate.....	$\text{Zn}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$	530.31	rhomb. pl.....
26	" , tetra-H.....	$\text{Zn}(\text{H}_2\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$	295.48	tricl.....
27	pyrophosphate.....	$\text{Zn}_2\text{P}_2\text{O}_7$	304.80	wh. powd.....
28	phosphide.....	Zn_3P_2	258.18	cub. dk. gray.....
29	hypophosphite.....	$\text{Zn}(\text{H}_2\text{PO}_2)_2 \cdot \text{H}_2\text{O}$	213.47	col., hyg. cr. powd.....
30	picrate.....	$\text{Zn}(\text{C}_6\text{H}_2\text{N}_3\text{O}_7)_2 \cdot 8\text{H}_2\text{O}$	665.71	yel. cr. powd., exp.....
31	salicylate.....	$\text{Zn}(\text{C}_7\text{H}_5\text{O}_3)_2 \cdot 3\text{H}_2\text{O}$	393.65	need.....
32	selenide.....	ZnSe	144.34	hex., 2.89.....
33	orthosilicate (willemite).....	Zn_2SiO_4 (or $2\text{ZnO} \cdot \text{SiO}_2$)	222.82	trig., 1.694, 1.723.....
34	silicate (calamine).....	$2\text{ZnO} \cdot \text{SiO}_2 \cdot \text{H}_2\text{O}$	240.84	rhomb., 1.614, 1.617, 1.636.....
35	metasilicate.....	ZnSiO_3	141.44	hex. col.....
36	stearate.....	$\text{Zn}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	632.31	light powd.....
37	sulfate (zinkosite).....	ZnSO_4	161.44	rhomb. col., 1.658, 1.669, 1.670.....
38	".....	$\text{ZnSO}_4 \cdot 6\text{H}_2\text{O}$	269.54	monocl. or tetr. col.....
39	" (goslarite).....	$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$	287.55	rhomb. col., effl., 1.457, 1.480, 1.484.....
40	sulfide (α -) (wurzite).....	ZnS	97.44	hex. col., 2.356, 2.378.....
41	" (β -) (sphalerite).....	ZnS	97.44	cub. col., 2.368.....
42	".....	$\text{ZnS} \cdot \text{H}_2\text{O}$	115.46	yelsh.-wh. powd.....
43	sulfite.....	$\text{ZnSO}_3 \cdot 2$ (or $2\frac{1}{2}\text{H}_2\text{O}$)	181.47 (190.48)	wh. cr. powd.....
44	tartrate.....	$\text{ZnC}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$ (or $2\text{H}_2\text{O}$)	231.47 (249.48)	wh. powd.....
45	tellurate.....	Zn_3TeO_6	419.75	heavy granular ppt. wh.....
46	telluride.....	ZnTe	192.99	cub. red, 3.56.....

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	6.15 calc.	<800				
2				s.		i. al., eth.
3	3.053	d. 125		.00000026	18	s. a., alk.
4	4.98	d.		sl. s.		s. HNO ₃ , alk.
5				0.877	1.32	s. HNO ₃ , NH ₄ OH
6	4.066 ^{14.2}	446	624	430 ⁰ ; 437.7 ³⁰	510 ¹⁰⁰	s. a., al., eth., NH ₄ (NH ₄) ₂ CO ₃
7				1.67 ¹⁵	16.7 ¹⁰⁰	v. sl. s. al.
8				5.7 ¹⁵	9 ³³	.104 h. 98% al.
9		128		0.01 ¹⁵	0.019 ¹⁰⁰	0.010 ¹⁵ al.
10	2.47	-5H ₂ O, 100		v. s.	v. s.	d. al., a.
11		45.5		327.3 ⁴⁰		
12	2.065 ¹⁴	36.4	-6H ₂ O, 105-131	184.3 ²⁰	∞	v. s. al.
13				d.		s. HCl
14		70		i.		sl. s. acet.
15	2.562 ^{24.5}	s. 100		.00079 ¹⁸		s. a., alk.
16	5.47	>1800		.00016 ²⁹		s. min. a., dil. ac. a., NH ₄ OH
17	5.606	>1800	subl. 1800	.00016 ²⁹		s. a., alk., NH ₄ Cl; i. NH ₃ , al.
18	1.571			0.0022		d. a.
19		138	subl.		v. s. d.	v. s. bz., acet.; s. al.
20		-8H ₂ O, 125		62.5	250 ¹⁰⁰	55.6 ²⁵ al.
21	3.998 ¹⁵	900		i.	i.	s. a., NH ₄ OH; i. al.
22	3.04	tr. >105		i.	i.	v. s. a., NH ₄ OH, NH ₄ salts
23	3.03	tr. >140		i.	i.	v. s. a., NH ₄ OH, NH ₄ salts
24	3.75	tr. >163		i.	i.	v. s. a., NH ₄ OH, NH ₄ salts
25	3.109 ¹⁵			i.		s. alk.
26		100 d.		d.		
27	3.75 ²³			i.	i.	s. a., alk., NH ₄ OH
28	4.55 ¹³	>420	1100	i.		d. H ₂ SO ₄ ev. H ₃ P, HNC ₃ viol. s. dil. a.; i. al.
29				s.		s. alk.
30		exp.		s.		
31				5 ²⁰		s. al.
32	5.42 ¹⁵			i.		s. a.
33	3.9	1509			i.	
34	3.45			i.	i.	
35	3.52	1437		i.		
36		130		i.		i. al., eth.
37	3.74 ¹⁵ ; (3.4)	d. 740		86.5 ⁸⁰	80.8 ¹⁰⁰	sl. s. al.
38	2.072 ¹⁵	tr. 70		s.	117.5 ⁴⁰	
39	1.97	tr. 39	-7H ₂ O, 280	96.5 ²⁰	663.6 ¹⁰⁰	sl. s. al.
40	4.087	1850 ¹⁵⁰ atm.	subl. 1185	.00069 ¹⁸		v. s. a.; i. ac. a.
41	4.102 ²⁵	tr. 1020		.000065 ¹⁸		v. s. a.
42	3.98	1049		i.		s. a.
43				0.16	d.	s. H ₂ SO ₃ ; i. al.
44				0.055 ³⁰		
45				i.	i.	s. a.
46	6.34 ¹⁵ ; 5.54 ¹³	1238.5		i.	i.	s. a.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Zinc				
1	thiocyanate.....	$\text{Zn}(\text{SCN})_2$	181.54	wh. powd.....
2	valerate.....	$\text{Zn}(\text{C}_5\text{H}_9\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	303.66	wh. glist. sc. or powd., disg. odor....
Zinc complexes:				
3	Tetramminezinc per- rhenate.....	$[\text{Zn}(\text{NH}_3)_4](\text{ReO}_4)_2$	634.13	wh. cub. cr.....
4	Tetrapyridinezinc fluosilicate.....	$\text{Zn}(\text{C}_5\text{H}_5\text{N})_4\text{SiF}_6$	523.83	rhomb. wh.....
Zirconium				
5	acetate, basic.....	$\text{ZrOH}(\text{C}_2\text{H}_3\text{O}_2)_3(?)$	91.22	cub. silv. wh.-gray.....
6	bromide, di-.....	ZrBr_2	285.36	wh. cr.....
7	“ tri-.....	ZrBr_3	251.05	blk. powd., ign. in air.....
8	“ tetra-.....	ZrBr_4	330.97	bl.-blk. powd.....
9	carbide.....	ZrC	410.88	wh. cr. powd., hyg.....
10	chloride, di-.....	ZrCl_2	103.23	hard gray metallic.....
11	“ tri-.....	ZrCl_3	162.13	blk.....
12	“ tetra-.....	ZrCl_4	197.59	brn.....
13	fluoride.....	ZrF_4	233.05	wh. lust. cr.....
14	hydroxide.....	$\text{Zr}(\text{OH})_4$	167.22	hex. col.....
15	iodide.....	ZrI_4	159.25	gelat. or wh. amor. powd.....
16	oxide, di- (baddeleyite) ..	ZrO_2	598.90	wh. or yel. cr.....
17	“ “ (zirconia) ($\text{HfO}_2 < 1\%$).....	ZrO_2	123.22	col.-yel. or br., monocl., 2.13, 2.19, 2.20.....
18	phosphide.....	ZrP_2	123.22	gray.....
19	selenate.....	$\text{Zr}(\text{SeO}_4)_2 \cdot 4\text{H}_2\text{O}$	153.26	hex. transp. cr.....
20	orthosilicate (zircon, hyacinth).....	ZrSiO_4	449.20	tetr. col.-red or var. color, 1.92-96, 1.97-2.02.....
21	silicide.....	ZrSi_2	183.28	steel-gray rhomb. lust. met.....
22	sulfate.....	$\text{ZrSO}_4 \cdot 2\text{H}_2\text{O}$	147.34	rhomb. col. or wh. cr. powd.....
23	sulfide.....	ZrS_2	355.40	steel-gray cr.....
24	Zirconyl bromide.....	$\text{ZrOBr}_2 \cdot \text{H}_2\text{O}$	155.34	brill. need., deliq.....
25	chloride.....	$\text{ZrOCl}_2 \cdot 8\text{H}_2\text{O}$	322.26	tetr. need. wh., effl., 1.552, 1.563.....
26	hydroxide (metazirconic acid).....	$\text{ZrO}(\text{OH})_2$ (or H_2ZrO_3).....	141.24	gelat. wh.....
27	iodide.....	$\text{ZrOI}_2 \cdot 8\text{H}_2\text{O}$	505.19	col. need., hyg.....
28	sulfide.....	ZrOS	139.28	yel. powd.....
29				

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	.....	.....	.....	s.	.....	s. al., NH_4OH
2	.....	.....	.....	2.6 ²⁴⁻²⁵	s.	ca. 2.5 al.; v. sl. s. eth.
3	3.608 ²⁵ ₄	.....	.....	.....	.....	0.1852 conc. NH_4OH
4	2.197	.....	.....	.....	.....	.....
5	6.4	1900	>2900	i.	i.	s. HF, aq. reg.; sl. s. a.
6	.....	.....	.....	s.	.....	.....
7	.....	d. >350	.....	d. ev. H_2	.....	.....
8	.....	d. 350	.....	d. ev. H_2	.....	.....
9	.....	volat.	.....	d.	.....	s. al., eth.
10	.....	3532	5100	i.	.....	s. a., dil. HF
11	.....	d. >350	.....	d. ev. H_2	.....	.....
12	.....	d. 350— ZrCl_2	.....	d. ev. H_2	.....	.....
13	2.80	subl. 300	.....	d. to ZrOCl_2	.....	s. al., eth., conc. HCl
14	4.43	subl.	d.	1.39	d.	s. HF; i. a.
15	3.25	— $2\text{H}_2\text{O}$, 550	.....	0.02	.....	s. a.; i. alk., al.
16	.....	.....	.....	s., d.	s.	d. al.; s. a., eth.; sl. s. bz., CS_2
17	5.49	2700	(4300)	i.	i.	s. H_2SO_4 , HF
18	5.71-3	2950-3000	.....	i.	i.	s. H_2SO_4 , HF
19	4.77 ²⁵ ₄	.....	.....	i.	.....	.....
20	.....	—$3\text{H}_2\text{O}$, 100	— $4\text{H}_2\text{O}$, 130	s.	.....	sl. s. al., conc. a.
21	4.56	2550	.....	i.	.....	i. a., aq. reg., alk.
22	4.88 ²²	.....	.....	.....	.....	.....
23	.....	—$3\text{H}_2\text{O}$, 120	.....	146 ^{39.5}	.....	s. H_2SO_4 ; i. al.
24	3.87	.....	.....	.....	.....	.....
25	.....	—\text{H_2O , 120	.....	s.	.....	s. h. conc. HBr
26	.....	—$6\text{H}_2\text{O}$, 150	— $8\text{H}_2\text{O}$, 210	s.	d.	s. al., eth.; sl. s. HCl
27	.....	.....	.....	sl. s.	.....	s. al.; sl. s. dil. HCl, dil. HNO_3 , oxal. a.
28	.....	d.	.....	v. s.	v. s.	v. s. eth.; s. al.
29	4.87	ign. in air	.....	.....	.....	.....

PHYSICAL CONSTANTS OF

Metallic salts of organic acids will be

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Aluminum:				
1	Diethylaluminum malonate	$\text{Al}(\text{C}_2\text{H}_{11}\text{O}_4)_3$	504.45	wh. need. or pr.....
2	Triethylaluminum.....	$\text{Al}(\text{C}_2\text{H}_5)_3$	114.15	col. liq., ign. in air, 1.480 ^{6.5}
3	Triethylaluminum etherate	$4\text{Al}(\text{C}_2\text{H}_5)_3 \cdot 3(\text{C}_2\text{H}_5)_2\text{O}$	678.97	col. liq.....
4	Trimethylaluminum.....	$\text{Al}(\text{CH}_3)_3$	72.07	col. liq., ign. in air, 1.432 ¹²
5	Triphenylaluminum.....	$\text{Al}(\text{C}_6\text{H}_5)_3$	258.27	wh. need.....
Antimony:				
6	Antimony ethoxide(ous) (triethyl antimonite)	$\text{Sb}(\text{C}_2\text{H}_5\text{O})_3$	256.94	col. liq.....
7	Pentamethylantimony..	$\text{Sb}(\text{CH}_3)_5$	196.93	existence doubtful.....
8	Triethylantimony.....	$\text{Sb}(\text{C}_2\text{H}_5)_3$	208.94	liq.....
9	Trimethylantimony.....	$\text{Sb}(\text{CH}_3)_3$	166.86	liq.....
10	Triphenylantimony, (triphenylstibine)	$\text{Sb}(\text{C}_6\text{H}_5)_3$	353.06	col. tricl. pl.....
Arsenic:				
11	Arsanilic acid (<i>p</i>) (<i>p</i> -aminophenylarsinic acid)...	$\text{H}_2\text{NC}_6\text{H}_4\text{AsO}(\text{OH})_2$	217.04	wh. need.....
12	Arsenoacetic acid.....	$(\text{AsCH}_2\text{COOH})_2$...	267.91	sm. yel. need.....
13	Arsenobenzene.....	$\text{C}_6\text{H}_5\text{As}:\text{AsC}_6\text{H}_5$...	304.02	wh. need.....
14	Cacodyl oxide (dicacodyl oxide)	$[(\text{CH}_3)_2\text{As}]_2\text{O}$	225.96	col. liq.....
15	Cacodyl sulfide (dicacodyl sulfide)	$[(\text{CH}_3)_2\text{As}]_2\text{S}$	242.02	oil.....
16	Dimethylarsine (cacodyl hydride)	$(\text{CH}_3)_2\text{AsH}$	105.99	col. liq., ign. in air.....
17	Dimethylarsinic acid (cacodylic acid)	$\text{As}(\text{CH}_3)_2\text{O} \cdot \text{OH}$	137.99	odorl., col. pr.....
18	Dimethylbromarsine (cacodyl bromide)	$(\text{CH}_3)_2\text{AsBr}$	184.89	yel. oil.....
19	Dimethylchlorarsine (cacodyl chloride)	$(\text{CH}_3)_2\text{AsCl}$	140.44	col. liq., infl.....
20	Methylarsine.....	CH_3AsH_2	91.96	col. liq.....
21	Phenylarsonic acid (benzene arsonic acid)	$\text{C}_6\text{H}_5\text{AsO}_3\text{H}_2$	202.03	col. pr.....
22	Tetraethyldiarsine (ethyl cacodyl)	$[(\text{C}_2\text{H}_5)_2\text{As}]_2$	266.06	oil.....
23	Tetraethyldiarsyl.....	$[\text{As}(\text{C}_2\text{H}_5)_2]_2$	266.06	liq.....
24	Tetramethyldiarsyl.....	$[\text{As}(\text{CH}_3)_2]_2$	209.96	col.-yel. oily liq., highly poisonous..
25	Triethylarsine (arsenic triethyl)	$\text{As}(\text{C}_2\text{H}_5)_3$	162.09	col. liq.....
26	Trimethylarsine (arsenic trimethyl)	$\text{As}(\text{CH}_3)_3$	120.01	col. liq.....
27	Triphenylarsine (arsenic triphenyl)	$\text{As}(\text{C}_6\text{H}_5)_3$	306.21	wh. need. or rhomb. pl., 1.6139 ⁴⁸ ...
Beryllium:				
28	Di- <i>n</i> -butylberyllium.....	$\text{Be}(\text{C}_4\text{H}_9)_2$	123.25	col. liq.....
29	Diethylberyllium.....	$\text{Be}(\text{C}_2\text{H}_5)_2$	67.14	col. liq.....
30	Dimethylberyllium.....	$\text{Be}(\text{CH}_3)_2$	39.09	wh. need.....
31	Dipropylberyllium.....	$\text{Be}(\text{C}_3\text{H}_7)_2$	95.19	liq.....
Bismuth:				
32	Methylbismuthine.....	$\text{CH}_3 \cdot \text{BiH}_2$	226.05	liq. (exist. quest.).....
33	Triethylbismuthine (bismuth triethyl)	$\text{Bi}(\text{C}_2\text{H}_5)_3$	296.18	liq.....
34	Trimethylbismuthine (bismuth trimethyl)	$\text{Bi}(\text{CH}_3)_3$	254.10	liq.....

METAL-ORGANIC COMPOUNDS

found in the preceding section of the table.

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids etc.
1	1.084 ¹⁰⁰	98	.....	i.	.....	s. org. solv.
2	.....	< -18	194	exp.; d. to	+ C ₂ H ₅	.....
3	.....	.....	112 ¹⁶	Al(OH) ₃ exp.		d. al.; s. bz., eth.
4	.....	0	130	d. to Al(O		s. eth.
5	.....	196-200	.....	d.	.....	d. al., chl., CCl ₄ ; s. bz.
6	1.524 ¹⁷	.....	95 ¹¹	d.	.....	s. org. liqs.
7	.....	96-100	.....	i.	i.	.....
8	1.324 ¹⁶	< -29	159.5	i.	i.	s. al., eth.
9	1.523 ¹⁵	.....	80.6	sl. s.	sl. s.	s. eth.; i. al.
10	1.4343 ²⁵ (1.4998)	50, (46-53)	> 220 ¹ ; > 360 ⁷⁶⁰	i.	i.	s. org. solv.; sl. s. al.
11	.....	232	.....	.....	.....	s. eth., MeOH; sl. s. al. acet.; i. bz., chl.
12	.....	> 260, d. 205	.....	i.	.....	s. pyr., alks., alk. carb; i. al., eth., chl.
13	.....	212	.....	i.	.....	s. bz., chl., CS ₂ ; sl. s. al.; i. eth.
14	1.486 ¹⁵	-25	149-51	sl. s.	.....	s. al., eth.
15	.....	.....	211	sl. s.	.....	s. al., eth.
16	1.213 ²⁹	.....	35.6 ⁷⁴⁷	.....	.....	s. al., eth., chl., bz., CS ₂
17	.....	200	.....	82.9 ²²	v. s.	s. al.; i. eth.
18	.....	.....	130	.....	.....	.....
19	> 1	< -45	106.5-107, (109)	i.	.....	v. s. al.; i. eth.
20	.....	.....	2	0.00085	.....	s. al., eth.
21	1.760	158-62 d.	.....	3.36 ²³	31.6 ²⁴	18.4 ²⁶ 95% al.
22	.....	.....	185-90	i.	.....	s. al., eth.
23	1.+	.....	186	i.	.....	s. al., eth.
24	1.15	-6	170	sl. s.	.....	s. al., eth.
25	1.152	.....	140 ⁷³⁶	i.	.....	.....
26	1.124	.....	70	sl. s.	.....	s. eth.
27	1.2225 ⁴⁸	60-60.5 (57)	> 360 (In CO ₂)	i.	.....	v. s. eth., bz.; sl. s. cold. al.
28	.....	.....	170 ²⁵	d.	d.	.....
29	.....	12	110 ¹⁵	d. to C ₂ H ₅	.....	.....
30	.....	.....	subl. 200	d. to CH ₄	.....	.....
31	.....	< -17	245	.....	.....	.....
32	2.30 ¹³	.....	110	i.	i.	s. al., eth.
33	1.82	.....	107 ⁷⁹	i.	.....	s. al., eth.
34	2.300 ¹³	.....	110	i.	i.	s. al., eth.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Bismuth:				
1	Triphenylbismuthine (bismuth triphenyl)	$\text{Bi}(\text{C}_6\text{H}_5)_3$	440.30	monocl.
Boron:				
2	Aminophenylboric acid (<i>m</i>)	$(\text{NH}_2\text{C}_6\text{H}_4)\text{B}(\text{OH})_2$	136.95	wh. hex. pl.
3	Amylboric acid (<i>n</i>)	$(\text{C}_5\text{H}_{11})\text{B}(\text{OH})_2$	115.98	col. fl.
4	Anisylboric acids, <i>o, m, p</i> (methoxyphenylboric acids)	$\text{CH}_3\text{OC}_6\text{H}_4\text{B}(\text{OH})_2$	151.96	wh. cr.
5	Borine carbonyl	BH_3CO	41.85	col. unst. gas.
6	Butylboric acid (<i>n</i>)	$\text{C}_4\text{H}_9\text{B}(\text{OH})_2$	101.95	col. cr.
7	Butylboric acid (<i>tert</i>)	$\text{C}_4\text{H}_9\text{B}(\text{OH})_2$	101.95	wh. cr.
8	Diethoxyboron chloride	$(\text{C}_2\text{H}_5\text{O})_2\text{BCl}$	136.40	col. liq.
9	Diisamylxyboron chloride	$(\text{C}_5\text{H}_{11}\text{O})_2\text{BCl}$	188.56	col. liq.
10	Dimethoxyborine	$(\text{CH}_3\text{O})_2\text{BH}$	73.90	col. liq., unst.
11	Dimethoxyboron chloride	$(\text{CH}_3\text{O})_2\text{BCl}$	108.35	col. liq.
12	Dimethylboric acid (dimethylhydroxyborine)	$(\text{CH}_3)_2\text{BOH}$	57.90	col. liq.
13	Dimethylboric anhydride	$(\text{CH}_3)_2\text{BOB}(\text{CH}_3)_2$	97.78	col.
14	Dimethylborine trimethylamine	$(\text{CH}_3)_3\text{NBH}(\text{CH}_3)_2$	101.01	col. liq.
15	Dimethylboron bromide	$(\text{CH}_3)_2\text{BBr}$	120.80	col. liq. or gas.
16	Dimethylboron iodide	$(\text{CH}_3)_2\text{BI}$	167.81	col. liq.
17	Dimethyldiborane (1,1) (unsym.)	$\text{B}_2\text{H}_4(\text{CH}_3)_2$	55.74	col. gas.
18	Dimethyldiborane (1,2) (sym.)	$\text{B}_2\text{H}_4(\text{CH}_3)_2$	55.74	col. unst. gas.
19	Dimethyltriborine triamine (<i>B</i>)	$(\text{CH}_3)_2\text{B}_3\text{N}_3\text{H}_4$	108.59	col. liq.
20	Dimethyltriborine triamine (<i>N</i>)	$(\text{CH}_3)_2\text{B}_3\text{N}_3\text{H}_4$	108.59	col. liq.
21	Dimethyltriborine triamine (<i>N-B</i>)	$(\text{CH}_3)_2\text{B}_3\text{N}_3\text{H}_4$	108.59	col. liq.
22	Diphenylboric acid (diphenylhydroxyborine)	$(\text{C}_6\text{H}_5)_2\text{BOH}$	182.03	col. radiating cr.
23	Diphenylboron bromide	$(\text{C}_6\text{H}_5)_2\text{BBr}$	244.93	col. visc. liq. or cr.
24	Diphenylboron chloride	$(\text{C}_6\text{H}_5)_2\text{BCl}$	200.48	col. visc. liq.
25	Di- <i>p</i> -tolylboric anhydride	$(\text{C}_7\text{H}_7)_2\text{BOB}(\text{C}_7\text{H}_7)_2$	402.15	wh. powd.
26	Ethoxyboron dichloride	$\text{C}_2\text{H}_5\text{OBCl}_2$	126.79	col. liq.
27	Ethyl boric acid	$(\text{C}_2\text{H}_5)_2\text{B}(\text{OH})_2$	73.90	wh. cr.
28	Furanylboric acid (β)	$(\text{C}_4\text{H}_3\text{O})\text{B}(\text{OH})_2$	111.90	wh. cr.
29	Hexylboric acid (<i>n</i>)	$\text{C}_6\text{H}_{13}\text{B}(\text{OH})_2$	130.00	wh. cr.
30	Isobutylboric acid	$\text{C}_4\text{H}_9\text{B}(\text{OH})_2$	101.95	col. cr.
31	Methoxyboron dichloride	CH_3OBCl_2	112.77	col. liq.
32	Methoxyboron difluoride	CH_3OBF_2	79.85	col. liq.
33	Methylboric acid	$\text{CH}_3\text{B}(\text{OH})_2$	59.87	wh. pl.
34	Methylborine trimethylamine	$(\text{CH}_3)_3\text{NBH}_2\text{CH}_3$	86.98	col. liq.
35	Methyldiborane	$\text{B}_2\text{H}_5\text{CH}_3$	41.71	col. very unst. gas.
36	Methyltriborine triamine (<i>B</i>)	$\text{CH}_3\text{B}_3\text{N}_3\text{H}_5$	94.56	col. liq.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.585	78	.....	.....	.....	v. s. chl.; s. eth., acet.; sl. s. al.
2	d.	d.	sl. s.	.....	s. al.; sl. s. eth.
3	93-4, d.	d.	s.	s.	s. eth., dichloroethane
4	d.	d.	sl. s.	.....	s. al., eth., bz.
5	-137.0	-63	d.	d.	.....
6	92-4	d.	s.	s.	v. s. al., eth., chl., acet., acet. a. and esters; sl. s. bz., CCl ₄ , pet. eth.
7	105 d.	d.	s.	.....	s. eth.
8	112.3	d.	d.	.....
9	110-15 ¹⁴	d.	d.	.....
10	-130.6	25.9	d.	d.	.....
11	-87.5	74.7	d.	d.	.....
12	0 ³⁶	v. s.	.....	.....
13	-37.3	43	hyd.	hyd.	.....
14	-18.0	d. 172	d.	d.	s. eth.
15	-123.4	22	d.	d.	.....
16	-110.7	65	d.	d.	.....
17	-150.2	-2.6	d.	d.	.....
18	-125	4.9	d.	d.	.....
19	-48	107	hyd.	hyd.	.....
20	108	hyd.	hyd.	.....
21	124	hyd.	hyd.	.....
22	264-67	215-35 ¹⁷	i.	i.	s. eth., al., pet. eth.
23	25	150-60 ⁶	d.	d.	s. bz.
24	271	d.	d.	s. bz., pet. eth.
25	78	.....	i.	.....	s. al., eth., bz.
26	77.9	d.	d.	.....
27	subl. 40	.....	s.	s.	s. al., eth.
28	110 d.	d.	s.	.....	v. s. eth., al., acet.; sl. s. bz., tol.
29	88-90, d.	d.	sl. s.	.....	s. eth.
30	106-12, d.	d.	s.	.....	s. eth., dichloroethane
31	-15	58.0	d.	d.	.....
32	1.417 ^{35.5} , 1.354 ^{76.5}	.....	86	d.	d.	.....
33	d.	d.	sl. s.	.....	s. al., eth.
34	0.8	177	d.	d.	s. eth.
35	-80 ⁵⁰ ; d. appr. -20	d.	d.	.....
36	-59	87	hyd.	hyd.	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Boron:				
1	Methyltriborine tri-amine (<i>N</i>)	$\text{CH}_3\text{B}_3\text{N}_3\text{H}_5$	94.56	col. liq.....
2	Nitrophenylboric acids <i>o. m. p</i>	$\text{NO}_2\text{C}_6\text{H}_4\text{B}(\text{OH})_2$...	166.94	yel. need. or pr.....
3	Phenylboron dibromide	$\text{C}_6\text{H}_5\text{BBr}_2$	247.75	col. cr.....
4	Phenylboron dichloride	$\text{C}_6\text{H}_5\text{BCl}_2$	158.83	col. liq.....
5	Sodium tri- α -naphthyl boride	$\text{Na}_2\text{B}(\text{C}_{10}\text{H}_7)_3$	438.28	bl. cr. (purple in dil. soln.).....
6	Tetramethoxydiborine	$(\text{CH}_3\text{O})_4\text{B}_2$	145.78	col. liq.....
7	Tetramethyldiborane (1,1,2,2)	$\text{B}_2\text{H}_2(\text{CH}_3)_4$	83.79	col. liq.....
8	Tetramethyltriborine triamine (<i>N-B-B'</i>)	$(\text{CH}_3)_4\text{B}_3\text{N}_3\text{H}_5$	136.64	col. liq.....
9	Thiophenylboric acid (α) ("thienylboric" acid)	$(\text{C}_6\text{H}_5\text{S})\text{B}(\text{OH})_2$	127.96	col. star-formed need.....
10	Tribenzylborine	$\text{B}(\text{C}_6\text{H}_5\text{CH}_2)_3$	284.20	prismatic need. or col. oily liq.....
11	Tri- <i>n</i> -butylborine	$\text{B}(\text{C}_4\text{H}_9)_3$	182.16	col. mobile liq.....
12	Tri- <i>tert</i> -butylborine	$\text{B}(\text{C}_4\text{H}_9)_3$	182.16	col. mobile liq.....
13	Tri- <i>n</i> -butyltriborine tri-oxane (<i>n</i> -butyl boron oxide)	$(\text{C}_4\text{H}_9)_3\text{B}_3\text{O}_3$	251.80	col. liq.....
14	Tri- <i>tert</i> -butyltriborine trioxane (<i>tert</i> -butyl boric oxide)	$(\text{C}_4\text{H}_9)_3\text{B}_3\text{O}_3$	251.80	col. liq.....
15	Trichloroborine di-methyletherate	$(\text{CH}_3)_2\text{OBCl}_3$	163.26	col. cr.....
16	Trichloroborine tri-methylamine	$(\text{CH}_3)_3\text{NBCl}_3$	176.30	col. cr.....
17	Tricyclohexylborine (boron tricyclohexyl)	$\text{B}(\text{C}_6\text{H}_{11})_3$	260.27	col. interlocking cr.....
18	Triethyl borate (tri-ethoxyborine)	$\text{B}(\text{OC}_2\text{H}_5)_3$	146.00	col. liq., 1.381.....
19	Triethylboron (triethylborine)	$\text{B}(\text{C}_2\text{H}_5)_3$	98.00	col. liq.....
20	Tri- <i>n</i> -hexyltriborine tri-oxane (hexylboric oxide)	$(\text{C}_6\text{H}_{13})_3\text{B}_3\text{O}_3$	335.96	col. liq., 1.4323 ²⁰
21	Triisomyl borate (tri-isomyl oxyborine)	$\text{B}(\text{OC}_5\text{H}_{11})_3$	272.24	liq., 1.421.....
22	Triisomylborine	$\text{B}(\text{C}_5\text{H}_{11})_3$	224.24	col. mobile liq., 1.43207 ^{22,6}
23	Tri- <i>p</i> -anisylborine	$\text{B}(\text{CH}_3\text{OC}_6\text{H}_4)_3$	332.20	wh. need.....
24	Triisobutyl borate (tri-isobutoxyborine)	$\text{B}(\text{OC}_4\text{H}_9)_3$	230.16	liq., 1.408.....
25	Triisobutylborine	$\text{B}(\text{C}_4\text{H}_9)_3$	182.16	col., mobile liq., 1.41882 ^{22,6}
26	Trimethylaminoborine	$(\text{CH}_3)_3\text{NBH}_3$	72.96	col. hex., columns or need.....
27	Trimethyl borate (tri-methoxyborine)	$\text{B}(\text{OCH}_3)_3$	103.92	col. liq.....
28	Trimethylboron (tri-methylborine)	$\text{B}(\text{CH}_3)_3$	55.92	col. gas.....
29	Trimethyldiborane (1,1,2)	$\text{B}_2\text{H}_2(\text{CH}_3)_3$	69.77	col. liq.....
30	Trimethyltriborine tri-amine (<i>B</i>)	$(\text{CH}_3)_3\text{B}_3\text{N}_3\text{H}_5$	122.61	col. cr. or liq.....
31	Trimethyltriborine tri-amine (<i>N</i>)	$(\text{CH}_3)_3\text{B}_3\text{N}_3\text{H}_5$	122.61	col. liq.....
32	Trimethyltriborine tri-amine (<i>N-B-B'</i>)	$(\text{CH}_3)_3\text{B}_3\text{N}_3\text{H}_5$	122.61	col. liq.....
33	Trimethyl triborine tri-oxane (methylboric anhydride or anide)	$(\text{CH}_3)_3\text{B}_3\text{O}_3$	125.56	col. mobile liq.....

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids etc.
1			84	hyd.	hyd.	
2		d.	d.	sl. s.	s.	s. al., eth.
3		34	100 ²⁰	d.	d.	s. bz.
4		0	175	d.	d.	s. bz.
5			d.	d.		s. eth.; sl. s. lgr.
6		-24	d. 93; 21 ⁴⁴	d.	d.	
7		-72.5	68.6	d.	d.	
8			158	hyd.	hyd.	
9		134	d.	s.		s. eth., al., acet., bz., CCl ₄
10		47	230 ¹³	i.		v. s. al., bz.; sl. s. eth.
11			90-19; 108-10 ²⁰	i.	i.	v. s. eth., al.
12		glass at low temp.	71 ¹²	i.		s. eth.
13			154 ²⁰	hyd.	hyd.	v. s. eth.
14		20	66-8 ⁵	hyd.	hyd.	s. eth.
15		d. 76	d.	d.		
16		243			s.	s. al.
17		100	194 ¹⁵	i.		s. eth.
18	0.8746 ¹⁰ ; 0.864 ^{20.5}		117.4, (120)	d.		
19	0.6961 ²³	-92.9	0 ^{12.5}	i.	i.	s. al., eth.
20	0.8876		178-82 ²⁴	hyd.	hyd.	s. org. solv.
21	0.872 ⁰		255			
22	0.76		119 ¹⁴	i.		s. eth.
23		128		i.	i.	s. al., eth., bz.
24	0.864 ⁰		212			
25	0.74		188. 86 ²⁰	i.	i.	s. eth.
26		94	172	d.	d.	s. eth.
27	0.915; 0.9205 ^{24.3}	-29	68.7, (65)	d.		s. al., eth.
28	1.9108 g/l, 0.625 ⁻¹⁰⁰	-161.5	-20.2	v. sl. s.		v. s. al., eth.
29		-123	45.5	d.		
30		31.5	129	hyd.	hyd.	
31			134	hyd.	hyd.	
32			139	hyd.	hyd.	
33		-37	79	hyd.	hyd.	s. eth.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Boron:				
1	Tri- β -naphthyl borate...	$B(C_{10}H_7O)_3$	440.29	col. leaflets.....
2	Tri- α -naphthylborine...	$B(C_{10}H_7)_3$	392.29	col. need.....
3	Triphenyl borate (triphenoxyborine)	$(C_6H_5O)_3B$	290.12	col. cr.....
4	Triphenylborine ammine*	$(C_6H_5)_3BNH_3$	259.15	col. cr.....
5	Triphenylboron.....	$B(C_6H_5)_3$	242.12	hex. need.....
6	Tripropyl borate (tripropoxyboron)	$B(OC_3H_7)_3$	188.08	liq.....
7	Tri- <i>n</i> -propylborine.....	$B(C_3H_7)_3$	140.08	col., mobile liq., 1.4135 ^{22.8}
8	Tri- <i>sec</i> -propylborine.....	$B(C_3H_7)_3$	140.08	col. mobile liq.....
9	Tri- <i>p</i> -tolylborine.....	$B(CH_3C_6H_4)_3$	284.20	separate wh. cr.....
10	Tri- <i>p</i> -xylylborine.....	$B(CH_3C_6H_4CH_3)_3$...	326.28	col. bushed need.....
Cadmium:				
11	Dibutylcadmium.....	$Cd(C_4H_9)_2$	226.64	oil.....
12	Diethylcadmium.....	$Cd(C_2H_5)_2$	170.53	oil.....
13	Diisomylcadmium.....	$Cd(C_5H_{11})_2$	254.69	oil.....
14	Disobutylcadmium.....	$Cd(C_4H_9)_2$	226.64	oil.....
15	Dimethylcadmium.....	$Cd(CH_3)_2$	142.48	oil.....
16	Dipropylcadmium.....	$Cd(C_3H_7)_2$	198.58	oil.....
Calcium:				
17	Dianilinecalcium.....	$Ca(NHC_6H_5)_2$	224.31	wh. cr.....
18	Ethylcalcium iodide.....	C_2H_5CaI	196.06	amor. powd.....
19	Glycocolcalcium.....	$(CH_2NHCOCOO)Ca$...	113.13	cr.....
Cobalt:				
20	Bis-dimethylglyoxime cobalto chloride	$HON:CCH_3CCH_3$ $NOH \cdot Co$ $HON:CCH_3CCH_3:$ $NOCl_2$	361.09	lt. grn. cr.....
21	Cobalt(ous) hexamethylenetetramine	$CoCl_2 \cdot C_6H_{12}N_4$	270.04	ultramarine blue.....
22	Cobalt(ous) hydroxyquinone	$Co(C_{10}H_5O_3)_2$	405.22	ruby red.....
Copper				
23	diazoaminobenzene(ous)	$CuN_2(C_6H_5)_2$	259.80	or. cr.....
Gallium:				
24	Dimethylgallium amide.	$Ga(CH_3)_2NH_2$	115.81	wh. cr.....
25	Dimethylgallium chloride monamine	$Ga(CH_3)_2Cl \cdot NH_3$	152.28	wh. cr.....
26	Dimethylgallium chloride diamine	$Ga(CH_3)_2Cl \cdot 2NH_3$	169.31	wh. cr.....
27	Methylgallium dichloride	$Ga(CH_3)Cl_2$	155.67	wh. cr.....
28	Methylgallium dichloride monamine	$Ga(CH_3)Cl_2 \cdot NH_3$..	172.70	wh. cr.....
29	Methylgallium dichloride pentamine	$Ga(CH_3)Cl_2 \cdot 5NH_3$	240.83	wh. cr.....
30	Triethylgallium.....	$Ga(C_2H_5)_3$	156.90	col. liq.....
31	Triethylgallium monamine	$Ga(C_2H_5)_3 \cdot NH_3$	173.93	col. liq.....
32	Triethylgallium monoetherate	$Ga(C_2H_5)_3 \cdot (C_2H_5)_2O$	231.02	col. liq.....
33	Trimethylgallium.....	$Ga(CH_3)_3$	114.82	col. liq.....
34	Trimethylgallium monamine	$Ga(CH_3)_3 \cdot NH_3$	131.86	wh. cr.....
35	Trimethylgallium monoetherate	$Ga(CH_3)_3 \cdot (C_2H_5)_2O$	188.94	col. liq.....

* This compound is the prototype of numerous stable complex compounds formed from organic

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		115		d.		s. bz.
2		203	d.	i.		sl. s. eth., al.; v. s. bz., CCl ₄ , chl., CS ₂
3		ca. 35	>360	d.		s. eth., bz.
4		d. 216	d.			s. al.; sl. s. bz.
5		136	203 ¹⁶	d.		d. al.; s. bz.
6	liq. 0.867 ¹⁶		175			
7	0.725		156, 60 ²⁰	i.		s. eth.
8			148-54, 33-5 ¹²	i.		s. eth.
9		175	233 ¹²	i.		v. s. bz.; sl. s. eth.
10		147	221 ¹²	i.		v. s. bz., chl., CCl ₄ : sl. s. eth.
11	1.3056 ^{19.5}	-48	103.5 ^{12.5}	d.	d.	
12	1.6564 ^{18.1}	-21	64	d.	d.	
13	1.2210 ¹⁹	-115	121.5 ¹⁵			
14	1.2693 ¹⁸	-37	90.5 ²⁰	d.	d.	
15	1.9846 ^{17.9}	-4.5	105.5 ⁷⁵³	d.	d.	
16	1.4201 ^{17.6}	-83	84 ^{21.5}	d.	d.	
17		d.		d.		i. eth., bz., lgr.
18				d.		sl. s.
19				s.		
20				s.		s. al.
21				s.		
22		d. 210-15				
23		d. 270		i.		s. bz.; i. al., lgr.
24			subl. 60 vac.			
25		54		d.	d.	v. s. NH ₃ ; s. eth.
26		112		d.	d.	v. s. NH ₃ ; i. eth.
27		75		d.		v. s. eth.
28				d.		i. eth.
29		d. > 80		d.		i. NH ₃
30	1.0576 ³⁰	-82.3	142.6	d.		s. eth.
31				d.		
32				d.		s. eth.
33		-19	55.7 ± .27 ⁵²	d.		s. eth., NH ₃
34		31	subl. vac.	d.		s. eth., NH ₃ ; i. pet. eth.
35		<-76	99	d.		s. NH ₃ , eth.

amines and tri-aryl-borines.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Germanium:				
1	Amyltriphenylgermanium (<i>n</i>)	$\text{Ge}(\text{C}_5\text{H}_{11})(\text{C}_6\text{H}_5)_3$	375.04	col. pl.
2	Benzyltriphenylgermanium	$\text{Ge}(\text{CH}_2\text{C}_6\text{H}_5)(\text{C}_6\text{H}_5)_3$	395.03	col. pl.
3	Bis-acetylacetone germanium dibromide	$[\text{CH}(\text{CCH}_3\text{O})_2]_2\text{GeBr}_2$	430.65	col. micr. cr.
4	Bis-acetylacetone germanium dichloride	$[\text{CH}(\text{CCH}_3\text{O})_2]_2\text{GeCl}_2$	341.73	col. pr.
5	Bis-(5-oxy-2, 8 dithio octane) germanium	$[\text{SCH}_2\text{CH}_2)_2\text{O}]_2\text{Ge}..$	345.05	col. cr.
6	Bis-propionylacetone germanium dichloride	$[\text{CHC}_2(\text{C}_2\text{H}_5)(\text{CH}_3)_2\text{O}]_2\text{GeCl}_2$	369.78	wh. cr. powd.
7	Bis-tribenzyl germanyl sulfide	$[(\text{C}_6\text{H}_5\text{CH}_2)_3\text{Ge}]_2\text{S}..$	724.02	col. cr.
8	Bis-tribiphenyl germanyl sulfide	$[(\text{C}_6\text{H}_5\cdot\text{C}_6\text{H}_4)_3\text{Ge}]_2\text{S}$	1096.42	col. cr.
9	Bis-trichlorogermanyl methane	$\text{CH}_2(\text{GeCl}_3)_2$	371.97	col. liq.
10	Bis-tricyclohexylgermanium disulfide	$[(\text{C}_6\text{H}_{11})_3\text{Ge}]_2\text{S}_2$	708.21	col. cr.
11	Bis-triethylgermanyl sulfide	$[(\text{C}_2\text{H}_5)_3\text{Ge}]_2\text{S}$	351.62	col. oily liq.
12	Bis-triphenylgermanyl sulfide	$[(\text{C}_6\text{H}_5)_3\text{Ge}]_2\text{S}$	639.86	col. cr.
13	Bis-tri-tolylgermanyl sulfide	$[(\text{C}_6\text{H}_4\text{CH}_3)_3\text{Ge}]_2\text{S}..$	724.02	col. cr.
14	Butyltriphenylgermanium (<i>n</i>)	$\text{Ge}(\text{C}_4\text{H}_9)(\text{C}_6\text{H}_5)_3$. . .	361.01	col. need.
15	Cyclopentamethylene germanium dichloride	$(\text{CH}_2)_5\text{GeCl}_2$	213.65	col. liq.
16	Diethylcyclopentamethylenegermanium (1,1)	$(\text{CH}_2)_5\text{Ge}(\text{C}_2\text{H}_5)_2$. . .	200.85	col. liq.
17	Diethyldiphenylgermanium	$\text{Ge}(\text{C}_2\text{H}_5)_2(\text{C}_6\text{H}_5)_2$. .	284.92	col. liq.
18	Diethylgermanium bromide	$(\text{C}_2\text{H}_5)_2\text{GeBr}_2$	290.55	col. liq.
19	Diethylgermanium chloride	$(\text{C}_2\text{H}_5)_2\text{GeCl}_2$	201.64	col. liq.
20	Diethylgermanium imine	$(\text{C}_2\text{H}_5)_2\text{GeNH}$	145.74	col. liq.
21	Diethylgermanium iodide	$(\text{C}_2\text{H}_5)_2\text{GeI}_2$	384.56	col. liq.
22	Diethylgermanium oxide(α)	$[(\text{C}_2\text{H}_5)_2\text{GeO}]_x$	146.72 _x	stable wh. amor. solid
23	Diethylgermanium oxide(β)	$[(\text{C}_2\text{H}_5)_2\text{GeO}]_3$	440.16	unst. col. liq.
24	Diphenylgermanium . . .	$[(\text{C}_6\text{H}_5)_2\text{Ge}]_4$	907.20	wh. cr.
25	Diphenylgermanium dibromide	$(\text{C}_6\text{H}_5)_2\text{GeBr}_2$	386.63	col. liq.
26	Diphenylgermanium dichloride	$(\text{C}_6\text{H}_5)_2\text{GeCl}_2$	297.72	col. liq.
27	Diphenylgermanium difluoride	$(\text{C}_6\text{H}_5)_2\text{GeF}_2$	264.80	col. liq.
28	Diphenyl- <i>sec</i> -propylgermanium bromide	$(\text{C}_6\text{H}_5)_2(\text{C}_3\text{H}_7)\text{GeBr}$	349.80	col. liq.
29	Di- <i>p</i> -tolylgermanium dibromide	$(\text{CH}_3\text{C}_6\text{H}_4)_2\text{GeBr}_2$. .	414.69	lt. yel. liq.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		42-3		i.	i.	v. s. bz., pet. eth.; sl. s. me. al.
2		82.5-3.5		i.	i.	v. s. bz., pet. eth., chl.; sl. s. isopropyl al.; i. me. al.
3		226				sl. s. h. acetyl acet.; i. org. solv.
4		240 d.				sl. s. org. solv.
5		159.0-.5				s. bz., abs. al.
6		128-9				s. c. chl.; i. pet. eth.
7		124				s. al., me. al. bz.; i. alk.
8		238				s. org. solv.; i. alk.
9			110 ¹³	hyd.	hyd.	s. org. solv.
10		87-8		i.		s. abs. al.
11			148-50 ¹²			s. org. solv.; i. alk.
12		138				s. org. solv.; i. alk.
13		156-7				s. org. solv.; i. alk.
14		84.5-5.5		i.	i.	v. s. pet. eth., bz., chl., eth.; sl. s. isopropyl al.; i. me. al.
15			55-60 ¹²			
16			52 ¹³			
17			316	i.	i.	v. s. org. solv.
18		< -33	202	d.	d.	d. liq. NH ₃ ; s. org. solv.
19		-39 to -37	175	d.	d.	d. liq. NH ₃ ; s. org. solv.
20			100 ^{9.01}			
21		-2 to -1	252	d.	d.	d. liq. NH ₃ ; s. org. solv.
22		175		i.	i.	i. org. solv., liq. NH ₃
23		18		i.	i.	s. org. solv.; i. liq. NH ₃
24		294-5		i.	i.	sl. s. bz., tol., chl.; i. pet. eth.
25			120 ^{.007} 205-7 ⁶¹²	hyd.	hyd.	s. org. solv.
26	.71	9	223 ¹²	hyd.	hyd.	s. org. solv.
27			100 ^{9.007}	hyd.	hyd.	s. org. solv.
28			215-50 ¹³			
29			230-33 ¹³	hyd.	hyd.	s. org. solv.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Germanium:				
1	Di- <i>p</i> -tolylphenylgermanium bromide	$(\text{CH}_3\text{C}_6\text{H}_4)_2(\text{C}_6\text{H}_5)\text{GeBr}$	411.87	col. pr.
2	Di-triphenylgermanyl methane	$[(\text{C}_6\text{H}_5)_3\text{Ge}]_2\text{CH}_2$	621.83	lg. col. pr.
3	Ethyl- <i>tris-p</i> -biphenylgermanium	$\text{Ge}(\text{C}_2\text{H}_5)(\text{C}_6\text{H}_4\text{-C}_6\text{H}_5)_3$	561.24	col. cr.
4	Ethylgermanium oxide	$(\text{C}_2\text{H}_5\text{GeO})_2\text{O}$	251.32	wh. powd.
5	Ethylgermanium tribromide	$(\text{C}_2\text{H}_5)\text{GeBr}_3$	341.41	col. liq.
6	Ethylgermanium trichloride	$\text{C}_2\text{H}_5\text{GeCl}_3$	208.03	col. liq.
7	Ethylgermanium trifluoride	$\text{C}_2\text{H}_5\text{GeF}_3$	158.66	col. liq.
8	Ethylgermanium triiodide	$\text{C}_2\text{H}_5\text{GeI}_3$	482.42	yel. liq.
9	Ethylphenyldi- <i>p</i> -tolylgermanium	$\text{Ge}(\text{C}_2\text{H}_5)(\text{C}_6\text{H}_5)(\text{C}_6\text{H}_4\text{CH}_3)_2$	361.01	wh. cr.
10	Ethyl- <i>sec</i> -propyldiphenylgermanium	$\text{Ge}(\text{C}_2\text{H}_5)(\text{C}_6\text{H}_5)(\text{C}_6\text{H}_5)_2$	298.95	liq.
11	Ethyltribenzylgermanium	$\text{Ge}(\text{C}_2\text{H}_5)(\text{CH}_2\text{-C}_6\text{H}_5)_3$	375.04	col. cr.
12	Ethyltriphenylgermanium	$\text{Ge}(\text{C}_2\text{H}_5)(\text{C}_6\text{H}_5)_3$	332.96	col. sld.
13	Hexabenzyl digermane	$(\text{C}_6\text{H}_5\text{CH}_2)_6\text{Ge}_2$	691.96	col. cr.
14	Hexaethyl digermane	$[(\text{C}_2\text{H}_5)_3\text{Ge}]_2$	319.56	col. liq.
15	Hexaphenyldigermane	$[(\text{C}_6\text{H}_5)_3\text{Ge}]_2$	607.80	wh. cr.
16	Hexaphenyldigermane (tribenzene)	$[(\text{C}_6\text{H}_5)_3\text{Ge}]_2 \cdot 3\text{C}_6\text{H}_6$	842.13	col. cr.
17	Hexa- <i>p</i> -tolyl digermane	$(\text{CH}_3\text{C}_6\text{H}_4)_6\text{Ge}_2$	691.96	col. cr.
18	Methyltriphenylgermanium	$\text{Ge}(\text{CH}_3)(\text{C}_6\text{H}_5)_3$	318.94	trans. col. cr.
19	Octaphenyltrigermane	$(\text{C}_6\text{H}_5)_8\text{Ge}_3$	834.60	wh. cr.
20	Phenylethyl- <i>sec</i> -propylgermanium bromide	$(\text{C}_6\text{H}_5)(\text{C}_2\text{H}_5)[\text{CH}(\text{CH}_3)_2]\text{GeBr}$	301.76	col. oil; opt. act., <i>d.</i> & <i>l.</i> forms
21	Phenylgermanium tribromide	$(\text{C}_6\text{H}_5)\text{GeBr}_3$	389.45	col. liq.
22	Phenylgermanium trichloride	$(\text{C}_6\text{H}_5)\text{GeCl}_3$	256.07	col. liq.
23	Phenylgermanium triiodide	$\text{C}_6\text{H}_5\text{GeI}_3$	530.46	wh. sol., dec. by light.
24	Phenyltri- <i>p</i> -tolylgermanium	$\text{Ge}(\text{C}_6\text{H}_5)(\text{C}_6\text{H}_4\text{CH}_3)_3$	423.08	wh. pr.
25	Propyltriphenylgermanium (<i>n</i>)	$\text{Ge}(\text{C}_3\text{H}_7)(\text{C}_6\text{H}_5)_3$	346.99	col. need.
26	Tetra- <i>i</i> -amylgermanium	$\text{Ge}(\text{C}_5\text{H}_{11})_4$	357.16	col. oily liq., 1.457 ^{17.5}
27	Tetra- <i>n</i> -amylthiogermanium	$\text{Ge}[\text{S}(\text{CH}_2)_4\text{CH}_3]_4$	485.40	col. liq., 1.5336 ²⁵
28	Tetraanhydro-tetrakis-diphenylgermanediol (<i>cyclo</i>)	$[\text{Ge}(\text{C}_6\text{H}_5)_2\text{O}]_4$	971.20	monocl. pr. & cubes
29	Tetrabenzylgermanium	$\text{Ge}(\text{CH}_2\text{C}_6\text{H}_5)_4$	437.11	col. sol.
30	Tetra- <i>p</i> -biphenylgermanium	$\text{Ge}(\text{C}_6\text{H}_4\text{C}_6\text{H}_5)_4$	685.37	wh. need.
31	Tetra- <i>p</i> -bromophenylthiogermanium	$\text{Ge}(\text{SC}_6\text{H}_4\text{Br})_4$	824.87	col. cr.
32	Tetra- <i>n</i> -butylgermanium	$\text{Ge}(\text{C}_4\text{H}_9)_4$	301.05	col. oily liq.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		119				
2		132-33		i.		v. s. bz., eth., pet. eth., chl.; i. liq. NH ₃ , al.
3		154-6				
4		>300	d.	s.	s.	s. HCl, al.; i. pet. eth.
5		<-33	200 ⁷⁵³	d.	d.	d. liq. NH ₃ ; s. bz., eth.
6		<-33	144 ⁷⁶²	d.	d.	d. liq. NH ₃ ; s. bz., eth.
7		-16.5 to -15.5	112 ⁷⁵⁰	d.	d.	d. liq. NH ₃ ; s. bz., eth.
8		-2.5 to -1.5	281 ⁷⁵⁵ d. >350	d.	d.	d. liq. NH ₃ ; s. bz., eth.
9		55				
10		175-90				
11		56-7				s. meth. al.
12		78.0-5		i.	i.	s. eth., pet. eth., bz., chl. acet.; i. meth. al.
13		183-4				s. glac. acet. a.
14		<-60	265 ⁷⁵⁵	i.	i.	s. bz., eth.
15		340		i.	i.	sl. s. h. bz., h. chl.; i. liq. NH ₃ , lgr.
16		d. -C ₆ H ₅		i.		s. bz.
17		226-7				
18		70.5-1.0		i.	i.	v. s. bz., eth., acet., chl. pet. eth.; i. e. meth. al., liq. NH ₃
19		247-8		i.	i.	s. h. bz., h. chl.
20			130-5 ¹³			
21			120-2 ¹³	hyd.	hyd.	d. liq. NH ₃ ; s. org. solv.
22			105-6 ¹²	hyd.	hyd.	d. liq. NH ₃ ; s. org. solv.
23		55-6		hyd.	hyd.	d. liq. NH ₃ ; s. glac. acet. a.; org. solv.
24		191		i.	i.	s. org. solv.
25		86.0-5		i.	i.	v. s. chl., bz., pet. eth.; sl. s. isopropyl al.; i. meth. al., liq. NH ₃
26	0.9147 ²⁰		163-4			
27	1.0697 ²⁵		240-1 ²⁻⁴			s. bz., abs. al.
28		218				s. ethyl acetate, pet. eth., eth.
29		107-8				
30		270-2		i.	i.	s. bz.
31		196.0-5				s. bz., abs. al.
32			178-80 ^{733?}			

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Germanium:				
1	Tetra- <i>tert</i> -butylphenylthiogermanium	$\text{Ge}[\text{SC}_6\text{H}_4\text{C}(\text{CH}_3)_3]_4$	733.66	col. tetrag
2	Tetra- <i>n</i> -butylthiogermanium	$\text{Ge}[\text{S}(\text{CH}_2)_3\text{CH}_3]_4$	429.29	liq., 1.5439 ²⁶
3	Tetra- <i>sec</i> -butylthiogermanium	$\text{Ge}[\text{SCH}(\text{CH}_3)(\text{C}_2\text{H}_5)]_4$	429.29	liq., 1.5497 ²⁵
4	Tetra- <i>tert</i> -butylthiogermanium	$\text{Ge}[\text{SC}(\text{CH}_3)_3]_4$	161.77	tetrag. columns
5	Tetracetylthiogermanium	$\text{Ge}[\text{SCH}_2(\text{CH}_2)_4\text{CH}_3]_4$	1102.55	wh. cr.
6	Tetracyclohexylthiogermanium	$\text{Ge}(\text{SC}_6\text{H}_{11})_4$	533.44	2 cr. mod α (stab.) tetrag.; β (metastab.) monoc.
7	Tetraethoxylgermanium (tetraethyl germanate)	$\text{Ge}(\text{OC}_2\text{H}_5)_4$	252.84	col. liq.
8	Tetraethylgermanium	$\text{Ge}(\text{C}_2\text{H}_5)_4$	188.84	col. oil, 1.443 ^{17.5} ; 1.554 ⁰ ; 1.439 ⁸⁰
9	Tetraethylthiogermanium	$\text{Ge}(\text{SC}_2\text{H}_5)_4$	317.08	liq., 1.5886 ²⁵
10	Tetra-iso-butylthiogermanium	$\text{Ge}[\text{SCH}_2\text{CH}(\text{CH}_3)_2]_4$	429.29	liq., 1.5381 ²⁵
11	Tetraisopropylthiogermanium	$\text{Ge}[\text{SCH}(\text{CH}_3)_2]_4$	373.19	liq., 1.5535 ²⁵
12	Tetramethylgermanium	$\text{Ge}(\text{CH}_3)_4$	132.74	col. liq.
13	Tetramethylthiogermanium	$\text{Ge}(\text{SCH}_3)_4$	260.98	liq., 1.6379 ²⁵
14	Tetraphenoxygermanium	$\text{Ge}(\text{OC}_6\text{H}_5)_4$	445.00	col. oil
15	Tetraphenylgermanium	$\text{Ge}(\text{C}_6\text{H}_5)_4$	381.00	tetr., col.
16	Tetra(2-phenylethyl)germanium	$\text{Ge}(\text{C}_6\text{H}_5\text{C}_2\text{H}_5)_4$	493.21	col. cr.
17	Tetraphenylthiogermanium	$\text{Ge}(\text{SC}_6\text{H}_5)_4$	509.24	col., rhomb. cr., 1.7348, 1.7821 (H green)
18	Tetra- <i>n</i> -propylgermanium	$\text{Ge}(\text{C}_3\text{H}_7)_4$	244.95	col. mob. liq., 1.451 ^{17.5}
19	Tetrapropylthiogermanium	$\text{Ge}(\text{SC}_3\text{H}_7)_4$	373.19	liq., 1.5612 ²⁵
20	Tetra- <i>N</i> -pyrrylgermanium	$\text{Ge}(\text{C}_4\text{H}_4\text{N})_4$	336.92	lt. yel. cr.
21	Tetra- α -thienylgermanium	$\text{Ge}(\text{C}_4\text{H}_3\text{S})_4$	405.10	wh. need., doubly refract.
22	Tetra- <i>o</i> -tolylgermanium	$\text{Ge}(\text{C}_6\text{H}_4\text{CH}_3)_4$	437.11	wh. hex. cr.
23	Tetra- <i>m</i> -tolylgermanium	$\text{Ge}(\text{C}_6\text{H}_4\text{CH}_3)_4$	437.11	wh. need.
24	Tetra- <i>p</i> -tolylgermanium	$\text{Ge}(\text{C}_6\text{H}_4\text{CH}_3)_4$	437.11	wh. rhbdr. tab.
25	Tetra- <i>p</i> -tolylthiogermanium	$\text{Ge}(\text{SC}_6\text{H}_4\text{CH}_3)_4$	565.35	col., rhomb. cr., 1.726, 1.7716 (H green)
26	Tolylgermanium tribromide(<i>p</i>)	$(\text{CH}_3\text{C}_6\text{H}_4)_3\text{GeBr}$	403.47	col. liq.
27	Tolylgermanium trichloride(<i>p</i>)	$(\text{CH}_3\text{C}_6\text{H}_4)_3\text{GeCl}$	270.10	col. liq.
28	Tolylgermanium triiodide(<i>p</i>)	$(\text{CH}_3\text{C}_6\text{H}_4)_3\text{GeI}$	544.49	col. cr., sensit. to light.
29	Trianhydrotetrakisdi-phenylgermanediol	$[\text{HO}-\text{Ge}(\text{C}_6\text{H}_5)_2-\text{O}-\text{Ge}(\text{C}_6\text{H}_5)_2-\text{O}]_4$	989.22	. . . . .
30	Tribenzylgermanium bromide	$(\text{C}_6\text{H}_5\text{CH}_2)_3\text{GeBr}$	425.90	col. cr.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	.....	155-6	.....	.....	.....	sl. s. al., glac. acet. a.; s. pet. eth., eth., acet; v. s. chl., bz.
2	1.1072 ²⁵	.....	222.5 ^{4,5}	.....	.....	s. abs. al.
3	1.1119 ²⁵	.....	200.5 ⁴	.....	.....	s. bz.
4	.....	172-73	subl. 170 ⁴	.....	.....	s. abs. al.
5	.....	50-1	.....	.....	.....	v. s. chl., bz.; s. pet. eth., eth.; sl. s. acet., al., glac. acet. a.
6	α 1.270 ¹⁵ β 1.259 ¹⁵	84 88	.....	i. i.	.....	s. abs. al., pet. eth. s. abs. al. pet. eth.
7	.....	-81	185-7	.....	.....	.....
8	1.198 ⁹ 0.991 ^{24.5} 24.5	-90	162.5-3.0	d.	d.	s. bz., eth., HCl
9	1.2574 ²⁵	.....	164.5-5.0 ⁵	.....	.....	s. bz.
10	1.0984 ²⁵	.....	199-200 ⁴⁻⁵	.....	.....	s. al.
11	1.1478 ²⁵	15	162-64 ⁴	.....	.....	s. abs. al.
12	1.006 ⁹	-88	43.4	.....	.....	s. al., eth., bz.
13	1.4364 ²⁵	-3	138-40 ⁴	.....	.....	s. al., bz.
14	.....	.....	210-20 ^{9,3}	.....	.....	s. bz.
15	.....	235.7	>400	i.	i.	s. chl., bz., tol.; sl. s. eth., acet., lgr. s. eth., al.
16	.....	56-7	.....	.....	.....	.....
17	.....	101.5	.....	.....	.....	s. bz., abs. al., meth. al.
18	0.9539 ²⁰ 20	-73	225 ⁷⁴⁶	.....	.....	.....
19	1.1662 ²⁵	.....	191-92 ⁵	.....	.....	s. abs. al.
20	.....	202	.....	.....	.....	s. pet. eth., chl.
21	.....	149-50	.....	i.	i.	s. bz., tol., acet., chl., CCl ₄ ; sl. s. al., meth. al.; i. pet. eth.
22	.....	175-6	.....	i.	i.	s. CCl ₄ , bz., xylene; sl. s. h. al.; i. pet. eth., al.
23	.....	146	.....	i.	i.	s. bz., tol., CCl ₄ ; sl. s. meth. al.
24	.....	227	.....	i.	i.	s. bz.
25	.....	110-11	.....	.....	.....	s. bz., abs. al.
26	.....	155-6 ¹³	.....	hyd.	hyd.	d. liq. NH ₃ ; s. org. solv.
27	.....	.....	115-6 ¹²	hyd.	hyd.	d. liq. NH ₃ ; s. org. solv.
28	.....	72	.....	hyd.	hyd.	d. liq. NH ₃ ; s. org. solv.
29	.....	149	.....	.....	.....	s. eth. acetate
30	.....	145	.....	.....	.....	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Germanium:				
1	Tribenzylgermanium chloride	$(C_6H_5CH_2)_3GeCl$...	381.44	col. cr.....
2	Tribenzylgermanium fluoride	$(C_6H_5CH_2)_3GeF$...	364.98	col. need.....
3	Tribenzylgermanium iodide	$(C_6H_5CH_2)_3GeI$	472.90	col. cr.....
4	Tribenzylgermanium oxide	$[(C_6H_5CH_2)_3Ge]_2O$	707.96	.....
5	Tri- <i>p</i> -biphenylgermanium bromide	$(C_6H_5C_6H_4)_3GeBr$..	612.09	wh. cr.....
6	Tri- <i>tert</i> -butylthiogermanium chloride	$Ge[SC(CH_3)_3]_3Cl$..	375.58	col. cr.....
7	Tricyclohexylgermanium bromide	$(C_6H_{11})_3GeBr$	401.96	col. cr.....
8	Tricyclohexylgermanium chloride	$(C_6H_{11})_3GeCl$	357.50	col. cr.....
9	Tricyclohexylgermanium fluoride	$(C_6H_{11})_3GeF$	341.05	col. need.....
10	Tricyclohexylgermanium hydroxide	$(C_6H_{11})_3GeOH$	339.06	.....
11	Tricyclohexylgermanium iodide	$(C_6H_{11})_3GeI$	448.97	col. cr.....
12	Triethylgermanium bromide	$(C_2H_5)_3GeBr$	239.70	col. liq.....
13	Triethylgermanium chloride	$(C_2H_5)_3GeCl$	195.24	col. liq.....
14	Triethylgermanium fluoride	$(C_2H_5)_3GeF$	178.78	col. liq.....
15	Triethylgermanium hydride	$(C_2H_5)_3GeH$	160.79	col. liq.....
16	Triethylgermanium imine	$[(C_2H_5)_3Ge]_2NH$..	334.58	col. liq.....
17	Triethylgermanium iodide	$(C_2H_5)_3GeI$	286.70	col. liq.....
18	Triethylgermanium oxide	$[(C_2H_5)_3Ge]_2O$	335.56	col. liq.....
19	Triethylphenylgermanium	$Ge(C_2H_5)_3(C_6H_5)$...	236.88	col. liq.....
20	Triethyl- <i>p</i> -tolylgermanium	$Ge(C_2H_5)_3CH_2C_6H_4$	250.91	col. liq.....
21	Triethyl-2,2,2, triphenyldigermene (1,1,1)	$(C_2H_5)_3Ge-Ge(C_6H_5)_3$	463.68	rhomb. cr.....
22	Trimethylgermanium bromide	$Ge(CH_3)_3Br$	197.62	col. oily liq., 1.4705
23	Trimethylphenylgermanium	$Ge(CH_3)_3(C_6H_5)$...	194.80	col. liq.....
24	Trimethylstannyltriphenylgermanium	$(CH_3)_3Sn-Ge(C_6H_5)_3$	467.70	wh. cr.....
25	Triphenylanisylgermanium	$Ge(C_6H_5)_3(CH_2OC_6H_4)$	411.03	wh. sld.....
26	Triphenyldimethylaminophenylgermanium	$Ge(C_6H_5)_3C_6H_4N(CH_3)_2$	424.07	wh. need.....
27	Triphenylgermanium amide	$(C_6H_5)_3GeNH_2$	319.93	wh. ppt.....
28	Triphenylgermanium bromide	$(C_6H_5)_3GeBr$	383.82	hex. col.....
29	Triphenylgermanium chloride	$(C_6H_5)_3GeCl$	339.36	wh. cr.....
30	Triphenylgermanium fluoride	$(C_6H_5)_3GeF$	322.90	wh. cr.....

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		155				
2		96				
3		141				
4		135				s. pet. eth.
5		242				s. bz.
6		66-7	156-7 ¹⁴			s. al., org. solv.
7		110		hyd.	hyd.	s. al.
8		102		hyd.	hyd.	s. meth. al.
9		92		hyd.	hyd.	s. meth. al.
10		176-7				s. al., bz., pet. eth.
11		99-100		hyd.	hyd.	s. meth. al.
12		-33	190.9	hyd.	hyd.	s. bz., eth., chl., CCl ₄
13		<-50	175.9	hyd.	hyd.	s. bz., eth., chl., CCl ₄
14			149.0 ⁷⁶¹	hyd.	hyd.	s. bz., eth., chl., CCl ₄
15			124.4 ⁷⁶¹	i.	i.	s. bz., eth.; i. liq. NH ₃
16			100 ^{0.1}	hyd.	hyd.	s. bz., eth., CCl ₄ , chl.; i. liq. NH ₃
17		<-50	212.3	hyd.	hyd.	s. bz., eth., chl., CCl ₄ ; i. liq. NH ₃
18		<-50	253.9	i.	i.	s. C ₂ H ₅ NH ₂ , bz., eth., org. solv.; i. liq. NH ₃
19			116-7 ¹³	i.		s. org. solv.
20			125-6 ¹²	i.		s. org. solv.
21		89.5-90.5		i.		v. s. bz., chl.; s. pet. eth., al.; sl. s. meth. al.
22	1.544 ¹⁸ / ₄₀	-25	113.7	d.	d.	s. org. solv.
23			182-3	i.		s. org. solv.
24		88		i.		s. pet. eth., CCl ₄ , chl., bz.; sl. s. al.; i. liq. NH ₃
25		158-9				s. al., glac. acet. a.
26		140-1				
27		d. -NH ₃		d.	d.	i. liq. NH ₃
28		138.7		i.	hyd.	s. bz., chl.; sl. s. lgr.
29		117-8	285 ¹²	i.	hyd.	s. bz., eth.
30		76.6		i.	hyd.	v. s. bz., eth., lgr., chl., i. liq. NH ₃

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Germanium:				
1	Triphenylgermanium hydride	$(C_6H_5)_3GeH$	304.91	wh. cr. (two forms).....
2	Triphenylgermanium hydroxide	$(C_6H_5)_3GeOH$	320.91	wh. cr.
3	Triphenylgermanium iodide	$(C_6H_5)_3GeI$	430.82	wh. cr.
4	Triphenylgermanium oxide	$[(C_6H_5)_3Ge]_2O$	623.80	col. pl.
5	Triphenylgermanium sodium	$Ge(C_6H_5)_3Na$	326.90	lt. yel.
6	Triphenylgermanium sodiumoxide	$Ge(C_6H_5)_3ONa$	342.90	wh. sld.
7	Triphenylgermanium sodiumtriammine	$Ge(C_6H_5)_3Na \cdot 3NH_3$	378.00	yel. sld.
8	Triphenyl- <i>m</i> -tolyl germanium	$Ge(C_6H_5)_3(C_6H_4-CH_3)$	395.03	wh. anisotropic need.
9	Triphenyl- <i>p</i> -tolyl germanium	$Ge(C_6H_5)_3(C_6H_4-CH_3)$	395.03	wh. sld.
10	Tri- <i>o</i> -tolylgermanium bromide	$(CH_3C_6H_5)_3GeBr$...	428.92	col. oil, (blue fluores.)....
11	Tri- <i>m</i> -tolylgermanium bromide	$(CH_3C_6H_5)_3GeBr$...	428.92	wh. need., anisotropic....
12	Tri- <i>p</i> -tolylgermanium bromide	$(CH_3C_6H_5)_3GeBr$...	428.92	col. cr.
13	Tri- <i>o</i> -tolylgermanium chloride	$(CH_3C_6H_5)_3GeCl$...	381.44	col. oil.
14	Tri- <i>m</i> -tolylgermanium chloride	$(CH_3C_6H_5)_3GeCl$...	384.46	sm. silky need.; opt. act.
15	Tri- <i>p</i> -tolylgermanium chloride	$(CH_3C_6H_5)_3GeCl$...	384.46	wh. cr.
16	Tri- <i>o</i> -tolylgermanium hydroxide	$(CH_3C_6H_5)_3GeOH$	366.01	amor. powd.
17	Tri- <i>m</i> -tolylgermanium oxide	$[(CH_3C_6H_5)_3Ge]_2O$...	714.01	wh. cr.
18	Tri- <i>p</i> -tolylgermanium oxide	$[(CH_3C_6H_5)_3Ge]_2O$...	714.01	wh. pr. anisotropic....
19	Tri- <i>m</i> -tolyl- <i>p</i> -tolyl..... germanium	$Ge(C_6H_4CH_3)_3 \cdot (C_6H_4CH_3)$	437.11	wh. sld.
20	Tri- <i>p</i> -tolyl- <i>o</i> -tolyl germanium	$Ge(C_6H_4CH_3)_3 \cdot (C_6H_4CH_3)$	437.11	wh. cr.
21	Tri-triphenylgermanium nitride	$[(C_6H_5)_3Ge]_3N$	925.71	col. need.
22	Tris-acetylacetonegermanium cupribromide	$[(C_5H_7O_2)_3Ge]CuBr_3$	673.24	gr. -blk. cr.
23	Tris-acetylacetonegermanium cuprobromide	$[(C_5H_7O_2)_3Ge]CuBr_2$	593.32	col. rect. pr.
24	Tris-acetylacetonegermanium cuprochloride	$[(C_5H_7O_2)_3Ge]CuCl_2$	504.40	col. pr.
25	Tris-acetylacetonegermanium dicuprobromide	$[(C_5H_7O_2)_3Ge]Cu_2Br_3$	736.81	col. pr.
Gold:				
26	Aminopyridinotribromogold (2)	$H_2NC_5H_4NAuBr_3$..	531.06	blk. pr.
27	Ethylenediaminodibutylgold bromide	$(CH_2NH_2)_2Au(C_4H_9)_2Br$	451.44	col. need.
28	Ethylenediaminodipropylgold bromide	$(CH_2NH_2)_2Au(C_3H_7)_2Br$	423.39	col. cr.
29	Pyridinotribromogold...	$C_5H_5NAuBr_3$	528.06	red need.
30	Quinolinotribromogold..	$C_9H_7NBr_3Au$	566.10	deep red lust. pr.
Indium				
31	trimethyl	$In(CH_3)_3$	159.86	col. cr.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		α , 47, β , 27		i.	i.	v. s. bz., tol., eth., chl., CCl ₄ ; sl. s. liq. NH ₃
2		134.2		i.	i.	s. bz., chl.; sl. s. lgr.
3		157		hyd.	hyd.	s. bz., eth.
4		183-4		i.	i.	s. bz., lgr., eth.
5		v. high		d.	d.	v. s. liq. NH ₃ ; sl. s. eth., bz.
6		high		d.	d.	i. liq. NH ₃
7		d.		d.	d.	v. s. liq. NH ₃
8		136.5-8.5		i.	i.	s. bz., h. pet. eth.; i. meth. al.
9		123-4				s. org. solv.
10			205-10 ¹			
11		78.0-.9	222-3 ¹			s. CCl ₄ , bz., eth.
12		128-9				s. pet. eth.
13			216-22 ¹			
14		84-5	221-4 ¹			s. pet. eth., bz.; i. c. CH ₃ OH
15		121				s. pet. eth.
16			212-4 ¹			
17		125.0-.2		i.	i.	s. al., bz., pet. eth.
18		148-50		i.	i.	s. h. lgr., c. bz.; sl. s. eth. al., meth. al.
19		98.5-100.5				s. meth. al.
20		164-6				
21		163-4		hyd.	hyd.	s. lgr., eth., bz.
22		139				i. chl.
23		165-6				s. chl.
24		147-8				s. chl.
25		195 d.				s. h. acet. acet.; i. chl.
26		160 d.		s.		s. chl.
27		d. 190		s.		s. al.
28		volat. 130	d. 190			
29		d. 150		s.		s. al., act.
30		d. >200				s. chl.
31	1.568 ¹⁹ / ₁₉	89.0-.8	subl.	d.		s. eth.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Lanthanum			
1	hexaantipyrine iodide	$\text{La}(\text{COC}_{19}\text{H}_{12}\text{N}_2)_6\text{I}_3$	2297.56	yel. cr.
	Lead:			
2	Hexaethyldilead (triethyllead)	$\text{Pb}_2(\text{C}_2\text{H}_5)_6$	588.78	liq.
3	Tetraethyllead	$\text{Pb}(\text{C}_2\text{H}_5)_4$	323.45	col. liq.; or. flame, grn. marg., 1.5195 ²⁰
4	Tetraisobutyllead	$\text{Pb}[\text{CH}_2\text{CH}(\text{CH}_3)_2]_4$	435.66	pl., 1.5042
5	Tetraisopropyllead	$\text{Pb}[\text{CH}(\text{CH}_3)_2]_4$	379.56	col. liq., dec. in air, 1.5223
6	Tetramethyllead	$\text{Pb}(\text{CH}_3)_4$	267.35	liq., 1.5120 ²⁰
7	Tetraphenyllead	$\text{Pb}(\text{C}_6\text{H}_5)_4$	515.61	wh. need.
8	Tetra- <i>n</i> -propyllead	$\text{Pb}(\text{C}_3\text{H}_7)_4$	379.56	col. liq., 1.5094
	Lithium:			
9	Ethyllithium	LiC_2H_5	36.00	hex. transp. pl.
	Mercury:			
10	Aminophenylmercuric acetate (<i>p</i>)	$\text{C}_6\text{H}_4(\text{NH}_2)\text{HgO}_2\text{C}_2\text{H}_3$	351.77	col. pr.
11	Biphenylmercury	$\text{Hg}(\text{C}_6\text{H}_5\text{C}_6\text{H}_5)_2$	507.00	sm. scales.
12	Chloromercuriphenol (<i>o</i>)	$\text{C}_6\text{H}_4\text{OHHgCl}$	329.17	
13	Di- <i>n</i> -amylmercury	$\text{Hg}(\text{C}_5\text{H}_{11})_2$	342.89	1.4998
14	Di-(<i>dl</i>)-amylmercury	$\text{Hg}(\text{C}_5\text{H}_{11})_2$	342.89	1.5014
15	Dibenzylmercury	$\text{Hg}(\text{C}_7\text{H}_7)_2$	382.86	long brittle col. need.
16	Di- <i>n</i> -butylmercury	$\text{Hg}(\text{C}_4\text{H}_9)_2$	314.84	1.5057
17	Diethylmercury	$\text{Hg}(\text{C}_2\text{H}_5)_2$	258.73	col. liq. of hazel odor
18	Di- <i>n</i> -hexylmercury	$\text{Hg}(\text{C}_6\text{H}_{13})_2$	370.94	1.4973
19	Diisoamylmercury	$\text{Hg}(\text{C}_5\text{H}_{11})_2$	342.89	1.4989
20	Diisobutylmercury	$\text{Hg}(\text{C}_4\text{H}_9)_2$	314.84	col. liq., 1.4965
21	Diisopropylmercury	$\text{Hg}(\text{C}_3\text{H}_7)_2$	286.78	1.5263
22	Dimethylaminophenylmercuric acetate (<i>p</i>)	$\text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2\text{HgO}_2\text{C}_2\text{H}_3$	379.82	long. col. need.
23	Dimethylanilinemercury (<i>p</i>)	$\text{Hg}[\text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2]_2$	440.95	lust. need.
24	Dimethylmercury	$\text{Hg}(\text{CH}_3)_2$	230.68	col. liq., sweet odor
25	Dinaphthylmercury (α)	$\text{Hg}(\text{C}_{10}\text{H}_7)_2$	454.92	rhomb. wh.
26	Dinaphthylmercury (β)	$\text{Hg}(\text{C}_{10}\text{H}_7)_2$	454.92	cryst. from bz.
27	Diphenylmercury	$\text{Hg}(\text{C}_6\text{H}_5)_2$	354.81	wh. glassy need.
28	Dipropylmercury	$\text{Hg}(\text{C}_3\text{H}_7)_2$	286.78	col. mobile liq., 1.5170
29	Ditolylmercury (<i>o</i>)	$\text{Hg}(\text{C}_7\text{H}_7)_2$	382.86	wh. tabl.
30	Ditolylmercury (<i>m</i>)	$\text{Hg}(\text{C}_7\text{H}_7)_2$	382.86	col. or lt. yel. need.
31	Ditolylmercury (<i>p</i>)	$\text{Hg}(\text{C}_7\text{H}_7)_2$	382.86	need.
32	Ethane hexamercarbide	$\text{C}_2\text{Hg}_6\text{O}_2(\text{OH})_2$	1293.70	yelsh.-wh. powd.
33	Ethylmercuric chloride	$\text{C}_2\text{H}_5\text{HgCl}$	265.13	silv. irid. leaf.
34	Ethylmercuric hydroxide	$\text{C}_2\text{H}_5\text{HgOH}$	246.68	silv. irid. leaf.
35	Ethylmercuric iodide	$\text{C}_2\text{H}_5\text{HgI}$	356.59	cr. from EtOH.
36	Mercury ethylmercaptide (<i>ic</i>)	$\text{Hg}(\text{SC}_2\text{H}_5)_2$	322.85	leaf.
37	Mercury phenylmercaptide (<i>ic</i>)	$\text{Hg}(\text{SC}_6\text{H}_5)_2$	418.93	yelsh. need.
38	Methylmercuric chloride	CH_3HgCl	251.10	wh. cr., disg. odor.
39	Methylmercuric iodide	CH_3HgI	342.56	col. pearly leaf.
40	Naphthylmercuric acetate (α)	$\text{C}_{10}\text{H}_7\text{HgO}_2\text{C}_2\text{H}_3$	386.81	fine need.
41	Naphthylmercuric chloride (α)	$\text{C}_{10}\text{H}_7\text{HgCl}$	363.22	silk quad. tabl.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		268-9 d.		41.8 ²⁰		
2	1.471		d.	i.		
3	1.659 ¹⁸		200 d.; 91 ¹⁹	i.		s. bz., pet., al., eth.
4	1.324	-23				
5	1.4504	-53.5	120 ¹⁴ ; 133-8 ²⁷	i.		s. bz., pet. eth.
6	1.995	-27.5	110	i.		s. bz., pet. eth., al.
7		227.7				s. bz.
8	1.44		126 ¹³			s. bz., pet. eth.; sl. s. al.
9		95		d.		d. eth.; s. bz., lgr.
10		167		i.	i.	s. dil. a.; sl. s. chl., al.; i. eth.
11		216		difficultly	soluble in	common solv.
12		152.5 ⁰				s. NaOH
13	1.6369		133 ¹⁰			
14	1.6700		93 ¹			s. al., eth., chl., CS ₂ , ac. a., bz., eth. acet.; sl. s. lgr.
15						
16	1.7779		105 ¹⁰			
17	liq. 2.444		159	i.	i.	v. s. eth.; sl. s. al.
18	1.5361		158 ¹⁰			
19	1.6397		125 ¹⁰			
20	1.835 ¹⁶ ; 1.7678	volat. 100	205-7; 86 ¹⁰	v. sl. s.		s. eth., al.
21	2.0024		63 ¹⁰			
22		165		i.	i.	s. bz., chl., al., dil. a.
23		169				s. chl.; sl. s. al., eth., dil. HCl
24	3.069		96			s. al., eth.
25	1.929	188 (243)	249	i.	sl. s.	s. h. CS ₂ , chl.; sl. s. bz., eth.; v. sl. s. h. bz.
26		247-8		i.		sl. s. al., eth.
27	2.318	121.8, subl.	204 ^{10,5} ; >306 d.	i.	i.	s. chl., CS ₂ , bz.; sl. s. eth., h. al.
28	2.0208		189-91; 73 ¹⁰	i.		v. s. eth.; s. al.
29		107	219 ¹⁴			s. h. bz.
30		102		i.		s. bz., chl., acet., eth. acet.
31		238		i.		s. h. bz., chl., CS ₂ ; sl. s. c. al.
32		exp. 230		i.	i.	i.
33	3.482	193		i.		v. s. h. al.; sl. s. eth.
34		37		i.	i.	v. s. h. al.; s. eth.; sl. s. c. al.
35		186				s. al.
36		76-7	d.	i.		d. a.
37		153 d.	d.	i.		sl. s. h. al.; v. s. bz., pyr.
38	4.063	170	volat. 100			
39		143		i.		v. s. meth. al.; s. eth., al.
40		154		i.	i.	s. al., ac. a., bz., CS ₂ , fats; sl. s. eth.
41		188-9		i.	i.	sl. s. bz., al.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Mercury:				
1	Phenylmercuric acetate.	$C_6H_5HgO_2C_2H_3$...	336.75	rhomb. sm. wh. lust. pr.
2	Phenylmercuric bromide	C_6H_5HgBr	357.63	rhomb. wh. lust. tabl.
3	Phenylmercuric chloride	C_6H_5HgCl	313.17	wh. satiny leaf
4	Phenylmercuric cyanide.	C_6H_5HgCN	303.73	rhomb. long pr.
5	Phenylmercuric iodide..	C_6H_5HgI	404.63	rhomb. satiny tabl.
6	Phenylmercuric nitrate..	$C_6H_5HgNO_3$	339.72	rhomb. tabl.
7	Tolylmercuric bromide (p)	C_7H_7HgBr	371.65	thin lust. gray sc.
8	Tolylmercuric chloride (p)	C_7H_7HgCl	327.19	rhomb. silky tabl.
Neodymium:				
9	Neodymium hexaantipy- rine iodide	$[Nd(COC_{19}H_{12}N_2)_6I_3]$	2302.91	rose cr.
Potassium:				
10	Potassium saccharate, acid (d)	$KHC_6H_5O_8$	248.23	rhomb. need.
11	Potassium- <i>m</i> -nitrophen- oxide	$KOC_6H_4NO_2 \cdot 2H_2O$	213.23	flat or. need.
12	Potassium- <i>p</i> -nitrophen- oxide	$KOC_6H_4NO_2 \cdot 2H_2O$	213.23	yel. leaf.
Rhenium:				
13	Bis-2:2'-dipyridyl rheni- chloride	$(C_{10}H_8N_2)_2ReCl_6$...	713.43	pa. grn. cr.
14	Dipyridyl <i>per</i> -rhenate (2:2')	$(C_5H_4N_2)HReO_4$...	343.42	col. need.
15	Dipyridyl rhenichloride (2:2')	$(C_5H_5N)_2ReCl_6$...	557.25	yel. need.
16	Trimethylrhenium.....	$Re(CH_3)_3$	231.41	col. oil.
17	Tripyridyl rhenichloride (2:2':2'')	$(C_5H_4N)_3HReCl_6$...	634.33	pa. grn. cr.
Silicon:				
18	Chloromethylsilicane....	SiH_2ClCH_3	80.57	
19	Di- <i>p</i> -aminoazobenzene fluosilicate	$(NH_2C_6H_4N_2C_6H_5)_2 \cdot H_2SiF_6$	538.54	long cinnamon br. need.
20	Di- <i>p</i> -aminobenzoic acid fluosilicate	$(NH_2C_6H_4COOH)_2 \cdot H_2SiF_6$	418.35	pr. wh. long, narrow.
21	Dianiline fluosilicate....	$(C_6H_5NH_2)_2 \cdot H_2SiF_6$	330.33	irreg. pl. wh.
22	Dichloromethylsilicane..	$SiHCl_2CH_3$	115.02	
23	Didiphenylamine fluo- silicate	$[(C_6H_5)_2NH]_2 \cdot H_2SiF_6$	482.51	wh. rods forming rosettes.
24	Diethylaniline fluosili- cate	$(C_6H_5NHC_2H_5)_2 \cdot H_2SiF_6$	386.43	wh. pointed pr.
25	Dimethylaniline fluosili- cate	$(C_6H_5NHCH_3)_2 \cdot H_2SiF_6$	358.38	monocl. wh. need.
26	Dimethylsilicane.....	$SiH_2(CH_3)_2$	60.14	
27	Di- α -naphthylamine fluosilicate	$(C_{10}H_7NH_2)_2 \cdot H_2SiF_6$	430.44	rosettes of wh. need.
28	Di- β -naphthylamine fluosilicate	$(C_{10}H_7NH_2)_2 \cdot H_2SiF_6$	430.44	hex. wh. pl.
29	Di- <i>m</i> -nitraniline fluosili- cate	$(C_6H_4NH_2NO_2)_2 \cdot H_2SiF_6$	420.33	rhomb. wh. pl.
30	Dinitrosodiphenylamine fluosilicate	$[(C_6H_5)_2N = NO]_2 \cdot H_2SiF_6$	540.51	butterfly shaped indigo cr.
31	Di- <i>o</i> -toluidine fluosilicate	$(C_6H_4NH_2CH_3)_2 \cdot H_2SiF_6$	358.38	rhomb. wh.
32	Di- <i>m</i> -toluidine fluosili- cate	$(C_6H_4NH_2CH_3)_2 \cdot H_2SiF_6$	358.38	wh. rect. pr. pl.
33	Di- <i>p</i> -toluidine fluosili- cate	$(C_6H_4NH_2CH_3)_2 \cdot H_2SiF_6$	358.38	wh. need., unst. irreg. outline.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		149		sl. s.	sl. s.	s. glac. ac. a., bz., al.
2		276		i.	i.	s. al., bz., pyr.
3		251				sl. s. h. al., bz., pyr., eth.
4		204			sl. s.	s. h. al., bz.
5		266		i.		s. chl., CS ₂ ; sl. s. al., eth., bz.
6		176-86		i.	sl. s.	s. h. al., bz.
7		228				s. chl., al., bz.; i. c. CS ₂
8		233		i.	i.	sl. s. h. al., bz., chl., acet., pyr.; i. eth.
9		270-2		12.7 ²⁰		
10				1.1 ⁶	more sol.	
11	1.691 ²⁰	-2H ₂ O, 130	d.	16.3 ¹⁵		s. al.
12	1.652 ²⁰	-2H ₂ O, 130	d.	7.5 ¹⁵		sl. s. al.
13				sl. s.		
14				2.1		
15				sl. s.		
16			60			
17				i.		
18	0.935 ⁻⁸⁰	-134.1	7			
19		220 d.				.187 ²⁵ 95% al.
20		242				.091 ²⁵ 95% al.
21		subl. 230		v.s.		s. h. al.
22	0.93 ⁰	-93				
23		169				2.449 ²⁵ 95% al.
24		165.3				.979 ²⁵ 95% al.
25						s. h. al.; i. c. al.
26	0.68 ⁻⁸⁰	-150	-20.1			
27		218				.1504 ²⁵ 95% al.
28		236.3				.0816 ²⁵ ; 1248 ³⁵ 95% al.
29		200				.121 ²⁵ ; .4736 ³⁵ 95% al.
30		124.5				.84 ²⁵ 95% al.
31						s. h. al.; i. c. al.
32						s. h. al.; i. c. al.
33						

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Silicon:				
1	Ethyltriphenylsilicane...	$(C_2H_5)(C_6H_5)_3Si$	288.42	rhomboidal pr.
2	Hexamethyldisilicane...	$Si_2(CH_3)_6$	146.33	
3	Methylsilicane...	SiH_3CH_3	46.12	
4	Methyltriphenyl silicane	$(CH_3)(C_6H_5)_3Si$	274.40	
5	Phenylenediamine fluo-silicate (m)	$C_6H_4(NH_2)_2 \cdot H_2SiF_6$	252.22	choe. br. need.-like pr.
6	Phenylenediamine fluo-silicate (p)	$C_6H_4(NH_2)_2 \cdot H_2SiF_6$	252.22	pink irreg. six-sided pl.
7	Silico-benzoic acid...	C_6H_5SiOOH	138.17	col. flaky resin
8	Tetrabenzylsilicane...	$Si(C_6H_5CH_2)_4$	392.57	
9	Tetraethylsilicane...	$Si(C_2H_5)_4$	144.30	liq., 1.4246
10	Tetramethylsilicane...	$Si(CH_3)_4$	88.20	col. liq.
11	Tetraphenylsilicane...	$Si(C_6H_5)_4$	336.46	col. flocc. amor. part.
12	Tolidine fluosilicate(o)	$(CH_3NH_2 \cdot C_6H_5)_2 \cdot H_2SiF_6$	356.36	tiny, micr. wh. pr.
13	Triethylphenylsilicane...	$(C_2H_5)_3(C_6H_5)Si$	192.34	
Sodium:				
14	Sodium acetamide...	$NaNHCOCH_3$	81.06	wh. tabl.
15	Sodium acetylide (ethynylsodium)	$NaHC_2$	48.03	wh. cr.
16	Sodium anilide...	$NaNHC_6H_5$	115.11	wh. cr., v. hydr.
17	Sodium anthraquinone- β -sulfonate ("Silver salt")	$NaC_{14}H_7O_6S \cdot H_2O$	328.27	silvery leaf.
18	Sodium arsanilate (atoxyl, soamin)	$NaC_6H_7O_3NAs \cdot 6H_2O$	347.13	wh. cr. powd., monocl.
19	Sodium benzamide...	$NaNHCOC_6H_5$	143.12	wh. powd.
20	Sodium- N -chloro- p -toluenesulfonamide	$NaC_7H_7O_2NClS \cdot 3H_2O$	281.70	col. pr.
21	Sodium ethoxide (sodium ethylate)	$NaOC_2H_5 \cdot 2C_2H_5OH$	160.19	wh. powd. or need.
22	Sodium, ethyl-...	NaC_2H_5	52.06	wh. cr., d. air.
23	Sodium- β -naphthoxide...	$NaOC_{10}H_7$	166.15	wh. powd., v. hydr.
24	Sodium- p -nitrobenzene isodiazotate	$NaC_6H_4O_3N_3 \cdot 2H_2O$	225.15	gold. leaf. or need.
25	Sodium- p -nitrophen-oxide	$NaOC_6H_4NO_2 \cdot 4H_2O$	233.16	yel. monoc. pr.
26	Sodium- o -sulfobenzoic imide (soluble saccharin)	$NaC_7H_4O_3NS \cdot 2H_2O$	241.20	wh. tabl.
27	Triphenylborylsodium*	$NaB(C_6H_5)_3$	265.12	yel.-or. silky need.
28	Triphenylmethylsodium	$NaC(C_6H_5)_3$	266.31	red. cr.
Tellurium:				
29	Di- n -butyl telluride...	$(C_4H_9)_2Te$	241.84	yel. oil.
30	Diethyl telluride...	$(C_2H_5)_2Te$	185.73	
31	Dimethyl telluride...	$(CH_3)_2Te$	157.68	pa. yel. oil; garlic-like odor.
32	Dimethyltelluronium dibromide (α)	$C_2H_5Br_2Te$	317.51	or. leaf-like cr.
33	Dimethyltelluronium dichloride (α)	$C_2H_5Cl_2Te$	228.59	leaf-like cr.
34	Dimethyltelluronium dichloride (β)	$C_2H_5Cl_2Te$	228.59	leaf-like cr.
35	Dimethyltelluronium diiodide (α)	$C_2H_5I_2Te$	411.52	red cr.

* All of the tri-arylborines form analogous addition-salts of the alkali metals.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		76		i.		s. chl., bz., eth. acet.; sl. s. al.
2		12.5-14	112.5			
3	0.62 ⁵⁷	-156.4	31			
4		67.3		i.		s. eth., chl., bz.; sl. s. al.
5		243-4				0.065 ²⁸ 95% al.
6		d.				0.014 ²⁸ 95% al.
7		40-50	215-6			s. eth., bz., chl.; sl. s. al., ac. a.
8			127.5	i.		s. eth., chl., bz.; sl. s. al.
9	.762 ²⁵		152.8-3.2			s. eth.; i. conc. H ₂ SO ₄
10	.651 ¹⁵		26.5			s. acetic anh. and chloro-sulphonic acid
11						.013 ²⁸ , .041 ³⁵ 95% al.
12		268-9				
13		148	230			
14		300-50 d.		d.		d. al.; sl. s. bz., liq. NH ₃
15		d. > 210		d.		d. a.; s. liq. NH ₃
16		d.	d.	d.		d. a., al.; s. liq. NH ₃
17		d.		0.84	27	v. sl. s. al.
18				16 ^{1.7}		sl. s. al.; s. CH ₃ OH
19		d.		d.		d. al.; i. eth., bz., chl.
20		expl.		s.	v.s.	
21		175-180 -2C ₂ H ₅ OH, 200	d.	d.	d.	v. s. al.; i. NH ₃
22		d.		d.		d. al., eth.; s. diethylzinc; i. bz., lgr.
23		d.		s.		v. s. al., eth.; i. lgr.
24		-H ₂ O over H ₂ SO ₄	exp.	v. s.		
25		-2H ₂ O, 36; -4H ₂ O, 120	d.	5.97 ²⁵		sl. s. al.
26		-H ₂ O		v. s.		sl. s. h. al.
27			d.	d.	d.	0.08 ¹⁸ eth.
28				d.		s. eth., bz., liq. NH ₃
29	1.334 ⁴⁰		132-5			
30			137-8	sl. s.		
31		sld. in liq. air	82, 94 ⁷⁰			
32		142 d.				s. al., eth.
33		92		s.	s.	s. al., eth.
34		134				s. al., eth.
35		127 d.		i.	v. sl. s.	s. chl., bz.

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Tellurium:				
1	Di- <i>p</i> -phenetyl ditelluride	$(C_2H_5OC_6H_4)_2Te_2$	497.53	or. brown need.
2	Ditelluromethane	CH_2Te_2	269.25	dk. red amor. sld.
3	Ethylmethyltellurophe- tone	$C_2H_5CTeCH_3$	183.71	dark yel. oil, 1.5055 ²⁶
Thallium				
4	triethyl	$Tl(C_2H_5)_3$	291.57	yel. liq.
Tin:				
5	Amyltetrathioorthostan- nate (<i>n</i>)	$Sn(SC_6H_{11})_4$	531.50	
6	Amyltetrathioorthostan- nate (<i>tert</i>)	$[CH_3CH_2C(CH_3)_2S]_4Sn$	531.50	
7	Bromobenzenetetrathio- orthostannate (<i>p</i>)	$Sn(SC_6H_4Br)_4$	870.97	
8	Butylbenzenetetrathio- orthostannate (<i>p</i>)	$Sn(SC_6H_4C_4H_9)_4$	779.76	
9	Butyltetrathioortho- stannate (<i>n</i>)	$Sn(SC_4H_9)_4$	475.39	
10	Butyltetrathioortho- stannate (<i>sec</i>)	$Sn(SC_4H_9)_4$	475.39	
11	Carbomethoxyphenyltri- chlorostannane (<i>o</i>)	$(CH_3OCOC_6H_4)SnCl_3$	360.21	
12	Chlorobenzenetetrathio- orthostannate (<i>p</i>)	$Sn(SC_6H_4Cl)_4$	693.14	
13	Cyclohexyltetrathio- orthostannate	$Sn(SC_6H_{11})_4$	579.54	
14	Di- <i>o</i> -anisylchloro- stannane	$(CH_3OC_6H_4)_2SnCl_2$	403.87	
15	Dibenzyl-diethylstannane	$(C_6H_5\cdot CH_2)_2Sn(C_2H_5)_2$	359.07	liq.
16	Dibenzylethylpropyl- stannane	$(C_6H_5\cdot CH_2)_2(C_2H_5)(C_3H_7)Sn$	373.10	liq.
17	Dibenzyltin acetate	$(C_6H_5CH_2)_2Sn(OCOCH_3)_2$	419.04	col. need. f. al.
18	Dibenzyltin dibromide	$(C_6H_5\cdot CH_2)_2SnBr_2$	460.79	col. need. f. pet.
19	Dibenzyltin dichloride	$(C_6H_5\cdot CH_2)_2SnCl_2$	371.87	col. need. f. acet.-HCl.
20	Dibenzyltin diiodide	$(C_6H_5\cdot CH_2)_2SnI_2$	554.79	col. lng. silky yel. need. f. pet. eth.
21	Dibutyltin dibromide	$(C_4H_9)_2SnBr_2$	392.76	sm. need.
22	Dibutyltin dichloride	$(C_4H_9)_2SnCl_2$	303.84	need.
23	Dichlorodi- <i>m</i> -tolyl stan- nane	$(CH_3C_6H_4)_2SnCl_2$	371.87	
24	Diethyldibromodipy- ridinetin	$(C_2H_5)_2SnBr_2(C_6H_5N)_2$	494.85	
25	Diethyldiisooamyltin	$(C_2H_5)_2Sn(C_6H_{11})_2$	319.10	
26	Diethyldiisobutyltin	$(C_2H_5)_2Sn(C_4H_9)_2$	291.05	
27	Diethyldiphenyltin	$(C_2H_5)_2(C_6H_5)_2Sn$	331.02	
28	Diethylisooamyltin bromide	$(C_2H_5)_2(C_6H_{11})SnBr$	327.88	
29	Diethylisooamyltin chloride	$(C_2H_5)_2(C_6H_{11})SnCl$	283.42	
30	Diethylisobutyltin bromide	$(C_2H_5)_2(C_4H_9)SnBr$	313.85	
31	Diethyl- <i>n</i> -propyltin bromide	$(C_2H_5)_2(C_3H_7)SnBr$	299.82	
32	Diethyl- <i>n</i> -propyltin chloride	$(C_2H_5)_2(C_3H_7)SnCl$	255.36	
33	Diethyl- <i>n</i> -propyltin fluoride	$(C_2H_5)_2(C_3H_7)SnF$	238.91	
34	Diethyltin	$Sn(C_2H_5)_2$	176.82	sl. yel. oily liq.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.666	108	d. > 108			s. lgr.
2		d. 214		i.	i.	i.
3	1.8711		63-6			
4	1.957 ²³ / ₂₃	-63	192			
5			162 ^{0.004}			
6		44				
7		217				
8		106				
9			136 ^{.001}			
10			111 ^{.001}			
11		164				
12		189				
13		53-4				
14		113				
15	1.+	< 20	223-4 ²⁰			s. org. solv.
16		> 0	220-5 ¹⁵			misc. all org. solv.
17		136-7				s. acet., chl., bz.
18		130				s. acet., al., eth., chl., CCl ₄
19		163-4				s. acet., al., eth., chl., CCl ₄ , h. ac. a.
20		86-7				s. acet., al., eth., chl., CCl ₄
21		20				
22		43				
23		39-40				
24		140				
25	1.0725 ¹⁹		131 ^{13.5}			
26	1.1030		108.2 ¹³			
27			154-6 ⁴			
28	1.4881 ¹⁷		137.5 ¹⁷			
29	1.2994 ^{19.9}		125.5 ¹³			
30	1.5108		122 ¹⁷			
31	1.5910 ²¹		112.2 ¹⁶			
32	1.3848 ^{15.7}		108 ¹⁷			
33		271				6.93 ³¹ meth. al.; 3.78 ³¹ al.; .05 ³¹ bz.
34	1.654	< -12	150 d. l	i.	i.	s. bz., eth., lgr., chl., CCl ₄

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Tin:				
1	Diethyltin dibromide	$(C_2H_5)_2SnBr_2$	336.65	col. need.
2	Diethyltin dichloride	$(C_2H_5)_2SnCl_2$	247.74	wh. need.
3	Diethyltin difluoride	$(C_2H_5)_2SnF_2$	214.82	sq. pl. or long rhomb. tab. f. meth. al.
4	Diethyltin diiodide	$(C_2H_5)_2SnI_2$	430.66	wh. need.
5	Diethyltin oxide	$(C_2H_5)_2SnO$	192.82	wh. powd.
6	Diisoamyltin dibromide	$(C_5H_{11})_2SnBr_2$	420.81	
7	Diisoamyltin dichloride	$(C_5H_{11})_2SnCl_2$	331.89	
8	Diisoamyltin diiodide	$(C_5H_{11})_2SnI_2$	514.82	oily liq.
9	Diisobutyltin diiodide	$(C_4H_9)_2SnI_2$	429.65	
10	Diisopropyltin dibromide	$(C_3H_7)_2SnBr_2$	364.71	pale yel. hyg. cr.
11	Diisopropyltin dichloride	$(C_3H_7)_2SnCl_2$	275.79	col. transp. cr.
12	Diisopropyltin oxide	$(C_3H_7)_2SnO$	220.87	
13	Dimethyldibromodipyridinetin	$(CH_3)_2SnBr_2(C_5H_5N)_2$	466.80	
14	Dimethyldichlorodipyridinetin	$(CH_3)_2SnCl_2(C_5H_5N)_2$	377.88	
15	Dimethyldiethyltin	$(CH_3)_2Sn(C_2H_5)_2$	206.89	col. liq.
16	Dimethyldiisobutyltin	$(CH_3)_2Sn(C_4H_9)_2$	262.99	
17	Dimethylethylpropyltin	$(CH_3)_2C_2H_5C_3H_7Sn$	220.92	
18	Dimethylethyltin iodide	$(CH_3)_2C_2H_5SnI$	304.75	1.5705 ¹⁸
19	Dimethyltin	$[(CH_3)_2Sn]_x$	(148.77) _x	yel. sld.
20	Dimethyltin dibromide	$(CH_3)_2SnBr_2$	308.60	col. pr.
21	Dimethyltin dichloride	$(CH_3)_2SnCl_2$	219.68	
22	Dimethyltin difluoride	$(CH_3)_2SnF_2$	186.77	wh. fine pl.
23	Dimethyltin diiodide	$(CH_3)_2SnI_2$	402.61	rhomb. wh.
24	Dimethyltin oxide	$(CH_3)_2SnO$	164.77	wh. powd.
25	Dimethyltin sulfide	$(CH_3)_2SnS$	180.83	
26	Di- α -naphthyltin	$Sn(C_{10}H_7)_2$	373.01	
27	Di (phenylthiol) diphenylstannane	$Sn(C_6H_5)_2(SC_6H_5)_2$	491.22	
28	Diphenyltin	$Sn(C_6H_5)_2$	272.90	yel. amor. powd.
29	Diphenyltin dibromide	$(C_6H_5)_2SnBr_2$	432.73	col. cr.
30	Diphenyltin dichloride	$(C_6H_5)_2SnCl_2$	343.82	col. cr.
31	Diphenyltin difluoride	$(C_6H_5)_2SnF_2$	310.90	
32	Diphenyltin diiodide	$(C_6H_5)_2SnI_2$	526.74	col. cr.
33	Diphenyltin hydroxychloride	$(C_6H_5)_2Sn(OH)Cl$	325.37	amor. wh. powd.
34	Diphenyltin oxide	$(C_6H_5)_2SnO$	288.90	col. amor. powd.
35	Di- <i>n</i> -propyldibromodipyridinetin	$(C_3H_7)_2SnBr_2(C_5H_5N)_2$	522.90	
36	Dipropyltin dibromide	$(C_3H_7)_2SnBr_2$	364.71	col. need.
37	Dipropyltin dichloride	$(C_3H_7)_2SnCl_2$	275.79	col. cr.
38	Dipropyltin difluoride	$(C_3H_7)_2SnF_2$	242.87	leaf.
39	Dipropyltin diiodide	$(C_3H_7)_2SnI_2$	458.71	col. oily liq.
40	Di- <i>m</i> -tolylstannane	$(CH_3C_6H_4)_2SnO$	316.95	wh. amor. infus.
41	Di- <i>m</i> -tolyl thiostannane	$(CH_3C_6H_4)_2SnS$	333.01	
42	Di- <i>p</i> -tolyltin	$(CH_3C_6H_4)_2Sn$	300.95	or.-yel. amor. powd.
43	Di- <i>o</i> -tolyltin dichloride	$(CH_3C_6H_4)_2SnCl_2$	371.87	
44	Di- <i>p</i> -tolyltin dichloride	$(CH_3C_6H_4)_2SnCl_2$	371.87	
45	Ditriphenylstannylmethane	$[(C_6H_5)_3Sn]_2CH_2$	714.03	wh. cr. sld.
46	Di- <i>p</i> -xyllytin	$[(CH_3)_2C_6H_3]_2Sn$	329.01	
47	Dodecyltetrahydroorthostannate (n)	$Sn(SC_{12}H_{25})_4$	924.23	

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.0687 ⁴	63	232-3	s.	s.	s. eth., org. solv.
2	84-5	220	s.	s.	s. HCl, org. solv.
3	229	.....	.....	.....	.45 ³¹ al.; 2.64 ³¹ meth. al.; .047 ³¹ bz.
4	44.5-5.0	240-5 d.	v. sl. s.	sl. s.	s. org. solv.
5	infus.	.....	i.	i.	s. HCl, dil. a., conc. alk.; i. org. solv.
6	-25 to -24	.....	.....	.....	.....
7	28	.....	.....	.....	.....
8	202-5 ⁸	.....	.....	.....
9	290-5	.....	.....	.....
10	54	.....	d.	d.	i. org. solv.
11	80-4	.....	s.	s.	s. al., h. bz., glac. ac. a.
12	d.	.....	i.	i.	s. h. HCl; i. org. solv., alk.
13	172	.....	.....	.....	.....
14	163	.....	.....	.....	.....
15	1.2319 ¹⁹	< -13	144-6	i.	i.	s. org. solv.
16	1.1179 ^{20.1}	.....	85 ^{16.5}	.....	.....	.....
17	1.2014 ²⁰	.....	149-51	.....	.....	.....
18	2.0264 ²⁰	.....	77-8 ¹¹ ; 185-7 ¹⁸	.....	.....	.....
19	i.	i.	i. org. solv.
20	74-6	208-13	s.	s.	s. org. solv.
21	90 (107)	188-90	s.	.....	s. org. solv.
22	d. < 360	4.66 ^{30.7}	.....	.08 ³¹ al., 33 ³¹ meth. al.
23	2.872	43 (30)	228	sl. s.	s.	s. org. solv.
24	infus.	d.	i.	i.	s. a., NaOH; i. org. solv., NH ₄ OH
25	148	.....	.....	.....	.....
26	200	d. 255	.....	.....	.....
27	65-65.5	.....	.....	.....	.....
28	225.7; (126-30)	.....	i.	i.	s. chl., bz., eth.; i. abs. al.
29	38	230 ⁴²	.....	.....	s. al., eth.
30	42	333-7 d.	v. sl. s., d.	.....	s. al., eth., lgr.
31	360	.....	.....	.....	.....
32	71-72	176-82 ²	i.	i.	s. org. solv.
33	187	.....	i.	i.	s. conc. a.; i. org. solv.
34	infus.	.....	i.	i.	s. conc. a.; i. org. solv.
35	123	.....	.....	.....	.....
36	49	.....	v. sl. s.	.....	s. org. solv.
37	81	.....	v. sl. s.	.....	s. org. solv.
38	205	.....	0.22 ³²	.....	.93 ³² al., 1.91 ³² meth. al.
39	< -15	270-3	i.	i.	s. org. solv.
40	i.	i.	s. min. a.; i. org. solv.
41	121.5-2	.....	.....	.....	v. s. chl., bz., eth. acetate, pyr., eth.; s. HCl
42	111.5	d. < 245	.....	.....	s. bz.
43	49-50	.....	.....	.....	.....
44	49-50	.....	.....	.....	.....
45	104.5	.....	.....	.....	v. s. bz., eth., chl.; s. h. pet. eth.
46	157	d. 240	.....	.....	.....
47	35.5	.....	.....	.....	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Tin:				
1	Ethylchlorostannic acid.	$\text{H}_2\text{SnC}_2\text{H}_5\text{Cl}_5$	327.06	col. deliq. pr.
2	Ethyl-diisoamyltin bromide	$(\text{C}_2\text{H}_5)(\text{C}_5\text{H}_{11})_2\text{SnBr}$	369.95	
3	Ethyl-diisobutyltin bromide	$(\text{C}_2\text{H}_5)(\text{C}_4\text{H}_9)_2\text{SnBr}$	341.90	
4	Ethylmethylpropyltin iodide	$\text{CH}_3\text{C}_2\text{H}_5\text{C}_3\text{H}_7\text{SnI}$	332.80	1.5548 ¹⁷
5	Ethyl- <i>n</i> -propyl-diisoamyltin	$(\text{C}_2\text{H}_5)(\text{C}_3\text{H}_7)\text{Sn}(\text{C}_5\text{H}_{11})_2$	333.13	
6	Ethylpropyltin dichloride	$(\text{C}_2\text{H}_5)(\text{C}_3\text{H}_7)\text{SnCl}_2$	261.76	need. f. lt. pet.
7	Ethyl stannic acid	$\text{C}_2\text{H}_5\text{-SnO-OH}$	180.77	wh. amor. gel or powd.
8	Ethyltetrathioorthostannate	$\text{Sn}(\text{SC}_2\text{H}_5)_4$	363.18	
9	Ethyltin tribromide	$\text{C}_2\text{H}_5\text{SnBr}_3$	387.51	col. feath. cr.
10	Ethyltin triiodide	$\text{C}_2\text{H}_5\text{SnI}_3$	528.52	
11	Ethyltri- <i>n</i> -butyltin	$\text{C}_2\text{H}_5(\text{C}_4\text{H}_9)_3\text{Sn}$	319.10	1.4732
12	Ethyltri- <i>n</i> -propyltin	$\text{C}_2\text{H}_5(\text{C}_3\text{H}_7)_3\text{Sn}$	277.02	
13	Hexadecyltetrathioorthostannate (<i>n</i>)	$\text{Sn}(\text{SC}_{16}\text{H}_{33})_4$	1148.65	
14	Hexaethyl distannane	$[\text{Sn}(\text{C}_2\text{H}_5)_3]_2$	411.76	
15	Hexaethylditin	$[(\text{C}_2\text{H}_5)_3\text{Sn}]_2$	411.76	liq.
16	Hexaphenylditin	$[(\text{C}_6\text{H}_5)_3\text{Sn}]_2$	700.00	
17	Hexa- <i>p</i> -tolylditin	$[(\text{C}_6\text{H}_4\text{CH}_3)_3\text{Sn}]_2$	784.16	flat tabl. f. bz.
18	Hexa- <i>p</i> -xylylditin	$[(\text{CH}_3)_2\text{C}_6\text{H}_3]_3\text{Sn}]_2$	868.32	flat rhomb. tabl. f. bz.-al.
19	Isopropylstannic acid	$\text{C}_3\text{H}_7\text{SnO-OH}$	194.79	wh. amor.
20	Isopropyltetrathioorthostannate	$\text{Sn}(\text{SC}_3\text{H}_7)_4$	419.29	
21	Isopropyltin tribromide	$\text{C}_3\text{H}_7\text{SnBr}_3$	401.53	pa. yel. deliq. pr.
22	Isopropyltin trichloride	$\text{C}_3\text{H}_7\text{SnCl}_3$	268.16	
23	Methylstannic acid	$(\text{CH}_3)\text{SnOOH}$	166.74	wh. amor. powd.
24	Methyltetrathioorthostannate	$\text{Sn}(\text{SCH}_3)_4$	307.08	
25	Methyltin tribromide	CH_3SnBr_3	373.48	wh. need.
26	Methyltin trichloride	CH_3SnCl_3	240.11	col. cr.
27	Methyltin triiodide	CH_3SnI_3	514.49	lt. yel. need.
28	Methyltribromodipyr-dinetin	$\text{CH}_3\text{SnBr}_3(\text{C}_5\text{H}_5\text{N})_2$	531.68	
29	Methyltri- <i>n</i> -butyltin	$\text{CH}_3(\text{C}_4\text{H}_9)_3\text{Sn}$	305.07	1.4735
30	Methyltri- <i>n</i> -propyltin	$\text{CH}_3(\text{C}_3\text{H}_7)_3\text{Sn}$	262.99	
31	Phenylbenzyltin dichloride	$(\text{C}_6\text{H}_5)(\text{C}_6\text{H}_5\text{CH}_2)\text{SnCl}_2$	357.84	col. need. f. dil. HCl
32	Phenyltetrathioorthostannate	$\text{Sn}(\text{SC}_6\text{H}_5)_4$	555.34	
33	Phenyltin tribromide	$\text{C}_6\text{H}_5\text{SnBr}_3$	435.55	
34	Phenyltin trichloride	$\text{C}_6\text{H}_5\text{SnCl}_3$	302.17	
35	Phenyltribenzyltin	$(\text{C}_6\text{H}_5)_3\text{Sn}(\text{C}_6\text{H}_5\text{CH}_2)_3$	469.18	liq.
36	Propyltetrathioorthostannate (<i>n</i>)	$\text{Sn}(\text{SC}_3\text{H}_7)_4$	419.29	
37	Propyltin triiodide	$\text{C}_3\text{H}_7\text{SnI}_3$	542.55	

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d.		d.		
2	1.3650		154-5 ¹⁶			
3	1.4089 ^{19.5}		130.6 ¹³			
4	1.8182 ²⁰ / ₂₀		108-11 ¹¹ ; 226-30 ^{7.0} sl. d.			
5	1.0654 ^{21.9}		141 ¹⁷			
6		57-8		s.		s. eth., al.
7		d. below red	heat	i.	i.	s. dil. min. a., KOH; i. al., eth., chl., xylene
8			105. ⁰⁰¹			
9		310		s.		s. al.
10			181-4 ¹⁹			
11	1.0783		129 ¹⁰			
12			101 ¹⁰			
13		53-54				
14			160 ²³			
15	1.412 ⁹		d. 270			
16		232.5	d. <280			.029 eth.; 18.08 chl.; 7.82 bz.
17		143.5	d. 335			sl. s. bz., eth.; v. sl. s. abs. al.
18		192.5	d. 368			21 ^{30.4} bz.
19		d.		i.		s. dil. min. a., KOH; i. org. solv.
20			92. ⁰⁰¹			
21		112				s. glac. ac. a.; sl. s. h. bz., chl.; i. dry eth.
22			75 ¹⁶			
23		infus.		i.	i.	s. a., alk.; i. org. solv.
24		31	81. ⁰⁰¹			
25		53-5	210-11 ⁷⁴⁶	s.		s. eth., al., bz., lgr., hyd. by alk.
26		43		s.		hyd. by alk.; s. org. solv.
27		86.5		s.	s.	s. eth., al., bz., chl., meth. al.
28		203				
29	1.0898 ²⁰ / ₄		121 ¹⁰			
30			93 ¹⁰			
31		83-4	80-100			
32		67				
33			182-3 ²⁹			
34			142-3 ²⁵	s.		
35			290 ⁵			s. all ord. org. solv. except al.
36			123. ⁰⁰¹			
37			d. 200 ¹⁶			

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Tin:				
1	Propyltri- <i>n</i> -amyltin (<i>n</i>)	$C_3H_7(C_5H_{11})_3Sn$	375.20	1.4732
2	Stannic bisacetylacetone dibromide	$(C_5H_7O_2)_2SnBr_2$	476.75	col. six sided cr.
3	Stannic bisacetylacetone dichloride	$(C_5H_7O_2)_2SnCl_2$	387.83	col. six sided cr.
4	Stannic bisbenzoylacetone dibromide	$(C_{10}H_{16}O_2)_2SnBr_2$	614.99	pa. yel. powd.
5	Stannic bisdibenzoylmethane dibromide	$(C_{16}H_{10}O_2)_2SnBr_2$	722.99	sulfur yel. cr.
6	Stannic bis-3-ethylacetylacetone dibromide	$(C_7H_{11}O_2)_2SnBr_2$	532.85	col. six sided pr.
7	Tetra- <i>il</i> -amyltin	$Sn(C_5H_{11})_4$	403.26	1.4730
8	Tetra- <i>n</i> -amyltin	$Sn(C_5H_{11})_4$	403.26	col. stable liq., 1.4720
9	Tetraaquastannic bisacetylacetone stannibromide	$(C_5H_7O_2)_2Sn(OH_2)_4SnBr_5$	987.17	col. tab. pr.
10	Tetrabenzyltin	$Sn(C_6H_5CH_2)_4$	483.21	col. pr. f. lt. pet.
11	Tetra- <i>n</i> -butyltin	$Sn(C_4H_9)_4$	347.15	col. stable liq., 1.4730
12	Tetracyclohexyltin	$Sn(C_6H_{11})_4$	451.30	wh. micr. grains
13	Tetraethyltin	$Sn(C_2H_5)_4$	234.94	col. liq.
14	Tetra- <i>n</i> -heptyltin	$Sn(C_7H_{15})_4$	515.47	1.4698
15	Tetra- <i>n</i> -hexyltin	$Sn(C_6H_{13})_4$	459.36	1.4706
16	Tetraisoamyltin	$Sn(C_5H_{11})_4$	403.26	liq.
17	Tetraisobutyltin	$Sn(C_4H_9)_4$	347.15	col. liq.
18	Tetramethyltin	$Sn(CH_3)_4$	178.84	col. liq.
19	Tetra- <i>n</i> -octyltin	$Sn(C_8H_{17})_4$	571.57	1.4691
20	Tetraphenyltin	$Sn(C_6H_5)_4$	427.10	tetr. col. f. xylene
21	Tetrapropyltin	$Sn(C_3H_7)_4$	291.05	col. liq.
22	Tetra- <i>o</i> -tolyltin	$Sn(C_6H_4CH_3)_4$	483.21	wh. cr. powd.
23	Tetra- <i>m</i> -tolyltin	$Sn(C_6H_4CH_3)_4$	483.21	col. need.
24	Tetra- <i>p</i> -tolyltin	$Sn(C_6H_4CH_3)_4$	483.21	col. need.
25	Tetra- <i>m</i> -xylyltin	$[(CH_3)_2C_6H_3]_4Sn$	539.31	rhomb. need. f. bz.-al.
26	Tetra- <i>p</i> -xylyltin	$[(CH_3)_2C_6H_3]_4Sn$	539.31	wh. quad. pr.
27	Tolylstannonic acid (<i>o</i>)	$CH_3C_6H_4SnO_2H$	242.83	amor. powd.
28	Tolylstannonic acid (<i>m</i>)	$CH_3C_6H_4SnO_2H$	242.83	
29	Tolyltetrathioorthostannate (<i>p</i>)	$Sn(SCH_2C_6H_4)_4$	611.45	
30	Tolyltin trichloride (<i>o</i>)	$CH_3C_6H_4SnCl_3$	316.20	
31	Tolyltin trichloride (<i>p</i>)	$CH_3C_6H_4SnCl_3$	316.20	
32	Tolyltrichlorostannane (<i>m</i>)	$CH_3C_6H_4SnCl_3$	316.20	col. liq.
33	Tri- <i>n</i> -amyltin bromide	$(C_5H_{11})_3SnBr$	412.03	1.4963
34	Tribenzylethyltin	$(C_6H_5CH_2)_3(C_2H_5)Sn$	421.14	col. tabl. f. al.-lt. pet.
35	Tribenzyltin chloride	$(C_6H_5CH_2)_3SnCl$	427.54	wh. need.
36	Tribenzyltin hydroxide	$(C_6H_5CH_2)_3SnOH$	409.09	rhomb., col. tabl.
37	Tribenzyltin iodide	$(C_6H_5CH_2)_3SnI$	519.00	need. like pr. f. glac. ac. a.
38	Tri- <i>n</i> -butyltin bromide	$(C_4H_9)_3SnBr$	369.95	1.5000
39	Triethyl- <i>n</i> -amyltin	$(C_2H_5)_3C_5H_{11}Sn$	277.02	

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.0368	.....	163 ¹⁰	.....	.....	.....
2	.....	.....	187	.....	.....	s. bz., chl., acet.; sl. s. eth., CCl ₄
3	.....	.....	202-3	s.	.....	s. bz., acet.
4	.....	.....	213-4	.....	.....	sl. s. org. solv.
5	.....	.....	276-8	i.	.....	sl. s. org. solv.
6	.....	164-6	.....	.....	.....	s. c. chl., bz.; sl. s. lt. pet.
7	1.0222	.....	174 ¹⁰	.....	.....	.....
8	1.0206	.....	181 ¹⁰	.....	.....	.....
9	.....	105-7	.....	.....	.....	s. bz.
10	.....	42-3	.....	i.	i.	s. common org. solv.; sl. s. lt. pet.
11	1.0572	.....	145 ¹⁰	.....	.....	.....
12	.....	263-4	.....	i.	i.	6.25 ³⁰ bz.; .086 ³⁰ al.; s. chl. CS ₂
13	1.187 ²³	-112	181	i.	i.	s. org. solv.
14	0.9748	.....	239 ¹⁰	.....	.....	.....
15	0.9959	.....	209 ¹⁰	.....	.....	.....
16	1.035 ^{19.6}	.....	188 ²⁴	.....	.....	.....
17	1.054 ²³	-13	267; 143 ^{16.5}	i.	i.	s. org. solv.
18	1.314 ⁰	.....	78	i.	i.	s. org. solv.
19	0.9605	.....	268 ¹⁰	.....	.....	.....
20	1.490 ⁰	226	>420	i.	i.	s. h. bz., pyr., CCl ₄ , chl., ac. a.; sl. s. al.
21	1.1065 ^{20.2}	.....	222-5	i.	i.	s. org. solv.
22	.....	158-9 (215)	.....	i.	i.	s. bz., eth.; i. al.
23	.....	128.5	.....	i.	i.	s. bz., h. eth., h. al.
24	.....	230-3	.....	i.	i.	s. bz., chl., CS ₂ , pyr.; sl. s. al., eth.
25	.....	219.5	d. 360	.....	.....	.314 ³⁰ al.; 5.28 ³⁰ eth.; 35.1 ³⁰ bz.; 43.2 ³⁰ chl.
26	.....	272-3	d. 360	i.	i.	.015 ³⁰ al.; 1.73 ³⁰ bz.; 2.80 ³⁰ chl., .29 ³⁰ eth.; .017 ³⁰ meth. al.
27	.....	d. 295	.....	.....	.....	.....
28	.....	.....	d. 295	i.	i.	s. c. meth. al., al., eth., chl., eth. acet., pyr., m. and bases; i. pet. eth.
29	.....	100	.....	.....	.....	.....
30	1.7619	.....	154-8 ²⁰	.....	.....	.....
31	1.7522	.....	156-7 ²³	sl. d.	.....	.....
32	1.7516	<-20	150-1 ²³	.....	.....	.....
33	1.2678	.....	.....	.....	.....	.....
34	.....	31-2	.....	.....	.....	s. eth., bz., chl.; sl. s. al.
35	.....	142-4	d.	i.	i.	s. ac. a., acet., bz., eth., chl., pyr.; i. al.
36	.....	117-21	.....	.....	.....	s. h. al., CS ₂ , bz.; sl. s. eth., lgr.; i. KOH
37	.....	102-3	.....	.....	.....	.....
38	1.3365	.....	.....	.....	.....	.....
39	.....	.....	102 ¹⁰	.....	.....	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Tin:				
1	Triethyl (<i>p</i> -dimethyl-aminophenyl) stannane	$(C_2H_5)_3(C_6H_5)_2$ NC_6H_4Sn	326.05	1.5610 ²²
2	Triethyl- <i>o</i> -hydroxyphenyl stannane	$(C_2H_5)_3OHC_6H_4Sn$	298.98	1.5377 ²⁵
3	Triethylisoamyltin	$(C_2H_5)_3Sn(C_5H_{11})$	277.02	
4	Triethylisobutyltin	$(C_2H_5)_3Sn(C_4H_9)$	262.99	
5	Triethylphenyltin	$(C_2H_5)_3(C_6H_5)Sn$	282.98	col. liq.
6	Triethyl- <i>n</i> -propyltin	$(C_2H_5)_3Sn(C_3H_7)$	248.97	
7	Triethyltin	$Sn(C_2H_5)_3$	205.88	col. liq.
8	Triethyltin bromide	$(C_2H_5)_3SnBr$	285.80	col. liq.
9	Triethyltin chloride	$(C_2H_5)_3SnCl$	241.34	col. liq.
10	Triethyltin ethoxide	$(C_2H_5)_3Sn(OC_2H_5)$	250.94	col. liq.
11	Triethyltin hydroxide	$(C_2H_5)_3SnOH$	222.89	col. cr.
12	Triethyltin iodide	$(C_2H_5)_3SnI$	332.80	col. liq.
13	Triisoamyltin bromide	$(C_5H_{11})_3SnBr$	412.03	
14	Triisoamyltin chloride	$(C_5H_{11})_3SnCl$	367.57	
15	Triisoamyltin fluoride	$(C_5H_{11})_3SnF$	351.12	need.
16	Triisoamyltin iodide	$(C_5H_{11})_3SnI$	459.04	
17	Triisobutylethyltin	$(C_4H_9)_3Sn(C_2H_5)$	319.10	
18	Triisobutylisoamyltin	$(C_4H_9)_3Sn(C_5H_{11})$	361.18	
19	Triisobutyltin bromide	$(C_4H_9)_3SnBr$	369.95	
20	Triisobutyltin chloride	$(C_4H_9)_3SnCl$	325.50	
21	Triisobutyltin fluoride	$(C_4H_9)_3SnF$	309.04	fine long pr.
22	Triisopropyltin iodide	$(C_4H_9)_3SnI$	416.96	col. liq.
23	Triisopropyltin bromide	$(C_3H_7)_3SnBr$	327.88	
24	Triisopropyltin iodide	$(C_3H_7)_3SnI$	374.88	
25	Trimethylethyltin	$(CH_3)_3(C_2H_5)Sn$	192.86	col. liq.
26	Trimethyltin	$Sn(CH_3)_3$	163.80	col. liq.
27	Trimethyltin bromide	$(CH_3)_3SnBr$	243.72	col. cr. or liq.
28	Trimethyltin chloride	$(CH_3)_3SnCl$	199.26	col. cr.
29	Trimethyltin fluoride	$(CH_3)_3SnF$	182.80	wh. short. thick rect. pr.
30	Trimethyltin hydride	$(CH_3)_3SnH$	164.81	col. oily liq.
31	Trimethyltin hydroxide	$(CH_3)_3SnOH$	180.81	col. pr.
32	Trimethyltin iodide	$(CH_3)_3SnI$	290.72	col. liq.
33	Trimethyltin oxide	$[(CH_3)_3Sn]_2O$	343.61	wh. amor. powd.
34	Trimethyltin sulfide	$[(CH_3)_3Sn]_2S$	359.67	lt. yel. oil
35	Triphenylbenzyltin	$(C_6H_5)_3Sn(C_6H_5CH_2)$	441.13	col. pl. f. al.
36	Triphenylethyltin	$(C_6H_5)_3SnC_2H_5$	379.06	wh. pr. f. al.
37	Triphenylmethyltin	$(C_6H_5)_3SnCH_3$	365.04	col. tetr. f. eth.
38	Triphenyl- α -naphthyltin	$(C_6H_5)_3Sn(C_{10}H_7)$	477.16	col. pr.
39	Triphenyltin	$Sn(C_6H_5)_3$	350.00	wh. powd.
40	Triphenyltin bromide	$(C_6H_5)_3SnBr$	429.92	col. cr.
41	Triphenyltin chloride	$(C_6H_5)_3SnCl$	385.46	col. cr.
42	Triphenyltin fluoride	$(C_6H_5)_3SnF$	369.00	fine pr.
43	Triphenyltin hydroxide	$(C_6H_5)_3SnOH$	367.01	
44	Triphenyltin iodide	$(C_6H_5)_3SnI$	476.92	4-sided monocl. wh.
45	Triphenyl- <i>p</i> -tolyltin	$(C_6H_5)_3Sn(C_7H_7)$	441.13	need. f. eth.
46	Triphenyl- <i>p</i> -xylyltin	$(C_6H_5)_3Sn(C_8H_8)$	560.31	col. lng. hex. sheets f. al.
47	Tri- <i>n</i> -propyl- <i>n</i> -butyl tin	$(C_3H_7)_3C_4H_9Sn$	305.07	
48	Tri- <i>n</i> -propylethyltin	$(C_3H_7)_3Sn(C_2H_5)$	277.02	
49	Tri- <i>n</i> -propylisobutyltin	$(C_3H_7)_3Sn(C_4H_9)$	305.07	
50	Tripropyltin chloride	$(C_3H_7)_3SnCl$	283.42	col. liq.
51	Tri- <i>n</i> -propyltin chloride	$(C_3H_7)_3SnCl$	283.42	

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.2425	.....	172-3 ³	.....	.....	.....
2	1.3229 ²⁵	.....	197-200 ³	.....	.....	.....
3	1.1203 ^{20.1}	.....	111 ^{18.5}	.....	.....	.....
4	1.139 ^{20.3}	.....	96.5 ¹⁷	.....	.....	.....
5	1.2639	.....	254	i.	i.	s. al., eth., org. solv.
6	1.1680 ^{20.6}	.....	82 ¹³	.....	.....	.....
7	1.3774	< -75	161 ²³	i.	i.	s. al., org. solv.
8	1.630	-13.5	223-4	v. sl. s.	.....	s. org. solv.
9	1.428 ³	10 (15.5)	208-10	i.	.....	sl. org. solv.
10	1.2634	.....	190	d.	.....	s. org. solv.
11	.....	43	271	s.	s.	s. org. solv.
12	1.833	-34.5	225 (231)	v. sl. s.	.....	s. org. solv.
13	1.2613 ^{20.7}	21	177 ¹⁵	.....	.....	.....
14	1.1290 ^{34.2}	-30.2	174 ¹³	.....	.....	.....
15	.....	288	.....	.....	.....	1.03 ³¹ al.; .967 ³¹ bz.; 1.22 ³¹ meth. al.
16	1.3777 ^{26.5}	-22	182 ¹³	.....	.....	.....
17	1.0779 ²¹	.....	125 ¹⁶	.....	.....	.....
18	1.0356 ^{26.8}	.....	152.9 ^{16.5}	.....	.....	.....
19	1.3523	-26.5	148 ¹³	.....	.....	.....
20	1.1290 ^{34.2}	+30.2	174 ¹³	.....	.....	.....
21	.....	244	.....	.....	.....	.414 ³² al.; 614 ³² meth. al.; .132 bz.
22	1.378 ^{26.5}	-22	284-6	.....	.....	s. eth., org. solv.
23	1.4263 ^{25.2}	-49	133 ¹²	.....	.....	s. org. solv.
24	1.4378 ^{22.2}	.....	151 ¹³	.....	.....	.....
25	.....	.....	108.2	i.	i.	s. org. solv.
26	1.570 ²⁶	23	182	i.	i.	s. org. solv.
27	.....	27	165	s.	s.	s. org. solv.
28	.....	37	.....	s.	s.	s. org. solv.
29	.....	360 seal. tube	d. < 375	.....	.....	2.45 ³¹ meth. al.; 1.08 ³¹ al.; 0.05 ³¹ bz.
30	.....	.....	60	v. sl. s.	.....	s. org. solv.
31	.....	118 d.	subl. > 80	s.	s.	s. a., al., bz., chl., CCl ₄ , alk.
32	2.1432	3.4	170	v. sl. s.	.....	s. bz., al., eth., acet.
33	.....	d.	.....	i.	i.	s. a., alk.; i. org. solv.
34	1.649 ²⁶	6	233.5	i.	.....	s. org. solv., HNO ₃
35	.....	90	250 ³	.....	.....	s. org. solv. except al.
36	1.2953 ⁶²	56	.....	.....	.....	.....
37	1.3113 ^{63.85}	60-1	.....	.....	.....	s. bz., chl., eth.
38	.....	125	.....	.....	.....	s. bz., chl., eth.
39	.....	232.5	d. 280	i.	i.	.079 ³⁰ al.; 7.82 ³⁰ bz.; .92 ³⁰ eth.; 18.1 ³⁰ chl.
40	.....	120.5	249 ^{13.5}	i.	i.	s. al., eth., org. solv.
41	.....	106	240 ^{13.5}	i.	i.	s. org. solv.
42	.....	357	.....	sl. s.	.....	sl. s. c. al., eth.
43	.....	118	.....	.....	.....	.....
44	.....	121	253 ^{13.5}	i.	i.	s. org. solv.
45	.....	124	.....	.....	.....	s. bz., chl., eth.
46	.....	100.5	.....	.....	.....	s. bz., eth., chl.
47	.....	.....	121 ¹⁰	.....	.....	.....
48	1.1225 ^{21.8}	.....	117.5 ^{23.3}	.....	.....	.....
49	1.0841 ^{24.1}	.....	128 ¹⁸	.....	.....	.....
50	1.2678 ²³	-23.5	.....	.....	.....	s. org. solv.
51	1.2678 ²³	-23.5	123 ¹³	.....	.....	.....

PHYSICAL CONSTANTS OF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
Tin:				
1	Tri- <i>n</i> -propyltin fluoride.	$(C_3H_7)_3SnF$	266.96	flat pr.
2	Tri- <i>n</i> -propyltin iodide.	$(C_3H_7)_3SnI$	374.88	col. liq.
3	Tri- <i>o</i> -tolyltin bromide.	$(C_6H_4CH_3)_3SnBr$	472.00	rhomb. tabl. f. al.
4	Tri- <i>p</i> -tolyltin bromide.	$(C_6H_4CH_3)_3SnBr$	472.00	rhbdr. f. al.
5	Tri- <i>o</i> -tolyltin chloride.	$(C_6H_4CH_3)_3SnCl$	427.54	short, thick pr. f. al.
6	Tri- <i>m</i> -tolyltin chloride.	$(CH_3C_6H_4)_3SnCl$	427.54	. . . . .
7	Tri- <i>p</i> -tolyltin chloride.	$(C_6H_4CH_3)_3SnCl$	427.54	rhomb. pl. f. al.
8	Tri- <i>p</i> -tolyltin fluoride.	$(C_6H_4CH_3)_3SnF$	411.08	hairlike felted need.
9	Tri- <i>p</i> -tolyltin hydroxide.	$(CH_3C_6H_4)_3SnOH$	409.09	. . . . .
10	Tri- <i>o</i> -tolyltin iodide.	$(C_6H_4CH_3)_3SnI$	519.00	rhomb. cr. fr. al.-eth.
11	Tri- <i>p</i> -tolyltin iodide.	$(C_6H_4CH_3)_3SnI$	519.00	rhomb. pl. fr. eth.-al.
12	Triphenylstannylmethane	$[(C_6H_5)_3Sn]_3CH$	1063.02	wh. cr. sld.
13	Tri- <i>p</i> -xyllytin bromide.	$[(CH_3)_2C_6H_3]_3SnBr$	514.07	lng. hex. cr. f. al.
14	Tri- <i>p</i> -xyllytin chloride.	$[(CH_3)_2C_6H_3]_3SnCl$	469.62	6-cornered col. f. al.
15	Tri- <i>m</i> -xyllytin fluoride.	$[(CH_3)_2C_6H_3]_3SnF$	453.16	fine felted need.
16	Tri- <i>p</i> -xyllytin fluoride.	$[(CH_3)_2C_6H_3]_3SnF$	453.16	fine lng. need.
17	Tri- <i>p</i> -xyllytin iodide.	$[(CH_3)_2C_6H_3]_3SnI$	561.08	hex. tabl. f. al.
Zinc:				
18	Di- <i>n</i> -butylzinc.	$Zn(CH_2CH_2CH_2CH_3)_2$	179.61	liq.
19	Diethylzinc.	$Zn(C_2H_5)_2$	123.50	col. liq. ign. in air or Cl.
20	Dimethylzinc.	$Zn(CH_3)_2$	95.45	col. liq.
21	Diphenylzinc.	$Zn(C_6H_5)_2$	219.58	wh. cr.
22	Di- <i>n</i> -propylzinc.	$Zn(CH_2CH_2CH_3)_2$	151.55	liq.
23	Di- <i>o</i> -tolylzinc.	$Zn(C_6H_4CH_3)_2$	247.63	wh. cr.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		275				4.26 ³¹ meth. al.; 2.73 ³¹ al.; 0.118 ³¹ bz.
2	1.692 ¹⁶	-53	260-2; 141 ¹³			s. org. solv.
3		99.5				s. bz., eth.; sl. s. al.
4		98.5				s. bz., eth.; sl. s. al.
5		99.5				s. bz., eth.; sl. s. al.
6		108				
7		97.5				sl. s. al., bz., eth.
8		305				s. al.
9		108-9				
10		119.5				s. bz., eth.; sl. s. al.
11		120.5				s. bz.-eth.; sl. s. al.
12		128		i.	i.	v. s. bz., eth., chl.; s. h. pet. eth.; sl. s. c. pet. eth., al.
13		151				s. bz., chl., eth.; i. c. al.
14		141.5				s. bz., chl., eth.; i. c. al.
15		205				s. bz., eth., al.
16		247				sl. s. bz., h. eth., al.
17		159.5				s. bz., chl., eth.; i. c. al.
18			81-2 ⁹	d.		
19	1.182 ¹⁸		118	d.		
20	1.386 ^{10.5}	-42.2	46	d.		d. al., a.; s. eth.
21		107		d.		s. xylene
22			146; 39-40 ⁹	d.		
23		207-10				s. xylene; v. sl. s. pet. eth.

PHYSICAL CONSTANTS OF ORGANIC COMPOUNDS

The naming and arrangement of compounds, the preparation of the abridged form of the International Union Rules for the Naming of Organic Compounds and the Prefix Names of Organic Radicals have been in charge of

AUSTIN M. PATTERSON

Professor Emeritus of Chemistry, Antioch College

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H. W. Adams,
Ill. State Normal
Univ.

P. M. Apfelbaum,
Coll of the City of
N. Y.

V. C. Aungier,
E. I. duPont de
Nemours & Co.

P. H. Austin,
E. I. Du Pont de
Nemours & Co.

J. C. Ballar,
Univ. of Ill.,

G. W. Bennett,
Grove City College

J. H. Billman,
Indiana Univ.

J. A. Bradley,
Newark Coll. of
Engr.

C. M. Brewster,
State Coll. of Wash.

C. W. Burchard,
A. & M. Coll. of Tex.

A. B. Burg,
Univ. of Southern
Calif.

J. W. Chittum,
Coll. of Wooster

G. H. Coleman,
Institute of Textile
Technology

Graham Cook,
Albright Coll.

W. A. Cook,
Univ. of Akron

J. E. Copenhaver,
Hartsville, S. Car.

D. L. Cottle,
Standard Oil Devel-
opment Company
Lenolin, N. J.

H. I. Cramer,
Sharples Chemicals,
Inc.

E. F. Degering,
Purdue Univ.

Clara deMilt,
H. S. Newcomb
College

O. C. Dermer,
Okla. A. and M. Coll.

H. L. Dunlap,
Ohio Univ.

M. S. Dunn,
Univ. of Calif. at Los
Angeles

P. W. Evans

G. C. Finger,
Ill. State Geological
Survey

W. A. Gilkey,
University of Mon-
tana

Henry Gilman,
Ia. State Coll. of
A. & M. Arts

R. C. Goodwin,
Tex. Tech. Coll.

R. I. Grady,
Coll. of Wooster

H. B. Hass,
Purdue, Univ.

G. F. Hennion,
Univ. of Notre Dame

W. B. Holton,
American Univ.

J. W. Howard,
Mont. State Univ.

C. D. Hurd,
Northwestern Univ.

R. E. Hussey,
Va. Polytechnic Inst.

E. M. Jones,
Adrian Coll.

R. J. Kaufman,
State College Fresno

Henry King,
Fresno State Teach-
ers Coll.

C. E. Kinney,
Penn. State College

S. S. Kistler,
Norton Company

M. M. MacMasters,
U. S. Dept. of Agriculture

C. S. Marvel,
Univ. of Ill.

J. P. Mason,
Boston Univ.

J. P. Montgomery,
Univ. of Ala.

W. M. Morgan,
Mount Union Coll.

Roger Mullinex,
U. S. Naval Reserve

A. M. Pardee,
Univ. of S. Dak.

F. N. Peters,
Quaker Oats Co.

C. B. Pollard,
Univ. of Fla.

H. W. Post,
Univ. of Buffalo

W. M. Potts,
A. & M. Coll. of Tex.

S. G. Powell,
Univ. of Wash.

H. J. Prebluda,
U. S. Ind. Chem. Co.

A. W. Ralston,
Armour & Co.

F. E. Ray,
Univ. of Cincinnati

G. R. Robertson,
Univ. of Calif.

C. J. Robinson,
Pomona Coll.

Edward Rosendahl,
Glyco Products Co.

E. R. Schlerz,
Univ. of Wyo.

W. H. Schuyler,
Bucknell Univ.

B. L. Shriner,
State University of Iowa

Lawrence Smith,
Glendale Calif.

J. G. Smull,
Lehigh Univ.

C. C. Spencer,
Syracuse Univ.

M. A. Spielman,
Abbott Laboratories

Sherlock Swann, Jr.,
Univ. of Ill.

Technical Div.,
Carbide & Carbon
Chemicals Corp.

P. L. Turrill,
Glendale Junior Coll.

H. B. Vickery,
Conn. Agr. Exp. Sta.

Nell Ward,
Municipal Univ. of
Omaha

L. S. Weatherby,
Univ. of Southern
Calif.

R. B. Whitney,
Amherst Coll.

L. F. Williams,
Univ. of N. Car.

J. H. Wilson,
Lafayette Coll.

L. E. Wise,
Institute of Paper
Chemistry

W. J. Wohlleben,
Univ. of Dayton

C. B. Wooster,
Ciba Products Corporation

G. R. Yohe,
Ill. State Geological
Survey

INTERNATIONAL UNION RULES FOR THE NAMING OF ORGANIC COMPOUNDS

Editor's Note.—These rules are taken from the "Definitive Report of the Commission on the Reform of the Nomenclature of Organic Chemistry," which was unanimously adopted by the Commission and by the Council of the International Union of Chemistry at Liège in 1930. A translation of the report, with comments, appeared in the *Journal of the American Chemical Society*, 55, 3905-25 (1933), and the reader is referred there for the full text and more extended comments. The comments here given in fine type are the editor's.

A. M. P.

I. General

1. As few changes as possible will be made in terminology universally adopted.

2. For the present, only the nomenclature of compounds of known constitution will be dealt with; the question of substances of imperfectly known constitution is postponed.

3. The precise form of words, endings, etc., prescribed in the rules should be adapted to the genius of each language by the subcommittees.

II. Hydrocarbons

4. The ending *ane* is adopted for saturated hydrocarbons. Open-chain hydrocarbons will have the generic name *alkanes*.

5. The present names of the first four normal saturated hydrocarbons (methane, ethane, propane, butane) are retained. Names derived from the Greek or Latin numerals will be used for those having more than four atoms of carbon.

As the names in this series are also used in forming names of unsaturated hydrocarbons, of alcohols, aldehydes, acids, etc. a list of them is here given, with the numbers of carbon atoms:

1 Methane	27 Heptacosane
2 Ethane	28 Octacosane
3 Propane	29 Nonacosane
4 Butane	30 Triacontane
5 Pentane	31 Hentriacontane
6 Hexane	32 Dotriacontane
7 Heptane	33 Tritriacontane
8 Octane	34 Tetratriacontane
9 Nonane	35 Pentatriacontane
10 Decane	36 Hexatriacontane
11 Hendecane (Undecane)	37 Heptatriacontane
12 Dodecane	38 Octatriacontane
13 Tridecane	39 Nonatriacontane
14 Tetradecane	40 Tetracontane
15 Pentadecane	41 Hentetracontane
16 Hexadecane	42 Dotetracontane
17 Heptadecane	43 Tritetracontane
18 Octadecane	44 Tetratetracontane
19 Nonadecane	45 Pentatetracontane
20 Eicosane	46 Hexatetracontane
21 Heneicosane	47 Heptatetracontane
22 Docosane	48 Octatetracontane
23 Tricosane	49 Nonatetracontane
24 Tetracosane	50 Pentacontane
25 Pentacosane	51 Henpentacontane
26 Hexacosane	52 Dopentacontane
	53 Tripentacontane

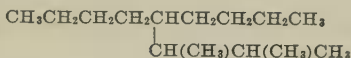
RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

54 Tetrapentacontane
55 Pentapentacontane
56 Hexapentacontane
57 Heptapentacontane

58 Octapentacontane
59 Nonapentacontane
60 Hexacontane

6. Branched-chain hydrocarbons are regarded as derivatives of the normal hydrocarbons; their names will be referred to the longest normal chain present in the formula by adding to it the designations of the side chains. In case of ambiguity, or if a simpler name would result, that chain which admits of the maximum of substitutions will be selected as the fundamental chain.

A simple example is 2-methylbutane, $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$. The principle of "maximum of substitutions" may be illustrated as follows: In the compound



the longest straight chain contains nine carbon atoms, which would lead to the name 5-(1, 2-dimethylpropyl)nonane; the number of substitutions in the main chain is only one, but the radical is a complicated one. By selecting a chain of eight we get three substitutions of simpler radicals and arrive at the name 4-butyl-2,3-dimethyloctane. Rules 6 and 7 apply to saturated hydrocarbons only.

7. In case there are several side chains, the order in which such chains are named will correspond to the order of their complexity. The chain having the greatest number of secondary and tertiary atoms will be considered the most complex. The alphabetic order may also be followed in such cases.

Two possible orders to be followed in arranging the names of substituting radicals in a compound are here referred to. In the "order of complexity" the radical of lowest weight comes first, then that of next lowest weight, and so on; of those having the same weight the least branched comes first and the most branched last, thus: methyl, ethyl, propyl, isopropyl, butyl, isobutyl, etc. The "alphabetic order" would of course be: butyl, ethyl, isobutyl, isopropyl, methyl, propyl (or else butyl, isobutyl, ethyl, methyl, propyl, isopropyl). (The alphabetic order is followed in the Organic Table in this handbook.)

8. In the names of open-chain unsaturated hydrocarbons having one double bond the ending *ane* of the corresponding saturated hydrocarbon will be replaced by the ending *ene*; if there are two double bonds, the ending will be *diene*, etc. These hydrocarbons will bear the generic names *alkenes*, *alkadienes*, *alkatrienes*, etc. Examples: propene, hexene, etc.

9. The names of triple-bond hydrocarbons will end in *yne*, *diyne*, etc. They will bear the generic name *alkynes*. Examples: propyne, heptyne, etc.

The ending *-yne* replaces *-ine* because the latter is reserved for bases (see Rule 33).

10. If there are both double and triple bonds in the fundamental chain the endings *enyn*, *dienyn*, etc., will be used. The generic names of these hydrocarbons will be *alkenynes*, *alkadienynes*, etc.

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

The double bonds are expressed first in the name (ene before yne) and take precedence in numbering (cf. Rule 64). Example: $\text{CH}_2\text{:CHCH:CH-C:CH}$, hexa-1,3-dien-5-yne, not hex-1-yne-3,5-diene. No provision is made for branched unsaturated hydrocarbons. It seems best, for general use, to select as the fundamental straight chain the longest one that contains the maximum of double and triple bonds. Example: $\text{CCH}_2\text{:C(C}_2\text{H}_5\text{)CH}_2\text{CH}_3$, 2-ethyl-1-butene, not 3-methylenepentane.

11. Saturated monocyclic hydrocarbons will take the names of the corresponding open-chain saturated hydrocarbons, preceded by the prefix *cyclo*. They will bear the generic name *cycloalkanes*.

Examples: cyclopropane, cyclobutane, cycloheptane.

12. When they are unsaturated, rules 8-10 will be applied. However, in the case of partially saturated polycyclic aromatic compounds the prefix *hydro*, preceded by *di*-, *tetra*-, etc., will be used. Example: dihydroanthracene.

Further examples: cyclobutadiene, cyclohexene (not tetrahydrobenzene).

13. Aromatic hydrocarbons will be denoted by the ending *ene* and will otherwise retain their customary names. However, the name *phene* may be used instead of benzene.

Examples: benzene, toluene, xylene (not benzol, toluol, xylol).

III. Fundamental Heterocyclic Compounds

14. The endings of customary names, endings which do not correspond to the function of the substance, will undergo the following modifications, so far as they are in accord with the genius of each language: (a) The ending *ol* will be changed to *ole*. Example: pyrrole. (b) The ending *ane* will be changed to *an*. Example: pyran.

15. When nitrogenous heterocycles not having the ending *ine* give basic compounds on progressive hydrogenation, such derivation will be indicated by the successive endings *ine*, *idine*. Examples: pyrrole, pyrroline, pyrrolidine; oxazole, oxazoline.

16. The ending *a* is adopted for hetero atoms occurring in a ring. Oxygen will accordingly be indicated by *oxa*, sulfur by *thia*, nitrogen by *aza*, etc. The letter *a* may be elided before a vowel. Examples: thiadiazole, oxadiazole, thiazine, oxazine.

While the universally accepted names of heterocyclic compounds are retained, the names of other heterocyclic compounds are derived from that of the corresponding homocyclic compound by adding to it the names of the hetero atoms ending in *a*. Example: 2, 7, 9-triazaphenanthrene.

The custom of naming complex heterocyclic ring systems from the names of their component rings (as, anthrapyrrole, naphthopyridine) is so "universally accepted" that it will no doubt continue to be followed. The rule adds a useful new device for certain cases.

RULES FOR NAMING ORGANIC COMPOUNDS

(Continued)

IV. Simple Functions

17. Substances of simple functions are defined as those containing a function of one kind only, which may be repeated several times in the same molecule.

That is, an alcohol may have one, two or more OH groups and still be a substance of simple function, while a hydroxy aldehyde or an amino acid is one of complex function.

18. When there is only one functional group, the fundamental chain will be selected so as to contain this group. When there are several functional groups the fundamental chain will be selected so as to contain the maximum number of these groups.

Example: $\text{CH}_3\text{CH}_2\text{CH}(\text{COOH})_2$, 2-ethylpropanedioic acid (ethylmalonic acid). According to the original Geneva system it was butanoic-2-methyloic acid.

19. Halogen derivatives will be designated by the name of the hydrocarbon from which they are derived, preceded by a prefix indicating the nature and number of the halogen atoms.

Examples: $\text{C}_2\text{H}_5\text{Cl}$, chloroethane; $\text{CH}_2\text{BrCH}_2\text{Br}$, 1, 2-dibromoethane.

20. Alcohols and phenols will be given the name of the hydrocarbon from which they are derived, followed by the suffix *ol*. In accordance with rule 1 names universally adopted will be retained, as: phenol, cresol, naphthol, etc.

This nomenclature may also be applied to heterocycles. Example: quinolinol.

Further examples: $\text{CH}_3\text{CHOHCH}_3$, 2-propanol; $\text{C}_6\text{H}_{11}\text{OH}$, cyclohexanol.

21. In naming polyhydric alcohols or phenols, one of the forms *di*, *tri*, *tetra*, etc., will be inserted between the name of the parent hydrocarbon and the suffix *ol*.

Examples: $\text{CH}_2\text{OHCH}_2\text{OH}$, 1, 2-ethanediol; *p*- $\text{C}_6\text{H}_4(\text{OH})_2$, 1, 4-benzenediol.

22. The name *mercaptan* as a suffix is abandoned; this function will be denoted by the suffix *thiol*.

Examples: CH_3SH , methanethiol; $\text{CH}_2\text{SHCH}_2\text{SH}$, 1, 2-ethanedithiol.

23. Ethers are considered as hydrocarbons in which one or several hydrogen atoms are replaced by alkoxy groups. However, for symmetrical ethers the present nomenclature may be retained. Examples: $\text{CH}_3\text{OC}_2\text{H}_5$, methoxyethane; CH_3OCH_3 , methoxymethane or methyl ether.

24. Oxygen linked, in a chain of carbon atoms, to two of these atoms will be denoted by the prefix *epoxy* in all cases where it would be unprofitable to name the substance as a cyclic compound. Examples: ethylene oxide = epoxyethane; epichlorohydrin = 3-chloro-1,2-epoxypropane; tetramethylene oxide = 1,4-epoxybutane.

25. Sulfides, disulfides, sulfoxides and sulfones will be named like the ethers, *oxy* being replaced by *thio*, *dithio*, *sulfinyl* and

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

sulfonyl, respectively. Examples: $\text{CH}_3\text{SO}_2\text{C}_2\text{H}_5$, methylsulfonylethane; $\text{CH}_3\text{SC}_2\text{H}_5$, methylthiopropene; $\text{CH}_3\text{CH}_2\text{CH}_2\text{SOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$, 1-(propylsulfinyl)butane.

26. Aldehydes are characterized by the suffix *al* added to the name of the hydrocarbon from which they are derived; thioaldehydes, by the suffix *thial*. Acetals will be named as 1,1-dialkoxyalkanes.

Examples: CH_3CHO , ethanal; CHOCHO , ethanedial; $\text{CH}_3\text{CH}_2\text{CHS}$, propanethial; $\text{CH}_3\text{C}(\text{OC}_2\text{H}_5)_2$, 1,1-diethoxyethane; $\text{C}_6\text{H}_5\text{CHO}$, benzene-carbonyl? (cf. rule 32, paragraph 2).

27. Ketones will receive the ending *one*. Diketones, triketones, thioketones will be designated by the suffixes *dione*, *trione*, *thione*.

Examples: CH_3COCH_3 , 2-propanone; $\text{CH}_3\text{COCOCH}_3$, 2,3-butanedione; $\text{CH}_3\text{CSCH}_2\text{CH}_3$, 2-butanethione; cyclohexanone.

28. The name *ketene* is retained.

Example: $(\text{CH}_3)_2\text{C}:\text{CO}$, dimethylketene.

29. For acids the rule of the Geneva nomenclature is retained. However, in cases where the use of that nomenclature would not be convenient the carboxyl group will be considered as a substituting group and the name of the acid will be formed by adding to the name of the hydrocarbon the suffix *carbonique* or *carboxylic*, according to the language.

Examples: $\text{CH}_3\text{CH}_2\text{COOH}$, propanoic acid; $\text{HOOCCH}_2\text{COOH}$, propanedioic acid; $\text{HOOCCH}_2\text{CH}(\text{COOH})\text{CH}_2\text{COOH}$, 1,2,3-propanetricarboxylic acid. In the Geneva system the last-named compound would have been called pentanedioic-3-methyloic acid.

30. Acids in which an atom of sulfur replaces an atom of oxygen will be named according to the Geneva nomenclature. Example: ethanethioic, -thiolic, -thionic, -thionothiolic. If the carboxyl is considered as a substituent the compounds will be named *carbothioic* acids. The suffix *carbothiolic* will be used if it is certain that the oxygen of the OH group is replaced by sulfur; the suffix *carbothionic* if it is the oxygen of the CO group; the suffix *carbodithioic* will be used if both oxygen atoms are replaced.

Examples of the two systems of names: CH_3COSH or CH_3CSOH (either one), ethanethioic acid, methanecarbothioic acid; CH_3COSH , ethanethiolic acid, methanecarbothiolic acid; CH_3CSOH , ethanethionic acid, methanecarbothionic acid; CH_3CSSH , ethanethionothiolic acid, methanecarbodithioic acid.

31. The existing conventions will be retained for salts and esters.

Examples: Sodium butanoate or sodium salt of butanoic acid; diethyl 1,2-ethanedicarboxylate or diethyl ester of 1,2-ethanedicarboxylic acid; sodium acetate; methyl succinate.

32. Acid anhydrides will retain their present mode of designation according to the names of the corresponding acids. For names formed in accordance with the Geneva nomenclature,

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

the amides, amidoximes, amidines, imides and nitriles will be named like the acids by adding to the name of the corresponding hydrocarbon the endings *amide*, *amidine*, *amidoxime*, *imide*, and *nitrile*, respectively, while the halides will be named by combining *chloride*, etc., with the name of the radical. Examples: C_3H_7COCl , butanoyl chloride; $C_3H_7CONH_2$, butanamide; etc.

If the carboxyl is considered as a substituent the endings *carbonamide*, *carbonamidine*, *carbonamidoxime*, *carbonimide*, *carbonitrile* will be used. Examples: C_3H_7COCl , propane-carbonyl chloride; $C_3H_7CONH_2$, propanecarbonamide; etc.

33. The ending *ine* is reserved exclusively for nitrogenous bases. The present nomenclature of monoamines is retained. For polyamines, the name of the hydrocarbon will be followed by the suffixes *diamine*, *triamine*, etc.

For aliphatic compounds containing quinquivalent nitrogen the ending *ine* will be changed to *onium*. For cyclic substances containing quinquivalent nitrogen in the ring the ending *ine* will be changed to *inium*; for those with the ending *ole*, this will be changed to *olium*. Examples: pyridine, pyridinium; imidazole, imidazolium.

Further examples: CH_3NH_2 , methylamine; $(CH_3)_2NH$, dimethylamine; $(CH_3)_3N$, trimethylamine; $NH_2CH_2CH_2NH_2$, 1,2-ethanediamine; dextrin (not dextrine); glycerol (not glycerine).

34. (revised 1938) (a) Derivatives of hydrogen arsenide, AsH_3 , will be named like the amines and their derivatives, with the ending *arsine*. The univalent radical $-AsH_2$ will be designated by the prefix *arsino*.

Examples: CH_3AsH_2 , methylarsine; $(CH_3)_3As$, trimethylarsine; $(CH_3)_2AsCl$, chlorodimethylarsine; $(CH_3)_3AsO$, trimethylarsine oxide; $H_2AsCH_2CH_2AsH_2$, 1, 2-diarsinoethane or ethane-1, 2-diarsine; $(C_2H_5)_4AsOH$, tetraethylarsonium hydroxide; $(CH_3)_2AsAs(CH_3)_2$, tetramethylbiarsine.

(b) Acids of the types $RHAs(:O)OH$ and $RR'As(:O)OH$ will be named *arsinic acids*; those of the type $RAs(:O)(OH)_2$ will be named *arsonic acids*. The radical $>AsO_2H$ will be designated by the prefix *arsinico*, the radical $-AsO_2H$ by the prefix *arsono*.

Examples: $(CH_3)_2AsO_2H$, dimethylarsinic acid; $C_6H_5AsO_3H_2$, benzene-arsonic acid.

(c) Rules *a* and *b* are applicable to the analogous compounds of phosphorus and antimony, the syllable "ars" being replaced respectively by *phosph* or *stib*.

(d) The following list includes the prefixes and suffixes applicable to the most common compounds of phosphorus, arsenic and antimony:

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

<i>Radical</i>	<i>Prefix</i>	<i>Suffix</i>
-AsH ₂	arsino	arsine
-AsO	arsenoso	
-AsO ₂	arso	
>As(:O)OH	arsinico	arsinic
-As(:O)(OH) ₂	arsono	arsonic
-As = As-	arseno	
-PH ₂	phosphino	phosphine
-PO	phosphoroso	
-PO ₂	phospho	
>P(:O)OH	phosphinico	phosphinic
-P(:O)(OH) ₂	phosphono	phosphonic
-P = P-	phosphoro	
-P = N-	phosphazo	
-P = As-	phospharseno	
-SbH ₂	stibino	stibine
-SbO	stiboso	
-SbO ₂	stibo	
>Sb(:O)OH	stibinico	stibinic
-Sb(:O)(OH) ₂	stibono	stibonic
-Sb = Sb-	antimono	
-Sb = As-	stibarseno	

(e) Derivatives of bismuthine, BiH₃, will be named like the arsines.

(f) Compounds of arsenic, phosphorus, antimony and bismuth which cannot be named clearly by the preceding rules will be named as derivatives of arsines, phosphines, stibines or bismuthines or (if possible) as organometallic derivatives (rule 48).

Examples: CH₃BiO, methylbismuth oxide; CH₃SbCl₄, methylantimony tetrachloride; (C₆H₅)₂AsOC₂H₅, ethoxydiphenylarsine; (CH₃)₂AsOH, hydroxymethylarsine or dimethylarsenic hydroxide; CH₃SbS, methylantimony sulfide; [(CH₃)₂As]₂O, bis(dimethylarsenic) oxide or cacodyl oxide.

35. Compounds derived from hydroxylamine by replacement of the hydrogen of the hydroxyl will be regarded as alkoxy derivatives; those in which an atom of hydrogen of the NH₂ group is replaced, as alkylhydroxylamines. Oximes will be named by adding the suffix *oxime* to the name of the corresponding aldehyde, ketone or quinone. Examples: C₂H₅ONH₂, ethoxyamine; C₂H₅NHOH, ethylhydroxylamine.

Further examples: CH₃CH₂CH:NOH, propanal oxime; CH₃C(:NOH)CH₃, propanone oxime.

36. The generic term *urea* is retained; it will be used as a suffix for the alkyl and acyl derivatives of urea. Examples: butylurea, C₄H₉NHCONH₂; butyrylurea, C₃H₇CONHCONH₂. The bivalent radical -NHCONH- will be named *ureylene*.

37. The generic name *guanidine* is retained.

38. The name *carbylamine* is retained.

Example: C₂H₅NC, ethylcarbylamine (or ethyl isocyanide).

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

39. Isocyanic and isothiocyanic esters (RNCO , RNCS) will be named *isocyanates* and *isothiocyanates*.

40. The name *cyanate* is reserved for true esters which on saponification yield cyanic acid or its hydration products. The name *sulfo cyanate* will be replaced by *thiocyanate*.

41. Nitro derivatives: no change in the present nomenclature.

Examples: $\text{C}_6\text{H}_5\text{NO}$, nitrosobenzene; $(\text{NO}_2)_3\text{C}_6\text{H}_2\text{OH}$, trinitrophenol.

42. Azo derivatives: the forms *azo*, *azoxy* are retained.

43. (a) Diazonium compounds, RN_2X , are named by addition of the suffix *diazonium* to the name of the parent substance (benzenediazonium chloride).

(b) Compounds having the same empirical formula but containing trivalent nitrogen will be named by replacing diazonium with *diazo* (benzenediazohydroxide).

(c) Substances of the type RN_2OM will be named *diazoates*.

(d) Compounds in which the two nitrogen atoms are united to a single carbon atom will be designated by the prefix *diazo* (diazomethane, diazoacetic acid).

(e) The term *diazoamino* is retained; however, these compounds may also be regarded as derivatives of triazene.

(f) Derivatives of the substances $\text{H}_2\text{NNHNNHNH}_2$; $\text{NH}:\text{NNHNNH}_2$; $\text{NH}:\text{NNHN}:\text{NH}$ will be named *tetrazanes*, *tetrazenes*, *pentazdienes*, etc.

Examples: (a) $\text{C}_6\text{H}_5\text{N}(\text{N})\text{Cl}$, benzenediazonium chloride; (b) $\text{C}_6\text{H}_5\text{N}:\text{NOH}$, benzenediazohydroxide; (c) $\text{C}_6\text{H}_5\text{N}:\text{NONa}$, sodium benzenediazoate; (d) N_2CH_2 , diazomethane; $\text{N}_2\text{CH}_2\text{COOH}$, diazoacetic acid, diazoethanoic acid or diazomethanecarboxylic acid; (e) $\text{C}_6\text{H}_5\text{N}:\text{NNHC}_6\text{H}_5$, diazoamino-benzene or 1,3-diphenyltriazene; (f) $\text{C}_6\text{H}_5\text{NHNHNNHNC}_6\text{H}_5$, 1,4-diphenyltetrazane; $\text{C}_6\text{H}_5\text{N}:\text{NNHNNH}_2$, 1-phenyl-1-tetrazene.

44. Hydrazines are designated by the name of the alkyl radicals from which they are derived, followed by the suffix *hydrazine*. In cases where the amino group of carbonamides is replaced by the hydrazino group, the suffix *hydrazide* will be used. Hydrazo derivatives are regarded as derivatives of hydrazine. Examples: CH_3NHNH_2 , methylhydrazine; $\text{C}_2\text{H}_5\text{NHNHC}_3\text{H}_7$, 1-ethyl-2-propylhydrazine; $\text{C}_3\text{H}_7\text{CONHNNH}_2$, butyrohydrazide or propanecarbohydrazide.

45. Hydrazones and semicarbazones are named like the oximes. The term *osazone* is retained.

Examples: $\text{CH}_3\text{CH}:\text{NNHC}_6\text{H}_5$, ethanal (or acetaldehyde) phenylhydrazone; $(\text{CH}_3)_2\text{C}:\text{NNHCONH}_2$, propane (or acetone) semicarbazone.

46. The name *quinone* is retained.

Examples: *p*-benzoquinone or *p*-quinone, 1,2-naphthoquinone or 1,2-naphthaquinone, phenanthrenequinone or phenanthraquinone.

47. Sulfonic and sulfinic acids will be designated by adding the suffixes *sulfonic* and *sulfinic* to the name of the hydrocarbon.

The analogous acids of selenium and tellurium will bear the names *alkaneselenonic* and *-seleninic* acids; *alkanetelluronic* and *-tellurinic* acids.

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

Examples: $\text{C}_2\text{H}_5\text{SO}_3\text{H}$, ethanesulfonic acid; $\text{C}_{10}\text{H}_6(\text{SO}_3\text{H})_2$, naphthalenedisulfonic acid; $\text{CH}_3\text{SeO}_3\text{H}$, methaneselenonic acid; $\text{C}_6\text{H}_5\text{TeO}_3\text{H}$, benzenetellurinic acid.

48. Organometallic compounds will be designated by the names of the organic radicals united to the metal which they contain, followed by the name of the metal. Examples: dimethylzinc, tetraethyllead, methylmagnesium chloride.

However, if the metal is united in a complex manner it may be considered as a substituent. Example: $\text{ClHgC}_6\text{H}_4\text{CO}_2\text{H}$, chloromercuribenzoic acid.

49₂ (revised 1938)

I. Cyclic hydrocarbons with aliphatic side chains are to be named according to one of the two following methods: (α) The radical names denoting the side chains are prefixed to the name of the cyclic hydrocarbon. (β) The cyclic hydrocarbon residue, if it can be named as a radical, is considered a substituent of the aliphatic chain. Naming according to (α) is in general preferable when the side chain is short or when several side chains are present. Naming according to (β) is more convenient when the side chain is long, and particularly when the cyclic hydrocarbon residue is not at the end of this chain.

Examples: (α) $\text{C}_6\text{H}_5\text{C}_2\text{H}_5$, ethylbenzene, $\text{CH}_3\text{C}_6\text{H}_4\text{C}_2\text{H}_5$, methylethylbenzene; $\text{C}_{10}\text{H}_7\text{CH}:\text{CH}_2$, ethenylnaphthalene.

(β) $\text{CH}_3\text{CH}(\text{C}_6\text{H}_5)(\text{CH}_2)_5\text{CH}_3$, 2-phenyloctane; $p\text{-(CH}_3)_2\text{CHC}_6\text{H}_4\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)(\text{CH}_2)_3\text{CH}_3$, 3-methyl-2-(4-isopropylphenyl)heptane.

For naming cyclic hydrocarbons with side chains according to (α), it is advisable in many cases to use the common names of simple aromatic hydrocarbons.

Examples $o\text{-CH}_3\text{C}_6\text{H}_4\text{C}_2\text{H}_5$, 2-ethyltoluene, $(\text{CH}_3)_2\text{C}_6\text{H}_4\text{CH}:\text{CH}_2(1,3,2)$, 2-ethenyl-*m*-xylene; $\text{CH}_3\text{C}_6\text{H}_3(\text{C}_2\text{H}_5)\text{CH}(\text{CH}_3)_2(1,2,4)$, 2-ethyl-*p*-cymene.

II When several cyclic hydrocarbon residues are united by an aliphatic chain the name of the compound will be derived from that of the aliphatic hydrocarbon, provided radical names are available for the cyclic hydrocarbon residues.

Examples: $\text{C}_6\text{H}_5\text{CH}_2\text{C}_6\text{H}_5$, diphenylmethane; $\text{C}_6\text{H}_5\text{CH}_2\text{CH}(\text{C}_6\text{H}_5)(\text{CH}_2)_2\text{CH}_3$, 1,2-diphenylpentane.

If this is not the case, or if the possibility of using a convenient radical name makes it desirable, the name of the compound will be derived from that of one of the cyclic hydrocarbons, on the principle of substitution.

Examples: $\text{C}_{11}\text{H}_9\text{CH}_2\text{C}_6\text{H}_5(2)$, 2-benzylanthracene (better than phenyl-(2-anthryl) methane), $\text{C}_{16}\text{H}_9\text{CH}_2\text{CH}_2\text{C}_6\text{H}_5$, (β -phenylethyl) pyrene

49₃ (revised 1938). When the cyclic hydrocarbons treated of in rule 49_a carry functions which can be expressed only by a prefix, the same possibilities for names exist as those indicated in rule 49_a.

Examples: $\text{C}_6\text{H}_5\text{CHClCH}_2\text{Cl}$, 1,2-dichloro-1-phenylethane or (α , β -dichloroethyl) benzene; $\text{C}_6\text{H}_5\text{CH}_2\text{CHCH}_3\text{CH}_2\text{Cl}$, 3-chloro-2-methyl-1-phenylpropane or (γ -chloroisobutyl) benzene; $p\text{-ClC}_6\text{H}_4\text{CH}_2\text{CH}_2\text{Cl}$, 4-chloro-1-(β -chloroethyl) benzene or 2-chloro-1-(4-chlorophenyl) ethane.

For naming derivatives of monocyclic hydrocarbons which have common names, it will be of advantage to employ these names.

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

Examples: $p\text{-ClC}_6\text{H}_4\text{CH}_3$, 4-chlorotoluene (4-chloro-1-methylbenzene); $p\text{-ClC}_6\text{H}_4\text{CH}_2\text{Cl}$, 4, ω dichlorotoluene (4-chloro-1-(chloromethyl) benzene, 4-chlorobenzyl chloride), $\text{CH}_3\text{C}_6\text{H}_4(\text{NO}_2)\text{CH}(\text{CH}_3)_2$ (1,2,4), 2-nitro- p -cymene (2-nitro-1-methyl-4-isopropylbenzene).

50. If it is necessary to avoid ambiguity, the names of complex radicals will be placed in parentheses. Examples: (dimethylphenyl)amine = $(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NH}_2$; dimethylphenylamine = $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$.

V. Complex Functions

51. For compounds of complex function, that is to say, for compounds possessing different functions, only one kind of function (the principal function) will be expressed by the ending of the name. The other functions will be designated by appropriate prefixes.

Example: 2-aminoethanol (not ethanolamine). By rule 1 very commonly used names like phenolsulfonic acid, naphthylaminesulfonic acid might still be used.

52. The following prefixes and suffixes will be used for designating the functions.

Function	Prefix	Suffix
Acid and derivatives	carboxy	carboxylic, carbonyl, carbonamide, etc., or oic, oyl, etc.
Alcohol	hydroxy	ol
Aldehyde	oxo, aldo (for aldehyde O) or formyl (for CHO)	al
Amine	amino	amine
Azo derivative	azo	...
Azoxy derivative	azoxy	...
Carbonitrile (nitrile)	cyano	carbonitrile or nitrile
Double bond	...	ene
Ether	alkoxy	...
Ethylene oxide, etc.	epoxy	...
Halide	halogeno(halo)	...
Hydrazine	hydrazino	hydrazine
Ketone	oxo or keto	one
Mercaptan	mercapto	thiol
Nitro derivative	nitro	...
Nitroso derivative	nitroso	...
Quinquevalent nitrogen	...	onium, inium (olium)
Sulfide	alkylthio	...
Sulfinic derivative	sulfino	sulfinic
Sulfone	sulfonyl	...
Sulfonic derivative	sulfo	sulfonic
Sulfoxide	sulfinyl	...
Triple bond	...	yne
Urea	ureido	urea

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

The order in which the functions are here listed has no significance; the rules do not establish any general order of precedence (cf. rules 7, 63).

53. The names of derivatives of fundamental heterocyclic substances will be formed according to the preceding rules.

Example: Hydroxyquinolinecarbonamide, not quinolinolcarbonamide.

VI. Radicals

54. Univalent radicals derived from saturated aliphatic hydrocarbons by removal of one atom of hydrogen will be named by replacing the ending *ane* of the hydrocarbon by the ending *yl*.

Examples: methyl, ethyl, pentyl (or amyl), etc. Since isopropylidene is recognized (rule 56) it was no doubt the intention of the Committee to recognize isopropyl similarly.

55. The names of univalent radicals derived from unsaturated aliphatic hydrocarbons will have the endings *enyl*, *ynyl*, *dienyl*, etc., the positions of the double or triple bonds being indicated by numerals or letters where necessary.

Examples: $\text{CH}_2\text{:CH—}$, ethenyl (or vinyl); CH:C— , ethynyl; $\text{CH}_3\text{—CH:—CH—CH}_2\text{—}$, 2-butenyl; $\text{CH}_2\text{:CH—CH:CH—}$, 1, 3-butadienyl.

56. Bivalent or trivalent radicals derived from saturated hydrocarbons by removal of 2 or 3 hydrogen atoms from the same carbon atom will be named by replacing the ending *ane* of the hydrocarbon by the endings *ylidene* or *ylidyne*. For radicals derived from unsaturated hydrocarbons, these endings will be added to the name of the hydrocarbon. The names isopropylidene and methylene are retained.

Examples: $\text{CH}_2<$, methylene; $\text{CH}_3\text{CH}<$, ethylidene; $\text{CH}_3\text{CH}_2\text{CH}<$, propylidene; $(\text{CH}_3)_2\text{C}<$, (1-methylethylidene) or isopropylidene; $\text{CH}_3\text{C:}$, ethylidyne; $\text{CH}_2\text{:CH—CH}_2\text{CH}<$, 3-butenylidene.

57. The names of bivalent radicals derived from aliphatic hydrocarbons by removal of a hydrogen atom from each of the two terminal carbon atoms of the chain will be ethylene, trimethylene, tetramethylene, etc.

Only saturated radicals are provided for: $\text{—CH}_2\text{CH}_2\text{—}$, ethylene; $\text{—CH}_2\text{—CH}_2\text{CH}_2\text{—}$, trimethylene, etc.

58. Radicals derived from acids by removal of OH will be named by changing the ending carboxylic to *carbonyl* or, if the Geneva nomenclature is used, *oic* to *oyl*.

Examples: CH_3CO , ethanoyl or methanecarbonyl (or acetyl).

59. Univalent radicals derived from aromatic hydrocarbons by removal of a hydrogen atom from the ring will in principle be named by changing the ending *ene* to *yl*. However, the radicals C_6H_5 and $\text{C}_6\text{H}_5\text{CH}_2$ will continue provisionally to be named phenyl and benzyl respectively. Moreover, certain abbreviations sanctioned by usage are authorized, as *naphthyl* instead of *naphthalyl*.

Examples: $\text{CH}_3\text{C}_6\text{H}_4\text{—}$, tolyl (instead of toluyyl), anthryl (instead of anthracyl), phenanthryl, fluoryl.

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

60. Univalent radicals derived from heterocyclic compounds by removal of hydrogen from the ring will be named by changing their endings to *yl*. In cases where this would give rise to ambiguity, merely the final *e* will be changed to *yl*. Examples: pyridine, pyridyl; indole, indolyl; pyrroline, pyrrolinyl; triazole, triazolyl; triazine, triazinyl.

61. Radicals formed by removal of a hydrogen atom from a side chain of a cyclic compound will be regarded as substituted aliphatic radicals.

Examples: $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{—}$, (2-phenylethyl); $\text{C}_6\text{H}_5\text{CH:CHCH}_2\text{—}$, (3-phenyl-2-propenyl). (For $\text{C}_6\text{H}_5\text{CH}_2$, see rule 59.)

62. In general, special names will not be given to multivalent radicals derived from cyclic compounds by removal of several hydrogen atoms from the ring. In this case prefixes or suffixes will be used. Examples: triaminobenzene or benzenetriamine; dihydroxypyrrole or pyrrolediol.

Comparison with rules 21, 33 and 51 will show that of the names given as examples, "benzenetriamine" and "pyrrolediol" are the ones ordinarily to be preferred (according to the rule of expressing the principal function in the ending of the name where there is a suffix denoting it).

63. The order in which prefixes or radicals are stated (alphabetic order or conventional order) remains optional.

See the comments on rule 7. There is no generally accepted "conventional order" for all prefixes.

VII. Numbering

64. In aliphatic compounds the carbon atoms of the fundamental chain will be numbered from one end to the other with the use of arabic numerals. In case of ambiguity the lowest numbers will be given (1) to the principal function, (2) to double bonds, (3) to triple bonds, (4) to atoms or radicals designated by prefixes. The expression "lowest numbers" signifies those that include the lowest individual number or numbers. Thus, 1, 3, 5 is lower than 2, 4, 6; 1, 5, 5 lower than 2, 6, 6; 1, 2, 5 lower than 1, 4, 5; 1, 1, 3, 4 lower than 1, 2, 2, 4.

Examples: $\text{CH}_2\text{:CHCH}_2\text{CH}_3$, 1-butene (not 3-butene); $\text{CH}_2\text{:CHC:CH}$, 1-buten-3-yne (not 3-buten-1-yne); $\text{CH}_2\text{:CH—CH}_2\text{OH}$, 2-propen-1-ol (not 1-propen-3-ol; the name allyl alcohol may also be used); $\text{CHCl}_2\text{—CH}_2\text{CH:CH}_2$, 4, 4-dichloro-1-butene. The principle of "low numbers" also applies to cyclic compounds, with due regard to their different structures (e.g., bridges and hetero atoms are usually given preferred positions). Examples: 1, 3-cyclohexadiene; 3-cyclohexen-1-one or simply 3-cyclohexenone; 4, 4-dichlorocyclohexene.

Position of Numbers.—Where shall position numbers be placed, *before* or *after* the parts of the name to which they refer? Usage varies; some chemists place them before, some place them after, some use a combination. The Committee has left full latitude on this point. The examples in the French version usually show the numbers placed after; the examples in these comments follow the practice of *Chemical Abstracts* in being placed before. Each method has certain advantages. In Beilstein numbers placed after are in parentheses, those placed before are not, e.g., "2-methyl-butanol-(4)."

65. Positions in a side chain will be designated by numerals or letters, starting from the point of attachment. The numerals or letters will be in parentheses with the name of the chain.

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

Examples: $(\text{CH}_3)_2\text{CH}-$, (1-methylethyl) or isopropyl; $\text{CH}_3\text{CHClCH}_2-$, (2-chloropropyl). The rule equally permits Greek letters, ordinary letters, primed numbers (1', 2'), numbers with indices (4^1 , 4^2) or other designations.

66. In case of ambiguity in the numbering of atoms or radicals designated by prefixes, the order will be that chosen for the prefixes before the name of the fundamental compound or side chain of which they are substituents.

Example: $\text{CH}_2\text{BrCH}_2\text{CH}_2\text{Cl}$, 1-bromo-3-chloropropane (alphabetic order), or 1-chloro-3-bromopropane (order of increasing radical weight). The purpose of the rule is to decide which prefixes shall have which numbers, when the set of numbers (in the above example 1, 3) for the prefixes has been determined.

67. The prefixes, *di*, *tri*, *tetra*, etc. will be used before simple expressions (for example, diethylbutanetriol) and the prefixes *bis*, *tris*, *tetrakis*, etc., before complex expressions. Examples: bis(methylamino)propane, $\text{CH}_3\text{NH}(\text{CH}_2)_3\text{NHCH}_3$; bis(dimethylamino)ethane, $(\text{CH}_3)_2\text{NCH}_2\text{CH}_2\text{N}(\text{CH}_3)_2$. The prefix *bi* will be used only to denote the doubling of a radical or compound; for example, biphenyl.

Additional example of the use of *bi*: *p*-($\text{C}_6\text{H}_4\text{CO}_2\text{H}$)₂, 4, 4'-bibenzoic acid or biphenyl-4, 4'-dicarboxylic acid.

68. A catalog of cyclic systems, with their numberings according both to the existing system and to that of Mr. Patterson, is in preparation under the auspices of the National Research Council of the United States and of the American Chemical Society.

This catalog appeared in 1940 as American Chemical Society Monograph No. 84, "The Ring Index" by Austin M. Patterson and Leonard T. Capell.

In order to avoid all confusion the Commission recommends placing a scheme of numbering at the head of each article.

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PREFIX NAMES OF ORGANIC RADICALS

This list is taken, by permission, from the Introduction to the Subject Index of *Chemical Abstracts*, Volumes 39 and 41, and represents the latest practice of that journal.

acenaphthenyl $C_{12}H_9$ — (from *acenaphthene*)
acetamido CH_3CONH —
acetenyl = ethynyl
acetimido $CH_3C(=NH)$ —
acetylonyl $CH_3C(=O)CH_2$ —
acetonilydene $CH_3COCH=$
acetoxyl CH_3COO —
acetyl CH_3CO —
acetylene $=CHCH=$
acridyl $C_{13}H_9N$ — (from *acridine*)
acrylyl $CH_2=CHCO$ —
adipyl $=OC(CH_2)_4CO$ —
alanyl CH_3CHNH_2CO —
alkoxy RO — ($R = \text{any alkyl radical}$)
allyl $CH_2=CHCH_2$ —
 β -allyl = isopropenyl
amido H_2N — (properly, in acid groups only;
 by some used synonymously with amino)
amidoxalyl = oxamyl
amino H_2N —
amoxy $CH_3(CH_2)_4O$ —
amyl $CH_3(CH_2)_4$ —

tert-amyl

CH_3CH_2
 |
 C
 ||
 $(CH_3)_2$
amylidene $CH_3(CH_2)_3CH=$
anilino C_6H_5NH —
anisal = anisylidene
anisoyl $p-CH_3C_6H_4CO$ —
anisyl = methoxyphenyl or methoxybenzyl
anisylidene $p-CH_3OC_6H_4CH=$
anthranoyl $o-H_2NC_6H_4CO$ —

anthraquinonyl $C_{14}H_7O_2$ — (from *anthraquinone*, 2 isomers)
anthryl $C_{14}H_9$ — (from *anthracene*, 9 isomers)
anthrylene $-C_{14}H_8-$ (from *anthracene*, 14 isomers)
antimono —Sb:Sb—
antipyroyl (from *antipyrine*)

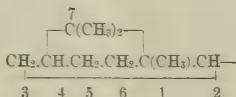
$OC.N(C_6H_5).N(CH_3).C(CH_3):CCO-$
 3 2 1 5 4
antipyryl (from *antipyrine*)

$OC.N(C_6H_5).N(CH_3).C(CH_3):C-$
 3 2 1 5 4

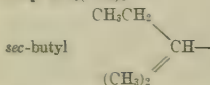
arseno —As:As—
arsenoso O:As—
arsinico (from *arsinic acid*) $(HO)OAs=$
arsino H_2As —
arso O_2As —
arsono (from *arsonic acid*) $(HO)_2OAs=$
arsylene $HAS=$
asaryl 2,4,5- $(CH_3O)_3C_6H_2$ —
asparagyl $H_2NCOCH_2CHNH_2CO$ —
aspartyl $-COCH_2CHNH_2CO$ —
auro Au—
azido N_3 —
azino = $NN=$
azo —N:N— (as connective)
azoxy —N(O)N—
benzal = benzylidene
benzamido C_6H_5CONH —
benzenyl = benzylidene
benzidino $H_2NC_6H_4C_6H_4NH$ — (from *benzidine*)

PREFIX NAMES OF ORGANIC RADICALS (Continued)

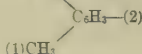
benzoyl $(C_6H_5)_2C(OH)CO-$
 benzimidazolyl $C_7H_5N_2-$ (from benzimidazole)
 benzimido $C_6H_5C(:NH)-$
 benzofuryl C_8H_5O- (from benzofuran)
 benzhydryl $(C_6H_5)_2CH-$
 benzhydrylidene $(C_6H_5)_2C=$
 benzopyranyl C_9H_7O- (2- α , etc.) (from benzopyran)
 benzoxazolyl C_7H_4NO- (from benzoxazole)
 benzoxy C_6H_5COO-
 benzoyl C_6H_5CO-
 benzoylene $-C_6H_4CO-$
 benzyl $C_6H_5CH_2-$
 benzylidene $C_6H_5CH=$
 benzylidyne $C_6H_5C\equiv$
 biphenylene $-C_{10}H_6C_6H_4-$
 biphenylenebisazo $-N:NC_6H_4C_6H_4N:-$
 biphenyl (2-, 3- or 4-) $C_6H_5C_6H_4-$ (from biphenyl)
 biphenylcarbonyl $C_6H_5C_6H_4CO-$
 biphenyloxy $C_6H_5C_6H_4O-$
 bornyl (from borneol)



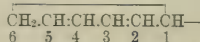
boryl $O:B-$
 bromo $Br-$
 1-butenyl $CH_3CH_2CH:CH-$
 2-butenyl $CH_3CH:CHCH_2-$
 3-butenyl $CH_2:CH(CH_3)-$
 butoxy $CH_3(CH_2)_3O-$
 butyl $CH_3(CH_2)_3-$



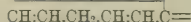
tert-butyl $(CH_3)_3C-$
 butylene (1,4) = tetramethylene
 butylidene $CH_3(CH_2)_2CH=$
 butyryl $CH_3(CH_2)_2CO-$
 camphanyl $C_{10}H_{17}-$ (from camphane, 3 isomers)
 camphoroyl $C_{10}H_{14}O_2=$ (from camphoric acid)
 camphoryl $C_{10}H_{15}O-$ (from camphor)
 camphorylidene $C_{10}H_{14}O=$ (from camphor)
 caproyl $CH_3(CH_2)_4CO-$
 capryl $CH_3(CH_2)_5CO-$
 caprylyl $CH_3(CH_2)_6CO-$
 carbamido = ureido
 carbamyl H_2NCO-
 carbanilino = phenylcarbamyl
 carbazolyl $C_{12}H_5N-$ (from carbazole, 5 isomers)
 carbethoxy C_2H_5OOC-
 carbomethoxy CH_3OOC-
 carbonyl $OC=$
 carbonyldioxy $-OCOO-$
 carboxy $HOOC-$
 carbyl $-C-$
 carvacryl (4) $(CH_3)_2CH$



cetyl = hexadecyl
 chaulmoogryl $(C_3H_7(CH_2)_{12}CO-$ (from chaulmoogric acid)
 chaulmoogryl $C_3H_7(CH_2)_{12}CH_2-$ (from chaulmoogryl alcohol)
 chloro $Cl-$
 chloromercuri $ClHg-$
 chrysenyl $C_{18}H_{11}-$ (from chrysene)
 cinnamal = cinnamylidene
 cinnamyl = styryl
 cinnamoyl $C_6H_5CH:CHCO-$
 cinnamyl $C_6H_5CH:CHCH_2-$
 cinnamylidene $C_6H_5CH:CHCH=$
 cresotyl 2,3- $HO(CH_3)_2C_6H_3CO-$ (from cresotic acid) (2,3-shown)
 cresoxy = toloxy
 cresyl = ar-hydroxytolyl; = tolyl
 cresylene = tolylene
 crotonyl $CH_3CH:CHCO-$
 crotyl = 2-butenyl
 cumal = p-cuminyldiene
 cumidino $(CH_3)_2CHC_6H_4NH-$
 cuminal = p-cuminyldiene
 cuminyl p- $(CH_3)_2CHC_6H_4CH_2-$
 cuminyldiene p- $(CH_3)_2CHC_6H_4CH=$
 cumoyl (from cumic acid) p- $(CH_3)_2CHC_6H_4-$
 CO
 cumyl $(CH_3)_2CHC_6H_4-$
 cyanato $NCO-$
 cyano $NC-$
 cyclobutyl (from cyclobutane) C_4H_7-
 cyclohexadienyl (2,4- shown)

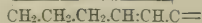


cyclohexadienyldiene (2,4- or 2,5-; 2,5-shown)



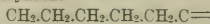
cyclohexenyl C_6H_9- (from cyclohexene, 3 isomers)

cyclohexenyldiene (2- shown)



cyclohexyl $C_6H_{11}-$ (from cyclohexane)

cyclohexylidene



cyclopentenyl C_5H_7- (from cyclopentene)

cyclopentyl C_5H_9- (from cyclopentane)

cyclopropyl C_3H_5- (from cyclopropane)

cymyl $C_{10}H_{13}-$ (from cymene)

2-p-cymyl = carvacryl

3-p-cymyl = thymyl

decyl $CH_3(CH_2)_9-$

desyl $C_6H_5COCH(C_6H_5)-$

diazo $-N:N-$ or $N:N=$

diazamino $-N:NNH-$

disilanoxy H_3SiSiH_2O-

disilanyl H_3SiSiH_2-

disilanylamino H_3SiSiH_2NH-

disilanylene $-SiH_2SiH_2-$

disilazanoxy $H_3SiNHSiH_2O-$

disilazanyl $H_3SiNHSiH_2-$

disilazanylamino $H_3SiNHSiH_2NH-$

disiloxanoxy $H_3SiOSiH_2O-$

disiloxanyl $H_3SiOSiH_2-$

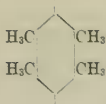
disiloxanylamino $H_3SiOSiH_2NH-$

dodecyl $CH_3(CH_2)_{10}CH_2-$

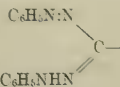
duryl 2,3,5,6- $(CH_3)_4C_6H-$

PREFIX NAMES OF ORGANIC RADICALS (Continued)

durylene



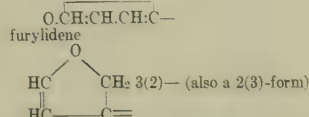
enanthyl $\text{CH}_3(\text{CH}_2)_5\text{CO}-$
 epoxy $-\text{O}-$ (to different atoms already united in some other way)
 ethene = ethylene
 ethenyl = ethylidene; = vinyl
 ethinyl = ethynyl
 ethoxalyl $\text{C}_2\text{H}_5\text{OCCO}-$
 ethoxy $\text{C}_2\text{H}_5\text{O}-$
 ethyl CH_3CH_2-
 ethylene $-\text{CH}_2\text{CH}_2-$
 ethylenedioxy $-\text{O}(\text{CH}_2)_2\text{O}-$
 ethylidene $\text{CH}_3\text{CH}=\text{CH}-$
 ethylidyne $\text{CH}_3\text{C}\equiv$
 ethynyl $\text{CH}\equiv$
 ethynylene $-\text{C}\equiv\text{C}-$
 fenchyl $\text{C}_{10}\text{H}_{17}-$ (from fenchane)
 fluorenyl C_{13}H_9- (from fluorene, 5 isomers)
 fluorenylidene $\text{C}_{13}\text{H}_8=$ (from fluorene)
 fluoro $\text{F}-$
 formamido $\text{HCONH}-$
 formazyl



formyl $\text{OCH}-$
 furfural = furfurylidene
 furfuryl O.CH:CH.CH:CCH_2-
 furfurylidene



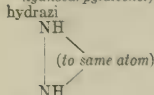
2-furoyl $\text{O.CH:CH.CH:C}\text{CO}-$
 3-furoyl $\text{CH:CH.O.CH:C}\text{CO}-$
 furyl (2 isomers, 2-shown)



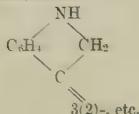
geranyl $\text{C}_{10}\text{H}_{17}-$ (from geraniol)
 glutamyl $-\text{OCCNH}_2(\text{CH}_2)_2\text{CO}-$
 glutaryl $-\text{OC}(\text{CH}_2)_3\text{CO}-$
 glyceroyl $\text{CH}_2\text{CHCH}_2\text{OHCO}-$

glyceryl $-\text{CH}_2\text{CHCH}_2-$
 glycolyl $\text{HOCH}_2\text{CO}-$
 glycolyl $\text{H}_2\text{NCH}_2\text{CO}-$
 glyoxyl $\text{OCHCO}-$
 guaiacetyl = *o*-methoxyphenyl
 guanidino $\text{H}_2\text{NC}(\text{NH})\text{NH}-$
 guanyl $\text{H}_2\text{NC}(\text{NH})-$
 hendecyl $\text{CH}_3(\text{CH}_2)_{10}-$
 heptyl $\text{CH}_3(\text{CH}_2)_6-$
 hexadecyl $\text{CH}_3(\text{CH}_2)_{14}\text{CH}_2-$
 hexyl $\text{CH}_3(\text{CH}_2)_5-$
 hippuryl $\text{C}_6\text{H}_5\text{CONHCH}_2\text{CO}-$
 homopiperonyl $3,4-(\text{CH}_2\text{O})_2\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2-$
 hydnocarpyl $\text{C}_8\text{H}_7(\text{CH}_2)_{10}\text{CO}-$ (from hydnocarpic acid)

hydnocarpyl $\text{C}_8\text{H}_7(\text{CH}_2)_{10}\text{CH}_2-$ (from hydnocarpylalcohol)



hydrazino $\text{H}_2\text{NNH}-$
 hydrazo $-\text{HNNH}-$ (to different atoms)
 hydrazono $\text{H}_2\text{NN}=\text{CH}-$
 hydrocinnamoyl $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CO}-$
 hydroxamino $\text{HONH}-$
 hydroximino = isonitroso
 hydroxy (hydroxyl) $\text{HO}-$
 -idene added to any radical usually means a double bond at point of attachment
 imidazolidyl $\text{C}_3\text{H}_7\text{N}_2-$ (from imidazolidine)
 imidazolyl $\text{C}_3\text{H}_3\text{N}_2-$ (from imidazole, 4 isomers)
 imido $\text{NH}=\text{CH}-$ (property, in acid groups only; by some used synonymously with imino)
 imino $\text{NH}=\text{CH}-$
 indanyl C_9H_9- (from indan, 4 isomers)
 indenyl C_9H_7- (from indene, 7 isomers)
 indolyl $\text{C}_8\text{H}_6\text{N}-$ (from indole, 7 isomers)
 indolyldiene



indyl = indolyl
 iodo $\text{I}-$
 iodoso $\text{OI}-$
 iodoxy $\text{O}_2\text{I}-$
 isoallyl = propenyl
 isoamoxy $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{O}-$
 isoamyl $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2-$
 isoamylidene $(\text{CH}_3)_2\text{CHCH}_2\text{CH}=\text{CH}-$
 isobutenyl = 2-methylpropenyl
 isobutoxy $(\text{CH}_3)_2\text{CHCH}_2\text{O}-$
 isobutyl $(\text{CH}_3)_2\text{CHCH}_2-$
 isobutyryl $(\text{CH}_3)_2\text{CHCO}-$
 isocyanato $\text{OCN}-$
 isocyno $\text{C}\equiv\text{N}-$
 isohexyl $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3-$
 isoindolyl $\text{C}_8\text{H}_6\text{N}-$ (from isoindole, 4 isomers)
 isoleucyl $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CHNH}_2\text{CO}-$
 isonitro $\text{HOON}=\text{CH}-$
 isonitroso $\text{HON}=\text{CH}-$
 1-isopentenyl = 3-methyl-1-butenyl
 isophthalal = isophthalylidene
 isophthaloyl $-\text{OCC}_6\text{H}_4\text{CO}-$ (m)
 isophthalylidene $=\text{HCC}_6\text{H}_4\text{CH}=\text{CH}-$ (m)
 isopropenyl $\text{CH}_2=\text{C}(\text{CH}_3)-$
 isopropoxy $(\text{CH}_3)_2\text{CHO}-$
 isopropyl $(\text{CH}_3)_2\text{CH}-$
 isopropylidene $(\text{CH}_3)_2\text{C}=\text{CH}-$
 isoquinolyl $\text{C}_9\text{H}_6\text{N}-$ (from isoquinoline, 7 isomers)
 isothiocyano $\text{S:C:N}-$
 isovaleryl $(\text{CH}_3)_2\text{CHCH}_2\text{CO}-$
 isoxazolyl $\text{C}_2\text{H}_2\text{NO}-$ (from isoxazole, 5 isomers)
 keto = oxo
 lauroyl (from lauric acid) $\text{CH}_3(\text{CH}_2)_{10}\text{CO}-$
 leucyl (from leucine) $(\text{CH}_3)_2\text{CHCH}_2\text{CHNH}_2\text{CO}-$
 malonyl $-\text{OCC}_2\text{H}_5\text{CO}-$

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PREFIX NAMES OF ORGANIC RADICALS (Continued)

pyridylidene



4(1), etc.

pyrimidyl $C_4H_3N_2$ — (from pyrimidine)

pyromucyl = 2-fur-yl

pyrrolidyl C_4H_5N — (from pyrrolidine, 3 isomers)

pyrroyl $CH:CH:CH:CH.N.CO$ —

pyrryl C_4H_4N — (from pyrrole, 3 isomers)

quinazolyl $C_8H_5N_2$ — (from quinazoline)

quinolyl C_9H_6N — (from quinoline, 7 isomers)

quinonyl $C_6H_3O_2$ — (from quinone)

quinoxalyl $C_8H_5N_2$ — (from quinoxaline)

salicyl = *o*-hydroxyphenyl; = *o*-hydroxybenzyl

salicylidene $HOC_6H_4CH=$ (*o*)

salicyloyl HOC_6H_4CO- (*o*)

selenino $(HO)OSe-$

seleninyl $OSe=$

seleno $Se=$

selenocyano $NCS-$

selenono HO_3Se-

selenonyl $-SeO_2-$

selenyl $HSe-$

semicarbazido $NH_2CONHNH-$

seneciyl $(CH_3)_2C:CHCO-$ (from *senecioic acid*)

siloxy H_2SiO-

silyl H_3Si-

silylamino H_3SiNH-

1-silyldisilanyl $(H_3Si)_2SiH-$

silylene $H_2Si=$

silylidene $ESi=$

stannyl H_3Sn-

stearoyl $CH_3(CH_2)_{16}CO-$

stibarseno $-Sb:f s-$

stibinico $HOOSb=$

stibino $H:Sb-$

stibo $O:Sb-$

stibono $(HO)_2OSb-$

stiboso $O:Sb-$

stibyl = stibino

stibylene $HSb=$

styrene $-CH(C_6H_5)CH_2-$

styrolene = styrene

styryl $C_6H_5CH:CH-$

succinamyl $H_2NCOCH_2CH_2CO-$

succinimido $(CH_2CO)_2N-$

succinyl $-OCCCH_2CH_2CO-$

sulfamino HO_2SNH-

sulfamyl H_2NO_2S-

sulfanilamido $p-H_2NC_6H_4SO_2NH-$ (from *sulfanilamide*)

sulfanilyl $p-H_2NC_6H_4SO_2-$ (from *sulfanilic acid*)

sulphydryl = mercapto

sulino HO_2S-

sulinyl $OS=$

sulfo HO_2S-

sulfonamido $-SO_2NH-$

sulfonyl $-SO_2-$

sulfuryl = sulfonyl

tauryl $H_2NCH_2CH_2SO_2-$

telluro $Te=$

terephthalal = terephthalylidene

terephthaloyl $-OCC_6H_4CO-$ (*p*)

terephthalylidene $=HCC_6H_4CH=$ (*p*)

tetramethylene $-CH_2CH_2CH_2CH_2-$

tetrazcyl CHN_4- (from *tetrazole*, 2 isomers)

thenoyl C_4H_3SCO- (from *thiophenecarboxylic acid*, 2 isomers)

thenyl (2 isomers) $C_4H_3SCH_2-$

thenylidene (2 isomers) $C_4H_3SCH=$

thiazolidyl C_3H_4NS- (from *thiazolidine*)

thiazolyl C_3H_2NS- (from *thiazole*, 3 isomers)

thienyl C_4H_3S- (from *thiophene*, 2 isomers)

thio $-S-$

thiocarbamyl H_2NCS-

thiocarbonyl $SC=$

thiocyano $NCS-$

thiohydroxy = mercapto

thiol (*S* replacing *O* in *OH*)

Used in place of "thio" when required for distinction

thiono (*S* replacing *O* in *CO*)

Used in place of "thio" when required for distinction

thionyl = sulfinyl

thioxo (*S* replacing *2H* in $>CH_2$)

thiuram = thiocarbamyl

thujyl $C_{10}H_{17}-$ (from *sabinane*, attached at 2-position)

thymyl (from *thymol*)

$HC:C(CH_3).CH:CH.C(CH(CH_3)_2).C-$

toloxy (*o*, *m*, or *p*) $CH_3C_6H_4O-$

toluidino (*o*, *m* or *p*) $CH_3C_6H_4ONH-$

toluyl (*o*, *m* or *p*) $CH_3C_6H_4CO-$

α -toluyl = phenylacetyl

tolyl (*o*, *m* or *p*) $CH_2C_6H_4-$

α -tolyl = benzyl

tolyene (6 isomers) $CH_3C_6H_5=$

α -tolyene = benzylidene

tosyl = tolylsulfonyl

triazeno $NH_2N:N-$

triazinyl $C_4H_2N_3-$ (from *triazine*)

triaz=azido

triazcyl $C_2H_2N_3-$ (from *triazole*)

tri-methylene $-CH_2CH_2CH_2-$

trisilanyl $H_3SiSiH_2SiH_2-$

trisilanylene $-SiH_2SiH_2SiH_2-$

tritryl = triphenylmethyl

tryptophyl $C_{11}H_{11}N_2O-$ (from *tryptophan*)

tyrosyl $p-HOC_6H_4CH_2CHNH_2CO-$ (from *tyrosine*)

undecyl = hendecyl (in sense $C_{11}H_{23}-$)

uramino = ureido

ureido $H_2NCONH-$ (by some used synonymously with *ureylene*)

ureylene $-HNCONH-$

valeryl $CH_3(CH_2)_3CO-$

valyl $(CH_3)_2CHCHNH_2CO-$ (from *valine*)

vanillal = vanillylidene

vanillyl 3,4- $(CH_3O)(HO)(C_6H_7CO-$

vanillyl 3,4- $(CH_3O)(HO)C_6H_4CH_2-$

vanillylidene 3,4- $(CH_3O)(HO)C_6H_3CH=$

veratral = veratrylidene

veratrcyl 3,4- $(CH_3O)_2C_6H_3CO-$

veratryl 3,4- $(CH_3O)_2C_6H_3CH_2-$

veratrylidene 3,4- $(CH_3O)_2C_6H_3CH=$

vinyl $H_2C:CH-$

vinylene $-CH:CH-$

vinylidene $H_2C:C=$

xanthyl $C_{13}H_9O-$ (from *xanthene*, 6 isomers)

xenyl = biphenyl

xyloyl $(CH_3)_2C_6H_3CO-$ (from *xylic acid*, 7 isomers)

xylyl $(CH_3)_2C_6H_3-$

xylylene $-H_2CC_6H_4CH_2-$

EXPLANATION OF TABLE

The table presents data for over 5000 compounds. They have been selected to include those of general or commercial importance as well as those commonly met with in the laboratory.

Arrangement. The entries are arranged alphabetically by *parent compounds*, substituting atoms and groups like bromo-, chloro-, ethyl-, methyl-, nitro-, etc. being placed after the rest of the name instead of before it; e.g., Acetic acid, dichloro- (and not Dichloroacetic acid). This practice, which is followed in some of the indexes to journals, makes it possible to bring many derivatives of the same parent together. Radicals such as propyl, butyl and amyl, and also compounds such as butyric acid and valeraldehyde, are assumed to be of normal structure unless otherwise stated.

Nomenclature. Compounds are indexed under their common names wherever these are acceptable, but a large number of *synonyms* and *cross references* are included. In particular, many names formed according to the International Union Rules (see preceding pages) are given and are distinguished by the symbol (*). Trade mark names are in quotations.

An **alphabetic order of substituting radicals** is employed in each name; e.g., Ether, ethyl methyl (not Ether, methyl ethyl). For a table of radicals, see preceding pages.

Acids are entered under their "trivial" names where these exist. Systematic names are derived from trivial names where this is feasible; as, Valeric acid, α -bromo-.

Alcohols. Important alcohols having common names, as Amyl alcohol, Isoamyl alcohol, Propyl alcohol, are so entered. For others the International Union names are used; as, 3-Buten-1-ol.

Aldehydes and amides are usually entered under names derived from the acid name; as, Propionaldehyde, Propionamide (from propionic acid).

Amines will be found under their usual names; as, Ethylamine, Triethylamine, Ethylenediamine.

Carbylamines are entered as Ethyl isocyanide, Phenyl isocyanide, etc.

Cyanides. See Nitriles, below.

Esters of organic acids will in general be found under the names of the corresponding acids, but those of glycerol and glycol are under the names of the alcohols. Esters of inorganic acids have independent entries; as, Ethyl sulphate, Ethylsulfuric acid.

Ethers. Simple, unsubstituted ethers occur under their own names; as, Ethyl ether, Phenyl ether. Most other monoethers are under *Ether*; as, Ether, isoamyl phenyl.

Halogen derivatives of hydrocarbons, when simple, are entered under their common names (as, Propyl chloride) or, when more complex, under their International Union names (as, 1-Pentane, 2-chloro-).

Hydrazine derivatives are found under *Hydrazine* or, if monoacyl derivatives, under the name of the corresponding acid (as, Benzoic acid, hydrazide). But **hydrazones** are placed under the corresponding carbonyl compound (as, Acetone, phenylhydrazone).

Hydrocarbons of the aliphatic series are entered under their Geneva (International Union) names; other hydrocarbons, under their commonly accepted names.

Isocyanides (Isonitriles) are named as Ethyl isocyanide, Phenyl isocyanide, etc.

Ketones having simple names are so entered (e.g., Acetone, Acetophenone); others are given International Union names if possible (as, 2-Butanone). Those familiar with "ketone" names will find a number of cross references under *Ketone*.

Mercaptans are named, according to the International Union rule, as Ethanethiol (C_2H_5SH), Benzenethiol (C_6H_5SH), etc.

Metallic salts of organic acids will be found in the preceding table, "Physical Constants of Inorganic Compounds."

Metal-organic compounds should be looked for under the name of the metal; as, Lead, tetraethyl-.

Nitriles (cyanides) are given names derived from the corresponding acid; as, Acetonitrile.

EXPLANATION OF TABLE (Continued)

Oximes are entered under the corresponding carbonyl compound; as, Formaldehyde, oxime.

Phenols will be found under their usual names; as, Phenol, Resorcinol.

Salts of bases are entered under the names of the bases; as, Aniline, hydrochloride. For metal salts of organic acids see the preceding table, "Physical Constants of Inorganic Compounds."

Semicarbazones are placed under the corresponding carbonyl compound; as, Acetone, semicarbazone.

Sulfides, sulfones and sulfoxides are treated like ethers (see Ethers, above); as, Ethyl sulfide; Sulfone, ethyl phenyl.

Sulfonic acids are named as Ethanesulfonic acid, Naphthalenedisulfonic acid, etc.

Boldface type is used to distinguish the parent compounds and their substituting radicals. When a parent compound is followed by derivatives its name is not repeated but is replaced in each succeeding entry by a dash.

Formulas. Structural formulas have been given in most cases, and the structure has been indicated as fully as is feasible without taking undue space.

Numbers have been assigned to all compounds to facilitate identification of data on the right hand page and for use in connection with the formula, melting point and boiling point indexes which immediately follow the table. Since the original numbering, some items have been deleted and many others added resulting in occasional breaks in the succession and the occurrence of letters in combination with the numbers.

Crystalline form and color are stated in easily interpreted abbreviations. Other important characteristics are often added. The **index of refraction**, follows. For crystals of two or three indices they are invariably given in the order ω , ϵ or α , β , γ . The **specific rotation**, $[\alpha]$, is given for certain compounds. Temperature and wavelength are indicated by the superior and inferior figures and letters following the numerical value. When not otherwise indicated the index of refraction and specific rotation are understood to be at 20°C. and for sodium light.

For example: 1.5236_D^{20} indicates an index of refraction of 1.5236 for sodium light ($\lambda = 589.3 \text{ m}\mu$) at 20°C; $[\alpha] - 65.6_D^{20}$ indicates a negative specific rotation of 65.6° for sodium light and a temperature of 20°C.

Density, is normally given in grams per milliliter, at 20°C, numerically equivalent to the specific gravity at 20° referred to water at 4°C. Specific gravity at other temperatures is shown with superior and inferior figures indicating, respectively, the temperature of the substance and that of water to which it is referred. The density of gases is given in grams per liter at 0°C and 760 mm Hg pressure unless otherwise indicated.

Example: 1.536 indicates a density in grams per milliliter at 20°C; 1.634_{-4}^{26} indicates a specific gravity of 1.634 at 25°C referred to water at 4°. 2.143g/l indicates the density of a gas at standard conditions, 0°C and 760 mm pressure, as 2.143 grams per liter.

Melting point and boiling point are given in °C. Other effects of temperature elevation such as dehydration, sublimation, decomposition, explosion are recorded in connection with the melting or boiling points. Decomposition on heating is indicated by the abbreviation d. If decomposition occurs at a definite temperature, the form d. 120 is used, while 120 d. indicates melting or boiling at 120°C with decomposition. Loss of water of crystallization is indicated by $-\text{H}_2\text{O}$. The boiling point is stated at normal atmospheric pressure (760 mm of Hg) unless otherwise indicated by a superior figure which shows the pressure in millimeters under which the compound boils at the temperature given.

Example: 125^{720} indicates a boiling point of 125°C at a pressure of 720 mm.

Solubility is stated in grams of substance dissolving in 100 ml of the solvent. Normal room temperatures, 20°C, is assumed unless the temperature is indicated by a superior figure. The term insoluble (i.) must usually be interpreted to mean that a negligible quantity of the compound dissolves. Many compounds commonly regarded as insoluble really dissolve to a slight extent. The terms very soluble (v.s.), soluble (s.), slightly soluble

EXPLANATION OF TABLE (Continued)

(sl.s.) are used for lack of definite figures. Conflicting statements are very common in the literature. Quantitative statements of solubility are likewise subject to uncertainty due to inexact statement of conditions. Values may be variously stated as parts by weight of solute in parts by weight or volume of the solvent or of the solution, and values are often given and quoted in the literature without proper designation. In the large number of values given there are many which are uncertain in this respect.

The form s. d. indicates solubility with more or less decomposition. The occurrence of d. alone in the statement of solubility indicates that decomposition is the primary action. The statement of solubility in acids or alkalis is usually understood to be accompanied by decomposition.

The policy has been followed of giving the solubility in water, ethyl alcohol and ethyl ether first, followed by statements in regard to other solvents.

As examples:

23.4²⁰ indicates a solubility of 23.4 grams of the substance in 100 ml of solvent at 20°C.

250 cm³ al. indicates the solubility of a gas in ethyl alcohol as 250 cm³ or ml of the gas in 100 ml of alcohol.

∞³⁵ indicates that the substance is miscible with the solvent above 35°C.

Molecular weights have been computed to the nearest hundredth according to the atomic weights of 1939.

ABBREVIATIONS

[α].....	specific rotation	glit.....	glittering	pr.....	prisms
a.....	acid	glyc.....	glycerin	purp.....	purple
abs.....	absolute	gran.....	granular	pyr.....	pyridine
abt.....	about	grn.....	green	pyram.....	pyramids
ac. a.....	acetic acid	grnsh.....	greenish	quad.....	quadrilateral
acet.....	acetone	h.....	hot	rac.....	racemic
al.....	alcohol	hex.....	hexagonal	rect.....	rectangular
alk.....	alkali	hyd.....	hydrate or hydrolyses	redsh.....	reddish
amor.....	amorphous	hyg., hydr.....	hygroscopic	resin.....	resinous
anh.....	anhydrous	i.....	inactive	rhomb.....	rhombic
arom.....	aromatic	i.....	insoluble	rhbdr.....	rhombohedral
art.....	artificial	ign.....	ignites	s.....	soluble
asym., as.....	asymmetric	inflam.....	inflammable	sc.....	scales
bi-py.....	bipyramidal	infus.....	infuses	sec.....	secondary
bl.....	blue	irid.....	iridescent	sh.....	short
blk.....	black	l.....	levorotatory	sl.....	slightly
boil.....	boiling	leaf. or lf.....	leaflets	slid.....	solid
br.....	brown	lg.....	large	slend.....	slender
bz.....	benzene	lgr.....	ligroin	sm.....	small
brnsh.....	brownish	liq.....	liquid	soft.....	softens
c.....	cold	lng.....	long	sol., soln.....	solutions
ca.....	about	lt.....	light	solv.....	solvents
carb.....	carbonates	lust.....	lustrous	st.....	steel
caust.....	caustic	lvs.....	leaves	stab.....	stable
chl.....	chloroform	m.....	meta-	subl.....	sublimes
col.....	colorless	me., meth.....	methyl	sym.....	symmetrical
comp.....	compound	met.....	metallic	tab., tabl.....	tablets
conc.....	concentrated	micr.....	microscopic	tert.....	tertiary
cr., cryst.....	crystals	min.....	mineral	tetr.....	tetragonal
d.....	decomposes	mixt.....	mixture	tol.....	toluene
d.....	dextrorotatory	mod.....	modification	trans.....	transparent
deliq.....	deliquescent	monocl.....	monoclinic	thk.....	thick
dil.....	dilute	need., nd.....	needles	tricl.....	triclinic
dist.....	distillable	o.....	ortho-	trim.....	trimetric
dk.....	dark	octahdr.....	octahedral	uns.....	unsymmetrical
dl.....	racemic	or.....	orange	unst.....	unstable
efflor.....	efflorescent	ord.....	ordinary	v.....	very
et.....	ethyl	org.....	organic	var.....	variable
et. ac.....	ethyl acetate	orth.....	orthorhombic	vic.....	vicinal
eth.....	ether	p.....	para-	vise.....	viscous
exp.....	explodes	pa.....	pale	volat.....	volatile or volatilizes
f.....	from	pet.....	petroleum	vlt.....	violet
feath.....	feathery	pet. eth.....	petroleum	w.....	water
fl.....	flakes	ph.....	phenyl	wh.....	white
fluores.....	fluorescent	PHNO ₂	nitrobenzene	yel.....	yellow
frz.....	freezes	pl.....	plates	yelsh., ylsh.....	yellowish
fum.....	fuming	pois.....	poison	>.....	above
gel.....	gelatinous	pois.....	poisonous	<.....	below
gen.....	generally	powd.....	powder	∞.....	soluble in all proportions
glac.....	glacial				

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1	Abietic Acid	abietinic acid; sylvic acid....	$C_{20}H_{30}O_2$	302.44
2	Acenaphthene	naphthyleneethylene.....	$C_{10}H_6(CH_2)_2$	154.20
2H	Acenaphthenequinone	1, 2-acenaphthenedione.....	$C_{10}H_6(CO)_2$	182.17
2M	Acenaphthylene.....	.....	$C_{10}H_6(CH)_2$	152.18
3	Acetal	1, 1-diethoxyethane*; acet- aldehyde diethyl acetal; ethylidene diethyl ether.	$CH_3CH(OC_2H_5)_2$..	118.17
4	—, amino-	See <i>Ethylamine</i> , β , β -diethox	y .*	
5	—, dichloro-	1, 1-dichloro-2, 2-diethoxy- ethane*	$CHCl_2CH(OC_2H_5)_2$	187.07
6	—, diethylamino-	See <i>Triethylamine</i> , β , β -dieth	oxy ..	
7	—, dimethyl-	See <i>Ethane</i> , 1, 1-dimethoxy*.		
8	—, dimethylamino-	See <i>Ethylamine</i> , β , β -diethox	y -N, N-dimethyl-	
9	—, trichloro-	See <i>Ethane</i> , 1, 1, 1-trichloro-2,	2-diethoxy*.	
10	Acetaldehyde	ethanal*; acetic aldehyde; aldehyde.	CH_3CHO	44.05
11	—, cyanohydrin.	See <i>Lactonitrile</i> .		
12	—, diethyl acetal.	See <i>Acetal</i> .		
13	—, dimethyl acetal.	See <i>Ethane</i> , 1, 1-dimethoxy*.		
13M	—, 2, 4-dinitro- phenylhydrazone	.....	$CH_3CH:NNHC_6H_3(NO_2)_2$	224.18
14	—, oxime.....	ethanal oxime*; acetaldoxime.	$CH_3CH:NOH$	59.07
15	—, phenylhydrazone.....	N-ethylidene-N'-phenyl- hydrazine	$CH_3CH:NNHC_6H_5$	134.18
16	—, semicarbazone.....	ethanal semicarbazone*.....	$CH_3CH:NNHCONH_2$.	101.11
17	—, butylethyl-	See <i>Caproaldehyde</i> , α -ethyl-		
18	—, dichloro-	dichloroethanal*; dichloroal- dehyde	$CHCl_2CHO$	112.95
19	—, methyl-	See <i>Propionaldehyde</i> .		
20	—, phenyl-	See α -Tolualdehyde.		
21	—, thio- , trimer.	See <i>s-Trithiane</i> , 2, 4, 6-trimet	hyl ..	
22	—, tribromo-	See <i>Bromal</i> .		
23	—, trichloro-	See <i>Chloral</i> .		
24	—, trimethyl-	See <i>Pivalaldehyde</i> .		
25	—, α -or β -trithio-.	See <i>s-Trithiane</i> , 2, 4, 6-trimet	hyl ..	
26	—, γ -trithio-.....	.....	$(CH_3CHS)_3$	180.34
27	Acetaldehyde-ammonia :	1-aminoethanol*; α -amino- ethyl alcohol; aldehyde- ammonia.	$CH_3CH(NH_2)OH$..	61.08
28	Acetaldoxime	See <i>Acetaldehyde</i> , <i>oxime</i> .		
29	—, trimethyl-	See <i>Pivalaldehyde</i> , <i>oxime</i> .		
30	Acetalyamine	See <i>Ethylamine</i> , β , β -diethox	y .*	
31	Acetamide	ethanamide*.....	CH_3CONH_2	59.07

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1	yel. amor. powd., 1.510, 1.578, 1.618	.....	137-66 (var.)	.....	i.	v. s.	v. s. eth.; s. glac. ac. a., acet., bz., CS ₂ , me. al.
2	wh. lng. need., 1.407, 1.468, 1.620; liq. 1.6048 ¹⁰⁰	1.024 $\frac{9.9}{4}$	95	277.5	i.	4.2 ²⁰ , 66.7 ⁷⁰	s. h. eth.; 36.9 ²⁰ chl.; 76 ²⁰ , 284.6 ⁶⁰ tol.; s. h. bz.
2H	yel. need. ....	.....	261	subl.	i.	sl. s. ....	.....
2M	rhomb.-yel. pl. f. al.	0.899 $\frac{1.6}{4}$	92-93	265-75, sl. d.	i.	v. s.	v. s. eth.
3	col. volat. liq., 1.38193	0.8254 $\frac{2.0}{4}$; 0.8461 $\frac{0}{4}$	.....	102-4	4.58 ²⁵	∞	∞ eth.
4	.....	.....	.....	.....	.....	.....	.....
5	liq.	1.138 ¹⁴	.....	184	.....	.....	.....
6	.....	.....	.....	.....	.....	.....	.....
7	.....	.....	.....	.....	.....	.....	.....
8	.....	.....	.....	.....	.....	.....	.....
9	.....	.....	.....	.....	.....	.....	.....
10	col. fum. inflam. liq., 1.3316	0.7834 $\frac{1.8}{4}$	-123.5	21	∞	∞	∞ eth., bz.
11	.....	.....	.....	.....	.....	.....	.....
12	.....	.....	.....	.....	.....	.....	.....
13	.....	.....	.....	.....	.....	.....	.....
13M	sm. yel. sc. ....	.....	167	.....	.....	s.	s. eth.
14	need. or col. liq.; liq. 1.42567 ^{20.4}	0.9656 $\frac{2.0}{4}$	47; frz. 13	114-5	s.	∞	∞ eth.
15	col. need. ....	.....	98-101 (57)	236-7 ²⁰	.....	.....	s. pet. eth.
16	need. f. w. or al.	1.0300 $\frac{0}{4}$	162-3	.....	3 ¹⁷	s.	.....
17	.....	.....	.....	.....	.....	.....	.....
18	col. liq. ....	.....	.....	90.5	.....	.....	.....
19	.....	.....	.....	.....	.....	.....	.....
20	.....	.....	.....	.....	.....	.....	.....
21	.....	.....	.....	.....	.....	.....	.....
22	.....	.....	.....	.....	.....	.....	.....
23	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	.....
25	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	81	100	.....	.....	.....
27	col. rhomb. ....	.....	97 (70-80)	100 sl. d.	v. s.	v. s.	sl. s. eth.
28	.....	.....	.....	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....	.....
30	.....	.....	.....	.....	.....	.....	.....
31	col. hex., or rhbdr., deliq. need. f. chl.; 1.54, 1.46 (stable mod.), 1.370, 1.485, 1.585 (meta-stable mod.); liq. 1.4274 ^{78.3}	1.159 $\frac{2.0}{4}$	81 (69.4)	222	97.5 ²⁰ , 178 ⁶⁰	25.0 ²⁰ , 257.1 ⁶⁰	sl. s. eth.; v. s. glyc.; s. chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
32	Acetamide, <i>N</i> -benzyl-	<i>N</i> -acetylbenzylamine; aceto- benzylamide	$C_6H_5CH_2NHCO-$ CH_3	149.19
33	—, <i>N</i> -bromo-.....	acetobromamide.....	$CH_3CONHBr$	137.98
34	—, α -chloro-.....	2-chloroethanamide*.....	$ClCH_2CONH_2$	93.52
35	—, cyanonitro-.....	See <i>Fulminuric acid</i> .		
36	—, α , α -dichloro-.....	2, 2-dichloroethanamide*.....	$CHCl_2CONH_2$	127.97
37	—, <i>N</i> , <i>N</i> -diphenyl-	<i>N</i> -acetyldiphenylamine; <i>N</i> -phenylacetanilide	$(C_6H_5)_2NCOCH_3$..	211.25
38	—, <i>N</i> -ethyl-.....	acetoethylamide.....	$CH_3CONHC_2H_5$..	87.12
39	—, hydroxy-.	See <i>Glycolamide</i> .		
40	—, <i>N</i> -(2-hydroxy-1-naphthyl)-.	See 2-Naphthol, 1-acetamido-.		
41	—, <i>N</i> -(4-hydroxy-1-naphthyl)-.	See 1-Naphthol, 4-acetamido-.		
42	—, isopropyl-.	See <i>Isovaleramide</i> .		
43	—, <i>N</i> -methyl- <i>N</i> -1-naphthyl-.	See 1-Naphthylamine, <i>N</i> -acetyl-.		
44	—, <i>N</i> -naphthyl-.	See <i>Naphthylamine</i> , <i>N</i> -acetyl-.		
45	—, <i>N</i> -phenyl-.	See <i>Acetanilide</i> .		
46	—, <i>N</i> -2-thienyl-.....	<i>N</i> -acetyl-2-thiophenine; 2-acetothiophenide	$CH_3CONHC_4H_3S$..	141.18
47	—, thio-.....	ethanethionamide*; aceto- thioamide	CH_3CSNH_2	75.13
48	—, <i>N</i> -(thiocarbamyl)-.	See <i>Urea</i> , <i>acetyl-thio</i> -.		
49	—, trichloro-.....	2, 2, 2-trichloroethanamide*..	CCl_3CONH_2	162.42
50	Acetamidine	ethanamidine*.....	$CH_3C(:NH)NH_2$..	58.08
51	—, <i>N</i> , <i>N'</i> -diphenyl-	ethenyldiphenylamidine.....	$CH_3C(:NC_6H_5)-$ NHC_6H_5	210.27
52	Acetanilide.....	<i>N</i> -phenylacetamide; antifebrin	$CH_3CONHC_6H_5$..	135.16
53	—, α -acetyl-.	See <i>Acetoacetanilide</i> .		
54	—, <i>o</i> -amino-.....	<i>N</i> -acetyl- <i>o</i> -phenylenediamine	$CH_3CONHC_6H_4-$ NH_2	150.18
55	—, <i>m</i> -amino-.....	<i>N</i> -acetyl- <i>m</i> -phenylenediamine	$CH_3CONHC_6H_4-$ NH_2	150.18
56	—, <i>p</i> -amino-.....	<i>N</i> -acetyl- <i>p</i> -phenylenediamine	$CH_3CONHC_6H_4-$ NH_2	150.18
57	—, <i>o</i> -bromo-.....	<i>N</i> -acetyl- <i>o</i> -bromoaniline.....	$BrC_6H_4NHCOCH_3$	214.07
58	—, <i>m</i> -bromo-.....	<i>N</i> -acetyl- <i>m</i> -bromoaniline, antiseptin, asepsin, bromanilid	$CH_3CONHC_6H_4Br$	214.07
59	—, <i>p</i> -bromo-.....	<i>N</i> -acetyl- <i>p</i> -bromoaniline, antiseptin, asepsin, bromanilid	$BrC_6H_4NHCOCH_3$	214.07
60	—, <i>o</i> -chloro-.....	<i>N</i> -acetyl- <i>o</i> -chloroaniline....	$CH_3CONHC_6H_4Cl$..	169.61
61	—, <i>m</i> -chloro-.....	<i>N</i> -acetyl- <i>m</i> -chloroaniline....	$CH_3CONHC_6H_4Cl$..	169.61
62	—, <i>p</i> -chloro-.....	<i>N</i> -acetyl- <i>p</i> -chloroaniline....	$CH_3CONHC_6H_4Cl$..	169.61
63	—, 2,4-dimethyl-.	See 2, 4-Acetoxylide.		
64	—, 2,4-dinitro-.....		$CH_3CONHC_6H_3-$ $(NO_2)_2$	225.16
65	—, <i>p</i> -ethoxy-.	See <i>p</i> -Acetophenetide.		
66	—, <i>o</i> -hydroxy-.....	<i>o</i> -acetamidophenol; <i>o</i> -acetylaminophenol	$CH_3CONHC_6H_4-$ OH	151.16
67	—, <i>m</i> -hydroxy-.....	<i>m</i> -acetamidophenol.....	$CH_3CONHC_6H_4-$ OH	151.16
68	—, <i>p</i> -hydroxy-.....	<i>p</i> -acetamidophenol.....	$CH_3CONHC_6H_4-$ OH	151.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
32	leaf. f. eth. ....	.....	61	>300	i.	s.	s. eth., lgr.
33	+1H ₂ O. lg. pl. ....	.....	+H ₂ O, 70-80; anh. 108	.....	s., d. ¹⁰⁰	s.	s. eth.
34	monocl. need. ....	.....	119.5	225.6	10 ²⁴	s.	v. sl. s. eth.
35	monocl. pr. ....	.....	98	234.6	v. s. h.	v. s.	v. s. eth.
36	ng. need. or	.....	103 (99-	subl.	sl. s.	s.	sl. s. eth.
37	rhomb. f. w.	.....	100)	.....	.....	.....	.....
38	liq.	0.942 ⁴⁻⁵ / ₄	.....	205	∞	∞	s. a.; i. dil. alk.
39	.....	.....	.....	.....	.....	.....	.....
40	.....	.....	.....	.....	.....	.....	.....
41	.....	.....	.....	.....	.....	.....	.....
42	.....	.....	.....	.....	.....	.....	.....
43	.....	.....	.....	.....	.....	.....	.....
44	.....	.....	.....	.....	.....	.....	.....
45	.....	.....	.....	.....	.....	.....	.....
46	wh. pl. ....	.....	160-1	.....	sl. s.	s.	sl. s. eth.
47	yel. monocl. tab. f. eth.	.....	108.5	.....	v. s.	s.	s. eth.
48	.....	.....	.....	.....	.....	.....	.....
49	monocl. tab. f. w.	.....	141	239-40	v. sl. s.	v. s.	v. s. eth.
50	unstable. ....	.....	166-7 d.	.....	s., d. h.	s.	s. a.
51	need. f. al. ....	.....	131-2	.....	.....	sl. s. c., v. s. h.	v. s. eth.; s. a.
52	rhomb., wh. leaf. f. w.	1.21 ⁴ / ₄	114	305	0.563 ²⁵ , 3.5 ²⁰	36.9 ²⁰	s. eth., glyc.; 13.6 ²⁰ , 44.9 ²⁰ chl.; 69.5 ²⁰ me. al.
53	.....	.....	.....	.....	.....	.....	.....
54	sm. lust. pl. ....	.....	132 (145)	.....	s.	.....	sl. s. eth.
55	col. need. f. bz.	.....	70	d. 86.5-7.5	v. s.	s.	sl. s. eth.
56	col. need. f. w.	.....	161-2	237	sl. s.	v. s.	v. s. eth.
57	need. f. al. ....	.....	99	.....	i.	s.	s. eth.
58	need. f. dil. al.	.....	87.5	.....	.....	s.	s. eth.
59	need. or mono cl. pr.	.....	168 (165-7)	.....	v. sl. s. h.	sl. s.	sl. s. eth.; s. chl., bz.
60	need. f. dil. ac. a.	.....	88	.....	sl. s.	s.	v. s. eth.; s. bz.
61	need. f. dil. ac. a.	.....	72.5	.....	sl. s.	s.	v. s. eth.; CS ₂ , bz.
62	rhomb. need. or pl.	1.385 ²² / ₄	178.4 (176-7)	.....	sl. s.	3.28 ¹⁰ , 4.37 ²⁰	s. eth., CS ₂
63	.....	.....	.....	.....	.....	.....	.....
64	need. f. al. ....	.....	120	.....	i. c.	v. s. h.	s. eth.
65	.....	.....	.....	.....	.....	.....	.....
66	col. leaf. f. dil. al.	.....	203	.....	sl. s.	s.	s. eth., KOH
67	col. need. f. w.	.....	149	.....	s.	s.	sl. s. eth., chl., bz.
68	col. monocl. f. al.	1.293 ²¹ / ₄	168	.....	v. sl. s.	v. s.	sl. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
69	Acetanilide, <i>o</i>-hydroxy-<i>N</i>-methyl-	<i>o</i> -(acetylmethylamino)-phenol	$\text{CH}_3\text{CON}(\text{CH}_3)\text{C}_6\text{H}_4\text{OH}$	165.19
70	—, <i>p</i>-hydroxy-<i>N</i>-methyl-	.....	$\text{CH}_3\text{CON}(\text{CH}_3)\text{C}_6\text{H}_4\text{OH}$	165.19
71	—, <i>p</i>-iodo-	.....	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{I}$	261.07
72	—, <i>p</i>-methoxy-	See <i>p</i> -Acetaniside.		
73	—, <i>N</i>-methyl-	exalgin.....	$\text{CH}_3\text{CON}(\text{CH}_3)\text{-C}_6\text{H}_5$	149.19
74	—, <i>o</i>-methyl-	See <i>o</i> -Acetotoluide.		
75	—, <i>N</i>-methyl-<i>p</i>-nitro-	.....	$\text{CH}_3\text{CON}(\text{CH}_3)\text{C}_6\text{H}_4\text{NO}_2$	194.19
76	—, <i>o</i>-nitro-	.....	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{NO}_2$	180.16
77	—, <i>m</i>-nitro-	.....	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{NO}_2$	180.16
78	—, <i>p</i>-nitro-	.....	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{NO}_2$	180.16
80	—, <i>N</i>-phenyl-	See <i>Acetamide, N, N</i> -diphenyl.		
81	—, <i>α</i>-phenyl-	See <i>α</i> -Toluanilide.		
82	—, <i>p</i>-phenylazo-	See <i>Azobenzene, p</i> -acetamido-		
83	—, thio-	.....	$\text{CH}_3\text{CSNHC}_6\text{H}_5$	151.22
84	<i>o</i>-Acetaniside	<i>N</i> -acetyl- <i>o</i> -anisidine; <i>o</i> -acetanisidide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-OCH}_3$	165.19
85	<i>p</i>-Acetaniside	<i>p</i> -methoxyacetanilide; <i>p</i> -acetamidoanisole; <i>N</i> -acetyl- <i>p</i> -anisidine; methacetin; <i>p</i> -acetanisidide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-OCH}_3$	165.19
86	Acetic acid	ethanoic acid*	CH_3COOH	60.05
87	—, esters.	For esters other than those listed below see also "acetate"		
88	—, allyl ester	allyl acetate, 2-propenyl ethanoate*	$\text{CH}_3\text{COOCH}_2\text{CH=CH}_2$	100.11
89	—, amyl ester	amyl acetate; 1-pentanol acetate; amyl acetic ester	$\text{CH}_3\text{COO}(\text{CH}_2)_4\text{-CH}_3$	130.18
90	—, benzyl ester	benzyl acetate; benzyl ethanoate*	$\text{CH}_3\text{COOCH}_2\text{C}_6\text{H}_5$	150.17
91	—, butyl ester	butyl acetate; butyl ethanoate*	$\text{CH}_3\text{COO}(\text{CH}_2)_3\text{-CH}_3$	116.16
92	—, <i>sec</i> -butyl ester	2-butanol acetate; <i>α</i> -methylpropyl ethanoate*	$\text{CH}_3\text{COOCH}(\text{CH}_3)\text{-C}_2\text{H}_5$	116.16
93	—, cetyl ester	cetyl acetate; hexadecylethanoate*; <i>n</i> -hexadecylacetate	$\text{CH}_3\text{COO}(\text{CH}_2)_{15}\text{-CH}_3$	284.47
94	—, ethyl ester	ethyl ethanoate*; acetic ester	$\text{CH}_3\text{COOC}_2\text{H}_5$	88.10
95	—, ethylene ester	See <i>Glycol, diacetate</i> .		
96	—, furfuryl ester	See <i>Furfuryl alcohol, acetate</i> .		
97	—, heptyl ester	<i>n</i> -heptyl acetate.....	$\text{CH}_3\text{COOC}_7\text{H}_{15}$	158.24
98	—, hexyl ester	<i>n</i> -hexyl acetate.....	$\text{CH}_3\text{COO}(\text{CH}_2)_5\text{-CH}_3$	144.21
99	—, isoamyl ester	isoamyl acetate; 3-methyl-1-butanol acetate; <i>γ</i> -methylbutyl ethanoate*	$\text{CH}_3\text{COO}(\text{CH}_2)_2\text{-CH}(\text{CH}_3)_2$	130.18
100	—, isobutyl ester	isobutyl acetate; <i>β</i> -methylpropyl ethanoate*	$\text{CH}_3\text{COOCH}_2\text{-CH}(\text{CH}_3)_2$	116.16

* Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
69	need. ....	.....	150	.....	sl. s.	v. s.	s. eth.
70	cr. ....	.....	240°	.....	v. sl. s.	v. s.	s. eth.
71	monocl.	$1.989 \frac{15-20}{4}$	183-4	.....	s. h.	5.05 ²¹	i. eth.; v. s. ac. a.
72	col. rhomb. pr. f. al. 1.560, 1.576, 1.647	$0.977 \frac{120}{4}$	101-4 (97-99)	254.7 (253 ⁷¹²)	i. (sl. s.)	s.	.....
73							
74	leaf. f. w. ....	.....	152-3	.....	.....	s.	s. eth.
75							
76	yel. monocl. leaf.	$1.419 \frac{15}{4}$	93 (90-1)	.....	s. h.	s.	v. s. eth., KOH
77	col.-yel. leaf. ...	.....	155 (150.5)	.....	s. h.	s.	i. eth.; s. chl., KOH
78	yel. rhomb. pr.	.....	215	.....	v. sl. s.	s.	s. eth., KOH
80	need. f. w. ....	.....	75	d.	i.	.....	i. eth.; s. alk., NaOH
81							
82							
83							
84	pearly, wh. cr. f. w.	.....	87-8 (84)	303-5	v. s. h.	55.3 ²¹	s. eth.; v. s. ac. a.
85	wh. powd., pr. or pl. f. w.	.....	137-38	.....	0.2 ¹⁵ , 8.3 ¹⁰⁰	12.7 ²¹	sl. s. eth.; s. chl., acet.
86	col. liq., 1.37182	$1.049 \frac{20}{4}$	16.6	118.1	∞	∞	∞ eth.; i. CS ₂
87	under <i>o</i> -Cresol,	<i>Cyclohexanol</i> , etc.	.....	103-4	sl. s.	∞	∞ eth.
88	col. liq., 1.40448						
89	col. liq., 1.4012	$0.879 \frac{20}{20}$	.....	148 ⁷⁸⁷ (145-7)	0.18 ²⁰	∞	∞ eth.
90	col. liq., 1.5232	$1.057 \frac{16}{4}$	-51.5	213.5 ⁷⁵⁶	v. sl. s.	∞	∞ eth.
91	col. inflam. liq., 1.3951	$0.882 \frac{20}{4}$	-76.8	126.5 (124-6)	0.5 ²⁵	∞	∞ eth.
		$0.9016 \frac{0}{0}$					
92	col. liq., 1.3866 ²⁵	$0.8648 \frac{25}{4}$	.....	112-3	i.	s.	s. eth.
93	need., 1.4358 ^{33.9}	$0.858 \frac{20}{4}$	18.5 (16-9)	200.5 ¹⁵	i.	v. sl. s.	v. s. eth.
94	col. inflam. liq., 1.37216 ^{18.9}	$0.901 \frac{20}{4}$	-83.6	77.15	8.6 ²⁰ , 7.4 ⁸⁵	∞	∞ eth., chl., oils
		$0.90657 \frac{15}{4}$					
95	col. liq., 1.4153	$0.874 \frac{16}{16}$	.....	191.5	i.	s.	s. eth.
96							
97	col. liq.	$0.8902 \frac{0}{0}$	.....	169.2	i.	v. s.	v. s. eth.
98	col. liq., 1.40170 ^{17.9}	$0.8699 \frac{25}{4}$	-78.5	142.5 (138-40)	0.16 ²⁵	∞	∞ eth.; s. amy ¹ al.
99	col. liq., 1.39114 ^{17.8}	0.8712	-98.9	116.5 (115-7)	0.63 ²⁵	∞	∞ eth.
100							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
101	Acetic acid , isopropyl ester	isopropyl acetate.....	$\text{CH}_3\text{COOCH}(\text{CH}_3)_2$	102.13
102	—, methylene diester.....	methylene acetate; methylene diacetate; methanediol diacetate	$(\text{CH}_3\text{COO})_2\text{CH}_2$...	132.11
103	—, methyl ester.....	methyl acetate.....	$\text{CH}_3\text{COOCH}_3$	74.08
104	—, β -phenylhydrazide.	See <i>Hydrazine, 1-acetyl- 2-phenyl-</i> .		
105	—, piperazinium salt.....	.....	$\text{C}_4\text{H}_{10}\text{N}_2 \cdot 2\text{C}_2\text{H}_4\text{O}_2$	206.24
106	—, piperidide.	See <i>Piperidine, 1-acetyl-</i> .		
107	—, propyl ester.....	<i>n</i> -propyl acetate.....	$\text{CH}_3\text{COOC}_3\text{H}_7$	102.13
108	—, acetamido- .	See <i>Aceturic acid</i> .		
109	—, (<i>p</i> - acetamidooanilino)-	See <i>Glycine, N-(p-acetamidophenyl)-</i> .		
109M	—, acetyl- .	See <i>Acetoacetic acid</i> .		
110	—, allyl- .	See <i>4-Pentenoic acid*</i> .		
111	—, amino- .	See <i>Glycine</i> .		
112	—, (<i>p</i> - aminoanilino)-	See <i>Glycine, N-(p-aminophenyl)-</i> .		
113	—, anilino- .	See <i>Glycine, N-phenyl-</i> .		
114	—, anthranilido- .	See <i>Anthranilic acid, N-(carboxymethyl)-</i> .		
115	—, benzamido- .	See <i>Hippuric acid</i> .		
116	—, benzoyl-	β -ketohydrocinnamic acid; 3-oxo-3-phenylpropanoic acid	$\text{C}_6\text{H}_5\text{COCH}_2\text{COOH}$	164.15
117	—, —, ethyl ester.....	ethyl- β -ketohydrocinnamate; benzoylacetic ester	$\text{C}_6\text{H}_5\text{COCH}_2\text{COOC}_2\text{H}_5$	192.21
118	—, —, methyl ester...	.....	$\text{C}_6\text{H}_5\text{COCH}_2\text{COOCH}_3$	178.18
119	—, bromo-	bromoethanoic acid*.....	CH_2BrCOOH	138.96
120	—, —, ethyl ester.....	ethyl bromoethanoate*.....	$\text{CH}_2\text{BrCOOC}_2\text{H}_5$..	167.01
121	—, sec-butyl- .	See <i>Valeric acid, β-methyl-</i> .		
122	—, butylethyl- .	See <i>Caproic acid, α-ethyl-</i> .		
123	—, chloro-	chloroethanoic acid*.....	CH_2ClCOOH	94.50
124	—, —, butyl ester.....	butyl 2-chloroethanoate*....	$\text{CH}_2\text{ClCOOC}_4\text{H}_9$..	150.61
125	—, —, ethyl ester.....	ethyl chloroacetate; ethyl chloroethanoate*	$\text{CH}_2\text{ClCOOC}_2\text{H}_5$..	122.55
126	—, —, methyl ester.....	methyl chloroethanoate*.....	$\text{CH}_2\text{ClCOOCH}_3$...	108.53
127	—, —, <i>p</i> -phenylphenacyl ester	.....	$\text{CH}_2\text{ClCOOCH}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	288.72
128	—, —, piperazinium salt	.....	$\text{C}_4\text{H}_{10}\text{N}_2 \cdot 2\text{CH}_2\text{ClCOOH}$	275.14
129	—, cyano-	cyanoethanoic acid*; malonic mononitrile	CNCH_2COOH	85.06
130	—, —, ethyl ester.....	.....	$\text{CH}_2(\text{CN})\text{COOC}_2\text{H}_5$	113.11
131	—, —, methyl ester.....	methyl cyanoethanoate*.....	$\text{CNCH}_2\text{COOCH}_3$..	99.09
132	—, diazo- , ethyl ester..	ethyl diazoethanoate*.....	$\text{N}_2\text{CHCOOC}_2\text{H}_5$...	114.10
133	—, dibromo-	dibromoethanoic acid*.....	CHBr_2COOH	217.87
134	—, —, ethyl ester.....	ethyl dibromoethanoate*....	$\text{CHBr}_2\text{COOC}_2\text{H}_5$..	245.92

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
101	col. liq.	0.877 ¹⁶ / ₄ ; 0.8690 ²⁵ / ₄	-73.4	89	3.09 ²⁰	=	∞ eth.
102	col. liq.	1.136 ²⁰ / ₄	.....	170	sl. s.	∞	∞ eth.
103	col. liq., 1.35935	0.92740 ²⁵ / ₄	-98.1	57.1	31.9 ²⁰	∞	∞ eth.
104	wh. cr. ....	.....	208.5-209	.....	s.	s.	i. eth.; s. h. n-butanol
105							
106	col. liq., 1.38438	0.887 ²⁰ / ₄	-92.5	101.6	1.89 ²⁰	∞	∞ eth.
107							
108							
109							
109M							
110							
111							
112							
113							
114							
115							
116	col. need. f. bz.	.....	103-4 d.	.....	sl. s.	s.	s. eth.; sl. s. lgr.
117	col. liq., 1.53115 ¹⁶	1.122 ²⁰ / ₄	<0	265-70 d.	v. v. sl. s.	∞	∞ eth.
118	col.-yel. liq., 1.53654 ^{24.7}	1.158 ²⁰ / ₄	.....	265 d.	i.	∞	∞ eth.
119	col. hex. or rhomb.	1.934 ²⁰ / ₄	50	208	∞, deliq.	=	∞ eth.
120	col. liq., 1.451	1.514 ¹³ / ₄	.....	159; 57-9 ¹⁵	i.	∞	∞ eth.
121	col. rhomb., 1.4297 ⁶⁵	1.58 ²⁰ / ₂₀	α 63, β 55-6, γ 50	189	v. s.	s.	s. eth., chl., CS ₂ , bz.
122							
123							
124	liq.	1.103 ⁰ / ₄	.....	175 (181-3)	.....	.....	.....
125	col. liq., 1.42274	1.159 ²⁰ / ₄	-26.0	144.2	i.	∞	∞ eth.
126	col. liq.	1.227 ²⁵ / ₄	-32.7	131.5	v. sl. s.	∞	∞ eth.
127	.....	.....	116	.....	.....	.....	.....
128	wh. cr. ....	.....	145-6	.....	s.	s. h.	i. eth.
129	deliq. col. cr.	.....	66 (69-70)	108 ¹⁵ , d. 160	s.	s.	s. eth.; sl. s. bz., chl.
130	col. liq., 1.41793 ^{20.5}	1.063 ²⁰ / ₄	-22.5	206	i.	∞	∞ eth.
131	col. liq.	1.123 ¹⁵	-22.5	200	i.	∞	∞ eth.
132	yel. oil, 1.4588 ^{17.5}	1.0852 ^{17.6} / ₄ ; 1.073 ²² / ₄	-22	140-41 ⁷²⁰	sl. s.	s.	s. eth., bz., lgr.
133	col. deliq. cr.	.....	48	232; 195-7 ²⁵⁰	sl. s.	s.	s. eth.
134	oil, 1.498	1.903 ²⁰ / ₂₀	.....	194	i.	=	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
135	Acetic acid, dichloro-	dichloroethanoic acid*.....	CHCl_2COOH	128.95
136	—, —, ethyl ester.....	ethyl dichloroethanoate*.....	$\text{CHCl}_2\text{COOC}_2\text{H}_5$...	157.00
137	—, diethyl- .	See <i>Butyric acid, α-ethyl-</i> .		
138	—, diethylmethyl- .	See <i>Butyric acid, α-ethyl-α-methyl-</i> .		
138M	—, difluoro-	difluoroethanoic acid*.....	CHF_2COOH	96.04
139	—, diiodo-	diiodoethanoic acid*.....	CHI_2COOH	311.88
140	—, dimethyl- .	See <i>Isobutyric acid</i> .		
141	—, di-n-octyl- .	See <i>Capric acid, α-octyl-</i> .		
142	—, diphenyl-	diphenylmethane-α-carboxylic acid	$(\text{C}_6\text{H}_5)_2\text{CHCOOH}$...	212.24
142M	—, diureido- .	See <i>Allantoic acid</i> .		
143	—, ethoxy-	ethoxyethanoic acid*; ethyloglycolic acid; glycolic acid ethyl ether	$\text{C}_2\text{H}_5\text{OCH}_2\text{COOH}$...	104.10
144	—, ethyl- .	See <i>Butyric acid</i> .		
145	—, (ethylamino)- .	See <i>Glycine, N-ethyl-</i> .		
146	—, ethyl dimethyl- .	See <i>Butyric acid, α, α-dimethyl-</i> .		
147	—, ethylene- .	See <i>Cyclopropanecarboxylic acid</i> .		
148	—, ethylmethyl- .	See <i>Butyric acid, α-methyl-</i> .		
149	—, ethylpropyl- .	See <i>Valeric acid, α-ethyl-</i> .		
149M	—, fluoro-	fluoroethanoic acid*.....	CHF_2COOH	78.04
150	—, 2-fural- .	See <i>2-Furanacrylic acid</i> .		
150M	—, 2-furoyl- ethyl ester	ethyl pyromucylacetate.....	$\text{C}_4\text{H}_7\text{OCOCH}_2\text{COOC}_2\text{H}_5$	182.17
151	—, guanido- .	See <i>Glycocyamine</i> .		
152	—, hydroxy- .	See <i>Glycolic acid</i> .		
153	—, iminodi-	diglycolamidic acid; iminoacetic acid (incorrect)	$\text{NH}(\text{CH}_2\text{COOH})_2$...	133.10
154	—, iodo-	iodoethanoic acid*.....	CHI_2COOH	185.96
155	—, isoamyl- .	See <i>Caproic acid, δ-methyl-</i> .		
156	—, isobutyl- .	See <i>Isocaproic acid</i> .		
157	—, isopropyl- .	See <i>Isovaleric acid</i> .		
158	—, isopropylmethyl- .	See <i>Butyric acid, α, β-dimethyl-</i> .		
159	—, isothiocyano-	mustard oil acetic acid.....	$\text{SCNCH}_2\text{COOH}$...	117.12
160	—, mercapto-	2-mercaptoethanoic acid*; thioglycolic acid	HSCH_2COOH	92.11
161	—, methoxy-	methoxyethanoic acid*; methyloglycolic acid	$\text{CH}_3\text{OCH}_2\text{COOH}$...	90.08
162	—, methyl- .	See <i>Propionic acid</i> .		
163	—, (α-methylguanido)-	See <i>Creatine</i> .		
164	—, methylpropyl- .	See <i>Valeric acid, α-methyl-</i> .		
165	—, oxydi- .	See <i>Diglycolic acid</i> .		
166	—, phenoxy-	glycolic acid phenyl ether....	$\text{C}_6\text{H}_5\text{OCH}_2\text{COOH}$...	152.14
167	—, phenyl- .	See <i>α-Toluic acid</i> .		
168	—, pyromucyl- .	See <i>Acetic acid, 2-furoyl-</i> .		
169	—, salicyl- .	See <i>Benzoic acid, o-(carboxymethyl)-</i> .		
170	—, silico- .	See <i>Methanesilicic acid</i> .		
171	—, sulfo-	sulfoethanoic acid*.....	$\text{HO}_3\text{SCH}_2\text{COOH}$...	140.11
172	—, 2-thienyl- .	See <i>2-Thiopheneacetic acid</i> .		
173	—, thiol-	ethanethioic acid*; methanecarbothioic acid; thioacetic acid	CH_3COSH	76.11
174	—, —, ethyl ester.....	.....	$\text{CH}_3\text{COSC}_2\text{H}_5$	104.16
175	—, tolyl- .	See <i>α-Toluic acid, methyl-</i> .		
176	—, tribromo-	tribromoethanoic acid*.....	CBr_3COOH	296.78
177	—, trichloro-.....	.....	\text{CCl_3COOH	163.40

* Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
135	col. liq., 1.4659 ²²	1.5634 ²⁰ ₄	5-6; frz. 11	194	8.63	s.	s. eth.
136	col. liq., 1.43860	1.2821 ²⁰ ₄	.....	158.2	v. sl. s.	∞	∞ eth.
137							
138							
138M	col. liq.	1.5359 ¹⁰	0.35	134.2 ⁷⁶⁶	v. s.	s.	s. eth.
139	yel. cr. ....	.....	110 (95-6)	.....	sl. s.	s.	s. eth., bz.
140							
141							
142	col. need. f. w. or lf. f. al.	.....	148	subl.	v. s. h.	v. s.	v. s. eth.; s. chl.
142M							
143	col. liq.	1.102 ²⁰ ₄	.....	206	v. s.	v. s.	v. s. eth.
144							
145							
146							
147							
148							
149							
149M	col. sld. ....	.....	33	165	s.	s.	.....
150							
150M	liq. ....	.....	.....	142-3 ¹⁰	i.	s.	s. eth.
151							
152							
153	col. rhomb. ...	.....	ca. 225	.....	2.43 ⁵	i.	i. eth.
154	col. rhomb. pl.	.....	82	d.	s.	s.	s. eth.
155							
156							
157							
158							
159	rhomb. pl. ....	.....	125-6	subl.	s. h.	.....	.....
160	liq.	1.3253 ²⁰ ₄	-16.5	104-6 ¹¹	s.	s.	s. eth.
161	col. hyg. liq.	1.1768 ²⁰ ₄	.....	89-91 ⁷	s.	s.	s. eth.
162							
163							
164							
165							
166	col. pl. or need. f. w.	.....	99	285 sl. d.	1.2 ¹⁰	s.	s. eth., ac. a., bz.
167							
168							
169							
170							
171	hyg. tab. f. w.	.....	86	ca. 245 d.	s.	v. s.	i. eth.
172							
173	col. liq.	1.074 ¹⁰ ₄	<-17	93	s.	∞	∞ eth.
174	liq.	0.9739 ²⁵ ₄	.....	115-16	i.	v. s.	v. s. eth.
175							
176	col. monoc. tab.	.....	135	245 d.	v. s.	v. s.	v. s. eth.; sl. s. c. lgr.
177	col. rhomb. deliq.	1.6298 ⁶¹ ₄	57.5	197.5	120 ²⁵	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
178	Acetic acid, trichloroethyl ester	.....	$\text{CCl}_3\text{COOC}_2\text{H}_5$	191.45
179	—, —, methyl ester.	.....	$\text{CCl}_3\text{COOCH}_3$	177.43
180	—, —, piperazinium salt	.....	$\text{C}_4\text{H}_{10}\text{N}_2\cdot 2\text{CCl}_3\text{COOH}$	412.94
180M	—, trifluoro-	trifluoroethanoic acid*	CF_3COOH	114.03
181	—, triiodo-	triiodoethanoic acid*	CI_3COOH	437.79
182	—, trimethyl-	See <i>Pivalic acid</i>.	.....	.....
183	—, triphenyl-.....	.....	$(\text{C}_6\text{H}_5)_3\text{CCOOH}$	288.33
184	—, ureido-	See <i>Hydantoic acid</i>.	.....	.....
185	—, vinyl-	See <i>3-Butenoic acid</i>*.	.....	.....
186	Acetic aldehyde.	See <i>Acetaldehyde</i>.	.....	.....
187	Acetic anhydride.	ethanoic anhydride*.....	$(\text{CH}_3\text{CO})_2\text{O}$	102.09
188	Acetic ester.	See <i>Acetic acid, ethyl ester</i>.	.....	.....
189	Acetin.	See <i>diacetate, monoacetate, triacetate, under Glycerol</i>.	.....	.....
190	Acetoacetanilide	β -ketobutyranilide; α -acetylacetanilide	$\text{CH}_3\text{COCH}_2\text{CONHC}_6\text{H}_5$	177.20
191	—, α-bromo-	2-bromo-3-oxo-N-phenylbutanamide	$\text{CH}_3\text{COCHBrCONHC}_6\text{H}_5$	256.11
191M	Acetoacetic acid	acetylacetic acid; 3-oxobutanonic acid*	$\text{CH}_3\text{COCH}_2\text{COOH}$	102.09
192	—, ethyl ester.....	ethylacetoacetate; acetoacetic ester; ethyl 3-oxobutanate*	$\text{CH}_3\text{COCH}_2\text{COOC}_2\text{H}_5$	130.14
193	—, methyl ester.....	methyl acetoacetate.....	$\text{CH}_3\text{COCH}_2\text{COOCH}_3$	116.11
194	—, γ-chloro- , ethyl ester	ethyl 4-chloro-3-oxobutanate*	$\text{CH}_2\text{ClCOCH}_2\text{COOC}_2\text{H}_5$	164.59
195	—, α, α-diethyl- , ethyl ester	ethyl 2,2-diethyl-3-oxobutanate*	$\text{CH}_3\text{COC}(\text{C}_2\text{H}_5)_2\text{COOC}_2\text{H}_5$	186.25
197	—, α-isopropyl- , ethyl ester	ethyl 2-isopropyl-3-oxobutanate*	$\text{CH}_3\text{COCH}(\text{C}_3\text{H}_7)\text{COOC}_2\text{H}_5$	172.22
198	—, α-methyl- , ethyl ester	ethyl 2-methyl-3-oxobutanate*; methylacetoacetic ester	$\text{CH}_3\text{COCH}(\text{CH}_3)\text{COOC}_2\text{H}_5$	144.17
199	Acetoacetic ester.	See <i>Acetoacetic acid, ethyl ester</i>.	.....	.....
200	Acetobenzylamide.	See <i>Acetamide, N-benzyl-</i>.	.....	.....
201	Acetobromamide.	See <i>Acetamide, N-bromo-</i>.	.....	.....
202	Acetocinnamone.	See <i>Acetone, benzylidene-</i>.	.....	.....
203	Acetoethylamide.	See <i>Acetamide, N-ethyl-</i>.	.....	.....
204	Acetoethyl nitrate.....	.....	$\text{C}_2\text{H}_4\text{O}(\text{C}_2\text{H}_5\text{NO}_2)_2?$	226.19
205	Acetoglyceral	glycerol ethylidene ether.....	$\text{C}_2\text{H}_5(\text{OH})\text{O}_2\text{C}_2\text{H}_4$	118.13
206	Acetoin	3-hydroxy-2-butanone*; acetyl methylcarbinol	$\text{CH}_3\text{COCHOHCH}_3$	88.10
207	Acetol	1-hydroxy-2-propanone*; hydroxyacetone; acetylcarbinol	$\text{CH}_3\text{COCH}_2\text{OH}$...	74.08
207M	—, fluoro-	See <i>Propane, 2,2-difluoro-</i>.	.....	.....
208	Acetonaphthalide.	See <i>Naphthylamine, N-acetyl-</i>.	.....	.....
208M	1-Acetonaphthone	methyl 1-naphthyl ketone....	$\text{CH}_3\text{COC}_{10}\text{H}_7$	170.20
209	—, α-phenyl-	See <i>Ketone, benzyl 1-naphthyl</i>.	.....	.....
209M	2-Acetonaphthone	methyl 2-naphthyl ketone....	$\text{CH}_3\text{COC}_{10}\text{H}_7$	170.20
210	—, 4-bromo-1-hydroxy-	2-acetyl-4-bromo-1-naphthol..	$\text{CH}_3\text{COC}_{10}\text{H}_5\text{BrOH}$	265.11
211	—, 1-hydroxy-	1-hydroxy-2-naphthyl methyl ketone; 2-acetyl-1-naphthol	$\text{CH}_3\text{COC}_{10}\text{H}_6\text{OH}$..	186.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
178	col. liq., 1.45068	1.383 $\frac{20}{4}$	.....	168	i.	∞	∞ eth.
179	col.	1.4868 $\frac{19.2}{4}$	-17.5	153.8	d.	d.	s. eth.
180	wh. cr. ....	.....	121-1.5	.....	s.	s. h.	i. eth.
180M	col. liq.	1.53514 ⁰	-15.25	72.4	v. s.	.....	.....
181	yel. leaf.	.....	150 d.	.....	s.	s.	s. eth.
182							
183	monocl. pr. ....	.....	265	.....	sl. s.	s.	sl. s. eth.; s. bz.
184							
185							
186							
187	col. liq., 1.39038	1.08712 $\frac{15}{4}$; 1.0820 $\frac{20}{4}$	-73.1	140.0	13.6 c., d.	∞	∞ eth.; s. chl., bz.
188							
189							
190	leaf. ....	.....	85	.....	sl. s.	s.	s. eth., a., alk., h. bz.
191	col. need. ....	.....	138 d.	d.	i.	s.	s. eth.
191M	col. syrup ....	.....	.....	<100, d.	■	s.	s. eth.
192	col. liq., 1.42092 ^{18.8}	1.025 $\frac{20}{4}$	<-80	180	14.3 ^{16.5}	s.	s. eth., bz., chl.
193	col. liq., 1.41837 ^{20.5}	1.077	.....	170	38.0	■	∞ eth.
194	col. liq.	1.176 $\frac{25}{4}$	.....	200	v. sl. s.	∞	∞ eth.
195	wh.-yel. liq., 1.43266 ^{17.2}	0.960 $\frac{26}{4}$	.....	211-6 d.	i.	∞	∞ eth.
197	col. liq.	0.957 $\frac{26}{4}$	.....	205 d.	v. sl. s.	∞	∞ eth.
198	col. liq., 1.42066 ^{17.8}	1.019 $\frac{20}{4}$	.....	186.8	v. sl. s.	s.	s. eth.
199							
200							
201							
202							
203							
204	liq.	1.045 $\frac{19}{4}$	.....	89 exp.	i.	s.	.....
205	liq. (mixt.?) ..	1.081 $\frac{0}{4}$	.....	184-8	sl. s.	s.	.....
206	1.4194 ¹⁵	1.002 $\frac{16}{4}$	15	148 (144)	s.	v. s.	i. eth., lgr.
207	col. liq., 1.4295	1.082 $\frac{20}{20}$	-17	146, d.	∞	∞	∞ eth.
207M							
208	cr.	1.1336	34	296; 166-7 ¹²	.....	s.	s. eth.
209							
209M	need. ....	.....	53 (51.5)	300; 172 ¹¹	.....	s.	.....
210	yel. need. ....	.....	127	.....	i.	s.	s. eth.
211	yel. need. ....	.....	99-101 (103)	325 d.	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
212	2-Acetonaphthone,		$\text{CH}_3\text{COC}_{10}\text{H}_7$	231.20
213	1-hydroxy-4-nitro-Acetone.	2-propanone*; dimethyl ketone	$(\text{NO}_2)\text{OH}$ CH_3COCH_3	58.08
215	For derivatives see also 2-Propanone, azine.	panone dimethylketazine; diisopropylidenehydrazine	$(\text{CH}_3)_2\text{C}:\text{NN}:\text{C}-(\text{CH}_3)_2$	112.17
216	—, cyanohydrin.	See Isobutyronitrile, α -hydroxy-	y-	
217	—, dichloride.	See Propane, 2,2-dichloro-*		
218	—, oxime.	See Acetoxime.		
219	—, phenylhydrazine.	2-propanone phenylhydrazine*	$(\text{CH}_3)_2\text{C}:\text{NNHC}_6\text{H}_5$	148.20
220	—, semicarbazone.	2-propanone semicarbazone*	$(\text{CH}_3)_2\text{C}:\text{NNHC}-\text{ONH}_2$	115.14
221	—, sodium bisulfite compound.		$(\text{CH}_3)_2\text{C}(\text{OH})-\text{SO}_3\text{Na}$	162.14
222	—, acetonyl- .	See 2,5-Hexanedione*.		
223	—, acetyl- .	See 2,4-Pentanedione*.		
224	—, allyl- .	See 5-Hexen-2-one*.		
225	—, anisal- .	See 3-Buten-2-one, 4-p-methoxyphenyl-.	yphenyl-	
226	—, benzal- .	See Acetone, benzylidene-.		
227	—, benzoyl- .	1-phenyl-1,3-butanedione*; α -acetylacetophenone; methyl phenaryl ketone; acetylbenzoylmethane	$\text{C}_6\text{H}_5\text{COCH}_2\text{COCH}_3$	162.18
228	—, benzyl- .	See 2-Butanone, 4-phenyl-*. benzalacetone; methyl styryl ketone; 4-phenyl-3-buten-2-one*; cinnamyl methyl ketone; acetocinnamone	$\text{C}_6\text{H}_5\text{CH}:\text{CHCOCH}_3$	146.18
229	—, benzylidene- .	See Styryl ketone.		
230	—, dibenzal- .	See 4-Heptanone, 2,6-dimethyl-*. See Phorone.	-*.	
231	—, sym-diisopropyl- .	See 3-Pentanone*.		
232	—, diisopropylidene- .	See 2-Propanone, 1,3-diphenyl-*. See 3-Penten-2-one*.	-*.	
233	—, sym-dimethyl- .	See 2-Pentanone, 3-methyl-*. See Acetone, furfurylidene-.	yl-*	
234	—, diphenyl- .	furfural acetone; 4-(2-furyl)-3-buten-2-one*		
235	—, ethylidene- .	See Acetol.	$\text{C}_4\text{H}_2\text{OCH}:\text{CHCOCH}_3$	136.14
236	—, unsym-ethylmet	See Pyruvaldehyde, aldoxime.		
237	—, 2-fural- .	See Mesityl oxide.		
238	—, furfurylidene- .	See 3-Buten-2-one, 4-p-methoxyphenyl-.	oxyphenyl-	
239	—, hydroxy- .	See Valerophenone, γ -oxo-.		
240	—, isonitroso- .	See Propane, 2,2-dichloro-*. See Chloretone.		
241	—, isopropylidene- .	γ -ketopimelic acid; 4-oxoheptanedioic acid*		
242	—, p-methoxybenzyl- .	β -ketoglutaric acid; 3-oxopentanedioic acid*		
243	—, phenacyl- .	e. See Propane, 2,2-bis(ethylsulfonyl)-*.		
244	—, chloride.	See Propane, 2, 2-difluoro-*. See Isobutyric acid, α -hydroxy-		
245	Acetone-chloroform.	ethanenitrile*; methyl cyanide	CH_3CN	41.05
246	Acetonediacetic acid.			
247	Acetonedicarboxylic acid			
248	Acetone diethylsulfone.			
248M	—, fluoride.			
249	Acetonic acid.			
250	Acetonitrile.			
251	—, allyl- .	See 4-Pentenitrile*.		
252	—, benzoyl- .	β -ketohydrocinnamonitrile; 3-oxo-3-phenylpropanenitrile; α -cyanoacetophenone	$\text{C}_6\text{H}_5\text{COCH}_2\text{CN}$	145.15
253	—, diethyl- .	See Butyronitrile, α -ethyl-.		
254	—, ethylmethyl- .	See Butyronitrile, α -methyl-.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
212	yel. need. ....	.....	.....	.....	i.	sl. s.	s. eth.
213	col. inflam. liq., 1.35886 ^{19.4}	0.792 ²⁰ / ₄ ; 0.8186 ⁰ / ₄	-95	56.5	∞	∞	∞ eth.; s. chl.
215	col. liq., 1.45102 ²⁵	0.8381 ²⁵ / ₄	.....	131	s.	∞	∞ eth.
216							
217							
218							
219	rhomb. cr. or oil	.....	42 (27)	163 ³⁶	s.	s.	s. eth., dil. min. a.
220	col. need. f. w.	.....	187-8	.....	sl. s.	s.	s. eth.
221	wh. leaf. ....	.....	d.	.....	v. s.	sl. s.	i. eth.
222							
223							
224							
225							
226							
227	col. pr., 1.56775 ^{77.8}	1.090 ⁶⁰ / ₄	61 (57-8)	261-2 (132 ¹⁴)	sl. s. c.	s.	s. eth., conc. alk.
228							
229	col. lustr. pl. .	1.0377 ¹⁵ / ₁₅	42	260-2	i.	v. s.	s. eth., chl., bz.
230							
231							
232							
233							
234							
235							
236							
237							
238	wh. nd.	.....	39-40	229 d.	i.	s.	s. eth.
239							
240							
241							
242							
243							
244							
245							
246	rhomb. f. w. .	.....	143	.....	s. h.	s.	sl. s. eth.; i. bz.
247	need. f. eth. .	.....	135 d.	d.	v. s.	s.	v. sl. s. eth.; i. bz., chl., lgr.
248							
248M							
249							
250	col. liq., 1.34596 ^{16.5}	0.7828 ²⁰ / ₄	-41 to -44	82	∞	∞	∞ eth.
251							
252	leaf. ....	.....	80-1	.....	sl. s. c.	s.	s. eth., chl., bz., alk., KCN
253							
254							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
255	Acetonitrile, 2-furyl-	See <i>2-Furanacetonitrile</i> .		
256	—, iminodi-	α, α' -diacyanodimethylamine; iminoacetonitrile (incorrect)	$\text{NH}(\text{CH}_2\text{CN})_2$	95.10
257	—, isobutyl-	See <i>Isoacetonitrile</i> .		
258	—, phenyl-	See α - <i>Tolunitrile</i> .		
259	—, trimethyl-	See <i>Propionitrile</i> , α, α -dimethyl-		
260	—, trinitro-	trinitroethanenitrile*.....	$(\text{NO}_2)_3\text{CCN}$	176.05
261	—, vinyl-	See <i>Allyl cyanide</i> .		
262	Acetonitrolic acid	ethylnitrolic acid.....	$\text{CH}_3(\text{NO}_2)\text{C}:\text{NOH}$	104.07
263	Acetonylamine	See <i>2-Propanone, 1-amino-</i>		
264	o-Acetophenetide	<i>o</i> -ethoxyacetanilide; <i>N</i> -acetyl- <i>o</i> -phenetidine	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-OC}_2\text{H}_5$	179.21
265	p-Acetophenetide	<i>p</i> -ethoxyacetanilide; <i>p</i> -acetophenetidine; phenacetin	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-OC}_2\text{H}_5$	179.21
266	—, α-amino-	See <i>Phenocoll</i> .		
267	Acetophenone	methyl phenyl ketone; hyponone; acetylbenzene	$\text{CH}_3\text{COC}_6\text{H}_5$	120.14
268	—, oxime		$\text{C}_6\text{H}_5\text{C}(:\text{NOH})\text{-CH}_3$	135.16
269	—, α-acetonyl-	See <i>Valerophenone, γ-oxo-</i>		
270	—, α-acetyl-	See <i>Acetone, benzoyl-</i>		
271	—, o-amino-	<i>o</i> -aminophenyl methyl ketone; <i>o</i> -acetylaniline	$\text{CH}_3\text{COC}_6\text{H}_4\text{NH}_2$..	135.16
272	—, m-amino-	<i>m</i> -aminophenyl methyl ketone	$\text{CH}_3\text{COC}_6\text{H}_4\text{NH}_2$..	135.16
273	—, p-amino-	<i>p</i> -aminophenyl methyl ketone	$\text{CH}_3\text{COC}_6\text{H}_4\text{NH}_2$..	135.16
274	—, benzal-	See <i>Chalcone</i> .		
274M	—, o-bromo-		$\text{CH}_3\text{COC}_6\text{H}_4\text{Br}$	199.05
275	—, p-bromo-		$\text{BrC}_6\text{H}_4\text{COCH}_3$	199.05
276	—, α-bromo-	phenacyl bromide.....	$\text{BrCH}_2\text{COC}_6\text{H}_5$	199.05
277	—, α-bromo-<i>p</i>-methyl-	<i>p</i> -methylphenacyl bromide...	$\text{CH}_3\text{C}_6\text{H}_4\text{COCH}_2\text{-Br}$	213.08
278	—, α-bromo-<i>p</i>-phenyl-	<i>p</i> -phenylphenacyl bromide...	$\text{BrCH}_2\text{COC}_6\text{H}_4\text{-C}_6\text{H}_5$	275.15
279	—, 4-tert-butyl-2-methyl-3,6-dinitro-	musk ketone; musk C.....	$\text{CH}_3\text{COC}_6\text{H}(\text{C}_4\text{H}_9)\text{-(CH}_3)(\text{NO}_2)_2$	280.28
279M	—, o-chloro-		$\text{CH}_3\text{COC}_6\text{H}_4\text{Cl}$	154.59
280	—, p-chloro-	methyl <i>p</i> -chlorophenyl ketone	$\text{CH}_3\text{COC}_6\text{H}_4\text{Cl}$	154.59
281	—, α-chloro-	phenacyl chloride.....	$\text{ClCH}_2\text{COC}_6\text{H}_5$	154.59
282	—, α-cyano-	See <i>Acetonitrile, benzoyl-</i>		
283	—, p, α-dibromo- ...	<i>p</i> -bromophenacyl bromide...	$\text{BrCH}_2\text{COC}_6\text{H}_4\text{Br}$..	277.96
284	—, 2,4-dihydroxy-	See <i>Resacetophenone</i> .		
285	—, 2,5-dihydroxy- ...	2-acetylhydroquinone; quinacetophenone	$\text{CH}_3\text{COC}_6\text{H}_3(\text{OH})_2$	152.14
286	—, α-ethoxy- α-phenyl-	See <i>Benzoin, ethyl ether</i> .		
287	—, α-hydroxy-	benzoylcarbinol; phenacyl alcohol; acetophenone alcohol	$\text{C}_6\text{H}_5\text{COCH}_2\text{OH}$...	136.14
288	—, 2-hydroxy-4-methoxy-	See <i>Peonol</i> .		
289	—, α-hydroxy-<i>p</i>-phenyl-	See also " <i>p</i> -phenylphenacyl ester" under <i>Acetic Acid</i> ,		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
255	col. leaf. f. eth.	.....	75	.....	s.	s.	sl. s. eth.
256							
257							
258	waxy .....	.....	41.5	exp. 220	d.	d.	s. eth.
259							
260							
261	yel. rhomb. f. w. or eth.	.....	88	d.	s.	s.	s. eth.
262							
263							
264	leaf. ....	.....	79	> 250	i.	s.	s. eth.
265	wh. powd. or monoc. pr. or leaf.; 1.54, 1.571, 1.59	.....	137-138	d.	.0055 ¹⁴ ; .11 ²⁵	7.45 ²⁵	1.56 ²⁵ eth.; 7.1 chl.
266	col. liq. or pl., 1.53418 ¹⁹	1.026 ²⁰ / ₄	19.7	202.3	i.	s.	s. eth., bz. chl., conc. H ₂ SO ₄
267							
268	col. need. f. w.	.....	58	.....	sl. s.	s.	s. eth.
269	yel. oil .....	.....	.....	252 sl. d.	i.	.....	s. eth.
270							
271							
272	yel. leaf. f. dil. al.	.....	99.5 (96.5)	290	.....	.....	.....
273	yel. need. f. w.	.....	103	295	v. sl. s.	s.	s. eth., HCl, bz.; sl. s. lgr.
274	col. liq. ....	.....	.....	117-118 ¹³	.....	.....	s. eth.
274M							
275	wh. leaf. f. al.	1.647	50	255.5; 129-30 ¹⁵	v. sl. s.	s.	s. eth., ac. a. bz., lgr.
276	trim. (rhomb.) pr. f. al.	1.647 ²⁰ / ₄	50	140 ¹²	i.	v. s.	v. s. eth.
277	col. need. or leaf. f. al.	.....	49-51	.....	i., d.	d.	s. eth.
278	lng. col. need.	.....	125.5	.....	.....	1.3 ²⁵ ; 6.7 ⁷⁸	.....
279	.....	.....	133	.....	i.	s.	s. eth.
279M	col. oil, 1.685 ²⁵	1.1884	.....	227-8 ⁷⁸ ; 113 ¹⁸	v. sl. s.	.....	s. eth.
280	cr.	1.188 ²⁰ / ₄	20 (14-15)	232	i.	∞	∞ eth.
281	col. rhomb. ...	1.324 ¹⁵ / ₄	59	247	i.	s.	s. eth.; 31.4 CS ₂
282	fine need. ....	.....	109.7	.....	i.	sl. s.	s. eth.
283							
284	yel. need. ....	.....	202	.....	i.	s.	sl. s. eth.
285							
286	hex. pl.	1.013	95 (83-84)	119 ¹¹	v. s. h.	s.	s. eth.
287							
288	chloro-; Butyric acid; Caproic acid; etc.	.....	.....	.....	.....	.....	.....
289							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
290	Acetophenone, α-hydroxy-<i>p</i>-phenyl-, acetate	<i>p</i> -phenylphenacyl acetate...	$\text{CH}_3\text{COOCH}_2\text{-COC}_6\text{H}_4\text{C}_6\text{H}_5$	254.27
291	—, —, benzoate.....	<i>p</i> -phenylphenacyl benzoate...	$\text{C}_6\text{H}_5\text{COOCH}_2\text{-COC}_6\text{H}_4\text{C}_6\text{H}_5$	316.34
292	—, α -hydroxy- α -phenyl-	See <i>Benzoin</i> .		
293	—, 5-isopropyl-2-methyl-	carvacryl methyl ketone; 2-acetyl- <i>p</i> -cymene	$\text{CH}_3\text{COC}_6\text{H}_3\text{(CH}_3)_2$	176.25
294	—, <i>p</i> -methoxy-.....	<i>p</i> -anisyl methyl ketone; <i>p</i> -acetylanisole	$\text{CH}_3\text{OC}_6\text{H}_4\text{COCH}_3$	150.17
295	—, <i>p</i> -methyl-.....	methyl <i>p</i> -tolyl ketone.....	$\text{CH}_3\text{COC}_6\text{H}_4\text{CH}_3$	134.17
296	—, <i>m</i> -nitro-.....		$\text{CH}_3\text{COC}_6\text{H}_4\text{NO}_2$	165.14
297	—, α -phenyl-	See <i>Desoxybenzoin</i> .		
298	—, 2,3,4-trihydroxy-	See <i>Gallacetophenone</i> .		
299	—, α -triphenyl-	See β -Benzopinacolin.		
300	o-Acetophenonecarboxylic acid.	See <i>Benzoic acid</i> , <i>o</i> -acetyl-.		
301	Acetophenone pinacol.	See 2,3-Butanediol, 2,3-diphenyl-.		
302	Acetophenone pinacolin.	See 2-Butanone, 3,3-diphenyl-.		
303	Acetopropionic acid.	See <i>Levulinic acid</i> .		
304	α-Acetothienone.	See <i>Ketone</i> , methyl 2-thienyl.		
305	Acetothioamide.	See <i>Acetamide</i> , thio-.		
306	2-Acetothiophenide.	See <i>Acetamide</i> , <i>N</i> -2-thienyl-.		
307	o-Acetotoluide.	<i>o</i> -methylacetanilide; <i>N</i> -acetyl- <i>o</i> -toluidine; acet- <i>o</i> -toluidide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-CH}_3$	149.19
308	—, <i>N</i> -methyl-.....	<i>N</i> -acetyl- <i>N</i> -methyl- <i>o</i> -toluidine	$(\text{CH}_3)_2\text{CH}_2\text{CO-NC}_6\text{H}_4\text{CH}_3$	163.21
309	<i>m</i>-Acetotoluide.	<i>N</i> -acetyl- <i>m</i> -toluidine; acet- <i>m</i> -toluidide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-CH}_3$	149.19
310	—, <i>N</i> -methyl-.....		$(\text{CH}_3)_2\text{CH}_2\text{CO-NC}_6\text{H}_4\text{CH}_3$	163.21
311	<i>p</i>-Acetotoluide.	<i>N</i> -acetyl- <i>p</i> -toluidine; acet- <i>p</i> -toluidide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-CH}_3$	149.19
312	—, <i>N</i> -methyl-.....		$(\text{CH}_3)_2\text{CH}_2\text{CO-NC}_6\text{H}_4\text{CH}_3$	163.21
313	Acetoxime	2-propanone oxime*; acetone oxime	$(\text{CH}_3)_2\text{C:NOH}$	73.09
314	2,4-Acetoxyliide.	aceto- <i>as</i> - <i>m</i> -xyliide; 2,4-dimethylacetanilide	$\text{CH}_3\text{CONHC}_6\text{H}_3\text{(CH}_3)_2$	163.21
315	Acetphenetidine.	See <i>Acetophenetide</i> .		
316	Acettoluide.	See <i>Acetotoluide</i> .		
317	Aceturic acid.	<i>N</i> -acetyl-glycine; acetamidacetic acid	$\text{CH}_3\text{CONHCH}_2\text{-COOH}$	117.10
318	—, <i>N</i> -phenyl-.....	<i>N</i> -acetyl- <i>N</i> -phenylglycine...	$\text{C}_6\text{H}_5\text{N(CH}_3\text{CO-CH}_2\text{COOH)}$	193.20
	Acetyl-.	For acetyl derivatives, see the parent compounds	(e.g., for acetylbenzoic acid)	
319	Acetyl bromide.	ethanoyl bromide*.....	CH_3COBr	122.96
320	—, bromo-.....	bromoethanoyl bromide*....	CH_2BrCOBr	201.87
321	Acetyl chloride	ethanoyl chloride*.....	CH_3COCl	78.50

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
290	.....	.....	111	.....	.....	.....	.....
291	.....	.....	167	.....	.....	.....	.....
292	.....	.....	.....	.....	.....	.....	.....
293	liq.	0.956 $\frac{20}{4}$	.....	240; 130-134 ¹³	.....	.....	.....
294	pl. f. eth., 1.54684 ^{41.3}	1.0493 $\frac{8.0}{4}$; 1.0818 $\frac{4.1}{4}$	38-9	258; 138-9 ¹⁵	sl. s.	s.	s. eth.
295	col. need. or pa. yel. liq., 1.53533 ^{17.4}	0.9891 $\frac{22}{4}$; 1.013 $\frac{13}{4}$	28	222	i.	v. s.	v. s. eth.
296	need.	.....	81 (74-76)	202	i.	s.	v. s. eth.
297	.....	.....	.....	.....	.....	.....	.....
298	.....	.....	.....	.....	.....	.....	.....
299	.....	.....	.....	.....	.....	.....	.....
300	.....	.....	.....	.....	.....	.....	.....
301	.....	.....	.....	.....	.....	.....	.....
302	.....	.....	.....	.....	.....	.....	.....
303	.....	.....	.....	.....	.....	.....	.....
304	.....	.....	.....	.....	.....	.....	.....
305	.....	.....	.....	.....	.....	.....	.....
306	.....	.....	.....	.....	.....	.....	.....
307	col. monocl., 1.556, 1.587, 1.700	1.168 $\frac{15}{4}$	110.4	296	0.8;	S.08	s. eth., bz., glyc., v. s. chl., glac. ac. a.
308	cr. ....	.....	56	230	.....	s.	.....
309	monocl. f. w.	1.141 $\frac{15}{4}$	65.5	303	0.44 ¹³	s.	s. eth.
310	cr. ....	.....	66 (60-61)	.....	.....	s.	.....
311	col. monocl. or tricl., 1.495, 1.625, 1.807	1.212 $\frac{15}{4}$	146-7	307	0.09	8.05c., v.s.h.	s. h. eth., glac. ac. a.; sl. s. bz., glyc.
312	leaf. ....	.....	80	283	.....	s.	s. h. lgr.
313	col. pr., 1.4156	0.97 $\frac{20}{20}$	61	135.3	v. s.	v. s.	v. s. eth., s. lgr.
314	need. ....	.....	129-30	.....	v. sl. s.	v. s.	.....
315	.....	.....	.....	.....	.....	.....	.....
316	.....	.....	.....	.....	.....	.....	.....
317	need. f. w. ....	.....	206	.....	2.17 ¹⁵	s.	i. eth.; sl. s. ac. a., acet., chl.; i. bz.
318	.....	.....	172-3.5	.....	.....	.....	.....
	see Benzoic acid	acetyl-.)	See also "acetate" under the names of alcohols and phenols				
319	col. fum. liq.	1.52 $\frac{9.5}{4}$	-96.5	76.7	d.	d.	v. sl. s. eth.
320	liq.	2.317 $\frac{21.5}{21.5}$	.....	147-50	d.	d.	.....
321	col. inflam. liq., 1.38976	1.1051 $\frac{20}{4}$	-112	51-2	d.	d.	∞ eth., bz., chl., acet., glac. ac. a.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
322	Acetyl chloride,	chloroethanoyl chloride*.....	CH_3ClCOCl	112.95
323	—, dichloro-	dichloroethanoyl chloride*...	CHCl_2COCl	147.40
324	—, phenyl-	See <i>α-Toluyyl chloride</i> .		
325	—, trichloro-		CCl_3COCl	181.85
326	Acetyl cyanide.	See <i>Pyruvonnitrile</i> .	$(\text{CH}_3\text{CO})_2\text{S}_2$	150.21
327	Acetyl disulfide	diacetyl disulfide.....		
328	Acetylene	ethyne*; ethine.....	$\text{CH}:\text{CH}$	26.04
329	—, dibromide.	See <i>Ethylene, 1,2-dibromo-</i> .		
330	—, tetrabromide.	See <i>Ethane, 1,1,2,2-tetrabromo-</i> *.		
331	—, tetrachloride.	See <i>Ethane, 1,1,2,2-tetrachloro-</i> *.		
332	—, amyl-	See <i>1-Heptyne</i> *.		
332M	—, amylmethyl-	See <i>2-Octyne</i> *.		
333	—, bromo-	bromoethyne*; ethynyl bromide	$\text{CH}:\text{CBr}$	104.94
334	—, butyl-	See <i>1-Hexyne</i> *.		
334M	—, butylethyl-	See <i>3-Octyne</i> *.		
335	—, butylmethyl-	See <i>2-Heptyne</i> *.		
336	—, chloro-	chloroethyne*.....	$\text{CH}:\text{CCl}$	60.49
336D	—, decylmethyl-	See <i>2-Dodecyne</i> *.		
336F	—, di-n-amyl-	See <i>6-Dodecyne</i> *.		
336H	—, dibromo-	dibromoethyne.....	$\text{BrC}:\text{CBr}$	183.85
336M	—, dibutyl-	See <i>5-Decyne</i> .		
336R	—, diiodo-	diiodoethyne.....	$\text{IC}:\text{CI}$	277.86
336T	—, diethyl-	See <i>3-Hexyne</i> *.		
337	—, dimethyl-	See <i>2-Butyne</i> *.		
338	—, diphenyl-	diphenylethyne; tolan.....	$\text{C}_6\text{H}_5\text{C}:\text{CC}_6\text{H}_5$	178.22
338M	—, dipropyl-	See <i>4-Octyne</i> *.		
339	—, divinyl-	See <i>1,5-Hexadien-3-yne</i> *.		
340	—, ethyl-	See <i>1-Butyne</i> *.		
341	—, ethylmethyl-	See <i>2-Pentyne</i> *.		
342	—, ethylphenyl-	See <i>Benzene, 1-butylyl-</i> .		
342M	—, ethylpropyl-	See <i>3-Heptyne</i> *.		
343	—, n-heptyl-	See <i>1-Nonyne</i> *.		
343M	—, hexadecyl-	See <i>1-Octadecyne</i> *.		
344	—, n-hexyl-	See <i>1-Octyne</i> *.		
345	—, isopropyl-	See <i>1-Butyne, 3-methyl-</i> *.		
346	—, methyl-	See <i>Propyne</i> *.		
347	—, methylphenyl-	See <i>Propyne, 1-phenyl-</i> .		
348	—, methylpropyl-	See <i>2-Hexyne</i> *.		
349	—, n-octyl-	See <i>1-Decyne</i> *.		
350	—, phenyl-	See <i>Benzene, ethynyl-</i> .		
351	—, n-propyl-	See <i>1-Pentyne</i> *.		
352	—, vinyl-	See <i>3-Buten-1-yne</i> *.		
353	Acetylenecarboxylic acid	id. ethyl-. See <i>2-Pentynoic acid</i> *,	$\text{COOH}:\text{C}:\text{COOH}$	114.06
354	Acetylenedicarboxylic acid	butynedioic acid*.....		
355	Acetylenediurein.	See <i>Glycoluril</i> .	CH_3COF	62.04
356	Acetyl fluoride	ethanoyl fluoride*.....		
357	Acetyl iodide	ethanoyl iodide*.....	CH_3COI	169.96

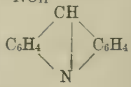
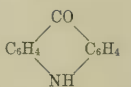
*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
322	col. liq.....	1.495 ⁰ / ₄	.....	108-10 (105-106)	d.	d.	∞ eth.
323	col. liq.....	.....	.....	108	d.	d.	∞ eth.
324							
325	col. liq.....	1.629	.....	118	d.	d.	∞ eth.
326							
327	col. cr. ....	.....	20	d.	i.	s.	v. s. eth.; s. CS ₂
328	col. inflam. gas	liq. 0.6208 ⁻⁸⁴ / ₄ ; solid 0.73 ⁻⁸⁵ ; gas 1.173 ⁰ g/l	-81.8	-83.6 subl.	100 ¹⁸ cm ³	600 ¹⁸ cm ³	2500 ¹⁸ cm ³ acet.; s. bz., chl.
329							
330							
331							
332							
332M							
333	pois. gas.....	4.684 ⁰ / ₇₆₀ g/l	.....	-2	sl. s.	.....	s. eth., dil. HNO ₃
334							
334M							
335							
336	unst. spon. inflam. gas	2	.....	-32 to -30 exp.	s.	s.	.....
336D							
336F							
336H	liq. (poison) ..	ca. 2	explodes w. trace of O ₂	ca. 76	i.	s.	s. eth.
336M							
336R	col. rhomb. ...	.....	78-82	80-100 d.	.....	.....	sl. s. sol. c. lgr.
336T							
337							
338	col. monoc. leaf. f. al.	.....	62.5 (60)	300	i.	v. s. h.	v. s. eth.
338M							
339							
340							
341							
342							
342M							
343							
343M							
344							
345							
346							
347							
348							
349							
350							
351							
352							
353							
354	lng. pr.....	.....	179	.....	v. s.	v. s.	v. s. eth.
355							
356	col. liq. or gas	0.993 ²⁰ / ₄	<-60	20.5	5, d.	d.	∞ eth.; s. bz., ac. a., chl.; v. sl. s. CS ₂
357	col.-br. fum. liq.	2.067	.....	104-6	d.	d.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
358	Acetyl peroxide	ethanoyl peroxide*; diacetyl peroxide	$(\text{CH}_3\text{CO})_2\text{O}_2$	118.09
358M	Acetylsalicylic acid .	See <i>Aspirin</i> .		
359	Achroödextrin		$\text{C}_{36}\text{H}_{62}\text{O}_{31}?$	990.86
360	Aconic acid	4,5-dihydro-5-keto-3-furan-carboxylic acid; formylsuccinic acid lactone	$\text{OCH:C}(\text{COOH})-\text{CH}_2\text{CO}$	128.08
361	Aconine		$\text{C}_{26}\text{H}_{41}\text{NO}_{11}$	523.44
362	—, acetylbenzoyl -.	See <i>Aconitine</i> .		
363	—, benzoyl -.	See <i>Benzaconine</i> .		
364	Aconitic acid	1,2,3-propenetricarboxylic acid*	$\text{C}_6\text{H}_5(\text{COOH})_3$	174.11
365	Aconitine	acetylbenzoylaconine	$\text{C}_{34}\text{H}_{49}\text{NO}_{11}$	647.74
366	—, hydrobromide		$\text{C}_{34}\text{H}_{49}\text{NO}_{11} \cdot \text{HBr} \cdot \frac{1}{2}\text{H}_2\text{O}$	737.68
367	—, hydrochloride (<i>l</i>)		$\text{C}_{34}\text{H}_{49}\text{O}_{11}\text{N} \cdot \text{HCl} \cdot 3\text{H}_2\text{O}$	738.26
368	—, nitrate (<i>l</i>)		$\text{C}_{34}\text{H}_{49}\text{NO}_{11} \cdot \text{HNO}_3 \cdot 5\text{H}_2\text{O}$	800.84
369	—, sulfate (<i>l</i>)		$(\text{C}_{34}\text{H}_{49}\text{NO}_{11})_2 \cdot \text{H}_2\text{SO}_4$	1393.57
370	—, diacetyl -.	aconitine <i>O</i> -diacetate	$\text{C}_{34}\text{H}_{47}(\text{C}_2\text{H}_3\text{O})_2 \cdot \text{NO}_{11}$	731.82
371	Acridine			179.21
372	—, 2-amino-5-<i>p</i>-aminophenyl -.	See <i>Chrysanthine</i> .		
373	—, 5, 10-dihydro -.	<i>ms</i> -dihydroacridine	$\text{C}_6\text{H}_4\text{CH}_2\text{C}_6\text{H}_4\text{NH}$	181.23
374	—, dihydroketo -.	See <i>ms</i> -Acridone.		
375	—, 3-methyl -.		$\text{C}_{13}\text{H}_8\text{N} \cdot \text{CH}_3$	193.24
376	—, 5-phenyl -.	<i>ms</i> -phenylacridine	$\text{C}_6\text{H}_5\text{C}_{13}\text{H}_8\text{N}$	255.30
377	<i>ms</i>-Acridone	dihydroketoacridine		195.21
378	Acrolein	acrylaldehyde; propenal*; acrylic aldehyde	$\text{CH}_2\text{:CHCHO}$	56.06
379	—, α, β-dimethyl -.	See <i>Tiglaldehyde</i> .		
380	—, α-ethyl- β-propyl -.	See <i>2-Hexenal</i> , <i>2-ethyl</i> -.		
381	—, β-2-furyl -.	3-(2-furyl) propenal*; furacrolein	$\text{C}_6\text{H}_5\text{OCH:CHCHO}$	122.12
381M	—, α-methyl -.	2-methylpropenal*; methacrolein	$\text{CH}_2\text{:C}(\text{CH}_3)\text{CHO}$	70.09
382	—, β-methyl -.	See <i>Crotonaldehyde</i> .		
383	—, β-phenyl -.	See <i>Cinnamaldehyde</i> .		
384	Acrylaldehyde .	See <i>Acrolein</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
358	col. leaf. ....	.....	30	63 ²¹	sl. s.	.....	v. s. eth.; d. NaOH
358M							
359	amor. wh. ....	.....			s.	i.	col. with I ₂
360	rhomb. f. w., α 1.385, γ 1.530	.....	164	d.	18 ¹⁵	.....	s. me. al.
361	d. (salts l.) amor. hyg.	.....	132	.....	v. s.	v. s.	v. sl. s. eth; s. chl.
362							
363							
364	col. leaf. or need. f. w.	.....	194-5 (191) d.	.....	18 ¹³	50 ¹²	sl. s. eth.
365	rhomb. pr. f. chl., [α] + 11 ²³ _D 3% al.	.....	188-97.8 (204)	.....	.031 ²⁵	4.54 ²⁵	2.27 ²⁵ eth.; 14.3 ²⁵ bz.; s. chl.
366	wh. to ylsb. hex. tab. f. w., [α] - 30.47 ^o _D in w.	.....	163; anh. 176-80	.....	s.	s.	s. eth.
367	wh. cr. ....	.....	149	.....	s.	s.	s. eth.
368					s.	s.	.....
369	ylsb. amor. powd.	.....			s.	s.	.....
370	cr. ....	.....	158	.....	s.	.....	.....
371	col. leaf. or need., rhomb. f. al.	1.1005 ¹⁹⁻⁷ ₄	108; subl. 100	346	v. sl. s.	v. s.	v. s. eth.; m. bz., CS ₂
372							
373	col. cr. f. al.	.....	169	subl.; d. 300	i.	s. h.	s. eth.
374							
375	yel. need. f. dil. al.	.....	134	.....	.....	v. s.	v. s. eth., bz.
376	yel. monocl. need. f. al.	.....	181	404	i.	sl. s.	s. eth.; v. s. bz.
377	yel. need. ....	.....	354	.....	i.	sl. s.	sl. s. eth.; s. h. ac. a., KOH; i. bz., chl.
378	col. inflam. liq., unst. 1.39975	0.841 ²⁰ ₄	-87.7	52.5	40	s.	s. eth.
379							
380							
381	yel. cr. ....	.....	51	260	i.	∞	s. eth.
381M	col. liq., 1.4191 ²⁰	0.830 ²⁰ ₄	.....	73.5	s.	∞	∞ eth.
382							
383							
384							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
384M	Acrylamide	propenamide*; acrylic amide.	$\text{CH}_2\text{:CHCONH}_2$..	71.08
385	Acrylic acid	propenoic acid*; ethylene-carboxylic acid	$\text{CH}_2\text{:CHCOOH}$...	72.06
385F	—, benzyl ester.....	benzyl acrylate.....	$\text{CH}_2\text{:CHCOOCH}_2\text{-C}_6\text{H}_5$	162.18
385K	—, butyl ester.....	<i>n</i> -butyl acrylate.....	$\text{CH}_2\text{:CHCOOC}_4\text{H}_9$	128.17
385P	—, cyclohexyl ester.....	cyclohexyl acrylate.....	$\text{CH}_2\text{:CHCOOC}_6\text{H}_{11}$	154.20
386	—, ethyl ester.....	ethyl acrylate; ethyl propenoate*	$\text{CH}_2\text{:CHCOOC}_2\text{H}_5$	100.11
387	—, methyl ester.....	methyl acrylate.....	$\text{CH}_2\text{:CHCOOCH}_3$	86.09
388	—, β -benzoyl-.....	4-oxo-4-phenyl-2-butenic acid	$\text{C}_6\text{H}_5\text{COCH:CHCOOH}$	176.16
389	—, α -chloro-.....	2-chloropropenoic acid*.....	$\text{CH}_2\text{:CClCOOH}$...	106.51
390	—, β -chloro-.....	3-chloropropenoic acid*.....	CHCl:CHCOOH ...	106.51
391	—, α , β -dimethyl-.	See <i>Tiglic acid</i> .		
392	—, α , β -diphenyl-.	See <i>Cinnamic acid</i> , α -phenyl-.		
393	—, β -2-furyl-.	See 2-Furanacrylic acid.		
394	—, β -hydroxy-.....	3-hydroxypropenoic acid*.....	HOCH:CHCOOH	88.06
395	—, β -isopropyl-.	See 2-Pentenoic acid, 4-methyl-.		
396	—, α -methyl-.	See <i>Methacrylic acid</i> .		
397	—, <i>cis</i> (?) - β -methyl-.	See <i>Isocrotonic acid</i> .		
398	—, <i>trans</i> (?) - β -methyl-.	See <i>Crotonic acid</i> (α or solid).		
399	—, β -(3,4-methylene	dioxystyryl)-. See <i>Piperic acid</i> .		
400	—, α -phenyl-.	See <i>Atropic acid</i> .		
401	—, β -phenyl-.	See <i>Cinnamic acid</i> .		
402	—, β -propyl-.	See 2-Hexenoic acid*.		
403	—, β -vinyl-.	See 2,4-Pentadienoic acid*.		
404	Acrylic aldehyde .	See <i>Acrolein</i> .		
404M	Acrylic amide .	See <i>Acrylamide</i> .		
405	2-Acrylonaphthone , 1-hydroxy- β -phenyl-.	1-hydroxy-2-naphthyl styryl ketone; 2-cinnamyl-1-naphthol	$\text{C}_6\text{H}_5\text{CH:CHCOOC}_{10}\text{H}_6\text{OH}$	274.30
406	Acrylonitrile	propenenitrile*; vinylcyanide	$\text{CH}_2\text{:CHCN}$	53.06
406H	Acrylyl chloride	propenoyl chloride*.....	$\text{CH}_2\text{:CHCOCl}$...	90.51
406R	Adalin	uradal; (α -bromo- α -ethylbutyryl) urea	$(\text{C}_2\text{H}_5)_2\text{CBrCO-NHCONH}_2$	237.11
407	Adenine	6-aminopurine.....	$\text{C}_5\text{H}_4\text{N}_4\cdot\text{NH}_2$	135.13
407M	Adermin .	See <i>Vitamin B₆</i> .		
408	Adipaldehyde	hexanedial*; adipic dialdehyde	$\text{CHO}(\text{CH}_2)_4\text{CHO}$..	114.14
408M	Adipamic acid	adipic acid monoamide.....	$\text{NH}_2\text{OC}(\text{CH}_2)_4\text{-COOH}$	145.16
409	Adipamide	hexanediamide*; adipic diamide	$(\text{CH}_2\text{CH}_2\text{CONH}_2)_2$	144.17
410	Adipic acid	hexanedioic acid*; 1,4-butanedicarboxylic acid	$\text{COOH}(\text{CH}_2)_4\text{-COOH}$	146.14
411	—, dibutyl ester.....		$(\text{CH}_2\text{CH}_2\text{COOC}_4\text{H}_9)_2$	258.35
412	—, diethyl ester.....	ethyl adipate.....	$(\text{CH}_2\text{CH}_2\text{COOC}_2\text{H}_5)_2$	202.25
412M	—, monoamide.	See <i>Adipamic acid</i> .		
413	—, piperazinium salt.....		$\text{C}_4\text{H}_{10}\text{N}_2\cdot\text{C}_6\text{H}_{10}\text{O}_4$..	232.28

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
384M	col. ....	.....	84-5	.....	.....	.....	.....
385	col. liq., 1.4224	1.062 ¹⁶ ₄	12.3	141.9	∞	∞	∞ eth.
385F	col. liq., 1.513 ²⁴ ₄	1.068 ²⁰ ₄	.....	113-14 ¹⁹	i.	∞	∞ eth.
385K	col. liq., 1.4185 ²⁰ ₄	0.898 ²⁰ ₄	.....	145-6	i.	∞	∞ eth.
385P	col. liq., 1.456 ²⁴ ₄	0.975 ²⁰ ₄	.....	88 ²⁰	i.	∞	∞ eth.
386	col. liq., 1.405 ²⁰ ₄	0.924 ²⁰ ₄	.....	99.8	v. sl. s.	∞	∞ eth.
387	col. liq., 1.3984	0.953 ²⁰ ₄	.....	80.5	v. sl. s.	s.	s. eth.
388	leaf. (+1H ₂ O)	.....	+1H ₂ O, 64, anh. 99	.....	s.	s.	s. eth.
389	need. ....	.....	65	subl.; 176-81 d.	s.	s.	s. eth.
390	leaf. ....	.....	85	.....	s.	s.	s. eth.
391	.....	.....	.....	.....	.....	.....	.....
392	.....	.....	.....	.....	.....	.....	.....
393	.....	.....	.....	.....	.....	.....	.....
394	liq. ....	.....	.....	.....	v. s.	v. s.	v. s. eth.
395	.....	.....	.....	.....	.....	.....	.....
396	.....	.....	.....	.....	.....	.....	.....
397	.....	.....	.....	.....	.....	.....	.....
398	.....	.....	.....	.....	.....	.....	.....
399	.....	.....	.....	.....	.....	.....	.....
400	.....	.....	.....	.....	.....	.....	.....
401	.....	.....	.....	.....	.....	.....	.....
402	.....	.....	.....	.....	.....	.....	.....
403	.....	.....	.....	.....	.....	.....	.....
404	.....	.....	.....	.....	.....	.....	.....
404M	.....	.....	.....	.....	.....	.....	.....
405	or. leaf. ....	.....	126	.....	i.	s.	■. eth.
406	col. liq., 1.393 ²⁰ ₄	0.797 ²⁰ ₄	-82	78-9	s.	∞	∞ eth.
406H	col. liq.	1.14	.....	75-76	d.	.....	.....
406R	col. cr. ....	.....	115-116	.....	s. h.	s.	s. bz., acet.
407	+3H ₂ O, need. f. c. w.	.....	365	.....	0.09 c.	sl. ■.	i. eth., chl.; s. h. NH ₄ OH
407M	oil. ....	.....	.....	92-94 ⁹	sl. s.	v. s.	v. s. eth.; s. bz.
408	.....	.....	.....	.....	.....	.....	.....
408M	need. f. w. ....	.....	125-130	.....	.....	.....	.....
409	col. pl. ....	.....	220 (226-227)	.....	0.44 ¹²	v. s.	v. sl. s. eth.
410	col. monoc. pr.	1.366	151-3	265 ¹⁰⁰	1.5 ¹⁵	v. s.	0.6 ¹⁵ eth.; s. HNO ₃
411	.....	0.9652 ²⁰ ₄	-37.5	183 ¹⁴	i.	∞	∞ eth.
412	col. liq.	1.009 ²⁰ ₄	-21	239-41 ⁷⁶¹	0.423 ²⁰	s.	s. eth.
412M	.....	.....	.....	.....	.....	.....	.....
413	wh. cr. ....	.....	244-5 d.	.....	s.	v. sl. s. h.	i. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
414	Adipic dialdehyde.	See Adipaldehyde.		
415	Adipic diamide.	See Adipamide.		
416	Adipic ketone.	See Cyclopentanone*.		
416M	Adipoin.....	2-hydroxycyclohexanone.....	$C_6H_{10}O_2$	114.14
417	Adipyl chloride.....	hexanedioyl chloride*.....	$ClCO(CH_2)_4COCl$	183.04
417M	Adonitol, Adonite.....		$C_5H_{12}O_5$	152.15
418	Adrenaline.....	3,4-dihydroxy- α -(methyl-aminomethyl) benzyl alcohol; suprarenine; epinephrine	$(HO)_2C_6H_3-CH(CH_2NHCH_3)-OH$	183.20
419	Aesculetin, Aesculin.	See Esculetin, Esculin.		
420	Alanine, β , β' -dithiodi-	See Cystine.		
421	—, β -hydroxy-	See Serine.		
422	—, β -p-hydroxy-phenyl-	See Tyrosine.		
423	—, β -(3-indyl)-.	See Tryptophan.		
424	—, β -mercapto-	See Cysteine.		
425	—, N-methyl.....		$CH_3CH(NHCH_3)-COOH$	103.12
426	d,l-Alanine.....	d,l-2-aminopropanoic acid*; d,l- α -aminopropionic acid	$CH_3CH(NH_2)-COOH$	89.09
427	—, ethyl ester hydrochloride	ethyl α -aminopropionate hydrochloride	$CH_3CHNH_2-COOC_2H_5.HCl$	153.61
428	—, N-benzoyl.....	α -benzamidopropionic acid...	$CH_3CH(NHCOC_6H_5)COOH$	193.20
429	—, β -phenyl.....		$C_6H_5CH_2CH(NH_2)COOH$	165.19
430	d-Alanine.....	d- α -aminopropionic acid; d-2-aminopropanoic acid*	$CH_3CH(NH_2)-COOH$	89.09
431	—, β -(3,5-diiodo-4-hydroxy-phenoxy)-3,5-di-	hydroxy-phenoxy)-3,5-di-	odophenyl]-. See	d-Thyr
432	—, β -phenyl.....	d- α -amino- β -phenylpropionic acid	$C_6H_5CH_2-CH(NH_2)COOH$	165.19
433	l-Alanine.....	l- α -aminopropionic acid; l-2-aminopropanoic acid*	$CH_3CH(NH_2)-COOH$	89.09
434	—, β -phenyl.....	l- α -aminohydrocinnamic acid	$C_6H_5CH_2CH(NH_2)COOH$	165.19
435	β -Alanine.....	3-aminopropanoic acid*; β -aminopropionic acid	$NH_2CH_2CH_2COOH$	89.09
435M	—, (N- α , γ -dihydroxy-	β , β -dimethylbutyryl)-.	See Pantothenic aci	d.
436	Alantolactone.	See Helenin.		
437	Alcohol.	See Ethyl alcohol.		
438	Aldehyde.	See Acetaldehyde.		
439	Aldehyde-ammonia.	See Acetaldehyde-ammonia.		
440	Aldehydine.....	5-ethyl-2-methylpyridine.....	$(C_2H_5)(CH_3)C_5H_3N$	121.18
441	Aldol.....	3-hydroxybutanal*; β -hydroxybutyraldehyde....	$CH_3CHOHCH_2-CHO$	88.10
442	Alizarin.....	1,2-dihydroxyanthraquinone..	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.20
443	—, 3-methyl.....		$C_6H_4(CO)_2C_6H_3(OH)_2$	254.23
444	—, 3-nitro.....	alizarin orange; β -nitro-alizarin	$C_6H_4(CO)_2C_6H_3(OH)_2NO_2$	285.20
445	—, 4-nitro.....	α -nitroalizarin.....	$C_6H_4(CO)_2C_6H_3(OH)_2NO_2$	285.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
414							
415							
416							
416M	cr. f. al. ....	.....	113 (92)	.....	sl. s. h.	s. h.	i. eth., bz., pet. eth.
417	col. liq. ....	.....		112-15 ¹⁰ (sl. d.)	d. h.	d. h.	.....
417M	pr. f. w. ....	.....	102	.....	s.	s. h.	i. eth., lgr.
418	wh.-brnsh. powd.	.....	216 d.	.....	0.027 ²⁰	sl. s.	i. eth., chl., acet., oils; s. a., alk.
419							
420							
421							
422							
423							
424							
425	col. rhomb. f. al.	.....	260 d.	subl. 292 sl. d.	s.	v. sl. s. c.	.....
426	need. or pr. f. w.	.....	295	subl. 200	16.6 ²⁵ , 32.2 ⁷⁵	0.57 ⁷⁵ 75% 0.084 ²⁵ 90%	i. eth.
427	col. need. ....	.....	64-8 (85-7)	d.	v. s.	v. s.	v. s. eth.
428	col. pl. or pr.	.....	163-5	d.	s.	sl. s.	sl. s. eth.
429	monocl. f. w. or leaf. f. al.	.....	318-20 d.	subl.	1.42 ²⁵ , 3.70 ⁷⁵	sl. s. c.	v. v. sl. s. eth.
430	rhomb. f. w.	.....	297 d.	.....	16.65 ²⁵ , 28.5 ⁷⁵	0.16	i. eth., acet.
431	oxime.						
432	leaf. f. w., [α] +35.08 ²¹⁶ in. w.	.....	283-4 d.	.....	2.83 ¹⁶	i.	i. eth.
433	pr. f. al. ....	.....	295 d.	subl.	2.2 ¹⁷	0.2 c. 80%	i. eth.
434	leaf., 1.600, 1.610, 1.675	.....	283 d.	.....	3 ²⁵	sl. s. h.	i. eth.
435	rhomb. pr. f. al.	.....	196 d.	.....	v. s.	v. sl. s.	i. eth., acet.
435M							
436							
437							
438							
439							
440	liq.	0.9184 ²³ 4	.....	174	i.	s.	s. eth., H ₂ SO ₄
441	col. syrupy liq.	1.103 ²⁰ 4	.....	83 ²⁰	∞	∞	∞ eth.
442	or. or red tri- cl. or rhomb.	.....	290	430	0.034 ¹⁰⁰	v. s.	v. s. eth.; s. me. al., bz., ac. a., CS ₂ , alk.
443	or. need. ....	.....	229	subl. 200	.....	s.	s. eth., acet.
444	or. need. f. bz.	.....	244 d.	subl. d.	sl. s.	s.	s. chl., bz.
445	yel. need. f. al.	.....	289 d.	subl. d.	sl. s.	s.	s. chl., bz., dil. alk., H ₂ SO ₄

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
446	β-Alizarin amide.	See <i>Anthraquinone, 2-amino-1-</i>	<i>hydroxy-</i>	
447	Alizarin bordeaux.	See <i>Quinalizarin</i> .		
448	6 (or 7)-Alizarincarboxylic acid.....	5,6 (or 7,8)-dihydroxy-2-anthraquinonecarboxylic acid	$(\text{OH})_2\text{C}_6\text{H}_2(\text{CO})_2\text{C}_6\text{H}_3\text{COOH}$	284.21
449	Alizarin orange.	See <i>Alizarin, 3-nitro-</i>		
450	Alizarin yellow A.	See <i>Benzophenone, 2,3,4-trihydroxy-</i>		
451	Alkannin.....		$\text{C}_{16}\text{H}_{16}\text{O}_8$	288.29
452	Alkargen.	See <i>Cacodylic acid</i> .		
453	Alkarsin, Alkarsine.	See <i>Cacodyl oxide</i> .		
453M	Allantoic acid.....	diureidoacetic acid.....	$\text{C}_4\text{H}_8\text{O}_4\text{N}_4$	176.14
454	Allantoin.....	5-ureidohydantoin; glyoxyldiureide	$\text{C}_4\text{H}_6\text{N}_4\text{O}_3$	158.12
455	Allanturic acid.....	5-hydroxy-2,4-imidazoledione; glyoxalylurea	NHCONHCOCHOH	116.08
456	Allene.	See <i>Propadiene*</i> .		
456M	—, unsym-dimethyl-	See 1,2-Butadiene, 3-methyl-		
457	—, ethyl-	See 1,2-Pentadiene*.		
458	—, methyl-	See 1,2-Butadiene*.		
459	Allocinnamic acid.	See <i>allo-Cinnamic acid</i> .		
460	Allocrotonic acid.	See <i>Isocrotonic acid</i> .		
460M	Allomucic acid.		$\text{C}_8\text{H}_{10}\text{O}_8$	210.14
461	Allophanamide.	See <i>Biuret</i> .		
462	Allophanic acid, ethyl ester	ethyl allophanate; ethyl ureacarboxylate	$\text{NH}_2\text{CONHCOOC}_2\text{H}_5$	132.12
462M	L-Allose.....		$\text{C}_6\text{H}_{12}\text{O}_6$	180.16
463	Alloxan.....	pyrimidinetrone; mesoxalylurea	NHCONHCOCOCO	142.07
464	—, 5-oxime.	See <i>Violuric acid</i> .		
465	Alloxanic acid.....	tetrahydro-4-hydroxy-2,5-diketo-4-imidazolecarboxylic acid	$\text{NHCONHCOC}(\text{OH})\text{COOH}$	160.09
466	Alloxantin.....		$\text{C}_8\text{H}_8\text{N}_4\text{O}_8$	286.16
467	—, tetramethyl-	See <i>Amalic acid</i> .		
468	Allyl. For allyl derivatives	see the parent compounds (e.g., 2-propen-1-ol*)	for allylaniline see <i>Aniline</i> , $\text{CH}_2:\text{CH}.\text{CH}_2\text{OH}$..	58.08
469	Allyl alcohol	(For derivatives see also 2-Propen-1-ol.*)		
470	—, dibromide.	See 1-Propanol, 2,3-dibromo*.		
471	—, dichloride.	See 1-Propanol, 2,3-dichloro*.		
472	—, γ-methyl-	See 2-Buten-1-ol*.		
473	—, γ-phenyl-	See <i>Cinnamic alcohol</i> .		
474	Allylamine.....	2-propenylamine*.....	$\text{CH}_2:\text{CHCH}_2\text{NH}_2$..	57.09
475	—, N-methyl-		$\text{CH}_2:\text{CHCH}_2\text{NHCH}_3$	71.12
476	Allyl bromide.....	3-bromopropene*.....	$\text{CH}_2:\text{CHCH}_2\text{Br}$...	120.99
477	Allyl bromide, α-bromo-	See <i>Propene, 2,3-dibromo-</i>	$\text{CH}_2:\text{CHCH}_2\text{Br}$	120.99
478	Allyl chloride.....	3-chloropropene*.....	$\text{CH}_2:\text{CHCH}_2\text{Cl}$	76.53
479	Allyl chloride, α-chloro-	See <i>Propene, 2,3-dichloro-</i>		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
446	red. need. ....	.....	305	subl.	v. sl. s.	s.	sl. s. eth.
447							
448							
449	br. red spears f. bz. [α] _D ²⁰ -157° (C ₆ H ₆)	.....	148	.....	i.	sl. s.	v. sl. s. eth.; sl. s. chl.; s. glac. ac. a., alk.
450							
451							
452	lf. f. me. al. ....	.....	173 d.	.....	sl. s. c.	.....	sl. s. org. solv.
453M							
454							
455	wh. monocl. f. h. w	.....	235	d.	0.06 ²⁰	v. sl. s.	i. eth.; s. NaOH
456	hyg. gum.....	.....	.....	.....	s.	i.	d. h. alk.
456M	need. f. w. ....	.....	166-71d.	.....	8 ¹⁰⁰	sl. s.	.....
457							
458							
459	need. f. w. ....	.....	192	d.	s. h., i. c.	0.5 ²¹	0.1 ²⁰ eth.
461							
462							
462M	pr. f. al. [α] _D ²⁰⁻²⁵ (H ₂ O)	.....	128-9	.....	s.	sl. s.	.....
463	initial -1.90°; final 13.38°. ana. dk. yel.; hyd., col. rhomb. pr.	.....	170 d.	.....	v. s.	s.	.....
464	tricl. ....	.....	d.	.....	v. s.	15.8	sl. s. eth.
465							
466							
467	rhomb. pr. f. w. with 2H ₂ O	.....	170 d.	253-5 d.	sl. s. c.	v. sl. s.	v. sl. s. eth.
468	allyl-. For allyl col. mobile liq.; pungent odor; 1.41345	esters of org 0.855 ²⁰ ■	anic acids se -129	e the acids. 96-97	∞	∞	∞ eth.
469	col. liq., 1.41943 ²²	0.761 ²⁰ 4	.....	53.2	∞	∞	∞ eth.; s. ch ^l
470							
471							
472	col. liq. ....	.....	.....	65	∞	.....	.....
473							
474							
475	col. liq., 1.46545	1.398 ²⁰ 4	-119.4	71.3	i.	∞	∞ eth.; s. chl., CS ₂ , CCl ₄
476	liq., 1.41538...	0.938 ²⁰ 4	-136.4	44.6	i.	s.	∞ eth.
477							
478							
479							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
480	Allyl cyanide	3-butenenitrile*; vinylacetone nitrile; β -butenenitrile	$\text{CH}_2\text{:CHCH}_2\text{CN}$...	67.09
481	Allylene .	See <i>Propyne</i> *.		
482	—, γ -bromo-.	See <i>Propyne</i> , 3-bromo*.		
483	Allylene dichloride .	See <i>Propene</i> , 1,2-dichloro*.		
484	Allylene oxide .	See <i>Propene</i> , 1,2-epoxy*.		
485	Allyl ether	3-(2-propenoxy)propene*; diallyl ether	$(\text{CH}_2\text{:CHCH}_2)_2\text{O}$..	98.14
486	—, thio-.	See <i>Allyl sulfide</i> .		
487	Allyl fluoride	3-fluoropropene*.....	$\text{CH}_2\text{:CHCH}_2\text{F}$	60.07
488	Allyl iodide	3-iodopropene*.....	$\text{CH}_2\text{:CHCH}_2\text{I}$	167.99
489	Allyl isocyanide		$\text{CH}_2\text{:CHCH}_2\text{NC}$...	67.09
490	Allyl mercaptan .	See 2-Propene-1-thiol*.		
491	Allyl mustard oil .	See <i>Isothiocyanic acid</i> , allyl ester.		
492	Allyl sulfide	3-(2-propenylthio)propene*; thioallyl ether; diallyl sulfide; allyl thioether; 2-propenyl sulfide*	$(\text{CH}_2\text{:CHCH}_2)_2\text{S}$..	114.20
493	Allyl sulfocyanide .	See <i>Thiocyanic acid</i> , allyl ester.		
494	Allyl tribromide .	See <i>Propane</i> , 1,2,3-tribromo*.		
495	Allyl trichloride .	See <i>Propane</i> , 1,2,3-trichloro*.		
496	Allyl trisulfide	diallyl trisulfide.....	$(\text{C}_3\text{H}_5)_2\text{S}_3$	178.32
497	Alolin		$\text{C}_{20}\text{H}_{18}\text{O}_9$	402.35
498	Alstonine	chlorogenine.....	$\text{C}_{21}\text{H}_{20}\text{N}_2\text{O}_4$ $3\frac{1}{2}\text{H}_2\text{O}$	427.44
498M	Altrose		$\text{C}_6\text{H}_{12}\text{O}_6$	180.16
499	Aluminum, triethoxy -*	aluminum ethoxide.....	$\text{Al}(\text{OC}_2\text{H}_5)_3$	162.15
500	—, triethyl-*	aluminum ethyl.....	$\text{Al}(\text{C}_2\text{H}_5)_3$	114.15
501	—, trimethyl-*	aluminum methyl.....	$\text{Al}(\text{CH}_3)_3$	72.07
502	Amalic acid	tetramethylalloxantin.....	$\text{C}_8(\text{CH}_3)_4\text{N}_4\text{O}_7$...	324.25
503	Amanitine .	See <i>Choline</i> .		
504	Amarine	4,5-dihydro-2,4,5-triphenylimidazole	$(\text{C}_6\text{H}_5)\text{CH}(\text{C}_6\text{H}_5)\text{CH}$ $\text{NH}(\text{C}_6\text{H}_5)\text{C:N}$ $(\text{C}_6\text{H}_5)_2$	298.37
505	Amaron	tetraphenylpyrazine; benzoin imide; ditolan azotide	$(\text{C}_6\text{H}_5)_2(\text{CNC})_2$ $(\text{C}_6\text{H}_5)_2$	384.46
506	Amidine, benzenylnap	thyl-. See <i>Benzamidine</i> , <i>N</i> -	1-naphthyl-.	
507	—, ethenyl-diphenyl-	See <i>Acetamidine</i> , <i>N</i> , <i>N'</i> -diphenyl-.		
508	Amidol .	See <i>Phenol</i> , 2,4-diamino-, dihydrochloride.		
	Amino -. See the parent compounds (e.g., for aminoacetophenone see <i>Acetophenone</i> ,			
510	Amino G acid	See 2-Naphthylamine-6,8-disulfonic acid.		
511	Ammelide	6-amino-s-triazine-2,4-diol; cyanuramide	$\text{N:C}(\text{OH})\text{N:C-}$ $(\text{OH})\text{N:C}(\text{NH}_2)$	128.09
512	Ammeline	4,6-diamino-s-triazin-2-ol; cyanurodiamide	$\text{N:C}(\text{OH})\text{N:C-}$ $(\text{NH}_2)\text{N:C}(\text{NH}_2)$	127.11
513	Ammonium bromide ,	(β -acetoxyethyl) trimethyl-. See <i>Choline</i> , <i>O</i> -acetyl-,		
514	—, ethyl-*	See <i>Ethylamine</i> , hydrobromide.		
515	—, tetraethyl-*		$(\text{C}_2\text{H}_5)_4\text{NBr}$	210.17
516	Ammonium chloride ,	derivatives of. See also "hydrochloride" under the various		
517	—, tetramethyl-*		$(\text{CH}_3)_4\text{NCl}$	109.60
518	Ammonium hydroxide ,	(carboxymethyl)trimethyl-, anhydride. See		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
480	col. liq., 1.40602	0.8318 ²⁰ / ₄	.....	116-9	v. sl. s.	∞	∞ eth.
481							
482							
483							
484							
485	liq.	0.805	.....	94.3	sl. s.	∞	∞ eth.
486							
487	col. gas. ....	.....	.....	-10	2.8 ¹³ cm ³	60 ¹³ cm ³	90 cm ³ eth.
488	yel. liq.	1.848 ¹² / ₁₂	-99.3	103.1	i.	s.	s. eth., chl.
489	liq.	0.794 ¹⁷ / ₄	.....	106	sl. s.	∞	∞ eth.
490							
491							
492	col. oil w. garlic odor, 1.4877 ²⁷	0.88765 ²⁷ / ₄	-83	ca. 138; 138.6 ⁷⁵⁸ (140-2)	sl. s.	∞	∞ eth.; s. chl., CCl ₄ , CS ₂
493							
494							
495							
496	liq.	1.085 ¹⁵	.....	140	i.	i.	∞ eth.
497	yel. need. ....	.....	147.9	.....	sl. s. c.	sl. s. c.	i. eth.; s. acet., KOH; i. chl.
498	br. amor. ....	.....	<100; 195 anh.	.....	sl. s.	s.	v. sl. s. eth.; s. chl.
498M	β-l, th. pointed pr.; [α] _D ²⁰ -28.75°	.....	l 107-9.5 d 103-5	.....	s.	s.	s. me. al.
499	.....	1.1422 ²⁰ / ₄	150-60	320	d.	.....	.....
500	col. liq., ign. in air, 1.480 ^{6.5}	.....	<-18	194	exp.	.....	s. eth.
501	col. liq., ign. in air, 1.432 ¹²	.....	0	130	d.	.....	s. eth.
502	cr. ....	.....	245 d.	.....	sl. s. h.	v. sl. s.	s. KOH
503							
504	pr. ....	.....	129	d.198 (anh.)	i.	s.	s. eth.
505	sm. need. f. acet.	.....	246	subl.	i.	s.	s. eth., chl., h bz.
506							
507							
508	amino-).						
510							
511	wh. cr. powd. ....	.....	d.	.....	v. sl. s.	.....	s. eth., alk., min. a.
512	wh. minute need. dendritic groups	.....	d.	.....	0.021 ²³	i.	i. eth.; s. KOH, alk., min. a.
513	bromide.						
514							
515	cr. f. al.	1.397 ²⁰ / ₄	.....	.....	.....	v. s.	s. chl.
516	amines.	.....	.....	.....	.....	.....	.....
517	col. cr.	1.169 ²⁰ / ₄	.....	.....	s.	s.	i. eth.
518	Betaine.						

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
519	Ammonium hydroxide, tetraethyl-*		$(C_2H_5)_4NOH$	147.26
520	—, tetramethyl-*		$(CH_3)_4NOH \cdot 5H_2O$	181.23
521	—, trimethylvinyl-	See <i>Neurine</i> .		
522	Ammonium purpurate	See <i>Murexide</i> .		
523	Amygdalic acid.....	amygdalinic acid; mandelic acid gentiobioside	$C_{19}H_{27}O_{11} \cdot COOH$	476.43
524	Amygdalin.....	mandelonitrile gentiobioside; amygdalose	$C_{20}H_{27}NO_{11}$	457.43
524M	Amygdalose.	See <i>Gentiobiose</i> .		
525	Amyl. For (normal) amyl derivatives see the parent compounds (e.g., for amylbenzene			
526	<i>pri-act</i> -Amyl alcohol.	See 1-Butanol, 2-methyl-*		
527	<i>pri-n</i> -Amyl alcohol.	See 1-Pentanol*		
528	<i>sec-act</i> -Amyl alcohol.	See 2-Pentanol*		
529	<i>tert</i> -Amyl alcohol.	See 2-Butanol, 2-methyl-*		
530	<i>n</i> -Amyl aldehyde.	See <i>Valeraldehyde</i> .		
530M	Amylamine.....	<i>n</i> -amylamine; pentylamine*; 1-aminopentane	$CH_3(CH_2)_4NH_2$	87.16
531	—, <i>N, N</i> -dimethyl.....		$CH_3(CH_2)_4N(CH_3)_2$	115.22
532	—, α -methyl.....	2-aminohexane.....	$CH_3(CH_2)_3CH(CH_3)NH_2$	101.19
533	—, 4-methyl-	See <i>Isohexylamine</i> .		
534	<i>sec-n</i> -Amylamine.	See <i>Butylamine</i> , α -methyl-; <i>Pr</i> (α , α -dimethylpropyl) amine;	<i>onylamine</i> , α -methyl- $CH_3CH_2C(CH_3)_2NH_2$	87.16
535	<i>tert</i> -Amylamine.....	dimethylethylcarbinyllamine	$CH_3(CH_2)_3CH_2Br$	151.06
536	Amyl bromide.....	1-bromopentane*; <i>n</i> -amyl bromide		
537	<i>pri-act</i> -Amyl bromide.	See <i>Butane</i> , 1-bromo-2-methyl-*		
538	Amyl chloride.....	1-chloropentane*; <i>n</i> -amyl chloride	$CH_3(CH_2)_3CH_2Cl$..	106.60
539	<i>pri-act</i> -Amyl chloride.	See <i>Butane</i> , 1-chloro-2-methyl-*		
540	<i>tert</i> -Amyl chloride.	See <i>Butane</i> , 2-chloro-2-methyl-*		
541	<i>n</i> -Amyl cyanide.	See <i>Capronitrile</i> .		
542	α - <i>n</i> -Amylene.	See 1-Pentene*		
543	β - <i>n</i> -Amylene.	See 2-Pentene*		
544	α - <i>n</i> -Amylene glycol.	See 1,2-Pentanediol*		
545	β - <i>n</i> -Amylene glycol.	See 2,3-Pentanediol*		
545M	Amyl ether.....	pentyloxypentane*; di- <i>n</i> -amyl ether	$[CH_3(CH_2)_3CH_2]_2O$	158.28
546	Amyl fluoride (<i>n</i>).....	1-fluoropentane*.....	$CH_3(CH_2)_3CH_2F$..	90.14
547	Amylin.	See <i>Dextrin</i> .		
548	Amyl iodide.....	1-iodopentane*; <i>n</i> -amyl iodide	$CH_3(CH_2)_3CH_2I$..	198.06
549	<i>pri-act</i> -Amyl iodide.	See <i>Butane</i> , 1-iodo-2-methyl-*		
550	<i>tert</i> -Amyl iodide.	See <i>Butane</i> , 2-iodo-2-methyl-*		
551	Amyl isocyanide.	<i>n</i> -amylcarbonylamine*.....	$CH_3(CH_2)_4NC$	97.16
552	Amyl mercaptan.	See 1-Pentanethiol*		
553	<i>pri-act</i> -Amyl mercaptan.	See 1-Butanethiol, 2-methyl-*		
554	<i>tert</i> -Amyl mercaptan.	See 2-Butanethiol, 2-methyl-*		
555	<i>n</i> -Amyl mustard oil.	See <i>Isothiocyanic acid</i> , amyl ester.		
556	Amyl nitrite (<i>n</i>).....	pentyl nitrite*.....	$CH_3(CH_2)_4NO_2$...	117.15
557	Amyl sulfate.....	di- <i>n</i> -amyl sulfate; pentyl sulfate	$[CH_3(CH_2)_4]_2SO_4$..	238.34
558	Amytal.	See <i>Barbituric acid</i> , 5-ethyl-5-isoamyl-.		
559	<i>l</i> -Anabasine.....	1-2-(3-pyridyl)piperidine.....	$C_{10}H_{14}N_2$	162.23
559	Anacardic acid.....		$C_{22}H_{32}O_3$	344.48

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
519	deliq. need. ....	.....	190 d.	.....	s.	s.	.....
520	hyg. need. ....	.....	anh. 63	d.	∞ ⁶³	v. s.	i. eth.
521							
522							
523	col. cr. ....	.....	118	.....	deliq.	i.	i. eth.
524	rhomb. f. w. ....	.....	214-6	.....	8.3 ¹⁰ , ∞ ¹⁰⁰	0.11 ¹⁰ , 9 ⁷⁸	i. eth.
524M	see <i>Benzene</i> , a <i>myl</i> -. For		amyl esters	of organic acids	see the acids.		
525							
526							
527							
528							
529							
530	col. liq.	0.7614 $\frac{20}{4}$	-55	104	s.	s.	= eth.
530M	col. liq., 1.4083 ²⁰	0.743 $\frac{20}{4}$	.....	122-3	sl. s.	.....	∞ eth.
531	.....	0.767 $\frac{20.4}{4}$	-19	130 ⁷⁴²	.....	.....	.....
532							
533							
534	col. liq.	0.7611 $\frac{0}{4}$	-105	78.5	∞	∞	∞ eth.
535	col. liq., 1.444	1.246 $\frac{0}{4}$; 1.218 $\frac{20}{4}$	-88.0	128-9 ⁷⁴⁰	i.	s.	∞ eth.
536							
537	col. liq., 1.4119 ¹⁸	0.883 $\frac{20}{4}$	-99	108.2 (107 ⁷⁴⁰)	i.	∞	∞ eth.
538							
539							
540							
541							
542							
543							
544							
545	ylsh. liq.	0.774 $\frac{20}{4}$	-69.3	190	i.	∞	= eth.
545M	col. liq., 1.35622	0.7880	<-80	62.8	i.	v. s.	v.s. eth.
546							
547	col. liq., 1.4955	1.517 $\frac{20}{4}$	-85.6	156	i.	s.	∞ eth.
548							
549							
550	liq.	0.806 $\frac{20}{4}$	-51.1	155.5	i.	s.	.....
551							
552							
553							
554							
555	pa. yel. liq., 1.38506	0.8528 $\frac{20}{4}$	.....	104	sl. s.	∞	∞ eth.
556	1.4270 ²⁵	1.0265 $\frac{25}{25}$	.....	117.0 ^{2.5}	.....	.....	.....
557							
558	col. liq., 1.5430 [α]-82.20 $\frac{20}{D}$	1.0481 $\frac{20}{20}$	.....	28.09	∞	s.	s. eth., bz.
559	cr. ....	.....	26	.....	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
560	Anaesthesin.	See <i>Benzocaine</i> .		
561	Analgen (1)	5-benzamido-8-ethoxyquinoline; quinalgen; chinalgen; labordin; benzanalgen	$C_9H_5N(NHCO-C_6H_5)OC_2H_5$	292.33
562	Analgen (2).	Formerly, 5-acetamido-8-ethoxyquinoline.		
563	Analgesine.	See <i>Antipyrine</i> .		
563	Anethole	<i>p</i> -propenylanisole; anise camphor; 1-methoxy-4-propenylbenzene	$CH_3CH:CHC_6H_4OCH_3$	148.26
564	Angelic acid	<i>cis</i> -2-methyl-2-butenic acid*; α -methylisocrotonic acid	$CH_3CH:C(CH_3)COOH$	100.11
565	Anhalonidine		$C_{12}H_{17}NO_3$	223.27
566	Anhalonine	1,2,3,4-tetrahydro-6-methoxy-1-methyl-7,8-methylene-dioxisoquinoline	$C_{12}H_{15}NO_3$	221.25
567	—, hydrochloride		$C_{12}H_{15}NO_3 \cdot HCl$	257.71
568	<i>d</i>l-Anhydroecgonine ..	ecgonidine	$C_9H_{13}NO_2$	167.20
569	—, hydrochloride		$C_9H_{13}NO_2 \cdot HCl$	203.67
570	Anhydroformaldehyde	aniline. See <i>s</i> -Triazine, hexa	<i>hydro</i> -1,3,5-triphenyl-	
571	Aniline	phenylamine; aminobenzene	$C_6H_5NH_2$	93.12
572	—, hydrochloride		$C_6H_5NH_2 \cdot HCl$	129.59
572F	—, nitrate		$C_6H_5NH_3NO_3$	156.14
572M	—, oxalate		$(C_6H_5NH_3)_2C_2O_4$	276.29
572T	—, picrate		$C_6H_5NH_3OC_6H_2(NO_2)_3$	322.23
573	—, sulfate		$(C_6H_5NH_2)_2H_2SO_4$	284.33
574	—, <i>o</i> -acetyl-	See <i>Acetophenone</i> , <i>o</i> -amino-		
575	—, <i>N</i> -acetyl-	See <i>Acetanilide</i> .		
576	—, <i>N</i> -allyl-	<i>N</i> -(2-propenyl)aniline	$CH_2:CHCH_2-NHC_6H_5$	133.19
577	—, <i>o</i> -amino-	See <i>o</i> -Phenylenediamine.		
578	—, <i>m</i> -amino-	See <i>m</i> -Phenylenediamine.		
579	—, <i>p</i> -amino-	See <i>p</i> -Phenylenediamine.		
580	—, azodi-	See <i>Azobenzene</i> , <i>diamino</i> -		
581	—, <i>N</i> -benzal-	See <i>Aniline</i> , <i>N</i> -benzylidene-		
582	—, <i>p,p'</i> -benzalbis- <i>N</i> ,	<i>N</i> -dimethyl-. See <i>Aniline</i> , <i>p,p'</i> -benzylidenebis- <i>N</i> ,		
583	—, <i>p,p'</i> -benzaldi-	See <i>Methane</i> , <i>p,p'</i> -diaminotriphenyl-		
584	—, <i>N</i> -benzal- <i>p</i> -hydroxy-	See <i>Phenol</i> , <i>p</i> -benzylideneamino-		
585	—, <i>m</i> -benzohydryl-	<i>m</i> -aminotriphenylmethane; <i>m</i> -aminotritan	$(C_6H_5)_2CHC_6H_4NH_2$	259.34
586	—, <i>p</i> -benzohydryl-	<i>p</i> -aminotriphenylmethane	$(C_6H_5)_2CHC_6H_4NH_2$	259.34
587	—, <i>o</i> , <i>m</i> , or <i>p</i> -benzoyl-	See <i>Benzophenone</i> , <i>amino</i> -		
588	—, <i>N</i> -benzoyl-	See <i>Benzanilide</i> .		
589	—, <i>m</i> -benzyl-	<i>m</i> -aminodiphenylmethane	$NH_2C_6H_4CH_2C_6H_5$	183.24
590	—, <i>p</i> -benzyl-	<i>p</i> -aminodiphenylmethane	$NH_2C_6H_4CH_2C_6H_5$	183.24
591	—, <i>N</i> -benzyl-	See <i>Benzylamine</i> , <i>N</i> -phenyl-		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
560							
561	col.-yel. need.	.....	210	.....	i.	v. sl. s.	v. sl. s. eth.; m. a.
562							
563	col. leaf. f. al., 1.5624 ¹²	0.9936 ¹⁵ / ₁₅	22.5, frz. 20-1	235.3	v. sl. s.	20 96%	s. eth., chl., bz., acet., CS ₂
564	col. monocl. pr., 1.4434 ⁴⁷ liq.	liq. 0.983 ⁴⁷ / ₄	45	185	sl. m.	s.	v. s. eth.
565	.....	.....	160	.....	s.	s.	sl. s. eth.; m. chl.
566	need.	.....	85	.....	s.	s.	s. eth., chl.
567	wh. cr. powd. [α]-41.9 ¹⁷ in w. D	.....	>230 d.	.....	sl. s. c., v. s. h.	sl. s.	sl. s. eth., chl.
568	wh. cr. f. w	.....	226-30 d.; (l. 235 d.)	.....	s.	sl. s. c.	v. sl. s. eth.
569	rhomb. need. f. al., [α] -61.50 °D	.....	240-1	.....	s.	s.	.....
570							
571	col. oily liq., 1.5863 ²⁰	1.022 ²⁰ / ₄	-6.2	184.4	3.4 ²⁰ , 6.4 ⁹⁰	∞	∞ eth., bz.
572	wh. leaf. or need.	1.222 ⁴ / ₄	198	245	18 ¹⁵ , 107 ²⁵	s.	i. eth.
572F	rhomb.	1.356	d. >190	.....	v. s.	v. s.	v. s. eth.
572M	tricl. pr.	.....	175 d.	.....	v. s. c.	sl. s.	i. eth.
572T	yel. or red monocl. pr.	1.558	181 d.	.....	.374 ¹⁸ (c.) d. h.	8.4 ¹⁵ 95%	0.078 ²⁰ bz.
573	leaf. f. al.	1.377 ⁴ / ₄	d.	.....	6.6 ¹⁵	sl. s.	i. eth.
574							
575							
576	yel. oil	0.982 ²⁵ / _m	.....	217-87 ³⁶ (209)	sl. s.	s.	∞ eth.
577							
578							
579							
580							
581							
582	dimethyl-						
583							
584							
585	need. f. eth.	.....	120	.....	.....	.....	.....
586	pr. f. eth.	.....	84	248 ¹³	i.	.....	s. eth., bz., lgr.
587							
588							
589	cr.	.....	46	.....	.....	.....	s. lgr.
590	col. monocl. f. lgr.	1.038 ⁵⁵	34-5 (37)	300	i.	v. s.	v. s. eth.; s. lgr.
591							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
592	Aniline, <i>N</i>-benzylidene-	benzalaniline.....	$C_6H_5CH:NC_6H_5...$	181.23
592M	—, <i>p,p'</i>-benzylidene-bis-<i>N,N</i>-dimethyl-	4,4'-bisdimethylaminotriphenylmethane; leucomalachite green	$C_6H_5CH[C_6H_4N(CH_3)_2]_2$	330.46
593	—, <i>o</i>-bromo-	1-amino-2-bromobenzene....	$BrC_6H_4NH_2.....$	172.03
594	—, <i>m</i>-bromo-	1-amino-3-bromobenzene....	$BrC_6H_4NH_2.....$	172.03
595	—, <i>p</i>-bromo-	1-amino-4-bromobenzene....	$BrC_6H_4NH_2.....$	172.03
596	—, <i>p</i>-bromo-<i>N,N</i>-diethyl-		$BrC_6H_4N(C_2H_5)_2...$	228.14
597	—, <i>p</i>-bromo-<i>N,N</i>-dimethyl-		$BrC_6H_4N(CH_3)_2...$	200.09
598	—, <i>N</i>-butyl-		$C_6H_5NHC_4H_9.....$	149.23
599	—, <i>p</i>-<i>tert</i>-butyl-	1-amino-4- <i>tert</i> -butylbenzene..	$(CH_3)_3CC_6H_4NH_2...$	149.23
600	—, <i>o</i>-chloro-	2-chlorophenylamine.....	$ClC_6H_4NH_2.....$	127.57
601	—, <i>m</i>-chloro-	3-chlorophenylamine.....	$ClC_6H_4NH_2.....$	127.57
602	—, <i>p</i>-chloro-	4-chlorophenylamine.....	$ClC_6H_4NH_2.....$	127.57
603	—, <i>N</i>-cyano-	See <i>Cyananilide</i> .		
604	—, <i>N,N</i>-diacetyl-	See <i>Diacetanilide</i> .		
605	—, <i>N,N</i>-dibenzyl-	See <i>Dibenzylamine, N-phenyl-</i> .		
606	—, 2, 4-dibromo-6-nitro-		$Br_2(NO_2)C_6H_2NH_2$	295.94
607	—, 2, 6-dibromo-4-nitro-		$Br_2(NO_2)C_6H_2NH_2$	295.94
608	—, <i>N,N</i>-dibutyl-	<i>N</i> -phenyldibutylamine.....	$C_6H_5N(C_4H_9)_2...$	205.33
609	—, 2, 3-dichloro-		$Cl_2C_6H_3NH_2.....$	162.02
610	—, 2, 4-dichloro-		$Cl_2C_6H_3NH_2.....$	162.02
611	—, 2, 5-dichloro-		$Cl_2C_6H_3NH_2.....$	162.02
612	—, 3, 4-dichloro-		$Cl_2C_6H_3NH_2.....$	162.02
613	—, 3, 5-dichloro-		$Cl_2C_6H_3NH_2.....$	162.02
614	—, <i>N</i>-(dichloromethylene)-	phenyliminophosgene; phenylcarbonylamine chloride	$C_6H_5NCCl_2.....$	174.03
615	—, 2, 6-dichloro-4-nitro-		$Cl_2(NO_2)C_6H_2NH_2$	207.02
616	—, <i>N,N</i>-diethyl-	<i>N</i> -phenyldiethylamine.....	$C_6H_5N(C_2H_5)_2...$	149.23
617	—, <i>N,N</i>-diethyl-<i>m</i>-nitro-		$NO_2C_6H_4N(C_2H_5)_2$	194.23
618	—, <i>N,N</i>-diethyl-<i>p</i>-nitro-		$NO_2C_6H_4N(C_2H_5)_2$	194.23
619	—, <i>N,N</i>-diethyl-<i>p</i>-nitroso-		$NOC_6H_4N(C_2H_5)_2...$	178.23
620	—, <i>ar</i>-dimethyl-	See <i>Nylidine</i> .		
621	—, <i>N,N</i>-dimethyl-		$C_6H_5N(CH_3)_2.....$	121.18
621M	—, —, hydrochloride		$C_6H_5N(CH_3)_2HCl...$	157.64

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
592	yel. need. f. CS ₂	1.07 ⁵⁰	54 (51-2)	300	i.	s.	s. eth.
592M	monocl. need. f. bz.	.....	93; 102	d.	i.	s.	v. s. eth.; s. bz.; sl. s. lgr.
593	cr.....	.....	32, frz. 28.7	229	sl. s.	s.	s. eth.
594	1.62604 ^{20.4}	1.5793 ^{20.4} ₄	18.5; frz. 16.7	251	v. sl. s.	s.	s. eth.
595	rhomb.....	1.799	66.4	d.	i.	v. s.	v. s. eth.
596	need. or pr.....	.....	33	270	i.	v. s.	v. s. eth.
597	.....	.....	55	264	i.	v. s.	v. s. eth.
598	col. liq.....	.....	.....	240.9	sl. s.	v. s.	v. s. eth.
599	oil.....	0.9525 ¹⁵ ₄	17	240.9	i.	∞	∞ eth.
600	liq., 1.5895.....	1.213 ²⁰ ₄	α-14; β-3.5; mixt. 0	208.8	i.	∞	s. eth., most org. solv., a.
601	liq., 1.59424 ^{20.7}	1.216 ²⁰ ₄	-10.4	229.8 (99-100 ¹⁰)	.....	∞	∞ eth.; s. most org. solv., a.
602	rhomb. pr.....	1.427 ¹⁹ ₄ ; liq. 1.170 ⁷⁰ ₄	70-2	231	s. h.	s.	s. eth., a., most org. solv.
603	.....	.....	.....	.....	.....	.....	.....
604	.....	.....	.....	.....	.....	.....	.....
605	.....	.....	.....	.....	.....	.....	.....
606	yel. cr.....	.....	127	.....	.....	.....	.....
607	yel. need.....	.....	203	.....	sl. s.	.....	.....
608	col. liq.....	0.907	.....	262.8 (271)	i.	s.	s. eth.
609	need. f. lgr.....	.....	24	252	.....	s.	v. sl. s. eth.; sl. s. bz., lgr. s. eth.
610	need. f. dil. me. al.	1.567 ²⁰ ₄	63	245	sl. s.	s.	s. eth.
611	need. f. lgr.....	.....	50	251	sl. s.	s.	s. eth., bz., CS ₂ ; sl. s. lgr.
612	need. f. lgr.....	.....	71.5	272	.....	s.	s. eth.; sl. s. lgr.
613	need.....	.....	50.5	260	i.	s.	s. eth.
614	col. oil.....	.....	.....	209	.....	.....	.....
615	yel. need. f. al.	.....	189-90 (195)	.....	.....	s.	.....
616	col.-yel. or brn. inflam. oil, 1.54105 ^{22.3}	.93507 ²⁰ ₄	-38.8	215.5	1.44 ¹²	v. s.	v. s. eth., CHCl ₃
617	yel. oil.....	.....	.....	288-90	.....	.....	.....
618	yel. monocl. need. f. al.	1.225	77-8	.....	.....	v. s. h.	sl. s. lgr.
619	grn. monocl...	1.24 ¹⁵	84	.....	sl. s.	v. s.	v. s. eth.
620	.....	.....	.....	.....	.....	.....	.....
621	yel. liq., 1.55819	0.9557 ²⁰ ₄	2.5	192.5-3.5	v. sl. s.	s.	s. eth., most ord. org. solv.
621M	hyg. pl.....	1.1156 ^{18.5} ₄	90	.....	s. c.	s.	i. eth.; s. chl.; sl. s. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
622	Aniline, <i>N, N</i> -di- methyl- <i>o</i> -nitro-	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2$	166.18
623	—, <i>N, N</i> -dimethyl- <i>m</i> -nitro-	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2$	166.18
624	—, <i>N, N</i> -dimethyl- <i>p</i> -nitro-	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2$	166.18
625	—, <i>N, N</i> -dimethyl- <i>p</i> - nitroso-	.....	$\text{NOcC}_6\text{H}_4\text{N}(\text{CH}_3)_2$	150.18
626	—, <i>N, N</i> -dimethyl- <i>p</i> -	phenylazo-. See Azobenzene,	<i>p</i> -dimethylamino-	
627	—, 2, 4-dinitro-.....	2,4-dinitrophenylamine.....	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{NH}_2$...	183.12
628	—, 2, 6-dinitro-.....	2,6-dinitrophenylamine.....	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{NH}_2$...	183.12
629	—, <i>N, N</i> -dipropyl-...	.....	$\text{C}_6\text{H}_5\text{N}(\text{C}_3\text{H}_7)_2$...	177.28
630	—, ethoxy-	See Phenetidine.		
631	—, ethoxyl-	See Ethanol, 2-anilino-		
632	—, <i>o</i> -ethyl-.....	<i>o</i> -aminoethylbenzene.....	$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{NH}_2$...	121.18
633	—, <i>m</i> -ethyl-.....	<i>m</i> -aminoethylbenzene.....	$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{NH}_2$...	121.18
634	—, <i>p</i> -ethyl-.....	<i>p</i> -aminoethylbenzene.....	$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{NH}_2$...	121.18
635	—, <i>N</i> -ethyl-.....	<i>N</i> -ethylphenylamine.....	$\text{C}_6\text{H}_5\text{NHC}_2\text{H}_5$...	121.18
636	—, <i>N</i> -ethyl- <i>o</i> , <i>m</i> or	<i>p</i> -hydroxy- See Phenol, eth	<i>ylamino</i> -	
637	—, <i>N</i> -ethyl- <i>N</i> - methyl-	.....	$\text{C}_6\text{H}_5\text{N}(\text{CH}_3)\text{C}_2\text{H}_5$	135.20
637K	—, <i>o</i> -fluoro-.....	1-amino-2-fluorobenzene.....	$\text{FC}_6\text{H}_4\text{NH}_2$	111.12
637M	—, <i>m</i> -fluoro-.....	1-amino-3-fluorobenzene.....	$\text{FC}_6\text{H}_4\text{NH}_2$	111.12
637P	—, <i>p</i> -fluoro-.....	1-amino-4-fluorobenzene.....	$\text{FC}_6\text{H}_4\text{NH}_2$	111.12
638	—, hexahydro-	See Cyclohexylamine*.		
639	—, <i>p</i> , <i>p'</i> -hydrazodi-	See Hydrazobenzene, 4, 4'-diam	<i>ino</i> -	
640	—, hydroxy-	See Phenol, amino-		
641	—, <i>m</i> -hydroxy- <i>N, N</i> -	dimethyl-. See Phenol, <i>m</i> -di	<i>methylamino</i> -*	
642	—, β -hydroxyethyl-	See Ethanol, 2-anilino-		
643	—, <i>p</i> , <i>p'</i> -iminodi-	See Diphenylamine, 4,4'-diam	<i>ino</i> -	
644	—, <i>o</i> -iodo-.....	.....	$\text{IC}_6\text{H}_4\text{NH}_2$	219.04
645	—, <i>m</i> -iodo-.....	.....	$\text{IC}_6\text{H}_4\text{NH}_2$	219.04
646	—, <i>p</i> -iodo-.....	.....	$\text{IC}_6\text{H}_4\text{NH}_2$	219.04
647	—, <i>N</i> -isoamyl-.....	<i>N</i> -isoamylphenylamine.....	$\text{C}_8\text{H}_{11}\text{NHC}_6\text{H}_5$...	163.26
647H	—, <i>p</i> -isobutyl-.....	.....	$\text{C}_4\text{H}_9\text{C}_6\text{H}_4\text{NH}_2$...	149.23
647M	—, <i>N</i> -isobutyl-.....	<i>N</i> -phenylisobutylamine.....	$\text{C}_6\text{H}_5\text{NHCH}_2\text{CH}(\text{CH}_3)_2$	149.23
648	—, <i>p</i> -isopropyl-	See Cumidine.		
649	—, 2-isopropyl-5-me	thyl-. See Thymylamine.		
650	—, 5-isopropyl-2-me	thyl-. See Carvacrylamine.		
651	—, mercapto-	See Phenol, aminothio-		
652	—, methenyltri-	See Leucaniline.		
653	—, methoxy-	See Anisidine.		
654	—, <i>o</i> , <i>m</i> or <i>p</i> -methyl-	-. See Toluidine.		
655	—, <i>N</i> -methyl-.....	.....	$\text{C}_6\text{H}_5\text{NHC}_2\text{H}_5$	107.15

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
622	red. monoc.	1.179	60-1	154 ²⁴	sl. s.	s.	s. eth.
623	red. monoc.	1.313 ¹⁷	66 (59-60)	285	i.	s.	s. eth.
624	pr. f. eth.						
624	yel. fluores.	.....	163	.....	i.	s.	s. conc. HCl,
625	need. f. al.	.....					h. ac. a.
625	grn. tricl. leaf.	.....	85	.....	i.	s.	s. eth.
626							
627	yel. monoc.	1.615	176 (188)	.....	sl. s. h.	0.7 ²¹	sl. s. h. HCl
627	f. dil. acet.						
628	yel. need. f. al.	.....	138 (141-2)	.....	i.	0.40 c.	s. eth., h. bz.;
629	yel. oil	0.9104 ²⁰ ₄	.....	245-6 (238-41)	i.	s.	i. lgr. s. eth.
630							
631							
632	liq.	0.983 ²² ₄	-43	215-6	sl. s.	v. s.	v. s. eth.
633	col. liq.	0.990 ⁰ ₄ ;	-64	214-5; 205)	sl. s.	v. s.	v. s. eth.
634		0.9631 ²⁰ ₄					
634	glit. leaf. or col.	0.975 ²² ₄	-5	216.5	sl. s.	v. s.	v. s. eth.
635	oil						
635	col. liq.,	0.9631 ²⁰ ₄	-63.5	204.72	i. (v. sl. s.)	∞	∞ eth.
636	1.55558 ^{20.3}						
637	col. liq.	0.9193 ⁵⁵	.....	201	i.	∞	∞ eth.
637 K	pa. yel. liq.,	1.1437 ¹⁸	-28.95	175	i.	s.	s. eth.
637 M	1.54672 ¹⁸						
637 M	pa. yel. liq.,	1.1561 ^{18.5}	.....	186.1	i.	s.	s. eth.
637 P	1.54528 ^{18.5}						
638	pa. yel. liq.,	1.1725	-0.82	187.6	.....	.....	.....
639	1.53945						
640							
641							
642							
643							
644	need.	.....	56.5	.....	v. sl. s.	v. s.	v. s. eth.
645	leaf. or need.	.....	33 (27)	.....	i.	s.	s. chl.
646	need. f. w.	.....	62.75 (67-8)	.....	i.	s.	s. eth., chl.
647	liq.	0.928 ¹⁵ ₄	.....	254.5	i.	∞	∞ eth.
647 H	pa. yel. liq.	.....	.....	235 ⁷⁶²	i.	∞	∞ eth.
647 M	.....	0.940 ¹⁸ ₄	.....	225-7	.....	.....	.....
648							
649							
650							
651							
652							
653							
654							
655	yel. liq.,	0.986 ²⁰ ₄	-57.0	195.7	v. sl. s.	s.	∞ eth.; s. chl.
655	1.57021 ^{21.2}						

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
655M	Aniline, <i>N</i>-methyl-, hydrochloride	.....	$C_6H_5NHCH_3 \cdot HCl$	143.62
656	—, <i>p</i> -methylamino-	See <i>p</i> -Phenylenediamine, <i>N</i> -methyl-	.....	.....
657	—, <i>N</i> -methyl- <i>o</i> -nitro-	.....	$NO_2C_6H_4NHCH_3$	152.15
658	—, <i>N</i> -methyl- <i>m</i> -nitro-	.....	$NO_2C_6H_4NHCH_3$	152.15
659	—, <i>N</i> -methyl- <i>p</i> -nitro-	.....	$NO_2C_6H_4NHCH_3$	152.15
660	—, <i>N</i> -methyl- <i>p</i> -nitroso-	.....	$NOC_6H_4NHCH_3$	136.15
661	—, <i>N</i> -methyl- <i>N</i> -nitroso-	methylphenylnitrosamine	$C_6H_5N(CH_3)NO$	136.15
662	—, <i>N</i> -methyl- <i>N</i> , 2, 4, methylene-	6-tetranitro- . See Tetryl.	.....	.....
663	—, <i>p</i> , <i>p'</i> -methylene-	See <i>s</i> -Triazine, hexahydro-1,3,5-triphenyl-	$CH_2[C_6H_4N(CH_3)]_2$	254.36
664	—, <i>p</i> , <i>p'</i> -methylene-bis- <i>N</i> , <i>N</i> -dimethyl-	<i>p</i> , <i>p'</i> -tetramethyldiaminodiphenylmethane	$NH_2C_6H_4CH_2C_6H_4NH_2$	198.26
666	—, <i>p</i> , <i>p'</i> -methylene-di-	4,4'-diaminodiphenylmethane	$C_6H_4N(CH_3)NO$	136.15
667	—, <i>N</i> -methyl- <i>N</i> -nitroso-	methylphenylnitrosamine	$NO_2C_6H_4NH_2$	138.12
668	—, <i>o</i> -nitro-	1-amino-2-nitrobenzene	$NO_2C_6H_4NH_2$	138.12
669	—, <i>m</i> -nitro-	1-amino-3-nitrobenzene	$NO_2C_6H_4NH_2$	138.12
670	—, <i>p</i> -nitro-	1-amino-4-nitrobenzene	$NO_2C_6H_4NH_2$	138.12
671	—, <i>N</i> -nitro-	phenylnitramine; nitranilide; diazobenzolic acid	$C_6H_5NHNO_2$	138.12
672	—, <i>p</i> -nitroso-	.....	$NOC_6H_4NH_2$	122.12
673	—, <i>ar</i> -pentabromo-	.....	$C_6Br_5NH_2$	487.66
674	—, <i>ar</i> -pentachloro-	.....	$C_6Cl_5NH_2$	265.37
675	—, <i>ar</i> -pentamethyl-	aminopentamethylbenzene	$C_6(CH_3)_5NH_2$	163.26
676	—, <i>p</i> -phenyl-	See <i>Xenylamine</i>.	.....	.....
677	—, <i>N</i> -phenyl-	See <i>Diphenylamine</i>*	.....	.....
678	—, phenylazo-	See <i>Azobenzene</i> , amino-	.....	.....
679	—, <i>N</i> -(2-propenyl)-	See <i>Aniline, N-allyl</i>-	.....	.....
680	—, <i>o</i> -propyl-	1-amino-2-propylbenzene	$CH_3CH_2CH_2C_6H_4NH_2$	135.20
681	—, <i>p</i> -propyl-	1-amino-4-propylbenzene	$CH_3CH_2CH_2C_6H_4NH_2$	135.20
682	—, <i>N</i> -propyl-	.....	$C_6H_5NHC_3H_7$	135.20
683	—, 2, 3, 4, 5-tetrachloro-	.....	$C_6HCl_4NH_2$	230.92
684	—, 2, 3, 5, 6-tetrachloro-	.....	$C_6HCl_4NH_2$	230.92
685	—, 2, 3, 4, 5-tetramethyl-	.....	$(CH_3)_4C_6HNNH_2$	149.23
686	—, 2, 3, 4, 6-tetramethyl-	See <i>Isoduridine</i>.	.....	.....
687	—, <i>p</i> , <i>p'</i> -thiodi-	4,4'-diaminodiphenyl sulfide; thioaniline	$S(C_6H_4NH_2)_2$	216.29
688	—, 2, 4, 6-tribromo-	.....	$Br_3C_6H_2NH_2$	329.85
689	—, 3, 4, 5-tribromo-	.....	$Br_3C_6H_2NH_2$	329.85
690	—, 2, 3, 4-trichloro-	.....	$Cl_3C_6H_2NH_2$	196.47
691	—, 2, 4, 5-trichloro-	.....	$Cl_3C_6H_2NH_2$	196.47

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
655M	need. ....	.....	121-122	.....	378.8 ²⁵	v. s.	i. eth., bz.; v. s. chl.
656	red need. f.	.....	36-7 (34)	d.	sl. s. h.	s.	s. eth.
657	pet. eth.	.....	.....	.....	i.	s.	s. eth.
658	red.-yel. need. f. al.	.....	66.0	.....	i.	sl. s.	sl. s. eth.; s. bz.; v. sl. s. lgr.
659	yel. need. f. al.	1.201 ¹⁵⁵	152	d.	i.	.....	.....
660	bl. fl. ....	.....	118	.....	.....	.....	.....
661	yel. liq., 1.5760 ^{222.7}	1.1277 ²⁰ / ₄	15	225 d.	i. (sl. s.)	s.	s. eth.
662	.....	.....	.....	.....	.....	.....	.....
663	.....	.....	.....	.....	.....	.....	.....
664	leaf. or tab. ....	.....	91-2	.....	i.	sl. s. c., s. h.	v. s. eth., bz., CS ₂
666	pearly leaf. f. bz.	.....	93 (77-84)	232 ¹¹	sl. s.	v. s.	v. s. eth.; s. bz.
667	yel. oil.	1.124 ²⁰ / ₄	12-5	225; 121 ¹³	.....	s.	s. eth.
668	or. rhomb. need. f. al.	1.442 ²⁰ / ₄	71.5	284.11 (270 d.)	0.126 ²⁵	15.8 ¹⁵ , 27.87 ²⁵	v. s. eth.
669	yel. rhomb. need. f. al.	1.430 ²⁰ / ₄	111.8	286; 306.35 (270 d.)	0.089 ²⁵	6.10 ²⁵	5.67 ²⁰ eth.
670	yel. monocl. need. f. al.	1.424	147.5	331.73 (260 d.)	0.08 ¹⁹ , 2.2 ¹⁰⁰	4.61 ²⁰	4.39 ²⁰ eth.
671	leaf. f. lgr. ....	.....	46	exp. 98	s.	v. s.	sl. s. lgr.
672	steel bl. need. f. bz.	.....	174	.....	s.	s.	s. bz.
673	need. ....	.....	222	261-2	.....	s.	.....
674	need. f. al. ....	.....	232	.....	.....	v. s.	v. s. eth.; sl. s. lgr.
675	monocl. f. al..	.....	152	278	i.	s.	s. eth.
676	.....	.....	.....	.....	.....	.....	.....
677	.....	.....	.....	.....	.....	.....	.....
678	.....	.....	.....	.....	.....	.....	.....
679	.....	.....	.....	.....	.....	.....	.....
680	liq.	0.949 ¹⁸	.....	222-4	i.	s.	s. eth.
681	liq. ....	.....	.....	224-6	sl. s.	.....	.....
682	pa. yel. oil.	0.949 ¹⁸ / ₄	.....	222	i.	v. s.	v. s. eth.
683	need. f. al. ....	.....	118	.....	.....	v. s.	v. s. eth.; s. bz., ac. a.
684	cr. f. lgr. ....	.....	90	.....	i.	s.	v. s. eth.
685	leaf. f. w. ....	.....	64-6	259-60	s. h.	v. s.	v. s. eth.; pet. eth.
686	.....	.....	.....	.....	.....	.....	.....
687	need. f. w. ....	.....	108-9 (105)	.....	v. sl. s.	s.	s. eth., h. bz.
688	col. rhomb. bi-pyr. need. f. bz.	2.35 ²⁰ / ₂₀	119	300	i.	sl. s.	s. eth., chl.
689	need. ....	.....	118-9	.....	i.	s.	s. eth.
690	need. f. lgr. ....	.....	67.5	291.5	.....	v. s.	s. lgr.
691	need. f. lgr. ....	.....	96	270	.....	v. s.	s. CS ₂ ; sl. s. lgr.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
692	Aniline, 2, 4, 6-tri-chloro-	<i>sym</i> -trichloroaniline.....	$\text{Cl}_3\text{C}_6\text{H}_2\text{NH}_2$	196.47
693	—, 2, 4, 5-trimethyl-	See <i>Pseudouridine</i> .		
694	—, 2, 4, 6-trimethyl-	See <i>Mesidine</i> .		
695	—, 2, 4, 6-trinitro-	picramide; "T.N.A.".....	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{NH}_2$...	228.12
695M	<i>p</i> -Anilinesulfonamide.	See <i>Sulfanilamide</i> .		
696	<i>o</i> -Anilinesulfonic acid.	See <i>Orthanilic acid</i> .		
697	<i>m</i> -Anilinesulfonic acid.	See <i>Metanilic acid</i> .		
698	<i>p</i> -Anilinesulfonic acid.	See <i>Sulfanilic acid</i> .		
699	Animal starch.	See <i>Glycogen</i> .		
700	Anisalcobol.	See <i>Anisyl alcohol</i> .		
701	Anisaldehyde.....	anisic aldehyde; <i>p</i> -methoxybenzaldehyde; <i>p</i> -anisaldehyde; aubepine.....	$\text{CH}_3\text{OC}_6\text{H}_4\text{CHO}$...	136.14
702	—, 3-hydroxy-	See <i>Isovanillin</i> .		
703	<i>o</i> -Anisaldehyde.	See <i>Benzaldehyde, o-methoxy-</i> .		
703M	Anisamide.....	<i>p</i> -methoxybenzamide.....	$p\text{-CH}_3\text{OC}_6\text{H}_4\text{-CONH}_2$	151.16
704	Anise camphor.....	See <i>Anethole</i> .		
705	Anisic acid.....	<i>p</i> -methoxybenzoic acid; <i>p</i> -anisic acid	$\text{CH}_3\text{OC}_6\text{H}_4\text{COOH}$	152.14
706	—, ethyl ester.....		$\text{CH}_3\text{OC}_6\text{H}_4\text{COOC}_2\text{H}_5$	180.20
707	—, methyl ester.....	methyl anisate.....	$\text{CH}_3\text{OC}_6\text{H}_4\text{-COOCH}_3$	166.17
708	—, piperazinium salt.....		$\text{C}_6\text{H}_{10}\text{N}_2 \cdot 2\text{C}_3\text{H}_5\text{O}_3$	390.43
709	—, 2-hydroxy-6-methyl-	See <i>Everninic acid</i> .		
710	Anisic aldehyde.	See <i>Anisaldehyde</i> .		
711	Anisidine, <i>N</i> -acetyl-	See <i>Acetaniside</i> .		
712	<i>o</i> -Anisidine.....	<i>o</i> -methoxyaniline.....	$\text{CH}_3\text{OC}_6\text{H}_4\text{NH}_2$...	123.15
713	<i>m</i> -Anisidine.....	<i>m</i> -methoxyaniline.....	$\text{CH}_3\text{OC}_6\text{H}_4\text{NH}_2$...	123.15
714	<i>p</i> -Anisidine.....	<i>p</i> -methoxyaniline.....	$\text{CH}_3\text{OC}_6\text{H}_4\text{NH}_2$...	123.15
714M	Anisoin.....	<i>p</i> , <i>p'</i> -dimethoxybenzoin.....	$\text{C}_{16}\text{H}_{10}\text{O}_4$	272.29
715	Anisole.....	methoxybenzene*; methyl phenyl ether	$\text{C}_6\text{H}_5\text{OCH}_3$	108.13
716	—, <i>p</i> -acetamido-	See <i>p</i> -Acetaniside.		
717	—, <i>p</i> -acetyl-	See <i>Acetophenone, p-methoxy-</i> .		
718	—, <i>p</i> -allyl-	See <i>Estragole</i> .		
719	—, <i>o</i> -bromo.....	1-bromo-2-methoxybenzene*; <i>o</i> -bromophenyl methyl ether	$\text{BrC}_6\text{H}_4\text{OCH}_3$	187.04
720	—, <i>p</i> -bromo.....	1-bromo-4-methoxybenzene*; <i>p</i> -bromophenyl methyl ether	$\text{BrC}_6\text{H}_4\text{OCH}_3$	187.04
721	—, 2,4-dinitro.....	2,4-dinitrophenyl methyl ether	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{OCH}_3$	198.13
722	—, <i>o</i> -hydroxy-	See <i>Guaiacol</i> .		
723	—, <i>o</i> -nitro.....	1-methoxy-2-nitrobenzene...	$\text{NO}_2\text{C}_6\text{H}_4\text{OCH}_3$...	153.13
724	—, <i>m</i> -nitro.....	1-methoxy-3-nitrobenzene...	$\text{NO}_2\text{C}_6\text{H}_4\text{OCH}_3$...	153.13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
692	lng. need. f. lgr.	.....	77.5	262.4	i.	v. s.	s. eth.; v. s. lgr.
693							
694							
695	yel. monocl. need. f. ac. a.	1.762	188	exp.	0.106	0.127	0.121 ¹⁷ eth., s. ac. a.
695M							
696							
697							
698							
699							
700							
701	col. liq., 1.5764 ^{112.7}	1.123 ²⁰ ₄	2.5	247	0.2 c.	∞	∞ eth.
702							
703							
703M	col. need. or tab.	.....	166.5-7.5	.....	s.	v. s.	.....
704							
705	col. monocl. need. or pr.	1.385 ⁴ ₄	184.2	280	0.04 ¹⁸	80 ²⁵	s. eth., chl., et. ac.
706		1.1028 ¹⁵ ₁₅	7	269; 134-5 ²⁰	i.	s.	s. eth.
707	col. sc. f. al...	.....	48	256	i.	s.	s. eth.
708	wh. cr.....	.....	172-4	.....	sl. s.	s. h.	i. eth.
709							
710							
711							
712	col. liq., 1.57536 ²⁰	1.108 ²⁶ ; 1.0923 ²⁰ ₄	5.2 (3-4)	225 (218)	sl. s.	s.	s. eth., dil. min. a.
713	col. liq.....	1.096 ²⁰ ₄	<-12	251	sl. s.	s.	s. eth.
714	rhomb. pl., 1.55592 ⁶⁷	1.071 ⁵⁵ ₄	59 (57.7)	240 (245)	v. sl. s.	v. s.	v. s. eth.
714M	pr.....	1.0605 ⁶⁷	113	.....	sl. s. h.	s. h.	sl. s. eth.
715	col. liq., 1.51791 ²⁰	0.9988 ¹⁵ ₁₅ ; 0.9954 ²⁰ ₄	-37.3	155, 42.8 ¹⁰	i.	s.	s. eth.
716							
717							
718							
719	oil, 1.57245....	1.5018 ²⁰ ₄	.....	221-3	i.	v. s.	v. s. eth.
720	cr. f. eth., 1.56051 ²⁰	1.4569 ²⁰ ₄	11-12	215, 100 ¹⁶	7.1	v. s.	v. s. eth., CHCl ₃
721	col.-yel. monocl. need. f. w. or al.	1.341 ²⁰ ₄	88-9 (95.2)	subl.	sl. s. h.	1.5 ²⁰ s. h.	s. eth.
722							
723	col. liq., 1.56198 ²⁰	1.2527 ²⁰ ₄	9.4 (10)	277 (272)	i. c.; 0.169 ³⁰	∞	∞ eth.
724	need. f. al.....	1.373 ¹⁸	38	258	i.	s.	v. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
725	Anisole, <i>p</i>-nitro-	1-methoxy-4-nitrobenzene....	$\text{NO}_2\text{C}_6\text{H}_4\text{OCH}_3$	153.13
726	—, <i>p</i>-propenyl-	See <i>Anethole</i> .		
727	—, 2,4,6-trinitro-	picric acid methyl ether; methyl picrate	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{OCH}_3$..	243.13
728	—, <i>o</i>-vinyl	<i>o</i> -methoxystyrene.....	$\text{CH}_2:\text{CHC}_6\text{H}_4\text{OCH}_3$	134.17
729	—, <i>m</i>-vinyl	<i>m</i> -methoxystyrene.....	$\text{CH}_2:\text{CHC}_6\text{H}_4\text{OCH}_3$	134.17
730	—, <i>p</i>-vinyl	<i>p</i> -methoxystyrene.....	$\text{CH}_2:\text{CHC}_6\text{H}_4\text{OCH}_3$	134.17
731	Anisoyl chloride	<i>p</i> -methoxybenzoyl chloride; anisyl chloride	$\text{CH}_3\text{OC}_6\text{H}_4\text{COCl}$..	179.59
732	Anisyl alcohol	<i>p</i> -methoxybenzyl alcohol; anisalcohol	$\text{CH}_3\text{OC}_6\text{H}_4\text{CH}_2\text{OH}$	138.16
732M	Anisylamine	See <i>Benzylamine, p-methoxy-</i> .		
733	Anisyl chloride	See <i>Anisoyl chloride</i> .		
734	Anol	<i>p</i> -propenylphenol.....	$\text{CH}_3\text{CH}:\text{CHC}_6\text{H}_4\text{OH}$	134.17
735	Anthracene		$\text{C}_6\text{H}_4:(\text{CH})_2\text{C}_6\text{H}_4$..	178.22
736	—, α-hexahydride	See <i>Anthracene, α-hexahydro-</i> .		
737	—, amino-	See <i>Anthrylamine</i> .		
738	—, diamino-	See <i>Anthradiamine</i> .		
739	—, 9,10-dibromo-*		$\text{C}_6\text{H}_4(\text{CBr})_2\text{C}_6\text{H}_4$..	336.04
740	—, 9,10-dichloro-*	<i>ms</i> -dichloroanthracene.....	$\text{C}_6\text{H}_4(\text{CCl})_2\text{C}_6\text{H}_4$..	247.12
741	—, 9,10-dihydro-*	anthracene 9,10-dihydride...	$\text{C}_6\text{H}_4:(\text{CH}_2)_2\text{C}_6\text{H}_4$	180.24
742	—, 9,10-dihydro-9-ke to-.	See <i>Anthrone</i> .		
743	—, dihydroxy-	See <i>Anthracenediol</i> .		
744	—, 9,10-dihydroxy-9,10-diketo-	See <i>Anthraquinone</i> .		
744M	—, 1,3-dimethyl-*		$\text{C}_{14}\text{H}_8(\text{CH}_3)_2$	206.27
745	—, 2,3-dimethyl-*		$\text{C}_{14}\text{H}_8(\text{CH}_3)_2$	206.27
746	—, 2,4-dimethyl-*		$\text{C}_{14}\text{H}_8(\text{CH}_3)_2$	206.27
747	—, 9-ethyl-*		$\text{C}_6\text{H}_4\text{CH}(\text{C}_2\text{H}_5)-\text{C}_6\text{H}_4$	206.27
748	—, 9-ethyl-9,10-dihydro-		$\text{C}_6\text{H}_4\text{C}_2\text{H}_5(\text{C}_2\text{H}_5)-\text{C}_6\text{H}_4$	208.29
749	—, α-hexahydro-	anthracene α -hexahydride....	$\text{C}_{14}\text{H}_{16}$	184.27
750	—, hydroxy-	See <i>Anthrol</i> .		
751	—, 9-hydroxy-	See <i>Anthranol</i> .		
752	—, 1-methyl	α -methylanthracene.....	$\text{C}_6\text{H}_4(\text{CH}_2)\text{C}_6\text{H}_3-\text{CH}_3$	192.25
753	—, 2-methyl	β -methylanthracene.....	$\text{C}_6\text{H}_4(\text{CH}_2)-\text{C}_6\text{H}_3\text{CH}_3$	192.25
754	—, 9-methyl		$\text{C}_6\text{H}_4\text{C}(\text{CH}_3)-\text{CHC}_6\text{H}_4$	192.25
755	—, 9-nitro		$\text{C}_{14}\text{H}_9\text{NO}_2$	223.22
756	—, 9-phenyl		$\text{C}_{14}\text{H}_9\text{C}_6\text{H}_5$	254.31
756M	Anthracenecarboxylic acid	See <i>Anthroic acid</i> .		
757	Anthracenediamine	See <i>Anthradiamine</i> .		
758	1,2-Anthracenediol	1,2-anthradiol; 1,2-dihydroxyanthracene	$\text{C}_6\text{H}_4(\text{CH})_2\text{C}_6\text{H}_2-(\text{OH})_2$	210.22
759	1,5-Anthracenediol	See <i>Rufol</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
725	col. monoc. pr. f. al., 1.57072 ⁶⁰	1.233 $\frac{20}{4}$; 1.2192 $\frac{60}{4}$	54	260 (274)	0.007 ¹⁵ ; 0.0589 ³⁰	s.	v. s. eth.; sl. s. c. pet. eth.
726							
727	col. monoc. pl. f. al.	1.408 $\frac{20}{4}$	68.4	.....	i.	s.	s. eth., bz., ac. a.
728	arom. liq., 1.556	1.0095 $\frac{15}{4}$	.....	195-200, 83-4 ¹²	i.	s.	s. eth.
729	oil.....	.....	.....	89-90 ¹⁴	i.	s.	s. eth.
730	arom. liq.	1.0029 $\frac{15}{4}$	.....	204 ⁷⁵⁶ ; 90-1 ¹⁸	i.	s.	s. eth.
731	need.....	.....	27 (22-3)	145 ¹⁴	i.	s. d.	s. eth., acet.
732	need.....	1.109 $\frac{26}{4}$	25 (19-21)	258.8	i.	v. s.	v. s. eth.
732M							
733							
734	col. leaf. f. h. w.	.....	93	250 d.	sl. s. h.	s.	s. eth., alk., ord. org. solv.
735	col. monoc.	1.25 $\frac{27}{4}$	217 (213)	354-5	i.	0.076 ¹⁶ 0.83 ⁷⁸	1.189 eth.; 1.767 chl.; 1.500 CS ₂ ; 7.5 ³⁰ bz.
736							
737							
738							
739	yel. need. f. xylene or tol.	.....	221 (226)	subl.	i.	sl. s.	sl. s. eth., c. bz.; s. chl., h. bz., h. tol.
740	yel. need. f. CCl ₄	.....	209-10	.....	.....	sl. s.	sl. s. eth.; s. bz.
741	col. tricl. or monoc. f. al.	0.8976 $\frac{11}{4}$	108.5	305 (313) subl.	i.	v. s.	v. s. eth.; s. bz.
742							
743							
744							
744M	pl. ....	.....	202-203	.....	i.	v. s.	v. s. eth.
745	col. fluores. leaf. f. bz.	.....	252 (246)	.....	.....	s.	v. s. bz.
746	need. f. al. ....	.....	71	.....	.....	s.	v. s. bz.
747	leaf. f. al., 1.6762 ^{99,2}	1.041 $\frac{99}{4}$	59	.....	i.	s.	s. eth.
748	oil.....	1.049 $\frac{18}{4}$	.....	320 sl. d.	i.	s.	s. eth.; ∞ bz.
749	col. leaf.....	.....	63	290	i.	v. s.	v. s. eth., bz.
750							
751							
752	col. leaf. f. al., 1.6803 ^{99,4}	1.047 $\frac{99}{4}$	86	200	i.	sl. s.	sl. s. eth.; s. bz., CS ₂
753	col. sc. ....	.....	207	subl.	i.	sl. s.	sl. s. eth.; s. bz., CS ₂
754	.....	1.066 $\frac{99}{4}$	80	.....	.....	.....	.....
755	yel. need. f. al.	.....	146	>360	.....	sl. s.	v. s. bz., CS ₂
756	leaf. f. al. ....	.....	153	417	.....	v. s.	v. s. eth.; s. h. bz.
756M							
757							
758	grnsh. leaf....	.....	160-2 (131 d.)	.....	.....	v. s.	v. s. eth.; s. ac. a., alk.
759							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
760	1,8-Anthracenediol* .	See <i>Chrysazol</i> .		
761	2,6-Anthracenediol* .	See <i>Flavol</i> .		
762	9,10-Anthracenediol* .	See <i>Oxanthranol</i> .		
763	Anthrachrysazin .	See <i>Anthrachrysone</i> .		
764	Anthrachrysone	1,3,5,7-tetrahydroxyanthraquinone; anthrachrysazin	$C_{14}H_4O_2 \cdot (OH)_4$...	272.20
765	9,10-Anthradiamine ...	9,10-anthracenediamine*; 9,10-diaminoanthracene	$C_{14}H_8(NH_2)_2$	208.25
766	Anthradiol .	See <i>Anthracenediol</i> .		
767	Anthraflavic acid	2,6-dihydroxyanthraquinone..	$HOC_6H_3(CO)_2-C_6H_3OH$	240.20
768	Anthragallol	1,2,3-trihydroxyanthraquinone	$C_6H_4(CO)_2C_6H(OH)_3$	256.20
769	Anthrahydroquinone .	See <i>Oxanthranol</i> .		
770	Anthramine .	See <i>Anthrylamine</i> .		
771	Anthranil		C_7H_5NO	119.12
772	Anthranilaldehyde ...	<i>o</i> -aminobenzaldehyde.....	$NH_2C_6H_4CHO$	121.13
773	Anthranilic acid	<i>o</i> -aminobenzoic acid.....	$NH_2C_6H_4COOH$...	137.13
774	—, ethyl ester.....	ethyl anthranilate; ethyl <i>o</i> -aminobenzoate	$NH_2C_6H_4COOC_2H_5$	165.19
775	—, methyl ester.....	methyl anthranilate.....	$NH_2C_6H_4COOCH_3$	151.16
776	—, <i>N</i> -acetyl.....	<i>o</i> -acetamidobenzoic acid....	$CH_3CONHC_6H_4COOH$	179.17
777	—, <i>N</i> -benzoyl.....	<i>o</i> -benzamidobenzoic acid.....	$C_6H_5CONHC_6H_4COOH$	241.24
778	—, <i>N</i> -carboxy-, anhydride.	See <i>Isatoic anhydride</i> .		
779	—, <i>N</i> -(carboxymethyl)-	phenylglycine- <i>o</i> -carboxylic acid; anthranilidoacetic acid	$HOOCCH_2NHC_6H_4COOH$	195.17
780	—, <i>N</i> -ethyl.....	<i>o</i> -ethylaminobenzoic acid; 2-ethylaminobenzenecarboxylic acid	$C_2H_5NHC_6H_4COOH$	165.19
781	—, <i>N</i> -methyl-, methyl ester		$CH_3NHC_6H_4COOCH_3$	165.19
782	—, 3-nitro	2-amino-3-nitrobenzoic acid..	$NO_2(NH_2)C_6H_3COOH$	182.13
783	—, 4-nitro	2-amino-4-nitrobenzoic acid..	$NO_2(NH_2)C_6H_3COOH$	182.13
784	—, 5-nitro	2-amino-5-nitrobenzoic acid..	$NO_2(NH_2)C_6H_3COOH$	182.13
785	—, 6-nitro	2-amino-6-nitrobenzoic acid..	$NO_2(NH_2)C_6H_3COOH$	182.13
786	—, <i>N</i> -phenyl.....	<i>o</i> -anilinobenzoic acid.....	$C_6H_5NHC_6H_4COOH$	213.23
787	Anthranilonitrile	<i>o</i> -aminobenzonitrile; <i>o</i> -aminophenyl cyanide	$NH_2C_6H_4CN$	118.13
788	Anthranol	9-anthrol; 9-hydroxyanthracene	$C_{14}H_9 \cdot OH$	194.22
789	—, 9,10-dihydro	hydroanthranol.....	$C_6H_4CHOHC_6H_4CH_2$	196.24
790	Anthranylamine .	See 9- <i>Anthrylamine</i> .		
791	Anthrapurpurin	1,2,7-trihydroxyanthraquinone; isopurpurin	$HOC_6H_3(CO)_2-C_6H_2(OH)_2$	256.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
760							
761							
762							
763							
764	silky yel. need. (+2H ₂ O)	.....	>360	-H ₂ O, 150, subl.	i.	s.	v. sl. s. eth.; s. ac. a., acet., chl., CS ₂ , bz., lgr.
765	pa. yel. leaf...	.....	160-6	.....	i.	.....	.....
766							
767	yel. need. f. al.	.....	330	subl.	i.	1.10 ¹⁷	i. eth.; s. conc. H ₂ SO ₄ ; sl. s. ac. a.; i. bz., chl.
768	or. red need. f. dil. ac. a.	.....	310 d.	subl. 290	v. sl. s.	s.	s. eth., ac. a.; sl. s. chl., CS ₂
769							
770							
771	col. oil, 1.5861	1.187 ¹⁵ / ₄	<-18	215	sl. s. h.	s.	s. ord. org. solv.
772	silv. leaf.....	.....	39-40	d.	sl. s.	v. s.	v. s. eth.; s. chl., bz., lgr.
773	col. trim. rhomb. leaf.	.....	145	subl.	0.35 ¹⁴	10.7 ^{9,6}	16.0 ⁷ eth.
774	cr.....	1.1174	13	260 (266-8); 135-6 ¹²	v. sl. s.	s.	s. eth.
775	col. liq.....	1.168 ¹⁵ / ₄	8.2; 24.5	135.5 ¹⁵	s.	v. s.	v. s. eth.
776	rhomb. f. ac. a.	.....	185	.....	sl. s. c., s. h.	s. h.	s. eth., bz., h. ac. a.
777	lng. need. f. al.	.....	181	.....	i.	s.	s. eth.
778							
779	need. f. me. al.	.....	215 (218-20)	.....	sl. s.	s.	s. eth.; i. bz.
780	pr.....	.....	152-3	.....	.....	s.	s. eth.
781				256	i.	s.	s. eth.
782	yel. need. f. w.	1.558 ¹⁵ / ₄	204	.....	i.	v. s.	v. s. eth.
783	red need.....	.....	264 (269.5)	.....	sl. s. h.	v. s.	v. s. eth.; m xylene
784	yel. need.....	.....	263 (270-80d.)	.....	s. h.	s.	s. eth.
785	yel. leaf. f. w.	.....	183-4 d.	.....	s. h.	v. s.	v. s. eth.
786	need. f. al.....	.....	181 (182-3)	>184 d.	v. sl. s. h.	v. s. h.	s. eth.
787	col.-ylsh. pr...	.....	50	264-6	.....	s.	s. eth.
788	pa. yel. need..	.....	170 d.(120)	.....	i.	s.	v. s. h. bz.; s. alk., ac. a.
789	need. f. pet. eth.	.....	76	.....	s. h.	s.	s. eth.
790							
791	or. need. f. al.	.....	369	462 d.	sl. s. h.	v. s.	sl. s. eth.; s. h. ac. a.; v. sl. s. chl., bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
792	α-Anthraquinoline.	See <i>Naphtho</i> -[2, 3- <i>f</i>] <i>quinoline</i> .		
793	Anthraquinonazine, <i>N</i>, <i>N'</i>-dihydro-	See <i>Indanthrone</i> .		
794	Anthraquinone	9,10-dihydro-9,10-diket. anthracene	$C_6H_4:(CO)_2:C_6H_4$	208.20
795	—, 1-amino-	α -anthraquinonylamine	$C_6H_4(CO)_2C_6H_3NH_2$	223.22
796	—, 2-amino-	β -anthraquinonylamine	$NH_2C_6H_3(CO)_2C_6H_4$	223.22
797	—, 2-amino-1-hydroxy-	β -alizarin amide	$C_{14}H_6O_2.(OH)NH_2$	239.22
798	—, 1-bromo-		$C_6H_4(CO)_2C_6H_3Br$	287.11
799	—, 2-bromo-		$C_6H_4(CO)_2C_6H_3Br$	287.11
800	—, 1-chloro-		$C_6H_4(CO)_2C_6H_3Cl$	242.65
801	—, 2-chloro-		$C_6H_4(CO)_2C_6H_3Cl$	242.65
805	—, 1, 2-diamino-		$C_6H_4(CO)_2C_6H_2(NH_2)_2$	238.24
806	—, 1, 3-diamino-		$C_6H_4(CO)_2C_6H_2(NH_2)_2$	238.24
807	—, 1, 4-diamino-		$C_6H_4(CO)_2C_6H_2(NH_2)_2$	238.24
808	—, 1, 5-diamino-		$NH_2C_6H_3(CO)_2C_6H_3NH_2$	238.24
809	—, 1, 6-diamino-		$NH_2C_6H_3(CO)_2C_6H_3NH_2$	238.24
810	—, 1, 7-diamino-		$NH_2C_6H_3(CO)_2C_6H_3NH_2$	238.24
811	—, 1, 8-diamino-		$NH_2C_6H_3(CO)_2C_6H_3NH_2$	238.24
812	—, 2, 3-diamino-		$C_6H_4(CO)_2C_6H_2(NH_2)_2$	238.24
813	—, 2, 6-diamino-		$NH_2C_6H_3(CO)_2C_6H_3NH_2$	238.24
814	—, 2, 7-diamino-		$NH_2C_6H_3(CO)_2C_6H_3NH_2$	238.24
815	—, 2, 3-dibromo-	β -dibromoanthraquinone	$C_6H_4(CO)_2C_6H_2Br_2$	366.02
816	—, 2, 7-dibromo-		$C_6H_3Br(CO)_2C_6H_3Br$	366.02
817	—, 1, 2-dihydroxy-	See <i>Alizarin</i> .		
818	—, 1, 3-dihydroxy-	See <i>Purpuroxanthin</i> .		
819	—, 1, 4-dihydroxy-	See <i>Quinizarin</i> .		
820	—, 1, 5-dihydroxy-	See <i>Anthrarufin</i> .		
821	—, 1, 8-dihydroxy-	See <i>Chrysazin</i> .		
822	—, 2, 3-dihydroxy-	See <i>Hyslazarin</i> .		
823	—, 2, 6-dihydroxy-	See <i>Anthraflavic acid</i> .		
824	—, 2, 7-dihydroxy-	See <i>Isoanthraflavic acid</i> .		
825	—, 1, 3-dinitro-		$C_6H_4(CO)_2C_6H_2(NO_2)_2$	298.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
792							
793							
794	ylsh. rhomb.	1.419 ⁻²⁰ ₄	286 subl.	379-81	i.	0.051 ¹⁰ ; 2.37 ⁰	v. sl. s. eth.; 6.4 ¹⁰⁰ tol.; sl. s. bz.
795	red need.		252 (243)	subl.	i.	s.	s. eth., chl., bz., acet.
796	red need. f. al.		302	subl.	i.	s.	sl. s. eth.; s. chl., bz., acet.
797	br. need. f. al.		226-7	subl.	i.	s.	s. eth.; sl. s. NH ₄ OH
798	yel. need. f. bz.		188	subl.	.....	s.	s. conc. H ₂ SO ₄
799	yel. need. f. amyl al.		204-5	subl.	.....	sl. s.	s. h. bz.
800	yel. need.		162	subl.	i.	sl. s.	i. eth.; s. ac. a., nitro-bz., amyl al., h. bz.
801	pa. yel. need. f. ac. a. or al.		211(203-5)	subl.	i.	sl. s.	i. eth.; s. h. bz., nitro-bz., conc. H ₂ SO ₄
805	vl. cr., grn. cast		303 (242-4)	.....	.....	.....	s. pyr., aniline; sl. s. chl., xylene
806	brick red cr. f. PhNO ₂		290	.....	.....	.....	s. h. PhNO ₂
807	dk. vlt. cr. f. al.		268	.....	sl. s. h.	v. s.	s. bz., pyr., nitro-bz., ani- line
808	red need. f. al. or ac. a.		319	subl.	v. sl. s.	sl. s.	sl. s. eth.; s. h. nitro-bz.; sl. s. bz., chl., acet.
809	red cr.		292	.....	.....	.....	s. h. PhNO ₂
810	red cr.		290	.....	.....	.....	s. h. PhNO ₂
811	red cr. f. al.		262	.....	i.	v. s.	sl. s. eth.; s. ac. a., nitro-bz., pyr.
812	red cr.		>320	.....	.....	.....	s. nitro-bz., pyr., H ₂ SO ₄ ; sl. s. chl.
813	redsh.-br. pr. f. h. pyr.		310-20 d.	.....	.....	s. h.	i. chl., xylene
814	or. cr. f. al. or nitro-bz.		>330	subl.	i.	sl. s.	sl. s. eth.; s. conc. a.
815	yel. need.		281 (269-70)	subl.	.....	v. sl. s.	s. chl., bz.
816	yel. need. or pl.		236.5	subl.	.....	v. sl. s. h.	s. bz., h. ac. a.
817							
818							
819							
820							
821							
822							
823							
824							
825	yel. need.		240 (246-50)	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
826	Anthraquinone, 1, 5-dinitro-	.....	$\text{NO}_2\text{C}_6\text{H}_3(\text{CO})_2\text{C}_6\text{H}_3\text{NO}_2$	298.20
827	—, 1,2,3,5,6,7-hexahydroxy-	droxy- . See <i>Rufigallic acid</i>		
828	—, 1(or α)-hydroxy-	erythrohydroxyanthraquinone	$\text{C}_6\text{H}_4(\text{CO})_2\text{C}_6\text{H}_3\text{OH}$	224.20
829	—, 2(or β)-hydroxy-	.....	$\text{C}_6\text{H}_4(\text{CO})_2\text{C}_6\text{H}_3\text{OH}$	224.20
830	—, 2-methyl-	.....	$\text{C}_6\text{H}_4(\text{CO})_2\text{C}_6\text{H}_3\text{CH}_3$	222.23
831	—, 1-nitro-	.....	$\text{NO}_2\text{C}_6\text{H}_3(\text{CO})_2\text{C}_6\text{H}_4$	253.20
832	—, 2-nitro-	.....	$\text{NO}_2\text{C}_6\text{H}_3(\text{CO})_2\text{C}_6\text{H}_4$	253.20
833	—, 1,2,5,6-tetrahydroxy-	oxy- . See <i>Rufopin</i> .		
834	—, 1,2,5,8-tetrahydroxy-	oxy- . See <i>Quinalizarin</i> .		
835	—, 1,3,5,7-tetrahydroxy-	oxy- . See <i>Anthrachrysone</i> .		
836	—, 1,2,3-trihydroxy-	See <i>Anthragallol</i> .		
837	—, 1,2,4-trihydroxy-	See <i>Purpurin</i> .		
838	—, 1,2,5-trihydroxy-	2-hydroxyanthrarufin.....	$\text{HOC}_6\text{H}_3(\text{CO})_2\text{C}_6\text{H}_2(\text{OH})_2$	256.20
839	—, 1,2,6-trihydroxy-	See <i>Flavopurpurin</i> .		
840	—, 1,2,7-trihydroxy-	See <i>Anthrapurpurin</i> .		
841	—, 1,2,8-trihydroxy-	2-hydroxychrysazin.....	$\text{HOC}_6\text{H}_3(\text{CO})_2\text{C}_6\text{H}_2(\text{OH})_2$	256.20
842	—, 1,3,8-trihydroxy-	6-methyl- . See <i>Emodin</i> .		
843	2-Anthraquinonecarboxylic acid, 5,6 (or 7,8)-dihydroxy-	xylic acid, 5,6 (or 7,8)-dihydroxy- . See <i>Anthraquinone, 1-amino-</i> .		
844	α-Anthraquinonylamine.	ne. See <i>Anthraquinone, 2-amino-</i> .		
845	β-Anthraquinonylamine.	ne. See <i>Anthraquinone, 2-amino-</i> .		
846	Anthrarufin.	1,5-dihydroxyanthraquinone..	$\text{HOC}_6\text{H}_3(\text{CO})_2\text{C}_6\text{H}_3\text{OH}$	240.20
847	—, 2-hydroxy-	See <i>Anthraquinone, 1,2,5-trihydroxy-</i> .		
848	1-Anthroic acid.	1-anthracenecarboxylic acid*; α -anthroic acid	$\text{C}_{14}\text{H}_9\text{COOH}$	222.23
849	2-Anthroic acid.	2-anthracenecarboxylic acid*; β -anthroic acid	$\text{C}_{14}\text{H}_9\text{COOH}$	222.23
850	9-Anthroic acid.	9-anthracenecarboxylic acid*; <i>ms</i> -anthroic acid	$\text{C}_{14}\text{H}_9\text{COOH}$	222.23
851	1-Anthrol.	1-hydroxyanthracene.....	$\text{C}_{14}\text{H}_9\text{OH}$	194.22
852	2-Anthrol.	2-hydroxyanthracene.....	$\text{C}_{14}\text{H}_9\text{OH}$	194.22
853	9-Anthrol.	See <i>Anthranol</i> .		
854	Anthrone.	9,10-dihydro-9-ketoanthracene	$\text{C}_{14}\text{H}_{10}\text{O}$	194.22
855	—, 10-hydroxy-	See <i>Oxanthranol</i> .		
856	1-Anthrylamine.	α -anthramine; 1-aminoanthracene	$\text{C}_{14}\text{H}_{11}\text{N}$	193.24
856M	2-Anthrylamine.	β -anthramine; 2-aminoanthracene	$\text{C}_{14}\text{H}_{11}\text{N}$	193.24
856T	9-Anthrylamine.	9-aminoanthracene; <i>meso</i> -anthramine; anthranilamine	<div style="text-align: center;"> $\begin{array}{c} \text{C}(\text{NH}_2) \\ \diagup \quad \diagdown \\ \text{C}_6\text{H}_4 \quad \text{C}_6\text{H}_4 \\ \diagdown \quad \diagup \\ \text{CH} \end{array}$ </div>	193.24
857	Antifebrin.	See <i>Acetanilide</i> .		
858	Antimony, pentamethyl-*	.....	$\text{Sb}(\text{CH}_3)_5$	196.93

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
826	pa. yel. need. f. nitro-bz. or xylene	.....	384-5	subl.	i.	v. sl. s.	v. sl. s. eth., bz.; s. h. nitro-bz., h. xylene; sl. s. ac. a.
827							
828	or. cr. f. al. ....	.....	190	subl.	i.	s.	s. eth.
829	yel. leaf. or need. f. al.	.....	302	subl.	v. sl. s.	s.	s. eth.
830	col-ylsh. need. f. al.	.....	175-7	subl.	.....	v. sl. s.	s. eth., conc. H ₂ SO ₄ ; v. s. bz.
831	yel. need. f. ac. a.	.....	230	270 ⁷ subl.	i.	sl. s.	sl. s. eth.
832	yel. need. f. al.	.....	181	subl.	i.	sl. s.	sl. s. eth.; v. s. chl.; s. H ₂ SO ₄
833							
834							
835							
836							
837							
838	red need. ....	.....	273-4	subl.	i.	.....	s. eth.
839							
840							
841	or. need. ....	.....	230	subl.	i.	v. sl. s.	.....
842							
843	<i>Alizarincarboxylic acid.</i>						
844							
845							
846	pa. yel. leaf. f. ac. a.	.....	280	subl.	v. sl. s.	sl. s.	sl. s. eth., acet.; s. bz., alk.
847							
848	yel. need. ....	.....	245	subl.	i.	sl. s.	sl. s. eth., bz., chl.
849	yel. leaf. ....	.....	281	subl.	i.	sl. s.	sl. s. eth., chl.; s. ac. a.; i. bz., CS ₂
850	pa. yel. need. f. al.	.....	217 d. (206)	d.	sl. s. h.	s.	.....
851	br. need. or leaf. f. a.	.....	d. 150-3	200 d.	i.	v. s.	v. s. eth.; s. NaOH, org. solv.
852	brnsh. need. ....	.....	d. 200	.....	i.	v. s.	v. s. eth.; s. acet.
853							
854	col. need. ....	.....	154-5	.....	i.	s.	s. bz., h. NaOH
855							
856			119 (130)	.....	.....	.....	.....
856M	yel. need. ....	.....	236-7	.....	i.	sl. s.	sl. s. eth.
856T	yel. cr. ....	.....	145-50	.....	.....	s.	s. eth., chl., bz.
857							
858				96-100	i.	s.	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
859	Antimony, triethyl-*	See <i>Stibine, triethyl-</i> .		
860	—, trimethyl-*	See <i>Stibine, trimethyl-</i> .		
860M	Antineuritic vitamin.	See <i>Vitamin B₁</i> .		
861	Antipyrine	1,5-dimethyl-2-phenyl-3-pyrazolone; analgesine; phenazone	$\text{N}(\text{CH}_3)\text{N}(\text{C}_6\text{H}_5)-\text{COCH:C}(\text{CH}_3)$	188.22
862	—, salicylate.	See <i>Salipyrine</i> .		
863	Antipyrine chloral hydrate.	See <i>Hypnal</i> .		
864	Antiscorbutin.	See <i>L-Ascorbic acid</i> .		
865	Antiseptin.	See <i>Acetanilide, p-bromo-</i> .		
866	Aphrodine.	See <i>Yohimbine</i> .		
867	Apiole	2,5-dimethoxy safrole; apiol; parsley camphor	$\text{CH}_2\text{:CHCH}_2\text{C}_6\text{H}(\text{OCH}_3)_2(\text{CH}_2\text{O}_2)$	222.23
868	Apoatropine	atropamine.....	$\text{C}_{17}\text{H}_{21}\text{NO}_2$	271.35
869	—, hydrochloride.....		$\text{C}_{17}\text{H}_{21}\text{NO}_2\cdot\text{HCl}$...	307.81
870	Apocodeine		$\text{C}_{18}\text{H}_{19}\text{NO}_2$	281.34
871	Apomorphine		$\text{C}_{17}\text{H}_{17}\text{NO}_2$	267.32
872	—, hydrochloride.....		$\text{C}_{17}\text{H}_{17}\text{NO}_2\cdot\text{HCl}$...	303.78
873	Apoquinine		$\text{C}_{19}\text{H}_{22}\text{N}_2\text{O}_2\cdot 2\text{H}_2\text{O}$...	346.42
874	Aposafrazone	10-phenyl-2(10)-phenazino- one; benzeneindone	$\text{C}_6\text{H}_4(\text{NC}_6\text{H}_5)-(\text{N})\text{C}_6\text{H}_3\text{:O}$	272.29
876	Arabinose , diphenylhydrazine		$\text{C}_6\text{H}_{10}\text{O}_4\text{N}(\text{C}_6\text{H}_5)_2$	316.35
877	dl-Arabinose	pectinose.....	$\text{C}_6\text{H}_{10}\text{O}_5$	150.13
878	α-Arabinose (d or l) ...		$\text{C}_6\text{H}_{10}\text{O}_5$	150.13
879	d-Arabitol	arabite; 1,2,3,4,5-pentane- pentol* (one form)	$\text{C}_6\text{H}_7(\text{OH})_5$	152.15
880	Arabonic acid	α, β, γ, δ-tetrahydroxy- valeric acid (one form)	$\text{CH}_2\text{OH}(\text{CHOH})_3\text{COOH}$	166.13
881	Arachic alcohol.	See <i>1-Eicosanol*</i> .		
882	Arachidic acid	eicosanoic acid*; arachic acid; n-eicosoic acid	$\text{CH}_3(\text{CH}_2)_{18}\text{COOH}$	312.52
883	—, ethyl ester.....		$\text{C}_{19}\text{H}_{39}\text{COOC}_2\text{H}_5$...	340.58
884	—, methyl ester.....		$\text{C}_{19}\text{H}_{39}\text{COOCH}_3$...	326.55
885	Arbutin	arbutoside.....	$\text{C}_{12}\text{H}_{16}\text{O}_7$...	272.25
886	Arecaidine, arecaine ...	1-methylguvacine; 1,2,5,6- tetrahydro-1-methyl- nicotinic acid	$\text{C}_7\text{H}_{11}\text{NO}_2\cdot\text{H}_2\text{O}$...	159.18
887	—, methyl ester.	See <i>Arecoline</i> .		
888	Arecoline	arecaidine methyl ester; meth- yl 1, 2, 5, 6-tetrahydro-1- methylnicotinate	$\text{C}_8\text{H}_{13}\text{NO}_2$	155.19
889	—, hydrobromide.....		$\text{C}_8\text{H}_{13}\text{NO}_2\cdot\text{HBr}$...	236.12
890	—, hydrochloride.....		$\text{C}_8\text{H}_{13}\text{NO}_2\cdot\text{HCl}$...	191.66

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
859							
860							
860M							
861	leaf. or sc. f. eth., bz. or w., 1.5697, 1.6935, 1.7324	1.19 ²⁰ / ₄	114 (109)	319 ¹⁷⁴	100	100	2.6 eth.; sl. s. lgr.
862							
863							
864							
865							
866							
867	col. need., 1.5380 ¹⁴ liq.; α1.583, β1.73 sol.	1.015 ²⁰ / ₄	29.5	294	v. sl. s.	s.	s. eth.
868	wh. pr. ....	.....	62	.....	sl. s.	v. s.	v. s. eth.; s. chl., CS ₂ , bz. s. eth.
869	col. cr. ....	.....	237-9	.....	s.	s.	s. eth.
870	pl. f. al. ....	.....	100-10 d.	.....	v. sl. s.	s.	s. eth.
871	wh. pr. f. eth., turns grn. in air	.....	170 d.	.....	sl. s.	s.	s. eth., bz.; v. s. chl., sl. s. HCl
872	monocl. pr., grn. on expos. to lt.	.....	200-10 d.	.....	2 ²⁵	2.47 ²⁵	0.0536 ²⁵ eth.; v. sl. s. chl.
873	need. f. eth. ....	.....	210 d.	.....	s. h.	s.	v. s. eth.; s. chl., bz., CS ₂ , KOH
874	dk. red met. cr. ....	.....	242 (248-9)	.....	sl. s.	s.	s. bz.; i. alk.
876	col. need., [α] +18.5 ²⁰ _D in pyr.	.....	197-204	.....	v. sl. s.	s. h.	.....
877	col. rhomb.	1.585 ²⁰ / ₄	164.5	.....	16.9 ¹⁰	0.35 h.	i. eth.
878	rhomb. pr.; l, [α] +105 ²⁰ _D in w.	1.585 ²⁰ / ₄	159.5	.....	58.9 ¹⁰	0.5 90%	i. eth.
879	col. warts or pr.	.....	103	.....	v. s.	2.08 ¹² 90%	i. eth.
880	cr. or syrup. ....	.....	89	d., -H ₂ O	v. v. s.	.....	.....
881							
882	lust. sc.	0.824 ¹⁰⁰ / ₄	76.3	328	i.	0.45 ²⁰	v. s. eth.
883	cr. ....	.....	50	295-7 ¹⁰⁰	i.	s.	s. eth.
884	cr. ....	.....	54.5	286 ¹⁰⁰	i.	s.	s. eth.
885	col. silky need.	.....	195	.....	12.5	6.67	i. eth., chl., CS ₂
886	.....	.....	224 d.	.....	v. s.	i.	i. eth.
887							
888	oily alk. liq. ....	.....	.....	220	∞	∞	∞ eth.; s. chl.
889	pr. f. al. ....	.....	168	.....	s.	s. h.	sl. s. eth., chl.
890	wh. cr. ....	.....	158	.....	s.	s.	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
891	<i>dl</i> -Arginine.....	<i>dl</i> - α -amino- δ -guanidovaleric acid; <i>dl</i> -N ⁶ -guanylorithine	NH ₂ C(:NH)NH-(CH ₂) ₃ CH(NH ₂)-COOH	174.21
892	<i>d</i> -Arginine.....	<i>d</i> - α -amino- δ -guanidovaleric acid	NH ₂ C(:NH)NH-(CH ₂) ₃ CH(NH ₂)-COOH	174.21
893	—, flavianate.....		C ₆ H ₁₄ N ₄ O ₂ .C ₁₀ H ₆ -N ₂ O ₈ S	488.43
893M	—, diflavianate.....		C ₆ H ₁₄ N ₄ O ₂ -(C ₁₀ H ₆ N ₂ O ₈ S) ₂	802.65
894	—, picrate.....		C ₆ H ₁₄ N ₄ O ₂ .C ₆ H ₃ -N ₃ O ₇ .2H ₂ O	439.35
895	Arsanilic acid.....	<i>p</i> -aminobenzenarsonic acid; <i>p</i> -aminophenylarsinic acid	NH ₂ C ₆ H ₄ AsO-(OH) ₂	217.04
897	Arsenic, bisdiethyl-.	See Biarsine, tetraethyl-.		
898	—, dimethyl-.	See Cacodyl.		
899	—, triethyl-.	See Arsine, triethyl-.		
900	Arsenic dichloride, methyl-.	See Arsine, dichloromethyl-.		
901	Arsenic oxide, bisdimethyl-.	See Cacodyl oxide.		
902	—, methyl-.	methyl arsinoxide.....	CH ₃ AsO.....	105.94
903	Arsenic sulfide, bisdimethyl-.	See Cacodyl sulfide.		
904	Arsenic trichloride, dimethyl-.	See Cacodyl trichloride.		
905	Arsenious chloride, diphenyl-.	See Arsine, chlorodiphenyl-.		
906	Arsenobenzene, 3,3'-diamino-4,4'-dihydroxy-,	See Arspenamine.		
907	Arsenobenzol.	1-*. See Cacodyl chloride.		
908	Arsine, chlorodimethyl-.	diphenylchloroarsine; diphenylarsenious chloride; blue cross; sneezing gas	(C ₆ H ₅) ₂ AsCl.....	264.57
909	—, chlorodiphenyl-.*.	methylarsenic dichloride; methyldichloroarsine	CH ₃ AsCl ₂	160.86
910	—, dichloromethyl-.*.		(C ₂ H ₅) ₂ AsH.....	134.04
910M	—, diethyl-.*.			
911	—, dimethyl-.*.	cacodyl hydride.....	(CH ₃) ₂ AsH.....	105.99
912	—, ethyl-.*.	arsinoethane.....	C ₂ H ₅ AsH ₂	105.99
913	—, methyl-.*.		CH ₃ AsH ₂	91.96
914	—, methyldichloro-.*.	See Arsine, dichloromethyl-.		
915	—, triethyl-.*.	arsenic triethyl.....	(C ₂ H ₅) ₃ As.....	162.09
916	—, trimethyl-.*.		(CH ₃) ₃ As.....	120.01
917	Arsinic acid, <i>p</i> -aminophenyl-.	See Arsianilic acid.		
918	—, dimethyl-.	See Cacodylic acid.		
919	—, methyl-.	See Methanearsonic acid.		
920	Arsinoxide, methyl-.	See Arsenic oxide, methyl-.		
921	Arspenamine.....	3,3'-diamino-4,4'-dihydroxyarsenobenzene dihydrochloride; salvarsan; arsenobenzol; "606"	C ₁₂ H ₁₂ As ₂ N ₂ O ₂ .2HCl.2H ₂ O.	475.02
922	Asaron.	See Benzene, 1,2,4-trimethoxy-5-propenyl-.		
923	Asaronic acid.....	2,4,5-trimethoxybenzoic acid.	(CH ₃ O) ₃ C ₆ H ₂ -COOH	212.20
924	<i>L</i> -Ascorbic acid.....	vitamin C; cevitamic acid; antiscorbutin	C ₆ H ₈ O ₆	176.12
925	Asepsin.	See Acetanilide, <i>p</i> -bromo-.		
926	Aseptol.	See 1-Phenol-2-sulfonic acid.		
927	Asparacemic acid.	See <i>dl</i> -Aspartic acid.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
891	.....	.....	217-8 d.	.....	.....	.....	.....
892	pr. f. w.; pl. f. al.	.....	238 d.	.....	15 ²¹	i.	i. eth.
893	or. pl.	.....	258-60 d.	.....	0.0177 ¹⁹	0.002	i. eth.
893M	yel. need.	.....	soft. 160; d. 228	.....	d.	d.	i. a.
894	yel. need.	.....	217-8 d.	.....	0.5 ¹⁶	i.	i. eth.
895	wh. need.	.....	232	.....	sl. s.	sl. s.	s. eth.; sl. s. ac. a.; i. bz., chl., acet.
897							
898							
899							
900							
901							
902	pr. f. CS ₂	.....	95	d.	.....	s.	s. bz.
903							
904							
905							
906	<i>Arsphenamine.</i>						
907							
908							
909	rhomb. pl.	1.583 ⁴⁰	44 (39)	333 d.	0.2	20	v. s. eth.; s. bz.
910	col. liq.	1.838 ²⁰ ₄	-59	133-6	sl. s.	s.	s. eth.
910M	liq., 1.4709, ign. in air	1.1338 ²³ ₄	.....	105 (96.5-97)	.....	.....	.....
911	col. liq., ign. in air	1.213 ²⁹ ₄	.....	36	.....	∞	∞ eth., chl., bz., CS ₂
912	col. liq.	1.217 ²² ₄	.....	36	0.00013 ¹⁹	s.	s. eth.
913	col. liq. or gas.	.....	.....	2	0.0085	v. s.	v. s. eth.
914							
915	col. liq., 1.467	1.150 ²⁰ ₄	.....	141 d.	i.	s.	s. eth.
916	col. liq.	1.124 ²² ₄	.....	52.8	sl. s.	s.	∞ eth.
917							
918							
919							
920							
921	hyg. yel. powd.	.....	.....	.....	v. v. s.	sl. s.	v. sl. s. eth.
922							
923	need. f. al.	.....	144	ca. 300	sl. s. c., s. h.	s.	s. bz., lgr.
924	wh. cr. powd., [α] _D ²⁰ +21-2°, w.	.....	190-2	.....	33.3	2;4 95%	i. eth., chl., bz.; 1 g. per 100 glyc.
925							
926							
927							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
928	<i>l</i>-Asparagine	<i>l</i> - α -aminosuccinamic acid; <i>l</i> - β -asparagine	$\text{NH}_2\text{COCH}_2\text{CH}(\text{NH}_2)\text{COOH}$	132.12
929	<i>dl</i>-Aspartic acid	<i>dl</i> -aminosuccinic acid; as- paracemic acid	$\text{COOHCH}_2\text{CH}(\text{NH}_2)\text{COOH}$	133.10
930	<i>d</i>-Aspartic acid	<i>d</i> -aminosuccinic acid	$\text{COOHCH}_2\text{CH}(\text{NH}_2)\text{COOH}$	133.10
931	<i>l</i>-Aspartic acid	<i>l</i> -aminosuccinic acid	$\text{COOHCH}_2\text{CH}(\text{NH}_2)\text{COOH}$	133.10
932	Aspidospermine		$\text{C}_{22}\text{H}_{30}\text{N}_2\text{O}_2$	354.48
933	Aspirin	acetylsalicylic acid; salicylic acid acetate; <i>o</i> -acetoxy- benzoic acid	$\text{CH}_3\text{COOC}_6\text{H}_4\text{-COOH}$	180.15
934	Atisine		$\text{C}_{22}\text{H}_{31}\text{NO}_2$	341.48
935	—, hydrochloride		$\text{C}_{22}\text{H}_{31}\text{NO}_2\cdot\text{HCl}$	377.94
936	<i>dl</i>-Atrolactic acid	<i>dl</i> - α -phenyllactic acid; <i>dl</i> - α -hydroxyhydratropic acid; <i>dl</i> -atrolactic acid See <i>Apoatropine</i> .	$\text{CH}_3\text{C}(\text{C}_6\text{H}_5)(\text{OH})\text{-COOH}$	166.17
937	Atropamine			
938	Atropic acid	α -phenylacrylic acid; α - methylene- α -toluic acid	$\text{CH}_2\text{:C}(\text{C}_6\text{H}_5)\text{-COOH}$	148.15
939	Atropine	<i>dl</i> -hyoscyamine; <i>dl</i> -daturine; tropic acid tropine ester	$\text{C}_{17}\text{H}_{23}\text{NO}_3$	289.36
940	—, chloroaurate		$\text{C}_{17}\text{H}_{23}\text{NO}_3\cdot\text{H}\cdot\text{AuCl}_4$	629.40
941	—, sulfate		$(\text{C}_{17}\text{H}_{23}\text{NO}_3)_2\cdot\text{H}_2\text{SO}_4$	676.80
942	—, valerate		$\text{C}_{17}\text{H}_{23}\text{NO}_3\cdot\text{C}_6\text{H}_{10}\text{-O}_2\cdot\text{H}_2\text{O}$	409.51
943	Atroscine	See <i>i</i> -Scopolamine.		
944	Aubepine	See <i>Anisaldehyde</i> .		
945	Auramine (base)	bis(<i>p</i> -dimethylaminophenyl)- methylenimine	$[(\text{CH}_3)_2\text{NC}_6\text{H}_4]_2\text{C: NH}$	267.36
946	—, hydrochloride	See <i>Auramine (dye)</i> .		
947	—, <i>N</i> -methyl-		$[(\text{CH}_3)_2\text{NC}_6\text{H}_4]_2\text{-C:NCH}_3$	281.39
948	Auramine (dye)	auramine (base) hydrochloride	$[(\text{CH}_3)_2\text{NC}_6\text{H}_4]_2\text{C: NH}_2\text{Cl}\cdot\text{H}_2\text{O}$	321.85
949	Aurin, Aurine	rosolic acid; pararosolic acid . .	$\text{C}_{19}\text{H}_{14}\text{O}_3$	290.30
950	—, hexamethoxy-	See <i>Eupitnone</i> .		
950M	Axerophthol	See <i>Vitamin A</i> .		
951	Azelaic acid	nonanedioic acid*; 1,7- heptanedicarboxylic acid	$\text{COOH}(\text{CH}_2)_7\text{-COOH}$	188.22
952	—, diethyl ester	ethyl azelate	$\text{CH}_3[(\text{CH}_2)_3\text{-COOC}_2\text{H}_5]_2$	244.32
953	Azete, tetrahydro-	See <i>Trimethylenimine</i> .		
954	Azetidine	See <i>Trimethylenimine</i> .		
955	Azimethylene	See <i>Methane, diazo-</i> *		
956	Azirine, dihydro-	See <i>Ethylenimine</i> .		
957	Azoaniline	See <i>Azobenzene, diamino-</i> .		
958	Azobenzene	diphenyldiimide; azobenzide .	$\text{C}_6\text{H}_5\text{N:NC}_6\text{H}_5$	182.22
959	—, <i>p</i> -acetamido-	<i>p</i> -phenylazoacetanilide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-N:NC}_6\text{H}_5$	239.27
960	—, <i>o</i> -amino-	<i>o</i> -phenylazoaniline; 2-benzeneazoaniline	$\text{NH}_2\text{C}_6\text{H}_4\text{N:NC}_6\text{H}_5$	197.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
928	col. rhomb., 1.549, 1.583, 1.625	1.543 $\frac{15}{4}$	236 d. cl. tube (226)	235 d.	2.46 ²⁵ 86.6 ¹⁰⁰	0.0003 ²⁵	i. eth.; s. NH ₃
929	monocl. pr. . . .	1.663 $\frac{12}{12}$	278-80 d.	.....	0.82 ²⁵ 4.79 ⁷⁵	0.032 ²⁵ 75%	.....
930			251				
931	col. rhomb. leaf.	1.6613 $\frac{12}{12}$	269-71	.....	0.39 ¹⁰ , 0.54 ²⁵ , 2.71 ⁷⁵	i.	i. eth.; s. dil. HCl
932	need. f. al. or pet. eth.	.....	208	.....	1.7 ²⁵	2.1 ²⁵	0.95 ²⁵ eth.; s. chl., bz.
933	col. need. f. w., 1.505, 1.645, 1.655	.....	133-5	d. 140	0.25	20 90%	3.57 eth.; 5.9 chl., v. sl. s. bz.
934	col. varnish. . . .	.....	85	.....	sl. s.	v. s.	v.s. eth.; s. chl.
935	pr. . . . .	.....	296	.....	v. s.	v. s.	i. eth.
936	rhomb. . . . .	.....	$\frac{1}{2}$ H ₂ O 90; anh. 93	.....	s.	.....	.....
937							
938	col. monocl. . . .	.....	106-7	267 d.	0.14 ¹⁹	s.	s. eth., bz., chl., CS ₂ , glac. ac. a.
939	col. rhomb. pr. or need.	.....	115.5; 118, subl.	.....	0.11 ²⁵	68.5	5.6 eth.; 64 chl.; 3.7 glyc.
940	leaf. or glist. powd.	.....	135-7	.....	sl. s.	.....	.....
941	col. need. or wh. cr. powd.	.....	183-4.5 anh.	.....	260	27	0.05 eth.; 0.16 chl.; s. glyc.
942	wh. crusts. . . .	.....	42	.....	v. s.	sl. s.	sl. s. eth.
943							
944							
945	yel. leaf. f. al.	.....	136	.....	i.	7 ²⁰ 96%	2.31 ²⁰ eth.
946							
947	yel. cr. f. al. . .	.....	130-3	.....	v. sl. s.	v. s.	v. s. ac. m.
948	yel. fl. . . . .	.....		.....	s.	s.	.....
949	red rhomb. need.	.....	308-10 d.	.....	0.12 ²⁵	s.	s. eth., ac. a., alk.; sl. s. chl.; i. bz., CS ₂
950							
950M							
951	col. leaf. or need, 1.4303 ^{110.6}	1.029 $\frac{20}{4}$	106.5	360 d.; 226 ¹⁰	0.24 ²⁰ , 2.26 ⁶⁵	v. s.	2.7 eth.
952		.....		291; 151-3 ¹⁴	i.	s.	s. eth.
953							
954							
955							
956							
957							
958	or.-red monocl. leaf.	1.203 $\frac{20}{4}$	68	297.4	i.	8.5 ¹⁶	s. eth.; 8.57 ²⁰ lgr.; 3.95 ¹⁰ me. al.
959		.....	144	.....	.....	.....	.....
960	golden need. . .	.....	123	.....	i.	v. s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
961	Azobenzene, <i>m</i>-amino-	<i>m</i> -phenylazoaniline; 3-benzeneazoaniline	$\text{NH}_2\text{C}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	197.23
962	—, <i>p</i> -amino-	<i>p</i> -phenylazoaniline; 4-benzeneazoaniline	$\text{NH}_2\text{C}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	197.23
963	—, 4-amino-2,3'-dimethyl-	ethyl-. See <i>m</i> -Toluidine, 4- <i>m</i> -tolylazo-		
964	—, 4-amino-3,4'-dimethyl-	ethyl-. See <i>o</i> -Toluidine, 4- <i>p</i> -tolylazo-		
965	—, 4'-amino-2, 3'-dimethyl-	methyl-. See <i>o</i> -Toluidine, 4- <i>o</i> -tolylazo-		
966	—, 2, 2'-diamino-	2, 2'-azodianiline.	$\text{H}_2\text{NC}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	212.25
967	—, 2,4-diamino-	See <i>Chrysoidine</i> (base).		
968	—, 4,4'-diamino-	4,4'-azodianiline.	$\text{H}_2\text{NC}_6\text{H}_4\text{N}_2\text{C}_6\text{H}_4\text{NH}_2$	212.25
969	—, diethoxy-	See <i>o</i> -Azophenetole.		
970	—, dihydroxy-	See <i>Azophenol</i> .		
971	—, dimethyl-	See <i>Azotoluene</i> .		
972	—, <i>p</i> -dimethyl-amino-	<i>N</i> , <i>N</i> -dimethyl- <i>p</i> -phenylazoaniline	$(\text{CH}_3)_2\text{NC}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	225.29
973	—, 4,4'-diphenyl-	See <i>p</i> , <i>p'</i> -Azobiphenyl.		
974	—, <i>o</i> -hydroxy-	<i>o</i> -phenylazophenol.	$\text{HOC}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	198.22
975	—, <i>m</i> -hydroxy-	<i>m</i> -phenylazophenol.	$\text{HOC}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	198.22
976	—, <i>p</i> -hydroxy-	<i>p</i> -phenylazophenol.	$\text{HOC}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	198.22
977	—, <i>p</i> -nitro- . . . . .	. . . . .	$\text{NO}_2\text{C}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	227.22
978	—, 2,4,3'-triamino-	See <i>m</i> -Phenylenediamine, 4-(3-aminophenylazo)-.		
979	Azobenzenedicarboxylic acid.	See <i>Azobenzoic acid</i> .		
980	Azobenzil.	See <i>Oxazole</i> , triphenyl-.		
981	<i>o</i> -Azobenzoic acid.	<i>o</i> , <i>o'</i> -azobenzenedicarboxylic acid	$\text{COOH}\text{C}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_4\text{COOH}$	270.24
982	<i>m</i> -Azobenzoic acid.	<i>m</i> , <i>m'</i> -azobenzenedicarboxylic acid	$\text{COOH}\text{C}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_4\text{COOH}$	270.24
983	<i>p</i> -Azobenzoic acid.	<i>p</i> , <i>p'</i> -azobenzenedicarboxylic acid	$\text{COOH}\text{C}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_4\text{COOH}$	270.24
984	<i>p</i> , <i>p'</i> -Azobiphenyl.	4,4'-diphenylazobenzene; <i>p</i> -azodiphenyl; di- <i>p</i> -xenyl-diimide	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_5$	334.40
985	Azodicarbonamide	azoformamide.	$\text{NH}_2\text{CON}:\text{NCONH}_2$	116.08
986	<i>p</i> -Azodiphenyl.	See <i>p</i> , <i>p'</i> -Azobiphenyl.		
987	Azoformamide.	See <i>Azodicarbonamide</i> .		
988	Azoimide, phenyl-	See <i>Benzene</i> , triazo-		
989	Azole.	See <i>Pyrrrole</i> .		
990	1,1'-Azonaphthalene	di-1-naphthyl-diimide; α , α' -azonaphthalene	$\text{C}_{10}\text{H}_7\text{N}:\text{NC}_{10}\text{H}_7$	282.33
991	—, 4-amino-	See 1-Naphthylamine, 4-(1-naphthylazo)-.		
992	1,2'-Azonaphthalene	α -naphthyl- β -naphthyl-diimide	$\text{C}_{10}\text{H}_7\text{N}:\text{NC}_{10}\text{H}_7$	282.33
993	2,2'-Azonaphthalene	di- β -naphthyl-diimide.	$\text{C}_{10}\text{H}_7\text{N}:\text{NC}_{10}\text{H}_7$	282.33
994	<i>o</i> -Azophenetole	<i>o</i> , <i>o'</i> -azodiphenetole; <i>o</i> , <i>o'</i> -diethoxyazobenzene	$(\text{C}_2\text{H}_5\text{OC}_6\text{H}_4)_2\text{N}_2$	270.32
995	<i>p</i> -Azophenetole	<i>p</i> , <i>p'</i> -azodiphenetole; <i>p</i> , <i>p'</i> -diethoxyazobenzene	$(\text{C}_2\text{H}_5\text{OC}_6\text{H}_4)_2\text{N}_2$	270.32
996	<i>o</i> -Azophenol	<i>o</i> , <i>o'</i> -azodiphenol; 2,2'-dihydroxyazobenzene	$\text{HOC}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_4\text{OH}$	214.22
997	<i>m</i> -Azophenol	<i>m</i> , <i>m'</i> -azodiphenol; 3,3'-dihydroxyazobenzene	$\text{HOC}_6\text{H}_4\text{N}:\text{NC}_6\text{H}_4\text{OH}$	214.22

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
961	or. need. ....	.....	57	.....	i.	s.	s. eth., bz., chl.
962	yel. monoc. ....	.....	126 (122-3)	>380	sl. s. h.	s. h.	s. eth., bz., chl.
963							
964							
965							
966	redsh. pl. f. al. or bz. ....	.....	134	.....	v. sl. s.	s.	s. eth.; v. s. acet.
967							
968	yel. need. f. al. ....	.....	241	.....	sl. s.	s.	s. eth., bz., chl.; sl. s. lgr.
969							
970							
971							
972	yel. leaf. f. al. ....	.....	117 (115)	d.	i.	v. s.	s. eth., conc. min. a.
973							
974	or. need. f. eth. ....	.....	82.5-3.0	.....	sl. s.	s.	s. eth., alk.
975	yel. pr. f. bz. ....	.....	114-7	.....	0.08 h.	s.	s. eth.
976	rhomb. pr. f. al. ....	.....	152 (155-6)	220-30 ²⁰ sl. d.	0.002 ²⁵	v. s.	v. s. eth.
977	or. red. leaf. or need. ....	.....	134	.....	.....	v. sl. s. h.	.....
978							
979							
980							
981	dk. yel. need. f. al. ....	.....	245 d. (237)	.....	v. sl. s.	s.	v. s. eth.; i. bz.
982	amor. powd. or yel. need. ....	.....	340	d.	sl. s.	0.24 ⁷⁸ 88%	sl. s. eth.
983	red. need. ....	.....	ca. 330	d.	v. sl. s.	v. sl. s.	v. sl. s. eth.
984	or.-red pl. f. bz. ....	.....	249-50	.....	i.	i.	s. eth.
985	or.-red cr. ....	.....	180 d.	.....	s. h.	i.	sl. s. eth.; d. h. HCl
986							
987							
988							
989							
990	red need.f. ac. a. ....	.....	190	subl.	i.	sl. s.	s. bz., ac. a., acet.
991							
992	br. leaf. f. ac. a. ....	.....	136	.....	i.	s.	s. bz., ac. a., conc. H ₂ SO ₄
993	red. leaf. f. bz. or chl. ....	.....	208	subl.	i.	sl. s.	sl. s. eth., me. al.; s. bz., chl.
994	red pr. f. al. ....	.....	131	240 d.	i.	s.	s. eth., HCl
995	yel. leaf. ....	.....	160.2	d.	i.	s. h.	v. s. eth.
996	yel. leaf. f. bz. or al. ....	.....	172	subl.	i.	0.33	v. s. eth.; 1.67 bz.; s. conc. alk.
997	yel. leaf. f. dil. al. ....	.....	205	.....	v. sl. s.	s. h.	sl. s. eth.; s. h. alk.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
998	p-Azophenol	<i>p,p'</i> -azodiphenol; 4,4'-di-hydroxyazobenzene	$\text{HO} \cdot \text{C}_6\text{H}_4 \cdot \text{N} : \text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{OH}$	214.22
999	o-Azotoluene	2,2'-dimethylazobenzene; di- <i>o</i> -tolylidimide	$\text{CH}_3\text{C}_6\text{H}_4\text{N} : \text{N} \cdot \text{C}_6\text{H}_4\text{CH}_3$	210.27
1000	m-Azotoluene	3,3'-dimethylazobenzene; di- <i>m</i> -tolylidimide	$\text{CH}_3\text{C}_6\text{H}_4 \cdot \text{N} : \text{N} \cdot \text{C}_6\text{H}_4\text{CH}_3$	210.27
1001	p-Azotoluene	4,4'-dimethylazobenzene; di- <i>p</i> -tolylidimide	$\text{CH}_3\text{C}_6\text{H}_4 \cdot \text{N} : \text{N} \cdot \text{C}_6\text{H}_4\text{CH}_3$	210.27
1002	Azoxybenzene (ordinary)	azoxybenzide.....	$\text{C}_6\text{H}_5(\text{NON})\text{C}_6\text{H}_5$	198.22
1003	Azoxybenzenedicarboxylic acid . See <i>Azoxybenzoic acid</i> .			
1004	o-Azoxybenzoic acid ..	<i>o,o'</i> -azoxydibenzoic acid; azoxybenzene-2,2'-dicarboxylic acid	$\text{C}_6\text{H}_4\text{COOH} \cdot (\text{NON})\text{C}_6\text{H}_4\text{COOH}$	286.24
1005	m-Azoxybenzoic acid ..	<i>m,m'</i> -azoxydibenzoic acid.....	$\text{C}_6\text{H}_4\text{COOH} \cdot (\text{NON})\text{C}_6\text{H}_4\text{COOH}$	286.24
1006	p-Azoxybenzoic acid ..	<i>p,p'</i> -azoxydibenzoic acid.....	$\text{C}_6\text{H}_4\text{COOH} \cdot (\text{NON})\text{C}_6\text{H}_4\text{COOH}$	286.24
1007	1,1'-Azoxynaphthalene	1,1'-azoxydinaphthalene; α, α' -azoxynaphthalene	$\text{C}_{10}\text{H}_7(\text{NON})\text{C}_{10}\text{H}_7$	298.33
1008	2,2'-Azoxynaphthalene	β, β' -azoxynaphthalene.....	$\text{C}_{10}\text{H}_7(\text{NON})\text{C}_{10}\text{H}_7$	298.33
1009	Baeyer's acid .	See <i>Croceic acid</i> .		
1010	Baphiin		$\text{C}_{12}\text{H}_{10}\text{O}_4$ or $\text{C}_{24}\text{H}_{20}\text{O}_8$	218.20 (436.40)
1011	Baptitoxine .	See <i>Cytisine</i> .		
1012	Barbital	5,5-diethylbarbituric acid; veronal; barbitone; malourea	$\text{NHCONHCOC} \cdot \text{CH}_2\text{CO}$ CH_2CO	184.19
1013	Barbituric acid	malonylurea; pyrimidine-trione	$\text{NHCONHCO} \cdot \text{CH}_2\text{CO}$ CH_2CO	128.09
1014	—, 5-amino-.	See <i>Uramil</i> .		
1015	—, 5,5-diallyl-.....	dial.....	$\text{NHCONHCOC} \cdot \text{CH}_2\text{CO}$ $(\text{C}_3\text{H}_5)_2\text{CO}$	208.21
1016	—, 5,5-diethyl-.	See <i>Barbital</i> .		
1017	—, 5,5-dipropyl-....	propional; propylal.....	$\text{NHCONHCOC} \cdot \text{CH}_2\text{CO}$ $(\text{C}_3\text{H}_7)_2\text{CO}$	212.25
1018	—, 5-ethyl-5-iso-amyl-	amytal.....	$\text{NHCONHCOC} \cdot \text{CH}_2\text{CO}$ $(\text{C}_2\text{H}_5)(\text{C}_5\text{H}_{11})\text{CO}$	226.27
1019	—, 5-ethyl-5- α -methylbutyl-		$\text{NHCONHCOC} \cdot \text{CH}_2\text{CO}$ $(\text{C}_2\text{H}_5)(\text{C}_5\text{H}_{11})\text{CO}$	226.27
1020	—, 5-ethyl-5-phenyl-.	See <i>Phenobarbital</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
998	cr. (+1H ₂ O) f. dil. al.; α anh. grn. p o w d.; β anh. dk. red powd.	.....	216	.....	sl. s.	v. s.	v. s. eth.; s. bz.
999	red monocl. pr. f. eth.	.....	55	.....	i.	6 ^{14.5}	147.7 ^{18.5} eth.; s. bz.
1000	or. red rhomb. cr.	.....	54-5	.....	i.	v. s.	v. s. eth.
1001	or. yel. monocl. need. f. lgr.	.....	144	.....	i	s.	v. s. eth.; s. lgr.
1002	yel. rhomb. need. f. h. al., 1.6644 ²⁰	1.246 ²⁰ / ₄	36	d.	i.	17.5 ¹⁶	v. s. eth.; 43 ¹⁵ lgr.
1003	pa. yel. tricl. leaf. f. al.	.....	250 d.	d.	i.	sl. s.	sl. s. eth.
1004	pa. yel. need. or leaf.	.....	345 d.(320)	.....	i.	sl. s.	sl. s. eth.
1005	yel. amor.....	.....	240 d.	d.	i.	i.	i. eth.; s. pyr.
1007	yel.-red rhomb. f. al.	.....	127	.....	i.	s.	sl. s. eth.; s. conc. H ₂ SO ₄
1008	yel. rhomb. need. f. al.	.....	167-8	.....	i.	s. h.	sl. s. eth.; s. bz., chl.
1009	leaf.....	.....	d.	.....	i.	s.	s. eth.
1010	leaf.....	.....	d.	.....	i.	s.	s. eth.
1011	wh. cr. powd.	.....	191	.....	0.69 ²⁰ , 8.3 ¹⁰⁰	s.	v. s. eth.; s. acet., alk., pet. eth., ac. a.; sl. s. chl.
1012	wh. rhomb. pr.	.....	245	260 d.	sl. s.	sl. s.	s. eth.
1013	col. sc.....	.....	170	.....	sl. s.	s.	s. eth.
1014	col. cr.....	.....	145	.....	0.06c., 1.4 ¹⁰⁰	v. s.	v. s. eth.; s. dil. alk.
1015	col. cr.....	.....	145	.....	0.06c., 1.4 ¹⁰⁰	v. s.	v. s. eth.; s. dil. alk.
1016	col. cr.....	.....	145	.....	0.06c., 1.4 ¹⁰⁰	v. s.	v. s. eth.; s. dil. alk.
1017	col. cr.....	.....	145	.....	0.06c., 1.4 ¹⁰⁰	v. s.	v. s. eth.; s. dil. alk.
1018	col.....	.....	135	.....	sl. s.	s.	s. eth.
1019	col.....	.....	128.5-130	.....	sl. s.	s.	s. eth.
1020	col.....	.....	128.5-130	.....	sl. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1021	Barbituric acid, 5-(2-furfurylidene)-2-thio-	furfuralmalonylthiourea	$C_4H_5OCH_2:-$ $\underbrace{CCONHCSNHCO}$	222.21
1022	—, 5-hydroxy-	See <i>Dialuric acid</i> .		
1023	—, 5-isonitroso-	See <i>Violuric acid</i> .		
1025	Bassorin	tragacanthin	$C_{16}H_{10}O_5$ (?)	282.24
1026	Bebeerine		$C_{18}H_{18}NO_3$	297.34
1027	—, hydrochloride		$C_{18}H_{18}NO_3 \cdot HCl$	333.81
1028	Behenic acid	docosanoic acid*; <i>n</i> -docosoic acid	$CH_3(CH_2)_{20}COOH$	340.58
1029	—, ethyl ester		$C_{21}H_{43}COOC_2H_5$	368.63
1030	—, methyl ester		$C_{21}H_{43}COOCH_3$	354.60
1031	Behenolic acid	13-docosynoic acid*	$CH_3(CH_2)_7C:-$ $C(CH_2)_{11}COOH$	336.54
1032	Belladonnine		$C_{17}H_{21}NO_2$	271.35
1033	Benzaconine	benzoylaconine; napelline; picroconitine	$C_{32}H_{43}NO_{10}$	601.68
1033M	Benzal	See <i>Benzylidene</i> .		
1034	Benzalazine	See <i>Benzaldehyde</i> , <i>azine</i> .		
1035	Benzal bromide	See <i>Benzylidene bromide</i> .		
1036	Benzal chloride	See <i>Benzylidene chloride</i> .		
1037	Benzaldehyde	benzenecarbonyl*	C_6H_5CHO	106.12
1038	—, azine	benzalazine; benzylidene-azine; dibenzalhydrazine	$C_6H_5CH:NN:-$ CHC_6H_5	208.25
1039	—, cyanohydrin	See <i>Mandelonitrile</i> .		
1040	—, hydrazone	benzalhydrazine; benzylidenehydrazine	$C_6H_5CH:NNH_2$	120.15
1041	—, α-, trans-, or anti-oxime	<i>trans</i> -benzaldoxime	$C_6H_5CH:NOH$	121.13
1042	—, β-, cis-, or syn-oxime	<i>cis</i> -benzaldoxime	$C_6H_5CH:NOH$	121.13
1043	—, phenylhydrazone	benzalphenylhydrazine; benzylidenephénylhydrazine	$C_6H_5CH:-$ $NNHC_6H_5$	196.24
1044	—, 4-acetoxy-3-met	hoxy- . See <i>Vanillin</i> , <i>acetate</i> .		
1045	—, o-amino-	See <i>Anthranilaldehyde</i> .		
1046	—, m-amino-		$NH_2C_6H_4CHO$	121.13
1047	—, p-amino-		$NH_2C_6H_4CHO$	121.13
1048	—, o-chloro-	2-chlorobenzenecarbonyl*	ClC_6H_4CHO	140.57
1049	—, m-chloro-	3-chlorobenzenecarbonyl*	ClC_6H_4CHO	140.57
1050	—, p-chloro-	4-chlorobenzenecarbonyl*	ClC_6H_4CHO	140.57
1051	—, diacetyl-	See <i>Benzal diacetate</i> .		
1052	—, 2,4-dihydroxy-	See <i>β-Resorcyraldehyde</i> .		
1053	—, 3,4-dihydroxy-	See <i>Protocatechualdehyde</i> .		
1054	—, 2,4-dimethoxy-	2,4-dimethoxybenzenecarbonyl*; β -resorcyraldehyde dimethyl ether	$(CH_3O)_2C_6H_3CHO$	166.17
1055	—, 3,4-dimethoxy-	See <i>Veratraldehyde</i> .		
1056	—, p-dimethyl-amino-	4-dimethylaminobenzenecarbonyl*	$(CH_3)_2NC_6H_4CHO$	149.19
1057	—, 2,4-dinitro-	2,4-dinitrobenzenecarbonyl*	$(NO_2)_2C_6H_3CHO$	196.12

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1021	yel. flocks.....	.....	.....	.....	i.	.....	.....
1022							
1023							
1025	amor., a mucilage	.....	.....	.....	sl. s.	i.	s. alk.; d. h. a.
1026	mixture (?), pr. f. mc. al., [α]-298°D	.....	214	.....	0.016 c.	20	s. eth., chl., a.
1027	hyg. need. or sc.	.....	259-60	.....	s.	s.	.....
1028	col. need.....	.....	80.7 (84)	306 ⁶⁰	0.10c.	0.10 ¹⁷	1.92 ¹⁶ eth.
1029	need. f. al.....	.....	54-4.5	230-1 ⁵	i.	s.	s. eth.
1030	cr.....	.....	54-4.5	224-5 ¹⁵	i.	s.	s. eth.
1031	col. need. f. al.	.....	57.5	.....	i.	v. s.	v.s. eth.; s. chl.
1032	amor. resin....	.....	.....	.....	v. sl. s.	v. s.	v.s. eth.; s. chl.
1033	amor.....	.....	130	.....	.....	.....	.....
1033M							
1034							
1035							
1036							
1037	col. liq., 1.5462 ⁹ _{17.6}	1.0504 ¹⁶ ₄	-26; frz.-56	179.5; 112.5-13 ¹⁰⁰	0.33	∞	= eth., fixed and vol. oils
1038	lng. yel. lust. pr.	.....	93	d.	i.	v. s. h.	v. s. eth.; s. chl., bz.
1039							
1040	col. leaf. or liq.	.....	16	140 ¹⁴	d.	s.	d. a., alk.
1041	col. leaf., 1.5637 ^{21.4}	1.111 ²⁰ ₄	35	200, 134 ²⁰	sl. s.	v. s.	v. s. eth., bz.
1042	col. rhomb. tab. or need.	.....	130	.....	s. h.	15.5 ²⁰ , 53.6 ⁷⁰	v. s. eth.; sl. s. bz.
1043	col.-pink monoc. pr.	.....	156	.....	.....	s. h.	sl. s. eth.; s. bz.
1044							
1045							
1046	in solution only						
1047	pl. or leaf. f. w.	.....	71	.....	v. sl. s.	s.	s. eth.
1048	liq., 1.56564 ^{21.7}	1.252 ²⁰ ₄	11 (8-9)	208 ⁷⁴⁸	sl. s.	v. s.	v. s. eth.; s. bz.
1049	liq. or pr., 1.56500 ^{20.2}	1.2497 ¹⁵ ₄	17-8	213-4 (204)	sl. s.	v. s.	v. s. eth.; s. bz.
1050	leaf., 1.55525 ⁶¹	1.196 ⁶¹ ₄	47.5	214 (144-4.5 ¹⁰⁰)	sl. s.	v. s.	v. s. eth.; s. CS ₂ , ac. a., bz.
1051							
1052							
1053							
1054	need. f. dil. al.	.....	69-70	165 ¹⁰	i.	v. s.	v. s. eth.
1055							
1056	leaf. f. w.....	.....	74	176-7 ¹⁷	sl. s.	s.	s. eth., ac. a., ord. org. solv.
1057	pa. yel. cr. f. al.	.....	72	190-210 ¹⁰⁻²⁰	sl. s.	v. s.	v. s. eth.; s. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1058	Benzaldehyde, 2,6-dinitro-	2,6-dinitrobenzenecarbonal*	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CHO}$	186.12
1059	—, 4-ethoxy-3-methoxy-	vanillin ethyl ether; proto-catechualdehyde 4-ethyl-3-methyl ether See <i>Salicylaldehyde</i> .	$\text{C}_2\text{H}_5\text{O}(\text{CH}_3\text{O})-\text{C}_6\text{H}_3\text{CHO}$	180.20
1060	—, o-hydroxy-			
1061	—, m-hydroxy-		$\text{HOC}_6\text{H}_4\text{CHO}$	122.12
1062	—, p-hydroxy-		$\text{HOC}_6\text{H}_4\text{CHO}$	122.12
1063	—, 4-hydroxy-3-methoxy-	See <i>Vanillin</i> .		
1064	—, p-isopropyl-	See <i>Cumaldehyde</i> .		
1065	—, o-methoxy-	salicylaldehyde methyl ether; o-anisaldehyde See <i>Anisaldehyde</i> .	$\text{CH}_3\text{OC}_6\text{H}_4\text{CHO}$	136.14
1066	—, p-methoxy-	See <i>Tolualdehyde</i> .		
1067	—, methyl-	See <i>Tolualdehyde</i> .		
1068	—, 3,4-methylenedioxy-	See <i>Piperonal</i> .		
1069	—, o-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CHO}$	151.12
1070	—, m-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CHO}$	151.12
1071	—, p-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CHO}$	151.12
1072	—, 2,4,6-trinitro-		$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{CHO}$	241.12
1073	—, trithio-	See <i>s-Trithiane, triphenyl-</i> .		
1074	o-Benzaldehydesulfonic acid.	See <i>Benzenesulfonic acid, o-formyl-</i> .		
1075	Benzal diacetate	benzylidene diacetate; diacetylbenzaldehyde; α, α -diacetoxytoluene See <i>Benzaldehyde, oxime</i> .	$\text{C}_6\text{H}_5\text{CH}(\text{OOCCH}_3)_2$	208.21
1075M	Benzaldoxime.	See <i>Benzaldehyde, oxime</i> .		
1076	Benzaldoximecarboxylic anhydride.	See 2,3,1-Benzoxaz-1-one.		
1076M	Benzal fluoride	α, α -difluorotoluene; benzylidene fluoride	$\text{C}_6\text{H}_5\text{CHF}_2$	128.12
1077	Benzalimine, N-ethyl-	See <i>Ethylamine, N-Benzylidene</i> .		
1078	Benzamarone	1,2,3,4,5-pentaphenyl-1,5-pentanedione (one form); α, α' -benzalbisesoxybenzoin	$\text{C}_6\text{H}_5\text{CH}[\text{CH}(\text{C}_6\text{H}_5)\text{COC}_6\text{H}_5]_2$	480.58
1079	Benzamide	benzenecarbonamide; benzoic amide	$\text{C}_6\text{H}_5\text{CONH}_2$	121.13
1080	—, oxime	benzamidoxime; benzenylaminooxide	$\text{C}_6\text{H}_5\text{C}(\text{NOH})\text{NH}_2$	136.15
1081	—, o-amino-		$\text{NH}_2\text{C}_6\text{H}_4\text{CONH}_2$	136.15
1082	—, m-amino-		$\text{NH}_2\text{C}_6\text{H}_4\text{CONH}_2$	136.15
1083	—, p-amino-		$\text{NH}_2\text{C}_6\text{H}_4\text{CONH}_2$	136.15
1084	—, o-chloro-	2-chlorobenzenecarbonamide*	$\text{ClC}_6\text{H}_4\text{CONH}_2$	155.58
1085	—, m-chloro-	3-chlorobenzenecarbonamide*	$\text{ClC}_6\text{H}_4\text{CONH}_2$	155.58
1086	—, p-chloro-	4-chlorobenzenecarbonamide*	$\text{ClC}_6\text{H}_4\text{CONH}_2$	155.58
1087	—, o-hydroxy-	See <i>Salicylamide</i> .		
1088	—, m-hydroxy-		$\text{HOC}_6\text{H}_4\text{CONH}_2$	137.13
1089	—, p-hydroxy-		$\text{HOC}_6\text{H}_4\text{CONH}_2$	137.13
1089M	—, p-methoxy-	See <i>Anisamide</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1058	leaf. f. dil. ac. a.	.....	123	.....	s. h.	s.	s. eth., bz., ac. a., chl.; sl. s. CS ₂ , lgr.
1059	monocl. pr. ....	.....	64-5 (73-4)	subl.	sl. s. h.	sl. s.	s. eth.
1060							
1061	col. need. f. w.	.....	106 (101-3)	240	2.78 ⁴³	v. s.	s. eth.; 6.31 ⁶¹ bz.
1062	col. need. f. w.	1.129 ¹³⁰ / ₄	116	subl.	1.38 ^{80.5}	v. s.	v. s. eth.; 3.68 ⁶⁵ bz.
1063							
1064							
1065	pr., 1.5597....	1.133 ²⁰ / ₄	35	243	i.	s.	v. s. eth.
1066							
1067							
1068							
1069	yel. need. f. w.	.....	α40; β37.9	156 ¹⁵	0.23 ²⁵ , 1.53 ¹⁰³	v. s.	v. s. eth.; s. bz.
1070	lt. yel. need. f. w.	.....	58	164 ²³	0.16 ²⁵ , 1.95 ¹¹²	s.	v. s. eth.; s. chl.
1071	col. pr. f. w....	1.496 ⁰ / ₄	106.5	subl.	0.97 ⁸⁰	v. s.	sl. s. eth.; 5.01 ¹⁵ bz.
1072	pl. f. bz. ....	.....	119	.....	i.	s.	s. eth.
1073							
1074							
1075	.....	1.11 ²⁰ / ₄	44-6	220; 154 ²⁰	.....	s.	s. eth.
1075M							
1076							
1076M	col. liq.	1.13696 ¹⁹	.....	132	i.	s.	.....
1077							
1078	col. cr. ....	.....	217-8	.....	0.63 h.	sl. s.	1.6 ¹² bz.
1079	col. monocl.	1.341 ⁴ / ₄	130 (125-6)	290	0.58 ¹² , 1.35 ²⁵	17 ²⁵	v. s. eth.
1080	monocl. pr. f. w.	.....	79-80	.....	sl. s. c.	v. s.	v. s. eth.; s. chl., bz.; i. lgr.
1081	leaf. f. chl. ....	.....	109-11.5 (108)	300 d.	s. h.	v. s.	sl. s. eth., bz.
1082	yel. need. (+1H ₂ O) f. w.	.....	113-4 anh.; +H ₂ O 79	d. 300; -H ₂ O, 100-20	sl. s.	s.	s. eth.; sl. s. c. chl., c. bz.
1083	yel. cr. ....	.....	183 (anh.)	.....	sl. s.	s.	sl. s. eth.
1084	lng. rhomb. need. f. w.	1.34 ¹⁸ / ₄	142 (139)	.....	sl. s.	v. s.	v. s. eth.
1085	need. f. w. ....	.....	134.5	.....	sl. s.	v. s.	s. eth.
1086	need. f. eth. ....	.....	179 (170)	.....	v. sl. s.	v. s.	v. s. eth.
1087							
1088	col. leaf. f. w....	.....	170.5	.....	sl. s. c., s. h.	v. s.	v. s. eth.; i. chl., CS ₂
1089	need. f. w. ....	.....	162 anh.	-H ₂ O, 100	sl. s.	v. s.	sl. s. eth.; i. chl., CS ₂
1089M							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1090	Benzamide, o, m or p-	methyl-. See Toluamide.		
1091	—, o-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CONH}_2$	166.13
1092	—, m-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CONH}_2$	166.13
1093	—, p-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CONH}_2$	166.13
1094	—, N-phenyl-	See <i>Benzanilide</i> .		
1095	Benzamidine	benzenecarbonamidine*; benzenylamidine	$\text{C}_6\text{H}_5\text{C}(\text{:NH})\text{NH}_2$	120.15
1096	—, N-1-naphthyl-	benzenylnaphthylamidine	$\text{C}_6\text{H}_5\text{C}(\text{:NH})\text{-NHC}_{10}\text{H}_7$	246.30
1097	Benzamidoxime.	See <i>Benzamide, oxime</i> .		
1098	Benzamine.	See <i>β-Eucaine</i> .		
1099	Benzanalgen.	See <i>Analgen</i> .		
1100	Benzanilide	<i>N</i> -phenylbenzamide; <i>N</i> -benzoylaniline	$\text{C}_6\text{H}_5\text{CONHC}_6\text{H}_5$	197.23
1100M	—, p-amino-		$p\text{-H}_2\text{NC}_6\text{H}_4\text{-CONHC}_6\text{H}_5$	212.24
1101	—, o-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{-CONHC}_6\text{H}_5$	242.23
1102	—, o'-nitro-		$\text{C}_6\text{H}_5\text{CONHC}_6\text{H}_4\text{-NO}_2$	242.23
1103	—, m-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{-CONHC}_6\text{H}_5$	242.23
1104	—, m'-nitro-		$\text{C}_6\text{H}_5\text{CONHC}_6\text{H}_4\text{-NO}_2$	242.23
1105	—, p-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CONHC}_6\text{H}_5$	242.23
1106	—, p'-nitro-		$\text{C}_6\text{H}_5\text{CONHC}_6\text{H}_4\text{-NO}_2$	242.23
1107	—, thio-		$\text{C}_6\text{H}_5\text{CSNHC}_6\text{H}_5$	213.29
1108	—, 3,4,5-trihydroxy-	See <i>Gallanilide</i> .		
1109	Benzaurin	<i>p,p'</i> -dihydroxytriphenylcarbinol	$\text{C}_6\text{H}_5(\text{C}_6\text{H}_4\text{OH})_2$ COH or $\text{C}_6\text{H}_5(\text{OHC}_6\text{H}_4)\text{-C:C}_6\text{H}_4\text{:O}$	292.32 (274.30)
1110	Benzazide.	See <i>Benzoyl azide</i> .		
1111	1-Benzazine.	See <i>Quinoline</i> .		
1112	2-Benzazine.	See <i>Isoquinoline</i> .		
1113	Benzene*	benzol; benzole; phene*	C_6H_6	78.11
1114	—, hexabromide.	See <i>Cyclohexane, 1,2,3,4,5,6-hexabromo-</i> .		
1115	—, hexachloride.	See <i>Cyclohexane, 1,2,3,4,5,6-hexachloro-</i> .		
1116	—, acetyl-	See <i>Acetophenone</i> .		
1117	—, acetylenyl-	See <i>Benzene, ethynyl-</i> .		
1118	—, 1-allyl-3,4-methylenedioxy-	See <i>Safrole</i> .		
1119	—, amino-	See <i>Aniline</i> .		
1120	—, aminodimethylamino-	See <i>Phenylenediamine</i> .	<i>c,N,N</i> -dimethyl-	
1121	—, amoxy-	See <i>Ether, amyl phenyl</i> .		
1122	—, amyl-	1-phenylpentane	$\text{C}_6\text{H}_5(\text{CH}_2)_4\text{CH}_3$	148.24
1123	—, sec-n-amyl-	See <i>Benzene, (α-methylbutyl)-</i> .		
1124	—, tert-amyl-	2-methyl-2-phenylbutane	$\text{C}_6\text{H}_5\text{C}(\text{CH}_3)_2\text{C}_2\text{H}_5$	148.24
1125	—, 1-amyl-2,4-dihydroxy-	See <i>Resorcinol, 4-amyl-</i> .		
1126	—, anilino-	See <i>Diphenylamine*</i> .		
1127	—, azimino-	See <i>1,2,3-Benzotriazole</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1090							
1091	need. f. dil. al.	1.462 ³² / ₄	176.6	317	s. h.	s.	s. eth.
1092	yel. monoc. need. f. w.	.....	142.7	315	s. h.	s.	s. eth.
1093	need. f. w. ....	.....	201.4	.....	v. sl. s.	s.	s. eth.
1094							
1095	col. cr. ....	.....	80	d.	s.	v. s.	sl. s. eth.
1096	pl. f. al. ....	.....	141	.....	i.	s.	s. eth.
1097							
1098							
1099							
1100	col. leaf. f. al. .	1.321 ⁴ / ₄	161	117-9 ¹⁰	v. sl. s.	3.16 ³⁰	sl. s. eth.
1100M	col. cr. ....	.....	135-6	.....	.....	s.	.....
1101	wh. need. f. al. .	.....	155	.....	v. sl. s.	v. s.	sl. s. eth.
1102	yel. need. f. al. .	.....	94-8	.....	sl. s. h.	■.	v. s. eth.
1103	leaf. f. w. or al.	.....	153-4	subl.	v. sl. s. c.	s.	s. eth., bz.
1104	leaf. f. amyl al.	.....	157	.....	i.	sl. s.	v. s. chl.
1105	leaf. f. eth. ....	.....	210-11	.....	v. sl. s.	s.	s. eth.
1106	yel. need. ....	.....	199	.....	i.	sl. s. h.	.....
1107	yel. pr. f. al. .	.....	100-2	d.	i.	s.	v. s. eth.
1108							
1109	brick red powd.	.....	100	.....	v. sl. s.	s.	s. eth.; sl. s. h. bz.
1110							
1111							
1112							
1113	col. rhomb. pr. or inflam. liq.; 1.50142 ²⁰	0.8794 ²⁰	5.51; 5.48-.49	80.093-.094	0.082 ²²	∞	∞ eth., ac. a., acet., tol.; s. chl.
1114							
1115							
1116							
1117							
1118							
1119							
1120							
1121							
1122	col. liq., 1.4751 ¹⁵	0.860 ²² / ₄	-78.25	202.1	i.	s.	■ eth.
1123							
1124	liq., 1.49154 ²³	0.8736 ¹⁵	.....	189-91	i.	∞	■ eth.
1125							
1126							
1127							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1128	Benzene, benzoyl-	See <i>Benzophenone</i> .		
1229	—, benzyl-	See <i>Methane, diphenyl-</i> .		
1130	—, 1-benzyl-4-ethyl-	<i>p</i> -ethyl diphenylmethane.....	$C_6H_5CH_2C_6H_4C_2H_5$	196.28
1130M	—, 1-benzoyloxy-2-methoxy-4-propenyl-	See <i>Is</i> <i>oeugenol, benzyl ether</i> .		
1131	—, benzylphenyl-	See <i>Biphenyl, benzyl-</i> .		
1132	—, bromo-*	phenyl bromide.....	C_6H_5Br	157.02
1133	—, 1-bromo-4-(4-bromophenoxy)-	See <i>Ether, bis-<i>p</i>-bromophenyl</i> .		
1134	—, 1-bromo-3-chloro-*	<i>m</i> -bromochlorobenzene.....	BrC_6H_4Cl	191.47
1135	—, 1-bromo-4-chloro-*	<i>p</i> -bromochlorobenzene.....	BrC_6H_4Cl	191.47
1136	—, (α-bromoethyl)-	1-bromo-1-phenylethane.....	$CH_3CHBrC_6H_5$...	185.07
1137	—, 1-bromo-4-fluoro-*	.....	BrC_6H_4F	175.01
1138	—, 1-bromo-2-iodo-*	.....	BrC_6H_4I	282.93
1139	—, 1-bromo-3-iodo-*	.....	BrC_6H_4I	282.93
1140	—, 1-bromo-4-iodo-*	.....	BrC_6H_4I	282.93
1141	—, 1-bromo-2-nitro-*	.....	$BrC_6H_4NO_2$	202.02
1142	—, 1-bromo-3-nitro-*	.....	$BrC_6H_4NO_2$	202.02
1143	—, 1-bromo-4-nitro-*	.....	$BrC_6H_4NO_2$	202.02
1144	—, (β-bromovinyl)-	See <i>Styrene, β-bromo-</i> .		
1145	—, butoxy-*	See <i>Ether, butyl phenyl</i> .		
1146	—, butyl-	1-phenylbutane.....	$C_6H_5CH_2CH_2CH_2CH_3$	134.21
1147	—, sec-butyl-	2-phenylbutane.....	$C_6H_5CH(CH_3)C_2H_5$	134.21
1148	—, tert-butyl-	2-methyl-2-phenylpropane...	$C_6H_5C(CH_3)_3$...	134.21
1149	—, 1-tert-butyl-3,5-dimethyl-2,4,6-trinitro-	musk xylene.....	$(NO_2)_3C_6C(CH_3)_3(CH_3)_2$	297.27
1150	—, butylmethyl-	See <i>Toluene, butyl-</i> .		
1151	—, 1-butyryl-	1-phenyl-1-butyne; ethyl-phenylacetylene	$C_6H_5C \equiv CCH_2CH_3$	130.18
1151H	—, butyryl-	See <i>Butyrophenone</i> .		
1152	—, chloro-*	phenyl chloride	C_6H_5Cl	112.56
1153	—, 1-chloro-2,4-dinitro-*	4-chloro-1,3-dinitrobenzene...	$(NO_2)_2C_6H_3Cl$	202.56
1154	—, 1-chloro-3,5-dinitro-*	5-chloro-1,3-dinitrobenzene...	$(NO_2)_2C_6H_3Cl$	202.56
1155	—, 2-chloro-1,3-dinitro-*	.....	$(NO_2)_2C_6H_3Cl$	202.56
1156	—, 3-chloro-1,2-dinitro-*	.....	$(NO_2)_2C_6H_3Cl$	202.56
1157	—, 4-chloro-1,2-dinitro-*	.....	$(NO_2)_2C_6H_3Cl$	202.56
1157M	—, 1-chloro-4-fluoro-*	.....	ClC_6H_4F	130.55
1158	—, 1-chloro-4-iodo-*	.....	ClC_6H_4I	238.47

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1128 1129 1130 1130M 1131	liq.	0.985 ¹⁹	.....	294.5	.....	s.	s. eth., chl.
1132	col. oily liq., 1.55977	1.4991 ¹⁵ ₁₆	-30.6	155-6	0.0446 ³⁰	10.4 ²⁵	71.3 eth.; s. bz.
1133 1134	.....	1.6302 ²⁰ ₄	-21.2	196	i.	v. s.	v. s. eth.
1135	col. rhomb. or monocl. pr.	.....	67.4	196.3	i.	s.	s. eth.
1136	liq.	1.3108 ²³ ₄	.....	200-10 d.; 105-7 ³⁰	i.	s.	s. eth.
1137	col. liq., 1.5310 ¹⁵	1.593 ¹⁵	-17.4	151.6	i.	s.	s. eth.
1138	col. liq.	2.257 ²⁵ ₄	2.1	257 ⁷⁵⁴ (124-7 ¹⁷)	i.	v. sl. s.	v. sl. s. ac. a.
1139	col. oily liq. ....	.....	-9.3	252 ⁷⁵⁴	i.	v. sl. s.	v. sl. s. ac. a.
1140	col. need. or pl.	.....	92	251.5 ⁷⁵⁴	i.	sl. s.	s. eth.
1141	pa. yel. cr. f. al.	1.6245 ⁸⁰ ₄	42 (36-9)	261	i.	v. s.	s. eth., bz.
1142	rhomb. cr., 1.5979	1.7036 ²⁰ ₄	56	256.5	v. sl. s.	s.	s. eth., bz.
1143	col. rhomb. pr.	1.934 ²² ₄	127	256	i.	1.38 c.	s. eth., bz.
1144 1145 1146	col. liq., 1.494 ¹³	0.862	-81.2	180 (181-3)	i.	∞	∞ eth.
1147	col. liq., 1.4894 ²¹	0.8634 ²¹ ₄	-82.7	173.5	i.	∞	∞ eth.
1148	col. liq., 1.4960 ²⁰	0.867 ²⁰ ₄	-58.1	168.7	i.	v. s.	v. s. eth.
1149	.....	.....	113	.....	i.	sl. s.	s. eth.
1150 1151	.....	0.923 ²¹	.....	203	i.	s.	s. eth.
1151H 1152	col. liq., 1.52479	1.1066 ²⁰ ₄	-45, frz.-55	132	0.0488 ³⁰	∞	∞ eth.; s. chl., CS ₂ , bz.
1153	yel. rhomb. f. eth.	α1.697 ²² ; β1.680 ²⁰ ₄	α 53.4 (51); β43; γ27	315	i.	s.	s. eth.
1154	col. need. f. al.	.....	55 (59)	volat. in steam	i.	s.	s. eth.
1155	yel. need. f. al.	1.6867 ^{16.5}	87	315	i.	v. s.	s. eth.
1156	pr. f. et. al. ....	.....	78 (86.8)	.....	i.	s.	s. eth.
1157	yel. monocl. rhomb. f. eth.	α1.697 ²⁰ ₄ ; β1.6867 ²⁰ ₄	α36.3; β37.1; γ38.8; δ28	315 d.	i.	s.	v. s. eth.; s. bz., CS ₂
1157M	col. liq., 1.4990 ¹⁵	.....	-27.7	130.1	i.	s.	s. eth.
1158	col. leaf. f. al.	.....	57	226-7	i.	s.	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1159	Benzene, chloromercu	ri- . See <i>Mercury chloride, phenyl-</i> .*		
1160	—, 1-chloro-2-nitro- *	<i>o</i> -chloronitrobenzene.....	$\text{ClC}_6\text{H}_4\text{NO}_2$	157.56
1161	—, 1-chloro-3-nitro- *	<i>m</i> -chloronitrobenzene.....	$\text{ClC}_6\text{H}_4\text{NO}_2$	157.56
1162	—, 1-chloro-4-nitro- *	<i>p</i> -chloronitrobenzene.....	$\text{ClC}_6\text{H}_4\text{NO}_2$	157.56
1163	—, 1-chloro-2,4,5-trinitro-*	.....	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{Cl}$	247.56
1164	—, 1-chloro-2,4,6-tri	nitro- *. See <i>Picryl chloride</i> .		
1165	—, 2-chloro-1,3,5-tri	nitro- *. See <i>Picryl chloride</i> .		
1166	—, cyclohexyl- .	See <i>Cyclohexane, phenyl-</i> .		
1167	—, 1,4-diacetamido- .	See <i>o</i> -Phenylenediamine, <i>N, N'</i> -diacetyl-.		
1168	—, diamino- .	See <i>Phenylenediamine</i> .		
1169	—, diazoamino- .	See <i>Diazoaminobenzene</i> .		
1170	—, 1,2-dibromo- *	<i>o</i> -dibromobenzene.....	$\text{C}_6\text{H}_4\text{Br}_2$	235.92
1171	—, 1,3-dibromo- *	<i>m</i> -dibromobenzene.....	$\text{C}_6\text{H}_4\text{Br}_2$	235.92
1172	—, 1,4-dibromo- *	<i>p</i> -dibromobenzene.....	$\text{C}_6\text{H}_4\text{Br}_2$	235.92
1173	—, 1,2-dibutoxy- *	pyrocatechol dibutyl ether...	$\text{C}_6\text{H}_4[\text{O}(\text{CH}_2)_3\text{CH}_3]_2$	222.32
1173M	—, 1,4-di-tert-butyl-	.....	$\text{C}_6\text{H}_4[\text{C}(\text{CH}_3)_3]_2(p)$	190.32
1174	—, 1,2-dichloro- *	<i>o</i> -dichlorobenzene.....	$\text{C}_6\text{H}_4\text{Cl}_2$	147.01
1175	—, 1,3-dichloro- *	<i>m</i> -dichlorobenzene.....	$\text{C}_6\text{H}_4\text{Cl}_2$	147.01
1176	—, 1,4-dichloro- *	<i>p</i> -dichlorobenzene.....	$\text{C}_6\text{H}_4\text{Cl}_2$	147.01
1177	—, 1,3-dicyano- .	See <i>Isophthalonitrile</i> .		
1178	—, 1,2-diethoxy- *	pyrocatechol diethyl ether; catechol diethyl ether	$\text{C}_6\text{H}_4(\text{OC}_2\text{H}_5)_2$	166.21
1179	—, 1,3-diethoxy- *	resorcinol diethyl ether.....	$\text{C}_6\text{H}_4(\text{OC}_2\text{H}_5)_2$	166.21
1180	—, 1,4-diethoxy- *	hydroquinone diethyl ether..	$\text{C}_6\text{H}_4(\text{OC}_2\text{H}_5)_2$	166.21
1181	—, 1,2-diethyl- *	<i>o</i> -diethylbenzene.....	$\text{C}_6\text{H}_4(\text{C}_2\text{H}_5)_2$	134.21
1182	—, 1,3-diethyl- *	<i>m</i> -diethylbenzene.....	$\text{C}_6\text{H}_4(\text{C}_2\text{H}_5)_2$	134.21
1183	—, 1,4-diethyl- *	<i>p</i> -diethylbenzene.....	$\text{C}_6\text{H}_4(\text{C}_2\text{H}_5)_2$	134.21
1184	—, (diethylamino)m	ethyl- . See <i>Toluidine, N, N</i> -diethyl-.		
1185	—, 1,3-diethyl-5-met	hyl- *. See <i>Toluene, 3,5-diethyl-</i> .		
1186	—, dihydro- .	See <i>Cyclohexadiene</i> .*		
1187	—, 1,2-dihydroxy- .	See <i>Pyrocatechol</i> .		
1188	—, 1,3-dihydroxy- .	See <i>Resorcinol</i> .		
1189	—, 1,4-dihydroxy- .	See <i>Hydroquinone</i> .		
1190	—, 1,2-diiodo- *	<i>o</i> -diiodobenzene.....	$\text{C}_6\text{H}_4\text{I}_2$	329.93
1191	—, 1,3-diiodo- *	<i>m</i> -diiodobenzene.....	$\text{C}_6\text{H}_4\text{I}_2$	329.93
1192	—, 1,4-diiodo- *	<i>p</i> -diiodobenzene.....	$\text{C}_6\text{H}_4\text{I}_2$	329.93
1193	—, 1,3-diisoamoxy- .	resorcinol diisoamyl ether....	$\text{C}_6\text{H}_4[\text{OCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2]_2$	250.37

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1159							
1160	monocl. need.	1.368 $\frac{22}{4}$; 1.305 $\frac{80}{4}$	32.5	245.7	i.	s.	s. eth., bz.
1161	pa. yel. rhomb. pr. f. al.	1.534 $\frac{20}{4}$	unst. 23.7; stab. 44.4 (46)	235-6	i.	v. s. h.	s. eth., bz., ac. a., chl., CS ₂
1162	monocl. pr.	1.520 $\frac{18}{4}$	83.5	242	i.	s.	s. eth., CS ₂
1163	yel. cr. f. al. ....	.....	116	.....	i.	v. s. h.	s. h. bz.
1164							
1165							
1166							
1167							
1168							
1169							
1170	col. liq., 1.6117 ^{17.5}	1.9557 $\frac{20.5}{4}$	1.8 (5.6); frz. 6-7	221 (224)	i.	s.	= eth.
1171	col. liq., 1.6083 ^{17.5}	1.9523 $\frac{20.5}{4}$	-6.9	219.5 (217)	i.	s.	s. eth.
1172	col. monocl. f. al., 1.57425	2.261 $\frac{17}{4}$; liq. 1.841 ^{18.9}	86.9	218-19	i.	10 ²⁵	71 ²⁵ eth.; 90CS ₂ ; s. acet., lgr.
1173	pa. yel. liq. ....	.....	.....	135-8 ¹²	.....	.....	.....
1173M	wh. cr. ....	.....	75	236.5	i.	v. s.	s. eth.
1174	col. liq., 1.5518 ²²	1.3048 $\frac{20}{4}$	-17.5	180-3	0.0145 ²⁵	s.	s. eth.
1175	col. liq., 1.54570 ^{20.9}	1.288 $\frac{20}{4}$	-24.8	172	0.0123 ²⁵	s.	s. eth., bz.
1176	monocl. lf. f. al., 1.52104 ^{80.3}	1.4581 $\frac{20.5}{4}$	53	173.4	0.0079 ²⁵	sl. s. c., v. s. h.	v. s. eth.; s. bz., chl., CS ₂
1177							
1178	cr. f. pet. eth. ....	.....	43-5	.....	.....	.....	.....
1179	pr. ....	.....	12.4	234-5	i.	s.	s. eth.
1180	leaf. ....	.....	71-2	246	.....	v. s.	v. s. eth., chl.
1181	col. liq.	0.8662 $\frac{18}{4}$	<-20	184.0-4.5	i.	s.	s. eth.
1182	col. liq., 1.4955 ²⁰	0.8602 $\frac{20}{4}$	<-20	181-2	i.	s.	s. eth.
1183	col. liq., 1.4978 ¹⁴	0.8675 $\frac{14}{4}$; .865 $\frac{20}{4}$	-35	182-3	i.	s.	s. eth.
1184							
1185							
1186							
1187							
1188							
1189							
1190	monocl. pl. or pr. f. lgr.	.....	27; frz. 23.4	286-7	v. sl. s.	s.	v. s. eth.
1191	rhomb. pl. f. al.-eth.	.....	40; frz. 34.2	284.8	i.	s.	s. eth., chl.
1192	rhomb. lf. f. al.	.....	129.4	285, subl.	i.	s.	v. s. eth.
1193	cr. f. w. ....	.....	47	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1194	Benzene, 1,2-dimethoxy-	y-* . See <i>Veratrole</i> .		
1195	—, 1,3-dimethoxy-*	resorcinol dimethyl ether . . .	$C_6H_4(OCH_3)_2$	138.16
1196	—, 1,4-dimethoxy-*	hydroquinone dimethyl ether .	$C_6H_4(OCH_3)_2$	138.16
1197	—, 1,2-dimethyl-*	See <i>o-Xylene</i> .		
1198	—, 1,3-dimethyl-*	See <i>m-Xylene</i> .		
1199	—, 1,4-dimethyl-*	See <i>p-Xylene</i> .		
1200	—, 1,2-dinitro-*	<i>o</i> -dinitrobenzene	$C_6H_4(NO_2)_2$	168.11
1201	—, 1,3-dinitro-*	<i>m</i> -dinitrobenzene	$C_6H_4(NO_2)_2$	168.11
1202	—, 1,4-dinitro-*	<i>p</i> -dinitrobenzene	$C_6H_4(NO_2)_2$	168.11
1203	—, 1,3-diphenyl-	<i>m</i> -phenylbiphenyl; <i>m</i> -terphenyl	$(C_6H_5)_2C_6H_4$	230.29
1204	—, 1,4-diphenyl-	See <i>Terphenyl</i> .		
1205	—, 1,2-dipropoxy-*	pyrocatechol dipropyl ether .	$C_6H_4(OCH_2CH_2CH_3)_2$	194.27
1206	—, 1,3-dipropoxy-* . .	resorcinol dipropyl ether . . .	$C_6H_4(OCH_2CH_2CH_3)_2$	194.27
1207	—, ethenoxy-*	See <i>Ether, phenyl vinyl</i> .		
1208	—, ethoxy-*	See <i>Phenetole</i> .		
1209	—, 1-ethoxy-2-methoxy-4-propenyl-	See <i>Isoeugenol, ethyl ether</i> .		
1210	—, ethyl-	phenylethane	$C_2H_5C_6H_5$	106.16
1211	—, 1-ethyl-4-isobutyl-		$C_2H_5C_6H_4CH_2CH(CH_3)_2$	162.27
1212	—, 1-ethyl-3-isopropyl-		$C_2H_5C_6H_4CH_2CH(CH_3)_2$	148.24
1213	—, 1-ethyl-4-isopropyl-		$C_2H_5C_6H_4CH_2CH(CH_3)_2$	148.24
1214	—, ethylmethyl-	See <i>Toluene, ethyl-</i> .		
1215	—, 1-ethyl-2-nitro-		$NO_2C_6H_4C_2H_5$. . .	151.16
1216	—, 1-ethyl-3-nitro-		$NO_2C_6H_4C_2H_5$. . .	151.16
1217	—, 1-ethyl-4-nitro-		$NO_2C_6H_4C_2H_5$. . .	151.16
1218	—, 1-ethyl-4-propyl-		$C_2H_5C_6H_4(CH_2)_2CH_3$	148.24
1219	—, ethylsulfonyl-*	See <i>Sulfone, ethyl phenyl</i> .		
1220	—, ethynyl-	phenylacetylene; acetylenylbenzene	$C_6H_5C\equiv CH$	102.13
1221	—, fluoro-*	phenyl fluoride	C_6H_5F	96.10
1222	—, <i>p</i>-fluorobromo-	See <i>Benzene, 1-bromo-4-fluoro-*</i>		
1223	—, 1-fluoro-4-iodo-*		FC_6H_4I	222.01
1223H	—, 1-fluoro-2-nitro-*		$FC_6H_4NO_2$	141.10
1223K	—, 1-fluoro-3-nitro-*		$FC_6H_4NO_2$	141.10
1223M	—, 1-fluoro-4-nitro-*		$FC_6H_4NO_2$	141.10
1224	—, hexabromo-*	perbromobenzene	C_6Br_6	551.56

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1194							
1195	col. liq.	1.0803 $\frac{0}{4}$	-52	216.5-217.7	v. sl. s.	s.	s. eth.
1196	col. leaf. f. w.	1.053 $\frac{5.5}{5.5}$	56	212.6; 109 ²⁰	i.	v. s.	v. s. eth.; s. bz.
1197							
1198							
1199							
1200	col.-yel. monocl. pl. f. al.	1.565 $\frac{17}{4}$	118 (116-7)	319 ⁷⁷³	0.01 c., 0.38 ¹⁰⁰	3.8 ²⁵	27.1 ¹⁸ chl.; 5.0 ¹⁸ bz.; s. me. al.
1201	col.-yelsh. rhomb. need. or pl. f. al.	1.571 $\frac{0}{4}$; 1.5656 $\frac{2.0}{4}$	89.57	302.8 ⁷⁷⁰ (291)	0.0469 ¹⁵ , 0.32 ¹⁰⁰	2.60 ²⁰	6.7 ¹⁵ eth.; 34.7 ¹⁸ bz.; s. tol., chl., ethyl acet.
1202	col.-yel. monocl. need. f. al.	1.625 $\frac{2.0}{4}$	173-4	299 ⁷⁷⁷ , subl.	0.18 ¹⁰⁰	0.4 ²⁰	1.82 ¹⁸ chl.; 2.3 ¹⁸ bz.; s. ac. a.
1203	need. f. al. ....	.....	86-7	363	i.	s.	s. eth., ac. a- bz.
1204							
1205				117-20 ¹²	.....	.....	.....
1206	liq., 1.5138 ³³ ...	1.035 $\frac{2.0}{2.1}$	.....	251; 127-8 ¹²	.....	.....	.....
1207							
1208							
1209							
1210	col. liq., 1.49828 ^{14.5}	0.8669 $\frac{2.0}{4}$	-93.9 (-92.8)	136.15 (134-6)	0.014 ¹⁵	∞	∞ eth.
1211	liq. ....	.....	.....	209-13	i.	.....	s. eth.
1212	liq. ....	.....	<-20	190-2	i.	.....	s. eth.
1213	liq.	0.8606 $\frac{1.6}{4}$	<-20	197-8	i.	.....	s. eth.
1214							
1215	col. liq.	1.126 $\frac{24.5}{4}$	-23	223-4	i.	v. s.	v. s. eth.
1216	col. liq.	1.135 $\frac{2.0}{4}$	.....	242-3	i.	v. s.	v. s. eth.
1217	col. liq.	1.124 $\frac{2.5}{4}$	-32	241-2	i.	v. s.	v. s. eth.
1218	liq.	0.867 $\frac{1.4}{4}$	.....	202-5 ⁷⁶⁵	i.	.....	s. eth.
1219							
1220	col. liq., 1.5524 ^{12.5}	0.9295 $\frac{2.0}{4}$	-40 to -48 (-56)	143	i.	∞	∞ eth.
1221	col. liq., 1.4646 ^{22.8}	1.024 $\frac{2.0}{4}$	-41.9	84.85	0.154 ³⁰	∞	∞ eth.
1222							
1223	col. liq. ....	.....	-27.2; (-19.3)	183.2	i.	s.	s. eth.
1223 H	yel. liq., 1.54886	1.3375 ^{17.2}	-6	214.8	i.	s.	s. eth.
1223 K	yel. liq., 1.53622 ¹⁹	1.3254 ¹⁹	3.6	200.15	i.	s.	s. eth.
1223 M	sld., 1.53156...	1.330	27	205.3	i.	s.	s. eth.
1224	monocl. need. f. bz.	.....	306	.....	i.	i.	i. eth.; sl. s. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1225	Benzene, hexachloro-*	perchlorobenzene	C_6Cl_6	284.80
1226	—, hexaethyl- . . . . .	. . . . .	$C_6(C_2H_5)_6$	246.42
1227	—, hexahydro-	See <i>Cyclohexane</i> .		
1228	—, hexahydroxy-	benzenehexol	$C_6(OH)_6$	174.11
1229	—, hexaiodo-*	periodobenzene	C_6I_6	833.58
1230	—, hexamethyl- . . . . .	. . . . .	$C_6(CH_3)_6$	162.27
1231	—, hexyloxy-	See <i>Ether, hexyl phenyl</i> .		
1232	—, hydroxy-	See <i>Phenol</i> .		
1233	—, iodo-*	phenyl iodide	C_6H_5I	204.02
1234	—, 1-iodo-2-nitro-* . . . . .	. . . . .	$NO_2C_6H_4I$	249.02
1235	—, 1-iodo-3-nitro-* . . . . .	. . . . .	$NO_2C_6H_4I$	249.02
1236	—, 1-iodo-4-nitro-* . . . . .	. . . . .	$NO_2C_6H_4I$	249.02
1237	—, iodoso- . . . . .	. . . . .	C_6H_5IO	220.02
1238	—, iodoxy- . . . . .	. . . . .	$C_6H_5IO_2$	236.02
1239	—, isoallyl-	See <i>Benzene, propenyl-</i> .		
1240	—, isoamoxy-	See <i>Ether, isoamyl phenyl</i> .		
1241	—, isoamyl-	3-methyl-1-phenylbutane	$C_6H_5(CH_2)_2-CH(CH_3)_2$	148.24
1242	—, isobutoxy-	See <i>Ether, isobutyl phenyl</i> .		
1243	—, isobutyl-	2-methyl-1-phenylpropane	$C_6H_5CH_2-CH(CH_3)_2$	134.21
1244	—, isohexyl-	4-methyl-1-phenylpentane	$C_6H_5(CH_2)_3-CH(CH_3)_2$	162.27
1245	—, isopropenyl-	2-phenylpropene; <i>uns-methyl-phenylethylene</i>	$CH_3C(C_6H_5):CH_2$	118.17
1246	—, isopropoxy-*	See <i>Ether, isopropyl phenyl</i> .		
1247	—, isopropyl-	See <i>Cumene</i> .		
1248	—, isopropylmethyl-	See <i>Cymene</i> .		
1249	—, methoxy-*	See <i>Anisole</i> .		
1250	—, 1-methoxy-4-propenyl-	See <i>Anethole</i> .		
1251	—, methyl-	See <i>Toluene</i> .		
1252	—, (α-methylbutyl)-	2-phenylpentane; <i>sec-n-amylbenzene</i>	$C_6H_5CH(CH_3)-CH_2CH_2CH_3$	148.24
1253	—, 3,4-methylenedioxy-1-propenyl-	See <i>Isosafrole</i> .		
1254	—, (β-methylpropoxy)-*	See <i>Ether, isobutyl phenyl</i> .		
1255	—, methylpropyl-	See <i>Toluene, propyl-</i> .		
1256	—, nitro-* . . . . .	. . . . .	$C_6H_5NO_2$	123.11
1257	—, nitroso-* . . . . .	. . . . .	C_6H_5NO	107.11
1258	—, pentaamino-	See <i>Benzenepentamine*</i> .		
1259	—, pentabromo-* . . . . .	. . . . .	C_6HBr_5	472.65
1260	—, pentachloro-* . . . . .	. . . . .	C_6HCl_5	250.35
1261	—, pentaethyl-* . . . . .	. . . . .	$(C_2H_5)_5C_6H$	218.37

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1225	monocl. or rhomb. pr.	1.569 ²³⁶ ; 2.044 ²³	227 (224-6)	326	i.	i. c., v. sl. s. h.	v. sl. s. eth.; s. h. bz.
1226	col. monocl. f. al., 1.480 ^{130.4}	0.831 ¹³⁰	129	298	i.	s.	v. s. eth., bz.
1227	need. f. HCl.	.....	d. 200	.....	sl. s.	sl. s.	sl. s. eth., bz.
1228	red-br. need.	.....	350 d.	.....	i.	i.	i. eth.
1229	f. bz.	.....	.....	.....	.....	.....	.....
1230	col. rhomb. pl. f. al., 1.8012, 1.745, 1.5032 (587 m μ)	.....	166 (159-62)	265	i.	0.16 ⁹	v. s. bz.
1231							
1232							
1233	col. liq., 1.62145 ^{18.5}	1.832 ²⁰ / ₄	-31.4	188.6	0.034 ³⁰	s.	∞ eth.; s. chl.
1234	yel. rhomb. need.	1.810 ¹⁶ / ₄	49.4	290	i.	sl. s.	sl. s. eth.
1235	col. cr.	1.804 ¹⁶ / ₄	36	280	i.	sl. s.	sl. s. eth.
1236	col. need.	1.8090 ^{15.5} / ₄	171.5	288.1	i.	sl. s.	sl. s. eth.
1237	yel. powd. ....	.....	exp. abt. 210	.....	s.	s.	i. c., s. h. eth.; s. h. chl.
1238	need. f. w. ....	.....	exp. 236-7	.....	v. sl. s.	i.	v. s. bz., chl.; s. h. ac. a.
1239							
1240							
1241	col. liq.	0.885 ²⁰ / ₄	.....	194 (198-9)	i.	∞	∞ eth.
1242							
1243	col. liq., 1.4957 ^{14.5}	0.8673 ²⁰ / ₄	.....	171.4	i.	∞	∞ eth.
1244	liq.	0.857	.....	214-5	i.	sl. s.	s. eth.
1245	col. liq.	0.91939 ²⁰ / ₄	.....	160.5-1.5	i.	s.	s. eth.
1246							
1247							
1248							
1249							
1250							
1251							
1252	liq.	0.874 ¹⁵ / ₄	.....	189.3 (191-3)	i.	s.	s. eth.
1253							
1254							
1255							
1256	yel. liq., 1.55291	1.19867 ²⁵ / ₄	5.7	210.9	0.19 ²⁰ ; 0.8 ⁸⁰	v. s. c.	v. s. eth.; s. bz., oils
1257	col. rhomb. or monocl. f. eth.	.....	68	59 ¹⁸	i.	s.	s. eth., chl.; sl. s. lgr.
1258							
1259	need. f. al. ....	.....	293	subl.	.....	sl. s.	sl. s. eth.; s. bz.
1260	need. f. al.	1.8342 ¹⁶ / ₄	86	277	i.	v. sl. s.	v. s. eth.; s. bz., CS ₂
1261	col. liq., 1.516	0.896	<-20	277	i.	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1262	Benzene, pentaïodo-*		$C_6H_5I_5$	707.67
1263	—, pentamethyl-*		$(CH_3)_5C_6H$	148.24
1264	—, perbromo-*	See <i>Benzene, hexabromo-*</i> .		
1265	—, perchloro-*	See <i>Benzene, hexachloro-*</i> .		
1266	—, periodo-*	See <i>Benzene, hexaïodo-*</i> .		
1267	—, phenoxy-*	See <i>Phenyl ether</i> .		
1268	—, phenyl-*	See <i>Biphenyl</i> .		
1269	—, phenyldithio-*	See <i>Phenyl disulfide</i> .		
1270	—, phenylsulfonyl-*	See <i>Phenyl sulfone</i> .		
1271	—, phenylthio-*	See <i>Phenyl sulfide</i> .		
1272	—, (2-propenoxy)-*	See <i>Ether, allyl phenyl</i> .		
1273	—, propenyl-	1-phenylpropene; 1-propenylbenzene; isallylbenzene	$CH_3CH:CHC_6H_5$	118.17
1275	—, propoxy-*	See <i>Ether, phenyl propyl</i> .		
1276	—, propyl-	1-phenylpropane	$C_6H_5CH_2CH_2CH_3$	120.19
1277	—, 1-propynyl-*	See <i>Propyne, 1-phenyl-*</i> .		
1278	—, 1,2,3,5-tetra-bromo-*		$C_6H_2Br_4$	393.74
1279	—, 1,2,4,5-tetra-bromo-*		$C_6H_2Br_4$	393.74
1280	—, 1,2,3,4-tetra-chloro-*		$C_6H_2Cl_4$	215.90
1281	—, 1,2,3,5-tetra-chloro-*		$C_6H_2Cl_4$	215.90
1282	—, 1,2,4,5-tetra-chloro-*		$C_6H_2Cl_4$	215.90
1283	—, 1,2,3,4-tetra-ethyl-		$(C_2H_5)_4C_6H_2$	190.32
1284	—, 1,2,4,5-tetra-ethyl-		$(C_2H_5)_4C_6H_2$	190.32
1285	—, tetrahydro-*	See <i>Cyclohexene</i> .		
1286	—, tetrahydroxy-*	See <i>Benzenetetrol</i> .		
1287	—, 1,2,3,4-tetraïodo-*		$C_6H_2I_4$	581.76
1288	—, 1,2,3,5-tetraïodo-*		$C_6H_2I_4$	581.76
1289	—, 1,2,4,5-tetraïodo-*		$C_6H_2I_4$	581.76
1290	—, 1,2,3,4-tetrameth	yl-. See <i>Prehnitene</i> .		
1291	—, 1,2,3,5-tetrameth	yl-. See <i>Isodurene</i> .		
1292	—, 1,2,4,5-tetrameth	yl-. See <i>Durene</i> .		
1293	—, tri-amino-*	See <i>Benzenetriamine</i> .		
1294	—, triaz-	diazobenzene imide; phenyl azoimide	$C_6H_5N_3$	119.12
1295	—, 1,2,3-tribromo-*	<i>r</i> -tribromobenzene	$C_6H_3Br_3$	314.83
1296	—, 1,2,4-tribromo-*	<i>as</i> -tribromobenzene	$C_6H_3Br_3$	314.83
1297	—, 1,3,5-tribromo-*	<i>sym</i> -tribromobenzene	$C_6H_3Br_3$	314.83
1298	—, 1,2,3-trichloro-*	<i>r</i> -trichlorobenzene	$C_6H_3Cl_3$	181.46
1299	—, 1,2,4-trichloro-*	<i>as</i> -trichlorobenzene	$C_6H_3Cl_3$	181.46
1300	—, 1,3,5-trichloro-*	<i>sym</i> -trichlorobenzene	$C_6H_3Cl_3$	181.46
1301	—, 1,3,5-triethoxy-*	phloroglucinol triethyl ether	$C_6H_3(OC_2H_5)_3$	210.27

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1262	need. f. al. ....	.....	172	subl.	i.	v. sl. s.	v. sl. s. eth.; s. chl., h. ac. a.
1263	col. pr. f. dil. al., 1.50489 ^{72,8}	liq. 0.847 ¹⁰⁷	53	230	i.	v. s.	.....
1264							
1265							
1266							
1267							
1268							
1269							
1270							
1271							
1272							
1273	col. liq.	0.914 ²⁰ / ₄ ; 0.924 ¹⁶ / ₄	.....	175, (176-7)	i.	s.	∞ eth.
1275							
1276	col. liq., 1.49549 ^{12,25}	0.862 ²⁰ / ₄	-101.6	159.45 (153-7)	0.006 ¹⁵	s.	s. eth.
1277							
1278	need. f. al. ....	.....	98.5	329	i.	v. sl. s.	v. s. eth., bz.
1279	monocl. pr. f. CS ₂	3.027 ²⁰ / ₄	178	.....	i.	v. sl. s.	v. s. eth.
1280	need. ....	.....	47.5	254	i.	sl. s.	v. s. eth., CS ₂
1281	need. f. al. ....	.....	51	246	sl. s. c., s. h.	v. sl. s.	s. eth.; v. s. CS ₂
1282	monocl. need. f. eth.	1.734 ¹⁰ / ₄ ; 1.858 ²¹ / ₄	138	246	i.	sl. s. h.	s. eth., bz., CS ₂
1283	liq., 1.5083....	0.887 ²¹ / ₄	.....	254	i.	sl. s.	s. eth.
1284	col. liq. or cr., 1.5025	0.888 ¹⁶ / ₄	13	250	i.	v. s.	v. s. eth.
1285							
1286							
1287	pr. f. CS ₂....	.....	136	subl.	.....	v. s.	v. s. eth.; s. chl.
1288	pr. f. eth. ....	.....	148	subl.	i.	v. sl. s.	v. sl. s. eth.; v. s. h. ac. a.
1289	need. f. eth. ....	.....	254	subl.	i.	v. sl. s.	v. sl. s. eth.; v. s. CS ₂
1290							
1291							
1292							
1293							
1294	yel. oil, 1.56421 ^{22,5}	1.078 ^{22,5}	.....	59 ¹² ; exp.	i.	sl. s.	sl. s. eth.
1295	col. monocl. pr. f. al.	2.658	87.4	.....	i.	sl. s. h.	v. s. eth.
1296	need. f. al. ....	.....	44	276	i.	sl. s.	s. eth., CS ₂ ; v. s. bz.
1297	need. f. al. ....	.....	119-21	278	i.	sl. s. h.	s. eth., bz., chl.
1298	pl. f. al. ....	.....	52	219	i.	sl. s.	v. s. eth.
1299	col. rhomb., 1.5671	1.574 ¹⁰ / ₄	17	213	i.	sl. s.	v. s. eth.
1300	lng. need. ....	.....	63	208.5	i.	s.	v. s. eth.
1301	col. cr. ....	.....	43	175 ²⁴	i.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1302	Benzene, 1,2,4-triethyl-	<i>as</i> -triethylbenzene.....	$(C_2H_5)_3C_6H_3$	162.27
1303	—, 1,3,5-triethyl- ...	<i>sym</i> -triethylbenzene.....	$(C_2H_5)_3C_6H_3$	162.27
1304	—, 1,3,5-trihydroxam-	<i>ino</i> -. See 1,3,5-Cyclohexanetri-	one, trioxime.	
1305	—, 1,2,3-trihydroxy-	See <i>Pyrogallol</i> .		
1306	—, 1,2,4-trihydroxy-	See 1,2,4-Benzenetriol.		
1307	—, 1,3,5-trihydroxy-	See <i>Phloroglucinol</i> .		
1308	—, 1,2,3-triiodo-* ...	<i>v</i> -triiodobenzene.....	$C_6H_3I_3$	455.84
1309	—, 1,2,4-triiodo-* ...	<i>as</i> -triiodobenzene.....	$C_6H_3I_3$	455.84
1310	—, 1,3,5-triiodo-* ...	<i>sym</i> -triiodobenzene.....	$C_6H_3I_3$	455.84
1311	—, 1,2,3-trimethoxy-*	pyrogallol trimethyl ether...	$C_6H_3(OCH_3)_3$	168.19
1312	—, 1,3,5-trimethoxy-*	phloroglucinol trimethyl ether	$C_6H_3(OCH_3)_3$	168.19
1313	—, 1,2,4-trimethoxy-5-propenyl-	asaron.....	$CH_3CH:CHC_6H_2(OCH_3)_3$	208.25
1314	—, 1,2,3-trimethyl-	See <i>Hemimellitene</i> .		
1315	—, 1,2,4-trimethyl-	See <i>Pseudocumene</i> .		
1316	—, 1,3,5-trimethyl-	See <i>Mesitylene</i> .		
1317	—, 1,2,3-trinitro-* ...	<i>v</i> -trinitrobenzene.....	$C_6H_3(NO_2)_3$	213.11
1318	—, 1,2,4-trinitro-* ...	<i>as</i> -trinitrobenzene.....	$C_6H_3(NO_2)_3$	213.11
1319	—, 1,3,5-trinitro-* ...	<i>sym</i> -trinitrobenzene.....	$C_6H_3(NO_2)_3$	213.11
1320	—, 1,3,5-triphenyl- ...	<i>sym</i> -triphenylbenzene.....	$(C_6H_5)_3C_6H_3$	306.39
1321	—, vinyl-	See <i>Styrene</i> .		
1322	Benzenearsonic acid, p-	-amino- . See <i>Arsanilic acid</i> .		
1323	Benzene azimide.	See 1,2,3-Benzotriazole.		
1324	Benzenearsoaniline.	See <i>Azobenzene, amino-</i> .		
1325	Benzenearsoethane	ethaneazobenzene; ethylphenyldiimide	$C_6H_5N:NC_2H_5$	134.18
1326	Benzenearsomethane ..	methaneazobenzene; methylphenyldiimide	$C_6H_5N:NCH_3$	120.15
1327	Benzenearso-β-naphthol, p-nitro-	See 2-Naphthol.	1- <i>p</i> -phenylazo-	
1328	4-Benzenearso-α-naphthylamine.	See 1-Naphthylamine.	mine, 4-phenylazo-	
1328H	Benzenearsonic acid.	See <i>Boric acid, phenyl-</i> .		
1328R	Benzenearsonic acid, o-	and <i>m-chloro</i> . See <i>Boric acid, o (and m)-chlorophenyl-</i> .		
1329	Benzenecarbonal.*	See <i>Benzaldehyde</i> .		
1330	Benzenecarbonamide.	See <i>Benzamide</i> .		
1331	Benzenecarbonamidin e.*	See <i>Benzamidine</i> .		
1332	Benzenecarbonitrile.*	See <i>Benzonitrile</i> .		
1333	Benzenecarbonyl bromide*, etc.	See <i>Benzoyl bromide</i> .	etc.	
1334	Benzenecarbothioic acid*	See <i>Benzoic acid, thio-</i> .		
1335	Benzenecarboxylic acid*	See <i>Benzoic acid</i> .		
1336	1,2-Benzenediacetoni-trile	<i>o</i> -xylylene cyanide.....	$C_6H_4(CH_2CN)_2$...	156.18
1337	1,3-Benzenediacetoni-trile	<i>m</i> -xylylene cyanide.....	$C_6H_4(CH_2CN)_2$...	156.18
1338	1,4-Benzenediacetoni-trile	<i>p</i> -xylylene cyanide.....	$C_6H_4(CH_2CN)_2$...	156.18
1339	Benzenediamine.	See <i>Phenylenediamine</i> .		
1340	Benzenediazoanilide.	See <i>Diazoaminobenzene*</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1302	arom. liq., 1.4972	0.8819 $\frac{17}{4}$	.....	218	i.	s.	s. eth.
1303	col. liq., 1.4939	0.863 $\frac{20}{4}$	.....	218	i.	v. s.	v. s. eth.
1304							
1305							
1306							
1307							
1308	need. f. al. ....	.....	116	subl.	i.	v. s.	v. s. eth.
1309	need. f. al. ....	.....	91 (84)	subl.	i.	s.	s. eth., chl.
1310	need. f. ac. a. ....	.....	184 (180)	subl.	i.	v. sl. s.	v. sl. s. eth.; s. ac. a.
1311	col. rhomb. need. f. dil. al.	1.0987 $\frac{75}{75}$	47	241 (235)	.....	v. s.	v. s. eth., bz.
1312	col. pr. f. al. ....	.....	54-5 (52)	255.5	i.	v. s.	v. s. eth., bz.
1313	monocl. need. f. w., 1.5719 ¹¹	1.165	67	296, subl. d.	sl. s. h.	v. s.	v. s. eth.; s. ac. a., chl., CCl ₄
1314							
1315							
1316							
1317	lt. grn. pr. f. al. ....	.....	127.5	.....	i.	10 h.	.....
1318	col.-yel. cr.	1.73 $\frac{16}{4}$	61.0	.....	sl. s.	5.45 ¹⁵	7.13 ¹⁵ eth.
1319	col.-yel. rhomb. pl. f. bz.	1.688 $\frac{20}{4}$	61, 121	d.	0.04 ¹⁶	1.9 ¹⁶	1.07 ^{17,5} eth.; v. s. bz.
1320	rhomb. tab. f. eth.; 1.524, 1.867, 1.873	1.206 $\frac{20}{4}$	170	.....	.....	sl. s.	sl. s. eth.; s. bz.
1321							
1322							
1323							
1324							
1325	lt. yel. oil, N ^{21.9} 1.53133	0.9628 ^{21.9}	.....	175-85 d.	sl. s.	v. s.	v. s. eth.
1326	α yel. oil. ....	.....	.....	150	.....	s.	s. eth.
1327							
1328							
1328 H							
1328 R							
1329							
1330							
1331							
1332							
1333							
1334							
1335							
1336	col. cr. f. eth. ....	.....	59-60	.....	.....	s.	s. eth.
1337	cr. ....	.....	28-9	305-10 ³⁰⁰ sl. d.	i.	s.	s. eth., chl.
1338	lng. pr. f. eth. or need. f. w.	.....	98	.....	sl. s. h.	s.	s. eth., chl.
1339							
1340							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1341	Benzenediazonium chloride*	diazobenzene chloride	$C_6H_5N(:N)Cl$	140.57
1342	Benzenediazonium cyanide*	diazobenzene cyanide	$C_6H_5N(:N)CN$. . .	131.13
1343	Benzenediazonium nitrate*	diazobenzene nitrate	$C_6H_5N(:N)NO_3$. .	167.12
1344	Benzenediazonium tribromide*	diazobenzene perbromide . . .	$C_6H_5N(:N)Br_3$. . .	344.86
1345	Benzenedicarbinol.	See <i>Xylylene glycol</i> .		
1346	1,2-Benzenedicarbonyl	*. See <i>Phthalaldehyde</i> .		
1347	1,3-Benzenedicarbonyl	*. See <i>Isophthalaldehyde</i> .		
1348	1,4-Benzenedicarbonyl	*. See <i>Terephthalaldehyde</i> .		
1349	1,3-Benzenedicarbonitrile*	See <i>Isophthalonitrile</i> .		
1350	1,4-Benzenedicarbonitrile*	See <i>Terephthalonitrile</i> .		
1351	1,2-Benzenedicarbonyl chloride*	See <i>Phthalyl chloride</i> .		
1352	1,3-Benzenedicarbonyl chloride*	See <i>Isophthalyl chloride</i> .		
1353	1,4-Benzenedicarbonyl chloride*	See <i>Terephthalyl chloride</i> .		
1354	1,2-Benzenedicarboxylic acid*	See <i>Phthalic acid</i> .		
1355	1,3-Benzenedicarboxylic acid*	See <i>Isophthalic acid</i> .		
1356	1,4-Benzenedicarboxylic acid*	See <i>Terephthalic acid</i> .		
1357	1,2-Benzenediol*	See <i>Pyrocatechol</i> .		
1358	1,3-Benzenediol*	See <i>Resorcinol</i> .		
1359	1,4-Benzenediol*	See <i>Hydroquinone</i> .		
1360	1,3-Benzenedithiol*	See <i>Resorcinol, dithio-</i> .		
1361	1,4-Benzenedithiol*	See <i>Hydroquinone, dithio-</i> .		
1362	Benzenhexacarboxylic acid*	See <i>Mellitic acid</i> .		
1363	Benzenhexol*	See <i>Benzene, hexahydroxy-</i> .		
1364	Benzenindone.	See <i>Aposafrazone</i> .		
1365	Benzenepentacarboxylic acid*		$C_6H(COOH)_5$	298.16
1366	Benzenepentamine*	pentaaminobenzene	$C_6H(NH_2)_5$	153.19
1367	Benzenepropionic acid	See <i>Hydrocinnamic acid</i> .		
1368	Benzenesiliconic acid	silicobenzoic acid	C_6H_5SiOOH	138.17
1369	Benzenesulfanilide.	See <i>Benzenesulfonanilide</i> .		
1370	Benzene sulfide.	See <i>Phenyl sulfide</i> .		
1371	Benzenesulfinic acid*		$C_6H_5SO_2H$	142.17
1372	Benzenesulfonamide.	benzenesulfonic amide	$C_6H_5SO_2NH_2$	157.18
1372M	Benzenesulfonamide,	<i>p</i> -amino-. See <i>Sulfanilamide</i> .		
1372T	Benzenesulfonamide,	<i>p</i> -amino- <i>N</i> -2-pyridyl-. See <i>Sulfa pyridine</i> .		
1373	Benzenesulfonanilide	benzenesulfanilide	$C_6H_5SO_2NHC_6H_5$. .	233.28
1374	Benzene sulfone.	See <i>Phenyl sulfone</i> .		
1375	Benzenesulfone chloride.	See <i>Benzenesulfonyl chloride</i> .		
1376	Benzenesulfonic acid*		$C_6H_5SO_3H$	158.17
1377	—, sodium salt		$C_6H_5SO_3Na$	180.16
1378	—, <i>o</i> -amino-.	See <i>Orthanilic acid</i> .		
1379	—, <i>m</i> -amino-.	See <i>Metanilic acid</i> .		
1380	—, <i>p</i> -amino-.	See <i>Sulfanilic acid</i> .		
1381	—, <i>p</i> -(4-amino-1-naphthylazo)-		$SO_2HC_6H_4N:NC_{10}H_6NH_2$	327.35
1382	—, <i>o</i> -bromo-.		$BrC_6H_4SO_3H$	237.08
1383	—, <i>p</i> -bromo-.		$BrC_6H_4SO_3H$	237.08
1384	—, <i>p</i> -chloro-.		$ClC_6H_4SO_3H$	192.62
1385	—, <i>p</i> -(<i>p</i> -dimethylaminophenylazo)-, sodium salt.	See <i>Methyl orange</i> .		
1386	—, <i>o</i> -formyl-.	<i>o</i> -benzaldehydesulfonic acid . .	$C_6H_4(CHO)SO_3H$. .	186.18
1387	—, methyl-.	See <i>Toluenesulfonic acid</i> .		
1388	—, <i>o</i> -nitro-.		$NO_2C_6H_4SO_3H$	203.17

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1341	col. need.....	.....	d.	exp.	v. s.	s.	i. eth., bz., lgr.; s. acet.
1342	yel. pr.....	.....	69	.....	sl. s.	.....	.....
1343	col. need.....	1.37 ²⁰ / ₄	exp. at 90	.....	v. s.	s.	i. eth., chl., bz.
1344	or. yel. tab. f. al.	.....	63.5 d.	.....	i.	sl. s.	i. eth.
1345							
1346							
1347							
1348							
1349							
1350							
1351							
1352							
1353							
1354							
1355							
1356							
1357							
1358							
1359							
1360							
1361							
1362							
1363							
1364							
1365	rhomb.....	.....	238; +5H ₂ O d. 238	.....	s.	s.	sl. s. eth.; i. bz.
1366	need.....	.....	.....	.....	v. s.	i.	i. eth.
1367							
1368	glassy f. eth....	.....	92	.....	i.	.....	v. s. eth.; s. KOH
1369							
1370							
1371	pr. f. w.....	.....	84	100 d.	sl. s.	v. s.	v. s. eth.
1372	monocl. need. f. w. or pl. f. al.	.....	156	.....	0.43 ¹⁶	v. s. h.	v. s. eth.
1372M							
1372 T							
1373	tetr. pr., 1.600, 1.649	.....	110	.....	4.3 ¹⁶	v. s.	v. s. eth.
1374							
1375							
1376	col. leaf. or need.	.....	+1.5H ₂ O 43-4; anh. 50-1	d.	v. s.	v. s.	i. eth.; sl. s. bz.
1377	need. f. w.....	.....	450 d.	.....	47	sl. s. h.	.....
1378							
1379							
1380							
1381	vlt. need.....	.....	.....	.....	i.	v. sl. s.	.....
1382	deliq. need....	.....	.....	.....	v. s.	s.	.....
1383	deliq. need....	.....	102-3	155 ²⁵	s.	s.	.....
1384	deliq. need....	.....	68	147-8 ²⁵	s.	s.	i. eth., bz.
1385							
1386			114	.....	s.	.....	.....
1387							
1388	leaf.....	.....	70	d.	v. s.	s.	i. eth.; s. alk.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1389	Benzenesulfonic amide	e. See <i>Benzenesulfonamide</i> *.		
1390	Benzenesulfonyl chloride*	benzenesulfonic chloride; benzenesulfone chloride	$C_6H_5SO_2Cl$	176.62
1391	—, <i>p</i> -bromo-	.....	$BrC_6H_4SO_2Cl$	255.53
1392	1,2,3,4-Benzenetetracarboxylic acid*	See <i>Mellonic acid</i> .		
1393	1,2,3,5-Benzenetetracarboxylic acid*	See <i>Prehnitic acid</i> .		
1394	1,2,4,5-Benzenetetracarboxylic acid*	See <i>Pyromellitic acid</i> .		
1395	1,2,3,5-Benzenetetrol*	1,2,3,5-tetrahydroxybenzene..	$C_6H_2(OH)_4$	142.11
1396	1,2,4,5-Benzenetetrol*	.....	$C_6H_2(OH)_4$	142.11
1397	Benzenethiol*	See <i>Phenol, thio-</i> .		
1398	1,2,3-Benzenetriamine*	<i>tri</i> -triaminobenzene	$C_6H_3(NH_2)_3$	123.16
1399	1,2,4-Benzenetriamine*	<i>asym</i> -triaminobenzene	$C_6H_3(NH_2)_3$	123.16
1400	1,2,3-Benzenetricarboxylic acid*	See <i>Hemimellitic acid</i> .		
1401	1,2,4-Benzenetricarboxylic acid*	See <i>Trimellitic acid</i> .		
1402	1,3,5-Benzenetricarboxylic acid*	See <i>Trimesic acid</i> .		
1403	1,2,3-Benzenetriol*	See <i>Pyrogallol</i> .		
1404	1,2,4-Benzenetriol*	hydroxyquinol; hydroxyhydroquinone	$C_6H_3(OH)_3$	126.11
1405	1,3,5-Benzenetriol*	See <i>Phloroglucinol</i> .		
1406	1,3,5-Benzenetrisulfonic acid*	.....	$C_6H_3(SO_3H)_3$	318.29
1407	Benzenyl amidine.	See <i>Benzamidine</i> .		
1408	Benzenyl aminoxime.	See <i>Benzamide oxime</i> .		
1409	Benzenylphenyleneamidine.	See <i>Benzimidazole, 2-phenyl-</i> .		
1410	Benzhydrol.	See <i>Benzohydrol</i> .		
1411	Benzidine	<i>p,p'</i> -bianiline; 4,4'-diaminobiphenyl	$NH_2C_6H_4C_6H_4NH_2$	184.23
1412	—, 2-amino-	<i>o</i> -amino- <i>p,p'</i> -diaminobiphenyl	$(NH_2)_2C_6H_3C_6H_4-NH_2$	199.25
1413	—, <i>N,N'</i> -diacetyl-	<i>p,p'</i> -biacetanilide	$(CH_3CONHC_6H_4)_2$	268.31
1415	—, 3,3'-dimethyl-	See <i>o-Tolidine</i> .		
1416	—, <i>N,N'</i> -diphenyl- . . . . .	.....	$[C_6H_4NHC_6H_5]_2$	336.42
1417	—, 3-ethoxy-	4,4'-diamino-3-ethoxybiphenyl	$NH_2C_6H_4C_6H_3(OC_2H_5)NH_2$	228.29
1418	2,2'-Benzidinedisulfonic acid ($NH_2=1$)	4,4'-diamino-2,2'-biphenyldisulfonic acid	$(NH_2)_2C_{12}H_6(SO_3H)_2$	344.35
1419	Benzidine sulfone	dibenzothiophene-2,7-diamine 9-dioxide; 2,7-diaminobiphenylene sulfone	$(NH_2C_6H_3)_2SO_2$	246.28
1420	Benzil	diphenylglyoxal; bibenzoyl; dibenzoyl; diphenyl diketone	$C_6H_5COCOC_6H_5$	210.22
1421	—, α -dioxime . . . . .	.....	$(C_6H_5C:NOH)_2$	240.25
1422	—, β -dioxime . . . . .	.....	$(C_6H_5C:NOH)_2$	240.25
1423	—, γ -dioxime . . . . .	.....	$(C_6H_5C:NOH)_2$	240.25

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1389							
1390	rhomb. cr. or col. oily liq.	1.378 ²³	14.5; frz. 0	246-7d.	i.	v. s.	s. eth.
1391	tricl. or monocl. f. eth.	.....	75	153 ¹⁵	i.	d.	v. s. eth.
1392							
1393							
1394							
1395	need. f. w. ....	.....	165	.....	v. s.	v. s.	i. chl., bz.
1396	leaf. f. ac. a. ....	.....	220	.....	v. s.	v. s.	v. s. eth.; sl. s. HCl
1397							
1398	cr. ....	.....	103	336	v. s.	v. s.	v. s. eth.
1399	leaf. f. chl. ....	.....	100	340	v. s.	v. s.	v. sl. s. eth.; s. chl.
1400							
1401							
1402							
1403							
1404	col. monocl. leaf. f. w. or eth.	.....	140.5	.....	v. s.	v. s.	v. s. eth.; sl. s. bz.
1405							
1406	deliq. cr. +3H ₂ O	.....	d. >100	.....	s.	.....	.....
1407							
1408							
1409							
1410							
1411	wh. or sltly. redsh. cr. powd. or leaf. f. H ₂ O	1.250 ²⁰ / ₄	116.5-117, 120.5-121, 125, 129	401.7	0.04 ¹² , 0.94 ¹⁰⁰	s.	2.2 eth.
1412	need. ....	.....	134	.....	.....	.....	.....
1413	need. f. ac. a. ....	.....	331 (314-6)	subl. d.	i.	v. sl. s.	v. sl. s. eth.
1415							
1416	leaf. f. tol. ....	.....	242	.....	i.	sl. s.	s. h. tol.; sl. s. bz., acet.
1417	glit. flat need. f. w.	.....	134 (139)	.....	v. sl. s.	v. s. h.	v. sl. s. eth.
1418	monocl. pr. f. w.	.....	d. >175	.....	0.0791 ²²	v. sl. s.	v. sl. s. eth.
1419	yel. pl. ....	.....	327-8 (>350)	.....	i.	i.	i. eth., h. bz.
1420	yel. rhomb. need. f. al.	1.521 ^{13.3} / ₄	95	346-8 d.	i.	v. s.	v. s. eth.
1421	leaf. ....	.....	237 d.	.....	i.	0.05 ¹⁷	v. sl. s. eth., ac. a.; s. conc. NaOH
1422	need. (+C ₂ H ₅ O) f. al. ....	.....	206-7 d.	.....	sl. s. h.	15.26 ¹⁷	s. eth., ac. a., NH ₃ conc. NaOH
1423	need. (+al.) f. al.	.....	-al. 100; 164-5	.....	i.	>15.3 ¹⁷	s. conc. alk.; i. lgr.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1424	Benzil, α-mono-oxime.....	.....	$C_6H_5COC(:NOH)-C_6H_5$	225.24
1425	—, β -mono-oxime .....	.....	$C_6H_5COC(:NOH)-C_6H_5$	225.24
1426	—, <i>syn</i> (or α)-osazone.....	benzil <i>syn</i> -bisphenylhydrazone	$(C_6H_5C:NNHC_6H_5)_2$	390.47
1427	—, <i>anti</i> (or β)-osazone.....	benzil bisphenylhydrazone...	$(C_6H_5C:NNHC_6H_5)_2$	390.47
1428	Benzilam.	See <i>Oxazole, triphenyl</i> .		
1429	Benzilic acid	diphenylglycolic acid.....	$(C_6H_5)_2COHCOOH$	228.24
1430	Benzimidazole	benzoglyoxaline.....	$C_6H_4NHCH:N$...	118.13
1431	—, 2-phenyl-.....	2-phenylbenzoglyoxaline; benzylphenyleneamidine	$C_6H_4NHC(C_6H_5):N$	194.23
1432	2(3)-Benzimidazolone	phenyleneurea.....	$C_6H_4NHCONH$...	134.13
1433	Benzocaine	ethyl <i>p</i> -aminobenzoate; anaesthesin	$NH_2C_6H_4COOC_2H_5$	165.19
1434	1,3-Benzodiazine.	See <i>Quinazoline</i> .		
1435	1,4-Benzodiazine.	See <i>Quinoxaline</i> .		
1436	Benzodifluorochloride.	See <i>Toluene, α-chloro-α, α-difluoro</i> .		
1436M	Benzofluoride dichloride.	See <i>Toluene, α, α-dichloro-α-fluoro</i> .		
1437	Benzofuran	coumarone; benzfuran.	$C_6H_4OCH:CH$...	118.13
1438	2-Benzofurancarboxylic acid.	See <i>Coumarilic acid</i> .		
1439	Benzoglyoxaline.	See <i>Benzimidazole</i> .		
1440	Benzohydrazide.	See <i>Benzoic acid, hydrazide</i> .		
1441	Benzohydrol	diphenylcarbinol; benzhydrol	$(C_6H_5)_2CHOH$...	184.23
1442	—, <i>p</i> -amino-.....	<i>p</i> -aminodiphenylcarbinol....	$C_6H_5CHOHC_6H_4NH_2$	199.24
1443	—, <i>p,p'</i> -bisdimethylamino-	Michler's hydrol; tetramethyl-4,4'-diaminobenzohydrol	$HOCH(C_6H_4N(CH_3)_2)_2$	270.36
1444	<i>p</i>-Benzohydrolcarboxylic acid.	See <i>Benzoic acid, p-(α-hydroxybenzyl)-</i> .		
1445	Benzohydrol ether.	See <i>Benzohydryl ether</i> .		
1446	Benzohydroxamic acid.....	.....	$C_6H_5C(:NOH)OH$	137.13
1447	Benzohydrylamine	α -aminodiphenylmethane....	$(C_6H_5)_2CHNH_2$...	183.24
1448	Benzohydryl ether	benzohydrol ether	$[(C_6H_5)_2CH]_2O$..	350.44
1449	Benzoic acid	benzenecarboxylic acid*; phenylformic acid	C_6H_5COOH	122.12
1450	—, allyl ester.....	allyl benzoate.....	$C_6H_5COOC_3H_5$...	162.18
1451	—, anhydride.....	See <i>Benzoic anhydride</i> .		
1452	—, benzyl ester.....	benzyl benzoate; benzyl benzenecarboxylate	$C_6H_5COOCH_2C_6H_5$	212.24
1453	—, butyl ester.....	butyl benzoate; butyl benzenecarboxylate*	$C_6H_5COOC_4H_9$...	178.22
1454	—, ethyl ester.....	ethyl benzoate; ethyl benzenecarboxylate*	$C_6H_5COOC_2H_5$...	150.17
1455	—, ethylene ester.	See <i>Glycol, dibenzoate</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1424	lust. pl. f. al...	.....	137-8	d. 200	sl. s.	v. s.	v. s. eth.; s. chl., ac. a.; sl. s. c. bz., lgr.
1425	need. f. bz....	.....	113-4	.....	sl. s.	v. s.	v. s. eth.; s. most org. solv.; i. lgr.
1426	yel. need.....	.....	208	.....	.....	sl. s. c.	s. eth.; 1.7 ¹⁹ acet.
1427	need.....	.....	225	d.	i.	sl. s.	sl. s. eth.; 2.4 ¹⁹ acet.; v. s. h. chl., bz.
1428	monocl. need. f. w. rhomb. pl. f. al.	.....	150	d. 180	v. s. h.	v. s.	v. s. eth.; s. H ₂ SO ₄
1429		.....	170	>360	s.	■.	s. eth., a., alk.
1430		.....	280 (291)	.....	sl. s.	v. s.	sl. s. bz., chl.
1431	tab. f. ac. a.; need. f. w.	.....	305	.....	sl. s.	s.	sl. s. bz.; i. dil a.
1432	plates.....	.....	91-2 (88-90)	.....	0.04	20	14.3 eth.; s. chl.
1433	col. pr. f. al. or rhomb. f. eth.	.....	.....	.....	.....	.....	.....
1434	liq., 1.56450 ^{22.7}	1.0776 ¹⁵ ₁₅	<-18	174 (169)	i.	s.	s. eth.; i. alk.
1435							
1436							
1436M							
1437							
1438	silky need. f. lgr.	.....	68-69	298.5	0.05 c.	v. s.	v. s. eth.; s. ac. a., chl., CCl ₄
1439							
1440							
1441	need. f. bz. or h. w.	.....	121	.....	s.	v. s.	sl. s. eth., pet. eth., lgr.; s. me. al., acet., glac. ac. a.
1442	col. tricl. pr. f. bz.	.....	96	.....	i.	s.	s. eth., bz.
1443	rhomb. lvs....	.....	131-132	exp.	2.25 ⁶	s.	sl. s. eth.; i. bz.
1444							
1445							
1446	hex. pl. or liq., 1.5963 ²²	1.0635 ²² ₀	34	288 (301 ⁷⁴⁶)	sl. s.	.....	.....
1447	monocl. f. bz..	.....	109-11	315 ⁷⁴⁵ d.	.....	sl. s.	sl. s. eth.; s. bz.
1448	col. monocl. leaf. or need., 1.5397 ⁴¹⁵	1.2659 ¹⁵ ₄	122	249	0.18 ⁴ , 0.27 ¹⁸ , 2.2 ⁷⁵	47.1 ¹⁵	40 ¹⁵ eth.; s. chl., CCl ₄ , acet., me. al., bz., CS ₂
1449	yel. liq.....	1.058 ¹⁵ ₁₅	.....	230	i.	s.	∞ eth.
1450	col. oily liq., or need. or leaf., 1.5681 ²¹	1.114 ¹⁸	21 (18.5)	323-4 (316-7)	i.	s.	s. eth., chl.; i. glyc.
1451							
1452	thick col. oil..	1.000 ²⁰ ₄	-22.4	250.3	i.	∞	∞ eth.
1453	col. liq., 1.50682 ^{17.3}	1.0509 ¹⁵ ₄	-34.6	212.6	0.08 ²⁰	s.	∞ eth.; s. chl., pet. eth.
1454	.....	1.047 ²⁰ ₄	.....	.....	.....	.....	.....
1455	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1456	Benzoic acid , hydrazide.	benz(o)hydrazide; benzoyl-hydrazine	$C_6H_5CONHNH_2$..	136.15
1457	—, isoamyl ester.....	3-methyl-1-butanol benzoate	$C_6H_5COOC_5H_{11}$...	192.25
1458	—, isobutyl ester.....	isobutyl benzoate; β -methyl-propyl benzenecarboxylate*	$C_6H_5COOCH_2-CH(CH_3)_2$	178.22
1459	—, isopropyl ester.....	.....	$C_6H_5COOCH-(CH_3)_2$	164.20
1460	—, methylene diester.....	methylene dibenzoate; methylene benzoate; methanediol dibenzoate	$(C_6H_5COO)_2CH_2$..	256.25
1461	—, methyl ester.....	methyl benzoate; niobe oil...	$C_6H_5COOCH_3$...	136.14
1462	—, phenyl ester.....	phenyl benzoate.....	$C_6H_5COOC_6H_5$...	198.21
1463	—, phenylhydrazide.....	1-benzoyl-2-phenylhydrazine	$C_6H_5CONHNHC_6H_5$	212.24
1464	—, propyl ester.....	<i>n</i> -propyl benzoate.....	$C_6H_5COOC_3H_7$...	164.20
1465	—, <i>o</i> -acetamido-..	See <i>Anthranilic acid</i> , <i>N</i> -acetyl-.	.....	.....
1466	—, <i>m</i> -acetamido-..	.....	$CH_3CONHC_6H_4-COOH$	179.17
1467	—, <i>p</i> -acetamido-..	.....	$CH_3CONHC_6H_4-COOH$	179.17
1468	—, <i>o</i> -acetoxy-..	See <i>Aspirin</i>.	.....	.....
1469	—, <i>o</i> -acetyl-..	<i>o</i> -acetophenonecarboxylic acid	$CH_3COC_6H_4-COOH$	164.15
1470	—, <i>p</i> -acetyl-..	.....	$CH_3COC_6H_4COOH$	164.15
1471	—, <i>o</i> -amino-..	See <i>Anthranilic acid</i>.	.....	.....
1472	—, <i>m</i> -amino-..	.....	$NH_2C_6H_4COOH$...	137.13
1473	—, <i>p</i> -amino-..	.....	$NH_2C_6H_4COOH$...	137.13
1474	—, —, butyl ester.	See <i>Butesin</i>.	.....	.....
1475	—, —, β -diethylamino-	ethyl ester, hydrochloride. See <i>Procaine hydrochloride</i>.	.....	.....
1476	—, —, ethyl ester.	See <i>Benzocaine</i>.	.....	.....
1477	—, —, methyl ester.....	.....	$NH_2C_6H_4COOCH_3$	151.16
1478	—, 3-amino-2-nitro-	.....	$NH_2(NO_2)C_6H_3-COOH$	182.13
1479	—, 3-amino-4-nitro-	.....	$NH_2(NO_2)C_6H_3-COOH$	182.13
1480	—, 3-amino-5-nitro-	.....	$NH_2(NO_2)C_6H_3-COOH$	182.13
1481	—, 4-amino-2-nitro-	.....	$NH_2(NO_2)C_6H_3-COOH$	182.13
1482	—, 4-amino-3-nitro-	.....	$NH_2(NO_2)C_6H_3-COOH$	182.13
1483	—, 5-amino-2-nitro-	3-amino-6-nitrobenzoic acid..	$NH_2(NO_2)C_6H_3-COOH$	182.13
1484	—, <i>o</i> -anilino-..	See <i>Anthranilic acid</i> , <i>N</i> -phenyl-.	.....	.....
1485	—, azodi-..	See <i>Azobenzoic acid</i>.	.....	.....
1486	—, azoxydi-..	See <i>Azoxybenzoic acid</i>.	.....	.....
1487	—, <i>o</i> -benzamido-..	See <i>Anthranilic acid</i> , <i>N</i> -benzoyl-.	.....	.....
1488	—, <i>m</i> -benzamido-..	<i>m</i> -benzoylaminobenzoic acid	$C_6H_5CONHC_6H_4-COOH$	241.24
1489	—, <i>p</i> -benzamido-..	<i>p</i> -benzoylaminobenzoic acid..	$C_6H_5CONHC_6H_4-COOH$	241.24
1490	—, <i>o</i> -benzohydryl-..	triphenylmethane- <i>o</i> -carboxylic acid	$(C_6H_5)_2CHC_6H_4-COOH$	288.33

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1456	pl. f. w. ....	.....	112.5	267 d.	s.	s.	sl. s. eth., chl., bz.
1457	col. liq.	0.9925 ¹⁹	.....	262	i.	s.	∞ eth.
1458	col. liq.	1.002 ¹⁵ / ₄	.....	237	i.	—	∞ eth.
1459	col. liq.	1.0162 ¹⁵ / ₄	.....	218.5	i.	s.	s. eth.
1460	need. ....	.....	97.8	.....	sl. s.	s.	s. eth.
1461	col. liq., 1.51810 ¹⁶	1.0937 ¹⁵ / ₄ ; 1.088 ²⁰ / ₄	-12.5	199.6	0.0157 ³⁰	∞	∞ eth.
1462	col. monocl.	1.235 ³¹ / ₄	70	314	v. sl. s.	s.	s. eth.
1463	col. pl. f. al. ....	.....	168	.....	sl. s. h.	s. h.	sl. s. eth.
1464	col. liq.	1.027 ¹⁵ / ₄	-51.6	231.2	v. sl. s.	∞	∞ eth.
1465	need. f. al. ....	.....	249-50	subl.	v. sl. s.	sl. s. h.	sl. s. eth.
1466	need. ....	.....	250-2	.....	sl. s.	s.	sl. s. eth.
1468	cr. f. w. ....	.....	114-15	.....	s. h.	.....	.....
1469	need. f. h. w. ....	.....	200	subl.	sl. s.	sl. s.	sl. s. eth.; i. lgr.
1471	yel. need.	1.511 ²⁰ / ₄	174 (179.5)	subl.	0.59 ¹⁵	2.2 ¹⁰	1.81 ^{5.6} eth.
1472	yelsh.-red monocl.	.....	187	.....	0.34 ^{9.6}	11.3 ^{9.6}	8.21 ^{5.8} eth.
1473	col. leaf. ....	.....	112	.....	.....	.....	.....
1474	yel. need. f. w.	.....	156-7	165 d.	v. s. h.	v. s.	v. s. eth.
1475	red leaf. f. al.	.....	298 d.	.....	sl. s.	s.	s. eth.
1476	yel. pr. f. w. ....	.....	208	.....	sl. s.	v. s. h.	s. ac. a.
1477	red need. f. w.	.....	239.5 d.	.....	s. h.	v. s.	.....
1478	red-yel. need. f. al.	.....	284	.....	i.	sl. s. h.	.....
1479	yel. need. or pr.	.....	235 d.	.....	sl. s. h.	s. h.	sl. s. eth.
1480	red. pr. f. al.	1.5105 ⁴ / ₄	248 (174)	subl.	sl. s.	s.	s. eth.
1481	sm. need. f. al.	.....	278	.....	sl. s.	s.	s. eth., ac. a.
1482	need. f. al. ....	.....	161-2	subl.	i.	s.	s. eth.
1483	red. pr. f. al.	1.5105 ⁴ / ₄	248 (174)	subl.	sl. s.	s.	s. eth.
1484	sm. need. f. al.	.....	278	.....	sl. s.	s.	s. eth., ac. a.
1485	need. f. al. ....	.....	161-2	subl.	i.	s.	s. eth.
1486	red. pr. f. al.	1.5105 ⁴ / ₄	248 (174)	subl.	sl. s.	s.	s. eth.
1487	sm. need. f. al.	.....	278	.....	sl. s.	s.	s. eth., ac. a.
1488	need. f. al. ....	.....	161-2	subl.	i.	s.	s. eth.
1489	red. pr. f. al.	1.5105 ⁴ / ₄	248 (174)	subl.	sl. s.	s.	s. eth.
1490	sm. need. f. al.	.....	278	.....	sl. s.	s.	s. eth., ac. a.
1491	need. f. al. ....	.....	161-2	subl.	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1491	Benzoic acid, o-benzoyl-	benzophenone- <i>o</i> -carboxylic acid	$C_6H_5COC_6H_4COOH$	226.22
1492	—, <i>m</i>-benzoyl-	benzophenone- <i>m</i> -carboxylic acid	$C_6H_5COC_6H_4COOH$	226.22
1493	—, <i>p</i>-benzoyl-	benzophenone- <i>p</i> -carboxylic acid	$C_6H_5COC_6H_4COOH$	226.22
1494	—, benzoylamino-	See <i>Benzoic acid, benzamido-</i> .		
1495	—, <i>o</i>-benzyl-	diphenylmethane- <i>o</i> -carboxylic acid	$C_6H_5CH_2C_6H_4COOH$	212.24
1496	—, <i>m</i>-benzyl-		$C_6H_5CH_2C_6H_4COOH$	212.24
1497	—, <i>p</i>-benzyl-		$C_6H_5CH_2C_6H_4COOH$	212.24
1498	—, <i>o</i>-bromo-		BrC_6H_4COOH ...	201.03
1499	—, <i>m</i>-bromo-		BrC_6H_4COOH ...	201.03
1500	—, <i>p</i>-bromo-		BrC_6H_4COOH ...	201.03
1501	—, <i>p,p'</i>-carbonyldi-	<i>p,p'</i> -benzophenonedicarboxylic acid	$CO(C_6H_4COOH)_2$	270.23
1502	—, <i>o</i>-(carboxymethoxy)-	salicylic- <i>O</i> -acetic acid; salicylacetic acid	$HOOCCH_2OC_6H_4COOH$	196.15
1503	—, <i>o</i>-chloro-		ClC_6H_4COOH ...	156.57
1504	—, <i>m</i>-chloro-		ClC_6H_4COOH ...	156.57
1505	—, <i>p</i>-chloro-		ClC_6H_4COOH ...	156.57
1506	—, <i>p</i>-cyano-	terephthalic mononitrile	CNC_6H_4COOH ...	147.13
1507	—, 2,3-diamino-		$C_6H_3(NH_2)_2COOH$	152.15
1508	—, 2,4-diamino-		$C_6H_3(NH_2)_2COOH$	152.15
1509	—, 2,5-diamino-		$C_6H_3(NH_2)_2COOH$	152.15
1510	—, 3,4-diamino-		$C_6H_3(NH_2)_2COOH$	152.15
1511	—, 3,5-diamino-		$C_6H_3(NH_2)_2COOH$	152.15
1512	—, 2,3-dibromo-		$C_6H_3Br_2COOH$...	279.93
1513	—, 2,4-dibromo-		$C_6H_3Br_2COOH$...	279.93
1514	—, 2,5-dibromo-		$C_6H_3Br_2COOH$...	279.93
1515	—, 2,6-dibromo-		$C_6H_3Br_2COOH$...	279.93
1516	—, 3,4-dibromo-		$C_6H_3Br_2COOH$...	279.93
1517	—, 2,3-dichloro-		$Cl_2C_6H_3COOH$...	191.02
1518	—, 2,4-dichloro-		$Cl_2C_6H_3COOH$...	191.02
1519	—, 2,5-dichloro-		$Cl_2C_6H_3COOH$...	191.02
1520	—, 2,6-dichloro-		$Cl_2C_6H_3COOH$...	191.02
1521	—, 3,4-dichloro-		$Cl_2C_6H_3COOH$...	191.02
1522	—, 3,5-dichloro-		$Cl_2C_6H_3COOH$...	191.02
1523	—, 2,3-dihydroxy- ...	<i>o</i> -pyrocatechuic acid; pyrocatechol- <i>o</i> -acid	$(HO)_2C_6H_3COOH$	154.12
1524	—, 2,4-dihydroxy- ...	See <i>β-Resorcylic acid</i> .		
1525	—, 2,5-dihydroxy- ...	See <i>Gentisic acid</i> .		
1526	—, 2,6-dihydroxy- ...	See <i>γ-Resorcylic acid</i> .		
1527	—, 3,4-dihydroxy- ...	See <i>Protocatechuic acid</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1491	tricl. need. (+1H ₂ O) f. h. w.	.....	+H ₂ O, 93; anh. 127	.....	s. h.	v. s.	v. s. eth.
1492	need. f. dil. al.	.....	161-2	subl.	sl. s.	s.	s. eth.
1493	monocl. leaf. f. w.	.....	194	subl.	sl. s.	s.	s. eth., ac. a.; sl. s. chl., bz.
1494	need. f. dil. al.	.....	114	subl.	sl. s.	s.	s. eth., chl., bz.
1495	need. f. dil. al.	.....	107-8	subl.	v. sl. s.	s.	s. eth., chl.
1496	need. f. w. or leaf. f. dil. al.	.....	157-8	subl.	sl. s.	s.	s. eth., chl., bz.
1497	col. monocl. need. f. w.	1.929 ²⁵ / ₄	147-50	subl.	0.18 ²⁵	s.	s. eth., chl.
1498	col. monocl. need.	1.845 ²⁵ / ₄	155	280	0.04 ²⁵	s.	s. eth.
1499	col. monocl. need. or leaf. f. w.	1.894 ²⁵ / ₄	251-3	.....	0.0056 ²⁵	s.	s. eth.
1500	gel. ....	.....	subl. <360	.....	i.	sl. s.	sl. s. eth., bz., acet.; s. ac. a., s. eth., ac. a., acet.
1501	need. f. w. ....	.....	190	.....	s.	s.	v. s. eth.
1502	col. monocl.	1.544 ²⁰ / ₄	142	subl.	0.21 ²⁵	v. s.	v. s. eth.
1503	col. pr.	1.496 ²⁵ / ₄	158 (154-5)	subl.	0.04 ⁰	s.	s. eth.
1504	col. tricl.	1.541 ²⁴ / ₄	243 (235)	subl.	0.0077 ²⁵	v. s.	v. s. eth.
1505	leaf. f. w. ....	.....	213-4 (219)	.....	v. sl. s. c., s. h.	v. s.	v. s. eth.; s. h. ac. a.
1506	lng. need. ....	.....	190-1	d.	sl. s.	v. v. s.	v. s. ac. a.
1507	cr. ....	.....	ca. 140	.....	s. h.	s.	v. s. ac. a.
1508	sm. pr. ....	.....	.....	d.	v. sl. s.	v. sl. s.	v. sl. s. eth.
1509	leaf. ....	.....	210-1 d.	.....	sl. s. c., s. h.	.....	.....
1510	need. (+1H ₂ O) f. w.	.....	(-H ₂ O, 110) anh. 228-36	d.	1.1 ¹⁸	v. s.	v. s. eth.
1511	need. f. w. ....	.....	149-50	.....	sl. s. h.	.....	s. h. lgr.
1512	leaf. f. w. ....	.....	172-3	subl.	sl. s. h.	s.	s. eth.
1513	need. f. w. or al.	.....	153	.....	0.084 ¹¹	s.	s. eth., ac. a.
1514	need. f. w. ....	.....	146.5 (151-2)	209-10 ¹⁶	s. h.	s.	s. eth., chl.
1515	need. f. w. ....	.....	232-3	subl.	sl. s. h.	s.	s. eth.
1516	need. ....	.....	164 (160)	.....	sl. s. h.	s.	s. eth.
1517	need. f. w. or bz.	.....	164 (160, 158)	subl.	s. h.	s.	s. eth., chl., bz.
1518	col. need. f. w.	.....	154.4	301	0.084 ¹¹	s.	s. eth., alk.
1519	col. need. f. al.	.....	139 (132)	subl.	i.	s.	s. eth., bz., alk.
1520	col. need. f. w., al. or bz.	.....	208-9 (201-2)	subl.	sl. s.	s.	s. eth., alk.
1521	need. f. al. ....	.....	182-3	subl.	sl. s. c.	v. s.	s. eth.; sl. s. lgr.
1522	col. need. f. w.	.....	anh. 204	d.	s.	s.	s. eth.
1523	.....	.....	.....	.....	.....	.....	.....
1524	.....	.....	.....	.....	.....	.....	.....
1525	.....	.....	.....	.....	.....	.....	.....
1526	.....	.....	.....	.....	.....	.....	.....
1527	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1528	Benzoic acid, 3,5-dihydroxy-. See α -Resorcylic acid.	See α -Resorcylic acid.		
1529	—, 3,4-dimethoxy-. See <i>Veratric acid</i> .	See <i>Veratric acid</i> .		
1530	—, 2,3-dimethyl-. See <i>Hemellitic acid</i> .	See <i>Hemellitic acid</i> .		
1531	—, 2,4-dimethyl-. See 2,4-Xylic acid.	See 2,4-Xylic acid.		
1532	—, 2,5-dimethyl-. See <i>Isoxylic acid</i> .	See <i>Isoxylic acid</i> .		
1533	—, 2,6-dimethyl-. See 2,6-Xylic acid.	See 2,6-Xylic acid.		
1534	—, 3,4-dimethyl-. See 3,4-Xylic acid.	See 3,4-Xylic acid.		
1535	—, 3,5-dimethyl-. See <i>Mesitylenic acid</i> .	See <i>Mesitylenic acid</i> .		
1536	—, 2,4-dinitro-.....	.....	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{COOH}$	212.12
1537	—, 2,5-dinitro-.....	.....	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{COOH}$	212.12
1538	—, 2,6-dinitro-.....	.....	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{COOH}$	212.12
1539	—, 3,4-dinitro-.....	.....	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{COOH}$	212.12
1540	—, 3,5-dinitro-.....	.....	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{COOH}$	212.12
1540M	—, —, isobutyl ester .....	.....	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CO}_2\text{-CH}_2\text{CH}(\text{CH}_3)_2$	268.22
1541	—, o-ethoxy-.....	salicylic acid ethyl ether.....	$\text{C}_2\text{H}_5\text{OC}_6\text{H}_4\text{COOH}$	166.17
1542	—, m-ethoxy-.....	.....	$\text{C}_2\text{H}_5\text{OC}_6\text{H}_4\text{COOH}$	166.17
1543	—, p-ethoxy-.....	.....	$\text{C}_2\text{H}_5\text{OC}_6\text{H}_4\text{COOH}$	166.17
1544	—, o-ethyl-.....	.....	$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{COOH}$	150.17
1545	—, m-ethyl-.....	.....	$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{COOH}$	150.17
1546	—, p-ethyl-.....	.....	$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{COOH}$	150.17
1547	—, o-ethylamino-.	See <i>Anthranilic acid, N-ethyl</i>..	.....	.....
1548	—, m-ethylamino-..	.....	$\text{C}_2\text{H}_5\text{NHC}_6\text{H}_4\text{-COOH}$	165.19
1549	—, p-ethylamino-..	.....	$\text{C}_2\text{H}_5\text{NHC}_6\text{H}_4\text{-COOH}$	165.19
1550	—, o-fluoro-.....	.....	$\text{FC}_6\text{H}_4\text{COOH}$	140.11
1551	—, m-fluoro-.....	.....	$\text{FC}_6\text{H}_4\text{COOH}$	140.11
1552	—, p-fluoro-.....	.....	$\text{FC}_6\text{H}_4\text{COOH}$	140.11
1553	—, o-formyl-. See <i>Phthalaldehydic acid</i> .	See <i>Phthalaldehydic acid</i>.	.....	.....
1554	—, m-formyl-. See <i>Isophthalaldehydic acid</i> .	See <i>Isophthalaldehydic acid</i>.	.....	.....
1555	—, p-formyl-. See <i>Terephthalaldehydic acid</i> .	See <i>Terephthalaldehydic acid</i>.	.....	.....
1556	—, hexahydro-. See <i>Cyclohexanecarboxylic acid</i> .*	See <i>Cyclohexanecarboxylic acid</i>.*	.....	.....
1557	—, hydrazodi-. See <i>Hydrazobenzoic acid</i> .	See <i>Hydrazobenzoic acid</i>.	.....	.....
1558	—, o-hydroxy-. See <i>Salicylic acid</i> .	See <i>Salicylic acid</i>.	.....	.....
1559	—, m-hydroxy-.....	.....	$\text{HOC}_6\text{H}_4\text{COOH}$	138.12
1560	—, p-hydroxy-.....	.....	$\text{HOC}_6\text{H}_4\text{COOH}$	138.12
1561	—, p-(α -hydroxy-benzyl)-	p-benzohydroxycarboxylic acid	$\text{C}_6\text{H}_5\text{CH}(\text{OH})\text{C}_6\text{-H}_4\text{COOH}$	228.24
1562	—, 4-hydroxy-3-methoxy-. See <i>Vanillic acid</i> .	See <i>Vanillic acid</i>.	.....	.....
1563	—, o- β -hydroxyvinyl-, lactone. See <i>Isocoumarin</i> .	See <i>Isocoumarin</i>.	.....	.....
1564	—, o-iodo-.....	.....	$\text{IC}_6\text{H}_4\text{COOH}$	248.03
1565	—, m-iodo-.....	.....	$\text{IC}_6\text{H}_4\text{COOH}$	248.03

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1528							
1529							
1530							
1531							
1532							
1533							
1534							
1535							
1536	col. rhomb. pr. f. w.	.....	182-3; frz. 180.9	subl.	1.85 ²⁵	v. s.	0.71 ³⁰ bz.
1537	col. need. or monocl. pr. f. w.	.....	177	.....	sl. s. h.	s.	s. eth.
1538	col. need. f. w.	.....	202-3	d.	s. h.	s.	s. eth.
1539	col. need. ....	.....	163	165 subl.	0.67 ²⁵	v. s.	v. s. eth.
1540	yel. monocl. tab. f. w.	.....	204-5	subl.	1.9 ¹⁰⁰	v. s.	sl. s. eth., bz., CS ₂ ; s. ac. a.
1540M	monocl. pl. or need.	.....	87	.....	.....	.....	.....
1541	col. oil. ....	.....	19.3-5 (22)	d. ca. 300	sl. s. c.; s. h.	.....	.....
1542	col. need. f. w.	.....	137	subl.	sl. s. h.	s.	s. eth.
1543	col. need. ....	.....	195	.....	v. sl. s. h.	.....	.....
1544	col. need. f. h. w., 1.51012 ^{99.6}	.....	68	259	v. sl. s.	v. s.	v. s. eth.
1545	col. need. f. dil. al., 1.5345 ¹⁰⁰	1.042 ¹⁰⁰	47	.....	v. sl. s.	s.	v. s. eth.
1546	col. leaf. or pr. f. al.	.....	113	.....	s. h.	v. s.	v. s. eth.
1547							
1548	pr. ....	.....	101	subl.	v. sl. s.	s.	s. eth.
1549		.....	178	.....	.....	s.	s. eth.
1550	need. f. w.	1.460 ²⁵ ₄	122	.....	0.722 ²⁵	v. s.	v. s. eth.
1551	leaf. f. w.	1.474 ²⁵ ₄	124	.....	0.150 ²⁵	.....	.....
1552	monocl. pr. f. w.	1.476 ²⁵ ₄	182 (184-6)	.....	0.127 ²⁵	s.	s. eth.
1553							
1554							
1555							
1556							
1557							
1558							
1559	col. rhomb. f. w. or al.	1.473 ⁴ ₄	201.3 (199-200)	.....	0.92 ¹⁸	s. h.	9.7 ¹⁷ eth.; 0.01 ²⁵ bz.
1560	f. w. monocl. f. w.	1.443 ²⁰ ₄	213 (214.5-5.5)	subl. 76	0.79 ¹⁵ , 2.6 ⁷⁵	39.34 ¹⁵	9.4 ¹⁷ eth.; 0.01 ¹¹ bz.
1561	need. f. w. ....	.....	164-5	d.	s. h.	s.	s. eth.; sl. c. chl.
1562							
1563							
1564	col. need. f. w.	2.249 ²⁵ ₄	162	.....	0.095 ²⁵	sl. s.	sl. s. eth.
1565	need. f. acet.	2.171 ²⁵ ₄	185-7	subl. d.	0.0117 ²⁵	sl. s.	sl. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1566	Benzoic acid, <i>p</i>-iodo-		$\text{IC}_6\text{H}_4\text{COOH}$	248.03
1567	—, <i>o</i>-isopropyl-		$(\text{CH}_3)_2\text{CHC}_6\text{H}_4\text{COOH}$	164.20
1568	—, <i>p</i>-isopropyl-	See <i>Cumic acid</i> .		
1569	—, <i>o</i>-mercapto-	thiosalicylic acid; <i>o</i> -sulfhydrylbenzoic acid	$\text{HSC}_6\text{H}_4\text{COOH}$	154.18
1570	—, <i>o</i>-methoxy-	salicylic acid methyl ether	$\text{CH}_3\text{OC}_6\text{H}_4\text{COOH}$	152.14
1571	—, <i>m</i>-methoxy-		$\text{CH}_3\text{OC}_6\text{H}_4\text{COOH}$	152.14
1572	—, <i>p</i>-methoxy-	See <i>Anisic acid</i> .		
1573	—, methyl-	See <i>Toluic acid</i> .		
1574	—, 3,4-methylenedioxy-	See <i>Piperonylic acid</i> .		
1575	—, <i>o</i>-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{COOH}$	167.12
1576	—, —, ethyl ester		$\text{NO}_2\text{C}_6\text{H}_4\text{COOC}_2\text{H}_5$	195.17
1577	—, —, methyl ester		$\text{NO}_2\text{C}_6\text{H}_4\text{COOCH}_3$	181.14
1578	—, <i>m</i>-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{COOH}$	167.12
1579	—, —, ethyl ester		$\text{NO}_2\text{C}_6\text{H}_4\text{COOC}_2\text{H}_5$	195.17
1580	—, —, methyl ester		$\text{NO}_2\text{C}_6\text{H}_4\text{COOCH}_3$	181.14
1581	—, <i>p</i>-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{COOH}$	167.12
1582	—, —, ethyl ester		$\text{NO}_2\text{C}_6\text{H}_4\text{COOC}_2\text{H}_5$	195.17
1583	—, —, methyl ester		$\text{NO}_2\text{C}_6\text{H}_4\text{COOCH}_3$	181.14
1584	—, <i>o</i>-nitroso-		$\text{NOC}_6\text{H}_4\text{COOH}$	151.12
1585	—, <i>m</i>-nitroso-		$\text{NOC}_6\text{H}_4\text{COOH}$	151.12
1586	—, <i>p</i>-nitroso-		$\text{NOC}_6\text{H}_4\text{COOH}$	151.12
1587	—, pentamethyl-		$(\text{CH}_3)_5\text{C}_6\text{COOH}$	192.25
1588	—, <i>o</i>-phenoxy-	salicylic acid phenyl ether	$\text{C}_6\text{H}_5\text{OC}_6\text{H}_4\text{COOH}$	214.21
1589	—, <i>o</i>-phenyl-	<i>o</i> -biphenylcarboxylic acid	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{COOH}$	198.21
1590	—, <i>m</i>-phenyl-	<i>m</i> -biphenylcarboxylic acid	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{COOH}$	198.21
1591	—, <i>p</i>-phenyl-	<i>p</i> -biphenylcarboxylic acid	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{COOH}$	198.21
1592	—, <i>p</i>-phosphono-	<i>p</i> -benzophosphinic acid	$(\text{HO})_2\text{POC}_6\text{H}_4\text{COOH}$	202.11
1593	—, <i>o</i>-propyl-		$\text{C}_3\text{H}_7\text{C}_6\text{H}_4\text{COOH}$	164.20
1594	—, <i>p</i>-propyl-		$\text{C}_3\text{H}_7\text{C}_6\text{H}_4\text{COOH}$	164.20
1595	—, silico-	See <i>Benzenesiliconic acid</i> .		
1596	—, <i>o</i>-sulfamyl-	<i>o</i> -sulfamidobenzoic acid	$\text{NH}_2\text{O}_2\text{SC}_6\text{H}_4\text{COOH}$	201.19
1597	—, <i>m</i>-sulfamyl-		$\text{NH}_2\text{O}_2\text{SC}_6\text{H}_4\text{COOH}$	201.19
1598	—, <i>p</i>-sulfamyl-		$\text{NH}_2\text{O}_2\text{SC}_6\text{H}_4\text{COOH}$	201.19

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1566	pl. or leaf.	2.184 ²⁵ / ₄	269-70	subl. d.	0.0035 ²⁵	sl. s.	sl. s. eth.
1567	col. pr. f. w. ....	.....	51	.....	s. h.	s.	s. eth., bz.
1568	.....	.....	.....	.....	.....	.....	.....
1569	lt. yel. need. f. al. ....	.....	164	subl.	v. sl. s.	v. s.	s. eth., ac. a.
1570	monocl. tab. f. w.	1.180	98 (100-1)	200	0.5 ³⁰	v. s.	v. s. eth.
1571	col. need. f. w. ....	.....	107-8	170-2 ¹⁰ subl.	sl. s. c., v. s. h.	v. s.	v. s. eth.
1572	.....	.....	.....	.....	.....	.....	.....
1573	.....	.....	.....	.....	.....	.....	.....
1574	.....	.....	.....	.....	.....	.....	.....
1575	tricl. need. f. w.	1.575 ⁴ / ₄	147.5 (144-5)	.....	0.68 ²⁰	28 ¹⁰	21.6 ¹¹ eth.; s. alk.; v. sl. s. bz., chl.; i. lgr. s. eth.
1576	col. tricl. ....	.....	30	148-50 ¹⁰	i.	s.	.....
1577	yel. oil.	1.286 ²⁰ / ₄ ; 1.284 ²⁵ / ₂₅	-8	275 (269)	i.	∞	∞ eth.; i. pet. eth.
1578	monocl. leaf. f. w.	1.494 ⁴ / ₄	141.4	.....	0.31 ²⁰	33 ¹⁰	25.1 ¹¹ eth.; s. alk.; v. sl. s. bz., chl.; i. lgr. v. s. eth.
1579	monocl. pr. ....	.....	47 (40-1)	298; 171 ²⁵	i.	v. s.	v. s. eth.
1580	col. need. ....	.....	78.5 (70)	279	i.	sl. s.	s. eth.; sl. s. me. al.
1581	monocl. leaf. f. w.	1.550 ³² / ₄	242.4	subl.	0.024 ²⁵	0.9 ¹⁰	2.2 ¹¹ eth.; s. acet., alk.; v. sl. s. c. bz., chl.; i. lgr. s. eth.
1582	col. tricl. leaf. f. al. ....	.....	57	.....	i.	s.	.....
1583	yel. monocl. leaf. ....	.....	96	.....	i.	s.	s. eth.
1584	col. f. al. ....	.....	210 d.	.....	.....	s.	v. sl. s. eth., bz.; s. ac. a.
1585	col. cr. ....	.....	230 d.	.....	.....	s.	v. sl. s. eth., bz.
1586	yel. powd. ....	.....	250 d.	.....	.....	s.	v. sl. s. eth., bz.; sl. s. ac. a.
1587	need. f. w. ....	.....	210.5	subl.	v. sl. s.	s.	.....
1588	rhomb. leaf. f. dil. al. ....	.....	114.5	355 d.	0.01	v. s.	v. s. eth.; s. chl., glyc.
1589	col. monocl. need. f. al.	1.458 ²⁰ / ₄	114 (111)	343-4	sl. s. h., i. c.	v. s.	v. s. bz.; s. ac. a.
1590	col. leaf. f. al. ....	.....	160-2	.....	i. (sl. s.)	v. s.	v. s. eth., bz., ac. a., lgr.
1591	col. need. f. al. or bz. ....	.....	219 (224)	subl.	v. sl. s. h.	v. s.	v. s. eth.
1592	need. f. w. ....	.....	>300	.....	s.	s.	sl. s. HCl
1593	leaf. f. al. ....	.....	58	273	s.	v. s.	v. s. eth.
1594	col. leaf. f. w. ....	.....	141	.....	sl. s. h.	v. s.	v. s. eth.; s. bz.
1595	.....	.....	.....	.....	.....	.....	.....
1596	rhomb. f. al. ....	.....	165-7	.....	v. s.	v. s.	v. s. eth.
1597	need. or pl. f. w. ....	.....	238	.....	v. sl. s.	v. s.	v. s. eth.
1598	need. or pr. f. w. ....	.....	280 d.	.....	v. v. sl. s.	v. s.	sl. s. eth.; v. sl. s. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1599	Benzoic acid, o-sulphy	dryl- . See <i>Benzoic acid, o-mer</i>	<i>capto-</i> $\text{HO}_3\text{SC}_6\text{H}_4\text{COOH} \cdot 3\text{H}_2\text{O}$	256.23
1600	—, o-sulfo-			
1601	—, —, imide.	See <i>Saccharin</i> .		
1602	—, m-sulfo-		$\text{HO}_3\text{SC}_6\text{H}_4\text{COOH} \cdot 2\text{H}_2\text{O}$	238.21
1603	—, p-sulfo-		$\text{HO}_3\text{SC}_6\text{H}_4\text{COOH} \cdot 3\text{H}_2\text{O}$	256.23
1604	—, 2,3,4,5-tetrahydr	o- . See <i>1-Cyclohexene-1-carboxy</i>	<i>lic acid*</i> .	
1605	—, 2,3,4,5-tetrahydroxy-		$(\text{HO})_4\text{C}_6\text{HCOOH}$	186.12
1606	—, thio-	benzenecarbothioic acid*	$\text{C}_6\text{H}_5\text{COSH}$	138.18
1607	—, p-(p-toluy)		$\text{CH}_3\text{C}_6\text{H}_4\text{COC}_6\text{H}_4\text{COOH}$	240.25
1608	—, 2,3,5-triamino-		$(\text{NH}_2)_3\text{C}_6\text{H}_2\text{COOH}$	167.17
1609	—, 3,4,5-triamino-		$(\text{NH}_2)_3\text{C}_6\text{H}_2\text{COOH}$	167.17
1609M	—, 3,4,5-tribromo-		$\text{Br}_3\text{C}_6\text{H}_2\text{COOH}$	358.84
1610	—, 2,3,4-trichloro-		$\text{Cl}_3\text{C}_6\text{H}_2\text{COOH}$	225.47
1611	—, 2,4,5-trichloro-		$\text{Cl}_3\text{C}_6\text{H}_2\text{COOH}$	225.47
1612	—, 3,4,5-trichloro-		$\text{Cl}_3\text{C}_6\text{H}_2\text{COOH}$	225.47
1613	—, 2,3,4-trihydroxy-	4-pyrogallolcarboxylic acid...	$(\text{HO})_3\text{C}_6\text{H}_2\text{COOH}$	170.12
1614	—, 2,4,5-trihydroxy-	4-hydroxygentisic acid...	$(\text{HO})_3\text{C}_6\text{H}_2\text{COOH}$	170.12
1615	—, 2,4,6-trihydroxy-	phloroglucinolcarboxylic acid	$(\text{HO})_3\text{C}_6\text{H}_2\text{COOH}$	170.12
1616	—, 3,4,5-trihydroxy-	See <i>Gallie acid</i> .		
1617	—, 2,3,4-trimethoxy-		$(\text{CH}_3\text{O})_3\text{C}_6\text{H}_2\text{COOH}$	212.20
1618	—, 2,4,5-trimethoxy-	See <i>Asaronic acid</i> .		
1619	—, 3,4,5-trimethoxy-	gallic acid trimethyl ether...	$(\text{CH}_3\text{O})_3\text{C}_6\text{H}_2\text{COOH}$	212.20
1620	—, 2,3,4-trimethyl-	See <i>Prehnitylic acid</i> .		
1621	—, 2,3,5-trimethyl-	See <i>γ-Isodurylic acid</i> .		
1622	—, 2,3,6-trimethyl-		$(\text{CH}_3)_3\text{C}_6\text{H}_2\text{COOH}$	164.20
1623	—, 2,4,5-trimethyl-	See <i>Durylic acid</i> .		
1624	—, 2,4,6-trimethyl-	See <i>β-Isodurylic acid</i> .		
1625	—, 3,4,5-trimethyl-	See <i>α-Isodurylic acid</i> .		
1626	—, 2,4,6-trinitro-	<i>sym</i> -trinitrobenzoic acid....	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{COOH}$	257.12
1627	Benzoic amide.	See <i>Benzamide</i> .		
1628	Benzoic anhydride	benzoic acid anhydride.....	$(\text{C}_6\text{H}_5\text{CO})_2\text{O}$	226.22
1629	Benzoic sulfinide.	See <i>Saccharin</i> .		
1630	Benzoin	benzoylphenylcarbinol; α-hydroxy-α-phenylacetophenone	$\text{C}_6\text{H}_5\text{CHOHCOC}_6\text{H}_5$	212.24
1631	—, ethyl ether.....	α-ethoxy-α-phenylacetophenone, 2-ethoxy-1,2-diphenyl-1-ethanone	$\text{C}_6\text{H}_5\text{CH}(\text{OC}_2\text{H}_5)\text{COC}_6\text{H}_5$	240.29
1632	—, imide.	See <i>Amaron</i> .		
1633	—, <i>l</i> -oxime.....		$\text{C}_6\text{H}_5\text{CH}(\text{OH})\text{C}(\text{:NOH})\text{C}_6\text{H}_5$	227.25
1633M	—, p,p'-dimethoxy-	See <i>Anisoin</i> .		
1634	Benzol, Benzole.	See <i>Benzene*</i> .		
1635	Benzonitrile	benzenecarbonitrile*; phenyl cyanide	$\text{C}_6\text{H}_5\text{CN}$	103.12
1636	—, o-amino-	See <i>Anthranilonitrile</i> .		
1637	—, m-amino-	<i>m</i> -aminophenyl cyanide.....	$\text{NH}_2\text{C}_6\text{H}_4\text{CN}$	118.13
1638	—, p-amino-	<i>p</i> -aminophenyl cyanide.....	$\text{NH}_2\text{C}_6\text{H}_4\text{CN}$	118.13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1599							
1600	rhomb. need. f. w.		68-9; -3H ₂ O, 105; anh. 141		50	v. s.	i. eth.
1601							
1602	deliq. cr.		98; anh. 141		s.	s.	v. s. eth.; i. bz.
1603	need. f. w.		94; anh. 260		v. s.	v. s.	v. s. eth.
1604							
1605	cr.		148		v. s.		i. lgr.
1606	yel. oil or cr.		24	d.	i.	∞	∞ eth.
1607	need. f. acet.		130 (224)		v. sl. s.	v. s.	v. s. acet.; sl. s. bz.
1608	cr. f. w.				v. s. h.	v. sl. s. h.	i. eth.
1609	need. f. w.		-H ₂ O, >100	d.	s. h.	i.	i. eth.
1609M	col. need.		240		i.	s.	s. h. bz.
1610	need. f. al.		186-7 (129)		sl. s.	s.	s. eth.
1611	sm. need. f. w.		163	subl.	s. h.	s.	s. eth.
1612	need. f. al.		203	subl.	s. h.	v. s.	v. s. eth.
1613	need. f. w.		200 d.	subl.	0.13 ¹²	s.	v. s. eth.
1614	need. f. w.		217-8		v. s. h.	v. s.	
1615	cr. f. w.		100 d.		s. h.	s.	v. s. eth.; i. bz.
1616							
1617	cr. f. eth.		97-9		s.	s.	s. eth.
1618							
1619	monocl. need. f. w.		168	225-7 ¹⁰	v. sl. s.	v. s.	v. s. eth., chl.
1620							
1621							
1622	need. f. w.		84; 105-6		s.	s.	s. eth.
1623							
1624							
1625							
1626	yel. rhomb. need. f. w.		228.7 (220-3)	subl. d.	2.05 ²³	26.6 ²⁵	14.7 ²⁵ eth.
1627							
1628	col. rhomb. pr., 1.57665 ¹⁵	1.1989 ¹⁵ ₄	42	360	i.	s.	s. eth.
1629							
1630	col. hex. pr. f. al.	1.310 ²⁰ ₄	137	344; 194 ¹²	0.03 ²⁵	s.	sl. s. eth.
1631	need. f. lgr.		62	184-6		s.	s. eth.; v. s. bz.
1632							
1633	wh. amor. powd. or pr. f. bz.		163-4 (149-51)		i.	s.	s. eth., acet.
1633M							
1634							
1635	col. liq., 1.52892	1.0102 ¹⁵ ₁₅	-13	190.7	1 ¹⁰⁰	∞	∞ eth.
1636							
1637	need.		53-4	288-90	sl. s.	s.	s. eth.
1638	col. monocl. pr.		86	d.	v. s. h.	v. s.	v. s. eth.; i. HCl

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1639	Benzonitrile, <i>p</i>-bromo-	<i>p</i> -bromophenyl cyanide.....	BrC ₆ H ₄ CN.....	182.03
1640	—, <i>p</i> -chloro-.....	4-chlorobenzenecarbonitrile*; <i>p</i> -chlorophenyl cyanide	ClC ₆ H ₄ CN.....	137.57
1641	—, methyl-.....	See <i>Tolunitrile</i> .		
1642	—, <i>o</i> -nitro-.....	2-nitrobenzenecarbonitrile*; <i>o</i> -nitrophenyl cyanide	NO ₂ C ₆ H ₄ CN.....	148.12
1643	—, <i>m</i> -nitro-.....	.....	NO ₂ C ₆ H ₄ CN.....	148.12
1644	—, <i>p</i> -nitro-.....	.....	NO ₂ C ₆ H ₄ CN.....	148.12
1645	Benzo[<i>a</i>]phenanthrene.	See <i>Chrysene</i> .		
1646	Benzo[<i>def</i>]phenanthrene.	ne. See <i>Pyrene</i> .		
1647	Benzo[<i>l</i>]phenanthrene.	See <i>Triphenylene</i> .		
1648	Benzo[<i>a</i>]phenazine	α -benzophenazine; $\alpha\beta$ -naphthophenazine	C ₁₀ H ₆ :N ₂ :C ₆ H ₄	230.26
1649	Benzo[<i>b</i>]phenazine, 5,8-	-dihydro-8-imino-5-phenyl- ..	See <i>Rosinduline</i>	
1650	Benzophenone	phenyl ketone; diphenyl ketone; benzoylbenzene; α -oxodiphenylmethane	(C ₆ H ₅) ₂ CO.....	182.21
1651	—, oxime.....	.....	(C ₆ H ₅) ₂ C:NOH...	197.23
1652	—, phenylhydrazone.....	.....	(C ₆ H ₅) ₂ :C:NHC ₆ H ₅	272.34
1653	—, 2-amino-	<i>o</i> -aminodiphenylketone; <i>o</i> -benzoylaniline	C ₆ H ₅ COC ₆ H ₄ NH ₂	197.23
1654	—, 3-amino-	<i>m</i> -aminophenyl phenyl ketone; <i>m</i> -benzoylaniline	C ₆ H ₅ COC ₆ H ₄ NH ₂ ..	197.23
1655	—, 4-amino-	<i>p</i> -aminophenyl phenyl ketone; <i>p</i> -benzoylaniline	C ₆ H ₅ COC ₆ H ₄ NH ₂ ..	197.23
1656	—, 4,4'-bisdimethyl-amino-	Michler's ketone; tetramethyl-4,4'-diaminobenzophenone	CO[C ₆ H ₄ N(CH ₃) ₂] ₂	268.35
1657	—, 2,2'-diamino-	bis- <i>o</i> -aminophenyl ketone....	NH ₂ C ₆ H ₄ COC ₆ -H ₄ NH ₂	212.24
1658	—, 3,3'-diamino-	bis- <i>m</i> -aminophenyl ketone...	NH ₂ C ₆ H ₄ COC ₆ -H ₄ NH ₂	212.24
1659	—, 4,4'-diamino-	bis- <i>p</i> -aminophenyl ketone....	NH ₂ C ₆ H ₄ COC ₆ -H ₄ NH ₂	212.24
1660	—, 2,2'-dihydroxy- ..	bis- <i>o</i> -hydroxyphenyl ketone..	HOC ₆ H ₄ COC ₆ -H ₄ OH	214.21
1661	—, 2,3'-dihydroxy- ..	<i>m</i> -hydroxyphenyl <i>o</i> -hydroxyphenyl ketone	HOC ₆ H ₄ COC ₆ -H ₄ OH	214.21
1662	—, 2,4-dihydroxy-	4-benzoylresorcinol; 4-benzozoresoin	C ₆ H ₅ COC ₆ H ₃ (OH) ₂	214.21
1663	—, 2,4'-dihydroxy-	<i>o</i> -hydroxyphenyl <i>p</i> -hydroxyphenyl ketone; <i>p</i> -salicyloylphenol	HOC ₆ H ₄ COC ₆ -H ₄ OH	214.21
1664	—, 2,5-dihydroxy-	2,5-dihydroxyphenyl phenyl ketone	(HO) ₂ C ₆ H ₃ COC ₆ H ₅	214.21
1665	—, 3,3'-dihydroxy- ..	bis- <i>m</i> -hydroxyphenyl ketone..	HOC ₆ H ₄ COC ₆ -H ₄ OH	214.21
1666	—, 3,4'-dihydroxy- ..	<i>m</i> -hydroxyphenyl <i>p</i> -hydroxyphenyl ketone	HOC ₆ H ₄ COC ₆ -H ₄ OH	214.21
1667	—, 4,4'-dihydroxy- ..	bis- <i>p</i> -hydroxyphenyl ketone..	HOC ₆ H ₄ CCC ₆ -H ₄ OH	214.21
1668	—, 2,4-dihydroxy-6-	methoxy- . See <i>Isocotoin</i> .		
1669	—, 2,6-dihydroxy-4-	methoxy- . See <i>Cotoin</i> .		
1670	—, 4,4'-dimethyl-	di- <i>p</i> -tolyl ketone.....	CH ₃ C ₆ H ₄ COC ₆ -H ₄ CH ₃	210.26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1639	need. f. w. ....	.....	113	235-7	s. h.	s.	v. s. eth.
1640	need. f. al. ....	.....	92 (93-4)	223	sl. s.	s.	s. eth., bz.
1641							
1642	silky need. f. w. ....	.....	109	.....	s. h.	s.	s. eth., ac. a.
1643	need. f. w. ....	.....	118 (115-6)	subl.	sl. s.	s.	s. eth.
1644	yel. leaf. f. al. ....	.....	147	.....	sl. s. c.	sl. s. c., s. h.	s. chl., ac. a.
1645							
1646							
1647							
1648	yel. need. f. bz. ....	.....	142.5	>360	i.	v. sl. s.	v. sl. s. eth.; sl. s. c. bz.
1649							
1650	α(stab.) col. rhomb. pr.; β col. monoc. pr.	α1.0976 ⁵⁰ / ₅₀ ; β1.108 ²³ / ₄	α49; β 26; γ45-8; δ-51	306	i.	13 5 ¹⁸	17.5 ¹³ eth.; s. chl.
1651	need. ....	.....	144 (141-2.5)	.....	v. sl. s.	s.	v.s. eth., acet.; s. alk.
1652	need. ....	.....	137 (105)	.....	.....	.....	.....
1653	pa. yel. leaf. ....	.....	108	.....	.....	s.	s. eth.
1654	yel. need. ....	.....	86	.....	sl. s. w.	s.	s. eth.
1655	leaf. f. dil. al. ....	.....	124 (110-5)	.....	sl. s.	s.	s. eth.
1656	glit. leaf. f. al. ....	.....	174	>360 sl. d.	0.04 ²³	v. s.	v. s. eth., bz.
1657	pa. yel. leaf. f. dil. al.	.....	132-3	.....	i.	s.	.....
1658	yel. need. f. al. ....	.....	173-4 (171)	285 ¹¹	s. h.	s.	s. eth.
1659	hex. or rhomb. need. f. dil. al.	.....	244 (237)	.....	s. h., d. by boil.	s.	s. eth.
1660	leaf. or pr. f. lgr.	.....	59-60	340	i.	s.	s. eth., chl.
1661	need. f. w. ....	.....	126	.....	.....	s.	s. eth.
1662	.....	.....	144	.....	i.	s.	s. eth.
1663	yel. pyram. f. bz. or pl. f. h. w.	.....	150-1 (147-8)	.....	s. h.	s. h.	v. s. eth.; s. bz., alk.
1664	yel. need. f. dil. al.	.....	125	.....	s. h.	s.	s. eth., bz.
1665	sm. need. f. w. ....	.....	170 (162-3)	.....	s.	s.	s. alk.
1666	need. f. w. ....	.....	206 (197-200)	.....	s. h.	s.	s. eth.
1667	yel. need. f. lgr. ....	.....	210	subl.	v. s. h.	v. s.	v. s. eth.; s. me. al., acet.; i. bz., chl., CS ₂
1668							
1669							
1670	rhomb. f. al. ....	.....	95 (91-2)	333-4 ²⁵	i.	v. s.	v. s. eth.; s. chl., CS ₂

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1671	Benzophenone, <i>p</i>-hydroxy-	.....	$\text{HOC}_6\text{H}_4\text{COC}_6\text{H}_5$	198.21
1672	—, <i>o</i>-nitro-	<i>o</i> -nitrophenyl phenyl ketone	$\text{NO}_2\text{C}_6\text{H}_4\text{COC}_6\text{H}_5$	227.21
1673	—, <i>m</i>-nitro-.....	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{COC}_6\text{H}_5$	227.21
1674	—, <i>p</i>-nitro-.....	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{COC}_6\text{H}_5$	227.21
1675	—, 2,4,6,3',4'-pentahydroxy-	See <i>Maclurin</i> .		
1676	—, 2,2',6-trihydroxy-	2-salicylylresorcinol	$(\text{HO})_2\text{C}_6\text{H}_3\text{COC}_6\text{H}_4\text{OH}$	230.21
1677	—, 2,3,4-trihydroxy-	4-benzoylpyrogallol; alizarin yellow A	$\text{C}_6\text{H}_5\text{COC}_6\text{H}_2(\text{OH})_3$	230.21
1678	Benzophenonecarboxylic acid.	See <i>Benzoic acid</i> , benzoyl-		
1679	<i>p,p'</i>-Benzophenonedicarboxylic acid.	See <i>Benzoic acid</i> , <i>p,p'</i> -dicarboxylic acid.		
1680	2,3-Benzophenonedicarboxylic acid.	See <i>Phthalic acid</i> , benzoyl-		
1681	2,5-Benzophenonedicarboxylic acid.	See <i>Terephthalic acid</i> , benzoyl-		
1682	3,4-Benzophenonedicarboxylic acid.	See <i>Phthalic acid</i> , 4-benzoyl-		
1683	<i>p</i>-Benzophosphinic acid.	See <i>Benzoic acid</i> , <i>p</i> -phosphonic acid.		
1684	Benzopinacol	1,1,2,2-tetraphenyl-1,2-ethanediol*; tetraphenylethylene glycol; benz(o)-pinacone	$(\text{C}_6\text{H}_5)_2\text{COHCOH}(\text{C}_6\text{H}_5)_2$	366.44
1685	β-Benzopinacolin	α -triphenylacetophenone; benzoyltriphenylmethane; phenyl trityl ketone	$(\text{C}_6\text{H}_5)_3\text{CCOC}_6\text{H}_5$	348.42
1686	Benzopinacone.	See <i>Benzopinacol</i> .		
1687	Benzopyrazine.	See <i>Quinoxaline</i> .		
1688	Benzo[b]pyridine.	See <i>Quinoline</i> .		
1689	Benzo[c]pyridine.	See <i>Isoquinoline</i> .		
1690	Benzo[a]pyrimidine.	See <i>Quinazoline</i> .		
1691	1,2-Benzopyrone.	See <i>Coumarin</i> .		
1692	1,4-Benzopyrone, γ-Benzopyrone.	See <i>Chromone</i> .		
1693	2,1-Benzopyrone.	See <i>Isocoumarin</i> .		
1694	Benzo[b]pyrrole	See <i>Indole</i> .		
1695	Benzoquinhydrone.	See <i>Quinhydrone</i> .		
1696	Benzo[f]quinoline	5,6-benzoquinoline; β -naphthoquinoline	$\text{C}_{13}\text{H}_9\text{N}$	179.21
1697	—, 3-methyl-	3-methyl-5,6-benzoquinoline; β -naphthoquinaldine	$\text{C}_{13}\text{H}_9\text{NCH}_3$	193.24
1698	Benzo[h]quinoline	7,8-benzoquinoline; α -naphthoquinoline	$\text{C}_{13}\text{H}_9\text{N}$	179.21
1699	—, 2-methyl-	2-methyl-7,8-benzoquinoline; α -naphthoquinaldine	$\text{C}_{13}\text{H}_9\text{NCH}_3$	193.24
1700	<i>p</i>-Benzoquinone.	See <i>Quinone</i> .		
1701	4-Benzoresorcin.	See <i>Benzophenone</i> , 2,4-dihydroxy-		
1702	Benzothiazole. (Number beginning S=1).	2-benzothiazyl 2,4-dinitrophenyl sulfide	$\text{C}_6\text{H}_4\text{SC}-[\text{SC}_6\text{H}_3(\text{NO}_2)_2]:\text{N}$	333.33
1703	—, 2,2'-dithiobis- ...	2,2'-dibenzothiazyl disulfide	$\text{C}_{14}\text{H}_8\text{N}_2\text{S}_4$	332.46
1704	—, mercapto-	See <i>Benzothiazolethiol</i> .		
1705	—, 2-methyl-	μ -methylbenzothiazole; ethenylaminothiophenol	$\text{SC}(\text{CH}_3):\text{NC}_6\text{H}_4$	149.20
1706	—, 2-phenyl-	benzenylaminothiophenol	$\text{C}_6\text{H}_5\text{SC}(\text{C}_6\text{H}_5):\text{N}$	211.27
1707	2-Benzothiazolethiol ...	2-mercaptobenzothiazole; <i>o</i> -thiocarbamidothiophenol	$\text{C}_6\text{H}_4\text{SC}(\text{SH}):\text{N}$	167.24
1708	—, benzoate.....	.....	$\text{C}_{14}\text{H}_9\text{NOS}_2$	271.34

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1671	rhomb. leaf. f. dil. al.	.....	134	.....	s. h.	v. s.	v. s. eth.
1672	col. monoc. f. al.	.....	105	.....	.....	sl. s.	.....
1673	col. need. f. al.	.....	94-5	234 ⁴⁸	.....	s.	.....
1674	col. leaf. f. al.	.....	138	.....	v. sl. s.	s.	sl. s. bz., CS ₂
1675	.....	.....	.....	.....	.....	.....	.....
1676	yel. leaf. f. al.	.....	133	.....	sl. s. h.	s. h.	s. eth., bz., alk.
1677	yel. need. f. dil. al.	.....	140	.....	sl. s.	s.	s. eth., alk., H ₂ SO ₄ ; sl. s. bz.
1678	.....	.....	.....	.....	.....	.....	.....
1679	.....	.....	.....	.....	.....	.....	.....
1680	.....	.....	.....	.....	.....	.....	.....
1681	.....	.....	.....	.....	.....	.....	.....
1682	.....	.....	.....	.....	.....	.....	.....
1683	.....	.....	.....	.....	.....	.....	.....
1684	pr.....	.....	186 d.	.....	.....	2.02 h.	s. eth.
1685	need.....	.....	182.5	.....	i.	v. sl. s. c., s. h.	s. eth.; v. s. bz., chl., CS ₂
1686	.....	.....	.....	.....	.....	.....	.....
1687	.....	.....	.....	.....	.....	.....	.....
1688	.....	.....	.....	.....	.....	.....	.....
1689	.....	.....	.....	.....	.....	.....	.....
1690	.....	.....	.....	.....	.....	.....	.....
1691	.....	.....	.....	.....	.....	.....	.....
1692	.....	.....	.....	.....	.....	.....	.....
1693	.....	.....	.....	.....	.....	.....	.....
1694	.....	.....	.....	.....	.....	.....	.....
1695	.....	.....	.....	.....	.....	.....	.....
1696	sm. leaf. f. h. w.	.....	93	351	s. h.	v. s.	v. s. eth., bz.
1697	need. f. dil. al.	.....	82	>300	sl. s.	s.	s. eth.
1698	monoc. f. eth.	.....	52	351 (223 ⁴⁷)	v. sl. s.	v. s.	v. s. eth.; s. bz.
1699	liq.....	.....	.....	>300	i.	s.	.....
1700	.....	.....	.....	.....	.....	.....	.....
1701	.....	.....	.....	.....	.....	.....	.....
1702	yel. cr.....	1.24 ²⁰ / ₄	160-2	.....	i.	sl. s. c., s. h.	sl. s. eth.
1703	lt. yel. cr.....	1.50 ²⁰ / ₄	180.0	d.	i.	v. sl. s. h.	v. sl. s. chl.
1704	.....	.....	.....	.....	.....	.....	.....
1705	liq.....	.....	.....	238	i.	s.	.....
1706	need. f. al.....	.....	115	360	i.	s.	s. eth., CS ₂ , dil. HCl
1707	wh.-yel. cr....	1.42 ²⁰ / ₄	179.5	d.	i.	s. h.	v. sl. s. eth.; s. alk.
1708	yel. cr.....	.....	132	.....	i.	sl. s. c., s. h.	sl. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1709	2-Benzothiazolethiol , mercaptide with α , β - diphenylguanidine	.....	$C_{20}H_{18}N_4S_2$	378.50
1710	—, 6-nitro- , diethylthio	lthionocarbamic ester.....	$C_{12}H_{13}N_3O_2S_3$	327.43
1711	Benzothiofuran .	See <i>Thionaphthene</i> .		
1712	Benzothiophene .	See <i>Thionaphthene</i> .		
1713	o-Benzotoluide	<i>N</i> -benzoyl- <i>o</i> -toluidine.....	$C_6H_5CONHC_6H_4-$ CH_3	211.25
1714	m-Benzotoluide	<i>N</i> -benzoyl- <i>m</i> -toluidine; <i>m</i> - benzotoluidide	$C_6H_5CONHC_6H_4-$ CH_3	211.25
1715	p-Benzotoluide	<i>N</i> -benzoyl- <i>p</i> -toluidine.....	$C_6H_5CONHC_6H_4-$ CH_3	211.25
1716	1,2,3-Benzotriazole ...	aziminobenzene; benzene azi- mide	$C_6H_4NHN:N$	119.12
1717	Benzotrichloride .	See <i>Toluene</i> , α -trichloro-.		
1718	Benzotrifluoride .	See <i>Toluene</i> , α -trifluoro-.		
1719	Benzoxazole, 2-meth- yl-(O=1)	μ -methylbenzoxazole; ethe- nylaminophenol	$OC(CH_3):NC_6H_4$..	133.14
1720	2(3)Benzoxazolone	<i>o</i> -hydroxycarbanilic acid lactone	C_6H_4OCONH	135.12
1721	2,3,1-Benzoxaz-1-one ..	benzaldoximecarboxylic an- hydride	$C_6H_4COON:CH$	147.13
	Benzoyl- . For benzoyl deri	vatives see the parent compoun	ds (e.g., for benzoyla	cetic
1722	Benzoyl azide	benzazide.....	$C_6H_5CON_3$	147.13
1723	Benzoyl bromide	benzenecarbonyl bromide*...	C_6H_5COBr	185.03
1724	Benzoyl chloride	benzenecarbonyl chloride*...	C_6H_5COCl	140.57
1725	—, p-bromo-		BrC_6H_4COCl	219.48
1726	—, 3,5-dinitro-		$(NO_2)_2C_6H_3COCl$..	230.57
1727	—, p-methoxy-	See <i>Anisoyl chloride</i> .		
1728	—, m-nitro-		$NO_2C_6H_4COCl$...	185.57
1729	—, p-nitro-		$NO_2C_6H_4COCl$...	185.57
1730	Benzoyl cyanide	α -keto- α -tolunitrile; 2-oxo- 2-phenylethanenitrile	C_6H_5COCN	131.13
1731	Benzoyl disulfide	dibenzoyl disulfide.....	$(C_6H_5CO)_2S_2$	274.34
1732	Benzoyl fluoride	benzenecarbonyl fluoride*...	C_6H_5COF	124.11
1734	Benzoyl hydroperoxide ..	See <i>Perbenzoic acid</i> .		
1735	Benzoyl iodide	benzenecarbonyl iodide*...	C_6H_5COI	232.03
1736	Benzoyl peroxide	dibenzoyl peroxide.....	$(C_6H_5CO)_2O_2$	242.22
1737	Benzpinacone .	See <i>Benzopinacol</i> .		
	Benzyl- . For benzyl deriva	tives see the parent compounds	(e.g., for benzylbenz	oic acid
1738	Benzyl alcohol	phenylcarbinol; α -hydroxy- toluene	$C_6H_5CH_2OH$	108.13
1739	—, esters.	See "benzyl ester" under the c	orresponding acids.	
1740	—, o-chloro-		$ClC_6H_4CH_2OH$	142.58
1741	—, 3,4-dihydroxy-α-	(methylaminomethyl)-.	See <i>Adrenaline</i> .	
1742	—, α,α-dimethyl- .	See <i>2-Propanol, 2-phenyl-</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1709	yel. cr.	1.00	173	.....	i.	s.	i. eth.
1710	fine yel. cr. ....	.....	122	.....	i.	s. h.	s. eth., bz.
1711							
1712							
1713	rhomb. need., 1.621, 1.654, 1.691	1.205 $\frac{15}{4}$	146 (135-6.5)	.....	sl. s. h.	s.	s. eth.
1714	monocl. pr. f. dil. al.	1.170 $\frac{15}{4}$	125	.....	.....	10.02 ¹⁵	.....
1715	rhomb. need. f. al.	1.202 $\frac{15}{4}$	158	232	i.	3.3 ¹⁸	s. eth.
1716	need. f. bz. ....	.....	100	201-4 ¹⁵ mm	i.	s.	s. bz.
1717							
1718							
1719	liq.	1.136 $\frac{0}{4}$	.....	201	i.	s.	∞ eth.
1720	col. need. f. h. dil. HCl	.....	141-2 (138)	.....	sl. s. c.	v. s.	v. s. eth.
1721	cr. f. bz. ....	.....	d. 120	.....	.....	.....	.....
	acid see <i>Acetic acid</i> , benzoyl-)		See also	"benzoate"	under names of al	cohols and	
1722	phenols. col. pl. f. acet.	.....	32	exp.	i.	s.	s. eth.
1723	col. fum. liq.	1.570 $\frac{15}{4}$	O; frz., -24	218-19	d.	s. d.	∞ eth.
1724	col. fum. liq., 1.55369	1.2187 $\frac{15}{15}$	-1	197 (194 ⁷⁴²)	d.	s. d.	∞ eth.; s. bz., CS ₂ , oils
1725	col. need. ....	.....	42	245-7 sl. d.	d.	v. s.	v. s. eth.; s. bz., lgr. s. eth.
1726	yel. need. f. bz.	.....	68-9	196 ¹²	d.	d.	s. eth.
1727							
1728	yel. pr. ....	.....	34	278	d.	d.	s. eth.
1729	yel. need. f. lgr.	.....	72	154 ¹⁵	d.	d.	s. eth.
1730	col. tab. ....	.....	32-3	206-8	i.	v. s.	v. s. eth.
1731	pr. f. h. al., eth. or CS ₂	.....	133 (128)	d.	i.	sl. s.	sl. s. eth.; s. CS ₂ ; i. NH ₄ OH
1732	col. fum. liq.	>1	.....	159 (156)	hyd. h.	v. s.	v. s. eth.
1734							
1735	need. or leaf. ....	.....	3	135 ²⁵	d.	s.	∞ eth.
1736	col. rhomb. f. eth.; 1.545, 1.546, 1.837	.....	103.5 (106-8)	exp.	sl. s.	s.	s. eth., bz., olive oil; 2.53 ¹⁵ CS ₂
1737	see <i>Benzoic acid</i> , benzyl-)						
1738	col. liq., 1.53955	1.050 $\frac{15}{15}$	-15.3	205.2; 93 ¹⁰	4 ¹⁷	66.7 50%, ∞ abs.	∞ eth., chl., me. al.; s. acet.
1739							
1740	need. or leaf. f. dil. al.	.....	72	230	sl. s.	s.	s. eth.
1741							
1742							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1743	Benzyl alcohol, o-hydroxy-	oxy-. See <i>Saligenin</i> .		
1744	—, <i>m</i> -hydroxy-	α ,3-toluenediol	$\text{HOC}_6\text{H}_4\text{CH}_2\text{OH}$	124.13
1745	—, <i>p</i> -hydroxy-	α ,4-toluenediol	$\text{HOC}_6\text{H}_4\text{CH}_2\text{OH}$	124.13
1746	—, 4-hydroxy-3-methoxy-	hoxy-. See <i>Vanillyl alcohol</i> .		
1747	—, <i>p</i> -isopropyl-	See <i>Cumic alcohol</i> .		
1748	—, <i>o</i> -methoxy-	saligenin 2-methyl ether	$\text{CH}_3\text{OC}_6\text{H}_4\text{CH}_2\text{OH}$	138.16
1749	—, <i>p</i> -methoxy-	See <i>Anisyl alcohol</i> .		
1750	—, <i>o</i> , <i>m</i> or <i>p</i> -methyl-	See <i>Carbinol</i> , <i>tolyl</i> .		
1751	—, α -methyl-	methylphenylcarbinol; 1-phenylethanol	$\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{OH}$	122.16
1752	—, 3,4-methylenedioxy-	xy-. See <i>Piperonyl alcohol</i> .		
1753	—, <i>o</i> -nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_2\text{OH}$	153.13
1754	—, <i>m</i> -nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_2\text{OH}$	153.13
1755	—, —, benzoate.	<i>m</i> -nitrobenzyl benzoate.	$\text{C}_6\text{H}_5\text{COOCH}_2\text{C}_6\text{H}_4\text{NO}_2$	257.24
1756	—, <i>p</i> -nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_2\text{OH}$	153.13
1757	—, thio-	See α -Toluenethiol.		
1758	Benzylamine	α -aminotoluene	$\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$	107.15
1759	—, <i>N</i> -acetyl-	See <i>Acetamide</i> , <i>N</i> -benzyl-		
1760	—, <i>N,N</i> -diphenyl-	See <i>Diphenylamine</i> , <i>N</i> -benzyl-		
1760M	—, <i>p</i> -methoxy-	anisylamine, acc. to some.	$p\text{-CH}_3\text{OC}_6\text{H}_4\text{CH}_2\text{NH}_2$	137.18
1761	—, α -methyl-	α -phenylethylamine; 1-amino-1-phenylethane	$\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{NH}_2$	121.18
1762	—, <i>N</i> -methyl- <i>N</i> -phenyl-	<i>N</i> -benzyl- <i>N</i> -methylaniline	$\text{C}_6\text{H}_5\text{CH}_2\text{N}(\text{CH}_3)\text{C}_6\text{H}_5$	197.27
1763	—, <i>N</i> -nitroso- <i>N</i> -phenyl-	<i>N</i> -phenylbenzyl nitrosamine	$\text{C}_6\text{H}_5\text{CH}_2\text{N}(\text{NO})\text{C}_6\text{H}_5$	212.24
1764	—, <i>N</i> -phenyl-	<i>N</i> -benzylaniline	$\text{C}_6\text{H}_5\text{CH}_2\text{NHC}_6\text{H}_5$	183.24
1765	Benzyl azide	See <i>Toluene</i> , α -triazole.		
1766	Benzyl bromide	α -bromotoluene	$\text{C}_6\text{H}_5\text{CH}_2\text{Br}$	171.04
1767	Benzyl chloride	α -chlorotoluene	$\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$	126.58
1768	—, <i>o</i> -bromo-	<i>o</i> -bromo- α -chlorotoluene	$\text{BrC}_6\text{H}_4\text{CH}_2\text{Cl}$	205.49
1769	—, <i>p</i> -bromo-	<i>p</i> -bromo- α -chlorotoluene	$\text{BrC}_6\text{H}_4\text{CH}_2\text{Cl}$	205.49
1770	—, <i>p</i> -chloro-	α ,4-dichlorotoluene	$\text{ClC}_6\text{H}_4\text{CH}_2\text{Cl}$	161.03
1771	Benzyl cyanide	See α -Tolunitrile.		
1772	Benzyl disulfide	dibenzyl disulfide; α -(benzylthio) toluene	$(\text{C}_6\text{H}_5\text{CH}_2)_2\text{S}_2$	246.37
1773	Benzyl ether	dibenzyl ether	$(\text{C}_6\text{H}_5\text{CH}_2)_2\text{O}$	198.25
1773M	Benzyl fluoride	α -fluorotoluene	$\text{C}_6\text{H}_5\text{CH}_2\text{F}$	110.13
1774	Benzyl hydrosulfide	See α -Toluenethiol.		
1774H	Benzylidene- , For benzylidene derivatives see the parent compounds (e.g. for benzal bromide; α , α -dibromotoluene		$\text{C}_6\text{H}_5\text{CHBr}_2$	249.95
1774R	Benzylidene chloride	benzal chloride; α , α -dichlorotoluene	$\text{C}_6\text{H}_5\text{CHCl}_2$	161.03
1775	Benzyl iodide	α -iodotoluene	$\text{C}_6\text{H}_5\text{CH}_2\text{I}$	218.05
1776	Benzyl mercaptan	See α -Toluenethiol.		
1777	Benzyl mustard oil	See <i>Isothiocyanic acid</i> , benzyl ester.		
1778	Benzyl nitrosamine, N-phenyl-	See <i>Benzylamine</i> , <i>N</i> -nitroso- <i>N</i> -phenyl-		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1743							
1744	need. f. bz.		67	300 d.	v. s. h.	v. s.	v. s. eth.
1745	col. need. f. w.		124 (110)	252	s.	v. s.	v. s. eth.
1746							
1747							
1748	liq., 1.549 ¹⁷	1.0495 $\frac{15}{15}$		248-50; 131-2 ¹⁵	v. sl. s.	s.	∞ eth.
1749							
1750							
1751	col. liq.	1.013 $\frac{20}{4}$; 1.000 $\frac{25}{4}$		205 (105-7 ¹²)	i.	∞	∞ eth.
1752							
1753	need. f. w.		74	168 ²⁰	sl. s. c.	s.	s. eth.
1754	rhomb.		27	180 ³	sl. s.	s.	v. s. eth.
1755			69.0-.5		i.	s.	s. eth.
1756	need. f. w.		93	185 ¹²	sl. s. c., s. h.	v. s.	v. s. eth.
1757							
1758	col. liq., 1.5401	0.9826 $\frac{19}{4}$		185	∞	∞	∞ eth.
1759							
1760							
1760M	col. liq.	1.050 ¹⁵		236-237; 122-4 ¹⁴	s.	∞	∞ eth.
1761	arom. oil.	0.935 ¹⁵		187.4	4.2 ²⁰	∞	∞ eth.
1762	liq.		9.2	306	i.	v. s.	v. s. eth.
1763	yel. need. f. al.		57-8		i.	s.	s. eth., chl., lgr.
1764	col. monocl. pr. f. al.	1.0618 $\frac{25}{4}$; 1.038 $\frac{55}{4}$	37-8 (32)	306-7	i.	s.	s. eth., h. meth. al.
1765							
1766	col. pois. liq.	1.438 $\frac{22}{0}$	-4.0	198	i.	∞	∞ eth.
1767	col. liq., 1.5415 ¹⁵	1.1026 $\frac{18}{4}$	-43 (-48)	179	i. c., d. h.	∞	∞ eth.
1768				124-6 ²⁰	i.	v. s.	v. s. eth.
1769	need. f. al. or pet. eth.		41	236	i.	v. s. h.	v. s. eth.
1770	need.		29	222 (214) d.	i.	s. c., v. s. h.	s. eth., ac. a., CS ₂ , bz.
1771							
1772	leaf. f. al.		(1) 71-2; (2) 69-70		v. sl. s.	s. h.	s. eth., bz., h. me. al.
1773	col. oil.	1.0428 $\frac{20}{4}$	4-5	295-8 (157-60 ¹⁵)	i.	v. s. h.	s. eth.
1773M							
1774	col. liq.	1.02278 ^{25.3}	-35	139.9	d.		
1774H	benzylidenemalon- ic acid see 1.51 ¹⁵		Malonic acid	d. benzylidene. 140 ²⁰	i.	∞	∞ eth.
1774R	fum. oily liq., 1.541						
1774R	col. oily liq., 1.5502 ²⁰	1.2557 ¹⁴	-16; frz. -17	207 (203.5 ⁷⁵⁶)	i.	∞	∞ eth.
1775	col. cr.	1.733 $\frac{25}{4}$	24	93 ¹⁰	i.	s.	s. eth., CS ₂
1776							
1777							
1778							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1779	Benzyloxyamine*	α (or <i>O</i>)-benzylhydroxylamine	$C_6H_5CH_2NHOH$.	123.15
1780	Benzyl sulfide	dibenzyl sulfide	$(C_6H_5CH_2)_2S$	214.31
1781	Benzyl sulfone	dibenzyl sulfone	$(C_6H_5CH_2)_2SO_2$	246.31
1782	Benzyl sulfoxide	dibenzyl sulfoxide	$(C_6H_5CH_2)_2SO$	230.31
1783	Berbamine		$C_{18}H_{19}NO_3 \cdot 2H_2O$	333.37
1784	Berberine		$C_{20}H_{17}NO_4 \cdot 6H_2O$	443.44
1785	—, compd. with chloroform		$C_{20}H_{19}NO_6 \cdot CHCl_3$	472.75
1786	—, hydrochloride		$C_{20}H_{19}NO_5 \cdot HCl \cdot 2H_2O$	425.86
1787	—, nitrate		$C_{20}H_{19}NO_6 \cdot HNO_3$	416.38
1788	—, sulfate		$C_{20}H_{19}NO_6 \cdot H_2SO_4$	451.44
1789	—, tetrahydro-	See <i>Canadine</i> ; <i>Hydroberberine</i> .		
1790	Berberonic acid	2,4,5-pyridinetricarboxylic acid*	$C_6H_2N(COOH)_3 \cdot 1\frac{1}{2}H_2O$	238.15
1791	Betacaine	See β - <i>Eucaine</i> .		
1792	Betaine	lysine; oxyneurine; trimethylglycocoll; (carboxymethyl)-trimethylammonium hydroxide anhydride	$COCH_2N(CH_3)_3O$	117.15
1793	Betel phenol	See <i>Chavibetol</i> .		
1794	Betol	2-naphthyl salicylate; β -naphthyl salicylate	$HOC_6H_4COOC_{10}H_7$	264.27
1795	Betorcinol	See <i>Resorcinol</i> , 2,5-dimethyl-.		
1796	Betulinic acid		$C_{36}H_{54}O_6$	582.80
1797	Betulinol	betulin; betula camphor; birch camphor	$C_{36}H_{60}O_3(?)$	540.85
1798	<i>p,p'</i>-Biacetanilide	See <i>Benzidine</i> , <i>N,N'</i> -diacetyl-.		
1799	Biacetyl	See 2,3- <i>Butanedione</i> *.		
1800	Biacetylene	See <i>Butadiyne</i> .		
1801	Biallyl	See 1,5- <i>Hexadiene</i> *.		
1802	<i>o,p'</i>-Bianiline	See 2,4'- <i>Biphenyldiamine</i> .		
1803	<i>p,p'</i>-Bianiline	See <i>Benzidine</i> .		
1803M	Bianisal	See <i>Stilbene</i> , 4,4'-dimethoxy-.		
1804	4,4'-Bi-<i>o</i>-anisidine	4,4'-diamino-3,3'-dimethoxybiphenyl	$[CH_3O(NH_2)C_6H_3]_2$	244.29
1805	Biarsine, tetraethyl-	ethyl cacodyl; bis(diethylarsenic)	$(C_2H_5)_2AsAs-(C_2H_5)_2$	266.06
1806	—, tetramethyl-	See <i>Cacodyl</i> .		
1807	<i>o,o'</i>-Bibenzzoic acid	See <i>Diphenic acid</i> .		
1808	Bibenzoyl	See <i>Benzil</i> .		
1809	Bibenzyl	<i>sym</i> -or 1,2-diphenylethane; dibenzyl	$C_6H_5CH_2CH_2C_6H_5$	182.25
1810	—, 4,4'-diamino-	See α , α' - <i>Bi-p-toluidine</i> .		
1811	Bi-<i>sec</i>-butyl	See <i>Hexane</i> , 3,4-dimethyl*.		
1812	Bi-<i>tert</i>-butyl	See <i>Butane</i> , 2,2,3,3-tetramethyl*.		
1813	2,2'-Bicamphane-2,2'-diol	See <i>Camphor pinacol</i> .		
1814	Bicyclo [4,4,0] decane	See <i>Naphthalene</i> , <i>decahydro</i> *.		
1815	Bicyclo [2,2,1] heptane	See <i>Norcamphane</i> .		
1816	Bicyclo-[2,2,1]hept-2-ene, 1,7,7-trimethyl-	See <i>Bornylene</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1779	oil .....	.....	.....	118-9 ³⁰	s.	.....	.....
1780	col.rhomb.pl. f. eth. or chl.	1.0712 $\frac{50}{80}$	49	.....	i.	s.	s. eth.
1781	need. f. al. +bz.	.....	151	290 sl. d.	s. h.	sl. s.	v. s. acet.; s. bz., ac. a.
1782	leaf. f. al. or w.	.....	134 (130)	d. 210	i. c., s. h.	s.	s. eth.
1783	leaf. f. al., [α] 108.6 $\frac{25}{D}$	.....	anh. 200	.....	.....	s.	s. eth.
1784	yel. anh.need. f. eth.; cr. (+6H ₂ O) f. w.	.....	anh. 145	.....	22 ²¹	1 c.	v. sl. s. eth.; sl. s. chl., bz.
1785	tricl. tab. f. chl.	.....	179	.....	.....	.....	.....
1786	or. need. or yel. powd.	.....	.....	.....	s.	s.	.....
1787	yel. need. ....	.....	.....	.....	sl. s.	.....	.....
1788	yel. need. ....	.....	.....	.....	1 ²¹	sl. s.	.....
1789	.....	.....	.....	.....	.....	.....	.....
1790	tricl. pr. ....	.....	235; anh. 243	.....	v. sl. s.	v. sl. s.	i. eth., bz., chl.; s. dil. a.
1791	.....	.....	.....	.....	.....	.....	.....
1792	col. monocl. pr. or leaf.	.....	293 d.	.....	157 ¹⁹	8.6 ¹⁸	v. sl. s. eth.
1793	.....	.....	.....	.....	.....	.....	.....
1794	cr. f. al. ....	.....	95	.....	i.	s.	s. h. eth., h. bz.
1795	.....	.....	.....	.....	.....	.....	.....
1796	wh. powd. ....	.....	195	.....	sl. s.	v. s.	.....
1797	need. f. al. [α] + 19.96 $\frac{25}{D}$ in pyr.	.....	258	subl., d.	i.	0.85 c., 4 27 h.	0.4 c., 3.07 h. eth.
1798	.....	.....	.....	.....	.....	.....	.....
1799	.....	.....	.....	.....	.....	.....	.....
1800	.....	.....	.....	.....	.....	.....	.....
1801	.....	.....	.....	.....	.....	.....	.....
1802	.....	.....	.....	.....	.....	.....	.....
1803	.....	.....	.....	.....	.....	.....	.....
1803M	.....	.....	.....	.....	.....	.....	.....
1804	col. need. or leaf.	.....	131.5	.....	sl. s. h.	s.	v. s. eth.; s. acet., chl., bz.
1805	liq., ign. in air, 1.4709	1.1388 $\frac{23.7}{4}$	.....	185-90	i.	s.	s. eth.
1806	.....	.....	.....	.....	.....	.....	.....
1807	.....	.....	.....	.....	.....	.....	.....
1808	.....	.....	.....	.....	.....	.....	.....
1809	col. monocl. need. f. al.	0.995 $\frac{20}{4}$; 0.942 $\frac{80}{4}$	52.5	284	i.	s.	v. s. eth.; s. CS ₂
1810	.....	.....	.....	.....	.....	.....	.....
1811	.....	.....	.....	.....	.....	.....	.....
1812	.....	.....	.....	.....	.....	.....	.....
1813	.....	.....	.....	.....	.....	.....	.....
1814	.....	.....	.....	.....	.....	.....	.....
1815	.....	.....	.....	.....	.....	.....	.....
1816	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1817	Bicyclo[3,1,1]hept-2-en	e, 2,6,6-trimethyl-.	See <i>Pinene</i> .	
1818	Bicyclo[3,1,0]hexane, 1	-isopropyl-4-methylene-	See <i>Sabinene</i> .	
1819	Biethylene.	See 1,3-Butadiene*.		
1820	Biformyl.	See <i>Glyoxal</i> .		
1821	Biguanide	guanylguanidine; diguanide..	$\text{NH}_2\text{C}(\text{:NH})\text{NHC}(\text{:NH})\text{NH}_2$	101.12
1822	—, α -o-tolyl-		$\text{C}_7\text{H}_7\text{NHC}(\text{:NH})\text{NHC}(\text{:NH})\text{NH}_2 \cdot \frac{1}{2}\text{H}_2\text{O}$	200.24
1823	Bihexyl.	See <i>Dodecane</i> *.		
1824	Biisoamyl.	See <i>Octane</i> , 2,7-dimethyl*.		
1825	Biisobutyl.	See <i>Hexane</i> , 2,5-dimethyl*.		
1826	Biisopropenyl.	See 1,3-Butadiene, 2,3-dimethyl*.		
1827	Biisopropyl.	See <i>Butane</i> , 2,3-dimethyl*.		
1828	Bikhaconine, acetylver	atryl-. See <i>Bikhaconitine</i> .		
1829	Bikhaconitine	acetylveratrylbikhaconine...	$\text{C}_{36}\text{H}_{51}\text{NO}_{11}$	673.78
1830	Bilifuscin		$\text{C}_{16}\text{H}_{20}\text{N}_2\text{O}_4$	304.34
1831	Bilineurine.	See <i>Choline</i> .		
1832	Bilirubin		$\text{C}_{32}\text{H}_{36}\text{N}_4\text{O}_6$	572.64
1833	Biliverdin		$\text{C}_{32}\text{H}_{36}\text{N}_4\text{O}_8$	604.64
1834	1,1'-Bi-2-naphthol. . . .	β -dinaphthol; 2,2'-dihydroxy-1,1'-binaphthyl	$\text{HOC}_{10}\text{H}_6\text{C}_{10}\text{H}_6\text{OH}$	286.31
1835	4,4'-Bi-1-naphthol. . . .	α -dinaphthol; 4,4'-dihydroxy-1,1'-binaphthyl	$\text{HOC}_{10}\text{H}_6\text{C}_{10}\text{H}_6\text{OH}$	286.31
1836	1,1'-Binaphthyl*	α , α' -dinaphthyl	$\text{C}_{10}\text{H}_7\text{C}_{10}\text{H}_7$	254.31
1837	—, 2,2'-dihydroxy-.	See 1,1'-Bi-2-naphthol.		
1838	—, 4,4'-dihydroxy-.	See 4,4'-Bi-1-naphthol.		
1839	2,2'-Binaphthyl*	β , β' -dinaphthyl	$\text{C}_{10}\text{H}_7\text{C}_{10}\text{H}_7$	254.31
1840	Bindschedler green, leu	co base. See <i>Diphenylamine</i> , <i>p</i> .	<i>p</i> -bisdimethylamino-	
1841	Biocetyl.	See <i>Hexadecane</i> *.		
1842	Bioxirane.	See <i>i</i> -Erythritol, anhydride.		
1843	o,o'-Biphenol	2,2'-dihydroxybiphenyl	$\text{HOC}_6\text{H}_4\text{C}_6\text{H}_4\text{OH}$..	186.20
1844	o,p'-Biphenol	2,4'-dihydroxybiphenyl	$\text{HOC}_6\text{H}_4\text{C}_6\text{H}_4\text{OH}$	186.20
1845	m,m'-Biphenol	3,3'-dihydroxybiphenyl	$\text{HOC}_6\text{H}_4\text{C}_6\text{H}_4\text{OH}$..	186.20
1846	p,p'-Biphenol	4,4'-dihydroxybiphenyl	$\text{HOC}_6\text{H}_4\text{C}_6\text{H}_4\text{OH}$..	186.20
1847	p,p'-Biphenol, 2,2',6,6'	-tetramethoxy-. See <i>Hydrocervulignone</i> .		
1848	p,p'-Biphenol, 3,3',		$[\text{C}_6\text{H}_2(\text{NO}_2)_2\text{OH}]_2$..	366.20
1849	5,5'-tetranitro-Biphenyl	diphenyl; phenylbenzene	$\text{C}_6\text{H}_5\text{C}_6\text{H}_5$	154.20
1850	—, 2-amino-.	See <i>o</i> -Biphenylamine.		
1851	—, 3-amino-.	See <i>m</i> -Biphenylamine.		
1852	—, 4-amino-.	See <i>Xenylamine</i> .		
1853	—, 2-amino-4,4'-dia	mino-. See <i>Benzidine</i> , 3-amino-		
1854	—, 2-benzyl-	1-benzyl-2-phenylbenzene	$\text{C}_6\text{H}_5\text{CH}_2\text{C}_6\text{H}_4\text{C}_6\text{H}_5$	244.32

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1817							
1818							
1819							
1820							
1821	amor. or pr. f. al.		130		s.	s.	
1822	wh. cr.		$\frac{1}{2}$ H ₂ O 140-4; anh. 145-6		s. h.	s.	s. eth.
1823							
1824							
1825							
1826							
1827							
1828							
1829	cr.		113			s.	s. eth.
1830	br. powd.		183		sl. s.	s.	sl. s. eth.; s. glac. ac. a., alk.
1831							
1832	br. rhomb. cr.		192-2.5		i.	sl. s.	v. sl. s. eth.; s. CS ₂ , chl., bz., a., alk.
1833	grn.-blk. powd.				i.	s.	sl. s. eth.; s. bz., alk.; i. chl.
1834	need. f. al. or tol.		218	subl.	i.	s.	v. s. eth.; sl. s. chl.
1835	rhomb. f. al.		300	subl.	i.	s.	v. s. eth.; s. alk.; sl. s. chl., bz.
1836	col. rhomb. leaf. f. al.		160.5 (156)	ca. 360; 240-4 ¹²	i.	s. h.	s. eth., bz., CS ₂
1837							
1838							
1839	col. pl.		187-8 (181)	452	i.	sl. s.	sl. s. eth.; s. h. bz., CS ₂
1840							
1841							
1842							
1843	pr. f. tol.; leaf. (hyd.) f. w.		hyd. 73-5; anh. 109-10	326	s. h.	s.	s. eth., ac. a., bz., alk.
1844	monocl. pr. or need.		162-3	342	sl. s. h.	s.	s. eth.
1845	need. f. w.		123-4	247 ¹⁸	v. sl. s.	s.	s. eth., chl., bz., alk.
1846	rhomb. need. or pl. f. al.	1.25 $\frac{20}{4}$	274-5 (270-2)	subl.	sl. s.	s.	s. eth.; sl. s. bz.
1847							
1848	yel. need.		222-5		i.	s.	
1849	col. monocl., α 1.56841, β 1.59441, γ 1.61158; 1.58822 ^{77.1}	1.180 $\frac{0}{4}$; 0.9919 $\frac{73}{4}$	69-71	254-5	i.	10 c.	s. eth.; 6.57 ^{19.5} me. al.
1850							
1851							
1852							
1853							
1854	monocl. need.		54	283-7 ¹¹⁰	i.	s.	s. eth.; v. s. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1855	Biphenyl, 4-benzyl- ...	1-benzyl-4-phenylbenzene....	$C_6H_5CH_2C_6H_4C_6H_5$	244.32
1856	—, 2-bromo-*	2-bromodiphenyl.....	$C_6H_5C_6H_4Br$	233.11
1857	—, 4-bromo-*	4-bromodiphenyl.....	$C_6H_5C_6H_4Br$	233.11
1858	—, 2-chloro-*	<i>o</i> -chlorodiphenyl.....	$ClC_6H_4C_6H_5$	188.65
1859	—, 3-chloro-*	<i>m</i> -chlorodiphenyl.....	$ClC_6H_4C_6H_5$	188.65
1860	—, 4-chloro-*	<i>p</i> -chlorodiphenyl.....	$ClC_6H_4C_6H_5$	188.65
1861	—, 2,4'-diamino-	See 2,4'-Biphenyldiamine.		
1862	—, 4,4'-diamino-	See Benzidine.		
1862M	—, 4,4'-diamino-3,3'-	dimethoxy-. See 4,4'-Bi-	<i>o</i> -anisidine.	
1863	—, 4,4'-dibromo-*	<i>p,p'</i> -dibromodiphenyl.....	$BrC_6H_4C_6H_4Br$...	312.02
1864	—, 4,4'-dichloro-*	4,4'-dichlorodiphenyl.....	$ClC_6H_4C_6H_4Cl$...	223.10
1865	—, 4,4'-dichloro-2,2'-dinitro-*		$Cl(NO_2)C_6H_3C_6H_3(NO_2)Cl$	313.10
1866	—, 2,2'-dihydroxy-	See <i>o,o'</i> -Biphenol.		
1867	—, 2,4'-dihydroxy-	See <i>o,p'</i> -Biphenol.		
1868	—, 3,3'-dihydroxy-	See <i>m,m'</i> -Biphenol.		
1869	—, 4,4'-dihydroxy-	See <i>p,p'</i> -Biphenol.		
1870	—, 2,2'-dimethyl-	See <i>o,o'</i> -Bitolyl.		
1871	—, 2,3'-dimethyl-	See <i>o,m'</i> -Bitolyl.		
1872	—, 3,3'-dimethyl-	See <i>m,m'</i> -Bitolyl.		
1873	—, 4,4'-dimethyl-	See <i>p,p'</i> -Bitolyl.		
1874	—, 2,2'-dinitro-*	<i>o,o'</i> -dinitrodiphenyl.....	$NO_2C_6H_4C_6H_4NO_2$	244.20
1875	—, 2,4'-dinitro-*	<i>o,p'</i> -dinitrodiphenyl.....	$NO_2C_6H_4C_6H_4NO_2$	244.20
1876	—, 3,3'-dinitro-*	<i>m,m'</i> -dinitrodiphenyl.....	$NO_2C_6H_4C_6H_4NO_2$	244.20
1877	—, 4,4'-dinitro-*	<i>p,p'</i> -dinitrodiphenyl.....	$NO_2C_6H_4C_6H_4NO_2$	244.20
1878	—, 2-ethoxy-*		$C_6H_5C_6H_4OC_2H_5$...	198.25
1879	—, 3-ethoxy-*		$C_6H_5C_6H_4OC_2H_5$...	198.25
1880	—, 1,2,3,4,5,6-hexahydro-	See Cyclohexane, phenyl-.		
1881	—, hydroxy-	See Phenol, phenyl-.		
1882	—, 4-iodo-*		$C_6H_5C_6H_4I$	280.11
1883	—, 2-methoxy-*		$C_6H_5C_6H_4OCH_3$...	184.23
1884	—, 4-methoxy-*		$C_6H_5C_6H_4OCH_3$...	184.23
1885	—, 2-methyl-	<i>o</i> -phenyltoluene.....	$C_6H_5C_6H_4CH_3$...	168.23
1886	—, 3-methyl-	<i>m</i> -phenyltoluene.....	$C_6H_5C_6H_4CH_3$...	168.23
1887	—, 4-methyl-	<i>p</i> -phenyltoluene.....	$C_6H_5C_6H_4CH_3$...	168.23
1888	—, 2-nitro-*		$C_6H_5C_6H_4NO_2$...	199.20
1889	—, 3-nitro-*		$C_6H_5C_6H_4NO_2$...	199.20
1890	—, 4-nitro-*		$C_6H_5C_6H_4NO_2$...	199.20
1891	—, 3-phenyl-	See Benzene, 1,3-diphenyl-		
1892	—, 4-phenyl-	See Terphenyl.		
1893	—, 3,3',5,5'-tetrahydroxy-	See 5,5'-Biresorcinol.		
1894	—, 2,2',4,4'-tetra-nitro-*		$(NO_2)_2C_6H_3C_6H_3(NO_2)_2$	334.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1855	leaf.....		85	285-6100	i.	s.	s. eth.; v. s. bz.
1856	liq.....		<-20	296-8	i.	s.	s. eth.
1857	col. pl. f. al.....		89-90	310	i.	s.	s. eth.
1858	monocl.....		32	273-4	i.	s.	v. s. eth.; s. lgr., CCl ₄
1859	cr.....		89	284-5	i.	s.	s. eth.
1860	leaf. f. lgr. or al.....		77 (66-75)	291.2745 (282)	i.	s.	s. eth., lgr.
1861							
1862							
1862M							
1863	monocl. pr....	1.897 ²⁰ / ₄	164	355-60	i.	v. sl. s. h.	s. bz.
1864	monocl. pr. or need. f. tol.....	1.439 ²⁰ / ₄	148-9 (130-43)	315-9	i.		
1865	yel. need. f. al.....		138		i.	sl. s. c., s. h.	
1866							
1867							
1868							
1869							
1870							
1871							
1872							
1873							
1874	yelsh. monocl. need.....	1.45 ²⁰ / ₄	124		i.	s. h.	s. eth., h. ac. a., h. bz.; sl. s. lgr.
1875	col. monocl. need. or pr.....	1.474 ²⁰ / ₄	93.5		i.	s. h.	s. eth., h. ac. a., h. bz.
1876	or-yel. need.....		200		i.	sl. s.	sl. s. eth.; s. h. ac. a., h. bz.
1877	need. f. al.....	1.445 ²⁰ / ₄	233 (237-43)		i.	v. sl. s. c., s. h.	v. s. eth.; s. h. bz., h. ac. a.
1878	pr.....		34	276		v. s.	v. s. eth.
1879	cr.....		34	305		s.	s. eth.
1880							
1881							
1882	col. cr. f. ac. a.....		113-4 (109-11)	320 d.	i.	s. h.	s. eth., bz., ac. a.
1883	pr.....		29	274; 159-6018			
1884	leaf.....		90 (84-5)			s. h.	
1885	col. liq.....	1.010 ²⁰ / ₄		260	i.	s.	s. eth.
1886	col. liq.....	1.031 ⁰ / ₄		277	i.	s.	s. eth.
1887	col. liq.....	1.015 ²⁷	-3	267	i.	s.	s. eth.
1888	rhomb. bi-py. leaf. f. al.....	1.44 ²⁰ / ₄	37 (31-3)	320	i.	v. s.	v. s. eth.
1889	yel. leaf. f. w. +al.....		58.5-61		i.	v. s.	v. s. ac. a.; s. lgr.
1890	col. rhomb. bi-py. need. f. al.....	1.328 ²⁰ / ₄	113	340	i.	sl. s. c.	s. eth.; v. s. chl.
1891							
1892							
1893							
1894	yel. pr. f. bz....		164-5	d.	i.	sl. s.	sl. s. eth.; s. bz., ac. a.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1895	<i>o</i> -Biphenylamine.	2-aminobiphenyl.	$\text{NH}_2\text{C}_6\text{H}_4\text{C}_6\text{H}_5$	169.22
1896	<i>m</i> -Biphenylamine.	3-aminobiphenyl.	$\text{NH}_2\text{C}_6\text{H}_4\text{C}_6\text{H}_5$	169.22
1897	<i>p</i> -Biphenylamine.	See <i>Xenylamine</i> .		
1898	Biphenylcarboxylic acid.	d. See <i>Benzoic acid, phenyl-</i> .		
1899	2,4'-Biphenyldiamine	<i>o,p'</i> -bianiline; diphenylene; 2,4'-diaminobiphenyl	$\text{NH}_2\text{C}_6\text{H}_4\text{C}_6\text{H}_4\text{NH}_2$	184.23
1900	2,2'-Biphenyldicarbonyl chloride.	See <i>Diphenoyl chloride</i> .		
1901	2,2'-Biphenyldicarboxylic acid.	See <i>Diphenic acid</i> .		
1902	2,2'-Biphenyldisulfonic acid.	4,4'-diamino-. See <i>2,2'-Benzidinedisulfonic</i>		
1903	Biphenylene oxide.	See <i>Dibenzofuran</i> .		
1904	Biphenylene sulfone, 2,7-diamino-.	See <i>Benzidine sulfone</i> .		
1905	<i>p</i> -Biphenyl mustard oil.	See <i>Isothiocyanic acid, xenyl ester</i> .		
1906	Bipropargyl.	See 1,5-Hexadiyne.*		
1907	Bipropenyl.	See 2,4-Hexadiene*.		
1908	4,4'-Bipyridyl.	4,4'- or γ, γ' -dipyridyl.	$(\text{C}_5\text{H}_4\text{N})_2$	156.18
1909	Bipyromucyl.	See <i>Furil</i> .		
1910	2,3'-Biquinoline.	2,3'-biquinolyl; 2,3'-diquinolyl	$(\text{C}_9\text{H}_6\text{N})_2$	256.29
1911	2,7'-Biquinoline.	2,7'-diquinolyl.	$(\text{C}_9\text{H}_6\text{N})_2$	256.29
1912	6,6'-Biquinoline.	6,6'-diquinolyl.	$(\text{C}_9\text{H}_6\text{N})_2$	256.29
1913	Birch camphor.	See <i>Betulinol</i> .		
1914	5,5'-Biresorcinol.	3,3',5,5'-tetrahydroxybiphenyl	$(\text{HO})_2\text{C}_6\text{H}_3\text{C}_6\text{H}_3(\text{OH})_2 \cdot 2\text{H}_2\text{O}$	254.23
1915	Bismuth, triethyl-*.	triethylbismuthine; bismuth triethyl	$\text{Bi}(\text{C}_2\text{H}_5)_3$	296.18
1916	—, trimethyl-*.	trimethylbismuthine.	$(\text{CH}_3)_3\text{Bi}$	254.10
1917	—, triphenyl-*.	triphenylbismuthine.	$(\text{C}_6\text{H}_5)_3\text{Bi}$	440.30
1918	Bismuthine. For derivatives see under <i>Bismuth</i> .			
1919	2,2'-Bithienyl.	See 2,2'-Bithiophene.		
1919	2,2'-Bithiophene.	2,2'-bithienyl; α, α' -dithienyl	$(\text{C}_4\text{H}_3\text{S})_2$	166.25
1920	—, hexabromo-....	perbromo- α, α' -dithienyl.	$(\text{C}_4\text{Br}_3\text{S})_2$	639.70
1921	4,4'-Bi- <i>o</i> -toluidine	($\text{NH}_2=1$). See <i>o-Tolidine</i> .		
1922	α, α' -Bi- <i>p</i> -toluidine	4,4'-diaminobiphenyl; 4,4'-diamino- <i>s</i> -diphenylethane	$\text{H}_2\text{NC}_6\text{H}_4\text{C}_2\text{H}_4\text{C}_6\text{H}_4\text{NH}_2$	212.29
1923	<i>o,o'</i> -Bitolyl.	2,2'-dimethylbiphenyl.	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_6\text{H}_4\text{CH}_3$	182.25
1924	<i>o,m'</i> -Bitolyl.	2,3'-dimethylbiphenyl.	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_6\text{H}_4\text{CH}_3$	182.25
1925	<i>m,m'</i> -Bitolyl.	3,3'-dimethylbiphenyl; <i>m,m'</i> -ditolyl	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_6\text{H}_4\text{CH}_3$	182.25
1926	<i>p,p'</i> -Bitolyl.	4,4'-dimethylbiphenyl.	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_6\text{H}_4\text{CH}_3$	182.25
1927	Biuret.	allophanamide; carbamyl-urea; ureidoformamide	$\text{NH}_2\text{CONH}_2\text{CONH}_2 \cdot \text{H}_2\text{O}$	122.11
1928	—, acetyl-.	acetylallophanamide.	$\text{CH}_3\text{CONHCONHCONH}_2$	145.12
1929	Bivinyl.	See 1,3-Butadiene*.		
1930	—, α -methyl-.	See 1,3-Pentadiene*.		
1931	—, β -methyl-.	See <i>Isoprene</i> .		
1932	Blue cross.	See <i>Arsine, chlorodiphenyl-</i> .		
1933	Boric acid, benzyl-....	benzylboron dihydroxide; α -tolueneboronic acid	$\text{C}_6\text{H}_5\text{CH}_2\text{B}(\text{OH})_2$..	135.96

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1895	col. leaf. ....	.....	49.3 (45.5)	299	i.	s.	.....
1896	col. leaf. or need.	.....	30	254 ¹³⁵	sl. s.	s.	s. eth.
1897							
1898							
1899	need. f. dil. al.	.....	45	363	v. sl. s.	s.	s. eth.
1900							
1901							
1902	acid						
1903							
1904							
1905							
1906							
1907							
1908	need. (+2H ₂ O) f. w.	.....	2H ₂ O, 73; anh. 114	304.8	v. sl. s.	v. s.	v. s. eth.; s. chl., bz.
1909							
1910	yel. pl. or need. f. bz.	.....	176-7	>400	i.	v. s.	s. eth., h. chl., h. bz.
1911	monocl. pl. f. al.	.....	193	subl.	i.	v. sl. s.	sl. s. eth.; s. chl., h. bz.
1912	monocl. leaf. f. al.	.....	181 (178)	dist.	v. sl. s. h.	v. sl. s.	s. eth., bz.
1913							
1914	pl., need. or wh.cr.powd.	.....	anh. 310	.....	s. h.	s.	s. eth.; i. ac. a., acet.
1915	col. liq.	1.82 ²⁰ / ₄	.....	1077 ⁹ exp.	i.	s.	s. eth.
1916	.....	2.300 ¹⁸ / ₄	.....	110 ¹⁰	.....	.....	.....
1917	monocl.	1.585 ²⁰ / ₄	77-8	242 ¹⁴	i.	sl. s.	s. eth.; v. s. chl., acet.
1918							
1919	col. leaf. ....	.....	33	260	i.	v. s.	v. s. eth.; s. ac. a.
1920	need. ....	.....	255	.....	.....	i.	s. h. bz.
1921							
1922	lust. pl. f. w. ....	.....	134-5 (132)	subl.	s. h.	v. s.	.....
1923	col. liq. or cr. f. al.	0.955 ¹⁰ / ₄	17.8	272; 2587 ³⁸	i.	s.	s. eth., bz.
1924	col. liq. ....	.....	.....	270 (287.5)	i.	v. s.	v. s. eth.; s. bz.
1925	col. visc. liq.	0.9993 ¹⁶ / ₄	5-7	286-77 ¹³	i.	s.	s. eth., bz.
1926	col. monocl. pr. f. eth.	1.102 ²⁰ / ₄ ; liq. 0.917 ¹²¹	121	273-6 (295)	i.	s.	s. eth., bz., CS ₂
1927	col. need. (+1H ₂ O); anh. f. al.	.....	190 (193) d.	.....	1.54 ¹⁵ ; 45.5 ¹⁰⁰	v. s.	v. sl. s. eth.
1928	col. need. ....	.....	193	.....	s.	v. s.	sl. s. eth.; s. bz.
1929							
1930							
1931							
1932							
1933	wh. cr. ....	.....	-H ₂ O, 104; anh. 140	d.	sl. s. c.	.....	s. eth., bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1934	Boric acid, <i>p</i>-bromo-phenyl-	.....	$\text{BrC}_6\text{H}_4\text{B}(\text{OH})_2$...	200.84
1934M	—, <i>o</i> (and <i>m</i>)-chloro-phenyl-	<i>o</i> -and <i>m</i> -chlorobenzeneboronic acid	$\text{ClC}_6\text{H}_4\text{B}(\text{OH})_2$...	156.39
1935	—, <i>p</i> -chlorophenyl-	.....	$\text{ClC}_6\text{H}_4\text{B}(\text{OH})_2$...	156.39
1936	—, ethyl-	ethaneboronic acid.	$\text{C}_2\text{H}_5\text{B}(\text{OH})_2$	73.90
1937	—, isoamyl-.....	3-methyl-1-butaneboronic acid	$(i\text{so-C}_5\text{H}_{11})\text{B}(\text{OH})_2$	115.98
1938	—, isobutyl-.....	.....	$(\text{CH}_3)_2\text{CHCH}_2\text{B}(\text{OH})_2$	101.95
1939	—, phenyl-.....	phenylboron dihydroxide; benzeneboronic acid	$\text{C}_6\text{H}_5\text{B}(\text{OH})_2$	121.94
1940	—, propyl-.....	1-propaneboronic acid.....	$n\text{-C}_3\text{H}_7\text{B}(\text{OH})_2$...	87.92
1940M	—, <i>o</i> -(and <i>m</i>)-tolyl-	<i>o</i> -and <i>m</i> -tolueneboronic acid	$\text{CH}_3\text{C}_6\text{H}_4\text{B}(\text{OH})_2$...	135.96
1941	—, <i>p</i> -tolyl-	<i>p</i> -tolylboron dihydroxide.....	$\text{CH}_3\text{C}_6\text{H}_4\text{B}(\text{OH})_2$...	135.96
1942	Borine, difluoro-phenyl-	boron phenyl difluoride; phenylboron difluoride	$\text{C}_6\text{H}_5\text{BF}_2$	125.92
1943	—, difluoro- <i>p</i> -tolyl-	boron <i>p</i> -tolyl difluoride.....	$\text{CH}_3\text{C}_6\text{H}_4\text{BF}_2$	139.95
1944	—, triethyl-.....	triethylboron; boron triethyl	$(\text{C}_2\text{H}_5)_3\text{B}$	98.00
1945	—, triisoamyl-.....	triisoamylboron.....	$(\text{C}_5\text{H}_{11})_3\text{B}$	224.24
1946	—, triisobutyl-.....	triisobutylboron.....	$(\text{C}_4\text{H}_9)_3\text{B}$	182.16
1947	—, trimethyl-.....	trimethylboron; boron trimethyl	$(\text{CH}_3)_3\text{B}$	55.92
1948	—, triphenyl-.....	boron triphenyl; triphenylboron	$(\text{C}_6\text{H}_5)_3\text{B}$	242.12
1949	—, tripropyl-.....	tripropylboron.....	$(\text{C}_3\text{H}_7)_3\text{B}$	140.08
1950	Borneo camphor.	See <i>d</i> -Borneol.		
1951	<i>dl</i>-Borneol	<i>dl</i> -exo-2-camphanol; <i>dl</i> -bornyl alcohol; <i>dl</i> - α -camphol	$\text{C}_{10}\text{H}_{17}\text{OH}$	154.25
1952	—, acetate.....	<i>dl</i> -bornyl acetate.....	$\text{C}_{10}\text{H}_{17}\text{OOCCH}_3$...	196.28
1953	<i>d</i>-Borneol	<i>d</i> -exo-2-camphanol; <i>d</i> -bornyl alcohol; Borneo camphor; Malay camphor; Sumatra camphor; <i>d</i> - α -camphol	$\text{C}_{10}\text{H}_{17}\text{OH}$	154.25
1954	—, acetate.....	.....	$\text{CH}_3\text{COOC}_{10}\text{H}_{17}$...	196.28
1955	<i>l</i>-Borneol	<i>l</i> -exo-2-camphanol; ngai camphor	$\text{C}_{10}\text{H}_{17}\text{OH}$	154.25
1956	—, acetate.....	<i>l</i> -bornyl acetate.....	$\text{C}_{10}\text{H}_{17}\text{OOCCH}_3$...	196.28
1957	Bornyl acetate.	See <i>Borneol</i> , acetate.		
1958	Bornyl alcohol.	See <i>Borneol</i> .		
1959	Bornylamine.....	.....	$\text{C}_{10}\text{H}_{17}\text{NH}_2$	153.26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1934	need.		266				s. eth.
1934M	wh. cr.		indef. (de-hyd.)	d.	sl. s.	s.	s. eth., bz., lgr.
1935	need. or sheafs.		275				s. eth.
1936	wh. leaf. or pl.		subl. 40 (?); indef.; (d.)	d.	s.	s.	s. eth.
1937	col. sq. tab. doub. refractive		169 (101) d.	d.	s. c.; v. s. h.	s.	s. eth., all org. solv.
1938	lng. pointed doubly re- fracting pl.		112 (104)		s.	s.	s. eth.
1939	wh. need.		214-6 (d.)	d.	sl. s.	s.	s. eth., bz.
1940	wh. thick rect. pl.		107 (74-5) d.	d.	s.	s.	s. eth., dichloroethane
1940M	wh. need. or pl.		indef. (d.)	d.	sl. s.	s.	s. eth., bz.
1941	need.		240				s. eth.
1942	col. oil.			70-5	d.		s. eth., bz.
1943	col. oil.			95-7	d.		s. eth., bz.
1944	col. fum. liq. ...	0.6961 $\frac{23}{4}$		95	v. sl. s.	s.	s. eth.
1945	liq., 1.43207...	0.7600 $\frac{23.4}{4}$		119 ¹⁴			s. eth.
1946	liq., 1.42445 ^{22.8}	0.7380 $\frac{25}{4}$		188; 86 ²⁰			s. eth.
1947	col. gas.	1.9108 g/l	-161.5	-20	v. sl. s.	v. s.	v. s. eth.
1948	hex. columns, d. in air		136	245-50; (203 ¹⁵)	i.	d.	s. eth., bz.
1949	liq., 1.42354 ^{22.8}	0.7204 $\frac{24.7}{4}$		156 (60 ²⁰)			s. eth.
1950							
1951	col. hex. leaf. f. lgr., [α]-44.2° _D	1.011 $\frac{20}{4}$	210.5	subl.	v. sl. s.	v. s.	v. s. eth.; 25 ²⁰ bz.
1952	col., 1.4630. ...	0.985 $\frac{20}{4}$	27-8	114 ²²			
1953	col. hex. leaf., [α] +37.44° _D ²⁰ in al.	1.011 $\frac{20}{4}$	208	212 subl.	0.074 ²⁵	s.	s. eth., lgr.; 22.2 ²⁰ bz.
1954	col. rhomb., 1.46635 ¹⁵ , liq. [α] +44.45° _D ²⁰	liq. 0.9855 $\frac{20}{4}$	29	223-4 (225-6)	v. sl. s.	v. s.	s. eth.
1955	col. hex. pl., [α] 37.74° _D ²⁰ in al.	1.011 $\frac{20}{4}$	208.6	210 ⁷⁹⁹ subl.	0.0740 ²⁵	s.	v. s. eth.; 22.2 ²⁰ bz.
1956	col., 1.46635 ¹⁵	0.9855 $\frac{20}{4}$	29	223-4			
1957							
1958							
1959	col. cr., [α] +47.2° _D ²⁰ in al.		163	200 subl.	v. sl. s.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1960	Bornyl chloride	2-chlorocamphane (one form); pinene hydrochloride; artificial camphor	$C_{10}H_{17}Cl$	172.69
1961		See also <i>Isobornyl chloride</i> .		
1962	1-Bornylene	1,1,7,7-trimethylbicyclo-[2,2,1]-2-heptene	$C_{10}H_{16}$	136.23
1963	Bornyl esters.	See under <i>Borneol</i> .		
1964	Boron. (For other derivatives see under <i>Boric acid</i> and <i>Borine</i> .)			
1965	—, triethoxy-	See <i>Ethyl borate</i> .		
1966	—, trimethoxy-	See <i>Methyl borate</i> .		
1967	—, tripropoxy-	See <i>Propyl borate</i> .		
1968	Brasilein.	See <i>Brazilein</i> .		
1969	Brasilin.	See <i>Brazilin</i> .		
1970	Brassic acid, Brassic acid	<i>trans</i> -13-docosenoic acid*; isorucic acid; <i>trans</i> -erucic acid	$C_{23}H_{44}O_2$	338.56
1971	Brassicic anhydride		$(C_{21}H_{41}O)_2$	659.10
1972	Brazilein	brasilein	$C_{16}H_{12}O_5$	284.26
1973	Brazilin	brasilin	$C_{16}H_{14}O_6 \cdot 1\frac{1}{2}H_2O$	313.30
1974	British gum.	See <i>Dextrin</i> .		
1975	Bromacetol.	See <i>Propane, 2,2-dibromo*</i> .		
1976	Bromal	2,2,2-tribromoethanal*; tribromoacetaldehyde; tribromoaldehyde	CBr_3CHO	280.78
1977	—, hydrate	2,2,2-tribromo-1,1-ethanediol*; tribromoethylidene glycol	$CBr_3CH(OH)_2$	298.79
1978	Bromanilid.	See <i>Acetanilide, p-bromo</i> .		
1979	Bromelia.	See <i>Ether, ethyl 2-naphthyl</i> .		
1980	Bromine cyanide.	See <i>Cyanogen bromide</i> .		
1981	Bromo- See the parent compounds (e.g., for bromoacetic acid see <i>Acetic acid, bromo-</i>)			
1981	Bromoform	tribromomethane	$CHBr_3$	252.77
1982	—, nitro-	See <i>Bromopicrin</i> .		
1983	Bromopicrin	tribromonitromethane*; nitrotribromoform	NO_2CBr_3	297.77
1984	Brönner's acid.	See <i>2-Naphthylamine-6-sulfonic acid</i> .		
1985	Brucine		$C_{23}H_{26}N_2O_4 \cdot 4H_2O$	466.52
1986	—, hydrochloride		$C_{23}H_{26}N_2O_4 \cdot HCl$	430.92
1987	—, nitrate		$C_{23}H_{26}N_2O_4 \cdot HNO_3 \cdot 2H_2O$	493.51
1988	—, sulfate		$(C_{23}H_{26}N_2O_4)_2 \cdot H_2SO_4 \cdot 7H_2O$	1013.10
1989	Bulbocapnine		$C_{19}H_{19}NO_4$	325.35
1990	1,2-Butadiene*	methylallene	$CH_2:C:CHCH_3$	54.09
1990M	—, 3-methyl-	unsym-dimethylallene	$CH_2:C:C(CH_3)_2$	68.11
1991	1,3-Butadiene*	bivinyll; erythrene; pyrrolylene; vinyl ethylene; divinyl; biethvlene	$CH_2:CHCH:CH_2$	54.09

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1960	col. cr. ....	.....	131-2 (128)	207.4	i.	26.04	s. eth.
1961	col. cr. f. me. al., [α] -22.27° _D ²⁰ in bz.	.....	113	146 ⁷⁵⁰	i.	s.	s. eth., tol., me. al.
1962							
1963							
1964							
1965							
1966							
1967							
1968							
1969							
1970	col. leaf. f. al., 1.4347 ¹⁰⁰	0.8585 ⁵⁷ _■	61.5	282 ³⁰	0.74 ²⁴	v. sl. s. c.	s. eth.
1971	need.	0.835 ⁷⁰ ₄	64	.....	i.	sl. s.	s. eth.
1972	dk. red rhomb. leaf.	.....	.....	.....	sl. s. h.	■	s. eth., alk.
1973	wh. or pa. yel. rhomb. need. f. al.	.....	250	.....	sl. s.	■	s. eth., alk.
1974	yel. liq.	2.30 ¹⁵	.....	174	d.	s.	s. eth.
1975							
1976							
1977	col. monoc. pr.	2.566 ⁴⁰ ₄	53.5	d.	s.	s.	s. eth.
1978	col. liq. or hex. cr., 1.5980 ^{19.0}	2.890 ²⁰ ₄	6-7	149.5	0.319 ³⁰	■	■ eth.; s bz., chl., pet. eth. and oils
1979							
1980							
1981	pr., 1.5831 ¹³ ...	2.811 ^{12.5} ₄	10	127 ¹¹⁸	i.	s.	s. eth.
1982							
1983							
1984	monocl. pr. f. al. [α]-119° _D	.....	4H ₂ O, 105; anh. 178	.....	0.1 c., 0.67 ¹⁰⁰	81.8 ²⁵	0.75 eth.; 13 1 ²⁵ chl.; s. bz.; i. alk.
1985							
1986							
1987	wh. need. ....	.....	.....	.....	s.	s.	.....
1988	wh. pr. ....	.....	anh. 230 d.	.....	■	s.	.....
1989	lng. need. ....	.....	.....	.....	s.	s.	.....
1990	rhomb. pr. f. eth., [α] +237.1° _D	.....	199	.....	i.	s.	s. eth., chl.
1991	col. liq. ....	.....	.....	19	i.	∞	∞ eth.
1990M	liq.	0.683 ²⁰ ₄	-120	40.5-41.5	.....	.....	.....
1991	gas.	0.650 ⁻⁶ ₄	-113	-3	i.	v. s.	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
1992	1, 3-Butadiene, 2-chloro-*	ro-*. See <i>Chloroprene</i> .		
1993	—, 2,3-dimethyl-*	biisopropenyl.....	$\text{CH}_2:\text{C}(\text{CH}_3)-\text{C}(\text{CH}_3):\text{CH}_2$	82.14
1994	—, 2-methyl-*	See <i>Isoprene</i> .		
1995	Butadiyne*	butadiene; biacetylene.....	$\text{CH}:\text{CC}:\text{CH}$	50.06
1996	Butanal*	See <i>Butyraldehyde</i> .		
1997	Butanamide*	See <i>Butyramide</i> .		
1998	Butane	n-butane; methylethylmethane	$\text{CH}_3(\text{CH}_2)_2\text{CH}_3$...	58.12
1999	—, 1-amino-	See <i>Butylamine (n)</i> .		
2000	—, 2-amino-	See <i>sec-Butylamine</i> .		
2000H	—, 2-amino-2,3-dimethyl-*	ethyl-. See <i>Propylamine</i> , α , α , β -trimethyl-.		
2000R	—, 1-amino-2-ethyl-	. See <i>Butylamine</i> , β -ethyl-.		
2001	—, 1-amino-3-methyl-	yl-. See <i>Isoamylamine</i> .		
2001F	—, 3-amino-2-methyl-	yl-. See <i>Propylamine</i> , α , β -dimethyl-.		
2002	—, 1-benzoyloxy-	See <i>Ether</i> , <i>benzyl butyl</i> .		
2003	—, 2,2-bis(ethylsulfonyl)-*	onyl)-*. See <i>Trional</i> .		
2004	—, 1-bromo-	See <i>Butyl bromide (n)</i> .		
2005	—, 2-bromo-	See <i>sec-Butyl bromide</i> .		
2006	—, 1-bromo-2-methyl-*(d)	d-pri-act-amyl bromide.....	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)-\text{CH}_2\text{Br}$	151.06
2007	—, 1-bromo-3-methyl-*	See <i>Isoamyl bromide</i> .		
2008	—, 1-butoxy-	See <i>Butyl ether</i> .		
2009	—, 1-butyldithio-	See <i>Butyl disulfide</i> .		
2009H	—, 1-(butylsulfonyl)*	-. See <i>Butyl sulfoxide</i> .		
2009R	—, 1-(butylsulfonyl)-*	-. See <i>Butyl sulfone</i> .		
2010	—, butylthio-	See <i>Butyl sulfide (n)</i> .		
2011	—, 1-chloro-	See <i>Butyl chloride (n)</i> .		
2012	—, 2-chloro-	See <i>sec-Butyl chloride</i> .		
2013	—, 1-chloro-2-methyl-*	pri-act-amyl chloride.....	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)-\text{CH}_2\text{Cl}$	106.60
2014	—, 1-chloro-3-methyl-1-*	See <i>Isoamyl chloride</i> .		
2015	—, 2-chloro-2-methyl-*	tert-amyl chloride.....	$\text{CH}_3\text{CH}_2\text{CCl}(\text{CH}_3)-\text{CH}_3$	106.60
2016	—, 1,2,3,4-diepoxy-	See <i>i-Erythritol</i> , anhydride.		
2017	—, 1,4-dihydroxy-	See <i>1,4-Butanediol*</i> .		
2018	—, 2,2-dimethyl-*	ethyltrimethylmethane; neohexane	$(\text{CH}_3)_3\text{CCH}_2\text{CH}_3$..	86.17
2019	—, 2,3-dimethyl-*	isopropyl dimethylmethane; biisopropyl	$(\text{CH}_3)_2\text{CHCH}(\text{CH}_3)_2$	86.17
2020	—, 1-ethoxy-	See <i>Ether</i> , <i>butyl ethyl</i> .		
2021	—, 1-ethoxy-3-methyl-*	yl-*. See <i>Ether</i> , <i>ethyl isoamyl</i> .		
2021M	—, 1-fluoro-	See <i>Butyl fluoride (n)</i> .		
2022	—, 1-iodo-	See <i>Butyl iodide</i> .		
2023	—, 2-iodo-	See <i>sec-Butyl iodide</i> .		
2024	—, 1-iodo-2-methyl-*	pri-act-amyl iodide.....	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)-\text{CHI}$	198.06
2025	—, 1-iodo-3-methyl-*	*. See <i>Isoamyl iodide</i> .		
2026	—, 2-iodo-2-methyl-*	* tert-amyl iodide.....	$\text{CH}_3\text{CH}_2\text{CI}(\text{CH}_3)-\text{CH}_3$	198.06
2027	—, 1-methoxy-	See <i>Ether</i> , <i>butyl methyl</i> .		
2028	—, 2-methyl-*	ethyl dimethylmethane; isopentane	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$	72.15
2029	—, 3-methyl-1-(γ-methylbutoxy)-*	See <i>Isoamyl ether</i> .		
2030	—, 2-methyl-1-(β-methylbutylthio)-*	See <i>Sulfide</i> , bis(β -methylbutyl).		
2031	—, 3-methyl-1-(γ-methylbutylthio)-*	See <i>Isoamyl sulfide</i> .		
2032	—, 3-methyl-1-phenoxy-	See <i>Ether</i> , <i>isoamyl phenyl</i> .		
2033	—, 2-methyl-2-phenyl-	yl-. See <i>Benzene</i> , <i>tert-amyl</i> .		
2034	—, 3-methyl-1-phenyl-	yl-. See <i>Benzene</i> , <i>isoamyl</i> .		
2035	—, 3-methyl-1-(2-propenoxy)-*	See <i>Ether</i> , <i>allyl isoamyl</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1992							
1993	col. liq., 1.437717	0.7446 $\frac{0}{0}$; 0.727 $\frac{20}{20}$	-65	69.6	.....	.....	.....
1994							
1995	gas.....	2.233	-36.4	10.3	460 cm ³	s.	v. s. eth.
1996							
1997							
1998	col. gas or hex.	liq. 0.60 $\frac{0}{4}$	-135	-0.6 to -0.3	15 $\frac{17}{772}$ cm ³	1813 $\frac{17}{775}$ cm ³	2980 $\frac{18}{773}$ cm ³ eth.
1999							
2000							
2000 H							
2000 R							
2001							
2001 F							
2002							
2003							
2004							
2005							
2006	liq.....	1.221 $\frac{20}{4}$	.....	120-1	i.	s.	s. eth.
2007							
2008							
2009							
2009 H							
2009 R							
2010							
2011							
2012							
2013	liq.....	0.881 $\frac{18}{4}$	.....	97-9	i.	s.	s. eth.
2014							
2015	liq., 1.407 ¹⁸ ...	0.871 $\frac{20}{4}$	-73	86	i.	s.	s. eth.
2016							
2017							
2018	liq., 1.3675....	0.6487 $\frac{20}{4}$	-98.2	49.7	i.	s.	s. eth.
2019	liq., 1.3783....	0.668 $\frac{17}{4}$	-135.1	58.1	i.	s.	s. eth.
2020							
2021							
2021 M							
2022							
2023							
2024	liq., 1.4981 ¹⁵ ...	1.524	.....	148	i.	s.	s. eth.
2025							
2026	liq.....	1.497 ¹⁹	.....	125-8	i.	∞	∞ eth.
2027							
2028	col. liq., 1.355	0.621 ¹⁹	-160.5	28 (27-31)	i.	∞	∞ eth.
2029							
2030							
2031							
2032							
2033							
2034							
2035							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2036	Butane, (α-methylpro	poxy)-*. See <i>sec-Butyl ether</i> .		
2037	—, 1-nitro-*		$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NO}_2$	103.12
2038	—, 1-phenyl-	See <i>Benzene, butyl-</i> .		
2039	—, 2-phenyl-	See <i>Benzene, sec-butyl-</i> .		
2040	—, 2,2,3,3-tetra- methyl-*	<i>tert</i> -butyltrimethylmethane; bi- <i>tert</i> -butyl; hexamethyl- ethane	$\text{CH}_3\text{C}(\text{CH}_3)_2\text{C}(\text{CH}_3)_2\text{CH}_3$	114.23
2041	—, 2,2,3-trimethyl-*	isopropyltrimethylmethane..	$\text{CH}_3\text{C}(\text{CH}_3)_2\text{CH}(\text{CH}_3)\text{CH}_3$	100.20
2042	1-Butanearsonic acid	<i>n</i> -butylarsonic acid.....	$\text{CH}_3(\text{CH}_2)_3\text{AsO}(\text{OH})_2$	182.04
2042M	1-Butaneboronic acid, Butanediol*, Butanediamide*.	3-methyl- . See <i>Boric acid, isoamyl-</i> . See <i>Succinaldehyde</i> . See <i>Succinamide</i> . See <i>Malamide</i> . See <i>Putrescine</i> .		
2045	—, 2-hydroxy-*			
2046	1,4-Butanediamine*.			
2047	1,1-Butanedicarboxylic acid*.	See <i>Malonic acid, propyl-</i> .		
2048	1,2-Butanedicarboxylic acid.	See <i>Succinic acid, ethyl-</i> .		
2049	1,4-Butanedicarboxylic acid.	See <i>Adipic acid</i> .		
2050	2,3-Butanedicarboxylic acid, 2,3-dimethyl-	See <i>Succinic acid, tetramethyl-</i> .		
2051	Butanedinitrile*.	See <i>Succinonitrile</i> .		
2052	Butanedioic acid*.	See <i>Succinic acid</i> .		
2053	Butanedioic anhydride*.	See <i>Succinic anhydride</i> .		
2054	1,1-Butanediol, 2,2,3-trichloro-*.	See <i>Butyraldehyde, α, α, β-trichloro-</i> .		
2055	1,2-Butanediol*.....	α -butylene glycol; ethylene glycol	$\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{OH}$	90.12
2056	—, 3-methyl-*.....	isopropylethylene glycol; α -isoamylene glycol	$(\text{CH}_3)_2\text{CHCH}(\text{OH})\text{CH}_2\text{OH}$	104.15
2057	1,3-Butanediol*.....	β -butylene glycol; α -methyltrimethylene glycol	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{OH}$	90.12
2058	—, 3-methyl-*.....	γ -isoamylene glycol.....	$(\text{CH}_3)_2\text{COHCH}_2\text{CH}_2\text{OH}$	104.15
2059	1,4-Butanediol*.....	tetramethylene glycol; 1,4-dihydroxybutane	$\text{CH}_2\text{OH}(\text{CH}_2)_2\text{CH}_2\text{OH}$	90.12
2060	2,3-Butanediol*.....	pseudobutylene glycol; <i>sym</i> -dimethylethylene glycol	$\text{CH}_3\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}_3$	90.12
2061	—, 2,3-dimethyl-*.	See <i>Pinacol</i> .		
2062	—, 2,3-diphenyl-....	α , α' -dimethylhydrobenzoin; acetophenone pinacol	$\text{CH}_3\text{COH}(\text{C}_6\text{H}_5)_2$	242.31
2063	—, 2-methyl-*.....	trimethylethylene glycol; β -isoamylene glycol	$(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}(\text{OH})\text{CH}_3$	104.15
2064	1,3-Butanedione, 1-phenyl-*.	See <i>Acetone, benzoyl-</i> .		
2065	2,3-Butanedione*.....	dimethylglyoxal; biacetyl; dimethyl diketone; diacetyl	$\text{CH}_3\text{COCOCH}_3$	86.09
2066	—, dioxime*.	See <i>Glyoxime, dimethyl-</i> .		
2067	—, mono-oxime.....	biacetyl mono-oxime; α -isobutyronitrile methyl ketone	$\text{CH}_3\text{COC}(:\text{NOH})\text{CH}_3$	101.10
2068	Butanedioyl chloride*.	See <i>Succinyl chloride</i> .		
2069	Butanenitrile*.	See <i>Butyronitrile</i> .		
2070	—, 3-methyl-*.	See <i>Isovaleronitrile</i> .		
2071	1,2,3,4-Butanetetrol*.	(<i>anti</i>). See <i>i-Erythritol</i> .		
2072	1-Butanethiol*.....	butyl mercaptan.....	$\text{CH}_3(\text{CH}_2)_3\text{SH}$	90.15
2073	—, 2-methyl-*.....	<i>pri-act</i> -amyl mercaptan.....	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{SH}$	104.21
2074	—, 3-methyl-*.....	isoamyl mercaptan.....	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_2\text{SH}$	104.21
2075	2-Butanethiol, 2-methyl-*	<i>tert</i> -amyl mercaptan.....	$\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2\text{SH}$	104.21

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2036							
2037	liq. ....	.....	.....	151-2	v. sl. s.	∞	∞ eth.
2038							
2039							
2040	leaf. f. eth. ....	.....	104 (98-9)	106.8	i.	.....	s. eth.
2041	col. liq., 1.390	0.6900 $\frac{20}{4}$	-25.0	80.9	i.	s.	s. eth.
2042	.....	.....	158-9	.....	v. s.	■.	s. eth.
2042M							
2043							
2044							
2045							
2046							
2047							
2048							
2049							
2050							
2051							
2052							
2053							
2054	hydrate.						
2055	liq.	1.019 $\frac{0}{4}$	.....	192	sl. s.	■	.....
2056	liq.	0.9987 $\frac{0}{4}$	.....	206	.....	s.	s. eth.
2057	visc. liq.	1.005	.....	204	s.	■.	i. eth.
2058	thick syrup	0.9892 $\frac{20}{4}$	.....	202-3	s.	s.	.....
2059	need. or oil	1.020 $\frac{20}{4}$	16	230	∞	s.	sl. s. eth.
2060	liq.	1.048 $\frac{0}{4}$	.....	184	∞	■.	∞ eth.
2061							
2062	need. ....	.....	121-2; 116-7	.....	i.	v. s.	v.s.eth.; sl. s. pet. eth.
2063	thick oil	0.9893 $\frac{0}{0}$	.....	177	∞	∞	∞ eth.
2064							
2065	grnsh. yel. liq., 1.39331 ¹⁸	0.9904 $\frac{15}{11}$	.....	88	25 ¹⁵	∞	∞ eth.
2066							
2067	pr. f.chl.; leaf. f. w.	.....	74-5	186	sl. s.	v. s.	v. s. eth.; s. alk.
2068							
2069							
2070							
2071							
2072	col. liq.	0.858 $\frac{0}{4}$; 0.8365 $\frac{25}{4}$	-115.9	98	sl. s.	v. s.	v. s. eth.
2073	liq.	0.8415 $\frac{23}{4}$	.....	119-21	.....	.....	.....
2074	col. liq., 1.44118	0.835 $\frac{20}{4}$	.....	119	i.	∞	∞ eth.
2075							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2076	1,2,3-Butanetricarboxylic acid, 1,2,3-dimethyl-	See <i>Succinimide</i> .	*. See <i>l</i> -Camphoric acid.	
2077	Butanimide*.	See <i>Butyric acid</i> .		
2078	Butanoic acid*.	See <i>Isovaleric acid</i> .		
2079	—, 3-methyl*.	See <i>Acetoacetic acid</i> .		
2079M	—, 3-oxo*.	See <i>Butyric anhydride</i> .		
2080	Butanoic anhydride*.	See <i>Butyl alcohol (n)</i> .		
2081	1-Butanol*.			
2081M	—, 2-amino-.....		$\text{CH}_3\text{CH}_2\text{CH}(\text{NH}_2)\text{CH}_2\text{OH}$	89.14
2082	—, 2-ethyl*.....	3-methylolpentane; pseudo-hexyl alcohol	$(\text{C}_2\text{H}_5)_2\text{CHCH}_2\text{OH}$	102.17
2083	—, —, acetate.....	β -ethylbutyl acetate.....	$(\text{C}_2\text{H}_5)_2\text{CHCH}_2\text{OOCCH}_3$	144.21
2084	—, 2-methyl* (d)...	<i>d</i> -sec-butylcarbinol; <i>d</i> -pract-amyl alcohol	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{OH}$	88.15
2085	—, 3-methyl*.	See <i>Isoamyl alcohol</i> .		
2086	—, 3-methyl-1-phenyl*.	isobutylphenylcarbinol.....	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{OH})\text{C}_6\text{H}_5$	164.24
2086M	—, 2-nitro*.....		$\text{CH}_3\text{CH}_2\text{CH}(\text{NO}_2)\text{CH}_2\text{OH}$	119.12
2086R	—, 2-nitro-2-methyl-2-Butanol*.	ol-. See 1,3-Propanediol, 2-ethyl-2-nitro*.		
2087	—, 2,3-dimethyl-1-.....	See <i>sec</i> -Butyl alcohol.		
2088	—, 2,3-dimethyl-1-.....	isopropyl dimethylcarbinol....	$(\text{CH}_3)_2\text{COHCH}(\text{CH}_3)_2$	102.17
2089	—, 3,3-dimethyl*.	See <i>Pinacolyl alcohol</i> .		
2090	—, 2-methyl*.....	dimethylethylcarbinol; <i>tert</i> -amyl alcohol	$\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2\text{OH}$	88.15
2091	—, 3-methyl*.....	methylisopropylcarbinol; <i>sec</i> -isoamyl alcohol	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{OH})\text{CH}_3$	88.15
2092	—, 2,3,3-trimethyl*.	<i>tert</i> -butyl dimethylcarbinol; pentamethylethyl alcohol	$(\text{CH}_3)_3\text{CC}(\text{CH}_3)_2\text{OH}$	116.20
2093	Butanolide.	See <i>Butyrolactone</i> .		
2094	1-Butanone, 3-methyl-1-phenyl-.	See <i>Isovalerophenone</i> .		
2095	2-Butanone*.....	ethyl methyl ketone.....	$\text{CH}_3\text{COC}_2\text{H}_5$	72.10
2096	—, oxime.....	methyl ethyl ketoxime.....	$\text{CH}_3\text{C}(\text{NOH})\text{C}_2\text{H}_5$	87.12
2097	—, 3,3-dimethyl*.	See <i>Pinacolin</i> .		
2098	—, 3,3-diphenyl-.	acetophenone pinacolin.....	$\text{CH}_3\text{COC}(\text{C}_6\text{H}_5)_2$	224.29
2098M	—, 1-hydroxy-.....	ethylketol.....	$\text{CH}_3\text{CH}_2\text{COCH}_2\text{OH}$	88.10
2099	—, 3-hydroxy*.	See <i>Acetoin</i> .		
2100	—, 3-methyl*.....	isopropyl methyl ketone.....	$\text{CH}_3\text{COCH}(\text{CH}_3)_2$	86.13
2101	—, —, oxime.....	methyl isopropyl ketoxime...	$\text{CH}_3\text{C}(\text{NOHCH}(\text{CH}_3)_2)\text{CH}_3$	101.15
2102	—, 1-phenyl-.....	benzyl ethyl ketone.....	$\text{C}_2\text{H}_5\text{COCH}_2\text{C}_6\text{H}_5$	148.20
2103	—, 4-phenyl-.....	benzylacetone.....	$\text{C}_6\text{H}_5\text{CH}_2\text{COCH}_3$	148.20
2105	Butanoyl bromide*.	See <i>Butyryl bromide</i> .		
2106	Butanoyl chloride*.	See <i>Butyryl chloride</i> .		
2107	—, 3-methyl*.	See <i>Isovaleryl chloride</i> .		
2108	2-Butenal*.	See <i>Crotonaldehyde</i> .		
2109	—, 2-methyl*.	See <i>Tiglaldehyde</i> .		
2109M	2-Butenamide*.	See <i>Crotonamide</i> .		
2110	1-Butene*.....	α -butylene; ethylethylene...	$\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$	56.10
2111	—, 4-bromo*.....	δ -bromo- α -butylene; vinyl-ethyl bromide	$\text{CH}_2\text{BrCH}_2\text{CH}=\text{CH}_2$	135.01

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2076							
2077							
2078							
2079							
2079M							
2080							
2081							
2081M	1.453 ²⁰	0.944	-2	178; 79-80 ¹⁰	∞	.....	.....
2082	col. liq., 1.421	0.8328 ²⁰ / ₂₀	.....	149.5	0.63 ²⁴ , 0.43 ²⁰	s.	s. eth.
2083	col. liq., 1.410	0.879 ²⁰ / ₄	<-100	162.4	0.06	.....	.....
2084	col. liq., [α] -5.90 ²⁰ / _D	0.816 ²⁰ / ₄	.....	128	sl. s.	∞	∞ eth.
2085							
2086	thick oil	0.9537 ¹⁹ / ₄	.....	235-6 ⁷⁴⁶	i.	■.	s. eth.
2086M	.....	.....	-47 to -48	105 ¹⁰	20 ²⁰	.....	.....
2086 R							
2087							
2088	col. liq. w. odor of camphor	0.8232 ¹⁹ / ₄	-14	120-1	v. sl. s.	s.	∞ eth.
2089							
2090	col. liq., 1.4052	0.809	-11.9	101.8	12.5; 14 ³⁰	∞	∞ eth.; s. bz., chl., glyc., oils
2091	col. liq.	0.819 ²⁰ / ₄	.....	114 (112)	sl. s.	∞	∞ eth.
2092	col. liq.; +1H ₂ O need.	.....	17; frz. 15	131-2	i.	s.	s. eth.
2093							
2094							
2095	col. liq., 1.38071 ^{15.9}	0.805 ²⁰ / ₄	-86.4	79.6	35.3 ¹⁰ 19 ⁹⁰	∞	s. eth.
2096	col. liq., 1.4428	0.923 ²⁰ / ₄	-29.5	152	10	∞	∞ eth.
2097							
2098	pr. ....	.....	41-1.5	310-1	i.	s. c., v. s. h.	v. s. eth., bz., chl.
2098M	1.4250 ²¹	1.020 ²¹ / ₄	.....	51.5 ¹² , 48 ⁹	.....	.....	.....
2099							
2100	col. liq., 1.38788 ¹⁶	0.815 ¹⁶ / ₄	-92	93	v. sl. s.	∞	∞ eth.
2101	col. liq. ....	.....	.....	157-8	s.	∞	∞ eth.
2102	col. liq.	1.002 ⁰ / ₄	.....	230.2	i.	∞	∞ eth.
2103	liq.	0.989 ²³ / ₁₇	.....	235; 115 ¹³	.....	s.	s. eth.
2105							
2106							
2107							
2108							
2109							
2109M							
2110	gas.	0.668 ⁰ / ₄	-130	-5	i.	v. s.	v. s. eth.
2111	.....	1.33 ¹⁷ / ₄	.....	165-6 (99)	.....	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2112	1-Butene, 2,3-di-methyl-*	1-isopropyl-1-methylethylene	$\text{CH}_2:\text{C}(\text{CH}_3)-$	84.16
2113	—, 3,3-dimethyl-*	<i>tert</i> -butylethylene; pseudo-butylethylene	$\text{CH}(\text{CH}_3)_2$ $\text{CH}_2:\text{CHC}(\text{CH}_3)_3$	84.16
2114	—, 2-ethyl-*	3-methylenepentane; <i>uns</i> -diethylethylene	$\text{CH}_2:\text{C}(\text{C}_2\text{H}_5)-$ CH_2CH_3	84.16
2115	—, 2-ethyl-3-methyl-*	1-ethyl-1-isobutylethylene;	$\text{CH}_2:\text{C}(\text{C}_2\text{H}_5)-$	98.18
2116	—, 2-methyl-*	2-methyl-3-methylene-penta- <i>ne</i> ; <i>uns</i> -ethylmethylethylene	$\text{CH}(\text{CH}_3)_2$ $\text{CH}_2:\text{C}(\text{CH}_3)\text{CH}_2-$	70.13
2117	—, 3-methyl-*	isopropylethylene; α -iso-amylene	$(\text{CH}_3)_2\text{CHCH}:\text{CH}_2$	70.13
2118	2-Butene*	<i>sym</i> -dimethylethylene; β -butylene; pseudobutylene	$\text{CH}_3\text{CH}:\text{CHCH}_3$	56.10
2119	—, 2,3-dimethyl-*	tetramethylethylene	$(\text{CH}_3)_2\text{C}:\text{C}(\text{CH}_3)_2$	84.16
2120	—, 3-methyl-*	trimethylethylene; β -iso-amylene	$(\text{CH}_3)_2\text{C}:\text{CHCH}_3$	70.13
2121	3-Butene-1, 1-dicarboxylic acid.	See <i>Malonic acid</i> , allyl-		
2122	cis-Butenedioic acid*.	See <i>Maleic acid</i> .		
2123	trans-Butenedioic acid*.	See <i>Fumaric acid</i> .		
2123M	3-Butene-1,2-diol*.	See <i>Erythrol</i> .		
2123X	2-Butenenitrile*.	See <i>Crotononitrile</i> .		
2124	3-Butenenitrile*.	See <i>Allyl cyanide</i> .		
2125	3-Butenoic acid, cis(?)	See <i>Isocrotonic acid</i> .		
2126	—, trans(?)	See <i>Crotonic acid</i> .		
2127	—, 2-methyl-*	See <i>Tiglic acid</i> .		
2128	—, 4-oxo-4-phenyl-	See <i>Acrylic acid, β-benzoyl</i> .		
2129	3-Butenoic acid*.	vinylacetic acid; β -butenic acid	$\text{CH}_2:\text{CHCH}_2\text{COOH}$	86.09
2130	—, 2-hydroxy-4-phenyl-	benzallactic acid; styryl-glycolic acid	$\text{C}_6\text{H}_5\text{CH}:\text{CHCH}-$ OHCOOH	178.18
2131	—, 4-phenyl-	β -benzalpropionic acid	$\text{C}_6\text{H}_5\text{CH}:\text{CHCH}_2-$ COOH	162.18
2132	2-Buten-1-ol*.	propenylcarbinol; crotyl alcohol; crotonyl alcohol; γ -methylallyl alcohol	$\text{CH}_3\text{CH}:\text{CHCH}_2-$ OH	72.10
2133	—, acetate	2-butenyl ethanoate*; crotyl acetate; crotonyl acetate	$\text{CH}_3\text{COOC}_4\text{H}_7$	114.14
2134	3-Buten-1-ol*.	allylcarbinol; 1-buten-4-ol	$\text{CH}_2:\text{CHCH}_2\text{CH}_2-$ OH	72.10
2135	3-Buten-2-ol*.	methylvinylcarbinol	$\text{CH}_2:\text{CHCHOHCH}_3$	72.10
2136	3-Buten-2-one, 4-p-anisyl-	See <i>3-Buten-2-one, 4-p-methoxyphenyl-</i> .		
2137	—, 4-(2-furyl)-*	See <i>Acetone, furfurylidene-</i> .		
2137M	—, 4-p-methoxy-phenyl-	anisylideneacetone; <i>p</i> -methoxybenzylideneacetone	$\text{CH}_3\text{OC}_6\text{H}_4\text{CH}:$ CHCOCH_3	176.21
2138	—, 4-phenyl-*	See <i>Acetone, benzylidene-</i> .		
2139	—, 4-(2,6,6-trimethyl-1-cyclohexenyl)-	See β - <i>Ionone</i> .		
2140	—, 4-(2,6,6-trimethyl-1-cyclohexenyl)-	See α - <i>Ionone</i> .		
2141	—, 4-(2,2,6-trimethyl-1-cyclohexenyl)-	See β - <i>Irone</i> .		
2142	β-Butenenitrile.	See <i>Allyl cyanide</i> .		
2143	3-Buten-1-yne*	vinylacetylene	$\text{CH}:\text{CCH}:\text{CH}_2$	52.07
2144	Butesin	butyl <i>p</i> -aminobenzoate	$\text{H}_2\text{NC}_6\text{H}_4\text{COO}-$ $(\text{CH}_2)_3\text{CH}_3$	193.24
2145	—, picrate		$(\text{H}_2\text{NC}_6\text{H}_4\text{COOC}_4\text{H}_9)_2\text{C}_6\text{H}_2(\text{NO}_2)_3-\text{OH}$	615.59

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2112	.....	0.6803 $\frac{20}{4}$	.....	56.0-6.5	.....	.....	.....
2113	.....	0.6549 $\frac{15}{4}$	.....	41.2	.....	.....	.....
2114	.....	0.6914 $\frac{20}{4}$	.....	66.2-6.7	.....	.....	.....
2115	.....	0.7186 $\frac{20}{4}$	.....	88.7-9.1	.....	.....	.....
2116	col. liq. ....	.....	.....	31.0	.....	.....	.....
2117	col. liq.	0.648 $\frac{20}{4}$	-135	25 (21)	i.	∞	∞ eth.
2118	col. gas.	0.635	.....	(<i>cis</i>) 1 (<i>trans</i>) 2.5	i.	v. s.	v. s. eth.; i. H ₂ SO ₄
2119	liq., 1.4128....	0.712 $\frac{20}{4}$	.....	73	.....	.....	.....
2120	col. inflam. liq.	0.668 $\frac{13}{4}$	-124	38.4	v. sl. s.	s.	= eth.
2121	.....	.....	.....	.....	.....	.....	.....
2122	.....	.....	.....	.....	.....	.....	.....
2123	.....	.....	.....	.....	.....	.....	.....
2123M	.....	.....	.....	.....	.....	.....	.....
2123X	.....	.....	.....	.....	.....	.....	.....
2124	.....	.....	.....	.....	.....	.....	.....
2125	.....	.....	.....	.....	.....	.....	.....
2126	.....	.....	.....	.....	.....	.....	.....
2127	.....	.....	.....	.....	.....	.....	.....
2128	.....	.....	.....	.....	.....	.....	.....
2129	col. liq., 1.4257 ¹⁵	1.013 $\frac{15}{15}$	-39	163	s.	∞	∞ eth.
2130	need. f. w. ....	.....	46	98	s. h.	.....	sl. s. eth.; bz., CS ₂ , lgr.
2131	need. f. w. ....	.....	88 (83-4)	302 sl. d.	sl. s. h.	v. s.	v. s. eth.
2132	col. liq., 1.4240	0.8726 $\frac{0}{4}$; 0.854 $\frac{20}{4}$	<-30	118 (117-20)	16.6	∞	∞ eth.
2133	col. liq.	0.934 $\frac{0}{4}$	.....	129	sl. s.	s.	s. eth.
2134	col. liq., 1.4146 ^{17.5}	0.864 $\frac{0}{4}$; 0.848 $\frac{17}{0}$	.....	113	s.	∞	= eth.
2135	col. liq. ....	.....	.....	96-7	.....	.....	.....
2136	.....	.....	.....	.....	.....	.....	.....
2137	.....	.....	.....	.....	.....	.....	.....
2137M	leaf. ....	.....	72-4	.....	i.	v. s.	v. s. eth.
2138	.....	.....	.....	.....	.....	.....	.....
2139	.....	.....	.....	.....	.....	.....	.....
2140	.....	.....	.....	.....	.....	.....	.....
2141	.....	.....	.....	.....	.....	.....	.....
2142	.....	.....	.....	.....	.....	.....	.....
2143	col. liq.	0.6867 $\frac{20}{0}$	.....	5 ⁷⁵⁷	.....	.....	.....
2144	wh. cr. powd.	.....	55-7	1.7 ²	0.00014	s.	s. eth., bz., chl., dil. a.
2145	yel. amor. powd.	.....	109-10	.....	0.07	s.	s. eth., bz., chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2146	Butine.	See <i>Butyne</i> *.		
2147	Butyl- . For butyl derivatives see the parent compounds (e.g., for butylbenzene see			
2147	Butyl acetate, α, γ-dimethyl- . See 2-Pentanol, 4-methyl-, acetate.			
2148	—, β -ethyl-	See 1-Butanol, 2-ethyl-, acetate.		
2149	Butyl alcohol (n)	1-butanol*; propylcarbinol...	$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{OH}$	74.12
2150	sec-Butyl alcohol	2-butanol*; ethylmethylcarbinol	$\text{CH}_3\text{CH}_2\text{CHOH}-\text{CH}_3$	74.12
2151	tert-Butyl alcohol	2-methyl-2-propanol*; trimethylcarbinol	$(\text{CH}_3)_3\text{COH}$	74.12
2152	—, trichloro-	See <i>Chloreitone</i> .		
2153	Butylamine (n)	1-aminobutane.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}_2-\text{NH}_2$	73.14
2153H	—, <i>N</i> -ethyl-		$\text{CH}_3(\text{CH}_2)_3\text{NHC}_2\text{H}_5$	101.19
2153R	—, β -ethyl-	1-amino-2-ethyl- <i>n</i> -butane....	$(\text{C}_2\text{H}_5)_2\text{CHCH}_2-\text{NH}_2$	101.19
2154	—, <i>N</i> -methyl-		$\text{CH}_3\text{NHC}_2\text{H}_5$	87.16
2155	—, α -methyl-	methylpropylcarbinylamine; sec- <i>n</i> -amylamine; 2-aminopentane	$\text{CH}_3(\text{CH}_2)_2-\text{CH}(\text{CH}_3)\text{NH}_2$	87.16
2156	—, γ -methyl-	See <i>Isoamylamine</i> .		
2157	sec-Butylamine	(α -methylpropyl)amine; 2-aminobutane	$\text{CH}_3\text{CH}(\text{NH}_2)-\text{CH}_2\text{CH}_3$	73.14
2157M	—, <i>N</i> -ethyl-		$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)-\text{NHC}_2\text{H}_5$	101.19
2158	tert-Butylamine	(α , α -dimethylethyl) amine; trimethylcarbinylamine	$(\text{CH}_3)_3\text{CNH}_2$	73.14
2159	<i>n</i>-Butylarsonic acid.	See 1- <i>Butanearsonic acid</i> .		
2160	Butyl bromide (n)	1-bromobutane*.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{Br}$.	137.03
2161	sec-Butyl bromide	2-bromobutane*; methyl-ethylbromomethane	$\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$..	137.03
2162	tert-Butyl bromide ...	2-bromo-2-methylpropane*; trimethylbromomethane	$(\text{CH}_3)_3\text{CBr}$	137.03
2163	Butyl carbitol.	See <i>Diethylene glycol, monobutyl ether</i> .		
2164	Butyl cellosolve.	See <i>Ethanol, 2-butoxy-</i> *.		
2165	Butyl chloral.	See <i>Butyraldehyde, α, α, β-trichloro-</i> .		
2166	Butyl chloride (n)	1-chlorobutane*.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{Cl}$..	92.57
2167	sec-Butyl chloride	2-chlorobutane*; methyl-ethylchloromethane	$\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)\text{Cl}$..	92.57
2168	tert-Butyl chloride	2-chloro-2-methylpropane*; trimethylchloromethane	$(\text{CH}_3)_3\text{CCl}$	92.57
2169	Butyl cyanide (n).	See <i>Valeronitrile</i> .		
2170	sec-Butyl cyanide.	See <i>Butyronitrile, α-methyl-</i> .		
2171	tert-Butyl cyanide.	See <i>Propionitrile, α, α-dimethyl-</i> .		
2172	Butyl disulfide (n)	1-butyldithiobutane*.....	$[\text{CH}_3(\text{CH}_2)_3]_2\text{S}_2$	178.35
2173	α-Butylene.	See 1- <i>Butene</i> *.		
2174	β-Butylene.	See 2- <i>Butene</i> *.		
2175	γ-Butylene.	See <i>Propene, 2-methyl-</i> *.		
2176	α-Butylene glycol.	See 1, 2- <i>Butanediol</i> *.		
2177	β-Butylene glycol.	See 1,3- <i>Butanediol</i> *.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2146	<i>Benzene, butyl-</i>	For butyl	esters of or	ganic acids s	ee the ac	ids.	
2147							
2148							
2149	col. liq., 1.39931	0.80978 $\frac{20}{4}$	-89.2 to -89.8 (-79.9)	117.71	7.9 ²⁰	∞	∞ eth.
2150	col. liq., 1.397	0.808 $\frac{20}{4}$	-89	99.5-100	12.5 ²⁰	∞	∞ eth.
2151	col. liq. or rhomb. pr. or pl., 1.38779	0.7887 $\frac{20}{4}$	25.5	82.8	∞	∞	∞ eth.
2152							
2153	col. liq., 1.401	0.7401 $\frac{20}{4}$	-50.5	77.8 (76-8)	∞	s.	s. eth.
2153 H	.....	.....	.....	108-109	.....	.....	.....
2153 R	.....	.....	.....	125	.....	.....	.....
2154	col. liq., 1.40180 ^{18,1}	0.737 $\frac{20}{4}$	.....	91	.....	.....	.....
2155	col. liq.	0.73839 $\frac{20}{0}$	.....	92	∞	∞	∞ eth.
2156							
2157	col. liq., 1.39501 ^{16,7} [α] 7.4 ²⁰ _D	0.724 $\frac{20}{4}$ (0.718 $\frac{20}{4}$)	-104.5	63	∞	∞	∞ eth.
2157 M	.....	0.7358 $\frac{20}{0}$	.....	97-98 ⁷⁴¹	.....	.....	.....
2158	col. liq., 1.37940 ¹⁸	0.696 $\frac{20}{4}$	-67.5	46.4 (43.8)	∞	∞	∞ eth.
2159							
2160	col. liq., 1.4398	1.299 $\frac{20}{4}$	-112.4	101.6	i.	∞	∞ eth.
2161	col. liq., 1.4344 ²⁵	1.2580 $\frac{20}{4}$	.....	91.3	i.	.....	.....
2162	col. liq., 1.428	1.222 $\frac{20}{4}$	-20	73.3	i.	.....	.....
2163							
2164							
2165							
2166	col. liq., 1.4015	0.884; 0.9074 $\frac{0}{4}$	-123.1	73	0.066 ^{12,5}	∞	∞ eth.
2167	col. liq., 1.3953 ²⁵	0.8707 $\frac{20}{4}$	-131.3	68	v. sl. s.	∞	∞ eth.
2168	col. liq., 1.38686 ¹⁸	0.847 $\frac{15}{4}$	-28.5	51-2	v. sl. s.	∞	∞ eth.
2169							
2170							
2171							
2172	.....	.....	.....	100-3 ¹⁵	i.	∞	∞ eth.
2173							
2174							
2175							
2176							
2177							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2178	Butyl ether (n).....	1-butoxybutane*; di- <i>n</i> -butyl ether	$\text{CH}_3(\text{CH}_2)_3\text{O}(\text{CH}_2)_3\text{CH}_3$	130.23
2179	sec-Butyl ether	2-(α -methylpropoxy)butane*; di- <i>sec</i> -butyl ether	$[\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)]_2\text{O}$	130.23
2179M	Butyl fluoride (n).....	1-fluobutane*.....	$\text{CH}_3(\text{CH}_2)_3\text{F}$	76.11
2180	Butyl hydrogen sulfate	See <i>Butylsulfuric acid</i> .		
2181	Butyl iodide (n).....	1-iodobutane*.....	$\text{CH}_3(\text{CH}_2)_3\text{I}$	184.03
2182	sec-Butyl iodide	2-iodobutane*; methylethyl-iodomethane	$\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)\text{I}$	184.03
2183	tert-Butyl iodide	2-iodo-2-methylpropane*; trimethyliodomethane	$(\text{CH}_3)_3\text{CI}$	184.03
2184	Butyl isocyanide (n) ..	butylcarbylamine*.....	$\text{CH}_3(\text{CH}_2)_3\text{NC}$	83.13
2185	Butyl isocyanide, γ-methyl-	ethyl-. See <i>Isoamyl isocyanide</i> .		
2186	tert-Butyl isocyanide	(α , α -dimethylethyl)carbylamine*.....	$(\text{CH}_3)_3\text{CNC}$	83.13
2186M	<i>n</i>-Butyl ketone	See 5- <i>Nonanone</i> *.		
2187	Butyl mercaptan (n).....	See 1- <i>Butanethiol</i> *.		
2187M	<i>n</i>-Butylmercuric chloride	ide. See <i>Mercury chloride, <i>n</i>-butyl-</i> .		
2188	Butyl mustard oils	See the butyl esters under <i>Iso thiocyanic acid</i> .		
2189	Butyl nitrate * (n).....	.....	$\text{CH}_3(\text{CH}_2)_3\text{ONO}_2$	119.12
2190	sec-Butyl nitrate	α -methylpropyl nitrate*.....	$\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)\text{ONO}_2$	119.12
2191	Butyl nitrite * (n).....	.....	$\text{CH}_3(\text{CH}_2)_3\text{ONO}$	103.12
2192	sec-Butyl nitrite	α -methylpropyl nitrite*.....	$\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)\text{ONO}$	103.12
2193	tert-Butyl nitrite	α , α -dimethylethyl nitrite*.....	$(\text{CH}_3)_3\text{CONO}$	103.12
2194	Butyl sulfate (n).....	di- <i>n</i> -butyl sulfate.....	$(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_2\text{SO}_4$	210.29
2195	Butyl sulfide (n).....	dibutyl sulfide; butylthiobutane*.....	$(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_2\text{S}$	146.29
2196	sec-Butyl sulfide	di- <i>sec</i> -butyl sulfide; 1-methyl-1-(α -methylpropylthio)propane*.....	$[\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)]_2\text{S}$	146.29
2196H	Butyl sulfone	1-(butylsulfonyl)butane*; di- <i>n</i> -butyl sulfone	$[\text{CH}_3(\text{CH}_2)_3]_2\text{SO}_2$	178.29
2196R	Butyl sulfoxide	1-(butylsulfinyl)butane*; di- <i>n</i> -butyl sulfoxide	$[\text{CH}_3(\text{CH}_2)_3]_2\text{SO}$	162.29
2197	Butylsulfuric acid (n) ..	butyl hydrogen sulfate.....	$\text{C}_4\text{H}_9\text{OSO}_2\text{OH}$	154.18
2198	1-Butyne *.....	1-butine; ethylacetylene.....	$\text{CH}_3\text{C}\equiv\text{CCH}_2\text{CH}_3$	54.09
2199	—, 3-methyl-*.....	isopropylacetylene.....	$(\text{CH}_3)_2\text{CHC}\equiv\text{CH}$	68.11
2200	1-Butyne, 1-phenyl-	See <i>Benzene, 1-butyne</i> -.		
2201	2-Butyne *.....	2-butine; dimethylacetylene; crotonylene	$\text{CH}_3\text{C}\equiv\text{CCH}_3$	54.09
2202	Butynedioic acid *.....	See <i>Acetylenedicarboxylic acid</i> .		
2203	2-Butynoic acid *.....	See <i>Tetrollic acid</i> .		
2204	Butyraldehyde	butanal*; butyric aldehyde..	$\text{CH}_3(\text{CH}_2)_2\text{CHO}$	72.10
2205	—, oxime.....	butanal oxime*; butyraldoxime	$\text{CH}_3(\text{CH}_2)_2\text{CH}=\text{N}\cdot\text{OH}$	87.12
2206	—, phenylhydrazone.....	<i>N</i> -butylidene- <i>N'</i> -phenylhydrazine	$\text{CH}_3(\text{CH}_2)_2\text{CH}=\text{N}\cdot\text{NHC}_6\text{H}_5$	162.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2178	col. liq.	0.7841 $\frac{0}{4}$; 0.769 $\frac{20}{20}$	-95.2 (-98)	142	sl. s.	∞	∞ eth.
2179	.....	0.756 $\frac{21}{4}$	.....	121	sl. s.	=	= eth.
2179M	col. liq., 1.3419 ¹⁵	0.7761	.....	31.95	i.	v. s.	.....
2180	.....	.....	.....	.....	.....	.....	.....
2181	liq., 1.50006...	1.617 $\frac{20}{4}$	-103.5	131	0.0202 ^{17.5}	∞	∞ eth.
2182	col. liq.	1.595 $\frac{20}{4}$	-104.0	117.5 (119-22)	i.	s.	∞ eth.
2183	liq.	1.571 $\frac{0}{4}$	-33.65	100 d.	i., d.	∞	∞ eth.
2184	liq. ....	.....	.....	118	i.	=	∞ eth.
2185	.....	.....	.....	.....	.....	.....	.....
2186	lt. oil. ....	.....	.....	91 ^{37.5}	.....	s.	.....
2186M	.....	.....	.....	.....	.....	.....	.....
2187	.....	.....	.....	.....	.....	.....	.....
2187M	.....	.....	.....	.....	.....	.....	.....
2188	.....	.....	.....	.....	.....	.....	.....
2189	liq., 1.40130 ^{23.2}	1.048 $\frac{0}{4}$	.....	136	i.	s.	s. eth.
2190	liq.	1.0382 $\frac{0}{4}$	.....	124	.....	∞	∞ eth.
2191	liq.	0.9114 $\frac{0}{4}$	.....	75 (77-9)	.....	∞	∞ eth.
2192	liq.	0.8981 $\frac{0}{4}$	.....	68	.....	∞	∞ eth.
2193	lt. yel. liq.	0.8941 $\frac{0}{4}$	.....	63	sl. s.	v. s.	v. s. eth.; s. chl., CS ₂
2194	col. liq., 1.4210 ²⁵	1.0591 $\frac{25}{25}$	.....	97.4 ³	i.	.....	.....
2195	liq.	0.852 $\frac{0}{4}$; 0.839 $\frac{16}{0}$	-79.7	182 (186-9)	i.	v. s.	v. s. eth.
2196	liq.	0.8317 $\frac{23}{4}$	.....	165	i.	v. s.	v. s. eth.
2196H	pl. ....	.....	43	.....	i.	s.	s. eth.
2196R	need. ....	.....	32	d.	i.	s.	s. eth.
2197	syrup. ....	.....	.....	d.	v. s.	s.	s. eth.
2198	col. liq., 1.3962	0.668 $\frac{0}{4}$	-130	8.6	i.	s.	s. eth.
2199	col. liq.	0.6854 $\frac{0}{4}$	.....	29.3	i.	∞	∞ eth.
2200	.....	.....	.....	.....	.....	.....	.....
2201	liq., 1.3893 ²⁵ ...	0.688 ²⁵	.....	27.2 (28.9)	i.	s.	s. eth.
2202	.....	.....	.....	.....	.....	.....	.....
2203	.....	.....	.....	.....	.....	.....	.....
2204	col. liq., 1.38433	0.817 $\frac{20}{4}$	-99.0	75.7	3.7	∞	∞ eth.
2205	col. liq.	0.923 $\frac{20}{4}$	-29.5	152 ⁷¹⁵	10.8	∞	∞ eth.
2206	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2207	Butyraldehyde , sodium bisulfite compound	.....	$C_3H_7CHOHSO_3Na$	176.17
2208	—, α-ethyl-	2-ethylbutanal*.....	$CH_3CH_2CH(C_2H_5)CHO$	100.16
2209	—, β-hydroxy-	See <i>Aldol</i> .		
2210	—, β-methyl-	See <i>Isovaleraldehyde</i> .		
2211	—, α, α, β-trichloro-	2, 2, 3-trichlorobutanal*; butyl chloral	$CH_3CHClCCl_2CHO$	175.45
2212	—, —, hydrate	2,2,3-trichloro-1,1-butane-diol*; butyl chloral hydrate	$CH_3CHClCCl_2CH(OH)_2$	193.47
2213	Butyraldoxime .	See <i>Butyraldehyde, oxime</i> .		
2214	Butyramide	butanamide*; butyric amide.	$CH_3CH_2CH_2CONH_2$	87.12
2215	—, β-bromo-γ-oxo-	N-phenyl- . See <i>Acetoacetanilide</i> .	<i>ilide, α-bromo-</i>	
2216	—, β-methyl-	See <i>Isovaleramide</i> .		
2217	—, N-phenyl-	See <i>Butyranilide</i> .		
2218	Butyranilide	<i>N</i> -phenylbutyramide.....	$CH_3(CH_2)_2CONHC_6H_5$	163.21
2219	—, β-keto-	See <i>Acetoacetanilide</i> .		
2220	Butyric acid	butanoic acid*; ethylacetic acid	$CH_3CH_2CH_2COOH$	88.10
2221	—, allyl ester.....	allyl butyrate; 2-propenyl butanoate*	$C_3H_7COOCH_2CH=CH_2$	128.17
2222	—, amyl ester	amyl butyrate; pentyl butanoate*	$C_5H_7COO(CH_2)_4CH_3$	158.24
2223	—, benzyl ester.....	.....	$CH_3(CH_2)_2CO_2CH_2C_6H_5$	178.22
2224	—, butyl ester.....	butyl butyrate; butyl butanoate*	$CH_3CH_2CH_2COOC_4H_9$	144.21
2225	—, ethyl ester.....	ethyl butyrate; ethyl butanoate*	$CH_3CH_2CH_2COOC_2H_5$	116.16
2226	—, ethylene ester.	See <i>Glycol, dibutylate</i> .		
2227	—, furfuryl ester.	See <i>Furfuryl alcohol, butyrate</i> .		
2228	—, geranyl ester.	See <i>Geraniol, butyrate</i> .		
2229	—, glyceryl ester.	See <i>Glycerol, tributylate</i> .		
2230	—, isoamyl ester.....	γ -methylbutyl butanoate*.....	$CH_3(CH_2)_2COOC_5H_{11}$	158.24
2231	—, isobutyl ester.....	β-methylpropyl butanoate*	$CH_3(CH_2)_2COOCH_2CH(CH_3)_2$	144.21
2232	—, methyl ester.....	methyl <i>n</i> -butyrate.....	$CH_3CH_2CH_2COOCH_3$	102.13
2233	—, α-methylisoamyl ester .	See <i>2-Pentanol, 4-methyl-, butyrate</i> .		
2234	—, <i>p</i>-phenylphenacyl ester	.....	$CH_3(CH_2)_2COOCH_2COC_6H_4C_6H_5$	282.33
2235	—, propyl ester.....	<i>n</i> -propyl butyrate.....	$CH_3CH_2CH_2COOC_3H_7$	130.18
2236	—, piperazinium salt.....	.....	$C_4H_{10}N_2 \cdot 2C_3H_7COOH$	262.35
2237	—, α-amino-	2-aminobutanoic acid*.....	$CH_3CH_2CH(NH_2)COOH$	103.12
2238	—, β-amino-	3-aminobutanoic acid*.....	$CH_3CH(NH_2)CH_2COOH$	103.12
2239	—, γ-amino-	4-aminobutanoic acid*; piperidic acid	$NH_2CH_2CH_2CH_2COOH$	103.12
2240	—, α-amino-α-methyl-	See <i>Isovaline</i> .		
2241	—, α-amino-γ-methyl-	See <i>Methionine</i> .		
2242	—, α-bromo-	2-bromobutanoic acid*.....	$CH_3CH_2CHBrCOOH$	167.01

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2207	leaf . . . . .	.....	d.	.....	v. s.	sl. s.	i. eth.
2208	col. liq.	$0.814 \frac{20}{4}$	.....	116-7	sl. s.	■	■ eth.
2209							
2210							
2211	col. oily liq., 1.47554	$1.3956 \frac{20}{4}$	.....	164-5 ⁷⁵⁰	s.	s.	s. eth.
2212	rhomb. leaf. f. w.	$1.693 \frac{20}{4}$	78	d.	sl. s.	v. s.	s. eth.
2213							
2214	rhomb. f. bz. . .	$1.032 \frac{20}{4}$	116 (108-10)	216	16.28 ¹⁵	s.	sl. s. eth.
2215							
2216							
2217							
2218	monocl. leaf. . .	$1.134 \frac{20}{4}$	91-2	189 ¹⁵	i.	v. s.	v. s. eth.
2219							
2220	col. liq., 1.39906	$0.9587 \frac{20}{4}$	-7.9; frz. -19	163.5 ⁷⁵⁷	5.62-1.1	■	∞ eth.
2221	liq. . . . .	.....	.....	143	i.	∞	∞ eth.
2222	liq., 1.4110. . . .	$0.8713 \frac{15}{4}$	-73.2	185	0.054 ⁵⁰	v. s.	v. s. eth.
2223	.....	$1.016 \frac{17.5}{4}$	.....	240	i.	v. s.	v. s. eth.
2224	col. liq., 1.4049	$0.8721 \frac{20}{20}$	-91.5	166.4	sl. s.	∞	∞ eth.
2225	col. liq., 1.39302 ¹⁸	$0.879 \frac{20}{4}$	-93.3	121.3 (119-21)	0.68 ²⁵	s.	s. eth.
2226							
2227							
2228							
2229							
2230	col. liq.	$0.882 \frac{0}{4}$; $0.860 \frac{15}{4}$	-73.2	159-79 (184.8)	0.054 ⁵⁰	v. s.	v. s. eth.
2231	col. liq., 1.4035	$0.8606 \frac{25}{4}$	.....	156.9	v. sl. s.	∞	∞ eth.
2232	col. liq., 1.3879	0.898	<-95	102.3	1.56 ²¹	∞	∞ eth.
2233							
2234	.....	.....	97	.....	.....	.....	.....
2235	col. liq., 1.4005	$0.879 \frac{15}{4}$; $0.8710 \frac{25}{4}$	-95.2	143	0.167 ¹⁷	∞	∞ eth.
2236	wh. cr. . . . .	.....	89.5-90	.....	s.	s.	i. eth.; s. h. dioxane
2237	col. leaf. . . . .	.....	d. 285	subl.	28	0.182 ⁷⁸	i. eth.
2238	need. . . . .	.....	184	.....	100	i.	i. eth.
2239	leaf. or need. f. dil. al.	.....	193 (183-4, 202 d.)	.....	v. s.	i.	i. eth., bz.
2240							
2241							
2242	col. oily liq. . .	$1.567 \frac{20}{20}$	-4	212-7 d.; 181-2 ⁵⁰	6.7 c.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2243	Butyric acid, α-bromo-, ethyl ester	ethyl 2-bromobutanoate*	$\text{CH}_3\text{CH}_2\text{CHBr}-\text{COOC}_2\text{H}_5$	195.07
2244	—, α, β-dibromo-	2,3-dibromobutanoic acid* . . .	$\text{CH}_3\text{CHBrCHBr}-\text{COOH}$	245.92
2245	—, α, α-dimethyl-	2,2-dimethylbutanoic acid*; ethyldimethylacetic acid	$\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2-\text{COOH}$	116.16
2246	—, α, β-dimethyl-	2,3-dimethylbutanoic acid*; isopropylmethylacetic acid	$\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)\text{COOH}$	116.16
2247	—, α-ethyl-	2-ethylbutanoic acid*; 3-pentane carboxylic acid; diethylacetic acid	$(\text{C}_2\text{H}_5)_2\text{CHCOOH}$	116.16
2248	—, α-ethyl-α-methyl-	diethylmethylacetic acid	$\text{CH}_3\text{CH}_2\text{C}(\text{C}_2\text{H}_5)(\text{CH}_3)\text{COOH}$	130.18
2249	—, α-hydroxy-	2-hydroxybutanoic acid*	$\text{CH}_3\text{CH}_2\text{CHOH}-\text{COOH}$	104.10
2250	—, β-hydroxy-	3-hydroxybutanoic acid*	$\text{CH}_3\text{CHOHCH}_2-\text{COOH}$	104.10
2251	—, γ-hydroxy-	4-hydroxybutanoic acid*	$\text{CH}_2\text{OHCH}_2\text{CH}_2-\text{COOH}$	104.10
2252	—, γ-hydroxy- , lactone	e. See <i>Butyrolactone</i> .		
2253	—, α-isonitroso-	See <i>Butyric acid, α-oxo-, oxim e.</i>		
2254	—, α-keto-	See <i>Butyric acid, α-oxo-</i> .		
2256	—, γ-keto-γ-phenyl-	See <i>Propionic acid, β-benzoyl-</i> .		
2257	—, α-methyl-	2-methylbutanoic acid*; ethylmethylacetic acid; active valeric acid	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)-\text{COOH}$	102.13
2257M	—, α-oxo-	2-oxobutanoic acid*; α -keto-butyric acid	$\text{CH}_3\text{CH}_2\text{COCOOH}$	102.09
2257 R	— —, oxime	α -isonitrosobutyric acid	$\text{C}_2\text{H}_5\text{C}:(\text{NOH})-\text{COOH}$	117.10
2258	Butyric aldehyde.	See <i>Butyraldehyde</i> .		
2259	Butyric amide.	See <i>Butyramide</i> .		
2260	Butyric anhydride	butanoic anhydride*	$(\text{CH}_3\text{CH}_2\text{CH}_2-\text{CO})_2\text{O}$	158.19
2261	Butyrin.	See <i>Glycerol, tributyrat</i> .		
2262	Butyrolactone	4-hydroxybutanoic acid lactone*; γ -hydroxybutyric acid lactone; butanolide	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COO}$	86.09
2263	2-Butyronaphthone, 1-hydroxy-	1-hydroxy-2-naphthyl propyl ketone; 2-butyryl-1-naphthol	$\text{CH}_3(\text{CH}_2)_2\text{COC}_{10}\text{H}_6\text{OH}$	214.25
2264	Butyrene.	See <i>4-Heptanone*</i> .		
2266	Butyronitrile	butanenitrile*; <i>n</i> -propyl cyanide	$\text{CH}_3(\text{CH}_2)_2\text{CN}$	69.10
2267	—, β, γ-epoxy-	See <i>Epicyanohydrin</i> .		
2268	—, α-ethyl-	3-cyanopentane; 2-ethylbutanenitrile*; diethylacetoneitrile	$(\text{C}_2\text{H}_5)_2\text{CHCN}$	97.16
2269	—, α-methyl-	2-methylbutanenitrile*; <i>sec</i> -butyl cyanide; methylethylacetoneitrile	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)-\text{CN}$	83.13
2270	Butyrophenone	butyrylbenzene; phenyl propyl ketone	$\text{CH}_3\text{CH}_2\text{CH}_2-\text{COC}_6\text{H}_5$	148.20
2271	Butyryl bromide	butanoyl bromide*	$\text{CH}_3(\text{CH}_2)_2\text{COBr}$. .	151.01
2272	Butyryl chloride	butanoyl chloride*	$\text{CH}_3(\text{CH}_2)_2\text{COCl}$. .	106.55
2273	C acid.	See <i>2-Naphthylamine-4, 8-disulfonic acid</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2243	col. liq.	1.321 $\frac{25}{4}$	.....	179 d. (58-62 ¹⁰)	i.	s.	s. eth.
2244	(1) long need. f. eth. ....	.....	87	.....	sl. s.	v. s.	v. s. eth.
	(2) sm. need. f. lgr. ....	.....	59	.....	sl. s.	v. s.	v. s. eth.
2245	col. liq. ....	.....	-14	187	v. sl. s.	s.	s. eth.
2246	liq.	0.928 $\frac{15}{4}$	.....	189-91	s.	s.	s. eth.
2247	col. liq., 1.41788 ¹⁰	0.9195 $\frac{18}{4}$; 0.9331 $\frac{10}{4}$	<-15	190 (195-7)	sl. s.	∞	∞ eth.
2248	arom. oil. ....	.....	<-20	203-4	i.	s.	.....
2249	col. hyg. cr. ....	.....	42.5	260 d., subl. 60-70	s.	s.	s. eth.
2250	monocl.; syrup	.....	48-50	130 ¹²	v. s.	v. s.	v. s. eth.; i.bz.
2251	liq. ....	.....	-17	sl. d. ord. temp.	.....	.....	.....
2252							
2253							
2254							
2256							
2257	col. liq., 1.4051	0.941 $\frac{20}{4}$	<-80	174	sl. s.	∞	∞ eth.
2257M	hyg. pl. or oil.	1.200 $\frac{17}{4}$	32	85 ²¹	v. s.	v. s.	sl. s. eth.
2257R	need. f. w. ....	.....	151 (169-70)	.....	v. sl. s.	v. s.	v. sl. s. eth.
2258							
2259							
2260	col. liq.	0.9946 $\frac{20}{4}$	-75.0 (-56.1)	198	d.	d.	= eth.
2261							
2262	oil.	1.1286 $\frac{16}{0}$	.....	206	∞	s.	s. eth.
2263	yel-grn. need. ....	.....	78	.....	i.	s.	s. eth.
2264							
2266	col. liq., 1.3816 ²⁴	0.796 ¹⁵	-112.6	118	sl. s.	∞	∞ eth.
2267							
2268	oil. ....	.....	.....	144-6	.....	∞	∞ eth.
2269	liq.	0.8061 $\frac{0}{4}$	.....	125	.....	s.	s. eth.
2270	col. liq., 1.52016 ^{18,25}	0.988 $\frac{20}{4}$	11	232.3	i.	∞	∞ eth.
2271	liq.	1.4162 $\frac{17}{4}$	.....	128	.....	.....	.....
2272	col. liq., 1.41209	1.028 $\frac{20}{4}$	-89.0	102 (99-102)	d.	d.	= eth.
2273							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2274	Cacodyl	tetramethylbiarsine; diarsenic tetramethyl; arsenic dimethyl	$(\text{CH}_3)_2\text{AsAs}(\text{CH}_3)_2$	209.96
2275	—, ethyl-	See <i>Biarsine, tetraethyl-</i> .		
2276	Cacodyl chloride	dimethylarsenic monochloride; chlorodimethylarsine	$(\text{CH}_3)_2\text{AsCl}$	140.44
2277	Cacodyl hydride .	See <i>Arsine, dimethyl-</i> .		
2278	Cacodylic acid	dimethylarsinic acid; alkargen	$(\text{CH}_3)_2\text{AsOOH}$	137.99
2279	Cacodyl oxide	bisdimethylarsenic oxide; alkarsin, alkarsine	$[(\text{CH}_3)_2\text{As}]_2\text{O}$	225.96
2280	Cacodyl sulfide	bisdimethylarsenic sulfide...	$[(\text{CH}_3)_2\text{As}]_2\text{S}$	242.02
2281	Cacodyl trichloride ...	dimethylarsenic trichloride	$(\text{CH}_3)_2\text{AsCl}_3$	211.35
2282	Cadaverine	1,5-pentanediamine*; pentamethylenediamine	$\text{H}_2\text{N}(\text{CH}_2)_5\text{NH}_2$...	102.18
2283	Cadmium, diethyl -*	cadmium ethyl.....	$(\text{C}_2\text{H}_5)_2\text{Cd}$	170.53
2284	—, dimethyl-*		$(\text{CH}_3)_2\text{Cd}$	142.48
2285	Caffeic acid	3,4-dihydroxycinnamic acid	$(\text{HO})_2\text{C}_6\text{H}_3\text{CH}:$ CHCOOH	180.15
2286	Caffeine	1,3,7-trimethylxanthine; theine	$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$	194.19
2287	—, benzoate.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{C}_7\text{H}_5\text{O}_2$	316.31
2288	—, citrate.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{C}_6\text{H}_8\text{O}_7$	386.32
2289	—, hydriodide diiodide.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{HI} \cdot \text{I}_2 \cdot 1\frac{1}{2}\text{H}_2\text{O}$	602.99
2290	—, hydrobromide.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{HBr} \cdot 2\text{H}_2\text{O}$	311.15
2291	—, hydrochloride.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{HCl} \cdot 2\text{H}_2\text{O}$	266.69
2292	—, isovalerate.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{C}_5\text{H}_{10}\text{O}_2$	296.32
2293	—, mercurichloride.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{HgCl}_2$	465.72
2294	—, salicylate.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{C}_7\text{H}_5\text{O}_3$	332.31
2295	—, sulfate.....		$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \cdot \text{H}_2\text{SO}_4$	292.27
2296	Cajeputole .	See <i>Cineole</i> .		
2296M	Calciferol	vitamin D ₂ , irradiated ergosterol	$\text{C}_{28}\text{H}_{44}\text{OH}$	396.64
2296T	Calcium pantothenate		$[\text{C}_9\text{H}_{16}\text{NO}_6]_2\text{Ca}$	476.54
2297	Camphane	1,7,7-trimethylnorcamphane; hydrocamphene; 1,7,7-trimethylbicyclo (2,2,1) heptane	$\text{C}_{15}\text{H}_{18}$	138.25
2298	—, 2-chloro-.	See <i>Bornyl chloride; Isobornyl chloride</i> .		
2299	2-Camphanol .	See <i>Borneol</i> .		
2300	2-Camphanone .	See <i>Camphor</i> .		
2301	dl-Camphene	dl-2,2-dimethyl-3-methylenenorcamphane	$\text{C}_{10}\text{H}_{16}$	136.23
2302	d or l-Camphene		$\text{C}_{10}\text{H}_{16}$	136.23
2303	α-Camphol .	See <i>Borneol</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2274	col. oil.....	>1	-6	170	sl. s.	s.	s. eth.
2275	col. liq.....	>1	<-45	106.5	i.	∞	i. eth.
2276							
2277	col. tricl.....	.....	200	.....	83 ²²	28.5 ¹⁵ 90%	i. eth.
2278							
2279	col. liq.....	1.486 ¹⁵	-25	149-51	sl. s.	s.	s. eth.
2280	oil.....	.....	<-40 d.	211	sl. s.	s.	s. eth.
2281	cr. f. eth.....	.....	d. 50	.....	d.	d.	s. eth., CS ₂
2282	syrupey fum. liq.	0.9174 ⁰ / ₄	9	178-80	s.	s.	sl. s. eth.
2283	col. liq.....	1.653 ²² / ₄	-21	64 ¹⁹⁻⁵	.....	.....	∞ eth.
2284	col. liq.....	1.9846 ¹⁷⁻⁹	-4.5	105.5 ⁷⁵⁸	d.	.....	s. eth.
2285	yel. monocl. f. w.	.....	195	d.	s.	v. s.	sl. s. eth.
2286	wh. need. f. al.; cr. (+1H ₂ O) f.w.	1.23 ¹⁹ / ₄	anh. 235-7	subl. 180	1.35 ¹⁶ 45.5 ⁶⁵	2.3 ¹⁶ 85%	0.044 ¹⁶ eth.; 14.2 chl.; s acet., bz.
2287	wh. cr.....	.....	.....	.....	s.	s.	.....
2288	monocl.....	.....	.....	.....	s.	s. d.	.....
2289	dk. grn. pr.....	.....	182-4	.....	i.	s.	sl. s. chl.
2290	col. trans. cr.....	.....	.....	.....	s.	s. d.	.....
2291	monocl. col.....	.....	.....	.....	s. d.	s. d.	.....
2292	fatty glist. need.	.....	.....	.....	s.	.....	.....
2293	col. need.....	.....	246	.....	s.	.....	.....
2294	cr. masses.....	.....	.....	.....	s.	s.	.....
2295	wh. need.....	.....	.....	.....	s. d.	s. d.	.....
2296	col. lng. pr.....	.....	115-17	.....	i.	s.	v. s. eth.
2296M							
2296T	wh. odorless cryst. powd.	.....	198-200	.....	14.4 ²⁶	i. 95%	.....
2297	hex. pl. or pr.....	.....	152-4	160 subl.	i.	s. h.	s. eth., et. acetate, h. me. al.
2298	feathery need., 1.4402 ⁸⁰ d: featn. need., [α] +103.9 ¹⁷ in eth. D l: cr., 1.45514 ⁴⁵ , [α]-52°D	0.879 ²⁰ / ₄	50	159-60	i.	v. s.	v. s. eth.
2299			.....	.....	.....	.....	.....
2300		0.822 ⁷⁸	51 (48)	160-2; 52 ¹⁷	i.	sl. s.	s. eth.
2301		.....	42-52	158-60	.....	.....	s. eth.
2302	.....	.....	.....	.....	.....	.....	.....
2303	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2304	<i>dl</i>-Campholic acid . . .	<i>dl</i> -1,2,2,3-tetramethylcyclopentanecarboxylic acid*	$C_8H_{15}(CH_3)_4COOH$	170.25
2305	Camphor, 3-amino- . . .	α -aminocamphor; 3-camphorylamine	$C_{10}H_{15}O \cdot NH_2$	167.25
2306	—, artificial.	See <i>Bornyl chloride</i> .		
2307	—, Borneo.	See <i>d-Borneol</i> .		
2308	—, parsley.	See <i>Apiole</i> .		
2309	<i>d</i>-Camphor	<i>d</i> -2-camphanone; Japan camphor; laurel camphor; Formosa camphor; <i>d</i> -2-keto-1,7,7-trimethylnorcamphane	$C_{10}H_{16}O$	152.23
2310	—, oxime		$C_{10}H_{15}NOH$	167.25
2311	—, α-bromo-	3-bromo- <i>d</i> -camphor (one form)	$C_{10}H_{15}BrO$	231.14
2312	—, α' (or β)-bromo-	3-bromo- <i>d</i> -camphor (one form)	$C_{10}H_{15}BrO$	231.14
2313	—, α-chloro-	3-chloro- <i>d</i> -camphor (one form)	$C_{10}H_{15}ClO$	186.68
2314	—, 3-nitro-	α -nitrocamphor	$C_{10}H_{15}O \cdot NO_2$	197.23
2315	α-Camphoramic acid .	α -camphoramidic acid; 3-carbamyl-1,2,2-trimethylcyclopentanecarboxylic acid; camphoric acid 3-monoamide	$C_8H_4(CH_3)_3 \cdot (CONH_2)COOH$	198.24
2316	β-Camphoramic acid .	β -camphoramidic acid; 3-carbamyl-2,2,3-trimethylcyclopentanecarboxylic acid; camphoric acid 1-monoamide	$C_8H_4(CH_3)_3 \cdot (CONH_2)COOH$	198.24
2317	Camphoric acid, 1-mono-	amide. See <i>β-Camphoramic acid</i> .		
2318	—, 3-monoamide.	See <i>α-Camphoramic acid</i> .		
2319	<i>dl</i>-Camphoric acid . . .	<i>dl</i> - <i>cis</i> -1,2,2-trimethyl-1,3-cyclopentanedicarboxylic acid*; paracamphoric acid	$C_8H_{14}(COOH)_2$	200.23
2320	<i>d</i>-Camphoric acid		$C_8H_{14}(COOH)_2$	200.23
2321	<i>l</i>-Camphoric acid	<i>l</i> - <i>cis</i> -1,2,2-trimethyl-1,3-cyclopentanedicarboxylic acid*	$C_8H_{14}(COOH)_2$	200.23
2322	<i>dl</i>-Camphoric anhydride	<i>dl</i> - <i>cis</i> -1,2,2-trimethyl-1,3-cyclopentanedicarboxylic anhydride*	$C_8H_{14}(CO)_2O$	182.21
2323	<i>d</i>-Camphoric anhydride		$C_{10}H_{14}O_3$	182.21

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2304	<i>dl.</i> : col. tricl. pr. <i>d</i> : [α] +49.8 ^{°15} _D in al. <i>l</i> : [α] -49.1 ^{°15} _D in al.	.....	109 106	255	0.016 ¹⁹	51.29 c.	s. eth.
2305	waxy.....	.....	106-7	250	.....	.....	.....
2306	.....	.....	110	244	i.	s.	s. eth., a.
2307	.....	.....	.....	.....	.....	.....	.....
2308	.....	.....	.....	.....	.....	.....	.....
2309	col. trig., hex., 1.532 (1.5462), [α] 44.26 ^{°20} _D in al.	1.000 ⁰ ₀ ; 0.990 ²⁵ _■	176-7	204 subl.	0.1	100	173 eth.; 300 chl.; s. CS ₂ , bz., me. al., ac. a., acet.
2310	monocl. need. or pr. f. dil. al., [α] +42.4 ^{°20} _D in al.	1.01 ¹¹⁶ ₄	118 (114-6)	249-54 d.	i.	v. s.	s. eth., min. a.
2311	col. monocl., 1.5535, 1.5787, 1.5912, [α] ₅₄₆₁ +165°	1.449 ²⁰ _■	78	274 sl. d.	i.	12.1 ¹⁵ , 130 ⁵⁰	s. eth., chl., CCl ₄ , bz.
2312	.....	.....	61	130 ¹⁰	i.	s.	s. eth.
2313	(α) leaf. [α] +97 ^{°20} _D in al.	.....	93-4	244-7 part. d.	s. h.	s. h.	s. eth., chl., CS ₂ , bz.
2314	monocl. pr. f. bz.	.....	100-1	.....	i.	s.	s. eth., chl.; v. s. bz.
2315	.....	.....	176-7	.....	s. h.	s. h.	s. eth., h. me. al.
2316	.....	.....	182-3	.....	s. h.	s.	s. eth., acet.; sl. s. bz.
2317	.....	.....	.....	.....	.....	.....	.....
2318	.....	.....	.....	.....	.....	.....	.....
2319	col. monocl. need.	1.228 ²⁰ ₄	202 (208)	.....	0.76 ²⁵ , 10 ¹⁰⁰	s.	v. s. eth.
2320	col. monocl. pr. or leaf. [α] 47.7 ^{°20} _D in al.	1.186 ²⁰ ₄	187	.....	0.62 ¹² , 8.3 ¹⁰⁰	112	91.4 ²⁵ eth.; s. acet.; i. chl.
2321	.....	.....	187	.....	sl. s.	s.	s. eth., me. al.
2322	rhomb. f. al...	1.194 ²⁰ _■	221 (216-7)	270	v. sl. s.	0.63 c.	1.00 eth.; v. s. chl., et. ac.; s. bz., CS ₂
2323	rhomb.pr.f.al.	1.194 ²⁰ ₄	221	270 d.	v. sl. s.	v. s.	37.5 ⁵ bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2324	<i>l</i>-Camphoronic acid.	<i>l</i> -2,3-dimethyl-1,2,3-butane-tricarboxylic acid*; <i>l</i> - α , α , β -trimethyltricarballic acid	$(\text{CH}_3)_2\text{C}(\text{COOH})-\text{C}(\text{CH}_3)(\text{COOH})-\text{CH}_2\text{COOH}$	218.20
2325	Camphor pinacol (<i>l</i>).	<i>l</i> -2,2'-bicumphane-2,2'-diol...	$\text{C}_9\text{H}_{16}\text{COHCO}-\text{HC}_9\text{H}_{16}$	306.48
2326	3-Camphorylamine.	See <i>Camphor</i> , 3-amino-		
2327	β-Camphylamine.	2,3,3-trimethyl-1-cyclopentene-1-ethylamine	$\text{C}_8\text{H}_{13}\text{CH}_2\text{CH}_2\text{NH}_2$	153.26
2328	Canadine.	<i>l</i> -tetrahydroberberine.....	$\text{C}_{20}\text{H}_{21}\text{NO}_4$	339.38
2329	Cane sugar.	See <i>Sucrose</i> .		
2330	Cantharene.	dihydro- <i>o</i> -xylene.....	$\text{C}_6\text{H}_6(\text{CH}_3)_2$	108.18
2331	Cantharidin.	2,3-dimethyl-7-oxabicyclo-(2,2,1) heptane-2,3-dicarboxylic anhydride	$\text{C}_{10}\text{H}_{12}\text{O}_4$	196.20
2332	Capraldehyde.	decanal*; capric aldehyde; caprinaldehyde; <i>n</i> -decyl aldehyde	$\text{CH}_3(\text{CH}_2)_8\text{CHO}$...	156.26
2333	—, oxime.....	decanal oxime*; caprinaldoxime	$\text{CH}_3(\text{CH}_2)_8\text{CH}:\text{NOH}$	171.28
2334	Capramide.	decanamide*; <i>n</i> -decylic amide; capric amide	$\text{CH}_3(\text{CH}_2)_8\text{CONH}_2$	171.28
2335	Capric acid.	decanoic acid*; <i>n</i> -capric acid; <i>n</i> -decoic acid; <i>n</i> -decylic acid	$\text{CH}_3(\text{CH}_2)_8\text{COOH}$	172.26
2336	—, ethyl ester.....	ethyl caprate; ethyl decanoate*	$\text{CH}_3(\text{CH}_2)_8\text{COOC}_2\text{H}_5$	200.31
2337	—, methyl ester.....	methyl decanoate*; methyl caprate	$\text{CH}_3(\text{CH}_2)_8\text{COOCH}_3$	186.29
2338	—, α -octyl-.....	2-octyldecanoic acid*; 9-heptadecanecarboxylic acid*; di- <i>n</i> -octylacetic acid	$[\text{CH}_3(\text{CH}_2)_7]_2\text{CHCOOH}$	284.47
2339	Capric aldehyde.	See <i>Capraldehyde</i> .		
2340	Capric amide.	See <i>Capramide</i> .		
2341	Capric anhydride.	decanoic anhydride*; <i>n</i> -decylic anhydride	$[\text{CH}_3(\text{CH}_2)_8\text{CO}]_2\text{O}$	326.51
2342	Caprinaldehyde.	See <i>Capraldehyde</i> .		
2343	Caprinaldoxime.	See <i>Capraldehyde</i> , oxime.		
2344	Caprinitrile.	decanenitrile*; capric nitrile; <i>n</i> -nonyl cyanide	$\text{CH}_3(\text{CH}_2)_8\text{CN}$	153.26
2345	Caproaldehyde.	hexanal*; <i>n</i> -caproic aldehyde; <i>n</i> -hexoic aldehyde	$\text{CH}_3(\text{CH}_2)_4\text{CHO}$...	100.16
2346	—, oxime.....	hexanal oxime*; capronaldoxime	$\text{CH}_3(\text{CH}_2)_4\text{CH}:\text{NOH}$	115.17
2347	—, α -ethyl-.....	2-ethylhexanal*; butylethylacetaldehyde	$\text{C}_4\text{H}_9\text{CH}(\text{C}_2\text{H}_5)-\text{CHO}$	128.21
2348	—, α , β , γ , δ -tetrahydroxy-*	See <i>Fucose</i> .		
2349	Caproamide.	hexanamide*.....	$\text{CH}_3(\text{CH}_2)_4\text{CONH}_2$	115.17
2350	Caproic acid (<i>n</i>).	hexanoic acid*; <i>n</i> -hexoic acid	$\text{CH}_3(\text{CH}_2)_4\text{COOH}$	116.16
2351	—, amyl ester.....	amyl caproate; pentyl hexanoate*	$\text{CH}_3(\text{CH}_2)_4\text{COOC}_5\text{H}_{11}$	186.29

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2324	hyg. need. f. w., $[\alpha]_{\text{D}}^{20} -26.9$ in w.	.....	164-5 (158)	195-210 ¹³	12.5 ¹⁶	59.8 ¹⁶	5.28 ¹⁶ eth.; 42.9 chl.; s. acet.; v. sl. s. bz., CS ₂
2325	rhomb. bisphenoidal	.....	157.8	.....	i.	s.	s. eth.
2326	liq., 1.47284 ¹⁸	0.8736 ¹⁸ ₄	.....	194-6	.....	.....	.....
2327	$[\alpha] +6^{\circ}\text{D}$	.....	.....	.....	.....	.....	.....
2328	silky need. f. al., $[\alpha]_{\text{D}}^{20} -299$ in chl.	.....	133-4	.....	i.	s.	v. s. eth., chl., bz.
2329	col. oily liq., 1.4895	0.8521 ²⁰ ₄	.....	135	i.	∞	s. eth.
2330	col. rhomb. pl.	.....	218 (212)	subl. at 84	0.0033	0.02 ¹⁸	0.09 eth.; s. ac. a., conc. H ₂ SO ₄ , alk.; sl. s. chl., acet.
2331	liq., 1.42977 ¹⁵	0.828 ¹⁵ ₄	.....	208-9	i.	s.	s. eth.
2332	leaf. f. dil. me. al.	.....	69	.....	.....	s.	s. eth.
2333	cr.	0.999 ²⁰ ₄	108 (98)	.....	i.	s.	s. eth.
2334	col. need., 1.42855 ⁴⁰	0.8858 ⁴⁰ ₄	31.5	268-70	sl. s.	s.	s. eth.
2335	col. liq., 1.42575 ²⁰	0.8650 ²⁰ ₄	-19.96	224.5 (110-210)	∞	∞	∞ eth., chl.
2336	col. liq. ....	.....	-18	224	i.	v. s.	v. s. eth.
2337	need. or leaf. f. al.	.....	38.5	270-5 ¹⁰⁶	i.	s.	.....
2338	.....	.....	.....	.....	.....	.....	.....
2339	.....	.....	.....	.....	.....	.....	.....
2340	.....	.....	.....	.....	.....	.....	.....
2341	cr. ....	.....	23.9	.....	i.	s.	s. eth.
2342	.....	.....	.....	.....	.....	.....	.....
2343	.....	.....	.....	.....	.....	.....	.....
2344	col. liq.	0.8295 ¹⁵ ₄	-17.9	243.7 (236-7)	i.	v. sl. s.	s. eth.
2345	col. liq.	0.8335 ²⁰ ₄	.....	131	i.	v. s.	v. s. eth.
2346	cr. ....	.....	51	.....	.....	s.	s. eth.
2347	col. liq., 1.416	0.823 ²⁰ ₄	<-100	163.4	0.04 ²⁸	.....	.....
2348	.....	.....	.....	.....	.....	.....	.....
2349	cr.	0.999 ²⁰ ₄	101.0	255	v. sl. s.	v. s.	s. eth., bz.
2350	col. oily liq., 1.41635	0.945 ⁰ ₀ ; 0.929 ²⁰ ₄	-1.5 to -2.0 (-9.5)	205 (202)	0.4	s.	s. eth.
2351	col. liq. ....	.....	.....	222.2	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2352	Caproic acid , butyl ester	butyl caproate; butyl hexanoate*	$\text{CH}_3(\text{CH}_2)_4\text{COOC}_4\text{H}_9$	172.26
2353	—, ethyl ester.....	ethyl caproate; ethyl hexanoate*	$\text{CH}_3(\text{CH}_2)_4\text{COOC}_2\text{H}_5$	144.21
2354	—, isoamyl ester.....	γ -methylbutyl hexanoate*...	$\text{CH}_3(\text{CH}_2)_4\text{COOC}_5\text{H}_{11}$	186.29
2355	—, methyl ester.....	methyl hexanoate*; methyl caproate	$\text{CH}_3(\text{CH}_2)_4\text{COOCH}_3$	130.18
2356	—, <i>p</i> -phenylphenacyl ester	.....	$\text{CH}_3(\text{CH}_2)_4\text{COOCH}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	310.38
2357	—, piperazinium salt.....	.....	$\text{C}_4\text{H}_{10}\text{N}_2 \cdot 2\text{C}_5\text{H}_{11}\text{COOH}$	318.45
2358	—, α -amino-.	See <i>Norleucine</i> .		
2359	—, α -bromo-.....	2-bromohexanoic acid*.....	$\text{CH}_3(\text{CH}_2)_3\text{CHBrCOOH}$	195.07
2360	—, α, ϵ -diamino-.	See <i>Lysine</i> .		
2361	—, α -ethyl-.....	butylethylacetic acid; 3-heptanecarboxylic acid; 2-ethylhexanoic acid*	$\text{CH}_3(\text{CH}_2)_3\text{CH}(\text{C}_2\text{H}_5)\text{COOH}$	144.21
2362	—, α -hydroxy-.....	2-hydroxyhexanoic acid*.....	$\text{CH}_3(\text{CH}_2)_3\text{CHOHCOOH}$	132.16
2363	—, γ -hydroxy-, lactone	4-hydroxyhexanoic acid lactone*	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_2)_2\text{COO}$	114.14
2364	—, α -methyl-.....	2-methylhexanoic acid*.....	$\text{CH}_3(\text{CH}_2)_3\text{CH}(\text{CH}_3)\text{COOH}$	130.18
2365	—, δ -methyl-.....	5-methylhexanoic acid*; isoamylacetic acid; isoheptylic acid	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{COOH}$	130.18
2366	Caproic aldehyde .	See <i>Caproaldehyde</i> .		
2367	Caproic anhydride ...	hexanoic anhydride*.....	$[\text{CH}_3(\text{CH}_2)_4\text{CO}]_2\text{O}$	214.30
2368	Caproic nitrile .	See <i>Capronitrile</i> .		
2369	Caprokol .	See <i>Resorcinol</i> , 4-hexyl-.		
2370	Capronaldoxime .	See <i>Caproaldehyde</i> , oxime.		
2371	Caprone .	See 6- <i>Hendecanone</i> *.		
2372	Capronitrile	hexanenitrile*; caproic nitrile; <i>n</i> -amyl cyanide	$\text{CH}_3(\text{CH}_2)_4\text{CN}$...	97.16
2373	Caprophenone , 2,4-dihydroxy-	4-caproylresorcinol.....	$\text{CH}_3(\text{CH}_2)_4\text{COC}_6\text{H}_3(\text{OH})_2$	208.25
2374	Caproyl chloride	hexanoyl chloride*.....	$\text{CH}_3(\text{CH}_2)_4\text{COCl}$...	134.61
2375	Caprylaldehyde	octanal*; caprylic aldehyde; <i>n</i> -octylaldehyde	$\text{CH}_3(\text{CH}_2)_6\text{CHO}$...	128.21
2376	—, oxime.....	octanal oxime*; caprylal-doxime	$\text{CH}_3(\text{CH}_2)_6\text{CH}=\text{NOH}$	143.23
2377	Caprylamide	octanamide*.....	$\text{CH}_3(\text{CH}_2)_6\text{CONH}_2$	143.23
2378	sec-n-Caprylamine .	See <i>Heptylamine</i> , α -methyl-*		
2379	Capryl chloride	decanoyl chloride*.....	$\text{CH}_3(\text{CH}_2)_8\text{COCl}$...	190.71
2380	Caprylene .	See <i>Octylene</i> .		
2381	Caprylic acid	octanoic acid*; <i>n</i> -octoic acid; <i>n</i> -octylic acid	$\text{CH}_3(\text{CH}_2)_6\text{COOH}$	144.21
2382	—, ethyl ester.....	ethyl caprylate; ethyl octanoate*	$\text{CH}_3(\text{CH}_2)_6\text{COOC}_2\text{H}_5$	172.26
2383	—, isoamyl ester.....	γ -methylbutyl octanoate*....	$\text{CH}_3(\text{CH}_2)_6\text{COOC}_5\text{H}_{11}$	214.34
2384	—, methyl ester.....	methyl octanoate*; methyl caprylate	$\text{CH}_3(\text{CH}_2)_6\text{COOCH}_3$	158.24
2385	—, <i>p</i> -phenylphenacyl ester	.....	$\text{CH}_3(\text{CH}_2)_6\text{COOCH}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	338.43

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2352	col. liq.	0.8843 $\frac{0}{4}$	.....	204.3	v. sl. s.	∞	∞ eth.
2353	col. to yelsh. liq., 1.40727 ²⁰	0.8710 $\frac{20}{4}$	-67.5	168	0.0015 ²⁰	s.	s. eth.
2354	col. liq. ....	.....	.....	94-6 ¹⁰	i.	s.	.....
2355	col. liq.	0.9038 $\frac{0}{4}$	.....	149.5	i.	v. s.	v. s. eth.
2356	.....	.....	65	.....	.....	.....	.....
2357	wh. cr. ....	.....	111-1.5	.....	s.	s.	i. eth.; s. h. acet.
2358	.....	.....	.....	.....	.....	.....	.....
2359	liq. ....	.....	.....	240 (128-31 ¹⁰)	.....	s.	s. eth.
2360	.....	.....	.....	.....	.....	.....	.....
2361	col. liq.	0.903 $\frac{20}{4}$	<0	223-5	0.2	.....	.....
2362	col. need. ....	.....	62	subl. 100	s.	s.	s. eth.
2363	col. liq. ....	.....	<-18	220	s.	s.	.....
2364	liq. ....	.....	.....	209.6	∞	∞	∞ eth.
2365	col. liq.	0.926 $\frac{15}{4}$; 0.9138 $\frac{21}{4}$	<-25	211.5 (216.5)	sl. s.	s.	s. eth.
2366	.....	.....	.....	.....	.....	.....	.....
2367	col. oil.	0.9279 $\frac{17}{4}$	-40.6	241-3 sl. d.	d.	s.	∞ eth.
2368	.....	.....	.....	.....	.....	.....	.....
2369	.....	.....	.....	.....	.....	.....	.....
2370	.....	.....	.....	.....	.....	.....	.....
2371	.....	.....	.....	.....	.....	.....	.....
2372	col. liq., 1.40851 ^{14.3}	0.809 $\frac{20}{4}$	-79.4	163	v. sl. s.	s.	s. eth.
2373	.....	.....	56	196-8 ⁷	i.	s.	s. eth., chl., acet., pet. eth.; v. s. bz.
2374	col. liq., 1.4867	0.9704 $\frac{25}{4}$	-87.3	153	d.	d.	s. eth.
2375	col. liq., 1.4217	0.821 $\frac{20}{4}$	.....	163.4 (81 ³²)	v. sl. s.	∞	∞ eth.
2376	cr. ....	.....	58-9	120-5 ¹⁰	.....	.....	.....
2377	col. leaf. ....	.....	110 (104)	>200 d.	0.45 ¹⁰⁰	s.	s. eth.
2378	.....	.....	.....	.....	.....	.....	.....
2379	col. liq.	0.973 $\frac{8}{4}$	-34.5	232.3 (195-6)	d.	d.	s. eth.
2380	.....	.....	.....	.....	.....	.....	.....
2381	col. leaf. or oily liq., 1.4285	0.910 $\frac{20}{4}$	16	237.5	0.25 ¹⁰⁰	∞	∞ eth.; s. bz., chl., CS ₂ , glac. ac. a.
2382	col. liq., 1.41775 ²⁰	0.8667 $\frac{20}{4}$	-44.8 (-43.1)	208	0.063 ²⁰	s.	s. eth.
2383	col. liq. ....	.....	.....	136 ¹⁰	i.	s.	.....
2384	col. liq.	0.887 $\frac{20}{4}$	-41	192.9	i.	v. s.	v. s. eth.
2385	.....	.....	67	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2386	Caprylic acid, α-amino-, <i>dl</i>-	<i>dl</i> -2-aminooctanoic acid*....	$\text{CH}_3(\text{CH}_2)_5\text{CH}(\text{NH}_2)\text{COOH}$	159.23
2387	—, α -hydroxy-.....	2-hydroxyoctanoic acid*....	$\text{CH}_3(\text{CH}_2)_5\text{CHOHCOOH}$	160.21
2388	Caprylic anhydride	octanoic anhydride*; <i>n</i> -octoic anhydride	$[\text{CH}_3(\text{CH}_2)_5\text{CO}]_2\text{O}$	270.40
2389	Caprylidene .	See 1-Octyne*.		
2390	Caprylone .	See 8-Pentadecanone*.		
2391	Caprylonitrile	octanenitrile*; <i>n</i> -heptyl cyanide	$\text{CH}_3(\text{CH}_2)_6\text{CN}$	125.21
2392	Capryl chloride	octanoyl chloride*.....	$\text{CH}_3(\text{CH}_2)_6\text{COCl}$..	162.66
2393	Carbamamidine .	See Guanidine.		
2394	Carbamic acid, benzyl ester	benzyl carbamate; benzyl aminomethanoate*	$\text{NH}_2\text{COOCH}_2\text{C}_6\text{H}_5$	151.16
2395	—, ethyl ester.....	ethyl carbamate; urethan...	$\text{NH}_2\text{COOC}_2\text{H}_5$	89.09
2396	—, isoamyl ester.....	isoamyl carbamate; isoamyl urethan	$\text{NH}_2\text{COOC}_6\text{H}_{11}$	131.17
2397	—, isobutyl ester.....	β -methylpropyl amino-methanoate*	$\text{NH}_2\text{COOCH}_2\text{CH}(\text{CH}_3)_2$	117.15
2398	—, methyl ester.....	methyl urethan.....	$\text{NH}_2\text{COOCH}_3$	75.07
2400	—, propyl ester.....	<i>n</i> -propyl carbamate.....	$\text{NH}_2\text{COOC}_3\text{H}_7$	103.12
2401	—, cyclohexylethylthiolthiono-, cyclohexylethylammonium salt		$\text{C}_6\text{H}_{11}(\text{C}_2\text{H}_5)_2\text{NCSSNH}_2(\text{C}_2\text{H}_5)_6\text{C}_6\text{H}_{11}$	330.58
2402	—, cyclopentamethylenedithio-, salts. See under 1-Piperidinecarbo-	lenedithio-, salts. See under 1-Piperidinecarbo-		
2403	—, dibenzyl-dithio, dibenzylammonium salt		$(\text{C}_6\text{H}_5\text{CH}_2)_2\text{NCSSNH}_2(\text{CH}_2\text{C}_6\text{H}_5)_2$	470.67
2404	—, —, zinc salt.....		$[(\text{C}_6\text{H}_5\text{CH}_2)_2\text{NCSS}]_2\text{Zn}$	610.16
2405	—, dibutylthiolthiono-, zinc salt		$[(\text{C}_4\text{H}_9)_2\text{NCSS}]_2\text{Zn}$	474.11
2405M	—, diethyl-.....		$(\text{C}_2\text{H}_5)_2\text{NCOOH}$...	117.15
2406	—, diethylthiolthiono-, benzal diester		$[(\text{C}_2\text{H}_5)_2\text{NCSS}]_2\text{CHC}_6\text{H}_5$	386.64
2407	—, —, diethylammonium salt		$(\text{C}_2\text{H}_5)_2\text{NCSSNH}_2(\text{C}_2\text{H}_5)_2$	222.40
2408	—, diethylthiolthion	<i>o</i> -, 6-nitrobenzothiazyl ester. See 2-Benzothiazoleth		iol, 6-ni
2409	—, —, zinc salt.....		$[(\text{C}_2\text{H}_5)_2\text{NCSS}]_2\text{Zn}$	361.90
2410	—, dimethylthiolthiono-, dimethylammonium salt		$(\text{CH}_3)_2\text{NCSSNH}_2(\text{CH}_3)_2$	166.30
2411	—, —, 2,4-dinitrophenyl ester		$(\text{CH}_3)_2\text{NCSSC}_6\text{H}_3(\text{NO}_2)_2$	287.31
2412	—, —, selenium tetrasalt		$[(\text{CH}_3)_2\text{NCSS}]_4\text{Se}$..	559.79
2413	—, —, zinc salt.....		$[(\text{CH}_3)_2\text{NCSS}]_2\text{Zn}$..	305.79

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2386	waxy pl. ....	.....	263-4	d., subl.	0.61 ¹⁰⁰	v. sl. s.	v. sl. s. eth.
2387	pl. ....	.....	69.5	.....	v. sl. s.	v. s.	v. s. eth.
2388	liq.	0.9021 ²⁵ / ₄	-1	285	d.	s.	∞ eth.
2389	col. liq.	0.820 ¹³ / ₄ ;	-45.6	205.2 (194-5)	i.	v. sl. s.	s. eth.
2390		0.8058 ³⁰ / ₄					
2391		0.9671 ⁰ / ₄					
2392	liq.	0.9671 ⁰ / ₄	-6	195.55	d.	d.	s. eth.
2393	leaf. ....	.....	86	220 d.	sl. s.	s.	s. eth.
2394		.....				
2395	col. need. f. lgr.	0.9862 ²¹ / ₄ ; 1.11 ²⁰ / ₂₀	50 (48)	180	100+ ²⁵	166 ²⁵	v. s. eth., bz.; s. chl., glyc; sl. s. lgr.
2396	need. f. w.	0.944 ^{70.6} / ₄	63.5	220	s. h.	s.	s. eth.
2397	col. leaf.	0.943 ²⁰ / ₄	55	206-7	i.	s.	s. eth.
2398	col. pl.	1.136 ⁵⁶ / ₄	52	177	217 ¹¹	73 ¹⁵	s. eth.
2400	col. pr. ....	.....	60-1 (53)	200	v. s.	v. s.	s. eth.
2401	pa. yel. cr. ....	.....	95-6	.....	v. s.	v. s.	s. eth.
2402	acid.	.....	82.5	.....	s.	v. s.	sl. s. eth.
2403	yel. cr. ....	.....				
2404	cream colored	.....	176-7	.....	i.	i.	i. eth.; sl. s.
2405	powd.	1.26 ²⁰ / ₄	108-9	.....	i.	i.	chl.
2405	cream colored						sl. s. eth., chl.
2405M	powd.	.....	.....	.....	.....	.....	.....
2406	need. f. eth. ....	.....	74 unst. >-15	.....	v. s.	v. s.	2.6 ²² eth.
2406	yel. cr. ....	.....	178-9	.....	i.	s. h.	.....
2407	pa. yel. pl. ....	.....	81-2	.....	v. s.	v. s.	v. sl. s. eth.
2408	tro-, diethylthio-	hionocarbami-	ester.	.....	.....	.....	.....
2409	wh. powd.	1.24 ²⁰ / ₄	173-4	.....	i.	i.	i. eth.; sl. s.
2410	pa. yel. pl. ....	.....	129-30	.....	v. s.	v. s.	chl. v. sl. s. eth.
2411	yel. cr.	1.54 ²⁰ / ₄	139	.....	i.	s. h.	.....
2412	dense or. cr. ....	.....	179-80	.....	i.	i.	i. eth.; sl. s.
2413	wh. powd.	2.00 ²⁰ / ₄	248-50	.....	i.	i.	chl. i. eth.; sl. s.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2414	Carbamic acid, di-phenyl-, ethyl ester	diphenylurethan.....	$(C_6H_5)_2NCOOC_2H_5$	241.28
2415	—, dithio-	aminodithioformic acid; aminomethanethionothiolic acid*	NH_2CS_2H	93.16
2416	—, ethyl-, ethylester ...	ethylurethan.....	$C_2H_5NHCOOC_2H_5$	117.15
2417	—, ethylidenedi-, diethyl ester	ethylidenediurethan.....	$CH_3CH(NHCOOC_2H_5)_2$	204.23
2418	—, isobutyl-, ethyl ester	ethyl isobutylcarbamate; isobutylurethan	$(CH_3)_2CHCH_2NHCOOC_2H_5$	145.20
2419	—, methyl-, ethyl ester	methylurethan.....	$CH_3NHCOOC_2H_5$	103.12
2420	—, nitro-, ethyl ester ...	nitrourethan.....	$NO_2NHCOOC_2H_5$	134.09
2421	—, phenyl-, esters . See	under <i>Carbanilic acid</i> .		
2422	—, propyl-, ethylester	<i>n</i> -propylurethan.....	$C_3H_7NHCOOC_2H_5$	131.17
2423	—, thiol-, ethyl ester ...	aminomethanethiolic acid ethyl ester; thiourethan	$NH_2COSC_2H_5$	105.15
2424	—, thiono-, ethyl ester	thiourethan; xanthogenamide	$NH_2CSOC_2H_5$	105.15
2425	Carbamide.	See <i>Urea</i> .		
2426	Carbamide oxide.	See <i>Urea, hydroxy-</i> .		
2427	Carbamonitrile.	See <i>Cyanamide</i> .		
2428	Carbamyl chloride	chloroformamide; urea chloride; carbamide chloride	H_2NCOCI	79.49
2428M	—, diphenyl-	<i>N</i> -chloroformyldiphenylamine	$(C_6H_5)_2NCOCI$	231.68
2429	Carbanil.	See <i>Isocyanic acid, phenyl ester</i> .		
2430	Carbanilic acid, ethyl ester	<i>N</i> -phenylurethan; ethyl phenylcarbamate	$C_6H_5NHCOOC_2H_5$	165.19
2431	—, isobutyl ester	isobutyl phenylcarbamate ...	$C_6H_5NHCOOCH_2CH(CH_3)_2$	193.24
2431M	—, propyl ester	<i>n</i> -propylphenylurethan; <i>n</i> -propyl carbanilate	$C_6H_5NHCO_2C_3H_7$	179.21
2432	—, <i>o</i>-hydroxy-, lactone e.	See 2(3)- <i>Benzoxazolone</i> .		
2433	Carbanilide	<i>N,N'</i> -diphenylurea; <i>sym</i> -diphenylurea	$C_6H_5NHCONHC_6H_5$	212.24
2434	—, <i>N,N'</i>-diethyl-	<i>N,N'</i> -diethyl- <i>N,N'</i> -diphenylurea*	$CO-[N(C_2H_5)(C_6H_5)]_2$	268.35
2435	—, 2,2'-dimethylthio-	di- <i>o</i> -tolylthiourea.....	$CS(NHC_6H_4CH_3)_2$	256.36
2436	—, 4,4'-dimethylthio-	di- <i>p</i> -tolylthiourea.....	$CS(NHC_6H_4CH_3)_2$	256.36
2437	—, <i>N,N'</i>-diphenyl-	See <i>Urea, tetraphenyl-</i> .		
2438	—, <i>N</i>-methyl-		$C_6H_5(CH_3)NCONHC_6H_5$	226.27
2439	—, 2,2',4,4'-tetra-nitro-		$[(NO_2)_2C_6H_3NH]_2CO$	392.24
2440	—, thio-	<i>N,N'</i> -diphenylthiourea; <i>sym</i> -diphenylthiourea	$(C_6H_5NH)_2CS$...	228.30
2441	—, thio-<i>o,o'</i>-dimethyl-	<i>sym</i> -di- <i>o</i> -tolylthiourea.....	$(CH_3C_6H_4NH)_2CS$	256.36
2442	Carbanilonitrile.	See <i>Cyananilide</i> .		
2443	Carbazide.	See <i>Carbohydrazide</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2414	col. pr. f. lgr...	.....	71-2	360	s.	v. s.	v. s. eth.
2415	col. need.....	.....	.....	.....	v. s. d.	s.	s. eth.
2416	col. liq.....	0.981 $\frac{20}{4}$	.....	176	63.2 ^{15.5}	.....	.....
2417	need.....	.....	125-6	170-80 ²⁰ d.	sl. s. c.	s.	s. eth.
2418	col. liq., 1.4288	0.943 $\frac{20}{4}$	<-65	96 ¹⁷	i.	.....	.....
2419	col. liq., 1.4200 ^{18.9}	1.009 ¹⁹	.....	170	94.7 ^{15.5}	s.	.....
2420	col. leaf. f. lgr.	.....	64	.....	v. s.	v. s.	v. s. eth.; sl. m. lgr.
2421	liq.....	0.992 ¹⁵	.....	191.5-2.57 ¹⁸ (186)	9.80 ^{15.5}	.....	.....
2422	.....	.....	.....	.....	.....	.....	.....
2423	pl. or leaf.....	.....	108 (102-9)	subl. d.	v. sl. s. c. s. h. i. (v. sl. s.)	v. s. h.	v. s. h. eth.
2424	monocl. leaf. f. eth.	.....	41-2	d.	.....	s.	s. eth.
2425	.....	.....	.....	.....	.....	.....	.....
2426	.....	.....	.....	.....	.....	.....	.....
2427	.....	.....	.....	.....	.....	.....	.....
2428	col. liq.....	.....	50	61-2	d.	d.	.....
2428M	pl. f. al.....	.....	85	.....	.....	.....	.....
2429	.....	.....	.....	.....	.....	.....	.....
2430	lgn. need. f. w.	1.106 $\frac{30}{4}$; 1.079 $\frac{60}{4}$	52	238	v. sl. s.	v. s.	v. s. eth.; s. bz.
2431	cr.....	.....	85.5-86	216 d.	v. sl. s.	v. s.	v. s. eth.
2431M	wh. need.....	.....	50-51	.....	.....	.....	.....
2432	.....	.....	.....	.....	.....	.....	.....
2433	col. rhomb. f. al., 1.583	1.239 $\frac{20}{4}$	238-9 (235)	260 subl.	0.015 ²⁵	s.	v. s. eth.
2434	col. cr. f. w....	.....	72-3 (54)	.....	s.	v. s.	.....
2435	v. sm. col. need. f. al.	.....	156-8	218	v. sl. s.	sl. s.	v. sl. s. eth.; s. ac. a., bz.
2436	v. sm. rhomb. need.	.....	178-9 (176-7)	.....	v. sl. s.	sl. s.	v. sl. s. eth.
2437	.....	.....	.....	.....	.....	.....	.....
2438	col. need.....	.....	104	203-5	i.	sl. s.	v. s. eth., bz.
2439	yel. need.....	.....	189	.....	i.	v. s.	v. sl. s. eth.
2440	col. rhomb. leaf. f. al.	1.321 $\frac{4}{4}$	154	d.	i. (v. sl. s.)	s.	s. eth.
2441	need. f. al.....	.....	158	216-18	i.	s. h.	i. eth.; s. ac. a., bz.
2442	.....	.....	.....	.....	.....	.....	.....
2443	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2444	Carbazole	dibenzopyrrole; diphenyl-enimine	$C_6H_4NHC_6H_4$	167.20
2445	—, <i>N</i> -acetyl.....		$CH_3CONC_{12}H_5$	209.24
2446	—, <i>N</i> -ethyl.....		$C_{12}H_5NC_2H_5$	195.25
2447	Carbinol .	See <i>Methanol</i> .*		
2448	—, acetyl-.	See <i>Acetol</i> .		
2449	—, acetylenyl-.	See 2-Propyn-1-ol*.		
2450	—, acetylmethyl-.	See <i>Acetoin</i> .		
2451	—, allyl-.	See 3-Buten-1-ol*.		
2452	—, allyldiethyl-.	See 5-Hexen-3-ol, 3-ethyl*.		
2453	—, allyldimethyl-.	See 4-Penten-2-ol, 2-methyl*.		
2454	—, allylmethyl-.	See 4-Penten-2-ol*.		
2454M	—, allylmethylpropyl-.	See 1-Hepten-4-ol, 4-methyl*.		
2455	—, <i>p</i> -aminodiphenyl	See <i>Benzohydrol</i> , <i>p</i> -amino-.		
2456	—, amyl-.	See 1-Hexanol*.		
2457	—, amyldiethyl-.	See 3-Octanol, 3-ethyl*.		
2458	—, amyldimethyl-.	See 2-Heptanol, 2-methyl*.		
2459	—, amylhexyl-.	See 6-Dodecanol*.		
2460	—, amylmethyl-.	See 2-Heptanol*.		
2461	—, amylpropyl-.	See 4-Nonanol*.		
2462	—, benzoyl-.	See <i>Acetophenone</i> , α -hydroxy-.		
2463	—, benzoylphenyl-.	See <i>Benzoin</i> .		
2464	—, benzyl-.	See <i>Phenethyl alcohol</i> .		
2465	—, benzylphenyl-.	See <i>Ethanol</i> , 1,2-diphenyl-.		
2466	—, bis- <i>p</i> -aminophenyl-4-amino- <i>m</i> -tolyl-.	See <i>Rosaniline</i> .		
2467	—, butyl-.	See 1-Pentanol*.		
2468	—, sec-butyl-.	See 1-Butanol, 2-methyl*.		
2469	—, tert-butyl-.	See 1-Propanol, 2,2-dimethyl*.		
2470	—, butyldimethyl-.	See 2-Hexanol, 2-methyl*.		
2471	—, tert-butyl-.	See 2-Butanol, 2,3,3-trimethyl*.		
2472	—, butylethylmethyl-.	See 3-Heptanol, 3-methyl*.		
2473	—, butylmethyl-.	See 2-Hexanol*.		
2473M	—, 1-butynyldimethyl-.	See 3-Hexyn-2-ol, 2-methyl*.		
2474	—, dibutyl-.	See 5-Nonanol*.		
2475	—, diethyl-.	See 3-Pentanol*.		
2476	—, diethylisobutyl-.	See 3-Hexanol, 3-ethyl-5-methyl*.		
2477	—, diethylisopropyl-.	See 3-Pentanol, 3-ethyl-2-methyl*.		
2478	—, diethylmethyl-.	See 3-Pentanol, 3-methyl*.		
2479	—, diethylpropyl-.	See 3-Hexanol, 3-ethyl*.		
2480	—, <i>p,p'</i> -dihydroxytriphenyl-.	See <i>Benzaurin</i> .		
2481	—, diisobutyl-.	See 5-Nonanol, 2,8-dimethyl*.		
2482	—, diisobutyl-.	See 4-Heptanol, 2,6-dimethyl*.		
2483	—, diisopropyl-.	See 3-Pentanol, 2,4-dimethyl*.		
2484	—, dimethyl-.	See <i>Isopropyl alcohol</i> .		
2485	—, dimethylethyl-.	See 2-Butanol, 2-methyl*.		
2486	—, dimethylphenyl-.	See 2-Propanol, 2-phenyl-.		
2487	—, dimethylpropenyl-.	See 3-Penten-2-ol*.		
2488	—, dimethylpropyl-.	See 2-Pentanol, 2-methyl*.		
2489	—, diphenyl-.	See <i>Benzohydrol</i> .		
2490	—, diphenylene-.	See 9-Fluorene*.		
2491	—, dipropyl-.	See 4-Heptanol*.		
2492	—, ethyl-.	See <i>Propyl alcohol</i> .		
2493	—, ethyldipropyl-.	See 4-Heptanol, 4-ethyl*.		
2493M	—, ethylethynylmethyl-.	See 1-Pentyn-3-ol, 3-methyl*.		
2494	—, ethylhexyl-.	See 3-Nonanol*.		
2495	—, ethylisobutyl-.	See 3-Hexanol, 5-methyl*.		
2496	—, ethylisopropyl-.	See 3-Pentanol, 2-methyl*.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Acohol	Ether, etc.
2444	col. leaf.....	.....	246 (243-5)	354.8	i.	0.921.4	3.1 ⁸⁰ eth.; 5.3 ⁵⁰ bz., 3.1 ⁸⁰ tol.; 11.1 ⁸⁰ acet.; sl. s. ac. a., chl., CS ₂ , CCl ₄ v. s. eth., bz.
2445	need. f. w.....	.....	69	>360 d.	i. c., sl. s. h.	v. s.	v. s. eth., bz.
2446	leaf. f. eth.....	.....	67-8	.....	.....	s. h.	s. eth.
2447							
2448							
2449							
2450							
2451							
2452							
2453							
2454							
2454M							
2455							
2456							
2457							
2458							
2459							
2460							
2461							
2462							
2463							
2464							
2465							
2466							
2467							
2468							
2469							
2470							
2471							
2472							
2473							
2473M							
2474							
2475							
2476							
2477							
2478							
2479							
2480							
2481							
2482							
2483							
2484							
2485							
2486							
2487							
2488							
2489							
2490							
2491							
2492							
2493							
2493M							
2494							
2495							
2496							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2497	Carbinol, ethylisopropylmethyl-	See 3-Pentanol, 2,3-dimethyl- [*] .		
2498	—, ethylmethyl-	See sec-Butyl alcohol.		
2499	—, ethylmethylpropyl-	See 3-Hexanol, 3-methyl- [*] .		
2500	—, ethylphenyl-	See 1-Propanol, 1-phenyl-		
2501	—, ethylpropyl-	See 3-Hexanol [*] .		
2502	—, ethylvinyl-	See 1-Penten-3-ol [*] .		
2503	—, ethynyl-	See 2-Propyn-1-ol [*] .		
2503H	—, ethynylisopropylmethyl-	See 1-Pentyn-3-ol, 3,4-dimethyl- [*] .		
2503R	—, ethynylmethylpropyl-	See 1-Hexyn-3-ol, 3-methyl- [*] .		
2504	—, α -furyl-	See Furfuryl alcohol.		
2505	—, heptyl-	See 1-Octanol [*] .		
2506	—, heptylmethyl-	See 2-Nonanol [*] .		
2507	—, hexyldimethyl-	See 2-Octanol, 2-methyl- [*] .		
2508	—, hexylpropyl-	See 4-Decanol [*] .		
2509	—, isoamyl-	See 1-Pentanol, 4-methyl- [*] .		
2510	—, isoamylmethyl-	See 2-Hexanol, 5-methyl- [*] .		
2511	—, isobutyl-	See Isoamyl alcohol.		
2512	—, isobutyldimethyl-	See 2-Pentanol, 2,4-dimethyl- [*] .		
2513	—, isobutylmethyl-	See 2-Pentanol, 4-methyl- [*] .		
2514	—, isohexyl-	See 1-Hexanol, 5-methyl- [*] .		
2515	—, isopropyl-	See Isobutyl alcohol.		
2516	—, isopropyldimethyl-	See 2-Butanol, 2,3-dimethyl- [*] .		
2517	—, methyl-	See Ethyl alcohol.		
2518	—, methyl-tert-butyl-	See Pinacolyl alcohol.		
2519	—, methylpropyl-	See 4-Heptanol, 4-methyl- [*] .		
2520	—, methylhexyl-	See 2-Octanol [*] .		
2521	—, methylisopropyl-	See 2-Butanol, 3-methyl- [*] .		
2522	—, methylnonyl-	See 2-Hendecanol [*] .		
2523	—, methylphenyl-	See Benzyl alcohol, α -methyl-		
2524	—, methylpropyl-	See 2-Pentanol [*] .		
2525	—, methylvinyl-	See 3-Buten-2-ol [*] .		
2526	—, 1-naphthyl- diphenyl-	diphenyl- α -naphthylcarbinol	(C ₆ H ₅) ₂ (C ₁₀ H ₇)-COH	310.38
2527	—, nonyl-	See 1-Decanol [*] .		
2528	—, phenyl-	See Benzyl alcohol.		
2529	—, propenyl-	See 2-Buten-1-ol [*] .		
2530	—, propyl-	See Butyl alcohol (n).		
2531	—, styryl-	See Cinnamic alcohol.		
2532	—, α -thienyl-	See 2-Thiophenecarbinol.		
2533	—, o-tolyl-.....	o-methylbenzyl alcohol; o-tolubenzyl alcohol	CH ₃ C ₆ H ₄ CH ₂ OH..	122.16
2534	—, m-tolyl-.....	m-methylbenzyl alcohol; m-tolubenzyl alcohol	CH ₃ C ₆ H ₄ CH ₂ OH..	122.16
2535	—, p-tolyl-.....	p-methylbenzyl alcohol; p-tolubenzyl alcohol	CH ₃ C ₆ H ₄ CH ₂ OH..	122.16
2536	—, p,p',p''-triaminotriphenyl-	See Pararosaniline.		
2537	—, triethyl-	See 3-Pentanol, 3-ethyl- [*] .		
2538	—, trimethyl-	See tert-Butyl alcohol.		
2539	—, p-trinitrotriphenyl-	See Carbinol, tris (p-nitrophenyl)-.	(C ₆ H ₅) ₃ COH.....	260.32
2540	—, triphenyl-.....	See 4-Heptanol, 4-propyl- [*] .		
2541	—, tripropyl-	See Pararosaniline.		
2542	—, tris(p-aminophenyl)-	See Pararosaniline.		
2543	—, tris(p-nitrophenyl)-	ps-trinitrotriphenylcarbinol; 4,4',4''-trinitrotritanol	(NO ₂ C ₆ H ₄) ₃ COH..	395.32
2544	Carbinol o-carboxylic	anhydride, triphenyl-	See Phthalide, 3,3-di	phenyl-
2545	Carbinylamine, diethyl-	1-. See Propylamine, α -ethyl-		
2546	—, dimethylethyl-	See tert-Amylamine.		
2547	—, methylisopropyl-	See Propylamine, α , β -dimethyl-		
2548	—, methylpropyl-	See Butylamine, α -methyl-		
2549	—, trimethyl-	See tert-Butylamine.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2497							
2498							
2499							
2500							
2501							
2502							
2503							
2503 H							
2503 R							
2504							
2505							
2506							
2507							
2508							
2509							
2510							
2511							
2512							
2513							
2514							
2515							
2516							
2517							
2518							
2519							
2520							
2521							
2522							
2523							
2524							
2525							
2526	cr. f. lgr. ....	.....	136	d.	i.	s. h.	v. s. eth.; s. bz.; sl. s. h. lgr.
2527							
2528							
2529							
2530							
2531							
2532							
2533	col. need.	$1.023\frac{40}{4}$	34	219 (223.3)	1^{20} , 1.5^{100} 5 c.	v. s.	v. s. eth.
2534	col. liq.	$1.036\frac{0}{4}$	<-20	217		s.	s. eth.
2535	col. need. ....	.....	59.5	217	sl. s. c.	v. s.	v. s. eth.
2536							
2537							
2538							
2539							
2540	hex. pr. f. bz. .	$1.188\frac{20}{4}$	162.5	>360	i.	v. s.	v. s. eth., bz.
2541							
2542							
2543	monocl. or rhomb. cr. f. bz.	.....	193 (171-2)	.....	.....	sl. s. h.	sl. s. eth.; s. bz., ac. a.
2544							
2545							
2546							
2547							
2548							
2549							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2550	"Carbitol".	See <i>Diethylene glycol, monoethyl ether</i> .		
2551	—, butyl.	See <i>Diethylene glycol, monobutyl ether</i> .		
2552	—, diethyl.	See <i>Ether, bis(β-ethoxyethyl)</i> .		
2553	—, methyl.	See <i>Diethylene glycol, monomethyl ether</i> .		
2554	Carbocinchomeric acid	2,3,4-pyridinetricarboxylic acid	$C_5H_3N(COOH)_3 \cdot 1\frac{1}{2}H_2O$	238.15
2555	β-Carbocinchomeric acid.	See 3,4,5-Pyridinetricarboxylic acid.		
2556	Carbodiimide, diphenyl-	carbodiphenylimide.	$C_6H_5N:C:NC_6H_5$	194.23
2556M	Carbodinicotinic acid.	See 2,3,5-Pyridinetricarboxylic acid.		
2557	Carbodiphenylimide.	See <i>Carbodiimide, diphenyl-</i> .		
2558	Carbohydrazide.	carbonic acid dihydrazide; carbazide	$CO(NHNH_2)_2$	90.09
2559	—, 1,5-diphenyl-	<i>sym</i> -diphenylcarbazide.	$(C_6H_5NHNH)_2CO$	242.28
2560	Carbolic acid.	See <i>Phenol</i> .		
2561	Carbomethene.	See <i>Ketene</i> .		
2562	Carbon bisulfide.	See <i>Carbon disulfide</i> .		
2563	Carbon dioxide.	carbonic anhydride; carbonic acid gas	CO_2	44.01
2564	Carbon disulfethyl.	See <i>Carbonic acid, dithiol, diethyl ester</i> .		
2565	Carbon disulfide.	carbon bisulfide.	CS_2	76.13
2566	Carbon hexachloride.	See <i>Ethane, hexachloro-*</i> .		
2566M	Carbon hexafluoride.	See <i>Ethane, hexafluoro-*</i> .		
2567	Carbonic acid, dibutyl ester		$CO(OCH_2CH_2CH_2CH_3)_2$	174.24
2568	—, diethyl ester.	ethyl carbonate.	$(C_2H_5)_2CO_3$	118.13
2569	—, dihydrazide.	See <i>Carbohydrazide</i> .		
2570	—, diisoamyl ester.	isoamyl carbonate.	$CO(OC_4H_9)_2$	202.29
2571	—, diisobutyl ester.	isobutyl carbonate.	$CO-[OCH_2CH(CH_3)_2]_2$	174.24
2572	—, dimethyl ester.	methyl carbonate.	$CO(OCH_3)_2$	90.08
2573	—, diphenyl ester.	phenyl carbonate; diphenyl carbonate	$(C_6H_5)_2CO_3$	214.21
2574	—, dipropyl ester.		$CO(OCH_2CH_2CH_3)_2$	146.18
2575	—, ethyl methyl ester.		$CH_3C_2H_5CO_3$	104.10
2576	—, chloro-, esters.	See under <i>Formic acid, chloro-</i> .		
2577	—, dithiol-, diethyl ester	ethyldithiolcarbonate; carbon disulfethyl	$CO(SC_2H_5)_2$	150.25
2578	—, thiolithiono-, O-ethyl ester.	See <i>Xanthogenic acid</i> .		
2579	—, trithio-		$CS(SH)_2$	110.21
2580	Carbonic acid gas.	See <i>Carbon dioxide</i> .		
2581	Carbonic anhydride.	See <i>Carbon dioxide</i> .		
2582	Carbonyl, esters.	See under <i>Isocyanic acid</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2550	rhomb. f. w....	.....	(-H ₂ O, 115-20) anh. 250 d.	.....	1.2 ¹⁵	sl. s.	i. eth., bz.
2551							
2552							
2553							
2554							
2555	α: syrup.....	.....	168-70	330-1	.....	d. h.	v. s. bz.; d. HCl
2556							
2556M	β: cr.....	.....	168-70	.....	v. sl. s.	v. sl. s.	v. sl. s. eth.
2557	need. f. dil. al.	.....	152 exp.	.....	v. v. s.	v. v. s.	v. v. s. eth.; i. bz., chl.
2558							
2559	leaf.....	.....	172-3	d.	i.	s.	sl. s. eth.; s. bz.
2560	col. odorl. gas.	1.977 g/l; liq., 1.101 ⁻³⁷ ; solid 1.56 ⁻⁷⁹	-56.6 ⁵ at atm.	-78.5 subl.	179.7 ⁰ cm ³ , .355 ⁰ g, 90.1 ²⁰ cm ³ , .097 ⁴⁰ g, .058 ⁶⁰ g	31 ¹⁵ cm ³	.....
2561							
2562							
2563							
2564							
2565	col. inflam. liq., 1.62950 ¹⁸	1.2628 ²⁰ / ₄	-108.6; frz.-111	46.3	0.22 ²²	∞	∞ eth., bz.
2566	col. liq.....	0.9244 ²⁰ / ₄	.....	207 ²⁰	i.	s.	s. eth.
2566M							
2567	col. inflam. liq., 1.38456 ²⁰	0.9751 ²⁰ / ₄	-43	125.8	i.	∞	∞ eth.
2568	liq.....	0.912 ¹⁵ / ₄	.....	228.7	.....	.....	.....
2571	liq.....	0.919 ¹⁵ / ₄	.....	190.3	i.	∞	∞ eth.
2572	col. liq., 1.3687	1.0694 ²⁰ / ₄	0.5	90-1	i.	s.	s. eth.
2573	need. f. al.....	1.1215 ⁸⁷ / ₄	78; 81	306 (302)	i.	s.	s. eth., bz., CCl ₄
2574	col. liq.....	0.9411 ²⁰ / ₄	.....	168.2	v. sl. s.	∞	∞ eth.
2575	col. liq.....	1.002 ²⁷ / ₄	-14.5	109.2	i.	∞	∞ eth.
2576	yel. liq.....	1.085 ¹⁹	.....	196.7	i.	s.	s. eth.
2577							
2578	red brn. oil....	>1	d. 20-30	57 d.	i. d.	s.	s. eth., Na ₂ CO ₃ .
2579							
2580							
2581							
2582							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2583	Carbon monoxide.....		CO.....	28.01
2584	Carbon oxysulfide.	See <i>Carbonyl sulfide</i> .		
2585	Carbon suboxide.....	malonic anhydride (so-called); dioxopropadiene*	OC:C:CO.....	68.03
2586	Carbon tetrabromide ..	tetrabromomethane*	CBr ₄	331.67
2587	Carbon tetrachloride..	tetrachloromethane*.....	CCl ₄	153.84
2587M	Carbon tetrafluoride..	tetrafluoromethane*.....	CF ₄	88.01
2588	Carbon tetraiodide....	tetraiodomethane*.....	CI ₄	519.69
2589	Carbonyl chloride.	See <i>Phosgene</i> .		
2589M	Carbonyl fluoride.....	fluoroformyl fluoride.....	COF ₂	66.01
2590	Carbonyl sulfide.....	carbon oxysulfide	COS.....	60.07
2591	Carbostyryl.....	2-quinolinol or 2(1)-quin- olone; <i>o</i> -aminocinnamic acid lactam	C ₉ H ₇ NO.....	145.15
2592	—, 3-ethyl-.....		C ₆ H ₄ NHCOC- [C ₂ H ₅]CH	173.21
2593	—, 4-methyl-.....	2(1)-Iepidone	C ₁₀ H ₉ NO.....	159.18
2594	Carbothialdine.....		C ₆ H ₁₀ N ₂ S ₂	162.27
2595	Carbylamine chloride, phenyl-.	See <i>Aniline, N-(dichloromethylene)-</i> .		
2596	Carbylamine derivativ es.	See <i>Amyl isocyanide, Butyl isocyanide, etc.</i>		
2596	Carminic acid.....		C ₂₂ H ₂₀ O ₁₃	492.38
2597	Carnaubyl alcohol....		C ₂₄ H ₅₀ O.....	354.65
2599	α-Carotene.....	α-carotin.....	C ₄₀ H ₅₆	536.85
2600	β-Carotene.....	β-carotin; provitamin A....	C ₄₀ H ₅₆	536.85
2601	Carotin.	See <i>Carotene</i> .		
2602	<i>d</i> -Carpaine.....		C ₁₄ H ₂₅ NO ₂	239.35
2603	—, hydrochloride.....		C ₁₄ H ₂₅ NO ₂ ·HCl...	275.82
2604	Carubiose.	See <i>d-Mannose</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2583	col. odorl. pois. gas	liq. $0.814 \frac{-195}{44}$ $1.250 \frac{0}{4}$ g/l	-207 (-213)	-190 (-192)	0.0044 ⁰ g, 0.0028 ²⁰ g, 0.0010 ⁸⁰ g, 3.5 ⁰ cm ³	20 ²⁰ cm ³	s. bz., ac. a., Cu ₂ Cl ₂
2584							
2585	col. liq. or gas, 1.454	1.114 ⁰	-111.3 (-107)	7	d.	.....	s. eth.
2586	col. monoc. tab., 1.59998 ^{99.5} (He)	3.42	α 48.4 β 90.1	189.5 sl. d.	0.024 ³⁰	s.	s. eth., chl.
2587	col. liq., 1.46305 ¹⁵	1.595 ²⁰ ; $\frac{0}{4}$ 1.63195 ⁰ $\frac{0}{4}$	-22.8; frz. to tri-morph.; -28.6; -23.8; -21.2	76-7	0.08 ²⁰	∞	∞ eth., chl., bz.
2587M	col. gas.....	1.96 ⁻¹⁸⁴	-184	-128	sl. s.	.....	.....
2588	dk. red cub. . .	4.32	171 d.	subl. 90-100 vac.	i., d. h.	s., d. h.	s. eth.
2589							
2589M	col. gas.....	1.139 ⁻¹¹⁴	-114	-83	d.	d.	.....
2590	gas.....	liq. 1.24 ⁻⁸⁷ ; (A) 2.105; 2.721 g/l	-138	-50.2 (-47.5)	100 cm ³	800 ²² cm ³	4.4 ¹⁸ cm ³ pyr.; 12 ¹³ cm ³ ni-tro bz.; 1500 ²² cm ³ tol.
2591	pr. f. al.....	.....	200	subl.	v. sl. s.	v. s.	v. s. eth.; s. dil. HCl
2592	col. cr.....	.....	168	.....	.....	.....	.....
2593	col. need. f. w. . . . .	.....	217.4	270 ¹⁷	v. sl. s. c.	v. s. h.	v. sl. s. eth.; sl. s. bz.
2594	cr.....	.....	.....	.....	i.	sl. s.	i. eth., s. a.
2595							
2596	red monoc. pr.	.....	136 d.	.....	v. s.	s.	v. sl. s. eth.; s. conc. H ₂ SO ₄ , alk.; i. bz., chl.
2597	leaf.....	.....	69	.....	sl. s.	s.	.....
2599	[α] +364 ²⁸ _D in bz.	.....	175	.....	.....	.....	.....
2600	red-br. glist. cr.	.....	181-2	.....	i.	sl. s.	sl. s. eth., me. al., chl.; s. CS ₂ , bz., pet. eth.
2601							
2602	monoc. pr. f. al. [α] +21 ⁵⁵ _D in al.	.....	121	.....	i.	11	3 eth.; s. chl., bz., amyl al., CS ₂
2603	lng. wh. rhomb. or monoc. need.	.....	225 d.	.....	11.6	s.	s. eth.
2604							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2605	Carvacrol	2- <i>p</i> -cymenol; cymophenol...	$\text{CH}_3(\text{C}_3\text{H}_7)\text{C}_6\text{H}_3\text{-OH}$	150.21
2606	—, hexahydro-	See <i>Carvomenthol</i> .		
2607	Carvacrylamine	2- <i>p</i> -cymylamine; 2-amino- <i>p</i> -cymene; 5-isopropyl-2-methylaniline; cymidine	$(\text{CH}_3)_2\text{CH}(\text{CH}_3)\text{-C}_6\text{H}_3\text{NH}_2$	149.23
2608	Carvene .	See <i>d-Limonene</i> .		
2609	Carvenone	3- <i>p</i> -menthen-2-one	$\text{C}_{10}\text{H}_{16}\text{O}$	152.23
2610	Carveol, dihydro-	<i>p</i> -menth-8(9)-en-2-ol	$\text{C}_{10}\text{H}_{17}\text{OH}$	154.25
2611	Carvol .	See <i>d-Carvene</i> .		
2612	Carvomenthene	1- <i>p</i> -menthene	$\text{C}_{10}\text{H}_{18}$	138.25
2613	Carvomenthol	2- <i>p</i> -menthanol; hexahydro-carvacrol	$\text{C}_{10}\text{H}_{19}\text{OH}$	156.26
2614	Carvone, dihydro-	<i>p</i> -menth-8(9)-en-2-one	$\text{C}_{10}\text{H}_{16}\text{O}$	152.23
2615	<i>dl</i> - Carvone , oxime	<i>dl</i> -carvoxime	$\text{C}_{10}\text{H}_{14}\text{:NOH}$	165.23
2616	<i>d</i> - Carvone	<i>d</i> -6,8(9)- <i>p</i> -menthadien-2-one; carvol	$\text{C}_{10}\text{H}_{14}\text{O}$	150.21
2617	<i>dl</i> - Carvoxime .	See <i>dl-Carvone</i> , oxime.		
2618	Caryophyllin		$(\text{C}_{10}\text{H}_{16}\text{O})_3$	456.69
2619	<i>d</i> - Catechin .	See <i>d-Catechol</i> .		
2620	Catechol .	See also <i>Pyrocatechol</i> .		
2621	<i>d</i> - Catechol	<i>d</i> -catechin; 3,5,7,3',4'-flavan-pentol (one form); 2-(3,4-dihydroxyphenyl)-3,5,7-chromantriol (one form)	$\text{C}_{15}\text{H}_{14}\text{O}_6$	290.26
2622	Cedrarine .	See <i>Quinazoline</i> , 3,4-dihydro-3-	<i>phenyl-</i>	
2623	Cedrene (artificial)		$\text{C}_{15}\text{H}_{24}$	204.34
2624	Cedriret .	See <i>Cerulignone</i> .		
2625	Cellobiose	cellose; glucose β -glucoside...	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	342.30
2627	—, octaacetate (α)	octaacetylcellobiose	$\text{C}_{12}\text{H}_{14}\text{O}_3\text{-}(\text{OOCCH}_3)_8$	678.59
2628	Cellose .	See <i>Cellobiose</i> .		
2629	" Cellosolve ."	See <i>Ethanol</i> , 2-ethoxy-*		
2630	—, benzyl.	See <i>Ethanol</i> , 2-benzyl-oxy-		
2631	—, butyl.	See <i>Ethanol</i> , 2-butoxy-		
2632	—, methyl.	See <i>Ethanol</i> , 2-methoxy-*		
2633	Cellulose		$(\text{C}_6\text{H}_{10}\text{O}_5)_x$	(162-14) _x

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2605	col. oily liq., 1.52295	0.976	0.5 (1-2)	237.9	v. sl. s.	s.	s. eth., alk.
2606	oil, 1.543 ¹⁹ ...	0.9942 ²⁰ / ₄	-16	241; 118 ¹²	v. sl. s.	s.	s. eth.
2607							
2608	liq., 1.48377 ¹⁹	0.9263 ²⁰ / ₄	.....	233	i.	.....	.....
2609	liq., 1.48168...	0.927	.....	225	.....	.....	.....
2610	col. oily liq.	0.829 ²⁰	.....	175	.....	s.	.....
2611	oil, 1.46296....	0.904 ²⁰	.....	222 (220)	.....	s.	s. eth.
2612							
2613	oily liq., 1.47174 ¹⁹ , [α]-19° (-16°)D.	0.9253 ²⁰ / ₄	.....	220-1	.....	.....	.....
2614	monocl. cr. ....	.....	93-4 (70-71)	.....	s.	s.	.....
2615	col. liq., 1.49994 ^{18,2} , [α]+62.07°D (l [α]-39.34° ¹⁸ in al.)	0.9608 ²⁰ / ₄	.....	230 (227-8; 225)	v. sl. s.	∞	∞ eth.; s. chl.
2616	silky need. [α]+54.5°D in al.	.....	310	subl. 285	i.	sl. s.	v. s. eth.; i. alk.
2617	wh. cr. powd. or need. f. w.	1.344 ⁴ / ₄	175 (217)	240-5 d.	s.	s.	0.59 eth.; s. et. ac., alk.
2618							
2619	col. liq., 1.5001 ¹⁹ , [α]-52.6°D.	0.929	.....	262-3	.....	.....	.....
2620							
2621	col. need., [α]+24.4°D. in w.	.....	225	.....	s.	v. v. sl. s.	v. v. sl. s. eth.; i. acet.
2622	col. silky need., [α]+41.5°D in chl.	.....	228-9	.....	i.	s. h.	i. eth.
2623	wh. amorph.	1.27-1.61	.....	.....	i.	i.	i. eth., all ord. org. solv.; s. Cu(NH ₃) ₄ (OH) ₂
2624							
2625							
2626							
2627							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2636	Cellulose , acetate, tri-	.....	$C_6H_7O_2(OOCCH_3)_3$	288.25
2636M	—, ethyl ether.....	ethylcellulose; triethylcellulose	2,3, and 6 "OH" groups ethylated	indefinite
2637	—, hexanitrate.....	chief constituent of guncotton	$C_{12}H_{14}(ONO_2)_6O_4$	594.28
2638	—, pentanitrate.....	.....	$C_{12}H_{15}(ONO_2)_5O_5$	549.28
2639	—, tetranitrate.....	constituent of collodion.....	$C_{12}H_{16}(ONO_2)_4O_6$	504.28
2640	—, trinitrate.....	constituent of collodion.....	$C_{12}H_{17}(ONO_2)_3O_7$	459.28
2640M	—, ethyl-	See <i>Cellulose</i> , ethyl ether.		
2641	Cerane	isohexacosane.....	$C_{26}H_{54}$	366.79
2642	Cerotic acid	hexacosanoic acid*.....	$CH_3(CH_2)_{24}COOH$	396.68
2643	Cerotin .	See <i>Ceryl alcohol</i> .		
2644	Cerulignone	3,3',5,5'-tetramethoxydiphenoquinone; coerulignone; cedriret	$C_{16}H_{16}O_6$	304.29
2645	Ceryl alcohol	1-hexacosanol*; cerotin; <i>n</i> -hexacosyl alcohol	$CH_3(CH_2)_{24}CH_2OH$	382.70
2646	Cetane .	See <i>Hexadecane</i> *.		
2647	Cetyl alcohol	1-hexadecanol*; <i>n</i> -hexadecyl alcohol; ethal	$CH_3(CH_2)_{16}OH$	242.44
2648	—, acetate.	See <i>Acetic acid</i> , <i>cetyl ester</i> .		
2648M	Cetylamine	hexadecylamine* (<i>n</i>); 1-aminohexadecane	$CH_3(CH_2)_{16}NH_2$	241.45
2649	Cetyl cyanide .	See <i>Margaronitrile</i> .		
2650	Cetylene .	See <i>2-Hexadecyne</i> *.		
2651	Cetyl ether	1-hexadecyloxyhexadecane*; hexadecyl ether; dicetyl ether	$(C_{16}H_{33})_2O$	466.85
2652	Cetyl iodide	1-iodohexadecane*; <i>n</i> -hexadecyl iodide	$CH_3(CH_2)_{14}CH_2I$	352.35
2653	Cetyl sulfate	hexadecyl sulfate; di- <i>n</i> -hexadecyl sulfate	$[CH_3(CH_2)_{16}]_2SO_4$	546.91
2654	Cevadine .	See <i>Veratrine</i> (crystalline).		
2654M	Cevitamic acid .	See <i>L-Ascorbic acid</i> .		
2655	Chalcone	benzalacetophenone; benzylideneacetophenone; phenyl styryl ketone; 1,3-diphenyl-2-propen-1-one	$C_6H_5CH:CH-COC_6H_5$	208.25
2656	<i>d</i>-Chaulmoogric acid	<i>d</i> -13-(2-cyclopentenyl) tri-decanoic acid	$CH=CHCH_2CH_2C-\overbrace{H(CH_2)_{12}COOH}$	280.44
2657	Chavibetol	5-allylguaiacol; betel phenol..	$CH_2:CHCH_2C_6H_3(OH)(OCH_3)$	164.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2636	ylsh. amor. ....	.....	.....	.....	i.	i.	i. eth., acet.; s. chl., glac. ac. a., nitro-bz.
2636M	fine wh. need. f. 0.2% soln. in bz.	.....	240-255	.....	i.	sl. s.-s.	s. warm eth.
2637	wh. amor.	1.66	ign. 160-70	.....	i.	i.	i. eth., bz.; v. v. sl. s. eth. + al.; s. nitro-bz. †
2638	wh. amor.	ca. 1.66	.....	.....	i.	i.	i. eth., bz.; s. eth. + al.
2639	wh. amor.	1.66	.....	.....	i.	i.	i. eth., bz.; s. eth. + al., me. al.
2640	wh. amor.	1.66	.....	.....	i.	s.	s. me. al., h. glac. ac. a.; i. bz.
2640M	cr. f. eth. ....	.....	61	207 ⁷	i.	s.	s. eth.
2642	col. need. f. al.	0.836 ⁷⁹	87.7 (80-2)	d.	i.	v. sl. s.	20 ⁸⁵ eth.; s. acet., bz.
2643	.....	.....	d.	.....	i.	i.	s. H ₂ SO ₄ , phenol; i. ord. org. solv.
2644	bluish gr. need	.....	d.	.....	i.	i.	s. eth.
2645	col. rhomb. pl.	.....	79.5-79.8	305 ²⁰ d.	i.	s.	s. eth.
2646	.....	.....	.....	.....	.....	.....	.....
2647	leaf. f. al., 1.4283 ^{78,9}	0.8176 ⁵⁰ / ₄	49.3	190 ¹⁵ ; 344	i.	102	s. eth.; 97 ²⁴ me. al.; s. bz.
2648	.....	.....	.....	.....	.....	.....	.....
2648M	col. cr. ....	.....	.....	322.5; 143.9 ²	i.	s.	s. eth.
2649	.....	.....	.....	.....	.....	.....	.....
2650	.....	.....	.....	.....	.....	.....	.....
2651	leaf. ....	.....	55	270 d.	sl. s.	s.	s. eth.
2652	leaf. f. al., 1.4806	1.123	22	211 ¹⁵	i.	s.	s. eth.
2653	.....	.....	66.2-6.3	.....	.....	.....	.....
2654	.....	.....	.....	.....	.....	.....	.....
2654M	.....	.....	.....	.....	.....	.....	.....
2655	pa. yel. rhomb. pl.	1.071 ⁶² / ₄	62 (55-7)	348	i.	sl. s.	s. eth., chl., bz., CS ₂ conc. H ₂ SO ₄ ; v. sl. s. lgr.
2656	col. leaf. f. al. [α] + 62 °D in chl.	.....	68.5	247-8 ²⁰	i.	v. sl. s.	s. eth., chl.
2657	liq., 1.5413 ²⁰	1.0690 ¹⁵ / ₁₅	8.5	254-5	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

†All nitro celluloses are soluble in acet., et. ac., amyl acetate.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2658	Chavicol	<i>p</i> -allylphenol	$\text{CH}_2\text{:CHCH}_2\text{C}_6\text{H}_4\text{-OH}$	134.17
2659	—, methyl ether.	See <i>Estragole</i> .		
2660	Chelerythrine , alcoholate		$\text{C}_{21}\text{H}_{19}\text{NO}_5 \cdot \text{C}_2\text{H}_6\text{O}$	411.44
2661	Chelidonine , hydrochloride		$\text{C}_{20}\text{H}_{19}\text{NO}_5 \cdot \text{HCl}$	389.83
2662	d-Chelidonine		$\text{C}_{20}\text{H}_{19}\text{NO}_5 \cdot \text{H}_2\text{O}$	371.38
2663	Chick antidermatitis factor . See <i>Pantothenic acid</i> .			
2664	Chinalgen .	See <i>Analgen</i> .		
2664M	Chitosamine .	See <i>D-Glucosamine</i> .		
2665	Chloral	trichloroethanal*; trichloroacetaldehyde	CCl_3CHO	147.40
2666	—, alcoholate	2,2,2-trichloro-1-ethoxyethanol*; chloral hydrate monoethyl acetal	$\text{CCl}_3\text{CH}(\text{OH})\text{OC}_2\text{H}_5$	193.47
2667	—, diethyl acetal.	See <i>Ethane</i> , 1,1,1-trichloro-2,2-diethoxy-.		
2668	—, hydrate	2,2,2-trichloro-1,1-ethanediol*; trichloroethylidene glycol	$\text{CCl}_3\text{CH}(\text{OH})_2$	165.42
2669	Chloral-antipyrine .	See <i>Hypnal</i> .		
2670	Chloranil	tetrachloroquinone; tetrachloro- <i>p</i> -benzoquinone	$\text{C}_6\text{Cl}_4\text{O}_2$	245.89
2671	Chloranilic acid	2,5-dichloro-3,6-dihydroxyquinone	$\text{C}_6\text{Cl}_2(\text{OH})_2\text{O}_2$	208.99
2672	Chlorbutanol .	See <i>Chloretone</i> .		
2673	Chlorbutol .	See <i>Chloretone</i> .		
2674	Chloretone	1,1,1-trichloro-2-methyl-2-propanol*; trichloro- <i>tert</i> -butyl alcohol; acetone-chloroform; chlorbutol; chlorbutanol	$(\text{CH}_3)_2\text{C}(\text{OH})\text{CCl}_3$	177.47
2675	Chlorhydrin .	See 1,2-Propanediol, 3-chloro-.		
2676	Chlorine cyanide .	See <i>Cyanogen chloride</i> .		
	Chloro- .	See the parent compounds (e. g., for chloroacetic acid see		
2677	Chloroacetal	2-chloro-1,1-diethoxyethane*; chloroacetaldehyde diethyl acetal	$\text{CH}_2\text{ClCH}(\text{OC}_2\text{H}_5)_2$	152.62
2678	Chloroacetol .	See <i>Propane</i> , 2,2-dichloro-.		
2679	Chloroform	trichloromethane*	CHCl_3	119.39
2680	—, methyl-.	See <i>Ethane</i> , 1,1,1-trichloro-.		
2681	—, nitro-.	See <i>Chloropicrin</i> .		
2682	—, phenyl-.	See <i>Toluene</i> , α -trichloro-.		
2683	Chlorogenine .	See <i>Alstonine</i> .		
2684	α-Chlorohydrin .	See 1,2-Propanediol, 3-chloro-.		
2685	Chlorophyll a		$\text{C}_{55}\text{H}_{72}\text{MgN}_4\text{O}_6 \cdot \frac{1}{2}\text{H}_2\text{O}$	902.49
2686	Chlorophyll b		$\text{C}_{55}\text{H}_{70}\text{MgN}_4\text{O}_6$	907.47
2687	Chloropicrin	trichloronitromethane*; nitrochloroform	CCl_3NO_2	164.39

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2658	liq., 1.5441 ¹⁸ ...	1.033 ¹⁸ / ₄	<-25	237	s.	∞	∞ eth., chl.
2659							
2660	rhbdr. leaf.; sol. bl. fluores.	.....	207	.....	sl. s.	sl. s.	v. s. eth.; s. chl., amyl al., bz.
2661	wh. fine cr. ....	.....	.....	.....	0.31 ¹⁸	sl. s.	.....
2662	monocl. tab. ....	.....	135-6	.....	i.	v. s.	v. s. eth.; s. chl., amyl al.
2663							
2664							
2664M							
2665	col. liq., 1.45572	1.512 ²⁰ / ₄	-57.5	98	s.	∞	∞ eth.; s. chl.
2666	col. need.	1.143 ⁴⁰ / ₄	44-7 (55)	115	v. s.	s.	s. eth.
2667							
2668	col. monocl. tab., 1.538, 1.600, 1.602	1.9081 ²⁰ / ₄	51.7 (61-3)	96.3 ⁷⁶⁴ (98 d.)	470 ¹⁷	77 ²⁵	66.7 ²⁵ eth., s. chl.
2669							
2670	yel. monocl. pr. f. bz.	.....	290 (in sealed tube)	subl.	i.	s. h.	s. eth., bz.; sl. s. chl., CS ₂
2671	red leaf. ....	.....	283-4	.....	v. sl. s.	.....	.....
2672							
2673							
2674	wh. cr. (+1H ₂ O) f. w.	.....	+1H ₂ O 80-1 (anh. 97)	167	i. c.	v. s.	v. s. eth.; 125 glyc.; s. chl., acet., bz., glac. ac. a.
2675							
2676	Acetic acid, chlor o-).						
2677	liq.	1.026 ¹⁶ / ₄	.....	156.8 (62-4 ²⁰)	sl. s.	∞	∞ eth.
2678							
2679	col. liq., 1.44643 ¹⁸	1.49845 ¹⁵ / ₄	-63.5	61.26 (58-61.5)	1.0 ¹⁵	∞; const. boil. mixt. 7% et. al.	∞ eth.; s. bz., acet., CS ₂
2680							
2681							
2682							
2683							
2684							
2685	hex. lancet shaped pl.	.....	150-3	d.	i.	v. s.	v. s. eth.; s. pet. eth.
2686	pl. ....	.....	183-5	.....	i.	v. s.	v. s. eth.; s. me. al.
2687	col. liq., 1.46075 ²³	1.651 ²⁰ / ₄ ; 1.69225 ⁰ / ₄	-64, frz. -69	112	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2688	Chloroprene	2-chloro-1,3-butadiene*	$\text{CH}_2\text{:CHCl:CH}_2$	88.54
2689	Cholic acid	See <i>Cholic acid</i> .		
2690	Cholan acid, trihydr	oxy-. See <i>Cholic acid</i> .		
2691	Cholesterol	cholesterin	$\text{C}_{27}\text{H}_{46}\text{OH}$	386.64
2692	—, benzoate		$\text{C}_6\text{H}_5\text{COOC}_{27}\text{H}_{45}$	490.75
2693	Cholestrophan	dimethylparabanic acid	$\text{N}(\text{CH}_3)\text{CON}-$ $(\text{CH}_2)\text{COCO}$	142.11
2694	Cholic acid	cholic acid; trihydroxy- cholan acid; colalin	$\text{C}_{24}\text{H}_{40}\text{O}_6\cdot\text{H}_2\text{O}$	426.58
2695	Choline	(β -hydroxyethyl)trimethyl- ammonium hydroxide; bili- neurine; sincaline; amani- tine	$\text{HOCH}_2\text{CH}_2\text{N}-$ $(\text{CH}_3)_3\text{OH}$	121.18
2696	—, <i>O</i> -acetyl-, bromide	(β -acetoxyethyl) trimethyl- ammonium bromide	$\text{CH}_3\text{COOCH}_2\text{CH}_2\text{N}-$ $(\text{CH}_3)_3\text{Br}$	226.12
2697	—, <i>O</i> -acetyl- β - methyl-, chloride	β -acetoxypropyltrimethyl- ammonium chloride	$\text{CH}_3\text{CH}(\text{OOCCH}_3)-$ $\text{CH}_2\text{N}(\text{CH}_3)_3\text{Cl}$	195.69
2698	—, β -methyl-, chloride	β -hydroxypropyltrimethyl- ammonium chloride	$\text{CH}_3\text{CHOHCH}_2\text{N}-$ $(\text{CH}_3)_3\text{Cl}$	153.65
2699	3,5,7-Chromantriol	See <i>d-Catechol</i> .		
2700	Chromone	1,4-benzopyrone; γ -benzo- pyrone	$\text{C}_8\text{H}_6\text{OCH:CHCO}$	146.14
2701	Chromone, 2-phenyl-	See <i>Flavone</i> .		
2702	Chromotropic acid	4,5-dihydroxy-2,7-naphtha- lenedisulfonic acid	$(\text{HO})_2\text{C}_{10}\text{H}_4-$ $(\text{SO}_3\text{H})_2$	320.28
2703	Chrysammic acid	2,4,5,7-tetranitrochrysazin; chrysammic acid; 1,8-di- hydroxy-2,4,5,7-tetranitro- anthraquinone	$\text{C}_{14}\text{H}_2(\text{NO}_2)_4-$ $(\text{OH})_2\text{O}_2$	420.20
2704	Chrysaniline	2-amino-5- <i>p</i> -aminophenyl- acridine	$\text{C}_{19}\text{H}_{15}\text{N}_3\cdot 2\text{H}_2\text{O}$	321.37
2705	Chrysarobin		$\text{C}_{30}\text{H}_{38}\text{O}_7$	508.59
2706	Chrysazin	1,8-dihydroxyanthraquinone	$\text{HOC}_6\text{H}_3(\text{CO})_2-$ $\text{C}_6\text{H}_3\text{OH}$	240.20
2707	—, 2-hydroxy-	See <i>Anthraquinone</i> , 1,2,8-trihy	droxy-.	
2708	—, 3-methyl-	See <i>Chrysophanic acid</i> .		
2709	—, 2,4,5,7-tetranitro	-. See <i>Chrysammic acid</i> .		
2710	Chrysazol	1,8-anthracediol*; 1,8- anthradiol	$\text{HOC}_6\text{H}_3(\text{CH})_2-$ $\text{C}_6\text{H}_3\text{OH}$	210.22
2711	Chrysene	benzo [<i>a</i>] phenanthrene	$\text{C}_{18}\text{H}_{12}$	228.28
2712	Chrysenequinone	See <i>Chrysoquinone</i> .		
2713	Chrysin	5,7-dihydroxyflavone	$\text{C}_{15}\text{H}_{10}\text{O}_4$	254.23
2714	Chrysoidine (base)	2,4-diaminoazobenzene; 4- phenylazo- <i>m</i> -phenylene- diamine	$\text{C}_6\text{H}_5\text{N:NC}_6\text{H}_3-$ $(\text{NH}_2)_2$	212.25
2715	—, hydrochloride		$\text{C}_6\text{H}_5\text{N:NC}_6\text{H}_3-$ $(\text{NH}_2)_2\text{HCl}$	248.71

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2688	col. liq., 1.4583	0.9583 $\frac{20}{20}$	.....	59.4	v. sl. s.	=	= eth., s. most org. solv.
2689							
2690							
2691	monocl. pearly leaf.; cr. +1H ₂ O f. dil. al.	1.067 $\frac{20}{4}$	anh. 148.5	360 d.	0.26 ²⁰	1.08 ¹⁷ , 11 ⁷⁸	18 eth.; s. bz., chl., CS ₂ , pyr., h. ac. a.
2692	pl.		150-1	.....	.....	i.	s. eth.
2693	pearly leaf.		145	275-7	sl. s.	sl. s.	.....
2694	rhomb. cr. +1H ₂ O f. w.		195 (anh.)	d. 160	0.025	4.27 70%	1.40 c. eth.; s. ac. a., acet., alk.
2695	col. visc. liq. ....		.....	.....	s.	s.	i. eth.
2696	col. need.		143	d.	v. s.	v. s.	s. eth.
2697	micro. need. f. al., eth.		172-3	d.	v. s.	v. s.	i. eth.
2698	wh. pr. cr. f. N. butanol		165-7	d.	v. s.	v. s.	i. eth.
2699							
2700	wh. need. f. pet. eth.		59	subl.	i.	s.	s. eth., chl., bz.
2701							
2702	need. or leaf. (+2H ₂ O)		.....	.....	v. s.	i.	i. eth.
2703	yel. monocl. pr.		exp.	.....	i.	s.	s. eth., min. a.
2704	yel. need.		270	.....	v. sl. s.	sl. s.	.....
2705	yel. leaf.		205-10 (170-8)	.....	i.	s.	s. eth., chl.; sl. s. c. bz., CS ₂
2706	red or yel. need. or leaf. f. al.		193 (191)	.....	sl. s.	s.	s. eth., caust. alk., chl., ac. a., nitro-bz.
2707							
2708							
2709							
2710	yel. need. f. dil. al.		225 d.	.....	i.	s.	s. eth., alk., et. ac., bz.
2711	col. rhomb. pl. f. bz. or ac. a. with red-vlt. fluores.		254 (250)	448	v. sl. s.	0.08 c.	v. sl. s. eth., bz.; s. h. tol.; sl. s. CS ₂
2712							
2713	pa. yel. pl.		275	subl.	i.	0.43 c.	sl. s. eth., lgr., CS ₂ , bz., chl., alk.
2714	pa. yel. cr. f. w.		117.5	.....	sl. s.	s.	s. eth.; v. s. chl.
2715	redsh.-br. cr. or powd.		.....	.....	v. s.	s.	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2716	Chrysophanic acid	1,8-dihydroxy-3-methylanthraquinone; 3-methyl-chrysazin	$C_{14}H_6(OH)_2(CH_3)O_2$	254.23
2717	Chrysoquinone	chrysenequinone; 1,2-chrysenedione	$C_{18}H_{10}O_2$	258.26
2718	Cinchamidine .	See <i>Hydrocinchonidine</i> .		
2719	Cinchomeric acid . . .	3,4-pyridinedicarboxylic acid	$C_5H_3N(CO_2H)_2$. .	167.12
2720	Cinchonamine		$C_{19}H_{24}N_2O$	296.40
2721	Cinchonicine	cinchotoxine	$C_{19}H_{22}N_2O$	294.38
2722	Cinchonidine		$C_{19}H_{22}N_2O$	294.38
2723	—, bisulfate		$C_{19}H_{22}N_2O \cdot H_2SO_4 \cdot 5H_2O$	482.54
2724	—, hydrochloride		$C_{19}H_{22}N_2O \cdot HCl \cdot H_2O$	348.87
2725	—, sulfate		$(C_{19}H_{22}N_2O)_2 \cdot H_2SO_4 \cdot 3H_2O$	740.89
2726	Cinchonine		$C_{19}H_{22}N_2O$	294.38
2727	—, bisulfate		$C_{19}H_{22}N_2O \cdot H_2SO_4 \cdot 4H_2O$	464.53
2728	—, hydrochloride		$C_{19}H_{22}N_2O \cdot HCl \cdot 2H_2O$	366.88
2729	—, nitrate		$C_{19}H_{22}N_2O \cdot HNO_3 \cdot \frac{1}{2}H_2O$	366.41
2730	—, sulfate		$(C_{19}H_{22}N_2O)_2 \cdot H_2SO_4 \cdot 2H_2O$	722.88
2731	—, hydroxy-	See <i>Cupreine</i> .		
2731M	Cinchoninic acid	4-quinolinecarboxylic acid . .	C_9H_6NCOOH	173.16 (anh.)
2732	Cinchotine	hydrocinchonine; pseudo-cinchonine	$C_{19}H_{24}N_2O$	296.40
2733	Cinchotoxine .	See <i>Cinchonicine</i> .		
2734	Cineole	1,8-epoxy- <i>p</i> -menthane; eucalyptole; cajeputole	$C_{10}H_{18}O$	154.25
2735	1,4-Cineole	<i>p</i> -cineole; 1,4-epoxy- <i>p</i> -menthane	$C_{10}H_{18}O$	154.25
2736	1-Cineolic acid	<i>l</i> -tetrahydro-2,6,6-trimethyl-1,4-pyran-2,5-dicarboxylic acid*	$C_{10}H_{16}O_6$	216.23
2737	Cinnamaldehyde	3-phenylpropenal*; β -phenylacrolein; cinnamic aldehyde	$C_6H_5CH:CHCHO$.	132.15
2737M	Cinnamamide	cinnamic amide	$C_6H_5CH:CHCONH_2$	147.17
2738	Cinnamein .	See <i>Cinnamic acid, benzyl ester</i> .		
2739	Cinnamene .	See <i>Styrene</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2716	hex. or monocl. yel. cr. f. al.	0.92	196	subl.	sl. s.	0.050 ¹³ , 0.44 h.	s. eth., chl., bz., sl. s. CS ₂
2717	redsh. or. need. f. ac. a.	.....	239.5 (235)	subl.	i.	s. h.	sl. s. eth., c. ac. a., tol.; s. H ₂ SO ₄ , h. bz.
2718	pr. f. w. or HCl	.....	260 d. (266)	d.	v. sl. s.	sl. s.	v. sl. s. eth.; i. chl.
2720	rhomb. need. f. al.	.....	194 (185)	.....	i.	s.	s. eth., bz., chl.
2721	need. [α] _D 47.2 ¹³ in al. or chl.	.....	58-60	.....	sl. s.	s.	s. eth., chl., bz.
2722	trim. pr. f. al.; 1.610, 1.625, 1.675, [α] _D -107.9 ^{17,8}	.....	210.5 (202)	.....	0.019 ^{11,5}	4.81 c.	0.41 c. eth.; s. chl.
2723	lng. monocl. pr.	.....	.....	.....	v. s.	v. s.	.....
2724	wh. cr. powd.	.....	anh. 242	.....	5 ²⁰	25.6 ^{18,5}	0.33 ²⁵ eth.; v. s. chl.
2725	monocl. glist. need. efflor.	.....	anh. 205	.....	1.54	1.37	0.024 eth.; 0.16 ²⁵ chl.
2726	col. need., col. monocl. f. al.; 1.570, 1.685, 1.690; [α] _D 229.6 ¹⁷ in al.	.....	255 (264)	subl. 220	0.027 ²⁰	0.795 ²⁰	0.27 ¹⁹ eth.; s. chl.
2727	wh. rhomb. octah.	.....	.....	.....	217 ¹⁴	111 ¹⁴	s. eth.
2728	col. monocl., [α] +165.5	.....	anh. 217-8	.....	4.5 c.	100	0.18 eth.; s. chl.
2729	col. monocl.	.....	.....	.....	3.79 ¹²	s.	.....
2730	col. rhomb., [α] +170.3 ²⁰	.....	anh. 198.5	.....	1.55 ¹³	17 ¹¹	0.043 eth.; 2.1 chl.
2731	monocl. pr. or need. with 1H ₂ O f. w.	.....	253-4	.....	v. sl. s.	v. sl. s.	i. eth.
2732	pr., [α] _D +204.5 ¹⁴ in et. al.	.....	286	.....	i. c.; s. h.	sl. s.	v. sl. s. eth.
2733	col. liq., 1.4584 ¹⁵	0.9239 ²⁰ ₄	+1.5	176-7	0.2 c.	∞	∞ eth.; s. chl., glac. ac. a., oils
2735	1.4479 ¹⁸	0.8997 ²⁰	+1	173.4	0.2 c.	∞	∞ eth.
2736	cr.; α 1.480, γ 1.522	.....	196-7 d.	.....	1.4 d.	0.79 h.	0.71 eth.; sl. s. chl.
2737	col. liq., 1.61949	1.1119 ¹⁵ ₄	-7.5	251	v. sl. s.	∞	∞ eth.
2737M	need. ....	.....	147	.....	sl. s. h.	s.	s. eth., CS ₂
2738							
2739							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2740	Cinnamic acid (ordinary or <i>trans</i>)	<i>trans</i> - β -phenylacrylic acid; <i>trans</i> -benzenepropenoic acid	$C_6H_5CH:CH-COOH$	148.15
2741	—, allyl ester	allyl cinnamate	$C_6H_5CH:CH-COOC_3H_7$	188.22
2742	—, benzyl ester	cinnamein	$C_6H_5CH:CHCO-OCH_2C_6H_5$	238.27
2743	—, dibromide	See <i>Hydrocinnamic acid</i> , α , β -dibromo-		
2744	—, ethyl ester	ethyl <i>trans</i> -3-phenylpropenoate	$C_6H_5CH:CHCOOC_2H_5$	176.21
2745	—, methyl ester	methyl cinnamate	$C_6H_5CH:CHCOOCH_3$	162.18
2746	—, γ -phenylallyl ester	See <i>Styracin</i>		
2747	—, <i>p</i> -phenylphenacyl ester		$C_6H_5CH:CHCOO-CH_2COC_6H_4C_6H_5$	342.38
2748	—, α -acetyl-, ethyl ester	ethyl α -benzalacetoacetate	$C_6H_5CH:C(CO-CH_3)COOC_2H_5$	218.24
2749	—, <i>o</i> -amino-	β -(<i>o</i> -aminophenyl) acrylic acid	$NH_2C_6H_4CH:CHCOOH$	163.17
2750	—, —, lactam	See <i>Carbostyryl</i>		
2751	—, <i>m</i> -amino-		$NH_2C_6H_4CH:CHCOOH$	163.17
2752	—, <i>p</i> -amino-		$NH_2C_6H_4CH:CHCOOH$	163.17
2753	—, α -bromo-	2-bromo-3-phenylpropenoic acid; α -bromo- β -phenylacrylic acid	$C_6H_5CH:CHBrCOOH$	227.06
2754	—, β -bromo-	3-bromo-3-phenylpropenoic acid; β -bromo- β -phenylacrylic acid	$C_6H_5CHBr:CHCOOH$	227.06
2755	—, <i>o</i> -carboxy-	<i>o</i> , β -styrenedicarboxylic acid	$(COOH)C_6H_4CH:CHCOOH$	192.16
2756	—, <i>p</i> -carboxy-	<i>p</i> , β -styrenedicarboxylic acid	$(COOH)C_6H_4CH:CHCOOH$	192.16
2757	—, 2,4-dihydroxy-	See <i>Umbellic acid</i>		
2758	—, 2,5-dihydroxy-	3-(2,5-dihydroxyphenyl)-propenoic acid	$(HO)_2C_6H_3CH:-CHCOOH$	180.15
2759	—, 3,4-dihydroxy-	See <i>Caffeic acid</i>		
2760	—, α -ethyl-		$C_6H_5CH:C-(C_2H_5)COOH$	176.21
2761	—, <i>o</i> -hydroxy-	See <i>o</i> -Coumaric acid.		
2762	—, <i>m</i> -hydroxy-	See <i>m</i> -Coumaric acid.		
2763	—, <i>p</i> -hydroxy-	See <i>p</i> -Coumaric acid.		
2764	—, 3-hydroxy-4-methoxy-	See <i>Isoferulic acid</i>		
2765	—, 4-hydroxy-3-methoxy-	See <i>Ferulic acid</i>		
2766	—, β -ketohydro-	See <i>Acetic acid</i> , benzoyl-.		
2767	—, α -methyl-	α -benzalpropionic acid	$C_6H_5CH:-C(CH_3)COOH$	162.18
2768	—, <i>o</i> -nitro-		$NO_2C_6H_4CH:-CHCOOH$	193.15
2769	—, —, ethyl ester		$NO_2C_6H_4CH:CHCOOC_2H_5$	221.21
2770	—, <i>m</i> -nitro-		$NO_2C_6H_4CH:CHCOOH$	193.15
2771	—, —, ethyl ester		$NO_2C_6H_4CH:-CHCOOC_2H_5$	221.21
2772	—, —, methyl ester		$NO_2C_6H_4CH:-CHCOOCH_3$	207.18

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2740	col. monocl.	1.2475 $\frac{4}{4}$	133	300	0.120 0.588 ⁹⁸	23 ²⁰	v. s. eth.; s. bz., glac. ac. a., CS ₂ , 5.9 ¹⁹ chl.
2741	wh.-yel. cr.	1.052 $\frac{25}{25}$	.....	286 d.	i.	v. s.	∞ eth.
2742	col. pr.	.....	39	244 ²⁵ ; 195-200 ⁵	.....	s. h.	s. eth.
2743	col. liq.,	1.049	6.5 (12)	271; 141 ¹⁵	i.	s.	v. s. eth.
2744	1.55982						
2745	col. cr., 1.57661 ^{21.4}	1.0911 $\frac{20}{4}$; 1.042 $\frac{36}{0}$	36	261.9 (259.6)	i.	v. s.	s. eth.
2746	.....	.....	182.5	.....	.....	.....	.....
2747	.....	.....	59	181 ¹⁷	.....	s.	s. eth.
2748	.....	.....	159 d.	.....	sl. s. c., s. h.	s.	s. eth.
2749	yel. need.	.....	181	.....	sl. m.	s.	s. eth.
2750	pa. yel. need.	.....	175-6 d.	.....	sl. s.	s.	s. eth.
2751	.....	.....	120-1	111 ^{0.6}	s. h.	s.	s. CS ₂ , bz.
2752	(cis) rhomb. f. w.	.....	131-2	121 ^{0.6}	v. sl. s. h.	∞	∞ eth.
2753	(trans) need. f. w.	.....	160	111 ^{0.6}	sl. s. h.	sl. s. c.	s. eth., chl., h. bz.
2754	(cis) monocl. f. al.	.....	134-5	122 ^{0.6}	sl. s. h.	s.	s. h. bz.; sl. s. CS ₂
2755	(trans) need. f. w.	.....	175	.....	sl. s.	v. s.	sl. s. eth.; i. bz.
2756	need. f. w.	.....	358 d.	subl. >350	i.	.....	s. h. ac. a.
2757	infus. powd.	.....	207 d.	.....	.....	s.	.....
2758	cr. f. w.	.....	104-5 (81)	.....	0.01 ²⁵	s.	s. eth.; sl. s. pet. eth.
2759	need. f. w.	.....	74	288	0.12 h.	s.	s. eth., CS ₂ , bz.
2760	need. f. w.	.....	240	subl.	i. c.	0.21 ²⁵	.....
2761	sc. or need. f. al.	.....	44	.....	.....	v. s.	v. s. eth., bz.
2762	yel. rhomb. need.	.....	193 (199-200)	.....	v. sl. s.	sl. s.	.....
2763	col. (yel.) need. f. al.	.....	74-76	.....	i.	sl. s.	sl. s. eth.
2764	.....	.....	123-4	d.	i.	v. sl. s.	v. sl. s. eth.; v. s. chl., bz.
2765	pa. yel. pr. f. al.	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2773	Cinnamic acid, <i>p</i>-nitro-	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}:-\text{CHCOOH}$	193.15
2774	—, —, ethyl ester.....	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}:-\text{CHCOOC}_2\text{H}_5$	221.21
2775	—, α-phenyl-	<i>trans</i> - α,β -diphenylacrylic acid	$\text{C}_6\text{H}_5\text{CH}:-\text{C}(\text{C}_6\text{H}_5)\text{COOH}$	224.25
2776	<i>allo</i>-Cinnamic acid ...	<i>cis</i> -cinnamic acid (68°).....	$\text{C}_6\text{H}_5\text{CH}:-\text{CHCOOH}$	148.15
2777	—, α,β-dibromo- ...	<i>cis</i> -2,3-dibromo-3-phenylpropenoic acid*; β -dibromocinnamic acid	$\text{C}_6\text{H}_5\text{CBr}:-\text{CBrCOOH}$	305.97
2778	Cinnamic alcohol	3-phenyl-2-propen-1-ol*; styrylcarbinol; γ -phenylallyl alcohol; cinnamyl alcohol; styrene	$\text{C}_6\text{H}_5\text{CH}:-\text{CHCH}_2\text{OH}$	134.17
2779	—, 4-hydroxy-3-met	See <i>Coniferyl alcohol</i> .		
2779M	Cinnamic amide.	See <i>Cinnamamide</i> .		
2780	Cinnamic anhydride ..	<i>trans</i> - β -phenylacrylic anhydride	$(\text{C}_6\text{H}_5\text{CH}:\text{CHCO})_2\text{O}$	278.29
2781	Cinnamone.	See <i>Styryl ketone</i> .		
2782	Cinnamoyl chloride ...	cinnamyl chloride; <i>trans</i> - β -phenylacrylyl chloride; <i>trans</i> -benzenepropenoyl chloride	$\text{C}_6\text{H}_5\text{CH}:-\text{CHCOCl}$	166.60
2783	Cinnamyl alcohol.	See <i>Cinnamic alcohol</i> .		
2784	Cinnamyl chloride.	See <i>Cinnamoyl chloride</i> .		
2785	Cinnamyl chloride.	See also <i>Propene, 3-chloro-1-phenyl-</i> .		
2786	Citraconic acid	<i>cis</i> -methylbutenedioic acid*; methylmaleic acid	$\text{CH}_3\text{C}(\text{COOH}):-\text{CHCOOH}$	130.10
2787	Citraconic anhydride ..	methylmaleic anhydride.....	$\text{OCOC}(\text{CH}_3):\text{CHCO}$	112.08
2788	Citral a	geranial.....	$\text{C}_{10}\text{H}_{16}\text{O}$	152.23
2789	Citral b	neral.....	$\text{C}_{10}\text{H}_{16}\text{O}$	152.23
2790	<i>dl</i>-Citramalic acid ...	<i>dl</i> -2-hydroxy-2-methylbutanedioic acid*; <i>dl</i> - α -hydroxy-pyrotartaric acid; <i>dl</i> - α -methylmalic acid	$\text{CH}_3\text{C}(\text{OH})-(\text{COOH})\text{CH}_2-\text{COOH}$	148.11
2790M	Citramide	citric triamide.....	$\text{C}_6\text{H}_{11}\text{N}_3\text{O}_4$	189.17
2791	Citrene.	See <i>d-Limonene</i> .		
2792	Citric acid	2-hydroxy-1,2,3-propanetricarboxylic acid*; β -hydroxy-tricarballic acid	$(\text{COOH})\text{CH}_2\text{C}(\text{OH})(\text{COOH})-\text{CH}_2\text{COOH}$	192.12
2793	—, <i>p</i> -phenylphenacyl ester	.....	$\text{C}_{43}\text{H}_{35}\text{O}_{10}$	774.79
2794	—, trimethyl ester.....	methyl citrate.....	$\text{C}_3\text{H}_4(\text{OH})-(\text{COOCH}_3)_3$	234.20
2795	—, hydroxy-	See <i>Tricarballic acid, α,β-di</i>	hydroxy-.	
2795M	Citric triamide.	See <i>Citramide</i> .		
2796	<i>d</i>-Citronellal	<i>d</i> -rhodinal.....	$\text{CH}_2:\text{C}(\text{CH}_3)-(\text{CH}_2)_3\text{CH}-(\text{CH}_3)\text{CH}_2\text{CHO}$	154.25
2797	<i>l</i>-Citronellal.....	.....	$\text{C}_{10}\text{H}_{18}\text{O}$	154.25

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2773	lt. yel. pr. f. al.	.....	286	.....	0.0265 ²⁵	sl. s. h.	v. sl. s. eth.; i.
2774	yel. tricl. need.	.....	141 (136-7)	.....	i.	sl. s.	CS ₂ lgr. sl. s. eth.
2775	(trans) wh. need. f. dil. al.	.....	172	subl.	sl. s. h.	s.	s. eth.
	(cis) need. ....	.....	137-8	.....	.....	.....	.....
2776	monocl. pr.	1.284 $\frac{4}{4}$	68	125 ¹⁹ ; 265 d.	0.937 ²⁵	v. s.	v. s. eth.
2777	yel pl. f. chl. ....	.....	100	124 ^{0.5}	i.	s.	s. eth., chl., ac. a., lgr.; sl. s. pet. eth.
2778	need., 1.58190.	1.0440 $\frac{2.0}{4}$	33	257.5	sl. s.	v. s.	v. s. eth.
2779 2779M 2780	need. f. al. ....	.....	135-6	.....	i.	sl. s.	s. bz.
2781 2782	cr., 1.61364 ^{42.5}	.....	36	257.5	i.	s.	s. eth., pet. eth., chl.
2783 2784 2785 2786	monocl.	1.617	91	.....	238 c.	.....	sl. s. eth., bz., chl.; i. CS ₂
2787	.....	1.25 $\frac{15}{4}$	7-8	213-4	d.	v. s.	v. s. eth.
2788	col. liq., 1.48752	0.8868 $\frac{2.0}{4}$	.....	229 (224-9) d.	i.	∞	∞ eth.
2789	1.4900.	0.888 $\frac{1.9}{4}$	.....	103 ¹²	.....	.....	.....
2790	monocl. pr. (d [α] +34.7 ⁰¹⁴ in w.)	.....	119 (d 95; 109)	subl.	v. s.	s.	s. eth., acet., et. ac.; i. bz.
2790M 2791 2792	cr. f. w. ....	.....	210-215 d.	.....	2.7 ¹⁸	i.	i. eth.
2793 2794	col. rhomb., (cr. +1H ₂ O f. w.); 1.493, 1.498, 1.509 (hyd.)	1.542 $\frac{1.8}{4}$	-H ₂ O 70-5; 153	d.	133 c.	116 ²⁵	2.26 c. eth.
2795 2795M 2796	col. liq., 1.4483 ^{17.5} [α] +13.09 ⁰¹⁵ D	0.855 $\frac{1.7}{4}$	.....	205-8	v. sl. s.	∞	∞ eth.
2797	1.4570.	0.8567 $\frac{1.5}{4}$	.....	205-6	v. sl. s.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2798	<i>dl</i> -Citronellol.....	dihydrogeraniol.....	$C_{10}H_{20}O$	156.26
2799	<i>d</i> -Citronellol.....	.....	$C_{10}H_{19}OH$	156.26
2800	Clvetone.....	9-cycloheptadecen-1-one*.....	$CO(CH_2)_7CH:$ $CH(CH_2)_7$	250.41
2801	Clupanodonic acid.....	.....	$C_{21}H_{33}COOH$	330.50
2802	<i>l</i> -Cocaine.....	benzoylmethylecgonine.....	$C_{18}H_{13}N(OOCC_6H_5)(COOCH_3)$	303.35
2803	—, chromate.....	.....	$C_{17}H_{21}NO_4 \cdot H_2CrO_4 \cdot H_2O$	439.39
2804	—, hydrochloride.....	.....	$C_{17}H_{21}NO_4 \cdot HCl$...	339.81
2805	—, cinnamoyl-.....	so called; ecgonine cinnamate methyl ester	$C_{19}H_{23}NO_4$	329.38
2806	Codamine.....	.....	$C_{20}H_{25}NO_4$	343.41
2807	Codeine.....	morphine methyl ether.....	$C_{18}H_{21}NO_3 \cdot H_2O$...	317.37
2808	—, hydrochloride.....	.....	$C_{18}H_{21}NO_3 \cdot HCl \cdot 2H_2O$	371.86
2809	—, phosphate.....	.....	$C_{18}H_{21}NO_3 \cdot H_3PO_4 \cdot 2H_2O$	433.39
2810	—, sulfate.....	.....	$(C_{18}H_{21}NO_3)_2 \cdot H_2SO_4 \cdot 5H_2O$	786.87
2811	Coerulignone.	See <i>Cerulignone</i> .		
2812	Colain.	See <i>Cholic acid</i> .		
2813	<i>l</i> -Colchicine.....	.....	$C_{22}H_{25}NO_6$	399.43
2814	—, compd. with chloroform	.....	$C_{22}H_{25}NO_6 \cdot CHCl_3$	518.82
2815	α -Collidine.....	4-ethyl-2-methylpyridine*.....	$CH_3C_5H_3NC_2H_5$...	121.18
2816	β -Collidine.....	3-ethyl-4-methylpyridine*.....	$CH_3 \cdot C_5H_3N \cdot C_2H_5$..	121.18
2817	γ -Collidine.....	2,4,6-trimethylpyridine*.....	$(CH_3)_3C_5H_2N$	121.18

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2798	.....	0.8488 $\frac{19}{4}$	.....	991 ¹⁰	.....	.....	.....
2799	col. liq., 1.45659, [α] + 4 $\frac{217}{D}$	0.8565 $\frac{17}{4}$	.....	222	v. sl. s.	■	∞ eth.
2800	.....	.....	32.5 (31)	342 ⁷⁴² ; 158-60 ²	.....	.....	.....
2801	pa. yel. oil, 1.5057 ¹⁵	0.9410 $\frac{15}{4}$	< -78	236 ⁵	i.	.....	s. eth.
2802	col. monocl. pr. f. al., liq. 1.50218; solid α 1.49, [α] - 15.83 $\frac{220}{D}$ in chl.	.....	98	.....	0.16 ²⁵ , 0.38 ⁶⁰	20 ²⁵	26.3 eth.; s. bz., chl.
2803	or.-yel. leaf....	.....	127	.....	sl. s.	.....	.....
2804	col. monocl. pr. f. al. [α] - 71.95°D in w.	.....	197	.....	250 ²⁵	38.4 ²⁵	i. eth.; ■ chl.; s. glyc.
2805	need. f. bz....	.....	121	.....	i.	s.	s. eth., chl., bz.
2806	pr. ....	.....	121	.....	sl. s.	v. s.	s. eth.
2807	col. rhomb. octahdr. (+ 1H ₂ O) f. w.; (anh.) 1.620, 1.630, 1.650; (hyd.) 1.543, 1.636, 1.684, [α] - 137.75°D in al.	1.315 ¹⁴	anh. 155	.....	0.83 ²⁵ , 1.7 ⁶⁰	62.5 ²⁵	8 ²⁵ eth.; s. chl., bz., tol.
2808	col. need., [α] - 108.2 $\frac{222}{D}$ in w.	.....	anh. 264	.....	3.84 ¹⁵	s.	.....
2809	col. need. or efflor. powd. [α] - 134°D	.....	235 d.	.....	44.5 ²⁵	0.38 ²⁵	0.07 eth.; s. chl.
2810	col. rhomb. [α] - 101.2 $\frac{215}{D}$ in w.	.....	278 d.	.....	3.3 ²⁵	0.1 ²⁵	i. eth., chl.
2811	.....	.....	.....	.....	.....	.....	.....
2812	.....	.....	.....	.....	.....	.....	.....
2813	yel. varnish; yel. need. f. et. ac.	.....	anh. 143-7	.....	4.54	v. s.	0.638 eth.; v. s. chl.; 1 bz.
2814	need. f. chl....	.....	.....	.....	d. h.	.....	.....
2815	col. liq.	0.9268 $\frac{16}{4}$	.....	179	s. c., less. s. h.	v. s.	v. s. eth.; s. bz.
2816	col. liq.	0.966 $\frac{0}{4}$; 0.9286 $\frac{16.8}{4}$	.....	195-6	i.	s.	s. eth., chl.
2817	col. liq.	0.917 $\frac{20}{4}$	.....	172	20.8 ⁶ , 3.5 ²⁰	s.	■ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2819	Conhydrine	α -hydroxyconiine; 2-(α -hydroxypropyl)piperidine	$C_8H_{17}NO$	143.23
2820	ψ - Conhydrine .	See <i>Pseudoconhydrine</i> .		
2821	α - Coniceine		$C_8H_{16}N$	125.21
2822	β - Coniceine	2-allylpiperidine.....	$C_8H_{15}N$	125.21
2823	γ - Coniceine	1,2,3,4-tetrahydro-6-propylpyridine	$C_8H_{15}N$	125.21
2824	δ - Coniceine .	See <i>Piperolidine</i> .		
2825	ϵ - Coniceine	methylconiidine.....	$C_8H_{15}N$	125.21
2826	Conidine, methyl- .	See ϵ - <i>Coniceine</i> .		
2827	Coniferin		$C_{16}H_{22}O_8 \cdot 2H_2O$...	378.37
2828	Coniferyl alcohol	3-(4-hydroxy-3-methoxyphenyl)-2-propen-1-ol; 4-hydroxy-3-methoxycinnamic alcohol; γ -hydroxyisoeugenol	$(CH_3O)(OH)C_6H_3 \cdot CH:CHCH_2OH$	180.20
2829	Coniine, α-hydroxy- .	See <i>Conhydrine</i> .		
2830	<i>d</i> - Coniine	<i>d</i> -2-propylpiperidine.....	$C_8H_{10}N \cdot C_3H_7$	127.23
2831	—, hydrochloride.....		$C_8H_{17}N \cdot HCl$	163.69
2832	—, picrate.....		$C_8H_{17}N \cdot C_6H_3N_3O_7$	356.33
2833	Conquinamine		$C_{19}H_{24}N_2O_2$	312.40
2834	Conquinine .	See <i>Quinidine</i> .		
2835	Conylene .	octadiene (one form)	C_8H_{14}	110.19
2836	Conyrine .	2-propylpyridine.....	$C_8H_7 \cdot C_3H_4N$	121.18
2837	Coriandrol .	See <i>d</i> - <i>Linalool</i> .		
2839	Corybulbine		$C_{18}H_{16}N(OH) \cdot (OCH_3)_3$	355.42
2840	Corycavine		$C_{23}H_{23}NO_6$	409.42
2841	<i>dl</i> - Corydaline		$C_{18}H_{15}N(OCH_3)_4$..	369.45
2842	Corynine .	See <i>Yohimbine</i> .		
2843	Cotarnine		$C_{12}H_{16}NO_4$	237.25
2844	—, hydrochloride.....	stypticin.....	$C_{12}H_{15}NO_4 \cdot HCl$...	273.71
2845	—, phthalate.....	styptol.....	$2C_{12}H_{15}NO_4 \cdot C_6H_4 \cdot (COOH)_2$	640.63
2846	Cotoin	2,6-dihydroxy-4-methoxybenzophenone	$C_6H_2(OH)_2 \cdot (OCH_3)COC_6H_5$	244.24
2847	Coumalic acid	2-oxo-1,2-pyran-5-carboxylic acid*	$OCOCH:CHC \cdot (COOH):CH$	140.09

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2819	col. cr. f. eth., [α]+10° _D	.....	121	226	v. s.	s.	s. eth., chl.
2820	col. liq.	0.893 $\frac{15}{4}$	-16	158	sl. s.	.....	.....
2821	(mixt. ?)	0.8519 $\frac{50}{4}$	39-41	168-9	sl. s.	s.	s. eth.
2822	col. need. (l) [α] -50.47° ₄₅ D	0.872 $\frac{20}{4}$, 0.8825 $\frac{23}{4}$	>-50	172	sl. s.	s.	.....
2823	col. liq., 1.46068 ^{18.4}	0.8856 $\frac{15}{4}$	.....	151-4	.....	s.	s. eth.
2824	liq. (d) [α] +67.4° ₁₅ D	0.8624 $\frac{15}{4}$	.....	143-5	.....	.....	.....
2825	(l) [α] -87.34° ₁₅ D	0.8836 $\frac{15}{4}$	.....	150-1	.....	.....	.....
2826	(dl).....	.....	anh. 185	.....	0.51	sl. s.	i. eth.
2827	glit. need. (+2H ₂ O), [α]-66.9° ₂₀ D in w.	.....	73-4	.....	sl. s. h.	s.	s. eth., alk.
2828	pr. ....	.....	.....	.....	.....	.....	.....
2829	col. oily liq., 1.4511 ^{921.9} [α]+13.79° (+15.7°) _D	0.845	-2.5	166.5	1.1 c.	∞	v. s. eth.; s. bz., chl., amyl al., acet.
2830	col. rhomb. f. w.	.....	220 (217)	.....	50	s.	i. eth.; s. chl.
2831	yel. need.	.....	75	.....	.....	s.	s. eth.
2832	f. h. w.	.....	123	.....	.....	s.	v. s. eth.
2833	yel. tetr. ....	.....	.....	.....	.....	.....	.....
2834	liq.	0.770 $\frac{0}{4}$	.....	126 ⁷³⁸	.....	s.	.....
2835	liq.	<1	2	165	sl. s.	∞	∞ eth.
2836	.....	.....	238	.....	i.	sl. s.	sl. s. eth.; s. c. HCl
2837	need. ....	.....	218-9	.....	i.	i. c.	i. alk.
2838	rhomb. tab. f. al.	.....	dl 135; dl- meso, 158-9	.....	i.	s. h.	s. eth., chl.
2839	col. pr. f. al. (d) [α] +295° ₂₅ D in al.	.....	.....	.....	.....	.....	.....
2840	col. need. f. bz.	.....	132-3 d.	.....	sl. s.	s.	s. eth., NH ₄ OH
2841	yel. cr. powd. .	.....	142-4	.....	v. s.	v. s.	.....
2842	yel. cr. or powd.	.....	103	.....	v. s.	.....	.....
2843	yelsh. cr. f. h. w.	.....	130-1	.....	sl. s.	s.	s. eth., bz., chl., CS ₂ , acet.
2844	pr. ....	.....	205-10 part. d.	218 ¹²⁰ ; subl. part. d.	sl. s. c.	s.	sl. s. eth.; s. ac. a., acet.; i. chl., bz., lgr.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2848	<i>o</i> -Coumaric acid	<i>o</i> -hydroxycinnamic acid; <i>o</i> -coumaric acid	$\text{HOC}_6\text{H}_4\text{CH:CH-COOH}$	164.15
2849	—, lactone.	See <i>Coumarin</i> .		
2850	<i>m</i> -Coumaric acid	<i>m</i> -hydroxycinnamic acid; <i>m</i> -coumaric acid	$\text{HOC}_6\text{H}_4\text{CH:CH-COOH}$	164.15
2851	<i>p</i> -Coumaric acid	<i>p</i> -hydroxycinnamic acid; <i>p</i> -coumaric acid	$\text{HOC}_6\text{H}_4\text{CH:CH-COOH}$	164.15
2852	—, α, β -dihydro-	See <i>Phloretic acid</i> .		
2854	Coumarilic acid	2-benzofurancarboxylic acid; coumarone-2-carboxylic acid	$\text{C}_8\text{H}_5\text{O-COOH}$	162.14
2855	Coumarin	1,2-benzopyrone; <i>o</i> -coumaric acid lactone; coumarinilactone	$\text{C}_6\text{H}_4\text{OCOCH:CH}$	146.14
2856	—, 6,7-dihydroxy-	See <i>Esculetin</i> .		
2857	—, 7,8-dihydroxy-	See <i>Daphnetin</i> .		
2858	—, 7-hydroxy-	See <i>Umbelliferone</i> .		
2859	—, 3-methyl-	α -methylcoumarin	$\text{C}_6\text{H}_4\text{OCOC-}$ $(\text{CH}_3):\text{CH}$	160.16
2860	—, 4-methyl-	β -methylcoumarin	$\text{C}_6\text{H}_4\text{OCOCH:C-}$ (CH_3)	160.16
2861	Coumarone.	See <i>Benzofuran</i> .		
2862	Creatine	(α -methylguanido) acetic acid; methylglycocyamine	$\text{NH}_2\text{C}(\text{:NH})\text{N-}$ $(\text{CH}_3)\text{CH}_2\text{COOH}$	131.14
2863	Creatinine	1-methylglycocyamidine	$\text{CH}_3\text{NC}(\text{:NH})\text{NH-}$ COCH_2	113.12
2864	Creosol	2-methoxy-4-methylphenol; 4-methylguaiacol ($\text{OH}=1$); 2-methoxy- <i>p</i> -cresol ($\text{OH}=1$)	$\text{CH}_3\text{OC}_6\text{H}_3(\text{CH}_3)\text{-}$ OH	138.16
2865	Cresol. (In numbering derivatives, ($\text{OH}=1$)	See <i>Cyclohexanol, methyl-</i> .		
2866	<i>o</i> -Cresol	<i>o</i> -methylphenol; <i>o</i> -hydroxytoluene; <i>o</i> -cresyl alcohol (incorrect)	$\text{CH}_3\text{C}_6\text{H}_4\text{OH}$	108.13
2867	—, acetate	<i>o</i> -tolyl acetate; <i>o</i> -cresyl acetate	$\text{CH}_3\text{COOC}_6\text{H}_4\text{CH}_3$	150.17
2868	—, 3-amino-	3-amino-2-methylphenol; 2-amino-6-hydroxytoluene	$\text{CH}_3(\text{NH}_2)\text{C}_6\text{H}_3\text{OH}$	123.15
2869	—, 4-amino-	4-amino-2-methylphenol; 5-amino-2-hydroxytoluene	$\text{CH}_3(\text{NH}_2)\text{C}_6\text{H}_3\text{OH}$	123.15
2870	—, 5-amino-	5-amino-2-methylphenol; 4-amino-2-hydroxytoluene	$\text{CH}_3(\text{NH}_2)\text{C}_6\text{H}_3\text{OH}$	123.15
2871	—, 4,6-dinitro-	2-methyl-4,6-dinitrophenol	$(\text{NO}_2)_2\text{C}_6\text{H}_2(\text{CH}_3)\text{-}$ OH	198.13
2872	—, 3-nitro-		$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{OH}$	153.13
2873	—, 4-nitro-	2-methyl-4-nitrophenol	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{OH}$	153.13
2874	—, 5-nitro-	2-methyl-5-nitrophenol	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{OH}$	153.13
2875	—, 6-nitro-	2-methyl-6-nitrophenol	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{OH}$	153.13
2876	—, 3,4,5,6-tetra-bromo-		$\text{CH}_3\text{C}_6\text{Br}_4\text{OH}$	423.77
2877	—, thio-	2-toluenethiol*; <i>o</i> -tolyl mercaptan	$\text{CH}_3\text{C}_6\text{H}_4\text{SH}$	124.19
2878	<i>m</i> -Cresol	<i>m</i> -methylphenol; <i>m</i> -hydroxytoluene	$\text{CH}_3\text{C}_6\text{H}_4\text{OH}$	108.13
2879	—, 5-amino-	5-amino-3-methylphenol; 3-amino-5-hydroxytoluene	$\text{CH}_3(\text{NH}_2)\text{C}_6\text{H}_3\text{OH}$	123.15

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2848	need. f. w. ....	.....	207-8 d.	d.	sl. s.	v. s.	v. sl. s. eth.; i. CS ₂ , chl.
2849							
2850	col. pr. f. w. ....	.....	191	.....	v. s. h.	s.	v. s. eth.; s. bz.
2851	col. need. (+1H ₂ O) f. c. w., anh. f. h. w.	.....	210-3 (206)	.....	v. sl. s.	v. s.	v. s. eth.; sl. s. bz.; i. lgr.
2852							
2854	need. f. w. ....	.....	192-3	310-15 sl. d.	s. h.	s.	sl. s. CS ₂ , chl.
2855	col. rhomb. f. eth.	0.935 ²⁰ / ₄	67-8 (70)	301.72 (290-1)	0.01 ²⁵	13.7 ¹⁶ 90%	v. s. eth.; s. chl., oils
2856							
2857							
2858							
2859	need. ....	.....	90	.....	.....	s.	.....
2860	need. f. bz. ....	.....	82	.....	.....	s.	s. bz.
2861							
2862	col. monoc. pr. (+1H ₂ O) f. w.	.....	-H ₂ O, 100; anh. 295	.....	1.35 ¹⁸	0.0063 c.	i. eth.
2863	col. rhomb. pr. f. w.	.....	260 d.	d.	8.7 ¹⁶	0.98 ¹⁶	.....
2864	col. oil, 1.5353 ²⁵	1.0919 ²⁵ / ₄	5.5	221.8, 113.5 ²²	sl. s.	∞	∞ eth., bz.
2865							
2866	col. cr. or liq., 1.5453	1.0465 ²⁰ / ₄	30	191.5	3.1 ⁴⁰ , 5.6 ¹⁰⁰	∞ ^{>30}	∞ ^{>30} eth.; s. chl., ord. org. solv.
2867	.....	.....	.....	208 (83-5 ¹⁰)	v. sl. s.	v. s.	v. s. eth.
2868	need. ....	.....	129	.....	sl. s.	.....	sl. s. eth.
2869	need. f. bz. ....	.....	172-3	subl.	sl. s.	v. s.	v. s. eth.; sl. s. bz.
2870	col. pl. or need.	.....	159-61	subl.	sl. s. c., s. h.	v. s.	v. s. eth.
2871	yel. pr. f. al. ....	.....	85.8	.....	v. sl. s.	10.82 ¹⁵	v. s. eth.; s. acet.; sl. s. lgr.
2872	lt. yel. cr. f. w.	.....	142-3	.....	v. sl. s.	v. s.	v. s. eth.
2873	need. f. w.	.....	82-5; 79-80	.....	v. sl. s.	v. s.	v. s. eth.
2874	yel. need. f. lgr.	.....	118	.....	v. sl. s.	v. s.	v. s. eth.
2875	yel. pr.	.....	69.5	.....	i.	v. sl. s.	v. sl. s. eth.
2876	yel. need. f. chl.	.....	206-7	d.	i.	s.	v. s. eth.
2877	leaf. ....	.....	15	194.3	i.	s.	v. s. eth.
2878	col. liq., 1.5398	1.034 ²⁰ / ₄	11-2	202.8	2.35 ²⁰ , 5.8 ¹⁰⁰	∞	∞ eth.; s. chl., ord. org. solv.
2879	.....	.....	79	345	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2880	<i>m</i>-Cresol, 6-amino-	2-amino-5-methylphenol; 4-amino-3-hydroxytoluene	$\text{CH}_3(\text{NH}_2)\text{C}_6\text{H}_3\text{OH}$	123.15
2881	—, 4-nitro-	3-methyl-4-nitrophenol	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{OH}$	153.13
2882	—, 5-nitro-	3-methyl-5-nitrophenol	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{OH}$	153.13
2883	—, 6-nitro-	3-methyl-6-nitrophenol	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{OH}$	153.13
2884	—, thio-	3-toluenethiol*; <i>m</i> -tolyl mercaptan	$\text{CH}_3\text{C}_6\text{H}_4\text{SH}$	124.19
2885	—, 2,4,6-trinitro-		$(\text{NO}_2)_3\text{C}_6\text{H}(\text{CH}_3)\text{-OH}$	243.13
2886	<i>p</i>-Cresol	<i>p</i> -methylphenol; <i>p</i> -hydroxytoluene	$\text{CH}_3\text{C}_6\text{H}_4\text{OH}$	108.13
2887	—, 2-amino-	2-amino-4-methylphenol; 3-amino-4-hydroxytoluene	$\text{CH}_3(\text{NH}_2)\text{C}_6\text{H}_3\text{OH}$	123.15
2888	—, 3-amino-	3-amino-4-methylphenol; 2-amino-4-hydroxytoluene	$\text{CH}_3(\text{NH}_2)\text{C}_6\text{H}_3\text{OH}$	123.15
2889	—, 2,6-dinitro-	4-methyl-2,6-dinitrophenol	$(\text{NO}_2)_2\text{C}_6\text{H}_2(\text{CH}_3)\text{-OH}$	198.13
2890	—, 2-methoxy-	See <i>Creosol</i> .		
2891	—, 2-nitro-	4-methyl-2-nitrophenol	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{-H}_3\text{OH}$	153.13
2892	—, 3-nitro-	4-methyl-3-nitrophenol	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{-H}_3\text{OH}$	153.13
2893	—, thio-	4-toluenethiol*; <i>p</i> -tolyl mercaptan	$\text{CH}_3\text{C}_6\text{H}_4\text{SH}$	124.19
2894	Cresorcinol	4-methylresorcinol; cresorcin; 2,4-dihydroxytoluene	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})_2$	124.13
2895	2,3-Cresotic acid	2-hydroxy-3-methylbenzoic acid; 2-hydroxy- <i>m</i> -toluic acid; <i>o</i> -homosalicylic acid; <i>o</i> -cresotic acid; β -cresotic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2896	2,4-Cresotic acid	2-hydroxy-4-methylbenzoic acid; 2-hydroxy- <i>p</i> -toluic acid; α - <i>m</i> -homosalicylic acid; <i>m</i> -cresotic acid; γ -cresotic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2897	2,5-Cresotic acid	2-hydroxy-5-methylbenzoic acid; 6-hydroxy- <i>m</i> -toluic acid; <i>p</i> -homosalicylic acid; <i>p</i> -cresotic acid; α -cresotic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2898	2,6-Cresotic acid	2-hydroxy-6-methylbenzoic acid; 6-hydroxy- <i>o</i> -toluic acid; β - <i>m</i> -homosalicylic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2899	3,2-Cresotic acid	3-hydroxy-2-methylbenzoic acid; 3-hydroxy- <i>o</i> -toluic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2900	3,4-Cresotic acid	3-hydroxy-4-methylbenzoic acid; 3-hydroxy- <i>p</i> -toluic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2901	3,5-Cresotic acid	3-hydroxy-5-methylbenzoic acid; 5-hydroxy- <i>m</i> -toluic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2902	3,6-Cresotic acid	3-hydroxy-6-methylbenzoic acid; 5-hydroxy- <i>o</i> -toluic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2880	col. need. f. bz.		157-9				
2881	need. f. w.		129		v. sl. s.	v. s.	v. s. eth.
2882	lt. yel. cr.		90-1		v. sl. s.	v. s.	v. s. eth.
2883	yel. monocl.		56	volat.	sl. s.	s.	v. s. eth.
2884	liq.	1.0625 ⁶ / ₄ ,	<-20	195-200	i.	s.	∞ eth.
		1.052 ¹² / ₄					
2885	yel. need. f. w.		106	exp. 150	0.22 ²⁰ , 0.81 ¹⁰⁰	v. s.	v. s. eth., s. bz.
2886	col. pr., 1.5395	1.0347 ²⁸ / ₄	36 (32-4)	202.5	2.4 ⁴⁰ , 5.3 ¹⁰⁰	∞ > ³⁶	∞ > ³⁶ eth.; s. ord. org. solv.
2887	sc. f. eth., rhomb. f. bz.		135	subl.	v. sl. s.	v. s.	v. s. eth.; s. chl.; sl. s. bz.
2888	col. cr. f. w.		144.5	subl.	sl. s.		
2889	lng. yel. pr.		81		sl. s.	s.	v. s. eth.
2890							
2891	yel. need. f. dil. al.	1.2399 ³⁸ / ₄	36.5 (32)	125 ²⁵	v. sl. s.	v. s.	v. s. eth.
2892	yel. pr. f. eth.		77		v. sl. s.	v. s.	v. s. eth.
2893	leaf. f. eth.		42-3	195	i.	s.	v. s. eth.
2894	col. cr. f. bz. + pet. eth.		104-5	267-70	s.	s.	s. eth.; sl. s. bz., lgr.
2895	lng. need. f. w.		163-4		0.14 ²⁵ , 1.16 ¹⁰⁰	s.	s. eth., chl.
2896	sm. need. f. w.		178	subl.	4.36 ¹⁰⁰	v. s.	v. s. eth.; i. chl.
2897	lng. need. f. w.		152.5		v. sl. s.	v. s.	s. eth.; i. CS ₂
2898	need. f. w.		168		0.14 ²⁵	v. s.	v. s. eth.
2899	glit. need. f. w.		145-6		s.	v. s.	v. s. eth.
2900	lng. need.		207	subl.	v. sl. s.	v. s.	s. eth.
2901	tab. f. w.		208	subl.	5.25 ¹⁰⁰	v. s.	v. s. eth.
2902	need. f. w.		-H ₂ O 100; 177-8 (183-4)		sl. s.	v. s.	v. s. eth.; i. chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2903	4,2-Cresotic acid	4-hydroxy-2-methylbenzoic acid; 4-hydroxy- <i>o</i> -toluic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2904	4,3-Cresotic acid	4-hydroxy-3-methylbenzoic acid; 4-hydroxy- <i>m</i> -toluic acid	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})\text{-COOH}$	152.14
2905	Cresyl alcohol.	See <i>Cresol</i> .		
2906	Cresyl esters of organic acids.	See "tolyl ester" under the names of the acids.		
2907	Cresyl phosphate.	See <i>Tolyl phosphate</i> .		
2907	Croceic acid	2-naphthol-8-sulfonic acid; β -naphthol- α -monosulfonic acid; Baeyer's acid	$\text{HOC}_{10}\text{H}_6\text{SO}_3\text{H} \dots$	224.22
2908	Croconic acid	crocie acid	$\text{C}_6\text{O}_3(\text{OH})_2 \cdot 3\text{H}_2\text{O} \dots$	196.11
2909	Crotonaldehyde	2-butenal*; crotonic aldehyde; β -methylacrolein; propylene aldehyde	$\text{CH}_3\text{CH:CHCHO} \dots$	70.09
2909M	Crotonamide	α -crotonic amide; 2-butenamide*	$\text{CH}_3\text{CH:CH-CONH}_2$	85.10
2910	Crotonic acid (α or solid)	<i>trans</i> (?)-2-butenic acid*; <i>trans</i> (?)- β -methylacrylic acid	$\text{CH}_3\text{CH:CHCOOH}$	86.09
2911	—, methyl ester	methyl α -crotonate	$\text{C}_6\text{H}_5\text{COOCH}_3 \dots$	100.11
2912	—, β -bromo-	3-bromo- <i>trans</i> -2-butenic acid*	$\text{CH}_3\text{CBr:CH-COOH}$	165.00
2913	—, α -chloro-	2-chloro-2-butenic acid* (one form)	$\text{CH}_3\text{CH:CClCOOH}$	120.54
2914	—, α -ethyl-	2-ethyl- <i>trans</i> (?)-2-butenic acid*; 2-pentene-3-carboxylic acid*	$\text{CH}_3\text{CH:C(C}_2\text{H}_5\text{)-COOH}$	114.14
2915	—, β -hydroxy-	3-hydroxy-2-butenic acid*; desmotropic with acetoacetic acid	$\text{CH}_3\text{COH:CH-COOH}$	102.09
2916	β -Crotonic acid (liquid).	See <i>Isocrotonic acid</i> .		
2916M	α -Crotonic amide.	See <i>Crotonamide</i> .		
2917	Crotonic anhydride	2-butenic anhydride*	$(\text{CH}_3\text{CH:CH-CO})_2\text{O}$	154.16
2917H	Crotonic nitrile.	See <i>Crotononitrile</i> .		
2917R	Crotononitrile	crotonic nitrile; 2-butenenitrile*; propenyl cyanide	$\text{CH}_3\text{CH:CHCN} \dots$	67.09
2917V	Crotonyl alcohol	See <i>2-Buten-1-ol</i> .		
2918	Crotonylene.	See <i>2-Butyne</i> *.		
2919	Crotyl alcohol (and acetate).	See <i>2-Buten-1-ol</i> *.		
2920	Cryptopine . . . . .	.....	$\text{C}_{21}\text{H}_{23}\text{NO}_5 \dots$	369.40
2921	Crystal violet (base)	hexamethylpararosaniline	$[(\text{CH}_3)_2\text{NC}_6\text{H}_4]_3\text{-COH}$	389.53
2922	Cubebin . . . . .	.....	$\text{C}_{20}\text{H}_{20}\text{O}_6 \dots$	356.36
2923	Cumaldehyde	<i>p</i> -isopropylbenzaldehyde; <i>p</i> -cuminic aldehyde	$\text{C}_9\text{H}_7\text{C}_6\text{H}_4\text{CHO} \dots$	148.20
2924	Cumaric acid.	See <i>Coumaric acid</i> .		
2925	Cumene	isopropylbenzene; 2-phenylpropane; cumol	$\text{C}_6\text{H}_5\text{CH(CH}_3)_2 \dots$	120.19
2926	—, hexahydro-	See <i>Cyclohexane, isopropyl-</i> .		
2927	—, α -nitro-	2-nitro-2-phenylpropane; (α -nitroisopropyl) benzene	$\text{C}_6\text{H}_5\text{C(NO}_2\text{)-(CH}_3)_2$	165.19
2928	<i>o</i>-Cumenol.	See <i>Phenol, o-isopropyl-</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2903	monocl. f. al. or w.	.....	177.8	236-7, subl.	94 ¹⁰⁰	s.	s. eth.
2904	monocl. need. f. w.	.....	172	subl. sl. d.	s. h.	v. s.	v. s. eth.; s. chl.
2905							
2906							
2907							
2908	yel. leaf.....	.....	-3H ₂ O, 100; anh. 180	subl.	156 c.	14.99 c.	.....
2909	col. inflam. liq., 1.43838 ^{17.3}	0.8575 ¹⁵ / ₄	-69; frz. -74	104-5 (102.4)	18	∞	∞ eth., bz., tol.
2909M	need.....		158	.....	sl. s.	s.	v. sl. s. eth.; sl. s. bz.
2910	col. monocl. need. f. w. or lgr., 1.4228 ^{79.7}	1.018 ²⁰ / ₄ ; liq. 0.964 ⁸⁰	72	189	8.28 ¹⁵	.....	sl. s. lgr.
2911	col. liq.....	0.981 ⁴ / ₄	.....	120.7	i.	v. s.	v. s. eth.
2912	leaf.....	.....	97 (94-5)	.....	sl. s.	v. s.	v. s. eth.; s. CS ₂ , bz.
2913	long need.....	.....	99	212 subl.	2.12 c.	s.	s. eth.
2914	col. monocl. pr.	.....	45	209	sl. s.	s.	v. s. eth.
2915	liq.....	.....	.....	d.	∞	.....	.....
2916							
2916M							
2917	col. liq., 1.47446	1.0397 ²⁰ / ₄	.....	246-8	d.	d.	∞ eth.
2917H							
2917R	col. liq.....	0.826 ²³ / ₄	.....	118-119	.....	.....	.....
2917 V							
2918							
2919							
2920	pr. f. al., opt. i.	1.315 ²⁰ / ₄	220-1 (218)	.....	i.	sl. s.	sl. s. eth., chl.; v. sl. s. bz.
2921	vlt. cr. f. bz....	.....	195	.....	i.	s.	s. eth.
2922	wh. need. f. al. or bz.	.....	131-2 (125)	not volat.	v. sl. s.	1.03 ¹²	2.68 eth.; s. chl.
2923	col. liq., 1.5301	0.978 ²⁰ / ₄	.....	235	i.	s.	s. eth.
2924							
2925	col. liq., 1.4930 ²⁰	0.864 ²⁰ / ₄	-96.9	152-3	i.	s.	s. eth., bz.
2926							
2927	liq.....	1.1025 ²⁰ / ₀	-35	d. 224; 123-8 ¹²	i. c.	.....	.....
2928							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2929	Cumic acid	<i>p</i> -isopropylbenzoic acid; <i>p</i> -cuminic acid	$(\text{CH}_3)_2\text{CHC}_6\text{H}_4\text{-COOH}$	164.20
2930	Cumic alcohol	<i>p</i> -isopropylbenzyl alcohol; <i>p</i> -cuminic alcohol; cuminyl alcohol	$(\text{CH}_3)_2\text{CHC}_6\text{H}_4\text{-CH}_2\text{OH}$	150.21
2931	α-Cumidic acid	4,6-dimethylisophthalic acid; 4,6-dimethyl-1,3-benzenedicarboxylic acid*	$(\text{CH}_3)_2\text{C}_6\text{H}_2\text{-(COOH)}_2$	194.18
2932	Cumidine	<i>p</i> -isopropylaniline	$(\text{CH}_3)_2\text{CHC}_6\text{H}_4\text{-NH}_2$	135.20
2933	<i>p</i>-Cuminic acid.	See <i>Cumic acid</i> .		
2934	<i>p</i>-Cuminic alcohol.	See <i>Cumic alcohol</i> .		
2935	<i>p</i>-Cuminic aldehyde.	See <i>Cumaldehyde</i> .		
2935M	Cuminyl alcohol.	See <i>Cumic alcohol</i> .		
2936	Cumol.	See <i>Cumene</i> .		
2937	Cumylic acid.	See <i>Durylic acid</i> .		
2938	Cupreine	hydroxycinchonine	$\text{C}_{19}\text{H}_{20}\text{N}_2(\text{OH})_2$...	310.38
2939	Curarine		$\text{C}_{19}\text{H}_{25}\text{N}_2\text{O-OH}$...	314.42
2940	Curcumin	1,7-bis (4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione*	$[(\text{CH}_3\text{O})(\text{OH})\text{C}_6\text{H}_3\text{CH:CHCO}]_2\text{-CH}_2$	368.37
2941	Curine		$\text{C}_{18}\text{H}_{19}\text{NO}_3$	297.34
2942	Cuscohygrine (anh.)		$\text{C}_{13}\text{H}_{24}\text{N}_2\text{O}$	224.34
2943	Cuscohygrine (hydrate)		$\text{C}_{13}\text{H}_{24}\text{N}_2\text{O} \cdot 3\frac{1}{2}\text{H}_2\text{O}$	287.40
2944	Cuskygrine.	See <i>Cuscohygrine</i> .		
2945	Cusparine	2-homopiperonyl-4-methoxyquinoline	$\text{C}_{19}\text{H}_{17}\text{NO}_3$	307.34
2946	Cyamelide	<i>s</i> -trioxanetriimine; insoluble cyanic acid	$(\text{HNCO})_3$	129.08
2947	Cyanamide	carbamonitrile	$\text{CN} \cdot \text{NH}_2$	42.04
2948	—, benzyl-		$\text{C}_6\text{H}_5\text{CH}_2\text{NHCN}$..	132.16
2949	—, diethyl-	<i>N</i> -cyanodiethylamine	$\text{CNN}(\text{C}_2\text{H}_5)_2$	98.15
2950	—, phenyl-	See <i>Cyananilide</i> .		
2951	Cyananilide.	carbanilonitrile; phenylecyanamide; <i>N</i> -cyanoaniline	$\text{C}_6\text{H}_5\text{NHCN}$	118.13
2952	Cyanic acid		HOCN	43.03
2953	—, ethyl ester		$\text{C}_2\text{H}_5\text{OCN}$	71.08
2954	—, insoluble.	See <i>Cyamelide</i> .		
2955	—, thio-	See <i>Thiocyanic acid</i> .		
2956	Cyanidine.	See <i>s</i> -Triazine.		
2957	—, trihydroxy-	See <i>Cyanuric acid</i> .		
2958	Cyano- . See the parent compounds (e.g., for cyanoacetic ethanedinitrile*; oxalonitrile; prussite)		acid see <i>Acetic acid</i> , <i>cyano-</i> . $\text{N}:\text{CC}:\text{N}$	52.04
2959	Cyanogen bromide	bromine cyanide	CNBr	105.93

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2929	col. tricl. f. al.	1.163 $\frac{4}{4}$	116.5	subl.	0.015 ²⁵	v. s.	v. s. eth.
2930	col.-yel. liq. (oil), 1.522 ²⁴	0.978 $\frac{20}{20}$	.....	248.4	sl. s.	∞	∞ eth.
2931	lng. pr. f. bz. +al. or need. f. w.	.....	266 (>320), subl. without melting	.....	sl. s.	s. h.	.....
2932	col. liq.	0.957 $\frac{20}{4}$	-63	225	i.	s.	s. eth., bz., a.
2933							
2934							
2935							
2935M							
2936							
2937							
2938	concentric pr. f. eth., [α]-175.5 ¹⁶ _D in al.	.....	anh. 198 (202)	.....	i.	s.	sl. s. eth.; v. sl. s. bz., chl.
2939	red-br. leaf	.....	161	.....	i.	s.	
2940	or.-yel. need. or powd.	.....	183 (177)	.....	i.	s.	sl. s. eth., CS ₂ ; 0.05 bz.; s. alk.; i. lgr.
2941	col. cr. ....	.....	212	.....	.....	.....	.....
2942	oil.	0.9782 $\frac{16}{4}$	.....	215 ²⁰	∞	.....	.....
2943	need. ....	.....	40-1; d. 120-30	.....	.....	.....	s. eth., bz. with sep. of H ₂ O
2944							
2945	lng. col. need.	.....	91-2	.....	.....	s.	s. eth.
2946	wh. amor.	1.127 $\frac{15}{4}$	.....	d.	0.01 ¹⁵	i.	i. eth., ord. org. solv.; s. conc. H ₂ SO ₄ ; sl. s. NH ₄ OH
2947	col. need., 1.4418 ⁴⁸	1.083	44	140 ¹⁹ d.	v. s.	v. s.	s. eth., chl., bz.
2948	pl. f. al. ....	.....	43 (33)	.....	i.	s.	s. eth.
2949	liq., 1.4126 ⁴⁸	0.854	.....	190; 68 ¹⁰	i.	s.	s. eth.
2950							
2951	need. f. eth. ....	.....	47	.....	sl. s.	s.	s. eth.
2952	col. gas.	liq. 1.140 $\frac{0}{4}$	.....	d.	sl. s.	.....	s. eth., ac. a.
2953	liq.	1.127 $\frac{15}{4}$; 0.89 $\frac{20}{4}$	.....	162 d.	i.	∞	∞ eth.
2954							
2955							
2956							
2957							
2958	col. pois. gas	liq. 0.866 $\frac{17}{4}$; 2.335 g/1	-34.4	-20.5	450 ²⁰ cm ³	2300 ²⁰ cm ³	500 ²⁰ cm ³ eth.
2959	col. need.	2.015 $\frac{20}{4}$	52	61.6	s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2960	Cyanogen chloride . . .	chlorine cyanide	CNCl	61.48
2961	—, trimer.	See <i>Cyanuric chloride</i> .		
2962	Cyanogen iodide	iodine cyanide	CNI	152.94
2963	Cyanogen sulfide .	See <i>Thiocyanic acid, cyanogen ester</i> .		
2964	Cyanuramide .	See <i>Ammelide</i> .		
2965	Cyanuric acid (<i>n</i>)	<i>s</i> -triazinetriol; trihydroxy-cyanidine; tricyanic acid	N:C(OH)N:C- $\quad\quad\quad\text{(OH)N:C(OH)}$	129.08
2966	—, tribenzyl ester	benzyl cyanurate	$(\text{C}_6\text{H}_5\text{CH}_2\text{OC:N})_3$	399.43
2967	—, trithio-.	See <i>Thiocyanuric acid</i> .		
2968	Cyanuric chloride	trichloro- <i>s</i> -triazine; tri-chlorocyanidine; tricyano-gen chloride	$\text{C}_3\text{Cl}_3\text{N}_3$	184.43
2969	Cyanurodiamide .	See <i>Ammeline</i> .		
2970	Cyanurotriamide .	See <i>Melamine</i> .		
2971	Cyclobutane *	tetramethylene	$\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2$	56.10
2972	—, benzoyl-.	See <i>Ketone, cyclobutyl phenyl</i> .		
2973	—, methyl- . . . . .	. . . . .	$\text{CH}_3\text{-}$ $\quad\text{CHCH}_2\text{CH}_2\text{CH}_2$	70.13
2974	1,2-Cyclobutanedi-carboxylic acid *	ethylenesuccinic acid	$\text{C}_4\text{H}_6(\text{COOH})_2$. . .	144.12
2975	1,3-Cyclobutanedi-carboxylic acid*	. . . . .	$\text{C}_4\text{H}_6(\text{COOH})_2$. . .	144.12
2976	Cyclobutene *	cyclobutylene	$\text{CH:CHCH}_2\text{CH}_2$. .	54.09
2977	9-Cycloheptadecen-1-one *	See <i>Civetone</i> .		
2978	Cycloheptane *	heptamethylene; suberane . .	$\text{CH}_2(\text{CH}_2)_5\text{CH}_2$. .	98.18
2979	Cycloheptanol *	suberyl alcohol; suberol; hydroxyheptamethylene	$\text{CH}_2(\text{CH}_2)_5\text{CHOH}$	114.18
2980	Cycloheptanone *	suberone; ketoheptamethy-lene	$\text{CO}(\text{CH}_2)_5\text{CH}_2$. . .	112.17
2981	Cycloheptene *	suberene; suberylene	$\text{CH:CH}(\text{CH}_2)_4\text{CH}_2$	96.17
2982	1,3-Cyclohexadiene * . .	1,2-dihydrobenzene; $\Delta^{1,3}$ -cy-clohexadiene	CH:CHCH:CH- $\quad\quad\quad\text{CH}_2\text{CH}_2$	80.12
2983	—, 5-isopropyl-2-met	hyl-. See <i>α-Phellandrene</i> .		
2984	1,4-Cyclohexadiene . . .	1,4-dihydrobenzene; $\Delta^{1,4}$ -cy-clohexadiene	$\text{CH:CHCH}_2\text{-}$ $\quad\quad\quad\text{CH:CHCH}_2$	80.12
2985	Cyclohexadiene-1,2-dic	arboxylic acid *. See <i>Phthalic acid, dihydro-</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2960	col. liq. or pois. gas	1.218 $\frac{4}{4}$; liq. 1.186 $\frac{20}{4}$	-6	13.8	2500 cm ³	10,000 cm ³	5,000 cm ³ eth.
2961	col. need. f. eth. or al.	.....	146.5, seal. tube	subl.	s.	s.	s. eth., volat. oils
2962							
2963							
2964	col. monocl. (+2H ₂ O) f. w., efflor.	1.768 $\frac{0}{4}$	>360	d.	0.25 ¹⁷	0.35 ²²	v. sl. s. eth.; s. conc. H ₂ SO ₄
2965							
2966	need. f. al. ....	.....	157	>320	i. c.	s.	sl. s. eth.
2967	monocl. f. eth.	1.32 $\frac{20}{4}$	146	190	sl. s.	v. s.	s. h. eth., ac. a.; v. s. chl.
2968							
2969	liq. or gas, 1.375 ²⁰	0.703 $\frac{0}{4}$	-50	13	i.	∞	∞ eth.; v. s. acet.
2970							
2971	col. liq., 1.3836 ²⁰	0.6931 ²⁰	.....	35-36 ⁷⁵⁸	i.	∞	∞ eth.
2972							
2973	(cis) pl. f. w. (trans) (dl) need. f. bz. (d) [α] _D ²⁰ +123.3° in w. (l) [α] _D ²⁰ -124.3° in w.	.....	138 131 105 105	.....	s. s.	s.	s. eth., sl. s. bz.
2974							
2975							
2976							
2977							
2978	oil, 1.4440	0.8099 $\frac{20}{4}$	-12	118.1	i.	v. s.	v. s. eth.
2979	.....	0.9717 $\frac{0}{4}$; 0.9565 $\frac{20}{4}$	.....	185.2 (184.5)	1.1	v. s.	v. s. eth.
2980	oil, 1.46027 ^{21.9}	0.9508 $\frac{20}{4}$	.....	179.5	sl. s.	v. s.	s. eth.
2981	oil, 1.4552	0.8228 $\frac{20}{4}$	.....	115	i.	s.	s. eth.
2982	col. liq., 1.4758, (1.4744)	0.8404 $\frac{20}{4}$	-98	80.5 (83-4)	i.	s.	v. s. eth.
2983	col. liq., 1.46806 ¹⁹	0.8471 $\frac{20}{4}$	.....	86-7 (81-2)	i.	∞	= eth.
2984							
2985							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
2986	1,3-Cyclohexadiene-1,4-dicarboxylic acid*	2,3-dihydroterephthalic acid..	$C_6H_6(COOH)_2$	168.14
2987	1,4-Cyclohexadienediol	ne*. See <i>Quinone</i> .		
2988	Cyclohexane*	hexahydrobenzene; hexamethylene	C_6H_{12}	84.16
2989	—, amino-	See <i>Cyclohexylamine*</i> .		
2990	—, bromo- *.....	cyclohexyl bromide.....	$C_6H_{11}Br$	163.07
2991	—, chloro- *.....	cyclohexyl chloride.....	$C_6H_{11}Cl$	118.61
2992	—, 1,3-dimethyl- ...	hexahydro- <i>m</i> -xylene.....	$C_6H_{10}(CH_3)_2$	112.21
2993	—, 1,4-dimethyl- ...	hexahydro- <i>p</i> -xylene.....	$C_6H_{10}(CH_3)_2$	112.21
2994	—, 1,2,3,4,5,6-hexabromo- (α or <i>trans</i>)	benzene <i>trans</i> -hexabromide...	$C_6H_6Br_6$	557.60
2995	—, —, (β or <i>cis</i>).....	benzene β -hexabromide.....	$C_6H_6Br_6$	557.60
2996	—, 1,2,3,4,5,6-hexachloro- (α or <i>trans</i>)	benzene <i>trans</i> -hexachloride...	$C_6H_6Cl_6$	290.85
2997	—, —, (β or <i>cis</i>).....	benzene <i>cis</i> -hexachloride.....	$C_6H_6Cl_6$	290.85
2998	—, —, (γ).....	benzene γ -hexachloride.....	$C_6H_6Cl_6$	290.85
2999	—, —, (δ).....	benzene δ -hexachloride.....	$C_6H_6Cl_6$	290.85
3000	—, isopropyl-	hexahydrocumene; normenthane	$C_3H_7 \cdot C_6H_{11}$	126.24
3001	—, 4-isopropyl-1-methyl-	thyl-. See <i>p</i> -Menthane.		
3002	—, methyl-	hexahydrotoluene; cyclohexylmethane	$CH_3C_6H_{11}$	98.18
3003	—, phenyl-	cyclohexylbenzene; 1,2,3,4,5,6-hexahydrobiphenyl	$C_6H_5C_6H_{11}$	160.25
3004	—, 1,3,5-trimethyl-	hexahydromesitylene.....	$C_6H_9(CH_3)_3$	126.24
3005	Cyclohexanecarboxylic acid*	hexahydrobenzoic acid.....	$C_6H_{11}COOH$	128.17
3006	—, 2-hydroxy-	hexahydrosalicylic acid.....	$HOC_6H_{10}COOH$...	144.17
3007	—, 1,2,4,5-tetrahydroxy-	oxy*. See <i>Quinic acid</i> .		
3008	1,2-Cyclohexanedicarboxylic acid*	hexahydrophthalic acid.....	$C_6H_{10}(COOH)_2$...	172.18
3009	1,4-Cyclohexanedicarboxylic acid*	hexahydroterephthalic acid...	$C_6H_{10}(COOH)_2$...	172.18

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2986	flocks				i. c., s. h.		
2987	col. liq.,				i.	∞	∞ eth.
2988	1.42900 ¹⁵	0.7791 ²⁰ ₄	6.5	81.4			
2989	col. liq.,				i.	∞	∞ eth.
2990	1.49564 ¹⁵	1.3290 ¹⁵ ₁₅		163-5			
2991	col. liq.,				i.	∞	∞ eth., bz.
	1.46264	1.0161 ⁰ ₀	-43.9	142.5			
		1.000 ²⁰ ₄					
2992	col. liq. (cis)	0.7735 ²⁰ ₄	-85	121	i.	∞	∞ eth.
	1.4269						
	(trans) 1.4254	0.772 ²⁰ ₄		119 ⁷⁵⁶			
2993	col. liq., 1.421	(cis) 0.7671 ²⁰ ₄ ; (trans) 0.7638 ²⁰ ₄	-86	120.5 ⁷⁵⁵			
2994	col. monoc.		212	119	i.	sl. s.	sl. s. eth.; s. CHCl ₃
2995	pr. cub. cr. f. bz.		253 d.		i.		i. eth.; sl. s. bz.
2996	col. monoc.	1.87 ²⁰ ₄	157	288 d.	i.	s. h.	4.35 ¹⁵ chl.; 6.5 ¹⁸ bz.; v. s. aniline
2997	col. cr.	1.89 ¹⁹ ₁₁	297	subl.	i.	sl. s.	0.13 CHCl ₃ , ¹²² bz.; 0.289 ¹⁶ ac. a.
2998	need. f. al.		112-3		i.		
2999	pl.		129-32				
3000	col. liq.	0.7902 ²⁰ ₄		154.7	i.	v. s.	v. s. eth.
3001							
3002	col. liq., 1.4235	0.7864 ⁰ ₄ ; 0.769 ²⁰ ₄	-126.4	100.3	i.	s.	s. eth.
3003	oil	0.9440 ²⁰ ₄	7	237.5	i.	v. s.	v. s. eth.
3004	(cis) col. liq.,	0.773 ²⁰		140-			
	1.43010 ²⁹ _{H₂O}			140.5 ⁷⁵²			
	(trans)	0.7720 ²⁰		138.5-			
	1.42740 ²⁹ _{H₂O}			139 ⁷⁵⁴			
3005	col. monoc.	1.048 ¹⁵ ₄	31	233	0.201 ¹⁵	v. s.	v. s. eth.
3006	pr., 1.4561 ^{33,8}		111		v. s.	v. s.	v. s. eth.; sl. s. bz.
3007	cr. f. w.						
3008	(cis) tricl.		192; d.		0.2	s.	s. acet.
	pr. f. w.		-H ₂ O >192				
	(trans) monoc.		221				
3009	leaf. f. w.				v. s. h.	s.	s. eth., CHCl ₃
	(cis) leaflets		168-9				
	f. w.				1.34 h.	v. s.	sl. s. eth.; s. acet.; i. CHCl ₃
	(trans) pr. f. w.		300 subl.				

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3010	1,3-Cyclohexanedi-one*	3-hydroxy-2-cyclohexen-1-one* (tautomeric form); dihydroresorcinol; hydroresorcinol	$\text{COCH}_2\text{COCH}_2\text{CH}_2\text{CH}_2$ H_2	112.12
3011	1,4-Cyclohexanedi-one*	tetrahydroquinone; <i>p</i> -quinone tetrahydride	$\text{CO}(\text{CH}_2)_2$ COCH_2CH_2	112.12
3012	1,2,3,4,5,6-Cyclohexanehexacarboxylic acid*	hexahydromellitic acid.....	$\text{C}_6\text{H}_6(\text{COOH})_6$	348.22
3013	1,2,3,4,5,6-Cyclohexanehexone*	hexol* . See <i>i-Inositol</i> .		
3014	Cyclohexanehexone* , hydrate	triquinoyl hydrate.....	$\text{C}_6\text{O}_6 \cdot 8\text{H}_2\text{O}$	312.19
3015	Cyclohexanepentol*	See <i>d-Quercitol</i> .		
3016	1,3,5-Cyclohexanetri-one* , trioxime	1,3,5-trihydroxaminobenzene; phloroglucinol trioxime	$\text{C}_6\text{H}_6(\text{NOH})_3$	171.16
3017	Cyclohexanol*	hexahydrophenol; " Hexalin ".	$\text{C}_6\text{H}_{11}\text{OH}$	100.16
3018	—, acetate.....	cyclohexyl acetate.....	$\text{CH}_3\text{COOC}_6\text{H}_{11}$	142.19
3019	—, benzoate.....	cyclohexyl benzoate; cyclohexyl benzenecarboxylate	$\text{C}_6\text{H}_5\text{COOC}_6\text{H}_{11}$	204.26
3020	—, 2-methyl	hexahydro- <i>o</i> -cresol.....	$\text{CH}_3\text{C}_6\text{H}_{10}\text{OH}$	114.18
3021	—, 3-methyl -(<i>I</i>).....	<i>l</i> -hexahydro- <i>m</i> -cresol.....	$\text{CH}_3\text{C}_6\text{H}_{10}\text{OH}$	114.18
3022	—, 4-methyl	hexahydro- <i>p</i> -cresol.....	$\text{CH}_3\text{C}_6\text{H}_{10}\text{OH}$	114.18
3023	Cyclohexanone*	ketoexamethylene; pimelic ketone	$\text{CO}(\text{CH}_2)_4\text{CH}_2$...	98.14
3024	—, 2,5-dimethyl -(<i>d</i>).....	.....	$\text{COCH}(\text{CH}_3)\text{CH}_2$ $\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2$	126.19
3024M	—, 2-hydroxy	See <i>Adipoin</i> .		
3025	—, 2-methyl.....	.....	$\text{COCH}(\text{CH}_3)\text{CH}_2$ $\text{CH}_2\text{CH}_2\text{CH}_2$	112.17
3026	—, 3-methyl.....	.....	$\text{COCH}_2\text{CH}(\text{CH}_3)$ $\text{CH}_2\text{CH}_2\text{CH}_2$	112.17
3027	—, 4-methyl.....	.....	$\text{COCH}_2\text{CH}_2\text{CH}$ $(\text{CH}_3)\text{CH}_2\text{CH}_2$	112.17
3028	Cyclohexanone pinacol	See <i>1,2-Ethanediol</i> , <i>1,2-dicyclohexyl</i>		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3010	pr. f. bz. or ethyl acetate	.....	105-6	.....	s.	s.	v. sl. s. eth., CS ₂ , lgr.; s. chl.
3011	monocl. f. w...	.....	78	subl. 100	s.	s.	s. eth.
3012	cr.....	.....	d.	.....	v. s.	v. s.	v. s. eth.
3013	mier. need. f. dil. HNO ₃	.....	95	.....	s. h.	i.	i. eth., s. alk.
3014		.....	.....	.....	.....	.....	.....
3015		.....	exp. 155	.....	v. sl. s.	v. sl. s.	s. chl., ac. a.
3016	cr. powd.....	.....	.....	.....	.....	.....	.....
3017	col. need., hyg., 1.46560 ^{22.6}	0.9449 ^{$\frac{25}{4}$} ; 0.9624 ^{$\frac{20}{4}$}	24 (22-25)	161.5	5.67 ¹⁵	s.	s. eth.; ∞ bz., CS ₂ , turpentine
3018	.....	.....	.....	177 (171-6)	i.	∞	∞ eth.
3019	.....	.....	.....	160 ¹⁸	i.	s.	s. eth.
3020	(cis) col. liq., 1.4640 ²⁰	0.937 ²⁰	-9.5 to -9.2	165	v. sl. s.	∞	s. eth.
	(trans) col. liq., 1.4611 ²⁰	0.9238 ²⁰	-21.2 to -20.5	166.5	v. sl. s.	∞	s. eth.
3021	(cis) syrup, 1.45497 ^{21.8}	0.9145 ^{$\frac{21.8}{4}$}	-47	173-4	1.03	∞	∞ eth.
	(trans) syrup, 1.45497 ^{21.8}	0.9145 ^{$\frac{21.8}{4}$}	.....	174-5 ⁷⁶²	.....	.....	.....
3022	(cis) aromatic liq., 1.45327 ^{21.5}	0.9129	.....	173-4 ⁷⁵⁰	v. sl. s.	∞	s. eth.
	(trans) aromatic liq., 1.45307 ^{20.7}	0.9118	.....	173-4.5 ⁷⁴⁵	v. sl. s.	∞	s. eth.
3023	col. liq., 1.4507	0.9478 ^{$\frac{20}{4}$}	frz. -45	156.7 (155)	2.4 ²¹	s.	s. eth.
3024	oil, 1.44807 ²⁰ ; [α] _D ²⁰ +11.6	0.8985 ²⁰	.....	172-174 ⁷⁵⁰	i.	s.	s. eth.
3024M	liq., 1.45049 ^{14.6}	0.9248 ¹⁸	.....	163	i.	s.	s. eth.
3025							
3026	liq., (d) 1.4456 ²¹ ; [α] _D ¹⁵ +13.38; (d) 1.4430 ²⁰	0.915	.....	169	i.	s.	s. eth.
3027	liq., 1.44322 ^{24.4}	0.9136 ^{$\frac{24}{4}$} ; 0.912 ^{$\frac{24}{4}$}	.....	168 169	i. i.	s. s.	s. eth. s. eth.
3028	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3029	Cyclohexene*	1,2,3,4-tetrahydrobenzene....	$\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}=\text{CH}$	82.14
3030	—, 4-isopropyl-1-methyl-3-	See <i>Menthene</i> .		
3031	—, 3-isopropyl-6-methyl-2-	See <i>β-Phellandrene</i> .		
3032	—, 4-methyl-.....	1,2,3,6-tetrahydrotoluene....	$\text{CH}:\text{CHCH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2$	96.17
3033	1-Cyclohexene-1-carboxylic acid*	2,3,4,5-tetrahydrobenzoic acid	$\text{CH}_2(\text{CH}_2)_3\text{CH}:\text{C}(\text{COOH})$	126.15
3034	1-Cyclohexene-1,2-dicarboxylic acid*	Δ^1 -tetrahydrophthalic acid...	$\text{C}_6\text{H}_8(\text{COOH})_2$	170.16
3035	2-Cyclohexen-1-one, 3-hydroxy-*	See 1,3-Cyclohexanone.		
3036	Cyclohexyl acetate.	See <i>Cyclohexanol, acetate</i> .		
3037	Cyclohexylamine*	hexahydroaniline; aminocyclohexane	$\text{C}_6\text{H}_{11}\text{NH}_2$	99.17
3038	—, <i>N</i> -butyl-.....		$\text{C}_6\text{H}_{11}\text{NH}(\text{CH}_2)_3\text{CH}_3$	155.28
3039	—, <i>N</i> -ethyl-.....		$\text{C}_6\text{H}_{11}\text{NHC}_2\text{H}_5$	127.23
3040	—, cyclohexylethylthio-	thionocarbamate. See under		
3041	—, <i>N</i> -methyl-.....		$\text{C}_6\text{H}_{11}\text{NHCH}_3$	113.20
3042	Cyclohexyl benzoate.	See <i>Cyclohexanol, benzoate</i> .		
3043	Cyclohexyl bromide.	See <i>Cyclohexane, bromo-*</i> .		
3044	Cyclohexyl chloride.	See <i>Cyclohexane, chloro-*</i> .		
3045	1,3-Cyclopentadiene*		$\text{CH}:\text{CHCH}=\text{CHCH}_2$	66.10
3046	Cyclopentane*	pentamethylene.....	$\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2$	70.13
3047	—, bromo-*	cyclopentyl bromide.....	$\text{C}_5\text{H}_9\text{Br}$	149.04
3048	Cyclopentanecarboxylic acid, 3-carbamyl-1,2,2-trimethyl-.	See <i>α-Camphoric acid</i> .		
3049	—, 3-carbamyl-2, 2, 3-trimethyl-.	See <i>β-Camphoric acid</i> .		
3050	—, 1,2,2,3-tetramethyl-*	See <i>Campholic acid</i> .		
3051	1,2-Cyclopentanedicarboxylic acid*		$\text{C}_5\text{H}_8(\text{COOH})_2$	158.15
3052	1,3-Cyclopentanedicarboxylic acid*		$\text{C}_5\text{H}_8(\text{COOH})_2$	158.15
3053	—, 1,2,2-trimethyl- (cis).	See <i>Camphoric acid</i> .		
3054	—, 1,2,2-trimethyl- (trans).	See <i>Isocamphoric acid</i> .		
3055	1,3-Cyclopentanedicarboxylic anhydride*	See <i>Camphoric anhydride</i> .		
3056	Cyclopentanol*		$\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$	86.13
3057	Cyclopentanone*	ketopentamethylene; adipic ketone	$\text{COCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2$	84.11
3058	Cyclopentene*		$\text{CH}:\text{CHCH}_2\text{CH}_2\text{CH}_2$	68.11
3059	—, 2-acetyl-1,3,3,4,4-	pentamethyl-. See <i>Desosy mesityl oxide</i> .		
3060	1-Cyclopentene-1-ethylamine, 2,3,3-trimethyl-	See <i>β-Camphylamine</i> .		
3061	Cyclopentyl bromide.	See <i>Cyclopentane, bromo-*</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3029	col. liq., 1.44507 ²²	0.8102 $\frac{20}{4}$	-103.7	83	i.	s.	v. s. eth.
3030 3031 3032	liq.	0.841 $\frac{15}{4}$; 0.801 $\frac{20}{4}$	.....	102-3	i.	s.	s. eth.
3033	pl., 1.4903	1.109 $\frac{20}{4}$; 1.072 $\frac{47}{4}$	38	243	0.7 ²⁰	.....	.....
3034	monocl. leaf. f. w.	.....	120	.....	v. s.	.....	.....
3035 3036 3037	col. liq., 1.43716	0.8191 $\frac{20}{4}$ (0.8678)	.....	134	sl. s.	s.	s. eth.
3038	col. liq. ....	.....	.....	200-4	sl. s.	v. s.	v. s. eth.
3039	col. liq.	0.868 $\frac{0}{0}$	.....	164	sl. s.	∞	∞ eth.
3040	ethylthiolthiono-	.....	.....	145-7	sl. s.	v. s.	∞ eth.
3041	col. liq. ....	.....	.....	.....	.....	.....	.....
3042	.....	.....	.....	.....	.....	.....	.....
3043	.....	.....	.....	.....	.....	.....	.....
3044	.....	.....	.....	.....	.....	.....	.....
3045	col. liq., 1.4446 ¹⁹	0.80475 $\frac{19}{4}$	.....	42.5	i.	∞	∞ eth., bz.
3046	col. liq., 1.4036	0.7510 $\frac{20}{4}$	-93.3	49.5	i.	=	∞ eth.
3047	1.4875 ¹⁹	1.3692 $\frac{15}{15}$	.....	137-9	.....	.....	.....
3048	phoramic acid.	.....	.....	.....	.....	.....	.....
3049	.....	.....	.....	.....	.....	.....	.....
3050	.....	.....	.....	.....	.....	.....	.....
3051	(cis): need. f. w. (trans): warts f. w.	.....	139 161	anh. 150-60	v. s. v. s. h.	s. v. s.	..... v. sl. s. eth.; s. et. ac.; sl. s. bz., chl.
3052	(cis) pr. f. w. ....	.....	121	300 d.	v. s. h.	v. s.	v. s. eth.; s. chl., acet., h. bz.
3053	(trans) pr. f. CCl ₄	.....	88	.....	v. s. c.	.....	.....
3054	.....	.....	.....	.....	.....	.....	.....
3055	.....	.....	.....	.....	.....	.....	.....
3056	oil, 1.41530	0.9488 $\frac{20}{4}$	.....	139-40	sl. s.	s.	.....
3057	oil, 1.4366	0.9480 $\frac{20}{4}$	-58.2	130.6	sl. s.	=	∞ eth.
3058	liq., 1.4218 ¹⁸ ...	0.7743 $\frac{18}{4}$	-93.3	45-6 (44)	i.	s.	s. eth.
3059	.....	.....	.....	.....	.....	.....	.....
3060	.....	.....	.....	.....	.....	.....	.....
3061	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3062	Cyclopropane*	trimethylene.....	$\text{CH}_2\text{CH}_2\text{CH}_2$	42.08
3063	—, 1,1-dimethyl- ...	1,1-dimethyltrimethylene....	$(\text{CH}_3)_2\text{CCH}_2\text{CH}_2$...	70.13
3064	—, methyl-.....	.....	$\text{CH}_3\text{CHCH}_2\text{CH}_2$...	56.10
3065	Cyclopropanecarboxylic acid*	ethyleneacetic acid.....	$\text{CH}_2\text{CH}_2\text{CHCOOH}$	86.09
3066	1,1-Cyclopropanedicarboxylic acid.*	See <i>Vinacetic acid</i> .	$\text{C}_3\text{H}_3(\text{COOH})_2$...	174.11
3067	1,2,3-Cyclopropanetricarboxylic acid*			
3068	o-Cymene	<i>o</i> -isopropyltoluene; 2-isopropyl-1-methylbenzene	$\text{CH}_3\text{C}_6\text{H}_4\text{CH}(\text{CH}_3)_2$	134.21
3069	m-Cymene	<i>m</i> -isopropyltoluene; 3-isopropyl-1-methylbenzene; isocymene	$\text{CH}_3\text{C}_6\text{H}_4\text{CH}(\text{CH}_3)_2$	134.21
3070	p-Cymene	cymene; <i>p</i> -isopropyltoluene; 4-isopropyl-1-methylbenzene	$\text{CH}_3\text{C}_6\text{H}_4\text{CH}(\text{CH}_3)_2$	134.21
3071	—, 2-acetyl-	See <i>Acetophenone</i> , 5-isopropyl-	2-methyl-	213.12
3072	—, 2-amino-	See <i>Carvacrylamine</i> .		
3073	—, 2-bromo-	2-bromo-4-isopropyl-1-methylbenzene	$\text{CH}_3\text{C}_6\text{H}_3\text{BrC}_3\text{H}_7$...	213.12
3074	—, hexahydro-	See <i>p-Menthane</i> .	$\text{C}_{10}\text{H}_{18}\text{NO}_2$	179.21
3075	—, 2-nitro-	4-isopropyl-1-methyl-2-nitrobenzene		
3076	2-p-Cymenecarboxylic acid, 3-hydroxy-	See <i>o-Tymotic acid</i> .	$\text{HSCH}_2\text{CH}(\text{NH}_2)\text{COOH}$	121.15
3077	2,5-p-Cymenediol.	See <i>Thymohydroquinone</i> .		
3078	2-p-Cymenol.	See <i>Carvacrol</i> .	$[\text{SCH}_2\text{CH}(\text{NH}_2)\text{COOH}]_2$	240.29
3079	3-p-Cymenol.	See <i>Thymol</i> .		
3080	Cymidine.	See <i>Carvacrylamine</i> .	$[\text{SCH}_2\text{CH}(\text{NH}_2)\text{COOH}]_2$	240.29
3081	Cymophenol.	See <i>Carvacrol</i> .		
3082	2-p-Cymylamine.	See <i>Carvacrylamine</i> .	$[\text{SCH}_2\text{CH}(\text{NH}_2)\text{COOH}]_2$	240.29
3083	3-p-Cymylamine.	See <i>Thymylamine</i> .		
3084	l-Cysteine	<i>l</i> -2-amino-3-mercaptopropanoic acid*; <i>l</i> - β -mercaptoalanine	$\text{HSCH}_2\text{CH}(\text{NH}_2)\text{COOH}$	121.15
3085	dl-Cystine.....	.....	$[\text{SCH}_2\text{CH}(\text{NH}_2)\text{COOH}]_2$	240.29
3086	d-Cystine.....	.....	$[\text{SCH}_2\text{CH}(\text{NH}_2)\text{COOH}]_2$	240.29
3087	l-Cystine	<i>l</i> -3,3'-dithiobis (2-amino-propanoic acid*); <i>l</i> - β , β' -dithiodialanine; dicysteine	$[\text{SCH}_2\text{CH}(\text{NH}_2)\text{COOH}]_2$	240.29
3088	meso-Cystine.....	.....	$[\text{SCH}_2\text{CH}(\text{NH}_2)\text{COOH}]_2$	240.29
3089	Cytisine	ulexine; sophorine; baptitoxine	$\text{C}_{11}\text{H}_{14}\text{N}_2\text{O}$	190.24
3090	β-Cytisolidine.	See <i>Quinoline</i> , 6,8-dimethyl-*	$\text{OCOCH:CHC}_6\text{H}_4$ $\text{H}_2(\text{OH})_2$	178.14
3091	Dambose.	See <i>D-Inositol</i> .		
3092	Daphnetin	7,8-dihydroxycoumarin.....		
3093	Daturine.	See <i>Hyoscyamine</i> .	$\text{H}_2(\text{OH})_2$	
3094	dl-Daturine.	See <i>Atropine</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3062	col. gas.....	0.720 ⁻⁷⁹	-126.6	-34.4	i.	v. s.	v. s. eth.
3063	1.366.....	0.6604	.....	21	i.	s.	s. eth., H ₂ SO ₄
3064	col. gas.....	0.691 ⁻²⁰	.....	5	sl. s.	v. s.	v. s. eth.
3065	1.43901 ²⁰	1.0885 ²⁰ ₄	18-19	182-4 (181)	sl. s.	s.	s. eth.
3066							
3067	col. cr.....	.....	220	.....	s.	s.	.....
3068	col. liq., 1.50206 ^{15.15}	0.876 ²⁰ ₄	-73.5	175 (175-8)	i.	s.	s. eth., chl.
3069	col. liq., 1.49385 ^{17.05}	0.8696 ²⁰ ₄	<-25	175.7	i.	s.	s. eth., chl.
3070	col. liq., ^{15.0} 1.49474	0.8570 ²⁰ ₄	-73.5 (-68.9)	176	i.	v. s.	s. eth., chl.
3071							
3072							
3073	liq.....	1.269 ¹⁷ ₄	.....	233-5	i.	v. s.	s. eth.
3074							
3075	aromatic oil, 1.53093 ²⁰	1.0774 ²⁰ ₄	.....	130-5 ¹⁵	i.	v. s.	v s eth.
3076							
3077							
3078							
3079							
3080							
3081							
3082							
3083							
3084	cr. powd.....	.....	.....	.....	v. s.	.....	s. ac. a., NH ₄ OH
3085	need.....	.....	260 (225-7)	.....	0.006 ²⁵	.....	.....
3086	wh. hex. pl....	.....	247-9	.....	0.011 ²⁵	i.	s. min. a., alk.
3087	hex. pl. f. dil. HCl, 1.700, 1.640, [α] -206 ²⁰ in dil. HCl ^D	.....	258-61 d.	.....	0.011 ²⁵ , 0.052 ⁷⁵	i.	i. eth., chl., bz.; s. min. a., caustic alk., NH ₄ OH
3088	.....	.....	.....	.....	0.006 ²⁵	.....	.....
3089	col. lg. rhomb. cr. [α]-119.1 ⁰¹⁷ _D in w.	.....	152-3	.....	78 ¹⁶	30.1 ⁸	i. eth., CS ₂ , CCl ₄ ; s. chl., bz.
3090							
3091							
3092	pa. yel. need..	.....	256	.....	v. s. h.	s. h. dil.	v. sl. s. eth.; i. chl., bz.
3093							
3094							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3094M	1,3-Decadiene*.....	.....	$(\text{CH}_3)(\text{CH}_2)_5\text{CH}:\text{CHCH}:\text{CH}_2$	138.25
3095	"Decalin".	See <i>Naphthalene, decahydro*</i> .		
3096	Decamethylene glycol.	See 1,10-Decanediol*.		
3097	Decanal* .	See <i>Capraldehyde</i> .		
3098	Decanamide* .	See <i>Capramide</i> .		
3099	Decane*	<i>n</i> -decane.....	$\text{CH}_3(\text{CH}_2)_8\text{CH}_3$	142.28
3100	—, 1-amino- .	See <i>Decylamine*</i> .		
3101	—, 1-iodo*	<i>prim-n</i> -decyl iodide.....	$\text{CH}_3(\text{CH}_2)_9\text{I}$	268.19
3102	Decanedioic acid* .	See <i>Sebacic acid</i> .		
3103	1,10-Decanediol*	decamethylene glycol.....	$\text{CH}_2\text{OH}(\text{CH}_2)_8\text{CH}_2\text{OH}$	174.28
3104	Decanenitrile* .	See <i>Caprinitrile</i> .		
3105	Decanoic acid* .	See <i>Capric acid</i> .		
3106	Decanoic anhydride* .	See <i>Capric anhydride</i> .		
3107	1-Decanol*	<i>n</i> -decyl alcohol; nonylcarbinol	$\text{CH}_3(\text{CH}_2)_8\text{CH}_2\text{OH}$	158.28
3108	—, acetate.....	<i>n</i> -decyl acetate.....	$\text{CH}_3\text{COO}(\text{CH}_2)_9\text{CH}_3$	200.31
3109	—, nitrate.....	<i>n</i> -decyl nitrate.....	$\text{CH}_3(\text{CH}_2)_9\text{ONO}_2$...	203.28
3110	—, nitrite.....	<i>n</i> -decyl nitrite.....	$\text{CH}_3(\text{CH}_2)_9\text{ONO}$...	187.28
3111	—, sulfate.....	.....	$[\text{CH}_3(\text{CH}_2)_9]_2\text{SO}_4$...	378.60
3112	4-Decanol*	hexylpropylcarbinol; <i>sec</i> -decyl alcohol.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{OH})(\text{CH}_2)_5\text{CH}_3$	158.28
3113	2-Decanone*	methyl octyl ketone.....	$\text{CH}_3\text{COC}_8\text{H}_{17}$	156.26
3114	3-Decanone*	ethyl heptyl ketone.....	$\text{C}_2\text{H}_5\text{CO}(\text{CH}_2)_6\text{CH}_3$	156.26
3115	4-Decanone*	hexyl propyl ketone.....	$\text{CH}_3(\text{CH}_2)_2\text{CO}(\text{CH}_2)_5\text{CH}_3$	156.26
3116	Decanoyl chloride* .	See <i>Capryl chloride</i> .		
3117	1-Decene*	<i>n</i> -decylene.....	$\text{CH}_2:\text{CH}(\text{CH}_2)_7\text{CH}_3$	140.26
3118	Decine.	See <i>Decyne*</i> .		
3119	<i>n</i>-Decoic acid.	See <i>Capric acid</i> .		
3120	<i>n</i>-Decyl alcohol.	See 1-Decanol*.		
3121	<i>sec</i>-Decyl alcohol.	See 4-Decanol*.		
3122	<i>tert</i>-Decyl alcohol.	See 4-Heptanol, 4-propyl-*; 3-Octanol, 3-ethyl*.		
3123	<i>n</i>-Decyl aldehyde.	See <i>Capraldehyde</i> .		
3124	<i>n</i>-Decylamide.	See <i>Capramide</i> .		
3125	Decylamine*(<i>n</i>)	1-aminodecane.....	$\text{CH}_3(\text{CH}_2)_9\text{NH}_2$...	157.29
3126	<i>n</i>-Decylene.	See 1-Decene*.		
3127	<i>n</i>-Decyl esters.	See under 1-Decanol.		
3128	<i>n</i>-Decylic acid.	See <i>Capric acid</i> .		
3129	<i>n</i>-Decylic amide.	See <i>Capramide</i> .		
3130	<i>n</i>-Decylic anhydride.	See <i>Capric anhydride</i> .		
3131	<i>prim-n</i>-Decyl iodide.	See <i>Decane, 1-iodo*</i> .		
3131	1-Decyne*	1-decine; <i>n</i> -octylacetylene...	$\text{CH}:\text{C}(\text{CH}_2)_7\text{CH}_3$...	138.25
3131H	5-Decyne*	5-decine; dibutylacetylene...	$\text{C}_4\text{H}_9\text{C}:\text{C}:\text{C}_4\text{H}_9$...	138.25
3132	Dehydroacetic acid ...	3-acetyl-6-methyl-2,4-pyran-dione	$\text{OCOCH}(\text{COCH}_3)-\text{COCH}:\text{C}(\text{CH}_3)$	168.14
3133	Dehydromucic acid ...	2,5-furandicarboxylic acid...	$\text{C}_4\text{H}_2\text{O}(\text{COOH})_2$...	156.09
3134	—, dimethyl ester.....	.....	$\text{C}_4\text{H}_2\text{O}(\text{COOCH}_3)_2$	184.14
3135	—, tetrahydro-3, 4-di hydroxy-.	See <i>Isosaccharic acid</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3094M	liq.	0.750 ²⁰	.....	168-70	.....	.....	.....
3095							
3096							
3097							
3098							
3099	col. liq., 1.41203	0.73014 ²⁰ ₄	-39 to -32	174	i.	∞	∞ eth.
3100							
3101	liq., 1.48269...	1.2567 ²⁰ ₄	.....	132 ¹⁵	.....	.....	.....
3102							
3103	.....	.....	71.5	179 ¹¹	v. sl. s.	s.	i. eth.
3104							
3105							
3106							
3107	col. visc. liq., 1.43682 ²⁰	0.8292 ²⁰ ₄	-6	231	i.	s.	∞ eth.
3108	col. liq. ....	.....	-15.05	191.5; 125 ¹⁵	i.	s.	s. eth., bz.
3109	liq.	0.951 ⁰ ₄	.....	127-8 ¹¹	.....	.....	.....
3110	liq. ....	.....		105-8 ¹²	.....	.....	.....
3111	.....	.....	37.6-37.8	.....	.....	.....	.....
3112	thk. col. oil. .	0.826 ²⁰ ₄	.....	210-1	i.	s.	.....
3113	liq. or need., 1.4263 ²²	0.825	14 (2.5)	211	i.	s.	s. eth.
3114	liq. ....	.....	.....	211	.....	s.	s. eth.
3115	col. liq.	0.824 ²⁰ ₄	-9	207	v. sl. s.	∞	∞ eth.
3116							
3117	col. liq., 1.4385 ¹⁷	0.763 ⁰ ₄	-87	172	i.	∞	∞ eth.
3118							
3119							
3120							
3121							
3122							
3123							
3124							
3125	col. liq. or leaf.	0.951 ⁰ ₄	17	220.5	sl. s.	s.	s. eth.
3126							
3127							
3128							
3129							
3130							
3131	col. liq.	0.791	-40	80-2 ³²	i.	s.	s. eth.
3131H	col. liq., 1.4311	0.7673 ²⁵	.....	78.8 ²⁵ ; 116 ¹¹⁵	i.	s.	s. eth.
3132	rhomb. need. or pl.	.....	109	270	1 ⁶	s. h.	s. eth.
3133	pl. f. h. al.; need. f. w.	.....	>320	.....	i. c.	.....	.....
3134	need. f. w. ....	.....	109-10	154-6 ¹⁵	i. c.	s.	∞ eth.
3135							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3136	Dehydromucyl chlorid	e 2,5-furandicarboxyl chloride.	$C_4H_2O(COCl)_2$...	192.99
3137	Delphinine		$C_{34}H_{47}NO_9$	613.73
3138	Derritol		$C_{21}H_{22}O_6$	370.39
3139	Desoxalic acid	1,2-dihydroxy-1,1,2-ethane- tricarboxylic acid	$(COOH)CH(OH)-$ $C(OH)(COOH)_2$	194.10
3140	Desoxybenzoin	α -phenylacetophenone; ben- zyl phenyl ketone	$C_6H_5CH_2COC_6H_5$..	196.24
3141	—, α, α' -benzalbis-	See <i>Benzamarone</i> ; <i>Isobenzama</i>	<i>rone</i> .	
3142	Desoxymesityl oxide ..	2-acetyl-1,3,3,4,4-penta- methylcyclopentene	$C_{12}H_{20}O$	180.28
3143	Dextrin	starch gum; British gum; amylin; gommelin	$(C_6H_{10}O_5)_x$	(162- 14) $_x$
3144	Dextronic acid .	See <i>D-Gluconic acid</i> .		
3145	Dextrose .	See <i>D-Glucose</i> .		
3146	Di- . For dibromo, diethyl, e	tc. derivatives see the parent c	ompounds (e.g., <i>Acetic</i>	
3146	Diacetamide		$(CH_3CO)_2NH$	101.10
3147	—, <i>N</i> -phenyl-	See <i>Diacetanilide</i> .		
3148	Diacetanilide	<i>N</i> -phenyldiacetamide; <i>N,N</i> - diacetylaniline	$(CH_3CO)_2NC_6H_5$..	177.20
3149	—, <i>p</i> -ethoxy-	<i>N,N</i> -diacetyl- <i>p</i> -phenetidine..	$(CH_3CO)_2NC_6H_4-$ OC_2H_5	221.25
3150	Diacetin .	See <i>Glycerol</i> , <i>diacetate</i> .		
3151	Diacetoacetic acid , ethyl ester	ethyl 2-acetyl-3-oxobutano- ate*; ethyl α -acetylaceto- acetate	$(CH_3CO)_2CH-$ $COOC_2H_5$	172.18
3152	Diacetone alcohol .	See <i>2-Pentanone</i> , <i>4-hydroxy-4-</i>	<i>methyl</i> .*.	
3153	Diacetonealkamine, b	<i>enzoylvinyl</i> -. See <i>β-Eucat</i>	<i>ne</i> .	
3154	Diacetosuccinic acid , diethyl ester	diethyl 2,3-diacetylbutane- dioate*; ethyl α, β -diacetyl- succinate	$(CH_3COCHCOO-$ $C_2H_5)_2$	258.27
3155	Diacetyl .	See <i>2,3-Butanedione</i> *.		
3156	Diacetyl dioxime .	See <i>Glyoxime</i> , <i>dimethyl</i> -. See <i>Acetyl peroxide</i> .		
3157	Diacetyl peroxide .	See <i>Barbituric acid</i> , <i>5,5-diallyl</i> -. See <i>1,5-Hexadiene</i> *.		
3158	Dial .			
3159	Diallyl .	See <i>1,5-Hexadiene</i> *.		
3160	Diallylamine	di-2-propenylamine*.....	$(CH_2:CHCH_2)_2NH$	97.16
3161	Diallyl sulfide .	See <i>Allyl sulfide</i> .		
3162	Dialuramide .	See <i>Uramil</i> .		
3163	Dialuric acid	5-hydroxybarbituric acid; tartronylurea	$NHCONHCO-$ $CHOHCO$	144.09
3164	Diamino- . See the parent	compounds (e.g., for diaminop	henol see <i>Phenol</i> , <i>diamino</i> ;	
3164	Diamylamine	di- <i>n</i> -amylamine.....	$[CH_3(CH_2)_4]_2NH$..	157.29
3165	Diamyl ketone .	See <i>6-Hendecanone</i> *.		
3166	Di-<i>n</i>-amyl sulfate .	See <i>Amyl sulfate</i> .		
3167	Diarsenic tetramethyl .	See <i>Cacodyl</i> .		
3168	1,2-Diazine .	See <i>Pyridazine</i> .		
3169	1,3-Diazine .	See <i>Pyrimidine</i> .		
3170	1,4-Diazine .	See <i>Pyrazine</i> .		
3171	Diazoacetic acid , ethyl es	ter. See under <i>Acetic acid</i> , <i>diaz</i> o-		
3172	Diazoaminobenzene * ..	1,3-diphenyltriazene*; ben- zenediazoanilide	$C_6H_5N:NNHC_6H_5$	197.23
3173	—, (isomeric form).....		$C_6H_5N:NNHC_6H_5$	197.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3136	yel. pl. ....	.....	80	ca. 245	v. s.	.....	v. s. eth.
3137	rhomb. pl. ....	.....	191 d.	.....	0.002 ²⁰	4.8 ²⁰	9 ²⁰ eth.; v. s. chl.
3138	yel. need. f. ....	.....	161	.....	.....	.....	.....
3139	me. al. ....	.....	.....	d. 50	v. s.	v. s.	sl. s. eth.
3140	hyg. cr. ....	.....	.....	.....	.....	.....	.....
3140	wh. pl. f. al. ....	.....	60 (55-6)	322	sl. s. h.	s.	s. eth.
3141	.....	.....	.....	.....	.....	.....	.....
3142	liq. ....	.....	.....	218-20	i.	.....	.....
3143	col. amor., [α] gen. >+200°D	1.0384 ²⁰ / ₄	d.	.....	s.	i.	i. eth.
3144	.....	.....	.....	.....	.....	.....	.....
3145	acid, dibromo-; Benzene, diethyl-.	.....	.....	.....	.....	.....	.....
3146	col. need. f. eth.	.....	78	223.5	s.	s.	s. eth., lgr.
3147	.....	.....	.....	.....	.....	.....	.....
3148	col. pl. f. lgr. ....	.....	37-8	142 ¹¹	s.	s.	s. bz., lgr., tol.
3149	col. need. f. lgr. ....	.....	53.5-54 (55-56)	182 ¹²	0.25	v. s.	v. sl. s. eth.
3150	.....	.....	.....	.....	.....	.....	.....
3151	col. liq., 1.46950 ^{18.3}	1.104 ¹⁵ / ₄ ; 1.089 ²⁵ / ₂₅	.....	211 sl. d.	sl. s.	v. s.	v. s. eth.
3152	.....	.....	.....	.....	.....	.....	.....
3153	.....	.....	.....	.....	.....	.....	.....
3154	α ₁ oil. ....	.....	.....	.....	v. sl. s.	s.	s. eth.; 10 lgr.
3155	α ₂ cr. ....	.....	20-2	.....	.....	v. s.	v. s. eth.
3156	α ₃ pr. ....	.....	31-2	.....	i.	v. s.	v. s. eth.
3157	.....	.....	.....	.....	.....	.....	.....
3158	.....	.....	.....	.....	.....	.....	.....
3159	.....	.....	.....	.....	.....	.....	.....
3160	liq. ....	.....	.....	111-2	.....	.....	.....
3161	.....	.....	.....	.....	.....	.....	.....
3162	.....	.....	.....	.....	.....	.....	.....
3163	col. tetr. ....	.....	214-5 d.	.....	sl. s.	.....	.....
3164	for diamionaphthalene see	thalene see	Naphthalene	diamine).	.....	.....	.....
3165	col. liq. ....	.....	.....	202-3 ⁷⁴⁵	v. sl. s.	v. s.	∞ eth.
3166	.....	.....	.....	.....	.....	.....	.....
3167	.....	.....	.....	.....	.....	.....	.....
3168	.....	.....	.....	.....	.....	.....	.....
3169	.....	.....	.....	.....	.....	.....	.....
3170	.....	.....	.....	.....	.....	.....	.....
3171	.....	.....	.....	.....	.....	.....	.....
3172	(1) golden-yel. leaf. or pr. f. al. ....	.....	98-9	d. w. sl. exp.	i.	s. h.	s. eth., bz.
3173	(2) yel. pr. ....	.....	80-1	.....	.....	.....	.....
3173	yel. pr. ....	.....	80-1	exp.	i.	s. h.	s. eth., bz., lgr.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3174	Diazoaminobenzene, 4,4'-dinitro-*	1,3-bis(<i>p</i> -nitrophenyl)triazene*	$\text{NO}_2\text{C}_6\text{H}_4\text{NNN-HC}_6\text{H}_4\text{NO}_2$	287.23
3175	—, 4-methyl-	See Triazene-1-phenyl-3- <i>p</i> -tolyl-		
3176	1,1'-Diazoaminonaphthalene*	1,3-di-1-naphthyltriazene*	$\text{C}_{10}\text{H}_7\text{N:NNH-C}_{10}\text{H}_7$	297.35
3177	2,2'-Diazoaminonaphthalene*	1,3-di-2-naphthyltriazene*	$\text{C}_{10}\text{H}_7\text{N:NNH-C}_{10}\text{H}_7$	297.35
3178	Diazobenzene chloride	, etc. See Benzenediazonium chloride*, etc.		
3179	Diazobenzene imide	See Benzene, triazo-		
3180	Diazobenzene perbromide	See Benzenediazonium tribromide*.		
3181	Diazobenzolic acid	See Aniline, <i>N</i> -nitro-		
3182	1,2-Diazole	See Pyrazole.		
3183	Diazomethane	See Methane, diazo-		
3184	Dibenzanthracene		$\text{C}_{22}\text{H}_{14}$	278.33
3185	Dibenzo- <i>p</i> -dithiin	See Thianthrene.		
3186	Dibenzofuran	diphenylene oxide; biphenylene oxide	$\text{C}_6\text{H}_4\text{OC}_6\text{H}_4$	168.18
3187	—, 3-amino-		$\text{C}_{12}\text{H}_7\text{O-NH}_2$	183.20
3188	—, 2-bromo-		$\text{C}_{12}\text{H}_7\text{BrO}$	247.09
3189	—, 3-nitro-		$\text{O}_2\text{NC}_{12}\text{H}_7\text{O}$	213.18
3190	2-Dibenzofurancarboxylic acid		$\text{C}_{12}\text{H}_7\text{O-COOH}$	212.19
3191	Dibenzo(<i>a, i</i>)phenanthrene	See Picene.		
3192	Dibenzo-1,4-pyran	See Xanthene.		
3193	Dibenzopyrrole	See Carbazole.		
3194	Dibenzothiophene-2,7-diamine	9-dioxide. See Benzidine sulfone.		
3195	Dibenzoyl	See Benzil.		
3196	Dibenzyl	See Bibenzyl.		
3197	Dibenzylamine*		$(\text{C}_6\text{H}_5\text{CH}_2)_2\text{NH}$	197.27
3198	—, dibenzylthiolthionocarbamate	See under Carbamic acid, dibenzylthiolthionocarbamate.		
3199	—, <i>N</i> -phenyl-	<i>N, N</i> -dibenzylaniline	$(\text{C}_6\text{H}_5\text{CH}_2)_2\text{N-C}_6\text{H}_5$	273.36
3200	Dibenzyl disulfide	See Benzyl disulfide.		
3201	Dibromo-	See the parent compounds (e.g., for dibromobenzene see Benzene, dibromo-).		
3202	β -Dibromohydrin	See 1-Propanol, 2,3-dibromo-		
3203	Dibutylamine*	di- <i>n</i> -butylamine	$(\text{C}_4\text{H}_9)_2\text{NH}$	129.24
3204	—, <i>N</i> -phenyl-	See Aniline, <i>N, N</i> -dibutyl-		
3205	Di- <i>n</i> -butyl sulfate	See Butyl sulfate.		
3206	Dichloro-	See the parent compounds (e.g., for dichlorobenzene see Benzene, dichloro-).		
3207	α -Dichlorohydrin	See 2-Propanol, 1,3-dichloro-*		
3208	β -Dichlorohydrin	See 1-Propanol, 2,3-dichloro-*		
3209	Dichloronitrohydrin	See 2-Propanol, 1,3-dichloro-, nitrate*.		
3210	Dicyan(o)diamide	See Guanidine, 1-cyano-		
3211	Dicyan(o)diamidine	See Urea, guanyl-		
3212	Dicyclohexylamine*		$(\text{C}_6\text{H}_{11})_2\text{NH}$	181.31
3213M	Dicyclopentadiene		$\text{C}_{10}\text{H}_{12}$	132.20
3214	Dicysteine	See <i>l</i> -Cystine.		
3215	Di- <i>n</i> -decyl sulfate	See 1-Decanol, sulfate.		
3216	Di- <i>n</i> -dodecyl sulfate	See Dodecyl sulfate.		
3217	Diethanolamine	diethylolamine; 2,2'-iminoethanol; β, β' -dihydroxydiethylamine; iminoethyl alcohol (incorrect)	$\text{HN}(\text{CH}_2\text{CH}_2\text{OH})_2$	105.14
3218	Diethyl	For diethyl derivatives see the parent compounds (e.g., for diethylbenzene see		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3174	yel. cr.	233 d. (224-6)	i.	v. sl. s. h.	s. eth.
3175	yel. leaf. f. al.	exp.
3176							
3177	red need. f. xylene	156
3178	or. tab. f. bz. or brnsh. need. f. ac. a.	267.5	i.	i.	i. eth., ac. a., c. bz.
3179							
3180							
3181							
3182							
3183							
3184							
3185	col. leaf. f. al., bl. fluor.	87	288	i.	sl. s.	v. s. eth.; s. bz.
3186							
3187	need.	99-99.5	i.	v. s. h.	v. s. eth.
3188	leaf.	110	220 ⁴⁰	i.	s. h.	s. eth.
3189	yel. need.	181-3	i.	sl. s.	sl. s. eth.; s. h. glac. ac. a.
3190	amor.	246-7	v. sl. s.	s. h.	s. eth.
3191	col. liq., 1.5743 ²²	1.026 ²²	-26	300 (268 -71 ²⁵⁰)	i.	v. s.	v. s. eth.
3192							
3193							
3194							
3195							
3196							
3197	need. or pr. f. al., 1.60647 ⁸⁰	1.04436 ⁸⁰ / ₄	71-2 (69.5)	>300 d.	i.	sl. s.	s. eth., bz.
3200	col. liq.	0.767 ²⁰ / ₄	159-61	s.	v. s.	v. s. eth.
3201							
3202							
3203							
3204							
3205	pa. yelsh. cr. or powd.	83	sl. s.	s.	s. eth., bz., chl., CCl ₄ , ac. a.
3206	col. liq.	254-6 ⁷⁴⁵	sl. s.	v. s.	∞ eth.
3207							
3208							
3209							
3210							
3211	col. cr.	0.976 ³⁵	32.9	170 sl. d.	v. s.	v. s. eth.
3211M	liq. or col. pr., 1.4776 ²⁰	1.0966 ²⁰ / ₄	28	268	∞	∞	v. sl. s. eth., sl. s. bz.
3212							
3213							
3214							
3215	Benzene, diethyl -). For die thyl esters of organic acids see the acids.						

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3216	Diethylamine*		$(C_2H_5)_2NH$	73.14
3217	—, diethylthiolthionocarbamate. See under Carbamic acid, diethylthiolthionocarbamate.			
3218	—, hydrochloride.....	diethylammonium chloride*..	$(C_2H_5)_2NH \cdot HCl$...	109.60
3219	—, N-cyano-	See Cyanamide, diethyl-.		
3219M	—, 2,2'-diamino-	See Diethylenetriamine.		
3220	—, β, β'-dihydroxy-	See Diethanolamine.		
3221	—, β, β'-dihydroxy-N-methyl-	See Ethanol, 2,2'-methyliminodi-.		
3222	—, N-formyl-	See Formamide, N,N-diethyl-.		
3223	—, β-hydroxy-	See Ethanol, 2-ethylamino-*		
3224	—, N-methyl-		$(C_2H_5)_2NCH_3$	87.16
3225	—, N-nitro-	diethylnitramine; nitric diethylamide	$(C_2H_5)_2NNO_2$	118.14
3226	—, N-nitroso-	diethylnitrosamine; nitrous diethylamide	$(C_2H_5)_2NNO$	102.14
3227	—, N-phenyl-	See Aniline, N,N-diethyl-.		
3228	Diethylenediamine.	See Piperazine.		
3229	Diethylene dioxide.	See <i>p</i> -Dioxane.		
3230	Diethylene disulfide.	See <i>p</i> -Dithiane.		
3231	Diethylene glycol.	2,2'-oxydiethanol; 2,2'-dihydroxyethyl ether	$O(CH_2CH_2OH)_2$...	106.12
3232	—, diethyl ether.	See Ether, bis (β -ethoxyethyl).		
3233	—, dioleate.....		$(C_{17}H_{33}COOC_2H_5)_2O$	635.00
3234	—, distearate.....	glycoesterin.....	$(C_{17}H_{35}COOC_2H_5)_2O$	639.03
3235	—, monobutyl ether.....	2-(β -butoxyethoxy)ethanol*; butyl "Carbitol"	$C_4H_9OCH_2CH_2OCH_2CH_2OH$	162.23
3236	—, monobutyl ether acetate		$C_4H_9O(CH_2)_2O(CH_2)_2OOCCH_3$	204.26
3237	—, monoethyl ether.....	2-(β -ethoxyethoxy)ethanol*; "Carbitol"	$C_2H_5OCH_2CH_2OCH_2CH_2OH$	134.17
3238	—, monoethyl ether acetate		$C_2H_5O(CH_2)_2O(CH_2)_2OOCCH_3$	176.21
3238M	—, monolaurate.....	"Glaurin".....	$C_{11}H_{23}COOC_2H_4OC_2H_4OH$	288.42
3239	—, monomethyl ether.....	2-(β -methoxyethoxy)ethanol*; methyl "Carbitol"	$CH_3OCH_2CH_2OCH_2CH_2OH$	120.15
3240	Diethylene oxide 2-iminoethyl alcohol. See 4-Morpholinethanol.			
3240M	Diethylenetriamine. ...	2,2'-diaminodiethylamine....	$(NH_2C_2H_4)_2NH$...	103.17
3241	Diethylenimide oxide.	See Morpholine.		
3242	Diethyl ether.	See Ethyl ether.		
3242H	Diethyl formal.	See Methane, diethoxy-.		
3242R	Diethylolamine.	See Diethanolamine.		
3243	Diethylphosphoric acid	diethyl hydrogen phosphate..	$PO(OC_2H_5)_2OH$...	154.11
3244	Diethyl sulfate.	See Ethyl sulfate.		
3245	Diethyl sulfite.	See Ethyl sulfite.		
3246	Difurfurylamine.	α, α' -di-2-furyldimethylamine	$(C_4H_5OCH_2)_2NH$..	177.20
3247	m-Digallic acid.	gallic acid 3-monogallate....	$C_{14}H_{10}O_9$	322.22
3249	Diglycolamidic acid.	See Acetic acid, iminodi-.		
3250	Diglycolic acid.	oxydiethanoic acid*; oxydiacetic acid	$O(CH_2COOH)_2$	134.09
3251	Diglycolide.	See Glycolide.		
3252	Diglycolyl diamide.	See Glycine anhydride.		
3253	Diguanide.	See Biguanide.		
3254	Di-n-heptyl sulfate.	See Heptyl sulfate.		
3255	Di-n-hexadecyl sulfate.	See Cetyl sulfate.		
3256	Dihexyl.	See Dodecane*.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3216	col. inflam. liq., 1.38730 ¹⁸	.7108 ¹⁸ / ₄	-50 (-39)	55.5	81.5 ¹⁴⁴	s.	s. eth.
3217							
3218	leaf. f. et. al...	1.048 ²¹ / ₄	219-20	330	232 ²⁵	sl. s. c.	i. eth.
3219M							
3220							
3221							
3222							
3223							
3224	col. liq. ....	.....	.....	63-5	v. s.	s.	s. eth.
3225	liq. ....	.....	.....	206 ⁷⁵⁷	sl. s.	∞	∞ eth.
3226	yel. liq., 1.43864 ^{19,9}	0.9422 ²⁰ / ₄	.....	177 (175.4)	s.	∞	∞ eth.
3227							
3228							
3229							
3230							
3231	col. liq.	1.132 ⁹ ; 1.1177 ²⁰	-10.45 (-6.5)	244.5 (245-50)	s.	s.	s. eth.
3232							
3233	pa. yel. liq.	0.9310 ²⁰ / ₄	.....	.....	disper- sible	∞	∞ eth.
3234	wh. wax-like solid	0.9333 ²⁰ / ₄	54-5	.....	disper- sible	i.	i. eth.
3235	col. liq.	0.9553 ²⁰ / ₄	.....	231.2	∞	v. s.	v. s. eth.
3236	col. liq.	0.985 ²⁰ / ₄	.....	245	.....	.....	.....
3237	col. liq.	0.9902 ²⁰ / ₄	.....	201.9	∞	v. s.	s. eth.
3238	col. liq.	1.009 ²⁰ / ₄	.....	218	∞	.....	.....
3238M	straw-colored oily liq.	0.960 ²⁵ / ₂₅	17-18	>270	i.	s.	s. eth.
3239	col. liq., 1.4264 ²⁷	1.0354 ²⁰ / ₄	.....	193.2	∞	.....	.....
3240							
3240M	col.-yel. liq.	0.9586 ²⁰ / ₃₀	.....	207.1	∞	s.	i. eth.
3241							
3242							
3242H							
3242R							
3243	liq.	1.175	.....	203.3	i.	.....	.....
3244							
3245							
3246	col. liq. ....	.....	.....	102-3 ¹	i.	.....	s. eth.
3247	need. (+1H ₂ O) f. al. + w.	.....	268-70 d.	.....	.....	.....	.....
3249							
3250	rhomb. or monocl. pr. (+1H ₂ O) f. w.	.....	148	d.	s.	s.	s. eth.
3251							
3252							
3253							
3254							
3255							
3256							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3257	Di-<i>n</i>-hexyl sulfate. Dihydro- . See the parent compounds (e.g., for dihydronapthalene see <i>Naphthalene</i> , Dihydroxy- . See the parent compounds (e.g., for dihydroxyanthraquinone, see	See <i>Hexyl sulfate</i> .		
3258	Diimide, dinaphthyl- .	See <i>Azonaphthalene</i> .		
3259	—, diphenyl- .	See <i>Azobenzene</i> .		
3260	—, dixenyl- .	See <i>Azobiphenyl</i> .		
3261	—, ethylphenyl- .	See <i>Benzeneazothane</i> .		
3262	—, methylphenyl- .	See <i>Benzeneazomethane</i> .		
3263	—, α-naphthyl-β-naphthyl- . See 1,2'-Azonaphthalene.	bis (1,2'-Azonaphthalenyl-). See 1,2'-Azonaphthalenyl-.		
3264	Diisoamylamine	bis (γ -methylbutyl)amine*	$[(CH_3)_2CHCH_2-CH_2]_2NH$	157.29
3265	Diisoamyl sulfate.	See <i>Isoamyl sulfate</i> .		
3266	Diisoamyl sulfide.	See <i>Isoamyl sulfide</i> .		
3267	Diisobutylamine	bis (β -methylpropyl)amine*	$[(CH_3)_2CHCH_2]_2NH$	129.24
3268	Diisobutylene		$(CH_3)_2C:CHC-(CH_3)_3$	112.21
3269	Diisobutyl sulfate.	See <i>Isobutyl sulfate</i> .		
3270	Diisocrotyl.	See 2,4-Hexadiene, 2,5-dimethyl-.		
3271	Diisopropylamine*		$[(CH_3)_2CH]_2NH$	101.19
3272	—, <i>N</i>-nitroso-	diisopropylnitrosamine; nitrous diisopropylamide	$[(CH_3)_2CH]_2NNO$	130.19
3273	Diketone, dimethyl.	See 2,3-Butanedione*.		
3274	—, diphenyl.	See <i>Benzil</i> .		
3275	α, γ-Dilaurin.	See <i>Glycerol, 1,3-dilaurate</i> .		
	Dimethyl. For dimethyl derivatives see the parent compounds (e.g., for dimethyl-)			
3276	Dimethylamine*		$(CH_3)_2NH$	45.08
3277	—, dimethylthiothionocarbamate. See under Carbamic acid.			
3278	—, hydrochloride	dimethylammonium chloride*	$(CH_3)_2NH \cdot HCl$	81.55
3279	—, α, α'-dicyano- .	See <i>Acetonitrile, iminodimethyl-</i> .		
3280	—, α, α'-di-2-furyl- .	See <i>Difurfurylamine</i> .		
3281	—, <i>N</i>-nitro-	dimethylnitramine; nitric dimethylamide	$(CH_3)_2NNO_2$	90.08
3282	—, <i>N</i>-nitroso-	dimethylnitrosamine; nitrous dimethylamide	$(CH_3)_2NNO$	74.08
3283	Dimethylarsenic monochloride. See <i>Cacodyl chloride</i> .			
3284	Dimethylenimine.	See <i>Ethylenimine</i> .		
3284M	α, α-Dimethylpropyl.	See <i>tert-Butyl</i> .		
3285	Dimethyl sulfate.	See <i>Methyl sulfate</i> .		
3286	Dimethyl sulfite.	See <i>Methyl sulfite</i> .		
3287	1,2,7,8-Dinaphthantracene. See <i>Dibenzanthracene</i> .			
3288	α-Dinaphthol.	See 4,4'-Bi-1-naphthol.		
3289	Dinaphthyl.	See <i>Binaphthyl</i> .		
3290	Di-2-naphthylamine*		$C_{10}H_7NHC_{10}H_7$	269.33
3291	Dinicotinic acid	3,5-pyridinedicarboxylic acid*	$C_5H_3N(COOH)_2$	167.12
3292	Dinitro- . See the parent compounds (e.g., for dinitrobenzene see <i>Benzene, dinitro-</i>).			
3292M	Di-<i>n</i>-nonyl sulfate.	See <i>Nonyl sulfate</i> .		
3293	Diocadecylamine*(<i>n</i>).		$[CH_3(CH_2)_{17}]_2NH$	521.98
3294	Di-<i>n</i>-octadecyl sulfate.	See <i>Octadecyl sulfate</i> .		
3294	Di-<i>n</i>-octyl sulfate.	See <i>Octyl sulfate</i> .		
3295	Dionin.	See <i>Morphine, ethyl-, hydrochloride</i> .		
3296	<i>m</i>-Dioxane	1,3-dioxane; trimethylene glycol methylene ether; trimethylene methylene dioxide	$OCH_2OCH_2CH_2CH_2$	88.10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3257	<i>dihydro-</i>) <i>Anthraquinone</i> ,	<i>dihydroxy-</i> ; f	or dihydroxy	naphthalene	see <i>Naph</i>	<i>thalenedi</i>	<i>ol.</i>)
3258							
3259							
3260							
3261							
3262							
3263							
3264	col. liq., 1.42289 ²¹	0.7672 $\frac{21}{4}$	-44	190 (185-8)	sl. s. (i.)	s.	∞ eth.
3265							
3266							
3267	col. liq., 1.40934	0.7450 $\frac{20}{4}$	-70; frz. -77	139-40	v. sl. s.	s.	s. eth.
3268	col. liq.	0.715 $\frac{15}{4}$	.....	102.6	.....	.....	.....
3269							
3270							
3271	col. liq.	0.722 $\frac{22}{0}$	.....	83-4	sl. s.	.....	.....
3272	cr. f. eth.	.....	46	194.5	v. sl. s.	v. s.	s. eth., bz.
3273							
3274							
3275	benzoic acid see	<i>Benzoic acid</i> ,	<i>dimethyl-</i>).F	or dimethyl	esters of o	rganic ac	ids see the acids.
3276	col. liq. or gas, liq. 1.350 ¹⁷	0.6804 $\frac{0}{4}$	-96.0	7.4	v. s.	s.	s. eth.
3277							
3278	need. f. al. ....	.....	171	.....	369 ²⁵	v. s.	i. eth.; 25.16 ²⁷ chl.
3279							
3280							
3281	.....	.....	57-8	187	s.	s.	s. eth.
3282	yel. oily liq., 1.43743 ¹⁸	1.0049 $\frac{18}{4}$	.....	152-3	s.	s.	s. eth.
3283							
3284							
3284M							
3285							
3286							
3287							
3288							
3289							
3290	leaf. f. bz. ....	.....	171	471	i.	sl. s.	s. eth., h. ac a., bz.; blue fluores.
3291	cr. ....	.....	323	d.	v. sl. s.	.....	.....
3292							
3292M	col. cr. ....	.....	73.5-74.5	.....	i.	sl. s.	sl. s. eth.
3293							
3294							
3295							
3296	col. liq., 1.41652	1.03422 $\frac{20}{4}$	.....	105 ⁷⁵⁵	∞	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3297	p-Dioxane	1,4-dioxane; diethylene di-oxide; glycol ethylene ether	$\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2$	88.10
3298	2,5-p-Dioxanedione .	See <i>Glycolide</i> .		
3299	2,5-p-Dioxanedione, 3,6-dimethyl- .	See <i>Lactide</i> .		
3300	Dioxindole .	See <i>Oxindole</i> , 3-hydroxy-		
3301	1,3-Dioxolane, 2-methyl-	ethylene ethylidene ether; glycol ethylidene diether	$\text{OCH}(\text{CH}_3)\text{-OCH}_2\text{CH}_2$	88.10
3302	α, γ-Dipalmitin .	See <i>Glycerol</i> , 1,3-dipalmitate.		
3303	Dipentene .	See <i>dl-Limonene</i> .		
3304	Diphenic acid	2,2'-biphenyldicarboxylic acid; <i>o,o'</i> -bibenzoic acid; 1,10-diphenic acid	$(\text{COOH})\text{C}_6\text{H}_4\text{-C}_6\text{H}_4\text{COOH}$	242.22
3305	—, dimethyl ester.....	methyl diphenate.....	$(\text{C}_6\text{H}_4\text{COOCH}_3)_2$	270.27
3306	—, diphenyl ester.....	ethyl diphenate.....	$(\text{C}_6\text{H}_4\text{COOC}_2\text{H}_5)_2$	298.33
3307	—, 4,4',5,5',6,6'-hexahydroxy- , dilactone. See <i>Elagic acid</i> .			
3308	—, 3-nitro- (COOH=1)	<i>o</i> -nitrodiphenic acid.....	$\text{COOHC}_6\text{H}_3\text{NO}_2\text{C}_6\text{H}_4\text{COOH}$	287.22
3309	—, 4-nitro-	<i>m</i> -nitrodiphenic acid.....	$\text{COOHC}_6\text{H}_3\text{NO}_2\text{-C}_6\text{H}_4\text{COOH}$	287.22
3310	—, 5-nitro-	<i>p</i> -nitrodiphenic acid.....	$\text{COOHC}_6\text{H}_3\text{NO}_2\text{-C}_6\text{H}_4\text{COOH}$	287.22
3311	Diphenic anhydride ...		$(\text{C}_6\text{H}_4\text{CO})_2\text{O}$	224.20
3312	Diphenimide		$(\text{C}_6\text{H}_4\text{CO})_2\text{NH}$	223.22
3313	Diphenine .	See <i>Hydrazobenzene</i> , 4,4'-diamino-		
3314	Dipheniquinone, 3,3',5,5'-tetramethoxy- . See <i>Cerulignone</i> .			
3315	Diphenoyl chloride ...	2,2'-biphenyldicarbonyl chloride	$(\text{C}_6\text{H}_4\text{COCl})_2$	279.12
3316	Diphenyl . Diphenyl- . For diphenyl derivatives see the parent compounds (e.g., for diphenylmethane)	See <i>Biphenyl</i> .		
3317	Diphenylamine*	<i>N</i> -phenylaniline; anilino-benzene	$(\text{C}_6\text{H}_5)_2\text{NH}$	169.22
3318	—, <i>N</i>-acetyl- .	See <i>Acetamide</i> , <i>N</i> , <i>N</i> -diphenyl-		
3319	—, <i>o</i>-amino- .	See <i>o</i> -Phenylenediamine, <i>N</i> -phenyl-		
3320	—, <i>p</i>-amino- .	See <i>p</i> -Phenylenediamine, <i>N</i> -phenyl-		
3321	—, <i>N</i>-benzyl-	<i>N,N</i> -diphenylbenzylamine...	$\text{C}_6\text{H}_5\text{CH}_2\text{N}(\text{C}_6\text{H}_5)_2$	259.34
3322	—, <i>p,p'</i>-bisdimethylamino-	leuco base of Bindschedler green; tetramethyl-4,4'-diaminodiphenylamine	$\text{NH}[\text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2]_2$	255.35
3322M	—, <i>N</i>-chloroformyl- .	See <i>Carbamyl chloride</i> , diphenyl-		
3323	—, 4,4'-diamino-	<i>p,p'</i> -iminodianiline.....	$\text{NH}_2\text{C}_6\text{H}_4\text{NHC}_6\text{H}_4\text{NH}_2$	199.25
3324	—, 2,4'-dinitro*		$\text{NO}_2\text{C}_6\text{H}_4\text{NHC}_6\text{H}_4\text{NO}_2$	259.22
3325	—, 4,4'-dinitro*		$\text{NO}_2\text{C}_6\text{H}_4\text{NHC}_6\text{H}_4\text{NO}_2$	259.22
3326	—, <i>N</i>-ethyl-		$(\text{C}_6\text{H}_5)_2\text{NC}_2\text{H}_5$	197.27
3327	—, <i>N</i>-formyl- .	See <i>Formamide</i> , <i>N</i> , <i>N</i> -diphenyl-		
3328	—, hydroxy- . See <i>Phenol</i> , anilino-			
3329	—, <i>N</i>-methyl-		$(\text{C}_6\text{H}_5)_2\text{NCH}_3$	183.24
3330	—, <i>p</i>-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{NHC}_6\text{H}_5$	214.22
3331	—, <i>N</i>-nitroso-	diphenylnitrosamine; nitrous diphenylamide	$(\text{C}_6\text{H}_5)_2\text{NNO}$	198.22
3332	—, <i>p</i>-nitroso-		$\text{NOC}_6\text{H}_4\text{NHC}_6\text{H}_5$	198.22

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3297	col. liq., 1.4222	1.0353 ²⁰ ₄ (1.03034 ²⁰ ₄)	11.7 (9-13)	101.5	∞	∞	≡ eth., most org. liq.
3298							
3299							
3300							
3301	.....	1.002 ⁰ ₄	.....	82.5	66.7	.....	.....
3302							
3303							
3304	monocl. leaf. f. w.	.....	228-9	subl.	sl. s.	s.	s. eth., most org. solv.
3305	pr. f. me. al.	.....	74	.....	.....	.....	.....
3306	.....	.....	42	.....	.....	.....	.....
3307							
3308	.....	.....	248-50 d.	.....	.....	.....	.....
3309	.....	.....	268	.....	.....	.....	.....
3310	.....	.....	214-6	.....	.....	.....	.....
3311	.....	.....	219	subl.	i.	.....	sl. s. eth.
3312	need. ....	.....	217.5(219)	.....	i.	sl. s.	i. eth.; s. chl.
3313							
3314							
3315	.....	.....	94 (97)	.....	.....	.....	sl. s. eth.; s. bz.
3316	ane see <i>Methane</i> , <i>diphenyl-</i> .)						
3317	col. monocl. leaf.	1.159 ²⁰ ₄	53	302	0.0325	44 c.	v. s. eth.; 57.5 me. al.; s. bz., lgr.
3318							
3319							
3320							
3321	need. ....	.....	95 (88.5)	.....	v. sl. s.	sl. s. c., s. h.	v. s. eth.
3322	tetr. pl. f. CS ₂	.....	119	.....	v. sl. s.	s.	s. eth.
3322M							
3323	leaf. f. w. ....	.....	158	d.	sl. s.	s.	s. eth.
3324	yelsh.-red need. f. bz.	.....	222 (156-7)	.....	i.	sl. s.	s. acet., chl., pyr.
3325	yel. need. f. al.	.....	216 (214.5)	.....	i.	sl. s.	5.66 ²² acet.; s. glac. ac. a.; sl. s. bz.
3326	liq. ....	.....	.....	297	i.	s.	s. eth.
3327							
3328							
3329	col. liq.	1.048 ²⁰ ₄	-7.6	293.4	i.	s.	s. eth.
3330	yel. need. ....	.....	132	211.0 ³⁰	i.	v. s.	v. s. ac. a.
3331	yel. monocl. pl. f. lgr.	.....	66.5	.....	.....	sl. s. c., v. s. h.	s. h. bz.
3332	grn. pl. f. al. or bz.	.....	143	.....	sl. s.	s. c., v. s. h.	s. eth., bz.; v. s. chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3332M	Diphenylamine, 2,2',4,4'-tetrabromo-	.....	(C ₆ H ₃ Br ₂) ₂ NH....	484.85
3333	—, thio-	See <i>Phenothiazine</i> .		
3334	Diphenyl carbonate.	See <i>Carbonic acid, diphenyl ester</i> .		
3335	Diphenylene ketone oxide.	See <i>Xanthone</i> .		
3336	Diphenylene oxide.	See <i>Dibenzofuran</i> .		
3337	Diphenylenimine.	See <i>Carbazole</i> .		
3338	Diphenylene.	See 2,4'- <i>Biphenyldiamine</i> .		
3339	Diphosgene.....	trichloromethyl chloroformate; superpalite; perchloromethyl formate	ClCOOCCl ₃	197.85
3340	Dipicolinic acid.....	2,6-pyridinedicarboxylic acid*; α,α' -dipicolinic acid	C ₆ H ₃ N(COOH) ₂ ·1½H ₂ O	194.14
3341	Diplumbane, hexaethyl-	1-. See <i>Lead, hexaethyl-</i> .		
3342	Dipumbic hexaethyl.	See <i>Lead, hexaethyl-</i> .		
3343	Dipropargyl.	See 1,5- <i>Hexadiyne</i> *.		
3344	Di-2-propenylamine*.	See <i>Diallylamine</i> .		
3345	Dipropylamine*.....	di- <i>n</i> -propylamine.....	(CH ₃ CH ₂ CH ₂) ₂ NH	101.19
3346	—, <i>N</i> -nitroso-.....	dipropylnitrosamine; nitrous dipropylamide	(CH ₃ CH ₂ CH ₂) ₂ NNO	130.19
3347	Dipropylene.	See 2,4- <i>Hexadiene</i> *.		
3348	Di- <i>n</i> -propyl sulfate.	See <i>Propyl sulfate</i> .		
3349	Dipyridine.	See <i>Nicotyrine</i> .		
3350	Dipyridyl.	See <i>Bipyridyl</i> .		
3351	5,10-Dipyrrolo[1,2- <i>a</i> ,1,2- <i>d</i>]pyrazinedione.	See <i>Pyrrocoll</i> .		
3353	Diquinolyl.	See <i>Biquinoline</i> .		
3354	α,γ -Distearin.	See <i>Glycerol, 1,3-distearate</i> .		
3355	Disulfide, bis(dibutylthiocarbamyl)	tetrabutylthiuram disulfide..	[(C ₄ H ₉) ₂ NCS] ₂ S ₂ ...	408.73
3356	—, bis(diethylthiocarbamyl)	tetraethylthiuram disulfide..	[(C ₂ H ₅) ₂ NCS] ₂ S ₂ ...	296.52
3357	—, bis(dimethylthiocarbamyl)	tetramethylthiuram disulfide.	[(CH ₃) ₂ NCS] ₂ S ₂ ...	240.41
3358	—, bis(ethylmethylthiocarbamyl)	diethyldimethylthiuram disulfide	[(CH ₃)C ₂ H ₅ NCS] ₂ S ₂ ...	268.47
3359	—, bis(1-piperidylthiocarbonyl)	dicyclopentamethylenethiuram disulfide	(C ₅ H ₁₀ NCS) ₂ S ₂	320.54
3360	—, bis(tetrabenzylthiocarbamyl)	tetrabenzylthiuram disulfide..	[(C ₆ H ₅ CH ₂) ₂ NCS] ₂ S ₂	544.78
3361	—, diacetyl.	See <i>Acetyl disulfide</i> .		
3362	—, 2,2'-dibenzothiazyl.	See <i>Benzothiazole, 2,2'-dithiobis-</i> (<i>S</i> =1).		
3363	—, dibenzoyl.	See <i>Benzoyl disulfide</i> .		
3364	—, diethyl.	See <i>Ethyl disulfide</i> .		
3365	—, diisoamyl.	See <i>Isoamyl disulfide</i> .		
3366	—, dimethyl.	See <i>Methyl disulfide</i> .		
3367	—, diphenyl.	See <i>Phenyl disulfide</i> .		
3368	—, diphenylene.	See <i>Thianthrene</i> .		
3369	Ditaine.	See <i>Echitamine</i> .		
3370	Ditan.	See <i>Methane, diphenyl-</i> .		
3371	—, α -methyl-	See <i>Ethane, 1,1-diphenyl-</i> .		
3372	Di- <i>n</i> -tetradecyl sulfate.	See <i>Tetradecyl sulfate</i> .		
3373	<i>p</i> -Dithiane.....	1,4-dithiane; diethylene disulfide; tetrahydro- <i>p</i> -dithiin	SCH ₂ CH ₂ SCH ₂ -CH ₂	120.22
3374	1,3,5-Dithiazine, 5,6-dihydro-2,4,6-trimethyl-	See <i>Thialdine</i> .		
3375	α,α -Dithienyl.	See 2,2'- <i>Bithiophene</i> .		
3376	<i>p</i> -Dithiin, tetrahydro-	See <i>Di-p-thiane</i> .		
3377	Ditolan azotide.	See <i>Amaron</i> .		
3378	Di- <i>o</i> -tolylamine.....	.....	(CH ₃ C ₆ H ₄) ₂ NH....	197.27
3379	Di- <i>m</i> -tolylamine.....	.....	(CH ₃ C ₆ H ₄) ₂ NH....	197.27

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3332M	need., silky luster or pr.	.....	184	.....	i.	sl. s. h.	.....
3333							
3334							
3335							
3336							
3337							
3338							
3339	col. liq.	$1.653\frac{14}{4}$	-57	127.5	i.	v. s.	v. s. eth.
3340	col. need. (+1½H₂O) f. w.	.....	anh. 226 d.	.....	v. sl. s.	v. sl. s.	.....
3341							
3342							
3343							
3344							
3345	col. liq., 1.40455 ^{19.5}	$0.7384\frac{20}{4}$	-39.6	110.7	s.	s.	∞ eth.
3346	yel. liq.	$0.910\frac{26}{4}$	.....	205	v. sl. s.	∞	∞ eth.
3347							
3348							
3349							
3350							
3351							
3353							
3354							
3355	yel. or. liq. ....	.....	.....	.....	i.	sl. s.	s. eth.
3356	yel. cr. ....	.....	70	.....	i.	sl. s.	sl. s. eth.; s. chl.
3357	yel. cr.	$1.29\frac{20}{4}$	155-6 (141-5)	.....	i.	sl. s.	sl. s. eth.; s. chl.
3358	yel. cr. ....	.....	72	.....	i.	sl. s.	sl. s. eth.; s. chl.
3359	yel. cr. ....	.....	129-30	.....	i.	sl. s.	sl. s. eth.; s. chl.
3360	yel. cr. ....	.....	132-3	.....	i.	sl. s.	sl. s. eth.; s. chl.
3361							
3362							
3363							
3364							
3365							
3366							
3367							
3368							
3369							
3370							
3371							
3372							
3373	wh. monocl. pr. f. eth.	.....	112, subl.	200	v. sl. s.	s. h.	s. eth., CS₂
3374							
3375							
3376							
3377							
3378	bl. cr. ....	.....	52-3	313 4	v. sl. s.	.....	.....
3379	liq. ....	.....	<-12	320	v. sl. s.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3380	Di-<i>p</i>-tolylamine		$(\text{CH}_3\text{C}_6\text{H}_4)_2\text{NH}$...	197.27
3381	Diurea .	See <i>p</i> -Urazine.		
3382	Divinyl .	See 1,3-Butadiene*.		
3383	Docosane * (<i>n</i>)		$\text{CH}_3(\text{CH}_2)_{20}\text{CH}_3$...	310.59
3384	Docosanoic acid *.	See <i>Behenic acid</i> .		
3385	<i>cis</i>-13-Docosenoic acid	*. See <i>Erucic acid</i> .		
3386	<i>trans</i>-13-Docosenoic acid	cid*. See <i>Brassic acid</i> .		
3387	<i>n</i>-Docosoic acid .	See <i>Behenic acid</i> .		
3388	13-Docosynoic acid *.	See <i>Behenolic acid</i> .		
3389	Dodecanal *.	See <i>Lauraldehyde</i> .		
3390	Dodecane *	<i>n</i> -dodecane; bihexyl; dihexyl.	$\text{CH}_3(\text{CH}_2)_{10}\text{CH}_3$...	170.33
3391	—, 1-amino- .	See <i>Dodecylamine</i> *.		
3392	—, 1-bromo- *	dodecyl bromide; lauryl bromide	$\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{Br}$	249.24
3393	Dodecanenitrile *.	See <i>Lauronitrile</i> .		
3394	Dodecanoic acid *.	See <i>Lauric acid</i> .		
3395	1-Dodecanol *	<i>n</i> -dodecyl alcohol; lauryl alcohol	$\text{CH}_3(\text{CH}_2)_{11}\text{OH}$...	186.33
3396	6-Dodecanol *	amylhexylcarbinol	$\text{CH}_3(\text{CH}_2)_4\text{CHOH}-$ $(\text{CH}_2)_5\text{CH}_3$	186.33
3397	Dodecanoyl chloride *.	See <i>Lauroyl chloride</i> .		
3398	1-Dodecene *	α -dodecylene	$\text{C}_{12}\text{H}_{24}$	168.31
3398M	Dodecine .	See <i>Dodecyne</i> *.		
3399	<i>n</i>-Dodecyl alcohol .	See 1-Dodecanol*.		
3400	Dodecylamine * (<i>n</i>)	<i>pri-n</i> -dodecylamine; 1-amino-dodecane	$\text{CH}_3(\text{CH}_2)_{11}\text{NH}_2$...	185.35
3401	α-Dodecylene *.	See 1-Dodecene*.		
3402	Dodecyl sulfate	di- <i>n</i> -dodecyl sulfate	$[\text{CH}_3(\text{CH}_2)_{11}]_2\text{SO}_4$..	434.71
3402M	2-Dodecyne *	decylmethylacetylene	$\text{CH}_3\text{C}\equiv\text{C}(\text{CH}_2)_8-$ CH_3	166.30
3402T	6-Dodecyne *	6-dodecine; di- <i>n</i> -amylacetylene	$\text{C}_6\text{H}_{11}\text{C}\equiv\text{C}-\text{C}_6\text{H}_{11}$..	166.30
3403	Dotriacontane *	<i>n</i> -dotriacontane	$\text{CH}_3(\text{CH}_2)_{30}\text{CH}_3$...	450.85
3403M	1-Dotriacontanol *		$n-\text{C}_{32}\text{H}_{65}\text{OH}$	466.85
3404	Duboisine .	See <i>Hyoscyamine</i> .		
3405	Dulcin .	See <i>Urea, p-phenetyl-</i> .		
3406	Dulcitol	1,2,3,4,5,6-hexanehexol* (one form); dulcitol; melampyrin	$\text{C}_6\text{H}_5(\text{OH})_6$	182.17
3407	Durene	1,2,4,5-tetramethylbenzene ..	$(\text{CH}_3)_4\text{C}_6\text{H}_2$	134.21
3408	Durylic acid	2,4,5-trimethylbenzoic acid; cumylic acid	$(\text{CH}_3)_3\text{C}_6\text{H}_2\text{COOH}$	164.20
3409	Ecgonidine .	See <i>dl-Anhydroecgonine</i> .		
3410	Ecgonine, benzoyl-		$\text{C}_{16}\text{H}_{19}\text{NO}_4\cdot 4\text{H}_2\text{O}$..	361.39
3411	—, benzoylmethyl- .	See <i>Cocaine</i> .		
3412	<i>l</i>-Ecgonine	tropinecarboxylic acid	$\text{C}_9\text{H}_{14}\text{NO}_3\cdot \text{H}_2\text{O}$	203.24
3412M	—, cinnamate methyl ester .	See <i>l-Cocaine, cinnamoyl-</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3380	col. need. f. pet. eth.	.....	79	330.5	v. sl. s.	.....	.....
3381							
3382							
3383	cr. f. al.	0.778 $\frac{44}{4}$	44.4	317.4 (224 ¹⁵)	i.	4 ⁷⁸	v. s. eth.
3384							
3385							
3386							
3387							
3388							
3389							
3390	col. liq.	0.766 $\frac{0}{4}$; 0.7511 $\frac{20}{4}$	-12	214.5; 145 ¹⁰⁰	i.	v. s.	v. s. eth.
3391							
3392	liq. ....	.....	.....	175-80 ⁴⁵	i.	s.	s. eth.
3393							
3394							
3395	leaf. f. dil. al. .	0.8309 $\frac{24}{4}$	22.6 (24)	255	i.	s.	s. eth.
3396	cr. ....	.....	30	119 ⁹	.....	s.	s. eth.
3397							
3398	col. liq.	0.7732 $\frac{0}{4}$; 0.762 $\frac{15}{4}$	-31.5	213-5	i.	v. s.	v. s. eth.
3398M							
3399							
3400	col. cr. ....	.....	27-8	259.1; 93.5 ²	sl. s.	s.	s. eth.
3401							
3402			48.4-8.5	.....	.....	.....	.....
3402M	liq.	0.792 $\frac{15}{4}$	-9	105 ¹⁵	.....	.....	.....
3402 T	col. liq., 1.4374 ²⁵	0.7816 ²⁵	.....	100 ¹⁴ ; 115 ³⁰	i.	s.	s. eth.
3403	cr. pl. f. eth. .	0.7757 ^{9.4}	74-5 (70)	310 ¹⁵	.....	v. sl. s. c.	s. h. eth., h. ac. a.
3403M			89.3-89.5	.....	.....	.....	.....
3404							
3405							
3406	col. monoc. pr.	1.466 $\frac{15}{4}$	188	295 ^{5.5}	3.2 ¹⁵	0.0734 ¹⁵	v. sl. s. eth.
3407	col. monoc. leaf., β 1.615	liq. 0.838 $\frac{81}{4}$	80 (78-9)	193-5 subl.	i.	s.	s. eth., bz.; v. s. ac. a.
3408	col. need. f. bz.	.....	149.5	.....	v. sl. s. h.	v. s.	v. s. eth.; s. bz.
3409							
3410	lust. need. f. w.	.....	90.2; anh. 193-5	.....	sl. s. c., s. h.	s.	i. eth.; s. dil. a., alk.
3411							
3412	col. monoc. pr. f. al.	1.370 $\frac{12}{4}$; 0.777 $\frac{37}{4}$	198; anh. 205	.....	21.7 ¹⁷	1.5	v. sl. s. eth.
3412M							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3413	1-Ecgonine , hydrochloride	.....	$C_9H_{16}NO_3 \cdot HCl$...	221.68
3414	Echitamine ,	ditaine,	$C_{22}H_{28}N_2O_4 \cdot 4H_2O$..	456.53
3415	Echitin, .....	.....	$C_{35}H_{52}O_2$,	468.74
3416	Eglantine ,	See α -Toluic acid, isobutyl ester, ..	.....	.....
3417	Eicosane *,	<i>n</i> -eicosane, ..	$CH_3(CH_2)_{18}CH_3$...	282.54
3418	Eicosanoic acid *,	See <i>Arachidic acid</i>, ..	.....	.....
3419	1-Eicosanol *,	<i>pri</i> - <i>n</i> -eicosyl alcohol; arachic alcohol	$CH_3(CH_2)_{18}CH_2OH$	298.54
3420	<i>n</i> - Eicosoic acid ,	See <i>Arachidic acid</i>, ..	.....	.....
3421	<i>pri</i> - <i>n</i> - Eicosyl alcohol ,	See 1- <i>Eicosanol</i>*, ..	.....	.....
3422	Eikonogen ,	See 2-Naphthol-6-sulfonic acid, ..	.....	.....
3423	Elaidic acid ,	<i>trans</i> -9-octadecenoic acid*	$C_{17}H_{33}Br_2COOH$... $C_{17}H_{33}COOC_2H_5$...	282.46 442.29
3424	—, dibromide,	θ , ι -dibromostearic acid (one form)	.....	310.51
3425	—, ethyl ester, .....	.....	$C_{17}H_{33}COOCH_3$...	296.48
3426	—, methyl ester, .....	.....	.....	.....
3427	β-Elaterin, .....	.....	$C_{20}H_{28}O_5$,	348.43
3428	Eleomargaric acid ,	9,13-octadecadienoic acid* (?)	$C_{17}H_{31}COOH$,	280.44
3429	α-Eleostearic acid ,	<i>cis</i> -9,11,13-octadecatrienoic acid(?)	$C_{17}H_{29}COOH$,	278.42
3430	β-Eleostearic acid ,	<i>trans</i> -9,11,13-octadecatrienoic acid(?)	$C_{17}H_{29}COOH$,	278.42
3431	Ellagic acid ,	4,4',5,5',6,6'-hexahydroxydiphenic acid dilactone	$C_{14}H_6O_6 \cdot 2H_2O$...	338.22
3432	Emetine (<i>l</i>), .....	.....	$C_{29}H_{40}N_2O_4$,	480.63
3433	—, hydrochloride (<i>d</i>), .....	.....	$C_{29}H_{40}N_2O_4 \cdot 2HCl \cdot 7H_2O$	679.67
3434	Emodin ,	1,3,8-trihydroxy-6-methylanthraquinone; rheum emodin; frangula emodin	$CH_3C_{14}H_4O_2(OH)_3$	270.23
3435	Enanthaldehyde ,	heptanal*; enanthal; heptyl aldehyde; enanthole; <i>n</i> -heptaldehyde	$CH_3(CH_2)_6CHO$...	114.18
3436	—, oxime,	heptanal oxime*; enanthaldoxime; <i>n</i> -heptaldoxime	$CH_3(CH_2)_6CH:NOH$	129.20
3437	Enanthic acid ,	heptanoic acid*; enanthylic acid; oenanthic acid; <i>n</i> -heptoic acid; <i>n</i> -heptylic acid	$CH_3(CH_2)_6COOH$,	130.18
3438	—, ethyl ester,	ethyl heptanoate*,	$CH_3(CH_2)_6COOC_2H_5$	158.24
3439	—, heptyl ester,	<i>n</i> -heptyl <i>n</i> -heptylate,	$CH_3(CH_2)_6COOC_7H_{15}$	228.37
3440	—, methyl ester,	methyl heptanoate*,	$CH_3(CH_2)_6COOCH_3$	144.21
3441	—, <i>p</i> -phenylphenacyl ester, .....	.....	$CH_3(CH_2)_6COOCH_2COC_6H_4C_6H_5$	324.40
3442	—, piperazinium salt, .....	.....	$C_4H_{10}N_2 \cdot 2C_8H_{19}COOH$	346.50

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3413	rhomb. or tricl. tab., [α]-57 °D	.....	246	.....	s.	sl. s.	.....
3414	col. cr., [α]-28.8° ¹⁵ _D	.....	206 d.	.....	s.	v. s.	sl. s. eth., bz.; s. chl.
3415	leaf.....	.....	170	.....	.....	0.06 ¹⁵ 80%	sl. s. eth.; v. s. chl.
3416	cr., 1.434 ^{42.9}	0.778 ³⁷ ₄	38	205 ¹⁵	i.	.....	∞ eth.
3417							
3418							
3419							
3419	wh. waxy mass.	.....	71	220 ⁸	i.	v. sl. s.	s. h. bz.
3420	col. leaf. f. al.	0.851 ⁷⁹ ₄	51.5 (44-5)	288 ¹⁰⁰	i.	s.	s. eth., bz., chl.
3421							
3422							
3423							
3424	.....	.....	27	.....	i.	i.	s. eth.
3425	oil.....	0.868 ¹⁸ ₄	.....	217-8.5 ¹⁵	i.	s.	s. eth.
3426	liq.....	0.872 ¹⁵ ₄	.....	213.5 ¹⁵	i.	s.	s. eth.
3427	hex. pl.....	.....	195 (216)	.....	i.	s.	sl. s. eth., bz.; s. chl.
3428	rhomb. pl.....	.....	48	.....	.....	s.	s. eth.
3429	leaf. or need. f. al.	.....	48-9	235 ¹² sl. d.	i.	s.	v. s. eth., CS ₂ ; s. h. ac. a.
3430	pl. or need. f. al.	.....	72	.....	i.	sl. s.	s. warm glac. ac. a.
3431	yel. cr.....	1.667 ¹⁸ ₄	d.	.....	v. sl. s. h.	sl. s.	i. eth.
3432	amor.....	.....	68 (74)	.....	v. sl. s.	v. s.	v. s. eth.; s. chl.; sl. s. bz.
3433	need. f. h. w...	.....	235-55	.....	13.1 ¹⁸	s.	i. eth.
3434	or-red monocl. need.f. ac. a.	.....	253 (250)	subl.	i.	s.	s. glac. ac. a.; i. amylal., alk. sols.
3435	col. liq., 1.4131	0.850 ²⁰ ₄	-45	155	sl. s.	s.	= eth.
3436	large pl. f. al., 1.421 ^{83.9}	0.8583 ²⁰ ₄ ; 0.834 ⁸³ ₄	55.5	195	v. sl. s.	s.	s. eth.
3437	col. oily liq., 1.42162 ^{19.8}	0.9127 ²⁵ ₄	-10	223.5 (108-110 ⁹)	0.241 ¹⁵	s.	s. eth.
3438	col. liq., 1.41296 ²⁰	0.8685 ²⁰ ₄	.....	188	i.	s.	∞ eth.
3439	col. liq.....	0.865 ¹⁹ ₄	.....	273-475 ⁴ (137-40 ¹⁰)	i.	s.	s. eth.
3440	liq., 1.4114....	0.881 ¹⁵ ₅	.....	172.1 (174-6)	.....	.....	.....
3441	.....	.....	62	.....	.....	.....	.....
3442	wh. cr.....	.....	95-6	.....	s.	s.	i. eth.; s. h. acet.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3443	Enanthic anhydride ...	heptanoic anhydride*.....	$[\text{CH}_3(\text{CH}_2)_5\text{CO}]_2\text{O}$	242.35
3444	Enanthole.	See <i>Enanthaldehyde</i> .		
3445	Enanthone.	See 7- <i>Tridecanone</i> *.		
3446	Enanthylic acid.	See <i>Enanthic acid</i> .		
3447	Enanthylidene.	See 1- <i>Heptyne</i> *.		
3448	Enneamethylene glyco l.	See 1,9- <i>Nonanediol</i> *.		
3449	Eosin	2,4,5,7-tetrabromofluorescein	$\text{C}_{20}\text{H}_5\text{Br}_4\text{O}_6$	647.93
3450	—, (dye).....	alkali salt of eosin.	$\text{C}_{20}\text{H}_5\text{Br}_4\text{Na}_2\text{O}_6$...	691.91
3451	Ephedrine	2-methylamino-1-phenyl-1-propanol (one form)	$\text{C}_{10}\text{H}_{15}\text{CHOHCH}(\text{NHCH}_3)\text{CH}_3 \cdot \text{H}_2\text{O}$	183.25
3452	—, hydrochloride (l).....		$\text{C}_{10}\text{H}_{15}\text{NO} \cdot \text{HCl}$	201.69
3453	—, sulfate.....		$(\text{C}_{10}\text{H}_{15}\text{NO})_2 \cdot \text{H}_2\text{SO}_4$	428.54
3454	Epichlorohydrin	α -epichlorohydrin; 1-chloro-2,3-epoxypropane; γ -chloropropylene oxide; (chloromethyl)oxirane	$\text{OCH}_2\text{CHCH}_2\text{Cl}$...	92.53
3455	Epicyanohydrin	β , γ -epoxybutyronitrile; γ -cyanopropylene oxide; oxiraneacetoneitrile	$\text{OCH}_2\text{CHCH}_2\text{CN}$...	83.09
3456	α-Epidibromohydrin.	See <i>Propene</i> , 2,3-dibromo*.		
3457	α-Epidichlorohydrin.	See <i>Propene</i> , 2,3-dichloro*.		
3458	Epihydric alcohol.	See <i>Glycidol</i> .		
3459	Epiiodohydrin	α -epiiodohydrin; 1,2-epoxy-3-iodopropane; γ -iodopropylene oxide; (iodomethyl)oxirane	$\text{OCH}_2\text{CHCH}_2\text{I}$...	183.99
3460	Epinephrine.	See <i>Adrenaline</i> .		
3461	Ergosterol	ergosterin.....	$\text{C}_{28}\text{H}_{44}\text{O}$	396.64
3461M	—, irradiated.	See <i>Calciferol</i> .		
3462	Ergotinine (amorphous).	See <i>Ergotoxine</i> .		
3463	d-Ergotinine		$\text{C}_{35}\text{H}_{39}\text{N}_5\text{O}_5$	609.71
3464	Ergotoxine	ergotinine (amorphous).....	$\text{C}_{35}\text{H}_{41}\text{N}_5\text{O}_6$	627.72
3465	Erucic acid (<i>cis</i>).....	<i>cis</i> -13-docosenoic acid*.....	$\text{CH}_3(\text{CH}_2)_7\text{CH} \cdot \text{CH}(\text{CH}_2)_{11}\text{COOH}$	338.56
3466	trans-Erucic acid.	See <i>Brassicid acid</i> .		
3467	Erythrene.	See 1,3- <i>Butadiene</i> *.		
3468	i-Erythritol	<i>anti</i> -1,2,3,4-butanetetrol*; ordinary erythrite; erythrol; erythroglucin; phycitol	$(\text{CH}_2\text{OHCHOH})_2$...	122.12
3469	—, anhydride.....	1,2,3,4-diepoxybutane* (one form); bioxirane	$\text{OCH}_2\text{CHCHCH}_2\text{O}$	86.09
3470	—, tetranitrate.....	erythrol tetranitrate; nitro-erythrite	$(\text{CHNO}_3\text{CH}_2\text{NO}_3)_2$	302.12
3471	Erythroglucin.	See <i>i-Erythritol</i> .		
3472	Erythrohydroxyanthra quinone.	See <i>Anthraquinone</i> .	1-hydroxy- $\text{CH}_2 \cdot \text{CHCHOH} \cdot \text{CH}_2\text{OH}$	88.10
3472M	Erythrol	3-butene-1,2-diol.....		
3473	Erythrol.	See <i>i-Erythritol</i> .		
3473M	Erythrose		$\text{C}_4\text{H}_8\text{O}_4$	120.10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3443	liq., 1.4312....	0.932 ²⁰ ₄	17	258 (170-315)	i.	s.	s. eth.
3444							
3445							
3446							
3447							
3448							
3449	red monocl. need.	.....	.....	.....	i.	s.	s. ac. a., alk.
3450	red-br. powd.	.....	.....	.....	s.	s.	.....
3451	col. cr. f. eth.	.....	43 (40)	255 d.	s.	s.	s. eth., chl.
3452	wh. need. ....	.....	216 d.	.....	s.	s.	i. eth.
3453	wh. cr. ....	.....	.....	.....	s.	s. h.	.....
3454	col. liq., 1.44195 ^{11.55}	1.203 ⁰ ₄ ; 1.1801 ²⁰ ₄	-25.6	117	i.	∞	∞ eth.
3455	pr. ....	.....	162	.....	s. h.	s.	.....
3456							
3457							
3458							
3459	liq.	2.03 ¹³ ₄	.....	160-80	i.	s.	s. eth.
3460							
3461	cr. ....	.....	160-3	.....	i.	s.	s. eth.
3461M							
3462							
3463	lng. need. f. al., sol. fluores. vlt., [α] 335° _D in al.	.....	229	.....	i.	0.5 ²⁰	s. eth., chl., bz., acet.
3464	wh. amor. powd.	.....	162-4	.....	v. sl. s.	s. h.	sl. s. eth.; s. NaOH
3465	col. need. f. al.	0.860 ⁵⁵ ₄	33.5 (31-2)	281 ³⁰	i.	173	v. s. eth.; 163 ²¹ me. al.
3466							
3467							
3468	wh. tetr. pr., 1.544, 1.521	1.451 ²⁰ ₄	119-20 (126)	331	61.5	sl. s.	i. eth.
3469	col. liq.	1.113 ¹⁸ ₄	.....	138	∞ d.	.....	.....
3470	leaf. f. al. ....	.....	61	exp. by percussion	i.	s.	s. eth.
3471							
3472							
3472M		.....	.....	94-95 ¹²	.....	.....	.....
3473							
3473M	col. syrup; D-, [α] _D -14.5, L ⁺ -, [α] _D +21.5	.....	.....	.....	v. s.	v. s.	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3474	Erythrosin	2,4,5,7-tetraiodofluorescein...	$C_{20}H_8I_4O_5$	835.94
3475	Erythrosin (dye).....	alkali salt of erythrosin; iodeosin B	$C_{20}H_6I_4Na_2O_5$	879.92
3476	Esculetin	6,7-dihydroxycoumarin; aesculetin	$(HO)_2-$ $C_8H_7OCOCH:CH$	178.14
3477	Esculin	aesculin.....	$C_{15}H_{16}O_9 \cdot \frac{1}{2}H_2O$	349.29
3478	Eserine .	See <i>Physostigmine</i> .		
3479	Estragole	estragol; p-allylanisole; cha- vicol methyl ether	$CH_2:CHCH_2C_6H_4-$ OCH_3	148.20
3480	Ethal .	See <i>Cetyl alcohol</i> .		
3481	Ethanal *.	See <i>Acetaldehyde</i> .		
3482	—, hydroxy*.	See <i>Glycolaldehyde</i> .		
3483	—, trichloro*.	See <i>Chloral</i> .		
3484	Ethanamide *.	See <i>Acetamide</i> .		
3485	—, 2-cyano-2-nitro-*	*. See <i>Fulminuric acid</i> .		
3486	—, 2-hydroxy*.	See <i>Glycolamide</i> .		
3487	Ethanamidine *.	See <i>Acetamidine</i> .		
3488	Ethane *.....	bimethyl; methylmethane; dimethyl	CH_3CH_3	30.07
3489	—, amino-.	See <i>Ethylamine</i> *.		
3490	—, 1-amino-1-phenyl-	1-. See <i>Benzylamine</i> , α -methyl-		
3491	—, 1-amino-2-phenyl-	1-. See <i>Phenethylamine</i> .		
3492	—, arsino-.	See <i>Arsine</i> , ethyl-		
3493	—, 1,2-bisphenyl- sulfonyl*.	ethylenebisphenylsulfone....	$(CH_2SO_2C_6H_5)_2$...	310.37
3494	—, bromo*.	See <i>Ethyl bromide</i> .		
3495	—, 1-bromo-2- chloro*.	ethylene chlorobromide.....	CH_2ClCH_2Br	143.43
3496	—, 1-bromo-2-ethox	y*. See <i>Ether</i> , β -bromoethyl et	hyl.	
3497	—, 1-bromo-1-phenyl-	1-. See <i>Benzene</i> , (α -bromoethyl)	-.	
3498	—, chloro*.	See <i>Ethyl chloride</i> .		
3499	—, 1-chloro-2-(β -ch	loroethoxy)*. See <i>Ether</i> , bi	s- β -chloroethyl.	
3500	—, 1-chloro-2-(β -ch	loroethylthio)*. See <i>Sulfi</i>	de, β , β' -dichloroethyl.	
3501	—, 1-chloro-1-ethox	y*. See <i>Ether</i> , α -chloroethyl et	hyl.	
3502	—, 1-chloro-2-ethox	y*. See <i>Ether</i> , β -chloroethyl et	hyl.	
3502M	—, 1-chloro-1,1,- 2,2,2-penta- fluoro*.	.....	$CClF_2CF_3$	154.48
3503	—, sym-diacetyl-.	See <i>2,5-Hexanedione</i> *.		
3504	—, 4,4'-diamino-sym	-diphenyl-. See α , α -Bi-p	toluidine.	
3505	—, 1,1-dibromo*...	ethylidene bromide; ethyli- dene dibromide	CH_2CHBr_2	187.88
3506	—, 1,2-dibromo*.	See <i>Ethylene bromide</i> .		
3507	—, 1,1-dichloro*...	ethylidene chloride; ethyli- dene dichloride	CH_2CHCl_2	98.97
3508	—, 1,1-dichloro-2,2-	diethoxy*. See <i>Acetal</i> , dich	loro-.	
3509	—, 1,2-dichloro*.	See <i>Ethylene chloride</i> .		
3510	—, 1,2-dichloro-1-et	hoxy*. See <i>Ether</i> , α , β -dichlo	roethyl.	
3510R	—, 1,1-dichloro-1,- 2,2,2-tetra- fluoro*.	.....	CCl_2FCF_3	170.93
3511	—, 1,2-dichloro- 1,1,2,2-tetraflu	oro*.....	$CClF_2CClF_2$	170.93
3512	—, 1,1-diethoxy*.	See <i>Acetal</i> .		
3512L	—, 1,1-difluoro*....	ethylidene fluoride.....	CH_2CHF_2	66.05
3512M	—, 1,2-difluoro*.	See <i>Ethylene fluoride</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3474	or. cr. f. eth...	i.	s.	v. sl. s. eth.; i. bz.
3475	red-br. powd.	s.	s.
3476	need.....	270 d.	sl. s. c.	s.	v. sl. s. eth.; s. dil. alk.
3477	wh. need., [α] _D ¹⁸ -14.6 in me. al.	160 d.; anh. 205	d. 230	0.16 c., 8 h.	4.58 ⁷⁸	v. sl. s. eth.; s. h. chl., ac. a., alk.
3478	oil, 1.5230 ^{17,5} _D	0.9645 ²¹ ₄	215	i.	s.	s. eth.
3479							
3480	col. gas.....	1.357 ⁰ g/l; 0.561 ⁻¹⁰⁰	-172	-88.3	4.7 ²⁰ cm ³	46 ⁴ cm ³
3481							
3482							
3483							
3484							
3485							
3486							
3487							
3488							
3489							
3490	need. or leaf. f. al.	180	sl. s. h.	sl. s. h.	s. glac. ac. a., bz.
3491							
3492	col. liq.....	1.689 ¹⁹ ₄	-16.6	107-8	0.688 ³⁰	∞	∞ eth.
3493							
3494	col. gas.....	-38	i.	s.	s. eth.
3495							
3496							
3497							
3498							
3499							
3500							
3501							
3502							
3502M							
3503	liq., 1.51277...	2.089 ^{20,5} ₄	110 (108-10)	i.	v. s.	v. s. eth.
3504							
3505	col. liq., 1.41655	1.174 ²⁰ ₄	-96.7	57.3	0.55 ²⁰	v. s.	v. s. eth.
3506							
3507	col. gas.....	-2	i.	s.	s. eth.
3508							
3509							
3510							
3510 R							
3511							
3511	col. gas, 1.3092 ⁰	1.5312 ⁹	3.8	i.	s.	s. eth.
3512	col. gas.....	-24.7
3512 L							
3512M

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3513	Ethane, 1,1-diiodo-*	uns-diiodoethane; ethylidene iodide; ethylidene diiodide	CH_3CHI_2	281.89
3514	—, 1,2-diiodo-*	See <i>Ethylene iodide</i> .		
3515	—, 1,1-dimethoxy-*	acetaldehyde dimethyl acetal; dimethyl acetal; ethylidene dimethyl ether	$\text{CH}_3\text{CH}(\text{OCH}_3)_2$...	90.12
3516	—, 1,1-dinitro-*	uns-dinitroethane.....	$\text{CH}_3\text{CH}(\text{NO}_2)_2$...	120.07
3517	—, 1,2-diphenoxy-*	glycol diphenyl ether; ethylene diphenyl ether	$(\text{CH}_2\text{OC}_6\text{H}_5)_2$	214.25
3518	—, 1,1-diphenyl-...	uns-diphenylethane; α -methyliditan	$(\text{C}_6\text{H}_5)_2\text{CHCH}_3$...	182.25
3519	—, 1,2(or sym)-diphenyl-...	See <i>Bibenzyl</i> .		
3520	—, 1,2-epoxy-*	See <i>Ethylene oxide</i> .		
3521	—, ethenyloxy-*	See <i>Ether, ethyl vinyl</i> .		
3522	—, ethoxy-*	See <i>Ethyl ether</i> .		
3523	—, 1-ethoxy-2-(β-ethoxyethoxy)-*	See <i>Ether, bis(β-ethoxyethyl)</i> .		
3524	—, ethylidithio-*	See <i>Ethyl disulfide</i> .		
3525	—, ethylsulfinyl-*	See <i>Ethyl sulfoxide</i> .		
3526	—, ethylsulfonyl-*	See <i>Ethyl sulfone</i> .		
3527	—, ethylthio-*	See <i>Ethyl sulfide</i> .		
3528	—, fluoro-*	See <i>Ethyl fluoride</i> .		
3529	—, hexabromo-*	perbromoethane.....	CBr_3CBr_3	503.52
3530	—, hexachloro-*	perchloroethane; carbon hexachloride	CCl_3CCl_3	236.76
3530M	—, hexafluoro-*	perfluoroethane; carbon hexafluoride	CF_3CF_3	138.02
3531	—, hexamethyl-...	See <i>Butane, 2,2,3,3-tetramethyl-*</i> .		
3532	—, hexaphenyl-...		$(\text{C}_6\text{H}_5)_3\text{C}-\text{C}(\text{C}_6\text{H}_5)_3$	486.62
3533	—, iodo-*	See <i>Ethyl iodide</i> .		
3534	—, methoxy-*	See <i>Ether, ethyl methyl</i> .		
3535	—, methylthio-*	See <i>Sulfide, ethyl methyl</i> .		
3536	—, naphthyl-...	See <i>Naphthalene, ethyl-</i> .		
3537	—, nitro-...		$\text{C}_2\text{H}_5\text{NO}_2$	75.07
3538	—, pentabromo-*		$\text{CHBr}_3\text{CBr}_3$	424.61
3539	—, pentachloro-*		$\text{CHCl}_2\text{CCl}_3$	202.31
3539M	—, pentachloro-fluoro-*		$\text{CCl}_3\text{CCl}_2\text{F}$	220.31
3540	—, pentachloro(pentachloroethoxy)-*	See <i>Ether, bis(pentachloroethyl)</i> .		
3541	—, pentaiodo-*		CHI_2CI_3	659.63
3542	—, perbromo-*	See <i>Ethane, hexabromo-*</i> .		
3543	—, perchloro-*	See <i>Ethane, hexachloro-*</i> .		
3543M	—, perfluoro-*	See <i>Ethane, hexafluoro-*</i> .		
3544	—, phenyl-...	See <i>Benzene, ethyl-</i> .		
3545	—, phosphino-...	See <i>Phosphine, ethyl-</i> .		
3546	—, 1,1,1,2-tetrabromo-*	uns-tetrabromoethane.....	$\text{CH}_2\text{BrCBr}_3$	345.70
3547	—, 1,1,1,2-tetrabromo-*	sym-tetrabromoethane; acetylene tetrabromide	$\text{CHBr}_2\text{CHBr}_2$	345.70
3548	—, 1,1,1,2-tetrachloro-*	uns-tetrachloroethane.....	$\text{CH}_2\text{ClCCl}_3$	167.86

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3513	liq.	2.84 ⁰ / ₄	.....	179	i.	v. s.	v. s. eth.
3514	col. inflam.	0.8476 ²⁵ / ₄	.....	64.5	s.	s.	s. eth., chl.
3515	liq.						
3516	liq.	1.3503 ^{23.5} / _{23.5}	.....	185-6	sl. s.	s.	s. eth.
3517	col. leaf. f. al.	.....	98.5	.....	v. sl. s. (i.)	s. h.	v. s. eth.; s. chl.
3518	col. oil, 1.5761	1.006 ²¹ / ₄ ; 0.9877 ²⁵ / ₄	.....	272 (268-86)	i.	s.	s. eth.
3519							
3520							
3521							
3522							
3523							
3524							
3525							
3526							
3527							
3528							
3529	rhomb. pr., 1.740, 1.847, 1.863	3.823 ²⁰ / ₄	148-9 d.	d. 210	i.	sl. s.	s. CS ₂ ; v. sl. s. al. eth.
3530	col. rhomb. tab. f. al. or eth.	2.091 ²⁰ / ₄	subl. 187	.....	i.	v. s.	v. s. eth.
3530M	col. gas.	1.85-78	-100.6	-78.2	i.	.....	.....
3531							
3532	col. cr. ....	.....	145-7 d.	.....	i.	v. sl. s.	s. chl.
3533							
3534							
3535							
3536							
3537	w. wh. liq., 1.39007 ^{24.5}	1.052 ²⁰ / ₂₀	<-50; frz. -90	114.8	4.5 cc	∞	∞ eth.; s. chl., dil. alk.
3538	monocl. pr.	3.312 ²⁰ / ₄	57	210 ³⁰⁰ d.	i.	s.	v. s. eth.
3539	liq., 1.50250 ^{24.0}	1.709 ⁰ / ₄ ; 1.6728 ²⁵ / ₄	-29	162	i.	∞	∞ eth.
3539M	wh. sld. ....	.....	101.3	137.9	i.	s.	s. eth.
3540							
3541	col. monocl. pr. f. ac. a.	3.312 ²⁰ / ₄	56-7	210 d.	i.	s.	v. s. eth.; s. ac. a., bz.
3542							
3543							
3543M							
3544							
3545							
3546	col. liq., 1.62772	2.875 ²⁰ / ₄	0	103.5 ^{13.5}	.....	s.	.....
3547	col.-yel. liq., 1.63795	2.9638 ²⁰ / ₄	0.1	151 ⁵⁴ ; d. 239-42	0.0651 ³⁰	∞	∞ eth., chl., aniline, ac. a.
3548	liq., 1.48162 ^{22.2}	1.588 ²⁰ / ₄	.....	130.5	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3549	Ethane, 1,1,2,2-tetra-chloro-*	<i>sym</i> -tetrachloroethane; acetylene tetrachloride	$\text{CHCl}_2\text{CHCl}_2$	167.86
3549K	—, 1,1,1,2-tetra-chloro-2,2-di-fluoro-*	.....	$\text{CCl}_3\text{CClF}_2$	203.85
3549P	—, 1,1,1,2-tetra-chloro-1,2-di-fluoro-*	.....	$\text{CCl}_2\text{FCCl}_2\text{F}$	203.85
3550	—, 1,1,1,2-tetra-phenyl-	<i>uns</i> -tetraphenylethane; tri-phenylbenzylmethane; α -benzyltritan	$(\text{C}_6\text{H}_5)_3\text{CCH}_2\text{C}_6\text{H}_5$	334.44
3551	—, 1,1,2,2-tetra-phenyl-	<i>sym</i> -tetraphenylethane.....	$(\text{C}_6\text{H}_5)_2\text{CHCH}-$ $(\text{C}_6\text{H}_5)_2$	334.44
3552	—, 1,1,2-tribromo-*	vinyl tribromide.....	$\text{CH}_2\text{BrCHBr}_2$	266.79
3553	—, 1,1,1-trichloro-*	methylchloroform.....	CH_3CCl_3	133.42
3554	—, 1,1,1-trichloro-2,2-diethoxy-*	chloral diethyl acetal; tri-chloroacetal	$\text{CCl}_3\text{CH}(\text{OC}_2\text{H}_5)_2$	221.52
3555	—, 1,1,2-trichloro-*	vinyl trichloride.....	$\text{CH}_2\text{ClCHCl}_2$	133.42
3555R	—, 1,1,1-trichloro-2,2,2-trifluoro-*	.....	\text{CCl_3CF_3	187.39
3556	—, 1,1,2-trichloro-1,2,2-trifluoro-	.....	$\text{C}_2\text{Cl}_3\text{F}_3$	187.39
3557	—, 1,1,1-triethoxy-*	See <i>Orthoacetic acid, triethyl ester</i> .	CH_3CF_3	84.04
3557M	—, 1,1,1-trifluoro-*	methylfluoroform.....	CH_3Cl_3	407.80
3558	—, 1,1,1-triiodo-*	methyliodoform.....	CH_3I_3	407.80
3559	—, 1,1,1-triphenyl-	α -methyltritan.....	$(\text{C}_6\text{H}_5)_3\text{CCH}_3$	258.35
3560	—, 1,1,2-triphenyl-	.....	$(\text{C}_6\text{H}_5)_2\text{CHCH}_2-$ C_6H_5	258.35
3561	Ethaneazobenzene.	See <i>Benzeneazothane.</i>		
3561M	Ethaneboronic acid.	See <i>Boric acid, ethyl-</i> .		
3562	Ethanedial*.	See <i>Glyoxal.</i>		
3563	Ethanediamide*.	See <i>Oxamide.</i>		
3564	1,2-Ethanediamine*.	See <i>Ethylenediamine.</i>		
3565	1,1-Ethanedicarboxylic acid, 1-hydroxy-2-phenyl-	See <i>Tartronic acid,</i>		
3566	Ethanedinitrile*.	See <i>Cyanogen.</i>		
3567	Ethanedioic acid*.	See <i>Oxalic acid.</i>		
3568	1,1-Ethenediol, 2,2,2-tribromo-*	See <i>Bromal, hydrate.</i>		
3569	—, 2,2,2-trichloro-*	See <i>Chloral, hydrate.</i>		
3570	1,2-Ethenediol*.	See <i>Glycol.</i>		
3571	—, 1,2-dicyclohexyl-	dodecahydrohydrobenzoin; cyclohexanone pinacol	$\text{C}_{12}\text{H}_{22}\text{O}_2$	198.30
3572	—, 1,2-diphenyl-	See <i>Hydrobenzoin; Isohydrobenzoin.</i>		
3573	—, 1,1,2,2-tetraphenyl-	See <i>Benzopinacol.</i>		
3574	Ethanedioyl chloride*.	See <i>Oxalyl chloride.</i>		
3575	1,2-Ethanedisulfonic acid*	ethylenedisulfonic acid.....	$\text{C}_2\text{H}_4(\text{SO}_3\text{H})_2$	190.19
3576	1,2-Ethanedithiol*....	dithioglycol; ethylene mercaptan; ethylene dimer-captan	$\text{HSCH}_2\text{CH}_2\text{SH}$..	94.19
3577	Ethanenitrile*.	See <i>Acetonitrile.</i>		
3578	—, 2-oxo-2-phenyl-	See <i>Benzoyl cyanide.</i>		
3579	Ethanesulfonic acid*....	ethylsulfonic acid.....	$\text{C}_2\text{H}_5\text{SO}_2\text{H}$	94.13
3580	Ethanesulfonic acid*....	ethylsulfonic acid.....	$\text{C}_2\text{H}_5\text{SO}_2\text{OH}$	110.13
3581	—, 2-amino-	See <i>Taurine.</i>		
3582	—, 2-hydroxy-	See <i>Isethionic acid.</i>		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3549	col. liq., 1.4942	1.600 $\frac{20}{4}$	-43.8 (-36)	146.3	i.	∞	∞ eth.
3549 K	col. sld. ....	.....	40.6	91.5	i.	s.	s. eth.
3549 P	col. liq., 1.41297 ²⁵	1.64470 ²⁵	24.65	92.8	i.	s.	s. eth.
3550	col. monoc. f. eth.	.....	144	277-80 ²¹	i.	sl. s.	sl. s. eth.
3551	col. rhomb. need. f. chl.	1.182 $\frac{20}{4}$	211 (209)	383	.....	0.767 ⁸	14 bz.; s. ac. a.
3552	liq., 1.58902...	2.579 $\frac{20}{4}$	-26	188.4	.....	s.	.....
3553	col. liq., 1.43765 ^{21,0}	1.3249 $\frac{26}{4}$	.....	74.1	i.	∞	∞ eth.
3554	liq.	1.266 $\frac{15}{4}$	.....	197	0.5	∞	∞ eth., glyce.
3555	col. liq., 1.4711	1.443 $\frac{20}{4}$	-36.7	113.5	i.	∞	∞ eth.
3555 R	col. gas.	1.5702	13.2	45.8	i.	s.	s. eth.
3556	col. liq., 1.35572 ²⁵	1.56354 ²⁵	-36.4	47.7	i.	s.	s. eth.; ∞ bz.
3557	col. gas.	3.784 g/1	-107	-46.8	.....	.....	.....
3557 M	yel. octahdr. ....	.....	95 d.	.....	.....	sl. s.	v. s. eth., CS ₂ , bz.; sl. s. lgr.
3558	need. f. al. or eth.	.....	95	.....	i.	sl. s. c., s. h.	v. s. eth.
3560	monoc. leaf. f. dil. al.	.....	54-4.5	348-97 ⁵¹	i.	v. s.	v. s. eth.
3561	benzyl-.	.....	.....	.....	.....	.....	.....
3561 M		.....	.....	.....	.....	.....	.....
3562		.....	.....	.....	.....	.....	.....
3563		.....	.....	.....	.....	.....	.....
3564		.....	.....	.....	.....	.....	.....
3565		.....	.....	.....	.....	.....	.....
3566		.....	.....	.....	.....	.....	.....
3567		.....	.....	.....	.....	.....	.....
3568		.....	.....	.....	.....	.....	.....
3569		.....	.....	.....	.....	.....	.....
3570		.....	.....	.....	.....	.....	.....
3571	need. ....	.....	129-30	.....	.....	.....	v. s. bz.; s. pet. eth.
3572	cr. f. ac. a. ....	.....	.....	.....	.....	.....	.....
3573		.....	.....	.....	.....	.....	.....
3574		.....	.....	.....	.....	.....	.....
3575		.....	104	.....	v. s.	v. s.	.....
3576	liq.	1.123	.....	146	.....	s.	v. s. alk.; s. NH ₄ OH
3577	syrup. ....	.....	.....	.....	.....	.....	s. alk.
3578		.....	.....	.....	.....	.....	s. alk.
3579		.....	.....	.....	.....	.....	s. alk.
3580	hyg. cr. ....	.....	.....	.....	s., deliq.	s.	s. alk.
3581		.....	.....	.....	.....	.....	.....
3582		.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3583	Ethanesulfonyl chloride*	ethylsulfonyl chloride	C ₂ H ₅ SO ₂ Cl	128.58
3584	1,1,2,2-Ethanetetracarboxylic acid* , tetraethyl ester	ethyl <i>sym</i> -ethanetetracarboxylate	(COOC ₂ H ₅) ₂ CH-CH(COOC ₂ H ₅) ₂	318.32
3585	Ethanethial* , trimer.	See <i>sym</i> -Trithiane, 2,4,6-trime	thyl-,	
3586	Ethanethiol*	ethyl mercaptan; ethyl hydrosulfide; ethyl thioalcohol	C ₂ H ₅ SH	62.13
3587	—, sodium derivative.	sodium mercaptide; sodium thioethylate	C ₂ H ₅ SNa	84.12
3588	Ethanethiolic acid* .	See <i>Acetic acid, thiol</i> -. See <i>Acetamide, thio</i> -. ethenyltricarboxylic acid.		
3589	Ethanethionamide* .			
3590	1,1,1-Ethanetricarboxylic acid*		CH ₃ C(COOH) ₃	162.10
3591	1,1,2-Ethanetricarboxylic acid, 1,2-dihydroxy- *		See <i>Desoxalic acid</i> .	
3592	Ethanoic acid* .	See <i>Acetic acid</i> . See <i>Glyoxylic acid</i> . See <i>Acetic anhydride</i> . See <i>Ethyl alcohol</i> . See <i>4-Penten-1-ol*</i> . See <i>Acetaldehyde-ammonia</i> . β -aminoethyl alcohol; ethanolaniline; ethylolamine; β -hydroxyethylamine		
3593	—, oxo-*			
3594	Ethanoic anhydride* .			
3595	Ethanol* .			
3596	—, 2-allyl-.			
3597	—, 1-amino-*			
3598	—, 2-amino-*,		NH ₂ CH ₂ CH ₂ OH	61.08
3599	—, 2-anilino-	β -hydroxyethyl alcohol; ethanolaniline; ethylolamine; β -hydroxyethylamine	C ₆ H ₅ NHCH ₂ CH ₂ OH	137.18
3600	—, 2-benzoyloxy-	glycol monobenzyl ether; benzyl cellosolve	C ₆ H ₅ CH ₂ OCH ₂ CH ₂ OH	152.19
3601	—, 2-bromo-*	β -bromoethyl alcohol; ethylene bromohydrin	CH ₂ BrCH ₂ OH	124.98
3602	—, —, acetate.	β -bromoethyl acetate.	CH ₃ COOCH ₂ CH ₂ Br	167.01
3603	—, 2-butoxy-*	glycol monobutyl ether; butyl cellosolve	C ₄ H ₉ OCH ₂ CH ₂ OH	118.17
3604	—, 2-(β -butoxyethoxy)-*	See <i>Diethylene glycol</i> , <i>n</i> -butylethanolaniline	monobutyl ether. CH ₃ (CH ₂) ₃ NHCH ₂ CH ₂ OH	117.19
3604M	—, 2-butylamino-*			
3605	—, 2-chloro-*	β -chloroethyl alcohol; ethylene chlorohydrin	CH ₂ ClCH ₂ OH	80.52
3606	—, —, acetate.	β -chloroethyl acetate; 2-chloroethyl ethanoate*	CH ₃ COOCH ₂ CH ₂ Cl	122.55
3607	—, 2,2-dichloro-*	β , β -dichloroethyl alcohol.	CHCl ₂ CH ₂ OH	114.97
3608	—, 2-diethylamino-*	β -diethylaminoethyl alcohol; 2-hydroxytriethylamine	(C ₂ H ₅) ₂ NCH ₂ CH ₂ OH	117.19
3609	—, —, <i>p</i> -aminobenzoate	hydrochloride. See <i>Procaine</i> , β -dimethylaminoethyl alcohol	hydrochloride. (CH ₃) ₂ NCH ₂ CH ₂ OH	89.14
3610	—, 2-dimethylamino-*			
3611	—, 1,2-diphenyl-	benzylphenylcarbinol.	C ₆ H ₅ CH ₂ CHOHC ₆ H ₅	198.25
3612	—, 2-ethoxy-*	glycol monoethyl ether; "Cellosolve"	C ₂ H ₅ OCH ₂ CH ₂ OH	90.12
3613	—, —, acetate	β -ethoxyethyl acetate; "Cellosolve" acetate	CH ₃ COOCH ₂ CH ₂ OC ₂ H ₅	132.16
3614	—, 2-(β -ethoxyethoxy)-*	See <i>Diethylene glycol</i> , β -hydroxydiethylamine.	ethyl ether. C ₂ H ₅ HNCH ₂ CH ₂ OH	89.14
3615	—, 2-ethylamino-*			
3616	—, 2,2'-ethylenedioxydi-	See <i>Triethylene glycol</i> . β , β' -dihydroxytriethylamine	C ₂ H ₅ N(CH ₂ CH ₂ OH) ₂	133.19
3617	—, 2,2'-ethylimino-di-			

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3583	liq.	1.357 ²⁰ ₄	.....	177.5	d.	d.	v. s. eth.
3584	pr. ....	.....	76 (72-4)	305 d.	.....	s.	.....
3585							
3586	liq., 1.43055...	0.840	-121 (-147.3)	34.7 (34.5-5.5)	1.5	s.	s. eth., alk.
3587	wh. cr. ....	.....	.....	.....	s.	s.	.....
3588							
3589							
3590	pr. ....	.....	159 d.	.....	s.	s.	s. eth.
3591							
3592							
3593							
3594							
3595							
3596							
3597							
3598	col. liq., 1.4539	1.0180 ²⁰ ₄	10.5	172.2	∞	∞	0.72 eth.; s. chl.; sl. s. bz., lgr. s. eth., chl.
3599	col. liq.	1.110 ⁰ ₄	.....	286	v. sl. s.	s.	s. eth., chl.
3600	col. liq.	1.068	<-75	256	0.4	.....	.....
3601	col. liq., 1.4915	1.7720 ²⁰ ₄	.....	150.3	s.	∞	∞ eth.
3602	col. liq.	1.514 ²⁰ ₄	-13.8	161.5-4.5	v. s.	∞	∞ eth.
3603	col. liq.	0.9027 ²⁰ ₄	.....	170.6	∞	∞	∞ eth.
3604							
3604M	1.4437 ²⁰	0.8907 ²⁰ ₄	.....	200	s.	s.	s. eth.
3605	col. liq.	1.213 ²⁰ ₄	-69	128.8	∞	s.	2.3 ¹⁵ eth.
3606	col. liq., 1.4247	1.1783 ⁰ ₄	.....	145	i.	∞	∞ eth.
3607	liq.	1.145 ¹⁵ ₄	.....	146	sl. s.	s.	s. eth.
3608	col. liq., 1.4400 ²⁵	0.8601 ²⁵ ₂₅ 0.884 ²⁰ ₄	.....	163; 42-48	s.	s.	s. eth., bz.
3609							
3610	col. liq., 1.43 ..	0.8866 ²⁰ ₄	.....	135 (131-4)	∞	■	■ eth.
3611	need. ....	.....	66-8	167-70 ¹⁰	v. sl. s.	s.	v. s. eth.
3612	col. liq.	0.9311 ²⁰ ₄	.....	135.1	∞	∞	■ eth.
3613	col. liq.	0.9749 ²⁰ ₄	.....	156.2 (150-60)	22	∞	∞ eth.
3614							
3615	liq., 1.444.....	0.914 ²⁰ ₄	.....	167-9 ⁷⁵¹	v. s.	v. s.	v. s. eth.
3616							
3617	yel. liq., 1.4663	1.0135 ²⁰ ₄	.....	251-2 ⁷⁵⁰	s.	s.	sl. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3617M	Ethanol, 2-fluoro-* . . .	β -fluoroethyl alcohol; ethylene fluorohydrin	$\text{CH}_2\text{FCH}_2\text{OH}$	64.06
3618	—, 2-heptyl-2-methyl-	yl-. See 1-Nonanol, 2-methyl-*		
3619	—, 2,2'-iminodi-	See Diethanolamine.		
3619M	—, 2-isobutyl-amino-*	isobutylethanolamine.	$(\text{CH}_3)_2\text{CHCH}_2\text{NH}-\text{CH}_2\text{CH}_2\text{OH}$	117.19
3620	—, 2-methoxy-*	glycol monomethyl ether; methyl cellosolve	$\text{CH}_3\text{OCH}_2\text{CH}_2\text{OH}$	76.09
3621	—, —, acetate.	glycol monomethyl ether acetate; methyl cellosolve acetate	$\text{CH}_3\text{COOCH}_2\text{CH}_2\text{OCH}_3$	118.13
3622	—, 2-(β-methoxyethyl)	oxy)-. See Diethylene glycol, monomethyl ether.		
3623	—, 2-methyl-amino-*	β -hydroxy-N-methylethylamine	$\text{CH}_3\text{HNCH}_2\text{CH}_2\text{OH}$	75.11
3624	—, 2,2'-methyl-aminodi-	β , β' -dihydroxy-N-methyldiethylamine	$\text{CH}_3\text{N}(\text{CH}_2\text{CH}_2\text{OH})_2$	119.16
3625	—, 2-methyl-2-propyl-	yl-. See 1-Pentanol, 2-methyl-*		
3626	—, 2,2',2''-nitrilotri-	triethylamine; 2,2',2''-trihydroxytriethylamine. See Triethanolamine		
3627	—, 2-nitro-		$\text{NO}_2\text{CH}_2\text{CH}_2\text{OH}$. . .	91.07
3628	—, 2,2'-oxydi-	See Diethylene glycol.		
3629	—, pentamethyl-	See 2-Butanol, 2,3,3-trimethyl-		
3629M	—, 2-phenoxy-	β -hydroxyethyl phenyl ether; phenyl cellosolve	$\text{C}_6\text{H}_5\text{OCH}_2\text{CH}_2\text{OH}$	138.16
3630	—, 1-phenyl-	See Benzyl alcohol, α -methyl-		
3631	—, 2-phenyl-	See Phenethyl alcohol.		
3632	—, 2,2'-thiodi-	thiodiglycol; bis- β -hydroxyethyl sulfide	$\text{S}(\text{CH}_2\text{CH}_2\text{OH})_2$. . .	122.18
3633	—, 2,2,2-trichloro-*		$\text{CCl}_3\text{CH}_2\text{OH}$	149.42
3634	—, 2,2,2-trichloro-1-	ethoxy-*. See Chloral, alcoholate.		
3635	Ethanolamine.	See Ethanol, 2-amino-*		
3636	1-Ethanone, 2-ethoxy-	1, 2-diphenyl-. See Benzoin, ethyl ether.		
3637	Ethanoyl bromide* . . .	See Acetyl bromide.		
3638	Ethanoyl chloride* . . .	See Acetyl chloride.		
3639	Ethanoyl fluoride* . . .	See Acetyl fluoride.		
3640	Ethanoyl iodide*	See Acetyl iodide.		
3641	Ethanoyl peroxide* . . .	See Acetyl peroxide.		
3642	Ethene*	See Ethylene.		
3643	—, ethenyloxy-	See Vinyl ether.		
3644	—, ethenylthio-	See Vinyl sulfide.		
3645	Ethenol.	See Vinyl alcohol.		
3646	Ethenone.	See Ketene.		
3647	Ethenylamine*	See Vinylamine.		
3648	Ethenyltricarboxylic acid.	See 1,1,1-Ethanetricarboxylic acid*.		
3649	Ether.	See Ethyl ether.		
3650	—, allyl cresyl.	See Ether, allyl tolyl.		
3651	—, allyl ethyl.	3-ethoxypropene*	$\text{C}_2\text{H}_5\text{OCH}_2\text{CH}:\text{CH}_2$	86.13
3652	—, allyl isoamyl.	3-methyl-1-(2-propenoxy)-butane*	$\text{CH}_2:\text{CHCH}_2\text{OCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$	128.21
3653	—, allyl methyl.	3-methoxypropene*	$\text{CH}_2:\text{CHCH}_2\text{OCH}_3$	72.10
3654	—, allyl 2-naphthyl.	2-(2-propenoxy)naphthalene*	$\text{C}_{10}\text{H}_7\text{OCH}_2\text{CH}:\text{CH}_2$	184.23
3655	—, allyl phenyl.	2-propenoxybenzene*	$\text{CH}_2:\text{CHCH}_2\text{OC}_6\text{H}_5$	134.17
3656	—, allyl o-tolyl.	2-(2-propenoxy)toluene*; allyl o-cresyl ether	$\text{CH}_2:\text{CHCH}_2\text{OC}_6\text{H}_4\text{CH}_3$	148.20
3657	—, allyl m-tolyl.	3-(2-propenoxy)toluene*	$\text{CH}_2:\text{CHCH}_2\text{OC}_6\text{H}_4\text{CH}_3$	148.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3617M	col. liq., 1.36470 ^{18.4}	1.11124 ^{18.3}	-26.45	103.35	∞	∞	∞ eth.
3618							
3619							
3619M	1.4402 ²⁰	0.8818 ²⁰ ₄	.....	190	s.	s.	s. eth.
3620	col. liq.....	0.9660 ²⁰ ₄	.....	124.3	∞	v. s.	s. eth.
3621	liq.....	1.0054 ²⁰ ₂₀	.....	143	∞	.....	.....
3622							
3623	col. liq., 1.4385	0.937 ²⁰ ₄	.....	159 ⁷⁴⁷	∞	∞	∞ eth.
3624	liq., 1.4678....	1.0377 ²⁰ ₄	.....	246-8 ⁷⁴⁷	∞	∞	sl. s. eth.
3625							
3626							
3627	col. liq.....	1.270 ¹⁵ ₄	<-80	193.8	v. s.	v. s.	v. s. eth.
3628							
3629							
3629M	col. liq.....	1.1094 ²⁰ ₂₀	.....	245.2	2.6	s.	s. eth.
3630							
3631							
3632	col. liq., 1.519.	1.1824 ²⁰ ₄	-16	168 ¹⁴	∞	∞	sl. s. eth.
3633	rhomb. tab....	1.550 ²³ ₄	17.8	152.2	sl. m.	∞	∞ eth.
3634							
3635							
3636							
3637							
3638							
3639							
3640							
3641							
3642							
3643							
3644							
3645							
3646							
3647							
3648							
3649							
3650							
3651	col. liq., 1.38810	0.765 ²⁰ ₄	.....	67.6	1.	∞	∞ eth.
3652	liq.....	.....	.....	120	v. sl. s.	∞	∞ eth.
3653	col. liq.....	0.77 ¹¹ ₄	.....	46	v. sl. s.	∞	∞ eth.
3654	oil.....	.....	.....	d. 210	i.	.....	.....
3655	col. oil.....	0.9856 ¹⁵ ₁₅	.....	192; 85 ¹³	i.	s.	∞ eth.
3656	oil.....	0.969 ¹⁵ ₄	.....	205-8; 85 ¹²	.....	.....	.....
3657	.....	0.965 ¹⁵ ₄	.....	211-4; 92-4 ¹²	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3658	Ether, allyl <i>p</i>-tolyl. . .	4-(2-propenoxy)toluene*	$\text{CH}_2\text{:CHCH}_2\text{OC}_6\text{H}_4\text{CH}_3$	148.20
3658R	—, 2-aminodiethyl.	See <i>Ethylamine, β-ethoxy</i> .*		
3659	—, β-aminoethyl et	hyl. See <i>Ethylamine, β-ethoxy</i> .*		
3660	—, amyl ethyl.	1-ethoxypentane*	$\text{C}_2\text{H}_5\text{O}(\text{CH}_2)_4\text{CH}_3$	116.20
3661	—, amyl methyl.	See <i>Pentane, 1-methoxy</i> .*		
3662	—, amyl phenyl.	amoxybenzene	$\text{CH}_3(\text{CH}_2)_4\text{OC}_6\text{H}_5$	164.24
3663	—, benzyl butyl.	1-benzylxybutane	$\text{C}_6\text{H}_5\text{CH}_2\text{O}(\text{CH}_2)_3\text{CH}_3$	164.24
3664	—, benzyl ethyl.	α -ethoxytoluene	$\text{C}_6\text{H}_5\text{OCH}_2\text{C}_6\text{H}_5$	136.19
3665	—, benzyl methyl.	α -methoxytoluene	$\text{C}_6\text{H}_5\text{CH}_2\text{OCH}_3$	122.16
3666	—, benzyl 2-naphthyl	2-benzylxynaphthalene*	$\text{C}_6\text{H}_5\text{CH}_2\text{OC}_{10}\text{H}_7$	234.28
3667	—, bis-<i>p</i>-bromophenyl	4,4'-dibromodiphenyl ether; 1-bromo-4-(4-bromophenoxy)benzene*	$\text{BrC}_6\text{H}_4\text{OC}_6\text{H}_4\text{Br}$	328.02
3668	—, bis-β-chloroethyl	1-chloro-2-(β -chloroethoxy)ethane*; <i>sym</i> -dichloroethyl ether; β , β' -dichlorodiethyl ether	$(\text{ClC}_2\text{H}_4)_2\text{O}$	143.02
3669	—, bis-β-chloroisopropyl	1-chloro-2-(β -chloroisopropoxy)propane*; β , β' -dichloroisopropyl ether	$\text{ClCH}_2\text{CH}(\text{CH}_3)\text{OCH}(\text{CH}_3)\text{CH}_2\text{Cl}$	171.07
3670	—, bischloromethyl	chlro (chloromethoxy)methane*; <i>sym</i> -dichlorodimethyl ether	$\text{CH}_2\text{ClOCH}_2\text{Cl}$	114.97
3671	—, bis(<i>p</i>-chlorophenyl)	4,4'-dichlorodiphenyl ether	$(\text{ClC}_6\text{H}_4)_2\text{O}$	239.10
3672	—, bis-β-ethoxyethyl	1-ethoxy-2-(β -ethoxyethoxy)ethane*; diethylene glycol diethyl ether; diethyl carbitol	$(\text{C}_2\text{H}_5\text{OCH}_2\text{CH}_2)_2\text{O}$	162.23
3673	—, bis-<i>p</i>-nitrophenyl	1-nitro-4-(4-nitrophenoxy)benzene*; 4,4'-dinitrodiphenyl ether	$\text{NO}_2\text{C}_6\text{H}_4\text{OC}_6\text{H}_4\text{NO}_2$	260.20
3674	—, bispentachloroethyl	pentachloro (pentachloroethoxy)ethane*; perchloro ether; decachlorodiethyl ether	$\text{C}_2\text{Cl}_5\text{OC}_2\text{Cl}_5$	418.61
3675	—, β-bromoethyl ethyl	1-bromo-2-ethoxyethane*; β -bromoethyl ether	$\text{BrCH}_2\text{CH}_2\text{OC}_2\text{H}_5$	153.03
3676	—, bromophenyl me	thyl. See <i>Anisole, bromo</i> .		
3677	—, butyl cresyl.	See <i>Ether, butyl tolyl</i> .		
3678	—, butyl ethyl.	1-ethoxybutane*	$(\text{C}_2\text{H}_5)_2\text{O}(\text{CH}_2)_3\text{CH}_3$	102.17
3679	—, tert-butyl ethyl	2-ethoxy-2-methylpropane*	$\text{C}_2\text{H}_5\text{OC}(\text{CH}_3)_3$	102.17
3680	—, butyl 2-furylmethyl	butyl furfuryl ether	$\text{C}_4\text{H}_3\text{OCH}_2\text{OC}_4\text{H}_5$	154.20
3681	—, butyl methyl.	1-methoxybutane*	$\text{CH}_3\text{O}(\text{CH}_2)_3\text{CH}_3$	88.15
3682	—, butyl phenyl.	butoxybenzene*	$\text{CH}_3(\text{CH}_2)_3\text{OC}_6\text{H}_5$	150.21
3683	—, <i>n</i>-butyl tetrahyd	rofurfuryl. See <i>Furan, 2-bu</i>		
3684	—, butyl <i>o</i>-tolyl.	2-butoxytoluene*; butyl <i>o</i> -cresyl ether	$\text{CH}_3\text{C}_6\text{H}_4\text{O}(\text{CH}_2)_3\text{CH}_3$	164.24

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3658	.....	0.9728 $\frac{15}{15}$	.....	214.5; 91 ¹²	.....	.....	.....
3658 R							
3659	liq.	0.759 $\frac{18}{4}$	.....	119-20	sl. s.	∞	= eth.
3660							
3661	liq. ....	.....	.....	111 ¹⁷	.....	.....	.....
3662							
3663	.....	0.9310 $\frac{10}{4}$	.....	220-1 ⁴⁴	i.	∞	∞ eth.
3664	col. liq.	0.949 $\frac{20}{4}$	.....	185	i.	∞	∞ eth.
3665	liq.	0.987 $\frac{20}{4}$	.....	174	i.	s.	s. eth.
3666	leaf. f. al. ....	.....	99	.....	i.	v. s.	v. s. eth.; s. chl., bz.
3667	leaf. f. al. ....	.....	53-4 (54-6)	338-40	i.	v. s.	∞ eth.; v. s. bz.
3668	liq., 1.457.	1.222 $\frac{20}{4}$	-50	178	1.02	s.	s. eth.
3669	col. liq.	1.1127	.....	187.1 (93-5 ¹⁸)	0.19	.....	.....
3670	col. liq., 1.4346 ²⁰	1.315 $\frac{20}{4}$	.....	105	d.	∞	∞ eth.
3671	1.611.	1.3164 $\frac{11}{4}$	.....	312-4	i.	.....	.....
3672	col. liq.	0.907 $\frac{20}{4}$	.....	188	∞	.....	.....
3673	yel. need. f. al. ....	.....	142-3	.....	i.	sl. s.	sl. s. eth.; s. ac. a., bz.
3674	tetr. scales.	1.900 $\frac{14}{4}$	69	d.	.....	.....	.....
3675	.....	1.370 $\frac{0}{4}$	.....	126-9	sl. s.	∞	= eth.
3676							
3677							
3678	col. liq.	0.752 $\frac{20}{4}$	-124	91.4 (90-3)	i.	∞	∞ eth.
3679	liq.	0.7519 $\frac{20}{4}$	.....	68-9	i.	s.	s. eth.
3680	col. liq.	0.955 $\frac{20}{4}$	.....	189-90 ⁷⁶⁵	i.	s.	v. s. eth.
3681	col. liq.	0.764 $\frac{0}{4}$; 0.744 $\frac{20}{4}$	-115.5	70.3	v. sl. s.	∞	∞ eth.
3682	col. liq., 1.5046 ²⁰	0.9515 $\frac{20}{4}$	.....	210.3 (98-9 ¹⁰)	.....	.....	.....
3683							
3684	.....	0.9437 $\frac{0}{0}$	.....	223.0	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3685	Ether, butyl <i>m</i>-tolyl ..	3-butoxytoluene*.....	$\text{CH}_3\text{C}_6\text{H}_4\text{OC}_4\text{H}_9\ldots$	164.24
3686	—, butyl <i>p</i> -tolyl....	4-butoxytoluene*.....	$\text{CH}_3\text{C}_6\text{H}_4\text{OC}_4\text{H}_9\ldots$	164.24
3687	—, cetyl phenyl....	1-phenoxyhexadecane*.....	$\text{C}_6\text{H}_5\text{OCH}_2(\text{CH}_2)_{14}\text{CH}_3$	318.53
3688	—, chlorodiethyl.	See <i>Ether, chloroethyl ethyl</i> .		
3689	—, α -chloroethyl ethyl	1-chloro-1-ethoxyethane*; α -chlorodiethyl ether	$\text{CH}_3\text{CHClOC}_2\text{H}_5\ldots$	108.57
3690	—, β -chloroethyl ethyl	1-chloro-2-ethoxyethane*; β -chlorodiethyl ether	$\text{CH}_2\text{ClCH}_2\text{OC}_2\text{H}_5$	108.57
3691	—, chloromethyl methyl	chloromethoxymethane*.....	$\text{ClCH}_2\text{OCH}_3\ldots$	80.52
3692	—, chlorophenyl ethyl.	See <i>Phenetole, chloro-</i> .		
3693	—, cresyl ethyl.	See <i>Ether, ethyl tolyl</i> .		
3694	—, cresyl methyl.	See <i>Ether, methyl tolyl</i> .		
3695	—, cresyl propyl.	See <i>Ether, propyl tolyl</i> .		
3696	—, decachlorodiet	See <i>Ether, bis(pentachloroeth yl)</i> .		
3697	—, diallyl.	See <i>Allyl ether</i> .		
3698	—, di- <i>n</i> -amyl.	See <i>Amyl ether</i> .		
3699	—, dibenzyl.	See <i>Benzyl ether</i> .		
3700	—, 4,4'-dibromodiphenyl.	See <i>Ether, bis-<i>p</i>-bromoph enyl</i> .		
3701	—, dibutyl.	See <i>Butyl ether</i> .		
3702	—, dicetyl.	See <i>Cetyl ether</i> .		
3703	—, dichloro-.	See <i>Ether, α, β-dichloroethyl et hyl</i> .		
3704	—, β , β' -dichlorodiet hyl.	See <i>Ether, bis-β-chloroethyl l</i> .		
3704M	—, sym-dichlorodim ethyl.	See <i>Ether, bischlorometh yl</i> .		
3705	—, 4,4'-dichlorodiphenyl.	See <i>Ether, bis-<i>p</i>-chloroph enyl</i> .		
3706	—, sym-dichloroeth yl.	See <i>Ether, bis-β-chloroethyl</i> .		
3707	—, α , β -dichloro-ethyl ethyl	1,2-dichloro-1-ethoxyethane*; dichloroether; α , β -dichloroethyl ether	$\text{CH}_2\text{ClCHClOC}_2\text{H}_5$	143.02
3708	—, β , β' -dichloroisopropyl.	See <i>Ether, bis-β-chloroi sopropyl</i> .		
3709	—, diethyl.	See <i>Ethyl ether</i> .		
3710	—, di- <i>n</i> -heptyl.	See <i>Heptyl ether</i> .		
3711	—, 2,2'-dihydroxydiethyl.	See <i>Diethylene glycol</i> .		
3711M	—, β , β' -dihydroxydi- <i>n</i> -propyl.	See 2-Propanol, 1,1'-oxydi-.		
3712	—, 2,2'-dihydroxyet hyl.	See <i>Diethylene glycol</i> .		
3713	—, diisoamyl.	See <i>Isoamyl ether</i> .		
3714	—, diisobutyl.	See <i>Isobutyl ether</i> .		
3715	—, diisopropyl.	See <i>Isopropyl ether</i> .		
3716	—, dimethyl.	See <i>Methyl ether</i> .		
3717	—, dinaphthyl.	See <i>Naphthyl ether</i> .		
3718	—, di- <i>n</i> -octyl.	See <i>Octyl ether</i> .		
3719	—, diphenyl.	See <i>Phenyl ether</i> .		
3720	—, di- <i>n</i> -propyl.	See <i>Propyl ether</i> .		
3721	—, divinyl.	See <i>Vinyl ether</i> .		
3722	—, ethylene diphenyl.	See <i>Ethane, 1,2-diphenoxy*</i> .		
3723	—, ethyl 2-furyl-methyl	ethyl furfuryl ether.....	$\text{C}_4\text{H}_5\text{OCH}_2\text{OC}_2\text{H}_5$	126.15
3724	—, ethyl heptyl....	1-ethoxyheptane*.....	$\text{C}_2\text{H}_5\text{O}(\text{CH}_2)_6\text{CH}_3$	144.25
3725	—, ethyl hexyl.....	1-ethoxyhexane*.....	$\text{C}_2\text{H}_5\text{O}(\text{CH}_2)_5\text{CH}_3$	130.23
3725M	—, ethylidene dieth yl.	See <i>Acetal</i> .		
3725T	—, ethylidene dimet hyl.	See <i>Ethane, 1,1-dimethoxy*</i> .		
3726	—, ethyl isoamyl....	1-ethoxy-3-methylbutane*...	$\text{C}_2\text{H}_5\text{OCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$	116.20
3727	—, ethyl isobutyl...	1-ethoxy-2-methylpropane*...	$\text{C}_2\text{H}_5\text{OCH}_2\text{CH}(\text{CH}_3)_2$	102.17

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3685	$0.9470 \frac{0}{0}$	.....	229.2	.....	.....	.....
3686	$0.9419 \frac{0}{0}$	.....	229.5	.....	.....	.....
3687	leaf., $1.4556^{82.4}_{\alpha}$	$0.8434 \frac{82.4}{4}$	41.8	200 ¹	.....	.....	.....
3688	98 part d.	.....	.....	.....
3689	107-8	.....	.....	.....
3690	liq.	$1.0572 \frac{0}{4}$; $0.989 \frac{20}{4}$	.....	59.5	d.	s.	s. eth.
3691	liq., 1.3974.	$1.0625 \frac{10}{4}$	-103.5	.....	.....	.....	.....
3692
3693
3694
3695
3696
3697
3698
3699
3700
3701
3702
3703
3704
3704M
3705
3706
3707	col. inflam. liq.	$1.174 \frac{23}{4}$	.....	140-5	.....	v. s.	v. s. eth.
3708
3709
3710
3711
3711M
3712
3713
3714
3715
3716
3717
3718
3719
3720
3721
3722
3723	col. liq.	$0.9844 \frac{20}{4}$	.....	149.5- 50.5 ⁷⁰	i.	s.	s. eth.
3724	$0.790 \frac{16}{8}$	.....	166.6	i.	s.	s. eth.
3725	liq.	$0.8327 \frac{0}{4}$	.....	137	i.	v. s.	s. eth.
3725M
3725 T
3726	col. liq.	$0.764 \frac{18}{4}$	.....	112	i.	∞	∞ eth.
3727	col. liq.	$0.751 \frac{20}{4}$	.....	80 (78-80)	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3728	Ether, ethyl iso-propyl	2-ethoxypropane*	$C_2H_5OCH(CH_3)_2$	88.15
3729	—, ethyl methyl	methoxyethane*	$CH_3OC_2H_5$	60.09
3730	—, ethyl β-methyl	minoethyl. See <i>Ethylamine</i> ,	β -ethoxy- <i>N</i> -methyl-	
3731	—, ethyl β-4-morph	olyethyl. See <i>Morpholine</i> , 4-	(β -ethoxyethyl)-	
3732	—, ethyl-1-naphthyl	1-ethoxynaphthalene*	$C_{10}H_7OC_2H_5$	172.22
3733	—, ethyl 2-naph-thyl	2-ethoxynaphthalene*; bromelia; nerolin (new)	$C_{10}H_7OC_2H_5$	172.22
3734	—, ethyl octyl	1-ethoxyoctane*	$C_2H_5O(CH_2)_7CH_3$	158.28
3735	—, ethyl phenyl	See <i>Phenetole</i> .		
3736	—, ethyl propargyl	See <i>Propyne</i> , 3-ethoxy*.		
3737	—, ethyl propyl	1-ethoxypropane*	$C_2H_5OC_3H_7$	88.15
3738	—, ethyl tetrahydrof	urfuryl. See <i>Furan</i> , 2-ethoxy	methyltetrahydro-	
3739	—, ethyl o-tolyl	2-ethoxytoluene*; o-cresyl ethyl ether	$CH_3C_6H_4OC_2H_5$	136.19
3740	—, ethyl m-tolyl	3-ethoxytoluene*	$CH_3C_6H_4OC_2H_5$	136.19
3741	—, ethyl p-tolyl	4-ethoxytoluene	$CH_3C_6H_4OC_2H_5$	136.19
3742	—, ethyl vinyl	ethenoxyethane*	$CH:CH_2OC_2H_5$	72.10
3745	—, 2-furylmethyl methyl	furfuryl methyl ether	$C_4H_5OCH_2OCH_3$	112.12
3746	—, heptyl methyl	1-methoxyheptane*	$CH_3OC_7H_{15}$	130.23
3747	—, heptyl phenyl	1-phenoxyheptane*	$C_6H_5O(CH_2)_6CH_3$	192.29
3748	—, hexyl phenyl	hexyloxybenzene; 1-phenoxyhexane*	$CH_3(CH_2)_5OC_6H_5$	178.27
3748M	—, β-hydroxyethyl p	henyl. See <i>Ethanol</i> , 2-phenoxy-	y-	
3749	—, isoamyl 1-naphthyl	1-(γ -methylbutoxy)naphthalene*	$C_{10}H_7OCH_2CH_2CH(CH_3)_2$	214.30
3750	—, isoamyl 2-naphthyl	2-(γ -methylbutoxy)naphthalene*	$C_{10}H_7OCH_2CH_2CH(CH_3)_2$	214.30
3751	—, isoamyl phenyl	isoamoxybenzene; 3-methyl-1-phenoxybutane	$C_6H_5O(CH_2)_2CH(CH_3)_2$	164.24
3752	—, isobutyl methyl	1-methoxy-2-methylpropane*	$CH_3OCH_2CH(CH_3)_2$	88.15
3753	—, isobutyl phenyl	isobutoxybenzene; 2-methyl-1-phenoxypropane	$(CH_3)_2CHCH_2OC_6H_5$	150.21
3754	—, isopropyl methyl	2-methoxypropane*	$CH_3OCH(CH_3)_2$	74.12
3755	—, isopropyl phenyl	isopropoxybenzene; 2-phenoxypropane	$(CH_3)_2CHOC_6H_5$	136.19
3756	—, methylene diethyl	yl. See <i>Methane</i> , diethoxy*.		
3757	—, methylene dimethyl	hyl. See <i>Methane</i> , dimethoxy*.		
3758	—, o,o'-methylenedi	phenyl. See <i>Xanthene</i> .		
3759	—, methylenedipropyl	yl. See <i>Methane</i> , dipropoxy*.		
3760	—, methyl 1-naphthyl	1-methoxynaphthalene*; methyl α -naphthyl ether	$C_{10}H_7OCH_3$	158.19
3761	—, methyl 2-naphthyl	2-methoxynaphthalene*; methyl β -naphthyl ether; nerolin (old); yara-yara	$C_{10}H_7OCH_3$	158.19
3762	—, methyl phenyl	See <i>Anisole</i> .		
3763	—, methyl propargyl	See <i>Propyne</i> , 3-methoxy*.		
3764	—, methyl propyl	1-methoxypropane*	$CH_3OCH_2CH_2CH_3$	74.12
3765	—, methyl 6-quinoly	l. See <i>Quinoline</i> , 6-methoxy-		
3766	—, methyl o-tolyl	2-methoxytoluene*; o-cresyl methyl ether	$CH_3C_6H_4OCH_3$	122.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3728	col. liq.	0.745 $\frac{0}{4}$	.....	54	s.	∞	∞ eth.
3729	col. liq. or gas.	0.7260 $\frac{0}{4}$	.....	7.9 (11-2)	s.	∞	∞ eth.
3730							
3731							
3732	liq., 1.59509 ^{52.11}	1.061 $\frac{20}{4}$	5.5	276.4; 160 ¹⁹	i.	v. s.	v. s. eth.
3733	pl., 1.59752 ^{45.6} 1.5932 ^{47.8}	1.0606 $\frac{15}{4}$	37.5	282	i.	sl. s.	s. eth., pet. eth.
3734	liq.	0.794 $\frac{17}{4}$	.....	182-4	i.	s.	s. eth.
3735							
3736							
3737	col. liq., 1.36948	0.747 (0.732 $\frac{20}{4}$)	<-79	64 (61.4)	s.	∞	∞ eth.
3738							
3739	liq., 1.508 ^{13.3}	0.9592 $\frac{13.3}{4}$	.....	180.1; 69.6-70.2 ¹²			
3740	1.513.....	0.9560 $\frac{0}{0}$	.....	192; 73-5 ¹⁰			
3741	liq., 1.5058 ^{17.6}	0.9662 $\frac{0}{0}$	.....	189.9; 70-1 ¹⁵			
3742	liq.	0.763 $\frac{15}{18}$	.....	35.5	sl. s.	s.	∞ eth.
3745	col. liq.	1.0163 $\frac{20}{4}$	.....	134-5 ⁷²	i.	s.	v. s. eth.
3746	col. liq.	0.795 $\frac{0}{0}$	.....	149.8	i.	∞	∞ eth.
3747	.....	0.9319 $\frac{0}{0}$	.....	266.8			
3748	.....	0.9426 $\frac{0}{4}$	.....	246			
3748M							
3749	liq., 1.5705 ^{14.2}	1.0069 ^{14.2}	.....	317-9 ⁷² d.			
3750	leaf., 1.5768 ¹²	1.0155 $\frac{12}{4}$	26.5	323-6 d.	i.	s.	s. eth.
3751	col. liq., 1.4872 ²⁰	0.9198 $\frac{22}{4}$	.....	225			
3752	liq.	0.7507 $\frac{0}{4}$	.....	59 ⁷¹	i.	s.	s. eth.
3753	col. liq.	0.939 $\frac{15}{4}$	.....	198			
3754	col. liq.	0.7347 $\frac{20}{20}$	.....	32.5 ⁷⁷	sl. s.	s.	s. eth.
3755	col. liq.	0.9464 $\frac{15}{15}$	.....	177.2			
3756							
3757							
3758							
3759							
3760	col. liq., 1.6232 ^{13.9}	1.0964 $\frac{13.9}{4}$	<-10	265-9 (258)	i.	v. s.	v. s. eth.; s. bz.
3761	col. leaf. f. eth.	.....	72	274	sl. s.	sl. s.	v. s. eth.; s. CS ₂ , bz.
3762							
3763							
3764	col. liq., 1.3579	0.738 $\frac{20}{4}$	.....	38.9	3.05 ²⁵	∞	∞ eth.
3765							
3766	liq., 1.5199 ^{15.3}	0.9851 $\frac{15}{15}$	.....	171.3	i.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3767	Ether, methyl <i>m</i>-tolyl	3-methoxytoluene*.....	$\text{CH}_3\text{C}_6\text{H}_4\text{OCH}_3$	122.16
3768	—, methyl <i>p</i>-tolyl ...	4-methoxytoluene*.....	$\text{CH}_3\text{C}_6\text{H}_4\text{OCH}_3$	122.16
3769	—, 1-naphthyl propyl	1-propoxynaphthalene*.....	$\text{C}_{10}\text{H}_7\text{OCH}_2\text{CH}_2\text{CH}_3$	186.24
3770	—, 2-naphthyl propyl	2-propoxynaphthalene*.....	$\text{C}_{10}\text{H}_7\text{OCH}_2\text{CH}_2\text{CH}_3$	186.24
3771	—, octyl phenyl	1-phenoxyoctane*.....	$\text{C}_6\text{H}_5\text{O}(\text{CH}_2)_7\text{CH}_3$	206.32
3772	—, perchloro-	See <i>Ether, bis(pentachloroethyl)</i>		
3773	—, phenyl propyl ...	propoxybenzene*.....	$\text{C}_6\text{H}_5\text{OC}_3\text{H}_7$	136.19
3774	—, phenyl vinyl	ethenoxybenzene*.....	$\text{C}_6\text{H}_5\text{OCH}:\text{CH}_2$...	120.14
3775	—, propyl <i>o</i>-tolyl ...	2-propoxytoluene*; <i>o</i> -cresyl propyl ether	$\text{CH}_3\text{C}_6\text{H}_4\text{O}(\text{CH}_2)_2\text{CH}_3$	150.21
3776	—, propyl <i>m</i>-tolyl ...	3-propoxytoluene*.....	$\text{CH}_3\text{C}_6\text{H}_4\text{OC}_3\text{H}_7$...	150.21
3777	—, propyl <i>p</i>-tolyl ...	4-propoxytoluene*.....	$\text{CH}_3\text{C}_6\text{H}_4\text{OC}_3\text{H}_7$...	150.21
3778	Ethine.	See <i>Acetylene</i> .		
3779	Ethynyl tribromide.	See <i>Ethylene, tribromo-</i> .		
3780	Ethynyl trichloride.	See <i>Ethylene, trichloro-</i> .		
3781	Ethionic anhydride ...	carbyl sulfate; 1,3,2,4-dioxadithiane 2,4-bisoxide	$\text{SO}_2\text{OCH}_2\text{CH}_2\text{SO}_2\text{O}$	188.17
3782	Ethocain.	See <i>Procaine, hydrochloride</i> .		
3783	Ethoxyamine*	α -ethylhydroxylamine.....	$\text{C}_2\text{H}_5\text{ONH}_2$	61.08
3784	Ethyl. For ethyl derivatives see the parent compounds (e. g., for ethylbenzene see	See <i>Acetic acid, ethyl ester</i> .		
3784M	Ethylal.	See <i>Methane, diethoxy-</i> .		
3785	Ethyl alcohol	ethanol*; methylcarbinol; alcohol; spirit of wine	$\text{CH}_3\text{CH}_2\text{OH}$	46.07
3786	—, For other derivatives see	See <i>Ethanol</i> .		
3787	—, esters with organic acids. See "ethyl ester," under the	aminoethane.....	names of the acids. $\text{C}_2\text{H}_5\text{NH}_2$	45.08
3788	—, hydrobromide	ethylammonium bromide*...	$\text{C}_2\text{H}_5\text{NH}_2\cdot\text{HBr}$	126.01
3789	—, hydrochloride		$\text{C}_2\text{H}_5\text{NH}_2\cdot\text{HCl}$	81.55
3789M	—, hydroiodide		$\text{C}_2\text{H}_5\text{NH}_2\cdot\text{HI}$	173.01
3790	—, <i>N</i>-benzylidene ...	<i>N</i> -ethylbenzalimine; <i>N</i> -benzalethylamine	$\text{C}_6\text{H}_5\text{CH}:\text{NC}_2\text{H}_5$...	133.19
3791	—, β, β-diethoxy- ...	aminoacetaldehyde; 2, 2-diethoxyethylamine; aminoacetal; acetethylamine dimethylaminoacetal.....	$(\text{C}_2\text{H}_5\text{O})_2\text{CH}-\text{CH}_2\text{NH}_2$	133.19
3792	—, β, β-diethoxy-<i>N,N</i>-dimethyl-		$(\text{CH}_3)_2\text{NCH}_2-\text{CH}(\text{OC}_2\text{H}_5)_2$	161.24
3793	—, α, α-dimethyl-	See <i>tert-Butylamine</i> .		
3794	—, β-ethoxy*	2-aminodiethyl ether; β -aminoethyl ethyl ether	$\text{C}_2\text{H}_5\text{OCH}_2\text{CH}_2\text{NH}_2$	89.14
3795	—, β-ethoxy-<i>N</i>-methyl-	ethyl β -methylaminoethyl ether	$\text{CH}_3\text{NHCH}_2\text{CH}_2\text{OC}_2\text{H}_5$	103.16
3796	—, β-hydroxy-	See <i>Ethanol, 2-amino*</i> .		
3797	—, β-hydroxy-<i>N,N</i>-dimethyl-	See <i>Ethanol, 2-dimethylamino*</i> .		
3798	—, β-hydroxy-<i>N</i>-methyl-	See <i>Ethanol, 2-methylamino*</i> .		
3799	—, α-phenyl-	See <i>Benzylamine, α-methyl-</i> .		
3800	—, β-phenyl-	See <i>Phenethylamine</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3767	liq., 1.506 ²⁶ ...	0.9766 ^{$\frac{15}{15}$}	.....	177.2; (172-3)	.....	.....	.....
3768	liq., 1.51237 ^{19.3}	0.9709 ^{$\frac{19.3}{4}$}	.....	176.5 (173-4)	.....	.....	.....
3769	liq., 1.5928 ^{18.4}	1.0447 ^{18.4}	.....	298-9	.....	.....	.....
3770	need.....	.....	39.5-40	.....	.....	.....	.....
3771	col. liq.....	0.9139 ^{$\frac{15}{15}$}	8	285.2	.....	.....	.....
3772	.....	.....	.....	.....	.....	.....	.....
3773	col. liq.....	0.9530 ^{$\frac{15}{15}$}	.....	190.5	.....	s.	s. eth.
3774	.....	.....	.....	155-6	.....	.....	.....
3775	.....	0.9517 ^{$\frac{0}{0}$}	.....	204.1	.....	.....	.....
3776	.....	0.9484 ^{$\frac{0}{0}$}	.....	210.6	.....	.....	.....
3777	.....	0.9497 ^{$\frac{0}{0}$}	.....	210.4	.....	.....	.....
3778	.....	.....	.....	.....	.....	.....	.....
3779	.....	.....	.....	.....	.....	.....	.....
3780	.....	.....	.....	.....	.....	.....	.....
3781	deliq. cr.....	.....	80	.....	d.	.....	.....
3782	.....	.....	.....	.....	.....	.....	.....
3783	col. liq..... <i>Benzene, ethyl-</i>	0.8837 ^{.5} For ethyl	.....	68	∞	∞	∞ eth.
3784	.....	.....	esters of org	anic acids se	e the aci	ds.	.....
3784M	.....	.....	.....	.....	.....	.....	.....
3785	col. liq., 1.36242 ^{18.35}	0.7893 ^{$\frac{20}{4}$} ; 0.78505 ^{$\frac{25}{4}$}	-117.3; -114.6	78.5 (78.37)	∞	.....	∞ eth., chl.; s. me. al.
3786	.....	.....	.....	.....	.....	.....	.....
3787	col. liq.....	0.7059 ^{$\frac{0}{4}$} ; 0.689 ^{$\frac{15}{15}$}	-80.6	16.6	∞	∞	∞ eth.
3788	need. or pl. f. al.	1.741 ^{$\frac{20}{4}$}	159.5	.....	.....	.....	.....
3789	monocl. deliq. pl. f. al.	1.2045 ^{$\frac{21}{4}$}	108	d. 315	238 ¹⁷	s.	i. eth.
3789M	need. f. w.....	.....	188.5	.....	.....	sl. s.	.....
3790	1.541 ^{$\frac{20}{H_2}$}	0.937 ^{$\frac{20}{4}$}	.....	195	i.	∞	∞ eth.
3791	liq., 1.4120	0.9161 ^{$\frac{25}{4}$}	.....	163	s.	s.	s. eth., CHCl ₃
3792	yel. liq.....	0.885 ^{$\frac{7}{4}$}	.....	170-1	s.	s.	s. eth.
3793	.....	.....	.....	.....	.....	.....	.....
3794	liq., 1.4101 ²⁰ ...	0.8512 ^{$\frac{20}{4}$}	.....	108	∞	∞	∞ eth.
3795	liq., 1.4147....	0.8363 ^{$\frac{20}{4}$}	.....	114-5 ⁷⁴⁴	.....	.....	.....
3796	.....	.....	.....	.....	.....	.....	.....
3797	.....	.....	.....	.....	.....	.....	.....
3798	.....	.....	.....	.....	.....	.....	.....
3799	.....	.....	.....	.....	.....	.....	.....
3800	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3801	Ethyl arsenate	triethyl arsenate; ethyl orthoarsenate	$(C_2H_5)_3AsO_4$	226.09
3802	Ethyl arsenite	triethyl arsenite; ethyl orthoarsenite	$(C_2H_5)_3AsO_3$	210.09
3803	Ethyl borate	triethyl borate; triethoxyboron	$B(OC_2H_5)_3$	146.00
3804	Ethyl bromide	bromoethane*	CH_3CH_2Br	108.98
3805	—, vinyl-	See 1-Butene, 4-bromo-*		
3805M	Ethylcellulose	See Cellulose, ethyl ether.		
3806	Ethyl chloride	chloroethane*	CH_3CH_2Cl	64.52
3807	Ethyl cyanide	See Propionitrile.		
3808	Ethyl disulfide	ethyldithioethane*; diethyl disulfide	$(C_2H_5)_2S_2$	122.24
3809	Ethylene	ethene*; elayl.....	$CH_2:CH_2$	28.05
3810	—, esters.	See "diacetate", "dibenzoate", etc. under Glycol.		
3811	—, bromo-	See Vinyl bromide.		
3812	—, 1-bromo-2-phenyl-	See Styrene, β -bromo-		
3813	—, butyl-	See 1-Hexene*		
3814	—, sec-butyl-	See 1-Pentene, 3-methyl-*		
3815	—, tert-butyl-	See 1-Butene, 3,3-dimethyl-*		
3816	—, 1-butyl-1-methyl-	See 1-Hexene, 2-methyl-*		
3817	—, 1-butyl-2-methyl-	See 2-Heptene*		
3818	—, 1-sec-butyl-1-methyl-	See 1-Pentene, 2,3-dimethyl-*		
3819	—, 1-sec-butyl-2-methyl-	See 2-Hexene, 4-methyl-*		
3820	—, chloro-	See Vinyl chloride.		
3821	—, 1,2-dibromo-	acetylene dibromide; sym-dibromoethylene	$CHBr:CHBr$	185.87
3822	—, 1,1-dichloro-	uns-dichloroethylene.....	$CH_2:CCl_2$	96.95
3823	—, 1,2 (or sym)-dichloro-(cis)	acetylene dichloride.....	$CHCl:CHCl$	96.95
3823A	—, 1,2 (or sym)-dichloro-(trans)	acetylene dichloride.....	$CHCl:CHCl$	96.95
3824	Ethylene, 1,1 (or uns)-	diethyl-. See 1-Butene, 2-ethyl-*		
3825	—, 1,2 (or sym)-diethyl-	See 3-Hexene*		
3826	—, 1,1-diethyl-2-methyl-	See 2-Pentene, 3-ethyl-*		
3826M	—, 1,1-difluoro-	uns-difluoroethylene.....	$CH_2:CF_2$	64.04
3827	—, 1,2 (or sym)-diisopropyl-	See 3-Hexene, 2,5-dimethyl-*		
3828	—, 1,1 (or uns)-dimethyl-	See Propene, 2-methyl-*		
3829	—, 1,2 (or sym)-dimethyl-	See 2-Butene*		
3830	—, 1,1-dimethyl-2-propyl-	See 2-Hexene, 2-methyl-*		
3831	—, 1,2-dimethyl-1-propyl-	See 2-Hexene, 3-methyl-*		
3832	—, 1,1-diphenyl-	uns-diphenylethylene.....	$(C_6H_5)_2C:CH_2$	180.24
3833	—, trans-1,2-diphenyl-	See Stilbene.		
3834	—, ethyl-	See 1-Butene*		
3835	—, 1-ethyl-1,2-dimethyl-	See 2-Pentene, 3-methyl-*		
3836	—, 2-ethyl-1,1-dimethyl-	See 2-Pentene, 2-methyl-*		
3837	—, 1-ethyl-1-isobutyl-	See 1-Butene, 2-ethyl-3-methyl-*		
3838	—, 1-ethyl-2-isopropyl-	See 3-Hexene, 2-methyl-*		
3839	—, 1-ethyl-1-methyl-	See 1-Butene, 2-methyl-*		
3840	—, 1-ethyl-2-methyl-	See 2-Pentene*		
3841	—, 1-ethyl-1-propyl-	See 1-Pentene, 2-ethyl-*		
3842	—, 1-ethyl-2-propyl-	See 3-Heptene*		
3843	—, ethyltrimethyl-	See 2-Pentene, 2,3-dimethyl-*		
3843M	—, fluoro-	See Vinyl fluoride.		
3844	—, iodo-	See Vinyl iodide.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3801	.....	$1.3264\frac{0}{4}$	.....	238	d. c.	.....	.....
3802	.....	$1.224\frac{0}{4}$	.....	166	d. c.	.....	.....
3803	col. liq., 1.381	$0.864\frac{26.5}{4}$	.....	120	d.	∞	∞ eth.
3804	col. liq., 1.42386	$1.430\frac{20}{4}$; $1.4505\frac{25}{4}$	-119	38.0	1.08^9 , $0.96^{17.5}$, 0.91^{20}	∞	∞ eth., chl.
3805							
3805M							
3806	col. liq. or gas.	$0.9214\frac{0}{4}$	-138.7	12.2	0.574^{20}	48.3^{21}	∞ eth.
3807							
3808	oil, 1.50633 ²⁰	$0.99267\frac{20}{4}$	.....	153-4	v. sl. s.	∞	∞ eth.
3809	col. gas, 1.363 ⁻¹⁰⁰	1.245^9 g/l; $0.566\frac{-102}{4}$	-169.4; frz. -181	-103.9	25.6^9 cm ³	360 cm ³	s. eth.
3810							
3811							
3812							
3813							
3814							
3815							
3816							
3817							
3818							
3819							
3820							
3821	col. liq., 1.5428	$2.271\frac{17.5}{4}$	(cis)-53; (trans)-6.5	$110^{75.4}$, 108, 37	i.	v. s.	v. s. eth.
3822	liq.	$1.250\frac{15}{4}$	.....	.....	i.	.....	.....
3823	liq., 1.4519 ¹⁵ ...	$1.291\frac{15}{4}$	-80.5	60.1	i.	∞	∞ eth.
3823A	liq., 1.4490 ¹⁵ ...	$1.265\frac{15}{4}$	-50	48.4	i.	∞	∞ eth.
3824							
3825							
3826							
3826M	col. gas. ....	.....	.....	<-70	i.	s.	s. eth.
3827							
3828							
3829							
3830							
3831							
3832	col. liq., 1.610 ¹⁴	$1.038\frac{14}{4}$; $1.0206\frac{22}{4}$	9	277	.....	.....	.....
3833							
3834							
3835							
3836							
3837							
3838							
3839							
3840							
3841							
3842							
3843							
3843M							
3844							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3845	Ethylene, isoamyl-	See 1- <i>Hexene</i> , 5-methyl- [*] .		
3846	—, isobutyl-	See 1- <i>Pentene</i> , 4-methyl- [*] .		
3847	—, 1-isobutyl-1-methyl-	See 1- <i>Pentene</i> , 2,4-dimethyl- [*] .		
3848	—, 1-isobutyl-2-methyl-	See 2- <i>Hexene</i> , 5-methyl- [*] .		
3849	—, isopropyl-	See 1- <i>Butene</i> , 3-methyl- [*] .		
3850	—, 1-isopropyl-1,2-dimethyl-	See 2- <i>Pentene</i> , 3,4-dimethyl- [*] .		
3851	—, 2-isopropyl-1,1-dimethyl-	See 2- <i>Pentene</i> , 2,4-dimethyl- [*] .		
3852	—, 1-isopropyl-1-methyl-	See 1- <i>Butene</i> , 2,3-dimethyl- [*] .		
3853	—, 1-isopropyl-2-methyl-	See 2- <i>Pentene</i> , 4-methyl- [*] .		
3854	—, methyl-	See <i>Propene</i> [*] .		
3855	—, 1-methyl-1-phenyl-	See <i>Benzene</i> , <i>isopropenyl-</i> .		
3856	—, 1-methyl-1-propyl-	See 1- <i>Pentene</i> , 2-methyl- [*] .		
3857	—, 1-methyl-2-propyl-	See 2- <i>Hexene</i> [*] .		
3858	—, perchloro-	See <i>Ethylene</i> , <i>tetrachloro-</i> .		
3858M	—, perfluoro-	See <i>Ethylene</i> , <i>tetrafluoro-</i> .		
3859	—, phenyl-	See <i>Styrene</i> .		
3860	—, propyl-	See 1- <i>Pentene</i> [*] .		
3861	—, pseudobutyl-	See 1- <i>Butene</i> , 3,3-dimethyl- [*] .		
3862	—, tetrachloro-	perchloroethylene.....	CCl ₂ :CCl ₂	165.85
3862M	—, tetrafluoro-	perfluoroethylene.....	CF ₂ :CF ₂	100.02
3863	—, tetraiodo-.....	.....	CI ₂ :CI ₂	531.70
3864	—, tetramethyl-	See 2- <i>Butene</i> , 2,3-dimethyl- [*] .		
3865	—, tetraphenyl-.....	.....	(C ₆ H ₅) ₂ C:C-(C ₆ H ₅) ₂	332.42
3866	—, tribromo-	ethinyl tribromide.....	CHBr:CHBr.....	264.78
3867	—, trichloro-	ethinyl trichloride.....	CHCl:CCl ₂	131.40
3868	—, trimethyl-	See 2- <i>Butene</i> , 3-methyl- [*] .		
3869	—, triphenyl-	α-phenylstilbene.....	(C ₆ H ₅) ₂ C:CH-C ₆ H ₅	256.33
3870	—, vinyl-	See 1,3- <i>Butadiene</i> [*] .		
3871	Ethylene bromide	1,2-dibromoethane [*] ; ethylenedibromide; glycol dibromide	CH ₂ BrCH ₂ Br.....	187.88
3872	Ethylene bromohydrin	See <i>Ethanol</i> , 2-bromo- [*] .		
3873	Ethylenecarboxylic acid	d. See <i>Acrylic acid</i> .		
3874	Ethylene chloride	1,2-dichloroethane [*] ; ethylenedichloride; glycol dichloride	CH ₂ ClCH ₂ Cl.....	98.97
3875	Ethylene chlorobromide	See <i>Ethane</i> , 1-bromo-2-chloro- [*] .		
3876	Ethylene chlorohydrin	See <i>Ethanol</i> , 2-chloro- [*] .		
3877	Ethylene cyanide	See <i>Succinonitrile</i> .		
3878	Ethylene cyanohydrin	See <i>Hydracrylonitrile</i> .		
3879	Ethylenediamine (anh.)	1,2-ethanediamine [*]	NH ₂ CH ₂ CH ₂ NH ₂	60.10
3880	Ethylenediamine (hydrate)	.....	NH ₂ CH ₂ CH ₂ NH ₂ ·H ₂ O	78.12
3880M	—, hexavanadate.....	.....	2C ₂ H ₄ (NH ₂) ₂ ·H ₄ V ₆ O ₁₇ ·4H ₂ O	774.00
3881	—, hydrochloride	ethylenediammonium chloride	HCl·NH ₂ CH ₂ CH ₂ NH ₂ ·HCl	133.03
3882	—, N,N'-diphenyl-	sym-diphenylethylenediamine; ethylenediphenyldiamine	C ₆ H ₅ NHCH ₂ CH ₂ NHC ₆ H ₅	212.29
3883	1,1-Ethylenedicarboxylic acid , 2-phenyl-	See <i>Malonic acid</i> , benzylidene-.		
3884	cis-1,2-Ethylenedicarboxylic acid	See <i>Maleic acid</i> .		
3885	trans-1,2-Ethylenedicarboxylic acid	See <i>Fumaric acid</i> .		
3885M	Ethylene difluoride	See <i>Ethylene fluoride</i> .		
3886	Ethylene diiodide	See <i>Ethylene iodide</i> .		

^{*}Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3845							
3846							
3847							
3848							
3849							
3850							
3851							
3852							
3853							
3854							
3855							
3856							
3857							
3858							
3858M							
3859							
3860							
3861							
3862	col. liq., 1.50547	1.6311 $\frac{1.6}{4}$	-22.35	121.20	i.	∞	∞ eth.
3862M	col. gas. ....	.....	-142.5	-78.4	i.	.....	.....
3863	yel. monoc. pr.	2.983 $\frac{2.0}{4}$	187	subl.	i.	sl. s.	sl. s. eth.; v. s. CS ₂ ; s. bz., chl., tol., ac. a.
3864							v. sl. s. eth.; v. s. bz.
3865	col. monoc. or rhomb. f. bz.	.....	227 (221)	425	i.	v. sl. s.	.....
3866	liq.	2.708 $\frac{20.5}{4}$	.....	163-4; 53-5 ⁹	.....	.....	.....
3867	col. liq., 1.4777	1.45560 $\frac{2.6}{4}$	-73 (-86)	87	0.1	∞	∞ eth.
3868							
3869	narrow leaf. f. al. or ac. a.	.....	72-3	220-1 ¹⁴	i.	v. s.	v. s. eth.
3870							
3871	col. liq., 1.53789	2.1701 $\frac{2.5}{4}$	9.97 (10)	131.6	0.431 ³⁰	s.	∞ eth.
3872							
3873							
3874	col. liq., 1.44432	1.257 $\frac{2.0}{4}$	-35.3	83.5-3.7	0.92 ⁹ , 0.869 ²⁰	s.	∞ eth.; s. ord. org. solv.
3875							
3876							
3877							
3878							
3879	col. liq., 1.45400 ^{20.1}	0.8994 $\frac{2.0}{4}$	8.5	116.1 (117)	s.	.....	0.236 eth.; i. bz.
3880	col. liq., 1.4500	0.963 $\frac{2.1}{4}$	10	118	.....	.....	.....
3880M	brownish-yel. ....	.....	.....	.....	sl. s.	i.	i. eth.
3881	1.633. ....	.....	.....	.....	.....	.....	.....
3882	col. leaf. f. dil. al.	.....	65	.....	i.	v. s.	v. s. eth.
3883							
3884							
3885							
3885M							
3886							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3887	Ethylene dimercaptan.	See 1,2-Ethanedithiol*.		
3888	Ethylenediphenyldiamine.	See Ethylenediamine, N, N'-diphenyl-.		
3889	Ethylene diphenyl ether.	See Ethane, 1,2-diphenoxy-.		
3890	Ethylene disulfonic acid.	See 1,2-Ethanedisulfonic acid*.		
3891	Ethylene ethylidene ether.	See 1,3-Dioxolane, 2-methyl-.		
3891H	Ethylene fluoride.....	1,2-difluoroethane*; ethylene difluoride; glycol difluoride	$\text{CH}_2\text{FCH}_2\text{F}$	66.05
3891R	Ethylene fluorohydrin.	See Ethanol, 2-fluoro*.		
3892	Ethylene glycol.	See Glycol.		
3893	Ethylene imine.	See Ethylenimine.		
3894	Ethylene iodide.....	1,2-diiodoethane*; ethylene diiodide; glycol diiodide	$\text{CH}_2\text{ICH}_2\text{I}$	281.89
3895	Ethylene lactic acid.	See Hydracrylic acid.		
3896	Ethylene mercaptan.	See 1,2-Ethanedithiol*.		
3897	Ethylene nitrate.	See Glycol, dinitrate.		
3898	Ethylene nitrite.	See Glycol, dinitrite.		
3899	Ethylene oxide.....	1,2-epoxyethane*; oxirane...	$(\text{CH}_2)_2\text{O}$	44.05
3900	—, α,α -dimethyl-	1,2-epoxy-2-methylpropane; isobutylene oxide	$\text{CH}_2\text{C}(\text{CH}_3)_2\text{O}$	72.10
3900M	Ethylene sulfide.....	thiirane.....	$(\text{CH}_2)_2\text{S}$	60.11
3901	Ethylenimine.....	dimethylenimine; dihydroazirine	NHCH_2CH_2	43.07
3902	Ethyl ether.....	ethoxyethane*; diethyl ether; ether; ethyl oxide; sulfuric ether	$\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$	74.12
3903	Ethyl fluoride.....	fluoroethane*.....	$\text{CH}_3\text{CH}_2\text{F}$	48.06
3904	Ethyl hydrogen sulfat	e. See Ethylsulfuric acid.		
3905	Ethyl hydrosulfide.	See Ethanethiol*.		
3906	Ethylidene bromide.	See Ethane, 1,1-dibromo*.		
3907	Ethylidene chloride.	See Ethane, 1,1-dichloro*.		
3908	Ethylidene cyanohydrin.	See Lactonitrile.		
3908M	Ethylidene fluoride.	See Ethane, 1,1-difluoro*.		
3909	Ethylidene glycol, tribromo-.	See Bromal, hydrate.		
3910	—, trichloro-.	See Chloral hydrate.		
3911	Ethylidene iodide.	See Ethane, 1,1-diiodo*.		
3912	Ethyl iodide.....	iodoethane*.....	$\text{CH}_3\text{CH}_2\text{I}$	155.98
3913	Ethyl isocyanide.....	ethylcarbylamine*.....	$\text{C}_2\text{H}_5\text{NC}$	55.08
3914	Ethyl ketone.	See 3-Pentanone*.		
3915	Ethyl mercaptan.	See Ethanethiol*.		
3916	Ethyl mustard oil.	See Isothiocyanic acid, ethyl ester.		
3917	Ethyl nitrate.....	nitric ether.....	$\text{C}_2\text{H}_5\text{ONO}_2$	91.07
3918	Ethyl nitrite.....	nitrous ether.....	$\text{C}_2\text{H}_5\text{ONO}$	75.07
3919	Ethyloglycolic acid.	See Acetic acid, ethoxy-.		
3920	Ethylolamine.	See Ethanol, 2-amino*.		
3921	Ethyl orthoarsenate.	See Ethyl arsenate.		
3922	Ethyl orthoarsenite.	See Ethyl arsenite.		
3923	Ethyl orthosilicate.....		$(\text{C}_2\text{H}_5)_4\text{SiO}_4$	208.30
3924	Ethyl oxide.	See Ethyl ether.		
3925	Ethyl phosphate.....	triethyl phosphate.....	$(\text{C}_2\text{H}_5)_3\text{PO}_4$	182.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3887							
3888							
3889							
3890							
3891							
3891 H	col. gas. ....	.....	.....	10-11	.....	.....	.....
3891 R							
3892							
3893							
3894	yel. monoc. pr. f. eth.	2.132 $\frac{10}{4}$	81-2	d.	sl. s.	s.	s. eth.
3895							
3896							
3897							
3898							
3899	col. liq. or gas, 1.35988 ^{88.4}	1.965 ⁰ g/l; 0.887 $\frac{7}{4}$	-111.3	10.7	∞	∞	∞ eth.
3900	liq.	0.831	.....	51-2	.....	s.	s. eth.
3900 M	col. liq., 1.4914 ¹⁸	1.0368 $\frac{0}{4}$	d.	55-56	.....	v. sl. s.	v. sl. s. eth.
3901	oil.	0.832 $\frac{20}{4}$	.....	55-6	∞	s.	.....
3902	col. liq. or rhomb., 1.3497 ^{24.8}	0.7135 $\frac{20}{4}$	α-116.3 β-123.3	34.6	7.5 ²⁰	∞	∞ chl., bz.; s. conc. H ₂ SO ₄
3903	col. gas, 1.3057 ⁻⁴⁰	0.8158 ^{-37.7} ; 2.198 ⁰ g/l	-143.2	-37.7	198 ¹⁴ cm ³	v. s.	v. s. eth.
3904							
3905							
3906							
3907							
3908							
3908 M							
3909							
3910							
3911							
3912	col. liq., 1.5222 ^{27.0}	1.933 $\frac{20}{4}$; 1.9245 $\frac{25}{4}$	-108.5 (-105 to -111)	72.2	0.4 ²⁰	s.	s. eth., bz., chl.
3913	col. liq., 1.3659 ²⁴	0.7402 $\frac{20}{4}$	<-66	79	v. s.	∞	∞ eth.
3914							
3915							
3916							
3917	col. inflam. liq., 1.38484 ^{21.5}	1.105 $\frac{20}{4}$	-102 (-112)	88.7	1.3 ⁵⁵ (i.)	∞	∞ eth.
3918	col. or yelsh. liq.	0.900 ^{15.5}	.....	17	v. sl. s.	∞	s. eth.
3919							
3920							
3921							
3922							
3923	col. liq.	0.933 $\frac{20}{4}$	.....	165.5	d.	v. s.	∞ eth.
3924							
3925	liq., 1.40616 ¹⁰	1.0686 $\frac{25}{4}$	.....	216	100 ²⁵ d.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3926	Ethyl phosphite	triethyl phosphite.....	$(C_2H_5)_3PO_3$	166.16
3927	Ethyl selenide	diethyl selenide.....	$(C_2H_5)_2Se$	137.08
3928	Ethyl silicate	See <i>Ethyl orthosilicate</i> .		
3929	Ethyl sulfate	diethyl sulfate.....	$(C_2H_5)_2SO_4$	154.18
3930	Ethyl sulfide	ethylthioethane*; diethyl sulfide	$(C_2H_5)_2S$	90.18
3931	Ethylsulfinic acid	See <i>Ethanesulfinic acid</i> .*		
3932	Ethyl sulfite	diethyl sulfite.....	$(C_2H_5)_2SO_3$	138.18
3933	Ethyl sulfone	ethylsulfonylethane*; diethyl sulfone	$(C_2H_5)_2SO_2$	122.18
3934	Ethylsulfonic acid	See <i>Ethanesulfonic acid</i> *.		
3935	Ethyl sulfoxide	ethylsulfinylethane*; diethyl sulfoxide	$(C_2H_5)_2SO$	106.18
3936	Ethylsulfuric acid	ethyl hydrogen sulfate; acid ethyl sulfate	$C_2H_5OSO_3H$	126.13
3937	Ethyl telluride	tellurium ethyl; diethyl telluride	$(C_2H_5)_2Te$	185.73
3938	Ethyl thioalcohol	See <i>Ethanethiol</i> *.		
3939	Ethyne*	See <i>Acetylene</i> .		
3940	Ethynyl bromide	See <i>Acetylene, bromo-</i> .		
3941	α-Eucaine		$C_{19}H_{27}NO_4$	333.42
3942	—, hydrochloride.....		$C_{19}H_{27}NO_4 \cdot HCl$ H_2O	387.90
3943	β-Eucaine	benzamine; betacaine.....	$C_{15}H_{21}NO_2$	247.33
3944	—, hydrochloride.....		$C_{15}H_{21}NO_2 \cdot HCl$...	283.79
3945	—, lactate.....	4-benzyloxy-2,2,6-trimethylpiperidine lactate; benzamine lactate; benzoylvinylacetonealkamine lactate	$C_{15}H_{21}NO_2 \cdot C_3H_5O_3$	337.41
3946	Eucalyptole	See <i>Cineole</i> .		
3947	Eugenic acid	See <i>Eugenol</i> .		
3948	Eugenol	4-allylguaiacol; eugenic acid..	$CH_2:CHCH_2C_6H_3-(OCH_3)OH$	164.20
3949	—, methyl ether.....	See <i>Veratrole, 4-allyl-</i> .		
3950	—, methyl-.....	See <i>Veratrole, 4-allyl-</i> .		
3951	Eugetic acid	5-allyl-3-methoxysalicylic acid; eugetic acid	$C_3H_5C_6H_2(OCH_3)-(OH)COOH$	208.21
3952	Eupittone	hexamethoxyaurin; eupittonic acid	$C_{19}H_9(OCH_3)_6O_3$..	470.46
3953	Euxanthic acid		$C_{19}H_{16}O_{10} \cdot 3H_2O$...	458.37
3954	Euxanthone	1,7-dihydroxyxanthone.....	$HOC_6H_3(CO)(O)-C_6H_3OH$	228.19
3955	—, 3-methoxy-.....	See <i>Gentisin</i> .		
3956	Evernic acid	orsellinic acid 4-everninate; lecanoric acid monomethyl ether	$C_{17}H_{16}O_7$	332.30
3957	Evernic acid	2-hydroxy-6-methylanisic acid; orsellinic acid 4-methyl ether	$CH_3OC_6H_2(OH)-(CH_3)COOH$	182.17
3958	d-Evodiamine		$C_{19}H_{17}N_3O$	303.35
3959	i-Evodiamine (hydrate)		$C_{19}H_{17}N_3O \cdot H_2O$..	321.37
3960	Exalgin	See <i>Acetanilide, N-methyl-</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3926	col. liq., 1.4079	0.9687 $\frac{20}{4}$	.....	156.5	i.	v. s.	v. s. eth.
3927	liq., 1.4768....	1.2300 $\frac{20}{4}$	.....	108	i.	.....	.....
3928							
3929	col. oily liq., 1.4010 ¹³	1.1842 $\frac{15}{4}$; 1.172 $\frac{25}{4}$	-24.5	208 sl. d.; 96 ¹⁵	i., sl. d.; d. h.	∞, d. h.	∞ eth.
3930	col. liq., 1.44233	0.837 $\frac{20}{4}$	-102.1	92	0.313 ²⁰	s.	s. eth.
3931							
3932	col. liq., 1.4198 ¹¹	1.1062 $\frac{0}{4}$; 1.077 $\frac{20}{4}$	.....	158 (161.3)	s. d.	s.	s. eth.
3933	rhomb. pl.	1.357 $\frac{20}{4}$	73-4 (70)	248	15.6 ¹⁶	.....	s. h. eth.; v. s. bz.; i. pet. eth.
3934							
3935	syruy liq. ....	.....	5	89 ¹⁵ d.	s.	s.	s. eth.
3936	col. oily liq.	1.316 $\frac{17}{4}$	.....	280, d.	v. s.	s.	s. eth.
3937	red-yel. liq.	1.599 $\frac{15}{4}$	.....	138	i.	s.	.....
3938							
3939							
3940							
3941	shining pr. cr. ....	.....	103-5	.....	.....	.....	v. s. eth.
3942	rosettes f. sm. cr. ....	.....	ca. 200 d.	.....	10	117	sl. s. eth.
3943	wh. cr. ....	.....	78 (91)	.....	.....	.....	v. s. eth.
3944	wh. pl. or pr. ....	.....	268 d.	.....	3.33	3.53	s. eth., chl.
3945	col. cr. ....	.....	.....	.....	s.	s.	.....
3946							
3947							
3948	col. liq., 1.5416 ^{19,4}	1.0664 $\frac{20}{4}$; 1.0620 $\frac{25}{4}$	10.3	252-3	v. sl. s.	∞	∞ eth.; s. chl., oils
3949							
3950							
3951	pr. f. w. ....	.....	124; anh. 127	d.	sl. s. c.; s. h.	s.	s. eth., (NH ₄) ₂ CO ₃
3952	or. need. f. al. ....	.....	200 d.	.....	.....	sl. s. h.	s. glac. ac. a., alk., bl. color
3953	pa. yel. need. ....	.....	155-8 d. (162)	d.	sl. s.	s. h.	v. sl. s. eth.; s. alk.
3954	yel. need. ....	.....	240	subl. d.	i.	s. h.	sl. s. eth.; s. alk.
3955							
3956	need. or pr. f. al. ....	.....	168-9 d. (164)	.....	i. c., v. sl. s. h.	s.	s. eth.
3957	cr. f. w. ....	.....	170-1 d. (157)	.....	s. h.	s.	s. eth., h. bz.
3958	yel. leaf. ....	.....	278	.....	.....	.....	i. dil. a.
3959	rhomb. leaf. ....	.....	146-7	.....	.....	.....	.....
3960							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3962	6-Fenchanol.	See <i>Isofenchyl alcohol</i> .		
3963	2-Fenchanone.	See <i>Fenchone</i> .		
3964	1-α-Fenchene	<i>l</i> -7,7-dimethyl-2-methyl- enenorcamphane	$C_{10}H_{16}$	136.23
3965	d-Fenchone	<i>d</i> -2-fenchanone; <i>d</i> -1,3,3- trimethyl-2-norcampha- none; fenchone	$C_{10}H_{16}O$	152.23
3966	Ferulic acid	4-hydroxy-3-methoxycin- namic acid	$HO(OCH_3)C_6H_3-$ $CH:CHCOOH$	194.18
3967	Filixic acid		$C_{35}H_{40}O_{12}$	652.67
3968	Fisetin	3,7,3',4'-tetrahydroxyflavone	HOC_6H_3OC- $[C_6H_3(OH)_2]_2C-$ $(OH)CO$	286.23
3969	Flavaniline	2-(<i>p</i> -aminophenyl)lepidine.....	$NH_2C_6H_4C_9H_5N-$ CH_3	234.29
3970	3,5,7,3',4'-Flavenpento	1. See <i>d-Catechol</i> .		
3971	Flavianic acid, histidine	salt. See <i>Histidine, diflavianate</i> .		
3972	Flavol	2,6-anthracenediol*; 2,6- anthradiol	$HOC_6H_3(CH)_2-$ C_6H_3OH	210.22
3973	Flavone	2-phenylchromone; 2-phenyl- 1,4-benzopyrone	$C_6H_4OC(C_6H_5):$ $CHCO$	222.23
3974	—, 5,7-dihydroxy-.	See <i>Chrysin</i> .		
3975	—, 3,5,7,2',4'-pentahydroxy-.	See <i>Morin</i> .		
3976	—, 3,5,7,3',4'-pentahydroxy-.	See <i>Quercetin</i> .		
3977	—, 3,7,3',4'-tetrahydroxy-.	See <i>Fisetin</i> .		
3978	Flavopurpurin	1,2,6-trihydroxyanthra- quinone	$HOC_6H_3(CO)_2-$ $C_6H_2(OH)_2$	256.20
3979	Fluoran	9-hydroxy-9-xanthene- <i>o</i> - benzoic acid lactone	$C_{20}H_{12}O_3$	300.30
3980	—, 2,7-dihydroxy-.	See <i>Hydroquinonephthalein</i> .		
3981	Fluoranthene	idryl.....	$C_{16}H_{10}$	202.24
3982	Fluorene	diphenylenemethane.....	$C_6H_4CH_2C_6H_4$	166.21
3983	—, keto-.	See 9- <i>Fluorenone</i> *.		
3984	—, 9-oxo-.	See 9- <i>Fluorenone</i> *.		
3985	Fluorene alcohol.	See 9- <i>Fluorenol</i> *.		
3986	9-Fluorenol *.....	fluorene alcohol; diphenyl- enecarbinol	$C_6H_4CHOHC_6H_4$	182.21
3987	9-Fluorenone *.....	9-oxofluorene; ketofluorene; diphenylene ketone	$C_6H_4COC_6H_4$	180.19
3988	Fluorescein	resorcinolphthalein.....	$C_{20}H_{12}O_6$	332.30
3989	—, dibromohydroxy	mercuri-, disodium salt. See	<i>Mercurochrome</i>	220
3990	—, 4,5-dihydroxy-.	See <i>Gallein</i> .		
3991	—, 2,4,5,7-tetrabrom	o-. See <i>Eosin</i> .		
3992	—, 2,4,5,7-tetraiodo-	o-. See <i>Erythrosin</i> .		
3993	Fluoro- . See the parent co	mpounds (e.g., for fluorobenzen	e see <i>Benzene, fluor</i>	o-).
3993M	Fluoroform	trifluoromethane*.....	CHF_3	70.02
3993M	—, methyl-.	See <i>Ethane, 1,1,1-trifluoro-</i> *		
3994	Formal.	See <i>Methane, dimethoxy-</i> *		
3995	Formaldehyde	methanal*; oxomethane.....	$HCHO$	30.03
3996	—, diethyl acetal.	See <i>Methane, diethoxy-</i> *		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3962							
3963							
3964	liq., 1.4724 ¹⁹ ...	0.864 ²⁰ ₄	.....	158 (155-6)	i.	∞	∞ eth.
3965	oil, 1.4647 ^{14,5} ...	0.9460 ²⁰ ₄	6	193-5	i.	v. s.	v. s. eth.
3966	rhomb. need. f. w.	.....	168 (169-70)	d.	s. h.	v. s.	sl. s. eth., bz.
3967	cr. ....	.....	184 (160)	.....	i.	i.	sl. s. eth.; s CS ₂
3968	yel. need. ....	.....	360	.....	i.	s.	sl. s. eth., bz.
3969	col. pr. f. bz. ....	.....	97	.....	v. sl. s.	s.	s. bz.
3970							
3971							
3972	yel. cr. powd. f. al.	.....	295-300 d. (270 d.)	.....	i.	v. s.	v. s. eth.; s. ac. a.
3973	col. f. lgr. ....	.....	97	.....	i.	s.	s. eth.
3974							
3975							
3976							
3977							
3978	yel. need. f. al. ....	.....	>360	459	v. sl. s. h.	s. h.	sl. s. eth.
3979	flat need. ....	.....	173-5	.....	.....	s.	s. H ₂ SO ₄ , HNO ₃
3980							
3981	col. monoc. need. f. al.	.....	110	251 ⁶⁰	i.	sl. s. c.	v. s. eth.; s. CS ₂ , ac. a.
3982	col. leaf. f. al. ....	.....	116 (100-7)	295 (298)	i.	sl. s.	v. s. eth.; s. bz., CS ₂
3983							
3984							
3985							
3986	hex. need. f. w. ....	.....	153 (156)	.....	.....	s.	s. eth., bz.
3987	yel. rhomb. pr. ....	.....	84	341.5	i.	v. s.	v. s. eth.
3988	or.-red cr. powd.	.....	312-8 d. (d. 290)	.....	i.	s.	sl. s. eth.; s. alk. sol., dil. a., b. glac. ac. a.; i. bz., chl.
3989	<i>soluble.</i>						
3990							
3991							
3992							
3993	col. gas. ....	.....	-163	-82.2; 20 ⁴⁰ atm.	75 cm ³	364.5 cm ³	sl. s. CHCl ₃
3993M							
3994							
3995	col. gas.	0.815 ⁻²⁰ ₄	-92	-21	s.	s.	s. eth.
3996							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
3997	Formaldehyde , dimethyl	acetal. See <i>Methane, dimethox</i>	γ^*	
3997M	—, 2,4-dinitrophenylhydrazone	.....	$\text{HCH:NNHC}_6\text{H}_3(\text{NO}_2)_2$	210.15
3998	—, dipropyl acetal.	See <i>Methane, dipropoxy</i> .*		
3999	—, oxime	formoxime; formaldoxime.....	HCH:NOH	45.04
4000	—, 2-thienyl-	See <i>2-Thiophenecarbonal</i> .		
4001	—, thio- (trimer)	s-trithiane; trimethylene trisulfide; trithioformaldehyde; methanethial* (trimer)	$\text{SCH}_2\text{SCH}_2\text{SCH}_2$	138.26
4002	Formaldoxime .	See <i>Formaldehyde, oxime</i> .		
4003	Formamide	methanamide*.....	HCONH_2	45.04
4004	—, oxime.....	methenyl amidoxime; isuretin	HC(:NOH)NH_2 ...	60.06
4005	—, chloro-	See <i>Carbamyl chloride</i> .		
4006	—, N,N-diethyl-	N-formyldiethylamine.....	$\text{HCON}(\text{C}_2\text{H}_5)_2$	101.15
4007	—, N,N-diphenyl-	N-formyldiphenylamine; N-phenylformanilide	$\text{HCON}(\text{C}_6\text{H}_5)_2$	197.23
4008	—, N-ethyl-	N-ethylmethanamide.....	$\text{HCONHC}_2\text{H}_5$	73.09
4009	—, N-phenyl-	See <i>Formanilide</i> .		
4010	—, ureido-	See <i>Biuret</i> .		
4011	Formamidine , amino-	See <i>Guanidine</i> .		
4012	—, N,N-diphenyl-	.....	$\text{C}_6\text{H}_5\text{N:CHNH-C}_6\text{H}_5$	196.24
4013	Formamine .	See <i>Hexamethylenetetramine</i> .		
4014	Formanilide	N-phenylformamide.....	$\text{HCONHC}_6\text{H}_5$	121.13
4015	—, N-phenyl-	See <i>Formamide, N,N-diphenyl</i>		
4016	Formic acid	methanoic acid*.....	HCOOH	46.03
4017	—, allyl ester.....	allyl formate; 2-propenyl methanoate*	$\text{HCOOCH}_2\text{-CH:CH}_2$	86.09
4018	—, amyl ester.....	amyl formate; pentyl methanoate*	$\text{HCOO}(\text{CH}_2)_4\text{CH}_3$	116.16
4019	—, benzyl ester.....	benzyl formate; benzyl methanoate*	$\text{HCOOCH}_2\text{C}_6\text{H}_5$...	136.14
4020	—, butyl ester.....	butyl formate; butyl methanoate*	HCOOC_4H_9	102.13
4021	—, sec-butyl ester.....	.....	$\text{HCOOCH}(\text{CH}_3)\text{-C}_2\text{H}_5$	102.13
4022	—, ethyl ester	ethyl formate; ethyl methanoate*	HCOOC_2H_5	74.08
4023	—, ethylene ester.	See <i>Glycol, diformate</i> .		
4024	—, geranyl ester.	See <i>Geraniol, formate</i> .		
4025	—, heptyl ester.....	n-heptyl formate.....	$\text{HCOOC}_7\text{H}_{15}$	144.21
4026	—, hexyl ester.....	n-hexyl formate.....	$\text{HCOO}(\text{CH}_2)_5\text{CH}_3$	130.18
4027	—, isoamyl ester.....	γ -methylbutyl methanoate*..	$\text{HCOO}(\text{CH}_2)_2\text{-CH}(\text{CH}_3)_2$	116.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3997 3997M	yel. cr. ....	.....	167	.....	.....	s. h.	v. sl. s. eth.
3998 3999	col. liq. ....	.....	.....	84	ca. 10, d. h.	.....	.....
4000 4001	tetr. pr. ....	.....	215-6	subl.	i. c.; sl. s. h.	sl. s.	sl. s. eth.
4002 4003	col. liq., 1.44530 ^{22.7}	1.134 ²⁰ / ₄ ; 1.1292 ²⁵ / ₄	2.55	210.7 d. (92-5 ¹⁰)	∞	∞	sl. s. eth., bz.
4004	rhomb. f. acet. or al.	.....	114	d.	s.	sl. s.	sl. s. eth.; i. bz.
4005 4006	col. liq.	0.908 ¹⁹	.....	177-8	∞	v. s.	v. s. eth.
4007	rhomb. f. al. .	1.230 ²⁰ / ₄	74 (70-1)	337.5 ⁷⁶²	s. h.	s.	s. eth., bz.
4008 4009 4010 4011 4012	liq. need. f. al.	0.952 ²¹ / ₄ .....	.....	197-9 >250	■ sl. s.	∞ s.	∞ eth. v. s. eth.; s. bz., acet., chl., CS ₂ ; sl. s. pet. eth.
4013 4014	col. monoc. pr.	1.1437 ¹⁷ / ₄ ; 1.112 ⁶⁰ / ₄	47.5	271	s.	v. s.	s. eth.
4015 4016	col. liq., 1.37137	1.22647 ¹⁵ / ₄ ; 1.220 ²⁰ / ₄	8.40	100.7	∞	∞	∞ eth., glyc.
4017	liq.	0.948 ¹⁸ / ₄	.....	83	sl. s.	s.	∞ eth.
4018 4019	col. liq., 1.3951 ^{11.5} arom. liq.	0.8926 ¹⁵ / ₄ ; 1.081 ²⁰ / ₄	-73.5	130.4 203.4	sl. s. i.	■ s.	∞ eth. ■ eth.
4020	col. liq., 1.3891	0.9108 ⁰ / ₄ ; 0.8848 ²⁵ / ₄	-90.0	106.8	sl. s.	∞	∞ eth.
4021	.....	0.882 ²⁰ / ₄	.....	97	sl. s.	∞	∞ eth.
4022	col. liq., 1.35975	0.9236 ²⁵ / ₄	-80.5	54.3	11.8 ²⁵	s.	s. eth.
4023 4024 4025	col. liq.	0.894 ⁰ / ₄	.....	176.7	i.	s.	s. eth.
4026	col. liq.	0.898 ⁰ / ₄	.....	153.6	v. s.	∞	■ eth.
4027	col. liq., 1.391	0.871 ²⁰ / ₄	.....	123.5	0.307 ²²	s.	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4028	Formic acid , isobutyl ester	isobutyl formate; β -methylpropyl methanoate*	$\text{HCOOCH}_2\text{CH}(\text{CH}_3)_2$	102.13
4029	—, isopropyl ester	isopropyl methanoate*	$\text{HCOOCH}(\text{CH}_3)_2$	88.10
4030	—, <i>l</i> -linalyl ester.	See <i>l</i> -Linalool, formate.		
4031	—, methyl ester	methyl methanoate*; methyl formate	HCOOCH_3	60.05
4032	—, octyl ester	<i>n</i> -octyl formate	$\text{HCOO}(\text{CH}_2)_7\text{CH}_3$	158.24
4033	—, <i>p</i> -phenylphenacyl ester		$\text{HCOOCH}_2\text{COC}_6\text{H}_5$	240.25
4034	—, propyl ester	<i>n</i> -propyl formate	HCOOC_3H_7	88.10
4035	—, acetyl -	See <i>Pyruvic acid</i> .		
4036	—, <i>o</i>-aminobenzoyl -	See <i>Isatic acid</i> .		
4037	—, benzoyl -	See <i>Glyoxylic acid</i> , <i>phenyl</i> -		
4038	—, chloro -, butyl ester	<i>n</i> -butyl chlorocarbonate	$\text{ClCOO}(\text{CH}_2)_3\text{CH}_3$	136.58
4039	—, —, ethyl ester	ethyl chloromethanoate*; ethyl chlorocarbonate	$\text{ClCOOC}_2\text{H}_5$	108.53
4040	—, —, isoamyl ester	γ -methylbutyl chloromethanoate*; isoamyl chlorocarbonate	$\text{ClCOOC}_6\text{H}_{11}$	150.61
4041	—, —, isobutyl ester	β -methylpropyl chloromethanoate*; isobutyl chlorocarbonate	$\text{ClCOOCH}_2\text{CH}(\text{CH}_3)_2$	136.58
4042	—, —, methyl ester	methyl chloromethanoate*; methyl chlorocarbonate	ClCOOCH_3	94.50
4043	—, —, propyl ester	<i>n</i> -propyl chlorocarbonate	$\text{ClCOOCH}_2\text{CH}_2\text{CH}_3$	122.55
4044	—, —, trichloromethyl ester	See <i>Diphosgene</i> .		
4045	—, cyano -, ethyl ester	ethyl cyanomethanoate*; cyanoethyl carbonate	$\text{CNCOOC}_2\text{H}_5$	99.09
4046	—, phenyl -	See <i>Benzoic acid</i> .		
4047	—, 2-thenoyl -	See <i>2-Thiopheneacetic acid</i> , α -oxo-		
4048	Formohydrazide	formylhydrazine	HCONHNH_2	60.06
4049	Formonitrolic acid	methylnitrolic acid	$\text{HC}(\text{:NOH})\text{NO}_2$	90.04
4050	Formosa camphor	See <i>d</i> -Camphor.		
4051	Formoxime	See <i>Formaldehyde</i> , <i>oxime</i> .		
4052	Formyl chloride , chloro-	See <i>Phosgene</i> .		
4052M	Formyl fluoride , fluoro-	See <i>Carbonyl fluoride</i> .		
4053	Frangula emodin	See <i>Emodin</i> .	$\text{C}_{20}\text{H}_{20}\text{O}_9$	404.36
4054	Frangulin		$\text{C}_{16}\text{H}_{18}\text{O}_{10}$	370.31
4055	Fraxin		$\text{CH}_2\text{OH}(\text{CHOH})_3\text{COCH}_2\text{NH}_2$	179.17
4056	D-Fructosamine	isoglucosamine; isodextrosamine	$\text{C}_6\text{H}_{12}\text{O}_6$	180.16
4057	D-Fructose	levulose; fruit sugar		
4058	Fructosin	See <i>Levulin (synthetic)</i> .		
4059	Fruit sugar	See <i>D-Fructose</i> .		
4061	Fucose	2,3,4,5-tetrahydroxyhexanal* (one form)	$\text{C}_6\text{H}_{12}\text{O}_5$	164.16
4062	Fulminic acid , silver salt	silver fulminate; fulminating silver	AgCNO	149.90
4063	Fulminuric acid	2-cyano-2-nitroethanamide*; cyanonitroacetamide; isocyanuric acid	$\text{CNCH}(\text{NO}_2)\text{CONH}_2$	129.08

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4028	col. liq., 1.38584 ^{19.9}	0.875 $\frac{20}{4}$	-95.3	98.2	1.01 ²²	∞	∞ eth.
4029	liq.	0.883 $\frac{0}{4}$; 0.873 $\frac{20}{4}$	.....	71.3 (66.5-8.5)	2.1 ²²	∞	∞ eth.
4030							
4031	col. liq., 1.344	0.98149 $\frac{15}{4}$; 0.975 $\frac{20}{4}$	-99.0	31.50	30.4 ²⁰	∞	s. eth., me. al.
4032	col. liq., 1.414	0.872 $\frac{12.5}{4}$	.....	198	i.	.....	.....
4033	.....		74	.....	.....	.....	.....
4034	col. liq., 1.3771	0.9006 $\frac{20}{4}$	-92.9	81.3	2.79 ²⁰	∞	∞ eth.
4035							
4036							
4037							
4038	.....	1.074 $\frac{25}{4}$	.....	140-5	d.	d.	∞ eth.
4039	col. liq.	1.138 $\frac{20}{4}$	-80.6	94	d.	d.	s. eth., bz., chl.
4040	col. liq.	1.024 $\frac{25}{2.5}$	.....	156	d.	∞	∞ eth.
4041	col. liq.	1.037 $\frac{25}{4}$	.....	130	d.	s., d.	∞ eth.; s. bz., chl.
4042	col. liq.	1.236 $\frac{15}{4}$	.....	71.4	d.	∞	∞ eth.; s. bz., chl.
4043	col. liq.	1.090 $\frac{20}{4}$	.....	116	d.	∞	∞ eth.
4044							
4045	liq.	1.013 $\frac{20}{4}$	.....	116	i.	s.	s. eth.
4046							
4047							
4048	yel. pl. or need	.....	54	.....	i.	s. h.	s. h. eth.; v. s. chl., bz.
4049	need. f. eth....	.....	64	.....	v. s.	s.	v. s. eth.
4050							
4051							
4052							
4052M							
4053							
4054	yel. need. ....	.....	226	.....	v. sl. s.	s. h.	s. h. eth., h. bz.
4055	need. f. al. ....	.....	190	.....	s. h.	s.	i. eth.
4056	syrop. ....	.....	.....	.....	.....	i.	i. eth.; s. dil. a.
4057	need. f. w.	1.598 $\frac{20}{4}$; 1.669 $\frac{18}{4}$	105 (95)	.....	v. s.	6.71 ¹⁸	s. eth.
4058							
4059							
4061	need. f. al. ....	.....	145	d.	v. s.	1.66 ²²	i. eth.
4062	sm. wh. need. f. w.	.....	exp.	.....	0.075 ¹³	s.	s. NH ₄ OH; i. HNO ₃
4063	col. pr. f. al. ....	.....	145 exp.	.....	s.	s.	v. sl. s. eth.; i. chl., bz., lgr.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4064	Fumaric acid	<i>trans</i> -butenedioic acid*; <i>trans</i> -1,2-ethylenedicarboxylic acid	HOOCCH:CH-COOH	116.07
4065	—, diethyl ester	ethyl fumarate; diethyl fumarate	(:CHCOOC ₂ H ₅) ₂ ..	172.18
4066	—, dimethyl ester	methyl fumarate	(:CHCOOCH ₃) ₂ ..	144.12
4067	—, monoethyl ester	monoethyl fumarate	HOOCCH:CH-COOC ₂ H ₅	144.12
4068	—, bromo- .....	.....	BrC(COOH):CH-COOH	194.98
4069	—, chloro- .....	.....	ClC(COOH):CH-COOH	150.52
4070	—, methyl-	See <i>Mesaconic acid</i>.	.....	.....
4071	Furacrolein	See <i>Acrolein</i> , <i>β</i> -2-furyl-.	.....	.....
4072	Furacrylic acid	See 2- <i>Furanacrylic acid</i>.	.....	.....
4073	Fural	See <i>Furfural</i>.	.....	.....
4074	2-Furaldehyde	See <i>Furfural</i>.	.....	.....
4075	Furan	furfuran	<u>OCH:CHCH:CH</u>	68.07
4076	—, 2-acetyl-	See <i>Ketone</i> , 2-furyl methyl.	.....	.....
4077	—, 2-benzoyl-	See <i>Ketone</i> , 2-furyl phenyl.	.....	.....
4078	—, 3-bromo-	<i>β</i> -furyl bromide	C ₄ H ₃ OBr	146.98
4079	—, 2-butoxymethyl-tetrahydro-	tetrahydrofurfuryl <i>n</i> -butyl ether	C ₄ H ₇ O·CH ₂ OC ₄ H ₉	158.24
4080	—, 2-chloro-	<i>α</i> -furyl chloride; <i>α</i> -chloro-furfuran	C ₄ H ₃ OCl	102.52
4081	—, 2-chloromercuri- .....	.....	C ₄ H ₃ OHgCl	303.13
4082	—, 2-(chloromethyl)-	furfuryl chloride	C ₄ H ₃ OCH ₂ Cl	116.55
4083	—, 2-(chloromethyl)tetrahydro-	tetrahydrofurfuryl chloride ..	C ₄ H ₇ O·CH ₂ Cl	120.58
4084	—, 2-(diethoxymethyl)-	furfural diethyl acetal	C ₄ H ₃ O·CH-(OC ₂ H ₅) ₂	170.20
4085	—, 2,5-dimethyl- .....	.....	C ₄ H ₂ O(CH ₃) ₂	96.12
4086	—, 2,5-dinitro- .....	.....	C ₄ H ₂ O(NO ₂) ₂	158.07
4087	—, 2,5-diphenyl- .....	.....	C ₄ H ₂ O(C ₆ H ₅) ₂	220.26
4088	—, 2-ethoxymethyl-tetrahydro-	tetrahydrofurfuryl ethyl ether	C ₄ H ₇ O·CH ₂ OC ₂ H ₅	130.18
4089	—, 2-iodo-	<i>α</i> -furyl iodide	C ₄ H ₃ IO	193.98
4090	—, 3-iodo-	<i>β</i> -furyl iodide	C ₄ H ₃ IO	193.98
4091	—, 2,2'-mercuridi-	See <i>Mercury</i> , di-2-furyl-.	.....	.....
4092	—, 2-methyl-	<i>silvan</i> ; <i>sylvan</i>	C ₄ H ₃ OCH ₃	82.10
4093	—, 3-methyl- .....	.....	C ₄ H ₃ O·CH ₃	82.10
4094	—, 2-nitro- .....	.....	C ₄ H ₃ O·NO ₂	113.07
4095	—, tetrahydro-	tetramethylene oxide	<u>OCH₂CH₂CH₂CH₂</u>	72.10
4096	—, thio-	See <i>Thiophene</i>.	.....	.....
4097	—, 2,3,4-trichloro- ..	.....	C ₄ HCl ₃ O	171.42

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4064	col. monoc. pr.	1.635 ²⁰ ₄	287 (293-5)	290; subl. 200	0.70 ²⁵ , 9.8 ¹⁰⁰	5.75 ^{29.7} , 4.76 ⁷⁶	0.72 ²⁵ eth.; v. sl. s. CCl ₄ , chl. s. eth.
4065	col. liq.	1.054 ²⁰ ₂₀	0.6	218	sl. s.	s.	s. eth.
4066	col. tric. pr.		102	192	i.	sl. s.	sl. s. eth.; s. c. chl.
4067	pl.		66	147 ¹⁶	sl. s.	v. s.	v. s. eth.
4068	pl.		185-6	d. 200	s.	s.	.....
4069	pl. f. ac. a.		191-2	subl.	v. s.	v. s.	v. s. eth.; sl. s. bz.
4070							
4071							
4072							
4073							
4074							
4075	col. liq., 1.42157	0.9444 ¹⁵ ; 0.9360 ²⁰ ₄		327 ⁵⁸	i.	v. s.	v. s. eth.
4076							
4077							
4078	liq., 1.4981....	1.650 ²⁰ ₄		101.9-2.2 ⁷⁴⁴	i.	s.	.....
4079	col. liq.	0.9150 ²⁰ ₄		194.5-6.0 ⁷²¹	i.	s.	s. eth.
4080	col. liq., 1.4571	1.1923 ²⁰ ₄		77.2-7.5 ⁷⁴⁴	i.	s.	.....
4081	col. cr. powd. f. al.		148		i.	s. h.	sl. s. eth.
4082	col. liq., 1.4941	1.1783 ²⁰ ₄		49.1-9.4 ²⁶	i.	s.	s. eth.
4083	col. liq.	1.1102 ²⁰ ₄		149.0-9.5 ⁷²¹			.....
4084	col. liq.			184-5 ⁷⁴⁰	i.	v. s.	.....
4085	col. liq., 1.4363	0.9026 ^{17.7} ₄		94	i.	s.	s. eth., chl., ac. a., bz. s. eth.
4086	need. f. w., pr. f. al.		101			i. c.	s. eth.
4087	need. or leaf. f. dil. al.		91	343-5	i.	v. s.	v. s. eth.; s. most org. solv.
4088	col. liq.	0.9386		152-4 ⁷³⁶			.....
4089	col. oil, 1.5661 ²⁰	2.024 ²⁰ ₄		43-5 ¹⁵			s. eth.
4090	col. liq.	2.045 ²⁰ ₄		132.2 ⁷⁵²	i.		s. eth.
4091							
4092	col. liq.	0.916		62.5-3.0 ⁷³⁷	i.	s.	s. eth.
4093	col. liq.	0.923 ¹⁸ ₄		65.5		s.	s. eth.
4094	lt. yel. monoc. f. pet. eth. liq., 1.4040 ²⁵		28.8-9.2		i.		s. eth., alk.
4095				64-66	v. s.	s.	.....
4096							
4097		1.5471 ²⁰ ₄		151.7-2.7 ⁷³⁴			.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4098	2-Furanacetoneitrile ...	2-furylacetonitrile; furfuryl cyanide	$C_4H_3O \cdot CH_2CN$...	107.11
4099	2-Furanacrylic acid ...	β -2-furylacrylic acid; 2-furalacetic acid; fur-acrylic acid	$C_4H_3OCH:CH-COOH$	138.12
4100	—, amyl ester.....	<i>n</i> -amyl β -2-furylacrylate.....	$C_4H_3OCH:CH-COOCH_2C_4H_9$	208.25
4101	—, butyl ester.....	<i>n</i> -butyl β -2-furylacrylate.....	$C_4H_3OCH:CH-COOCH_2C_4H_9$	194.22
4102	—, ethyl ester.....	ethyl β -2-furylacrylate; ethyl furacrylate	$C_4H_3OCH:CH-COOCH_2C_2H_5$	166.17
4103	—, methyl ester.....	methyl β -2-furylacrylate.....	$C_4H_3OCH:CH-COOCH_3$	152.14
4104	—, propyl ester.....	<i>n</i> -propyl β -2-furylacrylate...	$C_4H_3OCH:CH-COOC_2H_5$	180.20
4105	2-Furancarbinol .	See <i>Furfuryl alcohol</i> .		
4106	2-Furancarbal* .	See <i>Furfural</i> .		
4107	2-Furancarbonyl chlor	ide. See <i>2-Furoyl chloride</i> .		
4108	2-Furancarboxylic aci	d. See <i>Furoic acid</i> .		
4109	3-Furancarboxylic aci	d 3-furoic acid.....	$C_4H_3O \cdot COOH$	112.08
4110	—, 4,5-dihydro-5-ke	to-. See <i>Aconic acid</i> .		
4111	—, 2,5-dimethyl- .	See <i>Pyrotritaric acid</i> .		
4112	—, 2-methyl-		$CH_3C_4H_2O \cdot COOH$	126.11
4113	—, —, ethyl ester.....		$CH_3C_4H_2O \cdot COOC_2H_5$	154.16
4114	—, tetrahydro-5-oxo	-. See <i>Paraconic acid</i> .		
4115	2,5-Furandicarbonyl c	hloride. See <i>Dehydromucyl c</i>	hloride.	
4116	2,3-Furandicarboxylic acid		$C_4H_2O(COOH)_2$...	156.09
4117	—, dimethyl ester.....		$C_4H_2O(COOCH_3)_2$	184.14
4118	2,5-Furandicarboxylic acid .	See <i>Dehydromucic acid</i> .		
4119	2,5-Furandione .	See <i>Maleic anhydride</i> .		
4120	2-Furanmethylanine .	See <i>Furfurylamine</i> .		
4121	Furfural .	2-furancarbal*; 2-furaldehyde; fural; furfuraldehyde; furole; furfurole	C_4H_3OCHO	96.08
4122	—, diacetate.....	furfurylidene diacetate.....	$C_4H_3OCH-(OOCCH_3)_2$	198.17
4123	—, diethyl acetal.	See <i>Furan, 2-(diethoxymethyl)-</i> .		
4124	—, hydramide.....	See <i>Hydrofuramide</i> .		
4125	—, phenylhydrazone.....		$C_4H_3OCH:NNH-C_6H_5$	186.21
4126	—, 5-methyl-	-methylfurfurole.....	$CH_3C_4H_2O \cdot CHO$	110.11
4127	—, 5-nitro-		$NO_2C_4H_2O \cdot CHO$...	141.08
4128	—, tetrahydro-	furfural tetrahydride.....	$C_4H_7O \cdot CHO$	109.11
4128T	Furfural acetone .	See <i>Acetone, furfurylidene-</i> .		
4129	Furfuralcohol .	See <i>Furfuryl alcohol</i> .		
4130	Furfuramide .	See <i>Hydrofuramide</i> .		
4131	Furfuran .	See <i>Furan</i> .		
4132	Furfurine		$C_{15}H_{12}N_2O_3$...	268.26
4133	Furfurole .	See <i>Furfural</i> .		
4134	Furfuryl alcohol	2-furancarbinol; furfuralcohol; α -furylcarbinol.	$C_4H_5O \cdot CH_2OH$...	98.10
4135	—, acetate.....		$C_4H_5OCH_2OOC-CH_3$	140.13
4136	—, butyrate.....		$C_4H_5OCH_2-OOCC_2H_5$	168.19

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4098	col. liq.	1.0854 ²⁵ / ₄	78-80 ²⁰	.....	sl. s.	v. s.	v. s. eth.
4099	wh. need. f. w., odorless, 1.5286 ²⁰	.....	141	226; 117 ⁸	i.	s.	s. eth.
4100	col. liq.	1.0322 ²⁰ / ₄	.....	119.4	i.	.....	.....
4101	col. liq.	1.0482 ²⁰ / ₄	.....	121.0 ⁵	i.	s.	.....
4102	col. liq., 1.5286 ²⁰	1.0891 ²⁵ / ₄	24.5	132-3 ¹⁸ ; 117 ⁸	i.	s.	.....
4103	col. liq., 1.4447 ²⁰	.....	27	114-5 ¹⁸ ; 227-8 ⁷⁴⁴	i.	s.	.....
4104	col. liq., 1.5229 ²⁰	1.0744	.....	119 ⁷	i.	s.	.....
4105							
4106							
4107							
4108							
4109	col. need. f. w.	.....	120.5-1.5	105-10 ¹²	i. c.	.....	v. s. eth.
4110							
4111							
4112	col. cr. f. w.	.....	102-3	.....	.....	s.	s. eth.
4113	col. liq. ....	.....	.....	85-7 ²⁰	i.	.....	s. eth.
4114							
4115							
4116	col. cr. powd.	.....	225	.....	s.	s.	s. eth.
4117	col. gran. cr.	.....	37	.....	i.	s.	v. s. eth.
4118							
4119							
4120							
4121	col.-yel. liq.; almond odor, 1.52608 ²⁰	1.1598 ²⁰ / ₄	-36.5	161.7	8.3 ²⁰	∞	∞ eth.
4122	col. cr. f. pet. eth.	.....	52-3	220 (143-4 ²⁰)	i.	s.	s. eth.
4123							
4124							
4125	.....	.....	97	.....	i.	s.	s. eth.
4126	col. liq.	1.1072 ¹⁸ / ₄ ; 1.109 ¹⁸ / ₁₈	.....	187; 106-7 ⁶⁰	3.3	v. s.	∞ eth.
4127	straw yel. ....	.....	36	.....	.....	.....	s. eth.
4128	col. liq.	1.10947 ²⁵ / ₄	.....	144-5 ⁷⁴⁰	i.	s.	.....
4128T							
4129							
4130							
4131							
4132	lt. br. need. ....	.....	117	.....	i.	s.	s. eth.
4133							
4134	col.-yel. liq., almost odor- less, 1.4850 ²⁵	1.1296 ²⁰ / ₄	.....	171 ⁷⁵⁰	∞	∞	∞ eth.
4135	col. liq., 1.4603 ²⁵	1.1175 ²⁰ / ₄	.....	175-7 ⁷⁶⁴	i.	s.	s. eth.
4136	col. liq.	1.0530 ²⁰ / ₄	.....	212-3 ⁷⁶⁴ (69-70 ¹)	v. sl. s.	s.	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4137	Furfuryl alcohol , pro- pionate	.....	$C_4H_3OCH_2-$ $OOCC_2H_5$	154.16
4138	—, 2-furoate.....	furfuryl furoate; furfuryl pyromucate	$C_4H_3OCO_2CH_2-$ C_4H_3O	192.16
4139	—, 5-methyl-.....	5-methyl-2-furancarbinol. . .	$CH_3C_4H_2O-CH_2OH$	112.12
4140	—, tetrahydro-.....	tetrahydro-2-furancarbinol . .	$C_4H_7O-CH_2OH$. . .	102.13
4141	Furfurylamine	2-furanmethylamine.....	$C_4H_3OCH_2NH_2$. . .	97.11
4142	—, tetrahydro-.....	tetrahydro-2-furanmethyl- amine	$C_4H_7OCH_2NH_2$. . .	101.15
4143	Furfuryl chloride .	See <i>Furan</i> , 2-(chloromethyl)-.		
4144	Furfuryl esters .	See under <i>Furfuryl alcohol</i> .		
4145	Furfurylidene diacetate	e. See <i>Furfural</i> , diacetate.		
4145	Furfuryl mercaptan . .	2-furylmethanethiol.....	$C_4H_3OCH_2SH$	114.16
4146	Furil	bipyromucyl; di-2-furyl- glyoxal	$C_4H_3OCOCOC_4-$ H_3O	190.15
4147	2-Furoic acid , Furoic acid	2-furancarboxylic acid; pyro- mucic acid	C_4H_3OCOOH	112.08
4147D	—, amyl ester.....	<i>n</i> -amyl furoate.....	$C_4H_3O-COOC_5H_{11}$	182.21
4147E	—, butyl ester.....	<i>n</i> -butyl furoate.....	$C_4H_3O-COOC_4H_9$. .	168.19
4147F	—, <i>sec</i> -butyl ester.....	<i>sec</i> -butyl furoate.....	$C_4H_3O-COOC_4H_9$. .	168.19
4147G	—, ethyl ester.....	ethyl furoate.....	$C_4H_3O-COOC_2H_5$. .	140.13
4147H	—, furfuryl ester.	See <i>Furfuryl alcohol</i> , 2-furoate.		
4147J	—, heptyl ester.....	<i>n</i> -heptyl furoate.....	$C_4H_3O-COOC_7H_{15}$. .	210.27
4147K	—, hexyl ester.....	<i>n</i> -hexyl furoate.....	$C_4H_3O-COOC_6H_{13}$. .	196.24
4147L	—, isoamyl ester.....	isoamyl furoate.....	$C_4H_3O-COOC_5H_{11}$. .	182.21
4147M	—, methyl ester.....	methyl furoate.....	$C_4H_3O-COOCH_3$. .	126.11
4147N	—, octyl ester.....	<i>n</i> -octyl furoate.....	$C_4H_3O-COOC_8H_{17}$. .	224.29
4147P	—, propyl ester.....	<i>n</i> -propyl furoate.....	$C_4H_3O-COOC_3H_7$. .	154.16
4147Q	—, 3-bromo-.....	β -bromopyromucic acid.....	$C_4H_2BrO-COOH$. .	190.99
4147R	—, 5-bromo-.....	δ -bromopyromucic acid.....	$BrC_4H_2O-COOH$. .	190.99
4147S	—, —, ethyl ester	.....	$BrC_4H_2O-COOC_2-$ H_5	219.04
4147T	—, 3-chloro-.....	β -chloropyromucic acid.....	$ClC_4H_2O-COOH$. .	146.53
4147U	—, 5-chloro-.....	δ -chloropyromucic acid.....	$ClC_4H_2O-COOH$. .	146.53
4147V	—, 5-methyl-.....	.....	$CH_3C_4H_2O-COOH$	126.11
4147W	—, —, methyl ester	.....	$CH_3C_4H_2O-COO-$ CH_3	140.13
4147X	—, 5-nitro-.....	.....	$NO_2C_4H_2O-COOH$	157.08
4147Y	—, tetrahydro-.....	tetrahydropyromucic acid.....	$C_4H_7O-COOH$	116.11
4148	3-Furoic acid .	See 3- <i>Furancarboxylic acid</i> .		
4149	Furoin.....	.....	$C_4H_3OCHOH-$ COC_4H_3O	192.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4137	col. liq.	1.1085 ²⁰ / ₄	.....	195-6 ⁷⁶²	v. sl. s. (i.)	s.	∞ eth.
4138	dimorphous ...	1.395; (1.330)	27.5 (19.5)	122 ²	i.	s.	s. eth.
4139	col. liq.	1.0769 ²⁰ / ₄	.....	194-6 ⁷⁴⁴	s.	v. s.	v. s. eth.
4140	col., almost odorless liq., 1.4502 ¹⁹	1.0495 ²⁰ / ₄	.....	177-78 ⁷⁴³	∞	∞	∞ eth.
4141	col. liq.	<1	.....	144-6	∞	s.	s. eth.
4142	col. liq. ....	.....	.....	151-2 ⁷³⁵	∞	∞	∞ eth.
4143							
4144							
4145	col. oily liq., 1.5329	1.13186 ²⁰ / ₄	.....	155; 84 ⁶⁵	i.	.....	.....
4146	yel. need. ....	.....	165-6	.....	i.	s.	s. eth.
4147	wh. monocl. need., subl.	.....	133	230-2; subl. 100	3.57 ¹⁵	s.	v. s. eth.
4147 D	col. liq.	1.0335	.....	95-7 ¹	i.	∞	.....
4147 E	col. oil, d. on standing	1.0555	.....	118-20 ²⁵ ; 83-4 ¹	1.	∞	= eth.
4147 F	col. liq.	1.0465	.....	67-9 ¹	i.	∞	∞ eth.
4147 G	wh. leaf. or pr., 1.4797 ^{20.8}	1.0974 ⁴⁰ / ₄ ; 1.1774 ²¹ / ₄	34 (30-3)	195 ⁷⁰⁶	i.	∞	∞ eth.
4147 H							
4147 J	col. liq.	1.0005 ²⁰ / ₄	.....	116-7 ¹	i.	s.	.....
4147 K	col. liq.	1.0170 ²⁰ / ₄	.....	105-7 ¹	i.	s.	.....
4147 L	col. liq. ....	.....	.....	135-7 ²⁵	i.	∞	.....
4147 M	col. liq.; turns yel. in light, 1.4860 ²⁰	1.1739 ¹⁵ / ₁₅	.....	181.3	i. (sl. s.)	∞	= eth.
4147 N	col. liq.	0.9885	.....	126-7 ¹	i.	s.	.....
4147 P	col. liq.	1.075	.....	211	i. (sl. s.)	s.	∞ eth.
4147 Q	wh. need. f. w.	.....	127-9	.....	1.3 ²⁰	s.	s. eth.; v. sl. s.
4147 R	wh. leaf. f. w.	.....	186	.....	v. sl. s. c.	s.	lgr., CS ₂ v. s. eth.
4147 S	pr.	1.528 ²⁰	17	235 ⁷⁶⁷	i.	s.	s. eth.
4147 T	wh. cr. ....	.....	148.5-9.5	.....	i.	s.	.....
4147 U	wh. leaf. ....	.....	179-80	.....	0.3 ²⁰	s.	.....
4147 V	pl. or need. f. w.	.....	108-9	.....	v. s. h.	v. s.	v. s. eth.
4147 W	col. liq. ....	.....	.....	98 ¹⁵	.....	.....	s. eth.
4147 X	wh. cr. f. w. ....	.....	185.0-5.5	subl.	s. h.	s.	s. eth.
4147 Y	wh. cr.	1.1933	21	131-2 ¹⁴	.....	.....	.....
4148							
4149	lt. br. need. ....	.....	134-5	.....	i.	sl. s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4150	Furole.	See <i>Furfural</i> .		
4151	Furoyl chloride	2-furoyl chloride; pyromucyl chloride	$C_4H_5OCOC\dot{C}l$	130.53
4152	β-Furyl bromide.	See <i>Furan</i> , 3-bromo-.		
4152H	α-Furyl chloride.	See <i>Furan</i> , 2-chloro-.		
4152M	α-Furyl iodide.	See <i>Furan</i> , 2-iodo-.		
4152S	β-Furyl iodide.	See <i>Furan</i> , 3-iodo-.		
4153	G acid.	See 2-Naphthol-6,8-disulfonic acid.		
4154	D-Galactonic acid	d-lactonic acid.	$CH_2OH(CHOH)_4COOH$ $C_6H_{12}O_6$	196.16 180.16
4155	D-Galactose			
4156	D-Galacturonic acid		$C_6H_8O_6COOH$	194.14
4157	Gallacetophenone	2,3,4-trihydroxyacetophenone; 4-acetylpyrogallol	$CH_3COC_6H_2(OH)_3$	168.14
4158	Gallanilide	gallanol; 3,4,5-trihydroxy-benzanilide	$C_6H_5NHCOC_6H_2(OH)_3$	245.23
4159	Gallein	pyrogallolphthalein, 4,5-dihydroxyfluorescein	$C_{20}H_{12}O_7$	364.30
4160	Gallic acid	3,4,5-trihydroxybenzoic acid.	$(HO)_3C_6H_2COOH$	170.12
4161	—, 3-monogallate.	See <i>m-Digallic acid</i> .		
4162	—, trimethyl ether.	See <i>Benzoic acid</i> , 3,4,5-trimethoxy-.		
4163	Gallin	3,4,5,6-tetrahydroxy-9-xanthene- <i>o</i> -benzoic acid	$C_{20}H_{14}O_7$	366.31
4164	Gelsemine , compd. with acetone		$C_{20}H_{22}N_2O_2 \cdot (CH_3)_2CO$	380.47
4165	d-Gelsemine		$C_{20}H_{22}N_2O_2$	322.39
4166	—, hydrochloride.		$C_{20}H_{22}N_2O_2 \cdot HCl$	358.86
4167	Gentianin	See <i>Gentisin</i> .		
4167M	Gentiobiose	amygdalose	$C_{12}H_{22}O_{11}$	342.30
4168	Gentisic acid	2,5-dihydroxybenzoic acid; hydroquinonecarboxylic acid	$(HO)_2C_6H_3COOH \cdot 3H_2O$	208.17
4169	—, 4-hydroxy-.	See <i>Benzoic acid</i> , 2,4,5-trihydroxy-.		
4170	Gentisin	1,7-dihydroxy-3-methoxy-xanthone; 3-methoxyeuxanthone; gentianin	$C_{14}H_{10}O_6$	258.22
4171	Geranial	See <i>Citral a</i> .		
4172	Geranic acid	3,7-dimethyl-2,6(and 2,7)-octadienoic acid*	$C_{10}H_{16}O_2$	168.23
4173	Geraniol	3,7-dimethyl-2,6-octadien-1-ol*, one form	$C_{10}H_{17}OH$	154.25
4174	—, acetate	geranyl acetate	$C_{12}H_{20}O_2$	196.28
4175	—, butyrate	geranyl butyrate	$CH_3(CH_2)_2COOC_{10}H_{17}$	224.33
4176	—, formate		$HCOOC_{10}H_{17}$	182.26
4177	—, dihydro-.	See <i>dl-Citronellol</i> .		
4178	—, tetrahydro-.	See 1-Octanol, 3,7-dimethyl-*		
4179	Geranyl esters.	See under <i>Geraniol</i> .		
4179	Germanium, tetraphenyl-*		$(C_6H_5)_4Ge$	381.00
4180	d-Glaucine		$C_{21}H_{26}NO_4$	355.42
4180M	Glaurin	See <i>Diethylene glycol, monolaurate</i> .		
4181	Glonoin	See <i>Nitroglycerin</i> .		
4182	Glucide	See <i>Saccharin</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4150	col. liq., lachrymatory	.....	0	59.5-61.57; 176	d.	.....	s. eth.
4151							
4152							
4152H							
4152M							
4152S							
4153	need. f. w. ....	.....	95-100	d. 140-1	s.	.....	.....
4154							
4155	hex. tab. f. al. ....	.....	+1H ₂ O 118-20; anh. 165-8	.....	10.3 ⁰ , 68.3 ²⁵	0.59 ³⁸ 85%	v. sl. s. me. al.
4156	micro. need., [α]+53.59 ⁰ _D	.....	159-60 d.	.....	s.	s. h.	i. eth.
4157	leaf .....	.....	173	.....	sl. s.	s.	s. eth.; v. sl. s. bz.
4158	col. cr. or powd. ....	.....	205	.....	s. h.	s.	s. eth.
4159	red cr. powd. ....	.....	d.	.....	v. sl. s. h.	s.	sl. s. h. eth.; s. alk.
4160	col. monoc. need. f. w.	1.694 ⁴ / ₄	220 d.	d.	1.16 ²⁵ , 33 ¹⁰⁰	27.2 ²⁵	2.5 ¹⁵ eth.; s. glyc.
4161	need. ....	.....	.....	.....	s.	s.	s. eth.
4162							
4163	pr. f. acet. ....	.....	anh. at 120	.....	.....	.....	.....
4164							
4165	.....	.....	178	.....	i.	s.	s. eth., chl., bz.
4166	pr. f. w. ....	.....	300	.....	s.	sl. s.	.....
4167	two cr. forms: α and β	.....	α189-95; β190-95	.....	s.	.....	n. h. me. al.
4167M							
4168	col. need. f. w.	.....	200	d.	v. s.	v. s.	v. s. eth.; i. CS ₂ , chl., bz.
4169	yel. need. ....	.....	267	400 subl.	v. sl. s.	sl. s. h.	sl. s. h. eth.; s. alk.
4170							
4171	thin oil, 1.48695 ^{20.2}	0.952 ²⁰ / ₄	.....	119 ²⁰	i.	s.	s. eth.
4172							
4173	col. liq., 1.4798	0.8812 ¹⁶ / ₄	<-15	229; 120-2 ¹⁷	i.	∞; 5.41 50%	∞ eth.
4174	col. liq., 1.4660	0.917 ¹⁵ / ₄	.....	242-5 ⁷⁶⁴ d.	v. sl. s.	v. s.	∞ eth.
4175	.....	0.9008 ¹⁷ / ₄	.....	151-3 ¹⁸	i.	s.	s. eth.
4176	liq.	0.927 ²⁰ / ₄	.....	113-4 ¹⁵	i.	s.	s. eth.
4177							
4178							
4179	col. tetr. ....	.....	235.7	>400	i.	.....	sl. s. eth., acet., lgr.; s. chl., bz., tol.
4180	yel. rhomb. pr.	.....	119-20	.....	s. h.	v. s.	n. eth.; v. s. chl.; sl. s. bz.
4180M	.....	.....	.....	.....	.....	.....	.....
4181							
4182							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4184	D-Glucos-α-heptose .....	.....	$\text{CH}_2\text{OH}(\text{CHOH})_5\text{CHO}$	210.18
4185	D-Gluconic acid	dextronic acid; <i>d</i> -glyconic acid; maltonic acid; glyconic acid	$\text{C}_6\text{H}_6(\text{OH})_5\text{COOH}$	196.16
4186	—, δ -lactone .....	.....	$\text{C}_6\text{H}_6(\text{OH})_4\text{COO}$	178.14
4186M	D-Glucosamine	chitosamine; 2-amino- <i>D</i> -glucose	$\text{C}_6\text{H}_{13}\text{NO}_5$	179.17
4187	D-Glucosazone	See <i>D-Glucose</i> , <i>phenylosazone</i> .		
4188	Glucose, β-glucoside	See <i>Cellobiose</i> .		
4188M	—, tetraethyl-	See <i>D-Glucose</i> , <i>tetraethyl ether</i> .		
4189	D-Glucose (anh.)	dextrose; grape sugar	$\text{C}_6\text{H}_{12}\text{O}_6$	180.16
4190	—, (α)	$\text{C}_6\text{H}_{12}\text{O}_6 \cdot \text{H}_2\text{O}$	198.17
4191	—, (β)	$\text{C}_6\text{H}_{12}\text{O}_6 \cdot \text{H}_2\text{O}$	198.17
4192	—, diacetate	diacetyl- <i>D</i> -glucose	$\text{C}_8\text{H}_{16}(\text{OOCCH}_3)_2(\text{OH})_3\text{CHO}$	264.23
4193	—, α -pentaacetate	pentaacetyl- α - <i>D</i> -glucose	$\text{C}_8\text{H}_{10}\text{O}(\text{OOCCH}_3)_5$	390.34
4194	—, β -pentaacetate	β -pentaacetyl- <i>D</i> -glucose	$\text{C}_8\text{H}_{10}\text{O}_6(\text{OOCCH}_3)_5$	390.34
4195	—, μ -pentaacetate .....	.....	$\text{C}_8\text{H}_{10}\text{O}(\text{OOCCH}_3)_5$	390.34
4197	—, α -phenylhydrazone .....	.....	$\text{C}_{12}\text{H}_{18}\text{O}_6\text{NNHC}_6\text{H}_5$	270.28
4198	—, β -phenylhydrazone .....	.....	$\text{C}_{12}\text{H}_{18}\text{O}_6\text{NNHC}_6\text{H}_5$	270.28
4199	—, phenylosazone	<i>d</i> -glucosone bisphenylhydrazone; dextrosazone; <i>d</i> -glucosazone	$\text{C}_{10}\text{H}_{10}\text{O}_4(\text{NNHC}_6\text{H}_5)_2$	358.39
4199H	—, tetraethyl ether	tetraethylglucose	$\text{C}_{14}\text{H}_{28}\text{O}_6$	292.37
4199R	—, 2-amino-	See <i>D-Glucosamine</i> .		
4200	—, pentaacetyl-	See <i>D-Glucose</i> , <i>pentaacetate</i> .		
4202	D-Glucoside, α-methyl- .....	.....	$\text{C}_7\text{H}_{14}\text{O}_6$	194.18
4203	—, β-methyl- .....	.....	$\text{C}_7\text{H}_{14}\text{O}_6$	194.18
4204	D-Glucosone, bisphenylhydrazone	See <i>D-Glucose</i> , <i>phenylosazone</i> .		
4205	Glutamic acid, β-hydroxy-(<i>dl</i>)	<i>dl</i> - α -amino- β -hydroxyglutaric acid	$\text{COOHCH}_2\text{CH}(\text{OH})\text{CH}(\text{NH}_2)\text{COOH}$	163.13
4206	β-hydroxy-(<i>d</i>)	<i>d</i> -2-amino-3-hydroxypentanedioic acid	$\text{COOHCH}_2\text{CHOHCH}(\text{NH}_2)\text{COOH}$	163.13
4207	<i>dl</i>-Glutamic acid	<i>dl</i> -glutaminic acid; <i>dl</i> - α -aminoglutaric acid	$\text{COOH}(\text{CH}_2)_2\text{CH}(\text{NH}_2)\text{COOH}$	147.13
4208	<i>d</i>-Glutamic acid	<i>d</i> -glutaminic acid; <i>d</i> - α -aminoglutaric acid	$\text{COOH}(\text{CH}_2)_2\text{CH}(\text{NH}_2)\text{COOH}$	147.13
4209	<i>l</i>-Glutamic acid	<i>l</i> -glutaminic acid; <i>l</i> - α -aminoglutaric acid	$\text{C}_5\text{H}_9(\text{NH}_2)(\text{COOH})_2$	147.13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4184	rhomb. pl. f. w.		215 d. (180-90)		9.5, v. s. h.	v. sl. s.	
4185	cr		125-6; (130-2)		s.	i.	i. eth.
4186	need		146 (130-5)				
4186M	need. f. et. al.		110		s.	sl. s.	i. eth., CHCl ₃
4187							
4188							
4188M							
4189	rhomb. need. f. al.	1.544 ²⁵ / ₄	(+1H ₂ O 118-20) anh. 146		83 ^{17.5}	1.94 ^{17.5}	i. eth.
4190		1.544 ²⁵ / ₄	146		32.3 ⁰ , 82.0 ²⁵	2 (initial), 4.5 (final) 80%	
4191	need. f. al.	1.5620 ¹⁸ / ₄	150		154 ¹⁵	4.9 (initial), 9.1 (final) 80%	i. eth.
4192	col. cr. or lt. yel. amor.		<100		s.	s.	s. eth.; i. bz.
4193	fine need. f. lgr. or al.		113 (111-2)	subl.	0.15 ^{18.5}	1.32 ¹⁵	2.7 ¹⁵ eth.
4194	need. f. al.		131		0.09 ^{18.5}	0.82 ¹⁹	2.1 ¹⁵ eth.
4195	monocl. tab.		116-8		s. warm	s.	sl. s. eth.
4197	col. cr.		160		v. s.	v. s. h.	v. sl. s. eth.
4198	col. need.		141		sl. s.	s.	v. sl. s. c. eth.
4199	yel. need.		208 d.		v. sl. s.	s. h.	
4199H	[α] _D ²⁰ 65.3 ⁰		61-4	138-90.5			
4199R							
4200							
4202	rhomb. f. w.		165		63	1.6	i. eth.
4203	tetr. f. al.		104		58	4.2	i. eth.
4204							
4205	rhomb. pr. and need.		198 d.		v. s. h.		
4206	pr. f. w.		soft. 100; hyd. 105; (rac. 198 d.)	d. >100	v. s.	i.	i. eth.; v. s. ac. a.
4207	tetr. pl.	1.4601 ²⁰ / ₄	225-7 d.		2.64 ²⁵ , 8.16 ⁵⁰	v. sl. s.	v. sl. s. eth.
4208	tetr. pl.	1.538	247-9 d.		0.89 ²⁵ , 2.23 ⁵⁰	0.037 ²⁵ , 75% 0.003 ²⁵ , 100%	0.007 ²⁵ me. al.; 0.0004 ²⁵ acet.
4209	col. rhomb. pl. f. w., 1.490, 1.605, 1.620	1.538 (1.460)	202 (198); 213 d.		1.5 ²⁰	0.07 ¹⁵	i. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4210	L-Glutamic acid , hydrochloride.....	.....	$C_5H_9NO_4 \cdot HCl$	183.60
4211	D-Glutamine	<i>d</i> - α -aminoglutaramic acid.....	$C_5H_9(NH_2)(CONH_2)COOH$	146.15
4212	Glutaramic acid , α -amino-.....	ino-. See <i>Glutamine</i> .		
4213	Glutaric acid	pentanedioic acid*.....	$COOH(CH_2)_3COOH$	132.11
4214	—, diethyl ester.....	diethyl pentanedioate*; ethyl glutarate	$C_5H_9OOC(CH_2)_3COOC_2H_5$	188.22
4215	—, piperazinium salt.....	.....	$C_4H_{10}N_2 \cdot 2C_5H_8O_4$..	350.37
4216	—, α -amino-.....	See <i>Glutamic acid</i> .		
4218	—, α -hydroxy-.....	2-hydroxypentanedioic acid*	$COOHCHOH(CH_2)_2COOH$	148.11
4219	—, β -keto-.....	See <i>Acetonedicarboxylic acid</i> .		
4220	—, α, β, γ -trihydroxy-(<i>dl</i>).....	.....	$COOH(CHOH)_3COOH$	180.11
4221	—, α, β, γ -trihydroxy-(<i>d</i> or <i>l</i>).....	2,3,4-trihydroxypentanedioic acid*	$COOH(CHOH)_3COOH$	180.11
4222	Glutaronitrile	pentanedinitrile*; trimethylene dicyanide; trimethylene cyanide	$CN(CH_2)_3CN$...	94.11
4223	Glyceraldehyde	2,3-dihydroxypropanal*; α, β -dihydroxypropionaldehyde	$CH_2OHCHOHCHO$	90.08
4224	Glyceric acid	2,3-dihydroxypropanoic acid*; α, β -dihydroxypropionic acid	$CH_2OHCHOHCOOH$	106.08
4225	—, ethyl ester.....	ethyl 2,3-dihydroxypropanoate*	$CH_2OHCHOHCOOC_2H_5$	134.13
4226	—, methyl ester.....	methyl glycerate.....	$CH_2OHCHOHCOOCH_3$	120.10
4227	Glycerin	See <i>Glycerol</i> .		
4228	Glycerol	glycerin; 1,2,3-propanetriol*	$CH_2OHCHOHCH_2OH$	92.09
4229	—, borate.....	glyceryl borate.....	$(C_3H_5BO_3)_x$	(99-89) _x
4230	—, α -chlorohydrin.....	See 1,2-Propanediol, 3-chloro-*		
4231	—, diacetate.....	diacetin.....	$C_3H_5(OH)(OOCCH_3)_2$	176.17
4232	—, <i>sym</i> -dichlorohydrin.....	See 2-Propanol, 1,3-dichloro-*		
4233	—, <i>uns</i> -dichlorohydrin.....	See 1-Propanol, 2,3-dichloro-*		
4234	—, 1,3-dilaurate.....	α, γ -dilaurin.....	$(C_{11}H_{23}COO)_2C_3H_5OH$	456.69
4235	—, 1,3-dinitrate.....	.....	$C_3H_5(OH)(NO_3)_2 \cdot H_2O$	191.10
4236	—, 1,3-dipalmitate.....	α, γ -dipalmitin.....	$(C_{15}H_{31}COO)_2C_3H_5OH$	568.90
4237	—, 1,3-distearate.....	α, γ -distearin.....	$(C_{17}H_{35}COO)_2C_3H_5OH$	625.01
4238	—, ethylidene ether.....	See <i>Acetoglycerol</i> .		
4239	—, monoacetate.....	monoacetin.....	$CH_2OHCHOHCH_2OOCCH_3$	134.13
4240	—, 1-monolaurate.....	α -monolaurin.....	$C_{11}H_{23}COOCH_2CHOHCH_2OH$	274.39
4241	—, α -mononitrate.....	.....	$CH_2OHCHOHCH_2ONO_2$	137.09

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4210	tri-cr. pl., [α] _D ²⁰ 1.546; [β] _D ²⁰ 1.559	.....	d. 201	.....	v. s., d.	s.	v. sl. s. conc. HCl
4211	need. ....	.....	185-6	.....	4.25 ²⁵	.00046 ²⁵	i. eth.
4212	col. monoc., 1.4188 ^{106.4}	1.429 ¹⁵ / ₄ ; 1.192 ¹⁰⁶ / ₄	97.5; 95-6	304 d.	64 ²⁰	v. s.	v. s. eth.; s. bz., chl.; sl. s. pet. eth.
4214	symp. 1.4241 ²⁰	1.023 ²⁰ / ₄	-24.1	237	0.88 ²⁰	v. s.	s. eth.
4215	wh. cr. ....	.....	152	.....	s.	s. h.	i. eth.
4216	sm. col. cr. ....	.....	72-3	.....	s.	s.	.....
4219	col. tab. f. acet.	.....	152 d.	.....	v. s.	v. s. h.	s. acet.
4221	col. leaf. f. acet.	.....	128	.....	v. s.	v. s.	s. acet.
4222	col. liq., 1.4365 ^{23.2}	0.995 ¹⁵ / ₄	-29	287.4	s.	s.	i. eth.
4223	need. or pr. f. me. al.	1.453 ¹⁸ / ₄	138	.....	sl. s.	v. sl. s.	v. sl. s. eth.
4224	symp. ....	.....	.....	.....	∞	∞	i. eth.; v. s. acet.
4225	liq.	1.191 ¹⁵ / ₁₅	.....	230-40; 121 ¹⁴	s.	v. s.	v. s. eth.
4226	liq.	1.279 ¹⁵ / ₄	.....	239-44; 120 ¹⁴	∞	∞	v. sl. s. eth.
4227	rhomb. or col. liq., 1.4729	1.260 ²⁰ / ₄	17.9, solidifies at a much lower temperature	290	∞	∞	i. eth., chl.
4229	glassy yel. ....	.....	.....	.....	d.	.....	.....
4230	col. liq.	1.184 ¹⁶ / ₄	40	176 ⁴⁰ ; 280 (250-3)	∞	v. s.	s. eth.; i. CS ₂
4232	cr. ....	.....	56.6	.....	.....	s.	s. eth.
4233	liq.	1.47 ¹⁵ / ₄	<-30; anh. 26	148 ¹⁵	7.7	v. s.	s. eth.
4236	cr. f. al. or chl.	.....	70	.....	.....	sl. s. c., v. s. h.	sl. s. c., v. s. h. eth.; s. chl.
4237	rhomb. pl. f. chl. or lgr.	.....	79.1	.....	.....	sl. s. c., s. h.	sl. s. c., s. h. eth.
4238	col. oil.	1.2060 ²⁰ / ₄	.....	158 ¹⁶⁵	v. s.	v. s.	sl. s. eth.; i. bz.
4240	wh. need. ....	.....	63.0	.....	.....	sl. s. c., s. h.	sl. s. c., s. h. eth.
4241	col. pr.	1.40 ¹⁵ / ₄	58	155-60	70	v. s.	v. sl. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4242	Glycerol, β-mononitrate		$\text{CH}_2\text{OHCH}(\text{ONO}_2)\text{CH}_2\text{OH}$	137.09
4243	—, 1-monoöleate	monoölein	$\text{C}_{17}\text{H}_{33}\text{COOCH}_2\text{CHOHCH}_2\text{OH}$	356.53
4244	—, 1-monopalmitate	α -monopalmitin	$\text{C}_{16}\text{H}_{31}\text{COOCH}_2\text{CHOHCH}_2\text{OH}$	320.50
4245	—, monoricinoleate		$\text{C}_{17}\text{H}_{33}\text{COOC}_3\text{H}_5(\text{OH})_2$	356.53
4247	—, 1-monostearate	α -monostearin	$\text{C}_{17}\text{H}_{35}\text{COOCH}_2\text{CHOHCH}_2\text{OH}$	358.55
4248	—, 1-octadecyl ether	See 1,2-Propanediol, 3-octadecyl sodium glycerolate; sodium	loxy*.	
4249	—, 1-sodium derivative	glycerate (so called)	$\text{CH}_2\text{OHCHOHCH}_2\text{ONa}$	114.08
4250	—, triacetate	triacetin	$\text{C}_3\text{H}_5(\text{OOCCH}_3)_3$	218.20
4251	—, tribenzoate	tribenzoin	$\text{C}_3\text{H}_5(\text{OOCCH}_2\text{C}_6\text{H}_5)_3$	404.40
4252	—, tribromohydrin	See Propane, 1,2,3-tribromo*.		
4253	—, tributurate	butyrin; tributyrin	$(\text{CH}_3\text{CH}_2\text{CH}_2\text{CO})_3\text{C}_3\text{H}_5\text{O}_3$	302.36
4254	—, trichlorohydrin	See Propane, 1,2,3-trichloro*.		
4255	—, trilaurate	trilaurin; laurin	$(\text{C}_{11}\text{H}_{23}\text{COO})_3\text{C}_3\text{H}_5$	638.99
4256	—, trimyristate	myristin; trimyristin	$(\text{C}_{13}\text{H}_{27}\text{COO})_3\text{C}_3\text{H}_5$	723.15
4257	—, trinitrate	See Nitroglycerin.		
4258	—, trinitrite		$\text{C}_3\text{H}_5(\text{ONO})_3$	179.09
4259	—, trioleate	triolein; olein; glyceryl oleate	$(\text{C}_{17}\text{H}_{33}\text{COO})_3\text{C}_3\text{H}_5$	885.41
4260	—, tripalmitate	tripalmitin; palmitin	$(\text{C}_{16}\text{H}_{31}\text{COO})_3\text{C}_3\text{H}_5$	807.30
4261	—, tristearate	stearin; tristearin	$(\text{C}_{17}\text{H}_{35}\text{COO})_3\text{C}_3\text{H}_5$	891.46
4262	—, 1-thio-	3-mercapto-1,2-propanediol*	$(\text{HO})_2\text{C}_3\text{H}_5\text{SH}$	108.15
4263	Glycerol ether (of Berthelot and de Luca)	glyceryl ether	$\text{C}_8\text{H}_{10}\text{O}_3$	130.14
4264	Glycerophosphoric acid	glycerolphosphoric acid	$\text{C}_3\text{H}_5(\text{OH})_2\text{OPO}_3\text{H}_2$	172.08
4265	Glyceryl α-chlorohydrin	n. See 1,2-Propanediol, 3-chloro*		
4266	Glyceryl esters.	See under Glycerol.		
4267	Glyceryl ether.	See Glycerol ether (of Berthelot and de Luca).		
4268	Glyceryl nitrate.	See Nitroglycerin.		
4268	Glycidol	2,3-epoxy-1-propanol*; epihydric alcohol; glycidic acid	$\text{OCH}_2\text{CHCH}_2\text{OH}$	74.08
4269	Glycine	aminoacetic acid; aminoethanoic acid*; glycocoll	$\text{NH}_2\text{CH}_2\text{COOH}$	75.07
4270	—, methyl ester	methyl aminoethanoate*	$\text{NH}_2\text{CH}_2\text{COOCH}_3$	89.09
4271	—, <i>N</i> -(<i>p</i> -acetamidophenyl)-	(<i>p</i> -acetamidoanilino)acetic acid	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{NHCH}_2\text{COOH}$	208.21
4272	—, <i>N</i> -acetyl-	See Aceturic acid.		
4273	—, <i>N</i> -(<i>p</i> -aminophenyl)-	(<i>p</i> -aminoanilino)acetic acid	$\text{NH}_2\text{C}_6\text{H}_4\text{NHCH}_2\text{COOH}$	166.18
4274	—, <i>N</i> -benzoyl-	See Hippuric acid.		
4275	—, <i>N</i> -carbamyl-	See Hydantoic acid.		
4276	—, <i>N</i> -ethyl-	(ethylamino)ethanoic acid*; (ethylamino)acetic acid; <i>N</i> -ethylglycocoll	$\text{C}_2\text{H}_5\text{NHCH}_2\text{COOH}$	103.12
4277	—, <i>N</i> - <i>dl</i> -leucyl-		$(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{NH}_2)\text{CONHCH}_2\text{COOH}$	188.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4242	leaf.....	$1.40\frac{20}{4}$	54	160	s.	v. s.	sl. s. eth.
4243	.....	$0.947\frac{21}{4}$	35	.....	i.	s.	v. s. eth.
4244	leaf.....	.....	77.0	.....	.....	5.306 ^{22.5}	sl. s. c., s. h. eth.
4245	amber liq.....	$1.0284\frac{20}{4}$	.....	.....	disper- sible	■	∞ eth.
4247	need. or wax- like solid	$0.9841\frac{20}{4}$	81.1 (57-8)	.....	disper- sible	sl. s. c., v. s. h.	sl. s. c., v. s. h. eth.
4248	.....	.....	.....	.....	.....	.....	.....
4249	wh. powd.....	.....	d. 245	.....	d.	s.	.....
4250	col. liq.....	$1.161\frac{20}{4}$	-78	259	7.17	∞	∞ eth.
4251	need. f. me. al.	$1.228\frac{12}{4}$	76.5	d.	i.	s. h.	v. s. eth.
4252	.....	.....	.....	.....	.....	.....	.....
4253	col. oily liq., 1.4359	$1.0350\frac{20}{4}$	<-75	315 (203-425)	i.	v. s.	v. s. eth.
4254	.....	.....	.....	.....	.....	.....	.....
4255	col. need.....	$0.8944\frac{60}{4}$	46.4	.....	i.	s.	s. eth.; v. s. bz.
4256	glit. need. f. eth., 1.4429 ⁶⁰	$0.885\frac{60}{4}$	56.5	.....	i.	s.	s. eth., bz.; v. s. chl.
4257	.....	.....	.....	.....	.....	.....	.....
4258	yel. liq.....	$1.291\frac{10}{16}$	.....	150 sl. d.	i.	d.	s. eth., chl., bz.; i. CS ₂
4259	col. oil.....	$0.915\frac{20}{4}$	-17; frz.-6	240 ¹⁸	i.	sl. s.	v. s. eth.; s. chl.
4260	col. need. f. eth., 1.4381 ⁸⁹	$0.866\frac{80}{4}$	65.1; 46	310-20	i.	.004 ²¹	v. s. eth.; s. chl.
4261	col. cr. f. eth., 1.4399 ⁸⁹	$0.862\frac{80}{4}$	54.5; 70.8	.....	i.	v. sl. s.	s. eth.
4262	thick liq.....	$1.295\frac{14}{4}$	.....	d.	v. sl. s.	∞	i. eth.
4263	col. liq.....	$1.091\frac{20}{4}$	.....	173	∞	∞	∞ eth.
4264	col. oily liq....	$1.59\frac{14}{4}$	-20	.....	∞	∞	.....
4265	.....	.....	.....	.....	.....	.....	.....
4266	.....	.....	.....	.....	.....	.....	.....
4267	.....	.....	.....	.....	.....	.....	.....
4268	col. liq.....	$1.165\frac{0}{4}$	.....	162 d.	∞	∞	■ eth.
4269	wh. monocl., 1.495, 1.615, 1.650	1.601	233 d.; (225-30)	289-92 d.	25.3 ²⁵ , 57.5 ⁷⁵	0.043 ²⁵ , 90%	0.61 ²⁸ pyr.
4270	col. liq.....	.....	.....	ca. 130 d.	.....	.....	.....
4271	.....	.....	241-2	.....	.....	.....	.....
4272	.....	.....	.....	.....	.....	.....	.....
4273	leaf.....	.....	222-3 d.	.....	sl. s.	.....	.....
4274	.....	.....	.....	.....	.....	.....	.....
4275	.....	.....	.....	.....	.....	.....	.....
4276	leaf. f. al.....	.....	>160 d.	.....	s.	s.	.....
4277	cr. f. w.....	.....	243 d.	.....	6.6 h.	v. sl. s.	v. sl. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4278	Glycine, <i>N</i>-methyl-	See <i>Sarcosine</i> .		
4279	—, <i>N</i> - <i>o</i> -nitrophenyl-		$\text{NO}_2\text{C}_6\text{H}_4\text{NHCH}_2\text{COOH}$	196.16
4280	—, <i>N</i> -phenyl-	anilinoacetic acid	$\text{C}_6\text{H}_5\text{NHCH}_2\text{COOH}$	151.16
4281	—, —, <i>o</i> -carboxylic acid.	See <i>Anthranilic acid</i> , <i>N</i> -(carboxymethyl)-.		
4282	Glycine anhydride	2,5-piperazinedione; α , γ -diacipiperazine, diglycolyl diamide	$\text{NHCOC}_2\text{H}_4\text{NHCOCH}_2$	114.10
4283	Glycocholic acid		$\text{C}_{24}\text{H}_{39}\text{O}_4\text{NHCH}_2\text{COOH}$	465.62
4284	Glycocoli.	See <i>Glycine</i> .		
4285	Glycocyamidine, 1-methyl-	See <i>Creatinine</i> .		
4286	Glycocyamine	guanidoacetic acid	$\text{NH}_2\text{C}(\text{NH})\text{NHCH}_2\text{COOH}$	117.11
4287	—, methyl-	See <i>Creatine</i> .		
4288	Glycogen	animal starch	$(\text{C}_6\text{H}_{10}\text{O}_5)_x$	(162-14) _x
4289	Glycogenic acid.	See <i>D-Gluconic acid</i> .		
4290	Glycol	1,2-ethanediol*; ethylene glycol	$\text{CH}_2\text{OHCH}_2\text{OH}$	62.07
4291	—, For derivatives see also	1,2-Ethanediol.		
4292	—, cyanohydrin.	See <i>Hydracrylonitrile</i> .		
4293	—, diacetate.	ethylene acetate	$(\text{CH}_2\text{OOCCH}_3)_2$	146.14
4294	—, dibenzoate.	ethylene benzoate; ethylene dibenzoate	$(\text{C}_6\text{H}_5\text{COO})_2\text{C}_2\text{H}_4$	270.27
4295	—, dibromide.	See <i>Ethylene bromide</i> .		
4296	—, dibutyrate.	ethylene butyrate	$(\text{CH}_2\text{OOCCH}_2\text{CH}_2\text{CH}_3)_2$	202.25
4297	—, dichloride.	See <i>Ethylene chloride</i> .		
4297M	—, difluoride.	See <i>Ethylene fluoride</i> .		
4298	—, diformate.	ethylene formate	$\text{HCOOCH}_2\text{CH}_2\text{OOCH}$	118.09
4299	—, diiodide.	See <i>Ethylene iodide</i> .		
4300	—, dilaurate.	ethylene laurate	$(\text{C}_{11}\text{H}_{23}\text{COOCH}_2)_2$	426.67
4301	—, dimyristate.	ethylene myristate	$(\text{C}_{13}\text{H}_{27}\text{COOCH}_2)_2$	482.77
4302	—, dinitrate.	ethylene nitrate	$\text{C}_2\text{H}_4(\text{ONO}_2)_2$	152.07
4303	—, dinitrite.	ethylene nitrite	$\text{C}_2\text{H}_4(\text{ONO})_2$	120.07
4304	—, dipalmitate.	ethylene palmitate	$(\text{C}_{15}\text{H}_{31}\text{COOCH}_2)_2$	538.87
4305	—, diphenyl ether.	See <i>Ethane, 1,2-diphenoxy</i> .*		
4306	—, dipropionate.	ethylene propionate	$(\text{CH}_3\text{CH}_2\text{COOCH}_2)_2$	174.19
4307	—, distearate.	ethylene stearate	$[\text{CH}_3(\text{CH}_2)_{16}\text{COOCH}_2]_2$	594.98
4308	—, dithiocyanate.	ethylene (di)thiocyanate	$(\text{CH}_2\text{SCN})_2$	144.21
4309	—, ethylene ether.	See <i>p-Dioxane</i> .		
4310	—, ethylidene diether.	See 1,3-Dioxolane, 2-methyl-		
4311	—, monoacetate.		$\text{CH}_3\text{COOCH}_2\text{CH}_2\text{OH}$	104.10
4312	—, monobenzyl ether.	See <i>Ethanol, 2-benzoyloxy</i> .		
4313	—, monobutyl ether.	See <i>Ethanol, 2-butoxy</i> .*		
4314	—, monoethyl ether.	See <i>Ethanol, 2-ethoxy</i> .*		
4315	—, monoformate.	β -hydroxyethyl formate	$\text{HCOOCH}_2\text{CH}_2\text{OH}$	90.08

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4278							
4279	dk. red cr. f. al.	.....	192-3 d.	.....	v. sl. s.	v. s. h.	sl. s. eth.
4280	col. cr. ....	.....	127	.....	s.	s.	sl. s. eth.
4281							
4282	tab. ....	.....	275 d.	subl.	s. h.	v. s.	.....
4283	col. need. ....	.....	134	.....	0.33 c.	v. s.	0.09 ²⁰ eth.
4284							
4285							
4286	leaf. or need. f. w.	.....	d.	.....	0.45 ¹⁵	v. sl. s.	v. sl. s. eth.
4287							
4288	wh. amor. ....	.....	240	.....	v. s.	i. c., s. h.	i. eth.
4289							
4290	col. liq., 1.4274	1.1155 ²⁰ / ₄	-17.4 (-12)	197.2 (198-200)	∞	∞	7.89 eth.
4291							
4292							
4293	col. liq., 1.415	1.128 ⁰ / ₄ ; 1.104 ²⁰ / ₄	-31	186 (190.5)	14.3	∞	∞ eth.
4294	rhomb. pr. f. eth.	.....	73-4	d. 360	i.	.....	s. eth.
4295							
4296	liq.	1.024 ⁰ / ₄	.....	240	i.	v. s.	v. s. eth.
4297							
4297M							
4298	1.35800.	1.193 ⁰ / ₄	.....	174	sl. s.	s.	s. eth.
4299							
4300			50-2	188 ²⁰	i.	v. s.	v. s. eth.
4301	cr.		62-3		.....	.....	.....
4302	yel. liq.	1.483 ⁸	-20	exp. 114-6	i.	s.	d. alk.
4303	liq.	1.2156 ⁰ / ₄	<-15	98	i.	s.	s. eth.; d. alk.
4304	leaf. or need.	0.8594 ^{77.9}	68.7 (69-72)	226	i.	0.31 ³⁸	s. h. eth.
4305							
4306	liq.	1.0544 ¹⁵	.....	211; 90-2 ⁸	sl. s.	∞	∞ eth.
4307	leaf.	0.8581 ⁷⁸	76-7	241 ²⁰	i.	0.122 ⁴⁰	v. s. eth.
4308	col. rhomb. pl. or need.	.....	90	d.	s.	s.	s. eth.
4309							
4310							
4311	col. liq.	1.108 ¹⁵	.....	182	∞	∞	∞ eth.
4312							
4313							
4314							
4315	liq.	1.199 ¹⁵ / ₄	.....	180; 88 ²⁵	∞	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4316	Glycol , monomethyl ether.	See <i>Ethanol</i> , 2-methoxy-*		
4317	—, monomethyl ether acetate.	See <i>Ethanol</i> , 2-methoxy-*, acetate.		
4318	—, monopalmitate.		$C_{16}H_{31}COOCH_2CH_2OH$	300.47
4319	—, monostearate.		$C_{17}H_{35}COOCH_2CH_2OH$	328.52
4320	—, decamethylene .	See 1,10- <i>Decanediol</i> *.		
4321	—, diethylene .	See <i>Diethylene glycol</i> .		
4322	—, sym-dimethyl -.	See 2,3- <i>Butanediol</i> *.		
4323	—, uns-dimethyl -.	See 1,2- <i>Propanediol</i> , 2-methyl-*		
4323M	—, dipropylene .	See 2- <i>Propanol</i> , 1,1'-oxydi-.		
4324	—, dithio -.	See 1,2- <i>Ethanedithiol</i> *.		
4324M	—, divinyl -.	See 1,5- <i>Hexadiene</i> -3,4-diol*.		
4325	—, ethyl -.	See 1,2- <i>Butanediol</i> *.		
4326	—, ethylene .	See <i>Glycol</i> .		
4327	—, ethyl methyl .	See 2,3- <i>Pentanediol</i> *.		
4328	—, heptamethylene .	See 1,7- <i>Heptanediol</i> *.		
4329	—, isopropyl -.	See 1,2- <i>Butanediol</i> , 3-methyl-*		
4330	—, nonamethylene .	See 1,9- <i>Nonanediol</i> *.		
4331	—, octamethylene .	See 1,8- <i>Octanediol</i> *.		
4332	—, octylene .	See 4,5- <i>Octanediol</i> *.		
4333	—, pentamethylene .	See 1,5- <i>Pentanediol</i> *.		
4334	—, γ-pentylene .	See 1,4- <i>Pentanediol</i> *.		
4335	—, tetraethyl -.	See 3,4- <i>Hexanediol</i> , 3,4-diethyl-*		
4336	—, tetramethyl -.	See <i>Pinacol</i> .		
4337	—, tetramethylene .	See 1,4- <i>Butanediol</i> *.		
4338	—, tetraphenyl -.	See <i>Benzopinacol</i> .		
4339	—, thiodi -.	See <i>Ethanol</i> , 2,2'-thiodi-.		
4340	—, triethylene .	See <i>Triethylene glycol</i> .		
4341	—, trimethyl -.	See 2,3- <i>Butanediol</i> , 2-methyl-*		
4342	—, xylylene .	See <i>Xylylene glycol</i> .		
4343	Glycolaldehyde .	hydroxyethanal; glycolic aldehyde	CH_2OHCHO	60.05
4344	Glycolamide .	2-hydroxyethanamide*; hydroxyacetamide	$CH_2OHCONH_2$	75.07
4345	Glycoleucine .	See <i>Norleucine</i> .		
4346	Glycolic acid .	hydroxyethanoic acid*; hydroxyacetic acid	$HOCH_2COOH$	76.05
4347	—, ethyl ester.	ethyl hydroxyethanoate*	$CH_2OHCOOC_2H_5$	104.10
4348	—, ethyl ether.	See <i>Acetic acid</i> , ethoxy-		
4349	—, methyl ester.	methyl hydroxyethanoate*; methyl glycolate	$CH_2OHCOOCH_3$	90.08
4350	—, phenyl ether.	See <i>Acetic acid</i> , phenoxy-		
4351	—, benzoyl -.	α-hydroxy-β-ketohydrocinamic acid; 2-hydroxy-3-oxo-3-phenylpropanoic acid	$C_6H_5COCH(OH)COOH$	180.15
4352	—, diphenyl -.	See <i>Benzilic acid</i> .		
4353	—, phenyl -.	See <i>Mandelic acid</i> .		
4354	—, styryl -.	See 3- <i>Butenoic acid</i> , 2-hydroxy-4-phenyl-		
4355	—, thio -.	See <i>Acetic acid</i> , mercapto-		
4356	Glycolic aldehyde .	See <i>Glycolaldehyde</i> .		
4357	Glycolic anhydride .		$(CH_2OHCO)_2O$	134.09
4358	Glycolide .	2,5- <i>p</i> -dioxanediene; diglycolide	$OCOCH_2OCOCH_2$	116.07
4359	Glycoluric acid .	See <i>Hydantoic acid</i> .		
4360	Glycoluril .	acetylenediurein	$C_2H_2(CON_2H_2)_2$	142.12
4361	Glyconic acid .	See <i>Gluconic acid</i> .		
4362	Glycosterin .	See <i>Diethylene glycol</i> , distearate.		
4363	Glyoxal .	ethanedial*; oxalaldehyde; biformyl	$CHOCHO$	58.04
4364	—, dioxime.	See <i>Glyoxime</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4316							
4317							
4318	cr.	0.8786 $\frac{60.5}{4}$	51.5	.....	.....	24.08 ²⁵	s. h. eth.
4319	cr.	0.8780 $\frac{60}{4}$	58.5	.....	.....	10.61 ²⁹	s. h. eth.
4320							
4321							
4322							
4323							
4323M							
4324							
4324M							
4325							
4326							
4327							
4328							
4329							
4330							
4331							
4332							
4333							
4334							
4335							
4336							
4337							
4338							
4339							
4340							
4341							
4342							
4343	col. pl. ....	.....	97	.....	v. s.	v. s. h.	sl. s. eth.
4344	col. rhomb. ....	.....	120	.....	v. s.	sl. s.	sl. s. eth.
4345							
4346	rhomb. leaf. f. eth. ....	.....	α 63; β 79	d.	s.	s.	s. eth.
4347	col. liq.	1.0826 $\frac{23}{4}$	.....	160	.....	v. s.	v. s. eth.
4348							
4349	col. liq.	1.168 $\frac{18}{4}$	.....	151.2	s.	∞	= eth.
4350							
4351	lng. pr. ....	.....	125	.....	sl. s. c.	s.	s. eth.
4352							
4353							
4354							
4355							
4356							
4357	cr. powd. ....	.....	130	d.	i. c., s. h.	i.	i. eth.
4358	col. leaf. f. al. ....	.....	86-7	.....	s. h.	sl. s.	sl. s. eth.; s. ac. a., h. chl.
4359							
4360	wh. need. f. w. ....	.....	.....	.....	1.333 ¹⁵	s.	s. eth.
4361							
4362							
4363	yel. cr., 1.3828.	1.14 $\frac{20}{4}$	15	50.4	v. s.	s.	s. eth.
4364							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4365	Glyoxal, di-2-furyl-	See <i>Furil</i> .		
4366	—, dimethyl-	See 2,3- <i>Butanedione</i> *.		
4367	—, diphenyl-	See <i>Benzil</i> .		
4368	Glyoxalic acid.	See <i>Glyoxylic acid</i> .		
4369	Glyoxaline.	See <i>Imidazole</i> .		
4370	Glyoxime	glyoxal dioxime.....	HON:CHCH:NOH	88.07
4371	—, dimethyl-	2,3-butanedione dioxime*; diacetyl dioxime	CH ₃ C(:NOH)C- (:NOH)CH ₃	116.12
4372	Glyoxyldiureide.	See <i>Allantoin</i> .		
4373	Glyoxylic acid	oxoethanoic acid*; glyox- alic acid; oxalaldehydic acid	HCOCOOH.....	74.04
4374	—, o-aminophenyl-	See <i>Isatic acid</i> .		
4375	—, o-carboxyphenyl-	See <i>Phthalonic acid</i> .		
4376	—, o-nitrophenyl-	o-nitrobenzoylformic acid....	NO ₂ C ₆ H ₄ COCOOH	195.13
4377	—, phenyl-	benzoylformic acid.....	C ₆ H ₅ COCOOH....	150.13
4378	—, 2-thienyl-	See 2- <i>Thiopheneacetic acid</i> , α-		
4379	Gnoscopine	dl-narcotine.....	C ₂₂ H ₂₈ NO ₇	413.41
4380	Gommelin.	See <i>Dextrin</i> .		
4381	Granatonine, methyl-	See <i>Pseudopelletierine</i> .		
4382	Grape sugar.	See <i>D-Glucose</i> .		
4383	Guaiacol	o-methoxyphenol; pyroca- techol monomethyl ether; o-hydroxyanisole	CH ₃ OC ₆ H ₄ OH.....	124.13
4384	—, 4-allyl-	See <i>Eugenol</i> .		
4385	—, 5-allyl-	See <i>Chavibetol</i> .		
4386	—, 4-methyl-	See <i>Creosol</i> .		
4387	—, 4-propenyl-	See <i>Isoeugenol</i> .		
4388	—, 5-vinyl-	See <i>Hesperetol</i> .		
4389	Guaiene	2,3-dimethylnaphthalene....	C ₁₀ H ₆ (CH ₃) ₂	156.22
4390	Guaiole.	See <i>Tiglaldehyde</i> .		
4391	Guanidine	aminomethanamidine*; car- bamamidine; aminoform- amidine	NH:C(NH ₂) ₂	59.07
4391H	—, carbonate.....		2CH ₅ N ₃ ·H ₂ CO ₃ ...	180.18
4391R	—, picrate.....		CH ₅ N ₃ ·C ₆ H ₃ O ₇ N ₃ ...	288.18
4392	—, 1-amino-	guanylhvdrazine.....	NH ₂ NHC(:NH)- NH ₂	74.09
4393	—, 1-carbamyl-	See <i>Urea</i> , <i>guanyl-</i> .		
4394	—, 1-cyano-	dicyan(o)diamide; param....	NH ₂ C(:NH)- NHCN	84.08
4395	—, diphenyl-	melaniline.....	NH:C[NHC ₆ H ₅] ₂ ..	211.26
4396	—, —, mercaptide with 2	-benzothiazolethiol. See under	2- <i>Benzothiazolethiol</i> .	
4397	—, di-o-tolyl-		C ₁₅ H ₁₇ N ₃	239.31
4398	—, guanyl-	See <i>Biquanide</i> .		
4399	—, nitro- *		NH ₂ C(:NH)- NHNO ₂ (?)	104.07
4400	—, phenyl-o-tolyl- ..		C ₁₄ H ₁₅ N ₃	225.29
4401	—, 1,1,3,3-tetra- phenyl- *		NH:C[N(C ₆ H ₅) ₂] ₂	363.44
4402	—, 1,1,3-triphenyl- *	β-triphenylguanidine.....	HN:C(NHC ₆ H ₅)- N(C ₆ H ₅) ₂	287.35
4403	—, 1,2,3-triphenyl- *	α-triphenylguanidine.....	C ₆ H ₅ N:C- (NHC ₆ H ₅) ₂	287.35

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4365							
4366							
4367							
4368							
4369							
4370	rhomb. tab. f. w.	.....	178	.....	v. s. h.	s.	s. eth.
4371	col. cr. f. dil. al.	.....	234.5 (246)	.....	i.	v. s.	v. s. eth.
4372							
4373	col. rhomb. ....	.....	d.	.....	v. s.	s.	.....
4374							
4375							
4376	need. f. w. ....	.....	46-7	.....	v. s. h.	.....	.....
4377	col. cr. f. CCl ₄	.....	66	147-51 ¹²	s.	s.	s. eth.; i. CS ₂
4378							
4379	lng. need. ....	.....	229	.....	.....	.03	s. chl., bz.; i. alk.
4380							
4381							
4382							
4383	col. hex. pr., 1.53833 ^{21.4} _α	1.1287 ^{21.4} ₄	28.2 (32)	205; 106.5 ²⁴	1.5 ¹⁵	s.	s. eth., chl., glac. ac. a.
4384							
4385							
4386							
4387							
4388							
4389	leaf. f. al.	1.008 ²⁰ ₄	104-104.5	260-265	i.	s.	s. eth.
4390							
4391	col. cr. ....	.....	.....	.....	v. s.	v. s.	.....
4391H	octahr. or tetr. columns	1.24	197	.....	v. s. c.	i.	.....
4391R	or.-yel. pl. or need.	.....	333 d.	.....	.037 ⁹ ; .574 ⁸⁰	sl. s.	sl. s. eth.
4392	cr. ....	.....	d.	.....	s.	s.	i. eth.
4393							
4394	rhomb. leaf.	1.40 ¹⁴ ₄	205 (207)	d.	2.26 ¹³	1.26 ¹³	0.01 ¹³ eth.; i. bz.
4395	monocl. need. f. al.	1.13 ²⁰ ₄	147-8	d. >170	sl. s.	9.1 ²⁰ 90% ₅₁₅	v. sl. s. eth.; s. CCl ₄ , chl., h. bz., h. tol., dil. min. a.
4396							
4397	wh. cr.	1.10 ²⁰ ₄	179	.....	v. sl. s.	sl. s. c., s. h.	sl. s. eth.
4398							
4399	yelsh. need. f. w.	.....	246-7 (231)	.....	0.26 ^{18.3}	sl. s.	i. eth.; s. sol. KOH
4400	wh. cr. ....	.....	129.5-30	.....	v. sl. s.	sl. s. c., s. h.	sl. s. eth.
4401	rhomb. f. lgr. ....	.....	130	.....	i.	s.	s. eth.; v. s. bz.
4402	regular tab. ....	.....	131	.....	v. sl. s.	v. s.	v. s. eth.; sl. s. bz.
4403	wh. need. or pr. f. al.	1.13 ²⁰ ₄	145	d.	v. sl. s.	3.55 c.	s. eth., chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4404	Guanine	2-aminohypoxanthine.....	$C_5H_5N_5O$	151.13
4404M	D-Gulose	<i>l</i> -gulose, formerly.....	$C_6H_{12}O_6$	180.16
4405	Guncotton	See <i>Cellulose, hexanitrate</i> .		
4406	Guvacine	See <i>Arecaidine</i> .	$C_6H_9NO_2$	127.14
4407	—, 1-methyl-	See <i>1-Naphthol-3,6-disulfonic acid, 8-amino-</i> .		
4408	H acid	See <i>Hem-</i> .		
4409	Haem-		$C_{13}H_{14}N_2O$	214.26
4409	Harmaline		$C_{13}H_{12}N_2O$	212.24
4410	Harmine			
4411	Helenin	alantolactone.....	$C_{15}H_{20}O_2$	232.31
4412	<i>l</i>-Helicin	salicylaldehyde glucoside.....	$C_6H_4(OC_6H_{11}O_5)-CHO$	284.26
4413	Heliotropin	See <i>Piperonal</i> .		
4414	Hematein	haematin; hematin.....	$C_{16}H_{12}O_6$	300.26
4415	Hematin	haematin.....	$C_{32}H_{32}FeN_4O_4$	592.45
4416	Hematoxylin	haematoxylin.....	$C_{16}H_{14}O_6 \cdot 3H_2O$	356.32
4417	Hemellitene	See <i>Hemimellitene</i> .		
4418	Hemellitic acid	2,3-dimethylbenzoic acid; 2,3-xylic acid; <i>vic-o</i> -xylic acid	$(CH_3)_2C_6H_3COOH$	150.17
4419	Hemimellitene	1,2,3-trimethylbenzene; <i>vic</i> -trimethylbenzene; hemellitene	$(CH_3)_3C_6H_3$	120.19
4420	—, 4,5,6-trinitro-		$(NO_2)_3C_6(CH_3)_3$	255.19
4421	Hemimellitic acid	1,2,3-benzenetricarboxylic acid*	$C_6H_3(COOH)_3$	210.14
4422	Hempic acid	3,4-dimethoxyphthalic acid; hemipinic acid; narcotine hemipic acid	$(CH_3O)_2C_6H_2-(COOH)_2$	226.18
4423	Hemiterpene	See <i>Isoprene</i> .		
4424	Hendecanal *	undecanal*; <i>n</i> -undecylaldehyde	$CH_3(CH_2)_9CHO$...	170.29
4425	—, oxime		$CH_3(CH_2)_9-CH:NOH$	185.30
4426	Hendecane *	undecane*	$CH_3(CH_2)_9CH_3$	156.30
4427	—, 1-amino-	See <i>Hendecylamine</i> *		
4428	Hendecanoic acid *	undecanoic acid*; <i>n</i> -undecylic acid	$CH_3(CH_2)_9COOH$	186.29
4429	1-Hendecanol *	1-undecanol*; <i>pri-n</i> -undecyl alcohol	$CH_3(CH_2)_9CH_2OH$	172.30
4430	2-Hendecanol *	2-undecanol*; methylonylcarbinol	$CH_3(CH_2)_8CH-OHCH_3$	172.30
4431	2-Hendecanone *	2-undecanone*; methyl nonyl ketone	$CH_3CO(CH_2)_8-CH_3$	170.29
4432	3-Hendecanone *	3-undecanone*; ethyloctyl ketone	$C_2H_5CO(CH_2)_7-CH_3$	170.29

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4404	col. need. ....	.....	360 d.	.....	i.	v. sl. s.	v. sl. s. eth., NH ₄ OH; s. KOH
4404M	col. syrup, [α] _D ²⁰ -20.4°	.....	.....	.....	s.	sl. s.	.....
4405	lust. sc. ....	.....	271-2 d.	.....	s.	s.	i. eth.
4406							
4407							
4408							
4409	rhomb. pr. f. al.+bz.	.....	250 d. (238)	.....	v. sl. s.	sl. s.	sl. s. eth.
4410	monocl. or rhomb. pr. f. al.	.....	257-9 d.	.....	2.5 ²⁰	sl. s.	sl. s. eth.
4411	wh. need. f. al.+w.	.....	76	275; 192 ¹⁰	v. sl. s.	v. s.	v. s. eth.; s. bz., chl.
4412	fine need. ....	.....	175	.....	60 c., v. s. h.	s.	i. eth.
4413	br. pl. ....	.....	250 d.	.....	0.6 ²⁰	sl. s.	0.0093 ²⁰ eth.; s. alk.; i. bz., chl.
4414							
4415	br. powd. ....	.....	>200	.....	i.	i. c., s. h.	i. eth., chl.; s. alk.
4416	col.-yelsh. tetr. cr. f. dil. (NH ₄) ₂ SO ₃	.....	anh. 140	-H ₂ O, 100-20	v. sl. s.	s.	s. eth., NH ₄ OH, glyc., caustic alk.
4417	col. pr. f. al. ....	.....	144	.....	v. sl. s. h.	s.	s. eth.
4418							
4419	col. liq., 1.51335 ^{19,55}	0.895 ²⁰ 4	<-15	176.5	i.	s.	s. eth.
4420	pr. f. al. ....	.....	209	.....	i.	s.	.....
4421	col. need. ....	.....	190	d.	3.15 ¹⁹	.....	s. eth.
4422	monocl. cr. ....	.....	186-8; 159-60 anh.	subl.	sl. s.	sl. s.	0.7 eth.
4423	liq., 1.4334....	0.830 ²⁰ 4	-4	117 ¹⁶	i.	s.	s. eth.
4424							
4425	need. f. me. al.	.....	72	.....	s.	s.	s. eth.
4426	col. liq., 1.4184	0.741 ²⁰ 4	-26.5	195.84 (197)	i.	∞	∞ eth.
4427	col. sc. 1.4294 ^{45,2}	0.8905; 0.8889 ³⁰ 4	29.3	228 ¹⁶⁰	i.	sl. s.	s. eth.
4428							
4429	cr. or liq., 1.4404	0.8334 ²³ 4	11 (19)	131 ¹⁵	i.	s.	v. s. eth.
4430	liq.	0.8363	12	225.4; 228-9	.02 ²⁰	s.	s. eth.
4431	col. arom. liq., 1.43002 ^{17,5}	0.826 ²⁰ 4	15; (12.1); frz. 6	228 (226)	i.	s.	s. eth.
4432	liq. ....	.....	4.5	104-6 (227)	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4433	6-Hendecanone*	6-undecanone*; diamyl ketone; dipentyl ketone; (<i>n</i>)-caprone	$\text{CH}_3(\text{CH}_2)_4\text{CO}-(\text{CH}_2)_4\text{CH}_3$	170.29
4434	2-Hendecene*	2-undecene*; β -undecylene..	$\text{CH}_3\text{CH}:\text{CH}-(\text{CH}_2)_7\text{CH}_3$	154.29
4435	9-Hendecenoic acid* ...	9-undecenoic acid*; θ -undecylenic acid	$\text{CH}_3\text{CH}:\text{CH}-(\text{CH}_2)_7\text{COOH}$	184.27
4436	Hendecylamine* (<i>n</i>)...	<i>pri-n</i> -undecylamine; 1-aminohendecane	$\text{CH}_3(\text{CH}_2)_{10}\text{NH}_2$...	171.32
4436M	1-Hendecyne*	1-undecyne*; rutyldiene.....	$\text{CH}:\text{C}(\text{CH}_2)_8\text{CH}_3$...	152.27
4437	Heneicosane*.....	.....	$\text{CH}_3(\text{CH}_2)_{19}\text{CH}_3$...	296.57
4438	Hentriacontane*	<i>n</i> -hentriacontane.....	$\text{CH}_3(\text{CH}_2)_{29}\text{CH}_3$...	436.83
4439	16-Hentriacontanone*	dipentadecyl ketone; palmitone	$(\text{C}_{15}\text{H}_{31})_2\text{CO}$	450.81
4439M	Hepatoflavin.	See <i>D-Riboflavin</i> .		
4440	Heptacosane*	<i>n</i> -heptacosane.....	$\text{CH}_3(\text{CH}_2)_{25}\text{CH}_3$...	380.72
4440M	1-Heptacosanol*	<i>n</i> -heptacosyl alcohol.....	<i>n</i> - $\text{C}_{27}\text{H}_{55}\text{OH}$	396.72
4440Q	<i>n</i>-Heptacosyl alcohol.	See 1-Heptacosanol.*		
4441	Heptadecane*	<i>n</i> -heptadecane.....	$\text{CH}_3(\text{CH}_2)_{15}\text{CH}_3$...	240.46
4441M	—, 1-amino-.	See <i>Heptadecylamine*</i> (<i>n</i>).		
4442	9-Heptadecanecarboxylic acid* .	See <i>Capric acid</i> , α -octyl-.		
4443	Heptadecanenitrile* .	See <i>Margaronitrile</i> .		
4444	Heptadecanoic acid* .	See <i>Margaric acid</i> .		
4445	1-Heptadecanol*	<i>pri-n</i> -heptadecyl alcohol.....	$\text{CH}_3(\text{CH}_2)_{16}\text{OH}$...	256.46
4446	9-Heptadecanone*	<i>di-n</i> -octyl ketone; pelargone; nonylone	$(\text{C}_8\text{H}_{17})_2\text{CO}$	254.45
4447	<i>n</i>-Heptadecoic acid.	See <i>Margaric acid</i> .		
4448	<i>pri-n</i>-Heptadecyl alcohol.	See 1-Heptadecanol*.		
4448M	Heptadecylamine* (<i>n</i>)	1-aminoheptadecane.....	$\text{CH}_3(\text{CH}_2)_{16}\text{NH}_2$...	255.48
4449	<i>n</i>-Heptadecylic acid.	See <i>Margaric acid</i> .		
4450	2,4-Heptadiene*.....	.....	$\text{CH}_3\text{CH}:\text{CHCH}:\text{CHCH}_2\text{CH}_3$	96.17
4450M	1,3-Heptadiene, 2,6-dimethyl-*	isogeraniolene.....	$\text{CH}_2:\text{C}(\text{CH}_3)\text{CH}:\text{CHCH}_2\text{CH}(\text{CH}_3)_2$	124.22
4451	1,6-Heptadiene-3,5-dione, 1,7-bis(4-hydroxy-3-methoxyphenyl)-* .	See <i>Phorone</i> .		
4452	2,5-Heptadien-4-one, 2,6-dimethyl-* .	See <i>Enanthaldehyde</i> .		
4453	<i>n</i>-Heptaldehyde.	See <i>Enanthaldehyde</i> , ozime.		
4454	<i>n</i>-Heptaldoxime.	See <i>Cycloheptane*</i> .		
4455	Heptamethylene.	See <i>Cycloheptane*</i> .		
4456	Heptamethylene glycol.	See 1,7-Heptanediol*.		
4457	Heptanal* .	See <i>Enanthaldehyde</i> .		
4458	Heptane*	<i>n</i> -heptane.....	$\text{CH}_3(\text{CH}_2)_6\text{CH}_3$...	100.20
4458M	<i>n</i>-Heptane, 2-amino-.	See <i>Hexylamine</i> , α -methyl-.		
4459	Heptane, 1-bromo-* ...	<i>n</i> -heptyl bromide.....	$\text{CH}_3(\text{CH}_2)_6\text{Br}$	179.11
4460	—, 1-chloro-*	<i>n</i> -heptyl chloride.....	$\text{CH}_3(\text{CH}_2)_6\text{Cl}$	134.65
4461	—, 2,6-dimethyl-* ...	diisobutylmethane; isobutylisoamyl	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{CH}(\text{CH}_3)_2$	128.25
4462	Heptane, 1-ethoxy-* .	See <i>Ether</i> , ethyl heptyl.		
4463	—, 4-ethyl-*	ethyldipropylmethane.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}-(\text{C}_2\text{H}_5)(\text{CH}_2)_2\text{CH}_3$	128.25
4464	—, 1-heptyloxy-* .	See <i>Heptyl ether</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4433	leaf.....	0.8262 $\frac{20}{4}$	14-5	226	i.	v. s.	v. s. eth.
4434	col. liq., 1.4333	0.7729 $\frac{20}{4}$	.....	193	i.	∞	∞ eth.
4435	wh. cr. mass or col. to yelsh. liq.	0.9075 $\frac{25}{4}$	24.5	295	i.	∞	∞ eth.; s. chl.
4436	col. liq.....	.....	16.5	241.6	sl. s.	s.	s. eth.
4436M	liq.....	0.867 $\frac{25}{4}$	-33	210-5	i.	s.	s. eth.
4437	cr., 1.4344 ^{45.3}	0.778 $\frac{40}{4}$	40	215 ¹⁵	.....	.....	.....
4438	cr.....	0.781 $\frac{68}{4}$	68.1	302 ¹⁵	.....	.....	sl. s. eth.
4439	leaf. f. al., 1.4297 ^{93.5}	liq. 0.795 $\frac{91}{4}$	82.8	.....	i.	s.	s. eth.
4439M	.....	.....	.....	.....	.....	.....	.....
4440	cr.....	0.780 $\frac{60}{4}$	59.5	270 ¹⁵	i.	v. s.	sl. s. eth.
4440M	.....	.....	81.2-81.6	.....	.....	.....	.....
4440Q	.....	.....	.....	.....	.....	.....	.....
4441	hex. leaf., 1.437	0.778 $\frac{20}{4}$	22.5	303	i.	sl. s.	s. eth.
4441M	.....	.....	.....	.....	.....	.....	.....
4442	.....	.....	.....	.....	.....	.....	.....
4443	.....	.....	.....	.....	.....	.....	.....
4444	.....	.....	.....	.....	.....	.....	.....
4445	cr.....	.8475	53.31 (54)	308.5	.01+ ²⁰	s.	s. eth.
4446	pl. f. me. al.....	.....	53 (50.5 ⁰)	.....	.....	sl. s.	s. me. al.
4447	.....	.....	.....	.....	.....	.....	.....
4448	.....	.....	.....	.....	.....	.....	.....
4448M	col. cr.....	.....	.....	335.9; 155.0 ²	i.	■.	s. eth.
4449	.....	.....	.....	.....	.....	.....	.....
4450	liq.....	0.733 $\frac{21.5}{4}$	.....	107 (104-6)	.....	.....	.....
4450M	liq.....	0.765 $\frac{10}{4}$	.....	143-5 ⁷⁵⁵	i.	.....	.....
4451	See <i>Curcumin</i>.	.....	.....	.....	.....	.....	.....
4452	.....	.....	.....	.....	.....	.....	.....
4453	.....	.....	.....	.....	.....	.....	.....
4454	.....	.....	.....	.....	.....	.....	.....
4455	.....	.....	.....	.....	.....	.....	.....
4456	.....	.....	.....	.....	.....	.....	.....
4457	.....	.....	.....	.....	.....	.....	.....
4458	col. liq., 1.3867 ²³	0.684 $\frac{20}{4}$	-90.5	98.52	0.0052 ^{15.5}	100	∞ eth., chl.
4458M	.....	.....	.....	.....	.....	.....	.....
4459	col. liq.....	1.133 $\frac{16}{4}$	-58.86	178.8	i.	v. s.	v. s. eth.
4460	liq., 1.42844...	0.8725 $\frac{20}{0}$	-69.5	159.5	i.	∞	∞ eth.
4461	col. liq.....	0.7247 $\frac{0}{4}$;	.....	132-3	i.	i.	s. eth.
4462	.....	0.712 $\frac{20}{0}$	.....	.....	.....	.....	.....
4463	col. liq., 1.408	0.741 $\frac{20}{4}$	.....	139	i.	i.	s. eth.
4464	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4455	Heptane, 1-iodo-*	n-heptyl iodide.....	$\text{CH}_3(\text{CH}_2)_5\text{CH}_2\text{I}$...	226.11
4456	—, 1-methoxy-*	See <i>Ether, heptyl methyl</i> .		
4457	—, 2-methyl-*	amyl dimethylmethane; iso-octane	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_4\text{CH}_3$	114.23
4458	—, 3-methyl-*	butylethylmethylmethane...	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)(\text{CH}_2)_3\text{CH}_3$	114.23
4459	—, 4-methyl-*	methyl dipropylmethane.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{CH}_2)_2\text{CH}_3$	114.23
4470	—, 1-phenoxy-*	See <i>Ether, heptyl phenyl</i> .		
4471	3-Heptanecarboxylic acid.	See <i>Caproic acid, α-ethyl</i> .		
4472	1,7-Heptanedicarboxylic acid.	See <i>Azelaic acid</i> .		
4473	Heptanedioic acid.*	See <i>Pimelic acid</i> .		
4474	—, 4-oxo-*	See <i>Acetonediacetic acid</i> .		
4475	1,7-Heptanediol*	heptamethylene glycol.....	$\text{CH}_2\text{OH}(\text{CH}_2)_5\text{CH}_2\text{OH}$	132.20
4476	1-Heptanethiol*	n-heptyl mercaptan.....	$\text{CH}_3(\text{CH}_2)_5\text{CH}_2\text{SH}$	132.26
4477	Heptanoic acid*.	See <i>Enanthic acid</i> .		
4478	1-Heptanol*	n-heptyl alcohol.....	$\text{CH}_3(\text{CH}_2)_5\text{CH}_2\text{OH}$	116.20
4479	—, esters of organic acids.	See "heptyl ester" under the names of the acids.		
4480	—, nitrite.	See <i>Heptyl nitrite</i> .		
4481	2-Heptanol*	amyl methylcarbinol.....	$\text{CH}_3\text{CHOH}(\text{CH}_2)_4\text{CH}_3$	116.20
4482	—, 2-methyl-*	amyl dimethylcarbinol.....	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_4\text{CH}_3$	130.23
4483	3-Heptanol, 3-methyl-*	butylethylmethylcarbinol...	$\text{CH}_3\text{CH}_2\text{COH}(\text{CH}_2)_3\text{CH}_3$	130.23
4484	4-Heptanol*	dipropylcarbinol.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{CH}_2)_2\text{CH}_3$	116.20
4485	—, 2,6-dimethyl-*	diisobutylcarbinol.....	$[(\text{CH}_3)_2\text{CHCH}_2]_2\text{CHOH}$	144.25
4486	—, 4-ethyl-*	ethyl dipropylcarbinol.....	$\text{CH}_3\text{CH}_2\text{COH}(\text{CH}_2\text{CH}_2\text{CH}_3)_2$	144.25
4487	—, 4-methyl-*	methyl dipropylcarbinol.....	$\text{CH}_3(\text{CH}_2)_2\text{COH}(\text{CH}_2)_2\text{CH}_3$	130.23
4488	—, 4-propyl-*	tripropylcarbinol; <i>tert</i> -decyl alcohol	$(\text{C}_3\text{H}_7)_3\text{COH}$	158.28
4489	2-Heptanone*	amyl methyl ketone.....	$\text{CH}_3\text{CO}(\text{CH}_2)_4\text{CH}_3$	114.18
4490	3-Heptanone*	ethyl butyl ketone.....	$\text{C}_2\text{H}_5\text{CO}(\text{CH}_2)_3\text{CH}_3$	114.18
4491	—, 6-methyl-*	ethyl isocamyl ketone.....	$\text{C}_2\text{H}_5\text{COCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$	128.21
4492	4-Heptanone*	dipropyl ketone; butyrene.....	$\text{C}_3\text{H}_7\text{OOC}_3\text{H}_7$	114.18
4493	—, 2,6-dimethyl-*	diisobutyl ketone; <i>s</i> -diisopropylacetone; isovalerone; valerone	$[(\text{CH}_3)_2\text{CHCH}_2]_2\text{CO}$	142.24
4494	—, 2-methyl-*	isobutyl propyl ketone.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}(\text{CH}_2)_2\text{CH}_3$	128.21
4495	1-Heptene*	α-heptylene.....	$\text{CH}_3\text{CH}(\text{CH}_2)_4\text{CH}_2$	98.18
4496	2-Heptene*	1-butyl-2-methylethylene; β-heptylene	$\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_2)_3\text{CH}_3$	98.18
4497	3-Heptene*	1-ethyl-2-propylethylene; γ-heptylene	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_2)_2\text{CH}(\text{CH}_2)_2\text{CH}_3$	98.18

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4465	liq.	$1.4034 \frac{0}{4}$; $1.366 \frac{21}{4}$	-48.2	203.95; 91-3 ²⁰	i.	s.	s. eth.
4466	col. liq., 1.3935	$0.7029 \frac{20}{4}$	.....	116.0	i.	sl. s.	s. eth.
4467							
4468	liq.	0.7161	.....	122.2	i.	sl. s.	s. eth.
4469	col. liq., 1.398 ¹⁵	$0.7211 \frac{20}{4}$	.....	118.0	i.	sl. s.	s. eth.
4470	cr. ....	.....	12	259; 143-6 ⁸	s.	s.	i. eth.
4471							
4472							
4473							
4474							
4475							
4476	liq.	$0.8389 \frac{25}{4}$	-43.4	176.2 (174-5)	i.	∞	∞ eth.
4477	col. liq., 1.42410 ²⁰	$0.8219 \frac{20}{4}$	-34.6	176	0.091 ¹⁸ ; 0.281 ¹⁰⁰	∞	∞ eth.
4478							
4479	liq., 1.4213, 1.4190 ²⁵	.8187	.....	160.4	.35 ²⁰	s.	s. eth.
4480							
4481	col. liq., 1.4303	$0.879 \frac{20}{4}$	.....	162	i.	s.	s. eth.
4482	col. liq., 1.4279 ²⁰	$0.8282 \frac{20}{4}$	.....	163.5; 65.2- 65.8 ¹⁵	v. sl. s.	s.	s. eth.
4483							
4484	liq., 1.4205....	$0.820 \frac{20}{4}$	-41.5	155.4	i.	s.	s. eth.
4485	col. liq., 1.423 ²¹	$0.8237 \frac{0}{11}$; $0.8155 \frac{12}{4}$	.....	172-47 ⁵⁰	i.	s.	s. eth.
4486	liq.	$0.8349 \frac{20}{4}$	.....	179.5	i.	s.	s. eth.
4487	col. liq., 1.427.	$0.8248 \frac{20}{4}$	.....	161.5	i.	s.	s. eth.
4488	col. oil	$0.8338 \frac{21}{0}$	.....	190-2	i.	s.	.....
4489	col. liq.	$0.822 \frac{15}{4}$	.....	150	v. sl. s.	s.	s. eth.
4490	col. liq.	$0.8183 \frac{20}{4}$	-39.0	148.5	i.	∞	∞ eth.
4491	liq. ....	.....	.....	163.5	i.	s.	s. eth.
4492	col. liq., 1.40732 ²⁰	$0.8174 \frac{20}{4}$	-32.6; (-34)	144	i.	∞	∞ eth.
4493	col. oil, 1.412 ²¹ .	$0.806 \frac{20}{4}$	.....	168 (165-6)	i.	∞	∞ eth.
4494	liq.	0.813	.....	155	i.	s.	s. eth.
4495	col. liq.	$0.6993 \frac{20}{4}$	-10	94.9 (95-100)	i.	s.	s. eth.
4496	.....	$0.7034 \frac{20}{4}$	.....	98.1-8.4	.....	.....	.....
4497	.....	$0.7043 \frac{20}{4}$	.....	95.8-6.1	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4497M	1-Hepten-4-ol, 4-methyl.*	allylmethylpropylcarbinol...	$\text{CH}_2\text{:CHCH}_2\text{C-}$ $(\text{CH}_3)(\text{C}_3\text{H}_7)\text{OH}$	128.21
4498	5-Hepten-2-one, 6-methyl.*	.....	$(\text{CH}_3)_2\text{C:CH-}$ $(\text{CH}_2)_2\text{COCH}_3$	126.19
4499	Heptene.	See <i>Heptyne*</i> .		
4500	<i>n</i>-Heptoic acid.	See <i>Enanthic acid</i> .		
4501	<i>pri-n</i>-Heptyl alcohol.	See 1- <i>Heptanol*</i> .		
4502	<i>n</i>-Heptyl aldehyde.	See <i>Enanthaldehyde</i> .		
4503	Heptylamine* (<i>n</i>).	.....	$\text{CH}_3(\text{CH}_2)_6\text{NH}_2...$	115.22
4504	—, α-methyl-.....	2-aminooctane; <i>sec-n</i> -octylamine; <i>sec-n</i> -caprylamine	$\text{CH}_3(\text{CH}_2)_5\text{CH-}$ $(\text{CH}_3)\text{NH}_2$	129.24
4505	<i>n</i>-Heptyl bromide.	See <i>Heptane, 1-bromo*</i> .		
4506	<i>n</i>-Heptyl chloride.	See <i>Heptane, 1-chloro*</i> .		
4507	<i>n</i>-Heptyl cyanide.	See <i>Caprylonitrile</i> .		
4508	Heptylene.	See <i>Heptene*</i> .		
4509	Heptyl esters of organic acids.	See "heptyl ester," under	the names of the acids.	
	Heptyl ether.....	1-heptyloxyheptane*; <i>di-n</i> -heptyl ether	$(\text{C}_7\text{H}_{16})_2\text{O}.....$	214.38
4510	<i>n</i>-Heptylic acid.	See <i>Enanthic acid</i> .		
4511	<i>n</i>-Heptyl iodide.	See <i>Heptane, 1-iodo*</i> .		
4512	<i>n</i>-Heptyl mercaptan.	See 1- <i>Heptanethiol*</i> .		
4513	Heptyl nitrite (<i>n</i>).	.....	$\text{CH}_3(\text{CH}_2)_6\text{ONO}...$	145.20
4514	Heptyl sulfate.....	<i>di-n</i> -heptyl sulfate.....	$[\text{CH}_3(\text{CH}_2)_6]_2\text{SO}_4...$	294.44
4515	1-Heptyne*.....	1-heptene; <i>n</i> -amylacetylene; enanthylidene	$\text{CH:C}(\text{CH}_2)_4\text{CH}_3...$	96.17
4516	2-Heptyne*.....	2-heptene; butylmethylacetylene	$\text{CH}_3\text{C:C}(\text{CH}_2)_3\text{-}$ CH_3	96.17
4516F	3-Heptyne*.....	3-heptene; ethylpropylacetylene	$\text{C}_2\text{H}_5\text{C:C}(\text{CH}_2)_2\text{-}$ CH_3	96.17
4517	Herapathite.	See <i>Quinine, iodosulfate</i> .		
4518	Heroin.	See <i>Morphine, diacetyl</i> .		
4519	Hesperetic acid.	See <i>Isoferulic acid</i> .		
4520	Hesperetol.....	5-vinylguaiacol; 3-hydroxy-4-methoxystyrene	$\text{CH}_2\text{:CHC}_6\text{H}_3\text{-}$ $(\text{OCH}_3)\text{OH}$	150.17
4521	Hesperidene.....	See <i>d-Limonene</i> .		
4522	Hesperidin.....	.....	$\text{C}_{22}\text{H}_{26}\text{O}_{12}.....$	482.43
4523	Hexacosanoic acid*.	See <i>Cerotic acid</i> .		
4524	1-Hexacosanol*.	See <i>Ceryl alcohol</i> .		
4525	<i>n</i>-Hexacosyl alcohol.	See <i>Ceryl alcohol</i> .		
4526	Hexadecanal, oxime*.	See <i>Palmitaldehyde, oxime</i> .		
4527	Hexadecanamide*.	See <i>Palmitamide</i> .		
4528	Hexadecane*.....	<i>n</i> -hexadecane; cetane; biocetyl	$\text{CH}_3(\text{CH}_2)_{14}\text{CH}_3...$	226.44
4528M	—, 1-amino-.	See <i>Cetylamine</i> .		
4529	—, 1-hexadecyloxy*.	See <i>Cetyl ether</i> .		
4530	—, 1-iodo*.	See <i>Cetyl iodide</i> .		
4531	—, 1-phenoxy*.	See <i>Ether, cetyl phenyl</i> .		
4532	Hexadecanenitrile*.	See <i>Palmitonitrile</i> .		
4533	Hexadecanoic acid*.	See <i>Palmitic acid</i> .		
4534	1-Hexadecanol*.	See <i>Cetyl alcohol</i> .		
4535	Hexadecanoyl chloride*.	See <i>Palmitoyl chloride</i> .		
4536	7-Hexadecenoic acid*.	See <i>Hypogeic acid (artificial)</i> .		
4537	2-Hexadecene.	See 2- <i>Hexadecyne*</i> .		
4537M	<i>n</i>-Hexadecyl.	See <i>Cetyl</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4497M				159-160 ⁷⁴⁸			
4498	col. liq.	0.860 ²⁰ ₄	-67.3	174	i.	∞	∞ eth.
4499							
4500							
4501							
4502							
4503	col. liq., 1.424	0.777 ²⁰ ₄	-23	158.3	sl. s.	∞	∞ eth.
4504	liq., 1.4254...	0.7721 ²⁰ ₄		164-6	i.	v. s.	v. s. eth.
4505							
4506							
4507							
4508							
4509	col. liq.	0.815 ⁰ ₄		260	i.	s.	s. eth.
4510							
4511							
4512							
4513	liq.	0.8939 ⁰ ₄		155	i.		s. eth.
4514	col. liq., 1.436 ²⁵	0.9819 ²⁵ ₂₅	11.4	146.6 ^{1.5}			
4515	col. liq.	0.738 ^{12.6} ₄ ; 0.7288 ²⁵ ₄	>-70	99.8; 26.5 ⁵⁰	i.	∞	∞ eth.
4516	col. liq., 1.4220 ²⁵	0.745 ²⁵ ; 0.750 ¹⁹ ₄		112; 39.5 ⁵⁰	i.	∞	∞ eth.
4516F	col. liq., 1.415 ²⁵	0.7337 ²⁵		106-7	i.	∞	∞ eth.
4517							
4518							
4519							
4520	cr.		57		v. sl. s.	v. s.	v. s. eth.
4521							
4522	yel. hyg. need.		171	251 d.	0.02 h.	0.5	i. eth., bz.; s.h. ac. a.
4523							
4524							
4525							
4526							
4527							
4528	col. leaf.	0.7751 ²⁰ ₄	20 (16-7)	287.5	i.	∞	∞ eth.
4528M							
4529							
4530							
4531							
4532							
4533							
4534							
4535							
4536							
4537							
4537M							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4538	n-Hexadecylic acid.	See <i>Palmitic acid</i> .		
4538X	1-Hexadecyne*		$\text{CH}_3(\text{CH}_2)_{13}\text{C}:\text{CH}$	222.40
4539	2-Hexadecyne*	2-hexadecene; cetylene.	$\text{CH}_3(\text{CH}_2)_{12}\text{C}:\text{CCH}_3$	222.40
4540	7-Hexadecynoic acid*.	See <i>Palmitolic acid</i> .		
4541	1,5-Hexadiene*	biallyl; diallyl.	$\text{CH}_2:\text{CHCH}_2\text{CH}_2\text{CH}:\text{CH}_2$	82.14
4542	2,4-Hexadiene*	bipropenyl; dipropylene.	$\text{CH}_3\text{CH}:\text{CH}-\text{CH}:\text{CHCH}_3$	82.14
4543	—, 2,5-dimethyl-*	diisocrotyl.	$(\text{CH}_3)_2\text{C}:\text{CH}-\text{CH}:\text{C}(\text{CH}_3)_2$	110.19
4544	2,4-Hexadienedioic acid*.	See <i>Muconic acid</i> .		
4544M	1,5-Hexadiene-3,4-diol*	divinyl glycol.	$\text{CH}_2:\text{CH}.\text{CHOH}.\text{CHOH}.\text{CH}:\text{CH}_2$	114.14
4545	2,4-Hexadienoic acid*.	See <i>Sorbic acid</i> .		
4546	1,5-Hexadien-3-yne*	divinylacetylene.	$\text{CH}_2:\text{CHC}:\text{C}-\text{CH}:\text{CH}_2$	78.11
4547	1,5-Hexadiyne*	bipropargyl; 1,5-hexadiene; dipropargyl	$\text{CH}:\text{CCH}_2\text{CH}_2\text{C}:\text{CH}$	78.11
4548	"Hexalin".	See <i>Cyclohexanol*</i> .		
4549	Hexamethylene.	See <i>Cyclohexane*</i> .		
4550	Hexamethylenediamine.	See 1,6-Hexanediamine*.		
4551	Hexamethylene glycol.	See 1,6-Hexanediol*.		
4552	Hexamethylenetetramine	methenamine; formamine; hexamine; "Urotropin"	$(\text{CH}_2)_6\text{N}_4$	140.19
4553	Hexamine.	See <i>Hexamethylenetetramine</i> .		
4554	Hexanal*.	See <i>Caproaldehyde</i> .		
4555	Hexanamide*.	See <i>Caproamide</i> .		
4556	Hexane*	n-hexane.	$\text{CH}_3(\text{CH}_2)_4\text{CH}_3$	86.17
4557	—, 1-amino-*	See <i>Hexylamine</i> .		
4558	—, 2-amino-*	See <i>Amylamine</i> , α -methyl.		
4559	—, 1-bromo-*	n-hexyl bromide.	$\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{Br}$	165.08
4560	—, 1-chloro-*	n-hexyl chloride.	$\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{Cl}$	120.62
4561	—, 2-chloro-*		$\text{CH}_3\text{CHCl}(\text{CH}_2)_3\text{CH}_3$	120.62
4562	—, dihydroxy-*	See <i>Hexanediol*</i> .		
4563	—, 1,6-diiodo-*	1,6-hexylene iodide.	$\text{ICH}_2(\text{CH}_2)_4\text{CH}_2\text{I}$	338.00
4564	—, 2,3-dimethyl-*	isopropylmethylpropylmethane	$\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$	114.23
4565	—, 2,4-dimethyl-*	ethylisobutylmethylmethane	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$	114.23
4566	—, 2,5-dimethyl-*	biisobutyl.	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_2\text{CH}(\text{CH}_3)_2$	114.23
4567	—, 3,4-dimethyl-*	bi-sec-butyl; sec-butylethylmethylmethane	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$	114.23
4568	—, 1-ethoxy-*	See <i>Ether</i> , ethyl hexyl.		
4569	—, 3-ethyl-*	diethylpropylmethane.	$(\text{CH}_3\text{CH}_2)_2\text{CH}-\text{CH}_2\text{CH}_2\text{CH}_3$	114.23
4570	—, 1-iodo-*	n-hexyl iodide.	$\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{I}$	212.09
4571	—, 2-methyl-*	ethylisobutylmethane.	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_2\text{CH}_3$	100.20
4572	—, 3-methyl-*	ethylmethylpropylmethane.	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$	100.20
4573	—, 3-methylene-*	See 1-Pentene, 2-ethyl-*		
4574	—, 1-phenoxy-*	See <i>Ether</i> , hexyl phenyl.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4538	cr.	0.797 ²⁰ ₄	15 -25	155 ¹⁵ 280-5	i.	.....	.....
4538 X							
4539							
4540	liq., 1.4044....	0.6880 ²⁰ ₄	-141	59.6	i.	.....	s. eth.
4541							
4542	col. liq., 1.4384	0.7108 ²⁰ ₄	.....	82	i.	.....	.....
4543	col. liq.	0.7158 ²¹ ₄	-91.3	102.5 ⁷⁵	i.	s.	s. eth.
4544	1.4745 ²²	1.006 ²² ₄	.....	100-2 ¹²	.....	.....	.....
4544 M							
4545	col. liq., 1.504	0.7851 ²⁰ ₄	.....	83.5	.....	.....	.....
4546							
4547	col. liq., 1.4413 ^{23,8}	0.8049 ²⁰ ₄	frz. -6	86 (85.4)	i.	s.	v. s. eth.; s. ord. org. solv.
4548	rhomb. f. al. ....	.....	263	subl. 263 d.	150 ²⁰	3	i. eth.; s. H ₂ SO ₄
4549							
4550							
4551							
4552							
4553	col. liq., 1.37536	0.6603 ²⁰ ₄	-94.3	69.0	0.0138 ^{15,5}	50 ³³	s. eth., chl.
4554							
4555							
4556	liq., 1.4478....	1.1705 ²⁰ ₄	-85.0	156.0	i.	∞	∞ eth.
4557							
4558	col. liq., 1.4194	0.8719 ²⁰ ₄	-83	132.4	i.	.....	.....
4559							
4560	1.4142 ²²	0.876 ¹⁴ ₄	.....	123 (125-6)	.....	.....	.....
4561	col. need. or liq., 1.5899 ¹⁵	2.05 ¹⁸ ₄	9.5 (6-7)	163 ¹⁷ d.	i.	v. s.	v. s. eth.
4562							
4563	col. liq., 1.4093	0.7240 ²⁰ ₄	.....	113.9	i.	sl. s.	s. eth.
4564	col. liq., 1.4026	0.7077 ²⁰ ₄	.....	110.0	i.	sl. s.	s. eth.
4565	col. liq., 1.3926	0.6985 ²⁰ ₄	-91	108.25	i.	sl. s.	s. eth.
4566	liq., 1.4058....	0.721 ²⁰ ₄	.....	116.5	i.	sl. s.	s. eth.
4567	col. liq., 1.4016	0.7169 ²⁰ ₄	.....	118.9	i.	sl. s.	s. eth.
4568							
4569	col. liq., 1.4929	1.441 ²⁰ ₄	.....	180	.....	.....	.....
4570	col. liq.	0.6789 ²⁰ ₄	-119.1	90.0	i.	s.	s. eth.
4571	col. liq.	0.6957 ²⁰ ₄	-119.4	89.4 (31.8)	i.	s.	s. eth.
4572							
4573		(0.6870 ²⁰ ₄)					
4574							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4575	3-Hexanecarboxylic acid	d. See <i>Valeric acid</i> , α -ethyl.		
4576	Hexanedial*	See <i>Adipaldehyde</i> .		
4577	Hexanediamide*	See <i>Adipamide</i> .		
4578	1,6-Hexanediamine*	hexamethylenediamine	$\text{NH}_2(\text{CH}_2)_6\text{NH}_2$. . .	116.21
4579	Hexanedioic acid*	See <i>Adipic acid</i> .		
4580	—, 2,3,4,5-tetrahydroxy-	oxy-. See <i>Mucic acid</i> ; <i>Saccharic acid</i> .		
4581	1,6-Hexanediol*	hexamethylene glycol	$\text{CH}_2\text{OH}(\text{CH}_2)_4\text{CH}_2\text{OH}$	118.17
4582	2,3-Hexanediol*	2,3-dihydroxyhexane	$\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{OH})_2\text{CH}_3$	118.17
4583	3,4-Hexanediol, 3,4-diethyl-*	tetraethylethylene glycol	$(\text{C}_2\text{H}_5)_2\text{COHCOH}(\text{C}_2\text{H}_5)_2$	186.29
4584	2,3-Hexanedione, 3-oxime*	α -isonitrosobutyl methyl ketone	$\text{CH}_3\text{COC}(\text{CH}=\text{NOH})(\text{CH}_2)_2\text{CH}_3$	129.16
4585	2,5-Hexanedione*	acetonylacetone; <i>sym</i> -diacetylthane	$\text{CH}_3\text{CO}(\text{CH}_2)_2\text{COCH}_3$	114.14
4586	Hexanedioyl chloride*	See <i>Adipyl chloride</i> .		
4587	1,2,3,4,5,6-Hexanehexol*	*. See <i>Dulcitol</i> ; <i>Sorbitol</i> .		
4588	Hexanenitrile*	See <i>Capronitrile</i> .		
4589	1,2,3,4,5-Hexanepentol*	*. See <i>Rhamnitol</i> .		
4590	1-Hexanethiol*	<i>pri</i> -n-hexyl mercaptan	$\text{CH}_3(\text{CH}_2)_5\text{SH}$	118.23
4591	Hexanoic acid*	See <i>Caproic acid</i> .		
4592	Hexanoic anhydride*	See <i>Caproic anhydride</i> .		
4593	1-Hexanol*	n-hexyl alcohol; amylcarbinol	$\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{OH}$	102.17
4594	—, esters of organic acids.	See "hexyl ester" under the names of the acids.		
4595	—, nitrite	See <i>Hexyl nitrite</i> .		
4596	—, 2-ethyl-*		$\text{C}_4\text{H}_9\text{CH}(\text{C}_2\text{H}_5)\text{CH}_2\text{OH}$	130.23
4597	—, —, acetate	β -ethylhexyl acetate	$\text{C}_4\text{H}_9\text{CH}(\text{C}_2\text{H}_5)\text{CH}_2\text{OOCCH}_3$	172.26
4598	—, 3-isopropyl-5-methyl-*	isocapric alcohol; β -isoamylisoamyl alcohol; diamyl alcohol	$(\text{CH}_3)_2\text{CHCH}(\text{CH}_2\text{OH})(\text{CH}_2)_2\text{CH}(\text{CH}_3)_2$	158.28
4599	—, 2-methyl-*		$\text{CH}_3(\text{CH}_2)_3\text{CH}(\text{CH}_3)\text{CH}_2\text{OH}$	116.20
4600	—, 5-methyl-*	isoheptyl alcohol; isohexylcarbinol	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{CH}_2\text{OH}$	116.20
4601	2-Hexanol*	butylmethylcarbinol	$\text{CH}_3\text{CHOH}(\text{CH}_2)_3\text{CH}_3$	102.17
4602	—, 2-methyl-*	butyldimethylcarbinol	$\text{CH}_3\text{COH}(\text{CH}_3)_2(\text{CH}_2)_3\text{CH}_3$	116.20
4603	—, 5-methyl-*	isoamylmethylcarbinol	$\text{CH}_3\text{CHOH}(\text{CH}_2)_2\text{CH}(\text{CH}_3)_2$	116.20
4604	3-Hexanol*	ethylpropylcarbinol	$\text{CH}_3\text{CH}_2\text{CHOH}(\text{CH}_2)_2\text{CH}_3$	102.17
4605	—, 3-ethyl-*	diethylpropylcarbinol	$\text{CH}_3\text{CH}_2\text{COH}(\text{C}_2\text{H}_5)(\text{CH}_2)_2\text{CH}_3$	130.23
4606	—, 3-ethyl-5-methyl-*	diethylisobutylcarbinol	$(\text{C}_2\text{H}_5)_2\text{COHCH}_2\text{CH}(\text{CH}_3)_2$	144.25
4607	—, 3-methyl-*	ethylmethylpropylcarbinol	$\text{CH}_3(\text{CH}_2)_2\text{COH}(\text{CH}_3)\text{CH}_2\text{CH}_3$	116.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4575 4576 4577 4578	silk leaf.....	.....	39-40	196; (204-5) subl.	v. s.	sl. s.	sl. s. bz.
4579 4580 4581	need. f. w.....	.....	42	250	s.	s.	sl. s. h. eth.
4582	.....	$0.9669\frac{0}{4}$	.....	207	∞	s.	s. eth.
4583	.....	.....	27-8	230; 116-9 ¹⁷	i.	v. s.	v. s. eth.
4584	leaf.....	.....	49.5	.....	.....	.....	.....
4585	col. liq., 1.449.	$0.970\frac{2.0}{4}$	-9	192-4	∞	■	∞ eth.; i. KOH, K ₂ CO ₃
4586 4587 4588 4589 4590 4591 4592 4593	col. liq.....	$0.849\frac{2.0}{4}$	-81.03	149-50 ⁷⁶⁸	i.	∞	∞ eth.
4594 4595 4596	col. liq., 1.41790 ²⁰	$0.8186\frac{2.0}{4}$	-51.6	157.2	0.59 ²⁰	s.	∞ eth.
4597	col. liq.....	0.8340	<-76	183.5	.10 ²⁰	s.	s. eth.
4598	col. liq., 1.420.	$0.872\frac{2.0}{4}$	-93	199.3	0.01 ⁴³	.....	.....
4599	col. oil.....	$0.8569\frac{0}{4}$	.....	211 (203.3 ⁷⁶⁴)	i.	s.	.....
4600	liq.....	$0.831\frac{1.3}{4}$	.....	162-4 ⁷⁵⁰	i.	■	∞ eth.
4601	liq., 1.4254....	$0.8311\frac{0}{4}$; $0.825\frac{11.5}{4}$	.....	167-9	v. sl. s.	s.	s. eth.
4602	col. liq., 1.4126	$0.8287\frac{0}{4}$; $0.80977\frac{2.0}{4}$; $0.8044\frac{2.6}{4}$	.....	140-0.4 (136-9)	v. sl. s.	s.	∞ eth.
4603	col. liq., 1.4175 ²⁰	$0.8119\frac{2.0}{4}$	.....	139.4- 140.4 ⁷³⁵ ; 53-53.5 ¹⁵	v. sl. s.	∞	∞ eth.
4604	liq.....	$0.8185\frac{1.7}{4}$	.....	148-50	i.	s.	s. eth.
4605	col. liq.....	$0.8188\frac{2.0}{4}$	.....	135	v. sl. s.	s.	∞ eth.
4606	col. liq., 1.433.	$0.8379\frac{2.0}{0}$	.....	160.5	i.	s.	s. eth.
4607	liq.....	$0.8396\frac{2.2}{4}$	.....	172	i.	s.	s. eth.
4608	col. liq., 1.423.	$0.8234\frac{2.0}{4}$	.....	141	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4608	3-Hexanol, 5-methyl-*	ethylisobutylcarbinol.....	$\text{CH}_3\text{CH}_2\text{CHOH}-\text{CH}_2\text{CH}(\text{CH}_3)_2$	116.20
4609	—, 2,2,5,5-tetra-methyl-*	.....	$(\text{CH}_3)_3\text{CCH}_2\text{CH}-\text{OHC}(\text{CH}_3)_3$	158.28
4610	2-Hexanone*	butyl methyl ketone.....	$\text{CH}_3\text{CO}(\text{CH}_2)_3\text{CH}_3$	100.16
4611	—, 5-methyl-*	isoamyl methyl ketone.....	$\text{CH}_3\text{COCH}_2\text{CH}_2-\text{CH}(\text{CH}_3)_2$	114.18
4612	—, —, oxime	.....	$\text{CH}_3\text{C}(\text{:NOH})-\text{C}_6\text{H}_{11}$	129.20
4613	—, 1,3,4,5,6-pentahydroxy-*	See <i>Sorbose</i> .		
4614	3-Hexanone*	ethyl propyl ketone.....	$\text{C}_2\text{H}_5\text{CO}(\text{CH}_2)_2\text{CH}_3$	100.16
4614M	—, 4-hydroxy-*	See <i>Propionin</i> .		
4615	—, 5-methyl-*	ethyl isobutyl ketone.....	$\text{C}_2\text{H}_5\text{COCH}_2\text{CH}(\text{CH}_3)_2$	114.18
4616	Hexanoyl chloride*	See <i>Caproyl chloride</i> .		
4617	2-Hexenal, 2-ethyl-*	α -ethyl- β -propylacrolein.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}:\text{C}-(\text{C}_2\text{H}_5)\text{CHO}$	126.19
4618	1-Hexene*	butylethylene.....	$\text{CH}_2:\text{CH}(\text{CH}_2)_3-\text{CH}_3$	84.16
4618H	—, 5-amino-4-methyl-*	yl-. See 4-Pentenylamine, 1, 2-	<i>dimethyl-</i> $\text{CH}_2:\text{C}(\text{CH}_3)\text{CH}_2-$	98.18
4619	—, 2-methyl-*	1-butyl-1-methylethylene.....	$\text{CH}_2\text{CH}_2\text{CH}_3$	98.18
4620	—, 3-methyl-*.....	.....	$\text{CH}_2:\text{CHCH}(\text{CH}_3)-\text{CH}_2\text{CH}_2\text{CH}_3$	98.18
4621	—, 4-methyl-*.....	.....	$\text{CH}_2:\text{CHCH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$	98.18
4622	—, 5-methyl-*	isoamylethylene.....	$\text{CH}_2:\text{CHCH}_2\text{CH}_2-\text{CH}(\text{CH}_3)_2$	98.18
4623	2-Hexene*	β -hexylene; 1-methyl-2-propylethylene	$\text{CH}_3\text{CH}:\text{CH}-(\text{CH}_2)_2\text{CH}_3$	84.16
4624	—, 2-methyl-*	1,1-dimethyl-2-propylethylene	$(\text{CH}_3)_2\text{C}:\text{CHCH}_2-\text{CH}_2\text{CH}_3$	98.18
4625	—, 3-methyl-*	1,2-dimethyl-1-propylethylene	$\text{CH}_3\text{CH}:\text{C}(\text{CH}_3)-\text{CH}_2\text{CH}_2\text{CH}_3$	98.18
4626	—, 4-methyl-*	1- <i>sec</i> -butyl-2-methylethylene	$\text{CH}_3\text{CH}:\text{CHCH}(\text{CH}_3)\text{CH}_2\text{CH}_3$	98.18
4627	—, 5-methyl-*	1-isobutyl-2-methylethylene	$\text{CH}_3\text{CH}:\text{CHCH}_2-\text{CH}(\text{CH}_3)_2$	98.18
4628	3-Hexene*	<i>sym</i> -diethylethylene; γ -hexylene	$\text{CH}_3\text{CH}_2\text{CH}:\text{CH}-\text{CH}_2\text{CH}_3$	84.16
4629	—, 2,5-dimethyl-*	<i>sym</i> -diisopropylethylene.....	$(\text{CH}_3)_2\text{CHCH}:\text{CH}-\text{CH}(\text{CH}_3)_2$	112.21
4630	—, 2-methyl-*	1-ethyl-2-isopropylethylene ..	$(\text{CH}_3)_2\text{CHCH}:\text{CH}-\text{CH}_2\text{CH}_3$	98.18
4631	2-Hexenoic acid*	β -propylacrylic acid.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}:\text{CHCOOH}$	114.14
4632	—, 5-methyl-*	α , β -isoheptenic acid.....	$(\text{CH}_3)_2\text{CHCH}_2-\text{CH}:\text{CHCOOH}$	128.17
4633	5-Hexen-3-ol, 3-ethyl-*	allyldiethylcarbinol.....	$\text{CH}_2:\text{CHCH}_2\text{COH}-(\text{C}_2\text{H}_5)\text{CH}_2\text{CH}_3$	128.21
4634	5-Hexen-2-one*	allylacetone.....	$\text{CH}_2:\text{CHCH}_2\text{CH}_2-\text{COCH}_3$	98.14
4635	Hexine.	See <i>Hexyne*</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4608	liq.			148.2	i.	s.	s. eth.
4609	cr.		52-3	173-4	i.	s.	s. eth.
4610	col. liq., 1.39694 ^{17.4}	0.830 ⁰ ₄	-56.9	127.2	v. sl. s.	∞	∞ eth.
4611	col. liq.	0.818 ¹⁷ ₄		144	v. sl. s.	∞	∞ eth.
4612	col.-yel. oil ...	0.888 ²⁰ ₄		195-6 d.			
4613							
4614	col. liq., 1.39899 ²²	0.813 ^{21.8} ₄		124	v. sl. s.	∞	∞ eth.
4614M							
4615	col. liq.	0.815 ¹⁷ ₀		136	i.	∞	∞ eth.
4616							
4617	col. liq.	0.848 ²⁰ ₄		175	i.	s.	s. eth.
4618	col. liq., 1.3821	0.6732 ²⁰ ₄	-98.5	64.1	i.	∞	∞ eth.
4618H							
4619		0.7000 ²⁰ ₄		91.1-1.5			
4620		0.6953 ²⁰ ₄		84.0			
4621		0.6969 ²⁰ ₄		87.2-7.5			
4622		0.6936 ²⁰ ₄		84.7			
4623		0.6813 ²⁰ ₄		67.9-8.1			s. dil. H ₂ SO ₄
4624		0.7089 ²⁰ ₄		94.4-4.6			
4625		0.7120 ²⁰ ₄		93.1-3.3			
4626		(1) 0.7007 ²⁰ ₄		87.1-7.6			
		(2) 0.6981 ²⁰ ₄		85.1-5.6			
4627		(1) 0.6990 ²⁰ ₄		91.1-1.6			
		(2) 0.7020 ²⁰ ₄		85.6-6.1			
4628		(1) 0.722 ¹⁵ ₄		67.5			
		(2) 0.693 ²⁰ ₂₀		70-1			
4629				116-20			
4630		0.6942 ²⁰ ₄		86.4-6.9			
4631	need. f. w., 1.4467 ⁴⁰	0.965 ²⁰ ₄	32	217	sl. s.	s.	v. s. eth.
4632	1.4524	0.942 ²⁰ ₄	16.5	227		s.	
4633				156			
4634	col. liq., 1.42126 ^{15.4}	0.846 ²⁰ ₄		129.5	i.	∞	∞ eth.
4635							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4636	<i>n</i>-Hexoic acid.	See <i>Caproic acid</i> .		
4637	<i>n</i>-Hexoic aldehyde.	See <i>Caproaldehyde</i> .		
4638	Hexylene.	See <i>2-Hexyne</i> *.		
4639	Hexyl alcohol, active.	See <i>1-Pentanol, 3-methyl</i> *.		
4640	<i>n</i>-Hexyl alcohol.	See <i>1-Hexanol</i> *.		
4641	Hexylamine*(<i>n</i>)		$\text{CH}_3(\text{CH}_2)_5\text{NH}_2$...	101.19
4641M	—, α -methyl-.....	2-amino- <i>n</i> -heptane.....	$\text{CH}_3(\text{CH}_2)_4\text{CH}(\text{CH}_3)\text{NH}_2$	115.22
4642	<i>n</i>-Hexyl bromide.	See <i>Hexane, 1-bromo</i> *.		
4643	<i>n</i>-Hexyl chloride.	See <i>Hexane, 1-chloro</i> *.		
4644	Hexylene.	See <i>Hexene</i> *.		
4645	1,6-Hexylene iodide.	See <i>Hexane, 1,6-diiodo</i> *.		
4646	Hexyl esters of organic acids.	See "hexyl ester" under the	names of the acids.	
4647	<i>n</i>-Hexyl iodide.	See <i>Hexane, 1-iodo</i> *.		
4647	<i>pri-n</i>-Hexyl mercaptan.	See <i>1-Hexanethiol</i> *.		
4648	Hexyl nitrite(<i>n</i>)		$\text{CH}_3(\text{CH}_2)_5\text{ONO}$...	131.17
4649	Hexyl sulfate	di- <i>n</i> -hexyl sulfate.....	$[\text{CH}_3(\text{CH}_2)_5]_2\text{SO}_4$...	266.39
4650	1-Hexyne*	butylacetylene; 1-hexine.....	$\text{HC}\equiv\text{C}(\text{CH}_2)_3\text{CH}_3$...	82.14
4651	2-Hexyne*	2-hexine; methylpropylacetylene; hexoylene	$\text{CH}_3\text{C}\equiv\text{C}(\text{CH}_2)_2\text{CH}_3$	82.14
4651F	3-Hexyne*	3-hexine; diethylacetylene.....	$\text{C}_2\text{H}_5\text{C}\equiv\text{C}\cdot\text{C}_2\text{H}_5$...	82.14
4651H	1-Hexyn-3-ol, 3-methyl-*	ethynylmethylpropylcarbinol	$\text{HC}\equiv\text{C}\cdot\text{C}(\text{OH})(\text{CH}_3)\text{C}_3\text{H}_7$	112.17
4651R	3-Hexyn-2-ol, 2-methyl-*	1-butylnyldimethylcarbinol.....	$(\text{CH}_3)_2\text{C}(\text{OH})\text{C}\cdot\text{C}_2\text{H}_5$	112.17
4652	Hippuric acid.	<i>N</i> -benzoylglycine; benzamidoacetic acid	$\text{C}_6\text{H}_5\text{CONHCH}_2\text{COOH}$	179.17
4653	—, <i>p</i> -phenylphenacyl ester		$\text{C}_6\text{H}_5\text{CONHCH}_2\text{COOCH}_2\text{COC}_6\text{H}_5$	373.39
4653M	Histamine.	4-imidazoleethylamine; β -aminoethylglyoxaline	$\text{C}_3\text{H}_3\text{N}_2\cdot\text{CH}_2\text{CH}_2\text{NH}_2$	111.15
4654	<i>dl</i>-Histidine.	<i>dl</i> - α -amino-5-imidazolepropionic acid	$\text{C}_3\text{H}_3\text{N}_2\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$	155.16
4655	<i>d</i>-Histidine.		$\text{C}_3\text{H}_3\text{N}_2\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$	155.16
4656	<i>l</i>-Histidine.		$\text{C}_3\text{H}_3\text{N}_2\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$	155.16
4657	—, diflavinate.....		$\text{C}_6\text{H}_3\text{N}_3\text{O}_2(\text{C}_{10}\text{H}_6\text{N}_2\text{O}_5)_2$	783.61
4658	—, dihydrochloride.....		$\text{C}_6\text{H}_3\text{N}_3\text{O}_2\cdot 2\text{HCl}$...	228.09
4659	Homatropine.	mandelyltropeine; homatropine	$\text{C}_{16}\text{H}_{21}\text{NO}_3$	275.34
4660	—, hydrobromide.....		$\text{C}_{16}\text{H}_{21}\text{NO}_3\cdot\text{HBr}$...	356.26
4661	—, hydrochloride.....		$\text{C}_{16}\text{H}_{21}\text{NO}_3\cdot\text{HCl}$...	311.80
4662	Homoanthranilonitrile.	See <i>p-Tolunitrile, 2-amino</i> .		
4663	Homoatropine.	See <i>Homatropine</i> .		
4664	Homocinchonidine.		$\text{C}_{19}\text{H}_{22}\text{N}_2\text{O}$	294.38
4665	Homohydroquinone.	See <i>Toluhydroquinone</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4636							
4637							
4638							
4639							
4640							
4641	col. liq. ....	.....	-19	132.7	sl. s.	∞	= eth.
4641M	1.41997 ¹⁹	0.7665 ¹⁰ ₄	.....	142	sl. s.	s.	s. eth.
4642							
4643							
4644							
4645							
4646							
4647							
4648	yel. liq.	0.8851 ²⁰ ₄	.....	129-30	i.	s.	s. eth.
4649	1.4344 ²⁵	1.0039 ²⁵ ₂₅	.....	125.3 ²	.....	.....	.....
4650	col. liq.	0.736 ⁰ ₄ ; 0.7120 ²⁵ ₄	-150	71.5	i.	s.	s. eth.
4651	liq.	0.7494 ⁵ ; 0.7377 ¹³ ₄	.....	84	i.	∞	∞ eth.
4651F	col. liq., 1.4112 ²⁵	0.7263 ²⁵	.....	.....	i.	∞	= eth.
4561H	col. liq., 1.4338 ²⁰	0.8620 ²⁰	.....	58 ²⁰	s.	s.	s. eth.
4651R	col. liq., 1.4411 ⁰	0.962 ⁰	.....	145-147	s.	s.	s. eth.
4652	col. rhomb., 1.535, 1.592, 1.760	1.371 ²⁰ ₄	187.5 (189-90)	d.	0.33 ²⁰	sl. s.	sl. s. eth.; 0.11 chl.; i. bz., pet. eth.
4653	.....	.....	163	.....	.....	.....	.....
4653M	wh. cr. ....	.....	83-4	209-10 ¹⁸	s.	sl. s.	.....
4654	tetr. pr. ....	.....	285-6 d.	d.	s.	i.	i. eth., acet., chl.
4655	lng. pl. ....	.....	287-8	.....	.....	i.	i. eth., acet., chl.
4656	leaf. f. w. ....	.....	277 d.	d. 209 ¹⁸	s.	v. sl. s.	i. eth.
4657	need. ....	.....	251-2 d.	.....	sl. s.	i.	i. eth.
4658	rhomb. pl. ....	.....	245 d.	.....	v. s., d.	s.	i. eth.; v. sl. s. conc. HCl
4659	deliq. pr. f. eth.; glist. pr. f. al.	.....	95.5-8.5	.....	v. sl. s.	s.	s. eth., acet., dil. a., bz., chl.
4660	col. rhomb. pr.	.....	212 d.	.....	17.5 ²⁵	3.3	i. eth.; s. chl.
4661	sm. wh. cr. ....	.....	216-7	.....	s.	s.	.....
4662							
4663							
4664	pr. ....	.....	207.6	.....	i.	4.8	s. chl.
4665							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4666	Homophthalic acid	α -2-toluenedicarboxylic acid..	$C_6H_4(CH_2COOH)-COOH$	180.15
4667	4-Homopyrocatechol ..	4-methylpyrocatechol.....	$CH_3C_6H_3(OH)_2...$	124.13
4668	o-Homosalicylic acid .	See 2,3-Cresotic acid.		
4669	m-Homosalicylic acid (α).	See 2,4-Cresotic acid.		
4670	m-Homosalicylic acid (β).	See 2,6-Cresotic acid.		
4671	p-Homosalicylic acid ..	See 2,5-Cresotic acid.		
4672	Hordenine	p-hydroxy-N,N-dimethylphenethylamine	$C_{10}H_{15}NO$	165.23
4673	—, sulfate.....		$(C_{10}H_{15}NO)_2H_2SO_4 \cdot H_2O$	446.55
4674	Hydantoic acid	N-carbamylglycine; ureidoacetic acid; glycoluric acid; ureaacetic acid	$NH_2CONHCH_2COOH$	118.09
4675	Hydantoin	glycolylurea.....	$NHCONHCOCH_2$	100.08
4676	—, 1-methyl.....	β -methylhydantoin.....	$N(CH_3)CONHCOCH_2$	114.10
4677	—, 5-methyl.....	α -lactylurea.....	$NHCONHCOCH_2$	114.10
4678	—, 2-thio.....	glycolylthiourea.....	$(CH_3)C_3H_4N_2OS$	116.14
4679	—, 5-ureido-..	See Allantoin.		
4680	Hydracetic acid	See Hydrazine, 1-acetyl-2-phenyl-.		
4681	Hydracrylic acid	3-hydroxypropanoic acid*; β -hydroxypropionic acid; ethylene lactic acid	CH_2OHCH_2COOH	90.08
4682	—, α -phenyl-..	See Tropic acid.		
4683	Hydracrylonitrile	3-hydroxypropanenitrile*; ethylene cyanohydrin; glycol cyanohydrin; β -hydroxypropionitrile	$HOCH_2CH_2CN$..	71.08
4684	Hydrastine		$C_{21}H_{21}NO_6$	383.39
4685	—, hydrochloride.....		$C_{21}H_{21}NO_6 \cdot HCl$...	419.85
4686	Hydrastinine		$C_{11}H_{13}NO_3$	207.22
4687	—, bisulfate.....		$C_{11}H_{11}NO_2 \cdot H_2SO_4$	287.28
4688	—, hydrochloride (i).....		$C_{11}H_{11}NO_2 \cdot HCl$...	225.67
4689	Hydratropic acid	α -methyl- α -toluic acid; α -phenylpropionic acid	$C_6H_5CH(CH_3)-COOH$	150.17
4690	—, α -hydroxy-..	See Atrolactic acid.		
4691	Hydrazine, 1-acetyl-2-phenyl-	acetic acid β -phenylhydrazide; hydracetic; pyrocin	$CH_3CONHNH-C_6H_5$	150.18
4692	—, benzal-..	See Benzaldehyde, hydrazone.		
4693	—, benzalphenyl-..	See Benzaldehyde, phenylhydrazone.		
4694	—, benzoyl-..	See Benzoic acid, hydrazone.		
4695	—, 1-benzoyl-2-phenyl-..	See Benzoic acid, phenylhydrazone.		
4696	—, benzyl-..		$C_6H_5CH_2NHNH_2$..	122.17
4697	—, benzylidene-..	See Benzaldehyde, hydrazone.		
4698	—, benzylideneph-..	See Benzaldehyde, phenylhydrazone.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4666	cr. f. w. ....	.....	175	.....	s. h.	v. s.	sl. s. eth.
4667	col., 1.5425 ⁷⁴	1.129 ⁷⁴ / ₄	65	252	v. s.	v. s.	v. s. eth.
4668							
4669							
4670							
4671							
4672	rhomb. pr. ....	.....	117.8 subl.	140-50	s.	v. s.	v. s. eth.; s. chl.; sl. s. bz.
4673	col. cr. ....	.....	208-10	.....	s.	sl. s.	i. eth.
4674	monocl. pr. ....	.....	171	.....	3 ²⁰	0.39 ²⁰	v. sl. s. eth.
4675	need. ....	.....	220	.....	s. h.	■.	.....
4676	pr. ....	.....	157-8	subl.	■.	s.	.....
4677	rhomb. ....	.....	anh. 145	.....	v. s.	v. s.	v. sl. s. eth.
4678	need. f. h. w. ....	.....	d. 200	.....	s. h.	i.	i. eth.
4679							
4680							
4681	syrup. ....	.....	.....	d.	v. s.	s.	∞ eth.
4682							
4683	col. liq.	1.059 ⁰ / ₄	.....	221 ^{728.5}	∞	∞	1.64 ¹⁵ eth.
4684	col. rhomb. pr., [α] _D ²¹⁷ -678 in chl.	.....	132	.....	0.025 ⁸⁰	0.74 ²⁵	0.8 ²⁵ eth.; s. chl.
4685	wh. hyg. pwd. ....	.....	210 (116)	.....	s.	s.	v. sl. s. eth.; sl. s. chl.
4686	wh.-yelsh. need. f. lgr.	.....	116-7	.....	sl. s.	s.	s. eth., chl., a.; d. bz.
4687	grn. fluores. cr.	.....	216 d.	.....	s.	s.	.....
4688	yel. need.; aq. sol. bl. fluores.	.....	212 d.	.....	v. s.	v. s.	0.077 eth.; s. chl.
4689	col. liq.	1.1 ⁰ / ₄	<-20	265	sl. s.	.....	.....
4690							
4691	col. hex. ....	.....	128	.....	v. sl. s. c., v. s. h.	s.	sl. s. eth.; s. bz., chl.
4692							
4693							
4694							
4695							
4696	col. oil. ....	.....	26	103 ⁴¹	∞	■	∞ eth.
4697							
4698							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4699	Hydrazine, <i>p</i> -bromo-phenyl-.....		$\text{BrC}_6\text{H}_4\text{NHNH}_2$	187.05
4700	—, 1-butylidene-2-phenyl-.....	phenyl-. See Butyraldehyde, <i>p</i> -phenylhydrazine.		
4701	—, carbamyl-.....	See Semicarbazide.		
4702	—, dibenzal-.....	See Benzaldehyde, azine.		
4703	—, diisopropylidene-.....	See Acetone, azine.		
4704	—, dimethylphenyl-.....	See Hydrazine, <i>xylyl</i> -.		
4705	—, 1,2-di-1-naphthyl-.....	1,1'-hydrazonaphthalene.....	$\text{C}_{10}\text{H}_7\text{NHNHC}_{10}\text{H}_7$	284.35
4706	—, 1,2-di-2-naphthyl-.....	2,2'-hydrazonaphthalene.....	$\text{C}_{10}\text{H}_7\text{NHNHC}_{10}\text{H}_7$	284.35
4707	—, 2,4-dinitrophenyl-*		$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{NHNH}_2$	198.14
4708	—, 1,1-diphenyl-*	<i>uns</i> -diphenylhydrazine.....	$(\text{C}_6\text{H}_5)_2\text{NNH}_2$	184.23
4709	—, 1,2-diphenyl-*	hydrazobenzene; <i>sym</i> -diphenylhydrazine	$\text{C}_6\text{H}_5\text{NHNHC}_6\text{H}_5$	184.23
4710	—, 1,2-di- <i>o</i> -tolyl-.....	<i>o</i> -hydrazotoluene.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}-\text{C}_6\text{H}_4\text{CH}_3$	212.29
4711	—, 1,2-di- <i>m</i> -tolyl-.....	<i>m</i> -hydrazotoluene.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}-\text{C}_6\text{H}_4\text{CH}_3$	212.29
4712	—, 1,2-di- <i>p</i> -tolyl-.....	<i>p</i> -hydrazotoluene.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}-\text{C}_6\text{H}_4\text{CH}_3$	212.29
4713	—, ethyl-.....		$\text{NH}_2\text{NHC}_2\text{H}_5$	60.10
4714	—, 1-ethylidene-2-phenyl-.....	phenyl-. See Acetaldehyde, <i>phenylhydrazine</i> .		
4715	—, 1-ethyl-1-phenyl-.....		$\text{C}_6\text{H}_5(\text{C}_2\text{H}_5)\text{NNH}_2$	136.19
4716	—, 1-ethyl-2-phenyl-.....		$\text{C}_6\text{H}_5\text{NHNHC}_2\text{H}_5$	136.19
4717	—, formyl-.....	See Formohydrazide.		
4718	—, guanyl-.....	See Guanidine, 1-amino-.		
4719	—, 1-isoamyl-1-phenyl-.....		$\text{C}_6\text{H}_5\text{N}(\text{C}_5\text{H}_{11})\text{NH}_2$	178.27
4720	—, 1-isobutyl-1-phenyl-.....	1-(β -methylpropyl)-1-phenylhydrazine*	$\text{C}_4\text{H}_9(\text{C}_6\text{H}_5)\text{NNH}_2$	164.25
4721	—, methyl-*		CH_3NHNH_2	46.07
4722	—, 1-methyl-1-phenyl-.....		$\text{C}_6\text{H}_5\text{N}(\text{CH}_3)\text{NH}_2$	122.17
4723	—, 1-methyl-2- <i>m</i> -tolyl-.....	<i>m</i> -methylhydrazobenzene.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}-\text{C}_6\text{H}_4$	198.26
4724	—, 1-methyl-2- <i>p</i> -tolyl-.....	<i>p</i> -methylhydrazobenzene.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}-\text{C}_6\text{H}_4$	198.26
4725	—, (1-naphthyl)-.....		$\text{C}_{10}\text{H}_7\text{NHNH}_2$	158.20
4726	—, (2-naphthyl)-.....		$\text{C}_{10}\text{H}_7\text{NHNH}_2$	158.20
4727	—, <i>o</i> -nitrophenyl-.....		$\text{NO}_2\text{C}_6\text{H}_4\text{NHNH}_2$	153.14
4728	—, <i>m</i> -nitrophenyl-.....		$\text{NO}_2\text{C}_6\text{H}_4\text{NHNH}_2$	153.14
4729	—, <i>p</i> -nitrophenyl-.....		$\text{NO}_2\text{C}_6\text{H}_4\text{NHNH}_2$	153.14
4730	—, phenyl-*		$\text{C}_6\text{H}_5\text{NHNH}_2$	108.14
4731	—, hydrochloride.....		$\text{C}_6\text{H}_5\text{NHNH}_2\cdot\text{HCl}$	144.60
4733	—, 1-phenyl-2- <i>o</i> -tolyl-.....	<i>o</i> -methylhydrazobenzene.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}-\text{C}_6\text{H}_5$	198.26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4699	need.or leaf. f. al. or lgr.	.....	106	.....	i.	s.	s. eth., bz.
4700							
4701							
4702							
4703							
4704							
4705	col. leaf. f. bz.	.....	271; 274	.....	i.	v. s.	v. s. eth.; s. bz.
4706	col. flocks.....	.....	164	.....	i.	sl. s.	v. s. eth.
4707	purp.-red pr. f. al.; vit. fluores.	.....	194 (198 d.)	exp.	i.	v. sl. s.	i. (sl. s.) eth.; s. aniline, h. ethyl acetate; sl. s. chl., CS ₂ , bz.
4708	ylsh.-br. liq. or pl. f. lgr.	1.190 ¹⁶ / ₄	34.5; 44	220 ³⁰	v. sl. s.	v. s.	v. s. eth.; s. conc. H ₂ SO ₄
4709	col.-yelsh. rhomb. tab. f. al.	1.158 ¹⁶ / ₄	131 (126)	d.	v. sl. s.	3.95 ¹⁶	s. eth.
4710	col. leaf. f. al.	.....	185	d.	v. sl. s.	s.	s. eth., bz.
4711	col. oil.....	.....			i.	s.	.....
4712	col. monocl. pl. f. al.-eth.	0.957 ²⁰ / ₄	133-4 (126)	d.	i.	v. s.	v. s. eth.; s. bz.
4713	col. liq.....	.....		101.5	v. s.	v. s.	v. s. eth.
4714							
4715	liq.....	1.018 ¹⁵ / ₄		237			.....
4716	liq., 1.57108 ²⁰ / _{He}	1.004 ¹⁵ / ₁₅		240; 104 ¹⁰	sl. s.	s.	s. eth.
4717							
4718							
4719	liq.....	.....		173-5 ³⁰			.....
4720		0.9633 ²⁰ / ₄		245			.....
4721	col. hyg. liq...	.....		87.5	v. s.	∞	∞ eth.
4722	yel. liq., 1.583	1.040 ²⁰ / ₄		227.5	sl. s.	∞	∞ eth.
4723	col.-lt. yel. pr. f. lgr.	.....	59-61		i.	v. s.	sl. s. eth.; s. bz.
4724	col. sc. f. lgr...	.....	86-7			v. s.	v. s. eth., bz.
4725	col. leaf.....	.....	116	203 ³⁰	v. sl. s.	v. s. h.	sl. s. eth.; v. s. chl.
4726	col. leaf. f. w.	.....	124-5		sl. s. h.	v. s. h.	sl. s. eth.; s. chl., bz.
4727	brick red need	.....	90		i.	sl. s.	sl. s. eth.
4728	yel. need.....	.....	93		sl. s.	sl. s.	
4729	or.-red. leaf. or need.	.....	157	d.	sl. s.	s.	s. eth., chl., ethyl acetate; v. sl. s. bz.
4730	yel. monocl. or oil	1.0978 ²⁰ / ₄	19.6	sl. d.	12.6 ²⁰ , 23 ³⁰	∞	∞ eth.
4731	leaf. f. al.....	.....	240-1		v. s.	s.	i. eth.
4733	col. leaf. f. al	.....	101-2		i.	sl. s. c.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4734	Hydrazine, picryl-	2,4,6-trinitrophenylhydrazine	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{NHNH}_2$	243.14
4735	—, tetraphenyl-* . . . . .	.....	$(\text{C}_6\text{H}_5)_2\text{NN}-(\text{C}_6\text{H}_5)_2$	336.42
4736	—, o-tolyl- . . . . .	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}_2$	122.17
4737	—, m-tolyl- . . . . .	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}_2$	122.17
4738	—, p-tolyl- . . . . .	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHNH}_2$	122.17
4739	—, 2,4,6-trinitrophenyl-	See <i>Hydrazine, picryl-</i>.	.....	.....
4740	—, triphenyl-* . . . . .	.....	$(\text{C}_6\text{H}_5)_2\text{NNHC}_6\text{H}_5$	260.33
4741	—, 2,3-xylyl-	(2,3-dimethylphenyl)hydrazine	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NHNH}_2$	136.19
4742	—, 2,5-xylyl-	(2,5-dimethylphenyl)hydrazine	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NHNH}_2$	136.19
4743	Hydrazobenzene.	See <i>Hydrazine, 1,2-diphenyl-</i>*	.....	.....
4744	—, 4,4'-diamino-	<i>p,p'</i> -hydrazodianiline; diphenine	$\text{NH}_2\text{C}_6\text{H}_4\text{NHNHC}_6\text{H}_4\text{NH}_2$	214.27
4745	—, methyl-	See <i>Hydrazine, 1-phenyl-2-tolyl-</i>	.....	.....
4746	o-Hydrazobenzoic acid	<i>o,o'</i> -hydrazodibenzoic acid. . . .	$(\text{COOH}\text{C}_6\text{H}_4\text{NH})_2$	272.25
4747	m-Hydrazobenzoic acid	<i>m,m'</i> -hydrazodibenzoic acid	$(\text{COOH}\text{C}_6\text{H}_4\text{NH})_2$	272.25
4748	p-Hydrazobenzoic acid	<i>p,p'</i> -hydrazodibenzoic acid. . .	$(\text{COOH}\text{C}_6\text{H}_4\text{NH})_2$	272.25
4749	Hydrazonaphthalene.	See <i>Hydrazine, dinaphthyl-</i>.	.....	.....
4750	Hydrazophenylene.	See <i>Phenazine, 5,10-dihydro-</i>.	.....	.....
4751	Hydrazotoluene.	See <i>Hydrazine, ditolyl-</i>.	.....	.....
4752	Hydrindene.	See <i>Indan</i>.	.....	.....
4753	α-Hydrindone.	See <i>1-Indanone</i>.	.....	.....
4754	β-Hydrindone.	See <i>2-Indanone</i>.	.....	.....
4754M	Hydroanisoin	<i>p,p'</i> -dimethoxyhydrobenzoin, one form	$[p\text{-CH}_3\text{OC}_6\text{H}_4\text{-CHOH-}]_2$	274.31
4755	Hydroanthranol.	See <i>Anthranol, 9,10-dihydro-</i>.	.....	.....
4756	Hydrobenzamide	tribenzaldiamine; <i>N,N'</i> -dibenzylidene- α,α -toluenediamine	$(\text{C}_6\text{H}_5\text{CH})_2\text{N}_2$	298.37
4757	Hydrobenzoin	1,2-diphenyl-1,2-ethanediol (one form); tolylene glycol	$\text{C}_6\text{H}_5\text{CHOHCH-OHC}_6\text{H}_5$	214.25
4757M	—, <i>p,p'</i>-dimethoxy-	See <i>Hydroanisoin</i> ; <i>Isosydroanisoin</i>.	.....	.....
4758	—, α,α'-dimethyl-	See <i>2,3-Butanediol, 2,3-diphenyl-</i>.	.....	.....
4759	—, dodecahydro-	See <i>1,2-Ethanediol, 1,2-dicyclohexyl-</i>.	.....	.....
4760	Hydroberberine	tetrahydroberberine.	$\text{C}_{20}\text{H}_{21}\text{NO}_4$	339.38
4761	Hydrocarbostyryl	3,4-dihydro-2(1)-quinolone; <i>o</i> -aminohydrocinnamic acid lactam	$\text{C}_8\text{H}_4\text{NHCOC}_6\text{H}_4\text{CH}_2$	147.17
4762	Hydrocerulignone	4,4'-dihydroxy-3,3',5,5'-tetramethoxybiphenyl	$\text{C}_{12}\text{H}_4(\text{OH})_2(\text{OCH}_3)_4$	306.31
4763	Hydrocinchonidine	cinchamidine.	$\text{C}_{19}\text{H}_{24}\text{N}_2\text{O}$	296.40
4764	Hydrocinchonine.	See <i>Cinchotina</i>.	.....	.....
4765	Hydrocinnamaldehyde	3-phenylpropanal.	$\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CHO}$	134.17
4766	Hydrocinnamic acid	β -phenylpropionic acid; benzenepropionic acid	$\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{-COOH}$	150.17
4767	—, ethyl ester	ethyl benzenepropanoate; ethyl β -phenylpropionate	$\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{-COOC}_2\text{H}_5$	178.22
4768	—, piperazinium salt . . . . .	.....	$\text{C}_4\text{H}_{10}\text{N}_2\cdot 2\text{C}_9\text{H}_{10}\text{O}_2$	386.48
4769	—, α-acetyl-, ethyl ester	ethyl α -benzylacetoacetate. . .	$\text{C}_6\text{H}_5\text{CH}_2\text{CH}(\text{CO-CH}_3)\text{COOC}_2\text{H}_5$	220.26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4734	yel. need. ....	.....	186-7	d.	i.	sl. s.	sl. s. eth.
4735	rhomb. pr. f. al.+chl.	.....	147	.....	i.	v. sl. s. h.	s. bz., chl., acet., H ₂ SO ₄ , blue color
4736	col. tab. f. lgr.	.....	56	.....	.....	v. s.	v. s. eth., chl.; sl. s. lgr.
4737	liq. ....	.....	.....	224	.....	.....	.....
4738	col. rhomb. leaf	.....	61	240-4 d.	sl. s.	v. s.	v. s. eth., bz.
4739	need. f. bz.	0.869 ⁷⁰ / ₄	142 d.	.....	i.	s.	sl. s. eth.; v. s. bz.
4741	col. need. ....	.....	14 ^c -50	.....	.....	s.	s. eth.
4742	need. f. eth. ....	.....	85	d.	v. sl. s.	v. s.	s. eth.
4743	.....	.....	.....	.....	.....	.....	.....
4744	yel. cr. ....	.....	145	.....	s. h.	s.	s. eth.
4745	.....	.....	.....	.....	.....	.....	.....
4746	col. leaf. f. al. ....	.....	205	.....	i.	s.	s. alk.
4747	yel. cr. f. al. ....	.....	.....	.....	i.	sl. s. h.	s. alk.
4748	sm. need. f. al. ....	.....	.....	.....	i.	sl. s.	s. KOH
4749	.....	.....	.....	.....	.....	.....	.....
4750	.....	.....	.....	.....	.....	.....	.....
4751	.....	.....	.....	.....	.....	.....	.....
4752	.....	.....	.....	.....	.....	.....	.....
4753	.....	.....	.....	.....	.....	.....	.....
4754	.....	.....	.....	.....	.....	.....	.....
4754M	col. rhomb. tab.	.....	168-170; 170-171	.....	v. sl. s.	v. s. h.; s. c.	v. sl. s. eth.
4755	.....	.....	.....	.....	.....	.....	.....
4756	col. pr. f. al. ....	.....	101 (110)	130	i.	v. s.	v. s. eth.
4757	monocl. leaf. f. al.	0.927 ¹³⁴	139	>300	0.25 c., 1.25 h.	v. s.	.....
4757M	.....	.....	.....	.....	.....	.....	.....
4758	.....	.....	.....	.....	.....	.....	.....
4759	.....	.....	.....	.....	.....	.....	.....
4760	wh. need. or pa. yel. octahdr. cr.	.....	167	.....	i.	s.	s. chl., CS ₂
4761	col. pr. f. al., 1.479, 1.710, 1.810	.....	163	.....	v. sl. s.	v. s.	v. s. eth.
4762	monocl. pr. f. al.	.....	190	d.	sl. s.	s.	sl. s. eth.; i. CS ₂
4763	leaf. ....	.....	230	.....	i.	sl. s.	sl. s. eth.
4764	.....	.....	.....	.....	.....	.....	.....
4765	col. monocl. pr. f. al.	.....	47	280	i.	17	∞ eth.
4766	col. monocl. need. f. al.	1.071 ⁴⁹ / ₄	48.6	279.8	0.59 ²⁰	372 ²⁰	s. eth.
4767	col. liq., 1.495 ⁴²	1.015 ²⁰ / ₄	.....	249	i.	s.	s. eth.
4768	wh. cr. ....	.....	150.5-1.5	.....	sl. s.	s. h.	i. eth.
4769	col. liq.	1.061 ²⁵ / ₂₅	.....	290 d.	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4770	Hydrocinnamic acid, o-	-amino- , lactam. See <i>Hydrocarbostryl</i> .		
4771	—, α-amino-	See <i>Alanine, β-phenyl-</i> .		
4772	—, β-amino-	.....	$C_6H_5CH(NH_2)-CH_2COOH$	165.19
4773	—, α-amino-<i>p</i>-hydr	oxy- . See <i>Tyrosine</i> .		
4774	—, α, β-dibromo-(<i>i</i>)..	<i>i</i> -cinnamic acid dibromide....	$C_6H_5CHBrCH-BrCOOH$	307.99
4776	—, o-hydroxy-	See <i>Melilotic acid</i> .		
4777	—, <i>p</i>-hydroxy-	See <i>Phloretic acid</i> .		
4778	—, α-hydroxy-β-ket	o- . See <i>Glycolic acid, benzoyl-</i> .		
4779	Hydrocinnamonnitrile,	β-keto- . See <i>Acetonitrile, benzoyl-</i> .		
4780	Hydrocinnamyl alcohol	l . See <i>1-Propanol, 3-phenyl-</i> .		
4781	Hydrocotarnine.....	.....	$C_{12}H_{15}NO_2 \cdot \frac{1}{2}H_2O$	230.26
4782	o-Hydrocoumaric acid.	See <i>Melilotic acid</i> .		
4783	Hydrocyanic acid	hydrogen cyanide; prussic acid	HCN	27.03
4784	Hydrofuramide.	furfural hydramide; trifuraldiamine; furfuramide	$(C_5H_4O)_3N_2$	268.26
4785	Hydrogen cyanide.	See <i>Hydrocyanic acid</i> .		
4786	Hydrogen methyl sulfa	te. See <i>Methylsulfuric acid</i> .		
4787	Hydrohydrastinine.....	.....	$C_{11}H_{13}NO_2$	191.22
4788	α-Hydrophthoquinone	ne. See <i>1,4-Naphthalenediol*</i> .		
4789	Hydrophlorone.	See <i>Hydroquinone, 2,5-dimethyl-</i> .		
4790	Hydroquinine.....	.....	$C_{20}H_{26}N_2O_2$	326.43
4791	Hydroquinone	1,4-benzenediol* ; quinol; hydroquinol; <i>p</i> -dihydroxybenzene	$C_6H_4(OH)_2$	110.11
4792	—, diacetate	quinol diacetate; <i>p</i> -phenylene diacetate; diacetylhydroquinone	$C_6H_4(OOCCH_3)_2$..	194.18
4793	—, diethyl ether.	See <i>Benzene, 1,4-diethoxy*</i> .		
4794	—, dimethyl ether	See <i>Benzene, 1,4-dimethoxy*</i> .		
4795	—, monoamyl ether.	See <i>Phenol, <i>p</i>-amoxy-</i> .		
4796	—, monobutyl ether.	See <i>Phenol, <i>p</i>-butoxy-</i> .		
4797	—, monoethyl ether.	See <i>Phenol, <i>p</i>-ethoxy-</i> .		
4798	—, monoheptyl ether.	See <i>Phenol, <i>p</i>-heptyloxy-</i> .		
4799	—, monohexyl ether.	See <i>Phenol, <i>p</i>-hexyloxy-</i> .		
4800	—, monomethyl ether.	See <i>Phenol, <i>p</i>-methoxy-</i> .		
4801	—, monooctyl ether.	See <i>Phenol, <i>p</i>-octyloxy-</i> .		
4802	—, monopropyl ether.	See <i>Phenol, <i>p</i>-propoxy-</i> .		
4803	—, 2-acetyl-	See <i>Acetophenone, 2,5-dihydroxy-</i> .		
4804	—, bromo-	2-bromo-1,4-benzenediol*	$BrC_6H_3(OH)_2$	189.02
4805	—, chloro-	2-chloro-1,4-benzenediol* ; chloroquinol	$ClC_6H_3(OH)_2$	144.56
4806	—, 2,3-dimethyl-	2,3-dimethyl-1,4-benzenediol* ; <i>o</i> -xylohydroquinone; 3,6-dihydroxy- <i>o</i> -xylene	$(CH_3)_2C_6H_2(OH)_2$	138.16
4807	—, 2,5-dimethyl-	2,5-dimethyl-1,4-benzenediol* ; <i>p</i> -xylohydroquinone; hydrophlorone; hydro- <i>p</i> -xyloquinone; 2,5-dihydroxy- <i>p</i> -xylene	$(CH_3)_2C_6H_2(OH)_2$	138.16
4808	—, 2,6-dimethyl-	2,6-dimethyl-1,4-benzenediol* ; 2,5-dihydroxy- <i>m</i> -xylene	$(CH_3)_2(OH)_2C_6H_2$	138.16
4809	—, dithio-	1,4-benzenedithiol* ; <i>p</i> -phenylene dimercaptan	$C_6H_4(SH)_2$	142.23
4810	—, hydroxy-	See <i>1,2,4-Benzenetriol*</i> .		
4811	—, 2-isopropyl-5-me	thyl- . See <i>Thymoquinone</i> .		
4812	—, 2-methyl-	See <i>Toluyhydroquinone</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4770							
4771							
4772	monocl. f. w.		231 d.	.....	sl. s. c.	s.	sl. s. eth.
4773							
4774	monocl. pr.		203-4	.....	d. h.	s.	s. eth., CS ₂
4776							
4777							
4778							
4779							
4780							
4781	monocl. pr. f. al.		55-6	.....	.....	v. s.	v. s. eth., chl., bz.; s. alk.
4782							
4783	col. pois. liq., 1.2675 ¹⁰	0.6876 ²⁰ ₄	-14	26	∞	∞	∞ eth.
4784	need. f. al.		117	250 d.	i.	s.	s. eth.
4785							
4786							
4787	wh. cr.		66	.....	.....	v. s.	v. s. eth.
4788							
4789							
4790	+2H ₂ O, need. f. chl. or eth.		168; 172 anh.	.....	sl. s.	s.	s. eth., chl., acet., NH ₄ OH
4791	col. hex. pr. f. w., 1.633, 1.626	1.358 ²⁰ ₄	170.5 (173.1)	286.2	5.9 ¹⁵	v. s.	v. s. eth.
4792	pl. or leaf. f. al.		124	.....	sl. s. h.	sl. s.	v. s. eth.; s. chl.
4793							
4794							
4795							
4796							
4797							
4798							
4799							
4800							
4801							
4802							
4803							
4804	leaf. f. pet. eth.		110-1 (113-5)	subl.	s.	s.	s. eth., bz., ac. a., chl., lgr.
4805	monocl. leaf. f. chl.		106	263	v. s.	v. s.	s. eth., h. chl.
4806	cr. f. w.		221 d.	.....	s.	s.	s. eth.
4807	leaf. f. w.		217 (212)	subl.	sl. s.	s.	s. eth.; sl. s. CS ₂ , ac. a., chl.; v. sl. s. bz.
4808	need. f. xylene.		149-51	.....	.....	s.	s. eth.
4809	hex. leaf. f. dil. al.		98	.....	sl. s.	s.	s. eth., bz., lgr.; v. s. ac. a.
4810							
4811							
4812							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4813	Hydroquinone, tetra-chloro-	tetrachloro-1,4-benzenediol*..	$C_6Cl_4(OH)_2$	247.90
4813M	—, 2,3,5-trimethyl-	.....	$(CH_3)_3C_6H(OH)_2$..	152.19
4814	—, trichloro-.....	.....	$Cl_3C_6H(OH)_2$	213.46
4815	Hydroquinonecarboxylic acid. See <i>Gentisic acid</i>.	.....	.....	.....
4816	Hydroquinone-2-carboxylic acid, 5-hydroxy- . See <i>Benzoic acid, 2,4,5-trihydroxy-</i>	.....	.....	.....
4817	2,5-Hydroquinonedicarboxylic acid. See <i>Terephthalic acid, 2,5-dihydroxy-</i>	.....	.....	.....
4818	Hydroquinone-phthalein	2,7-dihydroxyfluoran	$C_{26}H_{12}O_6$	332.30
4819	Hydresorcinol.	See 1,3-Cyclohexanedione*.	.....	.....
4820	Hydrotoluquinone.	See <i>Toluhydroquinone</i>.	.....	.....
4821	Hydroxy- . See the parent compounds (e.g., for hydroxybenzoic acid see <i>Benzoic acid, hydroxy-</i>	β (or <i>N</i>)-benzylhydroxylamine	$C_6H_5CH_2NHOH$...	123.15
4822	Hydroxylamine, benzyl-*	See <i>Benzyloryamine*</i>
4823	—, α (or <i>O</i>)-benzyl-	β -ethylhydroxylamine	C_2H_5NHOH	61.08
4823	—, ethyl-*.....	.....	.....	.....
4824	—, α-ethyl-	See <i>Ethoxyamine*</i>
4825	—, methyl-*	β -methylhydroxylamine	CH_3NHOH	47.06
4826	—, α-methyl-	See <i>Methoxyamine*</i>
4827	—, phenyl-*	β -phenylhydroxylamine	C_6H_5NHOH	109.12
4828	—, propyl-*	.....	$CH_3CH_2CH_2NH-OH$	75.11
4829	—, <i>o</i>-tolyl-	β (or <i>N</i>)- <i>o</i> -tolylhydroxylamine	$CH_3C_6H_4NHOH$...	123.15
4830	—, <i>m</i>-tolyl-.....	.....	$CH_3C_6H_4NHOH$..	123.15
4831	—, <i>p</i>-tolyl-.....	.....	$CH_3C_6H_4NHOH$..	123.15
4832	Hyenic acid.....	.....	$C_{24}H_{49}COOH$	382.66
4833	Hyoscinine	<i>l</i> -scopolamine.	$C_{17}H_{21}NO_4$	303.35
4834	—, hydrobromide.....	.....	$C_{17}H_{21}NO_4 \cdot HBr \cdot 3H_2O$	438.32
4835	—, sulfate	<i>l</i> -scopolamine sulfate	$(C_{17}H_{21}NO_4)_2 \cdot H_2SO_4 \cdot 2H_2O$	740.80
4836	Hyoscyamine	<i>l</i> -hyoscyamine; daturine; duboisine	$C_{17}H_{23}NO_3$	289.36
4837	—, hydrobromide.....	.....	$C_{17}H_{23}NO_3 \cdot HBr$...	370.29
4838	—, hydrochloride.....	.....	$C_{17}H_{23}NO_3 \cdot HCl$...	325.83
4839	—, sulfate.....	.....	$(C_{17}H_{23}NO_3 \cdot N)_2 \cdot H_2SO_4 \cdot 2H_2O$	712.84
4840	<i>d</i>l-Hyoscyamine.	See <i>Atropine</i>.	.....	.....
4841	<i>d</i>-Hyoscyamine.....	.....	$C_{17}H_{23}NO_3$	289.36
4842	<i>d</i>-Hypaphorine.....	.....	$C_{14}H_{18}N_2O_2 \cdot 2H_2O$..	282.33
4844	Hypnal	antipyrine chloral hydrate; chloral-antipyrine	$C_{11}H_{12}N_2O \cdot CCl_3 \cdot CH(OH)_2$	353.64
4845	Hypogeic acid (artificial)	7-hexadecenoic acid	$CH_3(CH_2)_7CH : CH(CH_2)_5COOH$	254.40
4846	Hypoxanthine	6(1)-purinone; 6-oxypurine; sarcine	$C_5H_4N_4O$	136.11

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4813	col. monoc. f. bz.	.....	232	subl. d.	i.	v. s.	v. s. eth.; s. bz.
4813M	wh. cr. ....	.....	170-171	.....	v. sl. s. c.; s. h.	s.	s. eth.
4814	col. pr. f. w. ....	.....	134 (138)	subl.	0.6 ¹⁵	v. s.	v. s. eth.
4815	droxy-.	.....	232-4	d.	v. sl. s. h.	s.	s. eth., alk.; i. lgr.
4816							
4817							
4818							
4819	droxy-; for hydr	oxypropane	see <i>Propano</i>	l).	s.	.....	.....
4820							
4821	need. f. lgr. ....	.....	57	.....	.....	.....	.....
4822	col. leaf. or need. f. lgr.,	0.908 ²⁰ / ₄	59 d.	.....	v. s.	v. s.	sl. s. eth.
4823							
4824	hyg. pr.,	1.0003 ²⁰ / ₄	42	62.5 ¹⁵	v. s.	v. s.	sl. s. eth.
4825							
4826	col. need. ....	.....	82	.....	2 c., 10 h.	v. s.	v. s. eth.; v. sl. s. lgr.
4827							
4828	need. f. eth. ....	.....	ca. 46	.....	v. s.	s.	s. eth.; i. lgr.
4829	col. need. f. bz., eth.	.....	44	.....	i.	v. s.	v. s. eth.; sl. s. lgr.
4830	leaf. f. bz., eth.	.....	68	.....	sl. s. h.	s.	s. eth.; sl. s. lgr.
4831	col. leaf. f. bz.	.....	94	.....	1 c., 50 h., d.	v. s.	v. s. eth.; sl. s. bz.
4832	cr. f. eth. ....	.....	78	.....	i.	sl. s.	s. eth.
4833	col. syrup, [α]-33.1° _D	.....	55	.....	10.5 ¹⁵	v. s.	v. s. eth.; s. chl.; sl. s. bz.
4834	col. rhomb. cr. f. w., [α]-32.9° ¹⁵ _D	.....	194	.....	66.6 ²⁵	6.3 ²⁵	i. eth.; 0.13 chl.
4835	wh. micr. need. f. w.	.....	.....	.....	v. s.	v. s.	.....
4836	wh. need. ....	.....	106-8	.....	.....	s.	s. eth., chl.
4837	wh. deliq. pr.	.....	152	.....	v. s.	50	0.06 eth.
4838	wh. cr. ....	.....	149-51	.....	s.	s.	.....
4839	need. f. al., [α]-28.6° _D	.....	anh. 206	.....	v. s.	15.6	0.04 eth.; s. chl.
4840	silky need. f. w. + al., [α]-20.3° ¹⁵ _D	.....	106	.....	5	v. s.	s. eth., chl., bz.
4841							
4842	lg. monoc. cr. f. w.	.....	anh. 255	.....	.....	.....	.....
4844	rhomb. cr. ....	.....	68	.....	12	sl. s.	sl. s. eth.
4845	col. need. ....	.....	33	236 ¹⁵	i.	v. s.	s. eth.
4846	need. ....	.....	d. 150	.....	0.07 ¹⁹ , 1.4 ¹⁰⁰	sl. s.	s. eth., alk.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4847	Hypoxanthine, 2-amin	o-. See <i>Guanine</i> .		
4848	Hystazarin	2,3-dihydroxyanthraquinone; hystazin	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.20
4848M	Idose		$C_6H_{12}O_6$	180.16
4849	Idryl	See <i>Fluoranthene</i> .		
4850	Imesatin	3-iminooxindole.....	$C_6H_4NHCOC:NH$	146.14
4851	Imidazole	glyoxaline; iminazole.....	$NHCH:NCH:CH$	68.08
4852	—, 4,5-dihydro-2,4,5	-triphenyl-. See <i>Amarine</i> .		
4852M	—, 2-ketotetrahydro	- See <i>Urea, ethylene-</i> .		
4853	—, 1-methyl-.....	N-methylglyoxaline.....	$N(CH_3)CH:$ $NCH:CH$	82.10
4854	—, 2,4,5-triphenyl-	See <i>Lophine</i> .		
4855	4-Imidazolecarboxylic acid, tetrahydro-4-hydroxy-2,5-diketo-	See <i>Allanturic acid</i> .		See
4856	4-Imidazoleethyamine	e. See <i>Histamine</i> .		
4857	5-Imidazolepropionic acid, α-amino-	See <i>Histidine</i> .		
4858	2(3)-Imidazolone, dihydro-	See <i>Urea, ethylene-</i> .		
4859	Imidazo[4,5-d]pyrimidine	See <i>Purine</i> .		
4860	Imperatorin	See <i>Peucedanin</i> .		
4861	Indaconitine	acetylbenzoylpseudoaconine...	$C_{34}H_{47}NO_{10}$	629.73
4862	Indan	hydrindene; 2,3-dihydroindene	$C_6H_4CH_2CH_2CH_2$	118.17
4863	1-Indanone	1-ketoindan; α -hydrindone...	$C_6H_4COCH_2CH_2$	132.15
4864	2-Indanone	2-ketoindan; β -hydrindone...	$C_6H_4CH_2COCH_2$	132.15
4865	Indanthrene	N,N'-dihydroanthraquinonazine	$C_{28}H_{14}N_2O_4$	442.41
4866	Indene		$C_6H_4CH_2CH:CH$	116.15
4867	—, 2,3-dihydro-	See <i>Indan</i> .		
4868	Indican (of plants).....		$C_{14}H_{17}NO_6 \cdot 3H_2O$	349.33
4869	Indigo, Indigo blue	See <i>Indigotin</i> .		
4870	—, soluble.	See 5,5'-Indigotindisulfonic acid, disodium salt.		
4871	Indigo carmine	See 5,5'-Indigotindisulfonic acid, disodium salt.		
4872	Indigopurpurin	See <i>Indirubin</i> .		
4873	Indigo red	See <i>Indirubin</i> .		
4874	Indigotin	indigo; indigo blue.....	$C_{16}H_{10}N_2O_2$	262.26
4876	4,4'-Indigotindicarboxylic acid		$C_{18}H_{10}N_2O_6$	350.28
4877	5,5'-Indigotindisulfonic acid		$C_{16}H_{10}N_2O_8S_2$	422.38
4878	—, disodium salt	indigo carmine; soluble indigo	$C_{16}H_8N_2Na_2O_8S_2$	466.35
4878M	Indigotinsulfonic acid		$C_{16}H_{10}N_2O_6S$	342.32
4879	Indigo white	leucoindigo	$C_{16}H_{12}N_2O_2$	264.27
4880	Indirubin	indigo red; indigopurpurin...	$C_{16}H_{10}N_2O_2$	262.26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4847							
4848	yel. need. f. ac. a.	.....	260	.....	.....	sl. s.	sl. s. eth.; s. H ₂ SO ₄
4848M	glassy brittle mass, L- idose, [α] _D ²² + 63.2°	.....	osazone 168	.....	.....	.....	.....
4849							
4850	yel. pr.....	.....	.....	.....	i.	s.	sl. s. eth.
4851	col. pr.....	.....	90	256	v. s.	v. s.	s. eth.
4852							
4852M							
4853	.....	1.036 ¹⁰ ₄	-6	197-9	∞	.....	.....
4854							
4855	<i>Alloxanic acid.</i>						
4856							
4856M							
4857							
4858							
4859							
4860							
4861	cr.....	.....	202-3 d.	.....	i.	s.	s. eth.
4862	col. liq., 1.53877 ^{16.4}	0.965 ²⁰ ₄	.....	176.5	i.	∞	∞ eth.
4863	rhomb. need. f. w., 1.56084 ^{44.75}	1.101 ⁴⁵ ₄	41	244	v. sl. s.	v. s.	s. eth.
4864	need. f. al., 1.5377 ⁶⁶	1.071 ⁶⁷ ₄	61	225 d.	i.	v. s.	v. s. eth.
4865	bl. powd.....	.....	470-500 d.	.....	i.	i.	i. eth.; s. dil. alk. sol.
4866	col. liq., 1.57107 ^{12.7}	1.006 ²⁰ ₄	-2	182.4	i.	∞	∞ eth.; s. pyr., CCl ₄ , acet., CS ₂ , turpen- tine
4867							
4868	br. rhomb. ....	.....	51-7; anh. 100-2	d.	v. s.	v. s.	s. eth.; sl. s. bz.
4869							
4870							
4871							
4872							
4873							
4874	rhomb., purp..	1.35 ²⁰ ₄	392 d.	subl.	i.	i.	i. eth.; s. h. chl., h. anil.
4876	blue powd. ....	.....	.....	.....	i.	i.	i. eth., chl.; s. H ₂ SO ₄
4877	blue amor.....	.....	.....	.....	s.	s.	.....
4878	blue powd. ....	.....	.....	.....	s.	sl. s.	.....
4878M	purp.....	.....	200 d.	.....	s.	s.	.....
4879	wh. powd.....	.....	.....	.....	i.	s.	s. eth., alk.
4880	br. need.....	.....	.....	subl.	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4881	Indole	benzo(b)pyrrole	$C_8H_7NHCH:CH$..	117.14
4882	—, 1-acetyl-.....	.....	$CH_3CO-NCH:CHC_6H_4$	159.18
4883	—, 2-methyl -.....	α -methylindole; methylketole See <i>Skatole</i> .	$CH_3NC_6H_5$	131.17
4884	—, 3-methyl-.....	.....	.....	.....
4885	2-Indolecarboxylic acid	d, 3-hydroxy -. See <i>Indoxyl</i> ic acid.	.....	.....
4886	3-Indolepropionic acid	α -amino-. See <i>Tryptophan</i>.	.....	.....
4887	2,3-Indolinedione	See <i>Isatin</i>.	.....	.....
4888	3-Indolol	See <i>Indoxyl</i>.	.....	.....
4889	2(3)-Indolone	See <i>Oxindole</i>.	.....	.....
4890	Indophenin.....	.....	$(C_{12}H_7NOS)_x$	(213- 24) _x
4891	Indoxyl	3-indolol.....	$C_8H_7NHCH:COH$	133.14
4892	—, 1-nitroso -.....	isatoxime.....	$C_8H_7N(NO)-CH:COH$	162.14
4893	Indoxylic acid	3-hydroxy-2-indolecarboxylic acid	$C_8H_7NHC-(COOH)COH$	177.15
4894	i-Inositol	1,2,3,4,5,6-cyclohexane-hexol*; i-inosite; phaseo-mannitol; dambose	$C_6H_6(OH)_6$	180.16
4895	Inulin.....	.....	$(C_6H_{10}O_5)_6 \cdot H_2O$...	990.86
4896	Iodeosin B	See <i>Erythrosin (dye)</i>.	.....	.....
4897	Iodine cyanide	See <i>Cyanogen iodide</i>.	.....	.....
4898	Iodo- . See the parent compounds (e.g., for iodobenzene see Iodoform.....	.....	<i>Benzene, iodo-</i> . CHI_3	393.78
4899	—, methyl -.....	See <i>Ethane, 1,1,1-triiodo</i>.*	.....	.....
4900	dl-Iodogorgoic acid	3,5-dl-diiodotyrosine.....	$HOC_6H_2I_2CH_2-CH(NH_2)COOH$	433.01
4901	d-Iodogorgoic acid	d-3,5-diiodotyrosine.....	$C_9H_9I_2NO_3$	433.01
4902	Iodol	See <i>Pyrrole, 2,3,4,5-tetraiodo</i>-. .....	.....	.....
4903	Iodonium iodide, diphenyl.....	.....	$(C_6H_5)_2II$	408.04
4904	Iodophen	See <i>Phenolphthalein, 3',3'',5',5''-tetraiodo</i> -.	$C_{13}H_{20}O$	192.29
4905	α-Ionone	4-(2,6,6-trimethyl-1-cyclohexenyl)-3-buten-2-one	$C_{13}H_{20}:NNH-CONH_2$	249.35
4906	—, semicarbazone.....	.....	$C_{13}H_{20}O$	192.29
4907	β-Ionone	4-(2,6,6-trimethyl-1-cyclohexenyl)-3-buten-2-one	$C_{13}H_{20}:NNH-CONH_2$	249.35
4908	—, semicarbazone.....	.....	$C_{13}H_{20}O$	192.29
4909	β-Irone	natural irone; 4-(2,2,6-trimethyl-3-cyclohexenyl)-3-buten-2-one	$NH_2C_6H_4CO-COOH$	165.14
4910	Isatic acid	<i>o</i> -aminophenylglyoxylic acid; <i>o</i> -aminobenzoylformic acid; isatinic acid	.....	.....
4911	—, lactam.....	See <i>Isatin</i>.	.....	.....
4912	Isatin	2,3-indolinedione; isatic acid lactam	$C_8H_5NHCOCO$	147.13
4913	—, acetyl -.....	See <i>Pseudoisatin, 1-acetyl</i>-. .....	.....	.....

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4881	col. leaf. f. w.		52.5	254	s. h.	v. s.	v. s. eth.; s. bz., lgr.
4882	liq.			152-314			
4883	need. or leaf. ...	1.07 ²⁰ ₄	59	272.3	v. sl. s.	v. s.	v. s. eth.; s. H ₂ SO ₄
4884							
4885							
4886							
4887							
4888							
4889							
4890	bl. need.				i.	sl. s.	sl. s. eth.; s. H ₂ SO ₄ ; i. bz. s. alk.
4891	oil.		85	110			
4892	yel. need.		202		sl. s.	s.	s. KOH
4893	tricl.			subl. 123	sl. s., d. h.		
4894	col. monoc. f. w.	1.524 ¹⁵ ₄	anh. 225	319 ¹⁵ , d.	4.5 ¹⁵	i.	i. eth.
4895	col. hyg. cr. ...	anh. 1.35 ²⁰ ₄	178 d. (160)		0.01 ⁹	0.02 ¹⁶	
4896							
4897							
4898	yel. hex., 1.800, 1.750	4.008 ²⁰ ₄	119	subl.; 210 exp.	0.01 ²⁵	1.3 ¹⁶ , 7.9 ⁷⁸	13.6 ²⁵ eth.; s. chl., glyc., CS ₂
4899							
4900	rect. pr.		204 d.		0.04 ²⁵ , 0.56 ⁷⁵		
4901	need.		194 d.				
4902							
4903	yel. need. f. al.		182			s. h.	
4904							
4905	col. liq., 1.49842 ^{22.3}	0.930		147.5 ²³	v. sl. s.	∞	∞ eth.; s. chl.
4906	col. cr. f. bz., lgr.		110			s.	
4907	col. liq., 1.51977 ^{18.9}	0.944		140 ¹⁸	v. sl. s.	∞	∞ eth.
4908	need. f. al.		148		i.	s.	s. eth., bz.
4909	col. liq., 1.5011	0.939		144 ¹⁶	v. sl. s.	v. s.	v. s. eth.
4910	wh. powd.		d.		sl. s.		
4911							
4912	red monoc. need. f. al.		201 (198-9)	subl.	v. sl. s. c., s. h.	s.	sl. s. eth.; s. alk.
4913							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4914	Isatin, 1-methyl-	<i>N</i> -methylisatin.....	$C_6H_4N(CH_3)COCO$	161.15
4915	—, 5-methyl-	<i>p</i> -methylisatin.....	$CH_3C_6H_3NHCOCO$	161.15
4916	—, nitro-.....	.....	$C_6H_3(NO_2)NH-$ $COCO$	192.13
4917	—, thio-	See <i>Thionaphthenequinone</i> .		
4918	Isatin chloride	2-chloro-3-pseudoindolone....	$C_6H_4N:CClCO$	165.58
4919	Isatoic anhydride	<i>N</i> -carboxyanthranilic acid anhydride	C_6H_4COONH	163.13
4920	Isatoxime	See <i>Indoxyl, 1-nitroso-</i> .		
4921	α-Isatropic acid	1,2,3,4-tetrahydro-1-phenyl-1,4-naphthalenedicarboxylic acid (one form)	$C_{13}H_{16}O_4$	296.31
4922	Isethionic acid	2-hydroxyethanesulfonic acid	$CH_2OHCH_2SO_3H$	126.13
4922M	Isoalloxazine	See <i>D-Riboflavin</i> .		
4923	Isoamyl alcohol	atives see the parent compound isobutylcarbinol; 3-methyl-1-butanol*	s (e.g., for isoamylbenzene) $(CH_3)_2CHCH_2CH_2OH$	88.15
4924	sec-Isoamyl alcohol	See <i>2-Butanol, 3-methyl-</i> *		
4925	Isoamyl aldehyde	See <i>Isovaleraldehyde</i> .		
4926	Isoamylamine	1-amino-3-methylbutane.....	$(CH_3)_2CHCH_2CH_2NH_2$	87.16
4927	Isoamyl borate	triisoamyl borate.....	$B(OC_6H_{11})_3$	272.24
4928	Isoamyl bromide	1-bromo-3-methylbutane*....	$(CH_3)_2CHCH_2CH_2Br$	151.06
4929	Isoamyl chloride	1-chloro-3-methylbutane*....	$(CH_3)_2CHCH_2CH_2Cl$	106.60
4930	Isoamyl cyanide	See <i>Isocapronitrile</i> .		
4931	Isoamyl disulfide	diisoamyl disulfide.....	$C_6H_{11}S_2C_6H_{11}$	206.40
4932	α-Isoamylene	See <i>1-Butene, 3-methyl-</i> *		
4933	β-Isoamylene	See <i>2-Butene, 3-methyl-</i> *		
4934	α-Isoamylene glycol	See <i>1,2-Butanediol, 3-methyl-</i> *		
4935	β-Isoamylene glycol	See <i>2,3-Butanediol, 2-methyl-</i> *		
4936	γ-Isoamylene glycol	See <i>1,3-Butanediol, 3-methyl-</i> *		
4937	Isoamyl ether	3-methyl-1-(γ -methylbutoxy)butane*; diisoamyl ether	$(CH_3)_2CH(CH_2)_2O(CH_2)_2CH(CH_3)_2$	158.28
4938	Isoamyl iodide	1-iodo-3-methylbutane*.....	$(CH_3)_2CHCH_2CH_2I$	198.06
4939	Isoamyl isocyanide	γ -methylbutyl isocyanide; isoamylcarbylamine	$(CH_3)_2CH(CH_2)_2NC$	97.16
4940	Isoamyl mercaptan	See <i>1-Butanethiol, 3-methyl-</i> *		
4941	Isoamyl nitrate	γ -methylbutyl nitrate*.....	$(CH_3)_2CHCH_2CH_2ONO_2$	133.15
4942	Isoamyl nitrite	γ -methylbutyl nitrite*.....	$(CH_3)_2CHCH_2CH_2ONO$	117.15
4943	Isoamyl sulfate	diisoamyl sulfate.....	$[(CH_3)_2CH_2CH_2CH_2CH_2]_2SO_4$	240.35
4944	Isoamyl sulfide	diisoamyl sulfide; 3-methyl-1-(γ -methylbutylthio)butane*	$[(CH_3)_2CH(CH_2)_2]_2S$	174.34
4945	Isoamyl urethan	See <i>Carbamic acid, isoamyl ester</i> ^r .		
4946	Isoanthraflavic acid ...	2,7-dihydroxyanthraquinone	$HOC_6H_3(CO)_2C_6H_3OH$	240.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4914	red need. ....	.....	134	.....	.....	.....	.....
4915	red leaf. f. w. ....	.....	187	.....	sl. s. c.	sl. s.	sl. s. eth.; s. alk., h. HCl
4916	need. f. al. ....	.....	230	.....	sl. s.	v. s.	s. alk.
4917							
4918	br. need. ....	.....	180 d.	.....	i.	s.	v. s. eth.
4919	monocl. f. acet. ....	.....	240 d.	.....	0.7 ¹⁰⁰	3 ⁷⁸	sl. s. eth.; 1.3 h. acet.
4920							
4921	cr. ....	.....	237	.....	v. sl. s.	sl. s.	i. eth., bz., CS ₂
4922							
4922M				100 d.	v. s.	i.	.....
4923	see Benzene, iso col. liq., 1.4084 ^{17.8}	amyl-). For 0.812	isoamyl est -117.2	ers of organ 130.5 (130-2)	ic acids 2.672 ²²	see the a	cids. ∞ eth.
4924							
4925							
4926	col. liq.	0.7505 ²⁰ / ₄	.....	95	s.	∞	∞ eth.; s. chl.
4927	col. liq., 1.421	0.872 ⁰ / ₄	.....	255	d.	∞	∞ eth.
4928	col. liq., 1.4412	1.215	-111.9	120.65	0.02 ^{16.5}	s.	s. eth.
4929	col. liq.	0.893	.....	98.9	i.	∞	∞ eth.
4930							
4931	liq.	0.918 ¹⁹	.....	250;122-5 ¹⁰	d.	.....	.....
4932							
4933							
4934							
4935							
4936							
4937	col. liq., 1.408	0.78073 ¹⁵ / ₁₅	.....	172.5-3.0	i.	∞	∞ eth.
4938	col. liq.	1.510	.....	148	i.	s.	∞ eth.
4939	liq. ....	.....	.....	137	i.	s.	s. eth.
4940							
4941	col. liq., 1.41219 ^{21.7}	0.996 ²²	.....	148	v. sl. s.	s.	v. s. eth.
4942	ylsh. inflam. liq., 1.38708 ^{20.7}	0.872	.....	99	v. sl. s.	∞	∞ eth.
4943				149-51 ¹²	.....	.....	.....
4944	col. liq., 1.45238	0.84314 ²⁰ / ₄	.....	209-11 (216)	i.	v. s.	v. s. eth.
4945							
4946	lng. yel. need. f. dil. al. ....	.....	330 subl.	d.-H ₂ O, 100	.....	s.	v. sl. s. eth.; s. alk., H ₂ SO ₄

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4947	Isobenzamarone	α, α' -benzalbisdesoxybenzoin; 1,2,3,4,5-pentaphenyl-1,5-pentanedione (one form)	$C_6H_5CH[CH-(C_6H_5)COC_6H_5]_2$	480.58
4948	1(3)-Isobenzofuranone	See <i>Phthalide</i> .		
4949	Isobornyl chloride	2-chlorocamphane (one form); camphene hydrochloride; bornyl chloride (incorrect)	$C_{10}H_{17}Cl$	172.69
4950	Isobutane	2-methylpropane*; trimethylmethane	$(CH_3)_3CH$	58.12
	Isobutyl . For isobutyl derivatives see the parent compounds (e.g., for isobutyl benzene			
4951	Isobutyl alcohol	2-methyl-1-propanol*; isopropylcarbinol	$(CH_3)_2CHCH_2OH$	74.12
4952	Isobutyl aldehyde .	See <i>Isobutyraldehyde</i> .		
4953	Isobutylamine	1-amino-2-methylpropane.	$(CH_3)_2CHCH_2NH_2$	73.14
4954	—, <i>N</i> -methyl-		$CH_3NHCH_2CH-(CH_3)_2$	87.16
4954M	—, <i>N</i> -phenyl-	See <i>Aniline</i> , <i>N</i> -isobutyl-.		
4955	Isobutyl arsenite	triisobutyl (ortho)arsenite.	$As[OCH_2CH-(CH_3)_2]_3$	294.25
4956	Isobutyl borate	triisobutyl borate	$B(OC_4H_9)_3$	230.16
4957	Isobutyl bromide	1-bromo-2-methylpropane*	$(CH_3)_2CHCH_2Br$	137.03
4958	Isobutyl chloride	1-chloro-2-methylpropane*	$(CH_3)_2CHCH_2Cl$	92.57
4959	Isobutyl cyanide .	See <i>Isovaleronitrile</i> .		
4960	Isobutylene .	See <i>Propene</i> , 2-methyl-*.		
4960M	Isobutylene bromide	See <i>Propane</i> , 1,2-dibromo-2-methyl-*.		
4961	Isobutylene glycol .	See 1,2-Propanediol, 2-methyl-*.		
4962	Isobutylene oxide .	See <i>Ethylene oxide</i> , α , α -dimethyl-*.		
4963	Isobutyl ether	(2-methyl-1- β -methylpropoxy)propane*; diisobutyl ether	$[(CH_3)_2CHCH_2]_2O$	130.23
4964	Isobutyl fluoride	1-fluoro-2-methylpropane*	$(CH_3)_2CHCH_2F$	76.11
4966	Isobutyl iodide	1-iodo-2-methylpropane*	$(CH_3)_2CHCH_2I$	184.03
4967	Isobutyl isocyanide	β -methylpropylcarbylamine*	$(CH_3)_2CHCH_2NC$	83.13
4968	Isobutyl mercaptan .	See 1-Propanethiol, 2-methyl-*.		
4969	Isobutyl mustard oil .	See <i>Isothiocyanic acid</i> , isobutyl ester.		
4970	Isobutyl nitrate	β -methylpropyl nitrate*	$(CH_3)_2CHCH_2-ONO_2$	119.12
4971	Isobutyl nitrite	β -methylpropyl nitrite*	$(CH_3)_2CHCH_2-ONO$	103.12
4972	Isobutyl sulfate	diisobutyl sulfate	$[(CH_3)_2CHCH_2]_2SO_4$	210.29
4973	Isobutyl sulfide	diisobutyl sulfide; 2-methyl-1-(β -methylpropylthio)propane*	$[(CH_3)_2CHCH_2]_2S$	146.29
4974	Isobutyraldehyde	2-methylpropanal*; isobutyl aldehyde	$(CH_3)_2CHCHO$	72.10
4975	—, oxime	2-methylpropanal oxime; isobutyraldoxime	$(CH_3)_2CH-CH:NOH$	87.12
4976	Isobutyraldoxime .	See <i>Isobutyraldehyde</i> , oxime.		
4977	Isobutyramide	2-methylpropanamide*; isobutyric amide	$(CH_3)_2CHCONH_2$	87.12
4978	Isobutyric acid	2-methylpropanoic acid*; dimethylacetic acid; α -methylpropionic acid	$(CH_3)_2CHCOOH$	88.10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4947	cr.		179-80				4.1 ¹² bz.
4948							
4949	col. feath. cr.		148-50 (157)		i.	s.	s. eth.
4950	col. gas.	liq. 0.603 ⁹	-145	-10.2	13 ¹⁷ / ₇₇₂ cm ³	1320 ¹⁷ / ₇₇₅ cm ³	2790 ¹⁸ / ₇₇₃ cm ³ eth.
	see Benzene, isobutyl-. For isobutyl esters of organic acids see the acids.						
4951	col. inflam. liq., 1.3968 ^{17.5}	0.8011	-108	108.39 (106-8)	9.5 ¹⁸	∞	∞ eth.
4952							
4953	col. liq., 1.39878 ^{17.9}	0.736	-85.5	68 (67-9)	∞	∞	∞ eth.
4954	col. liq.	0.722 ¹⁸		76-8			
4954M							
4955				242			
4956	col. liq., 1.408	0.864 ⁰ / ₄		212	d.	∞	∞ eth.
4957	col. liq., 1.436	1.264	-118.5	91.5	0.0589 ¹⁶	∞	∞ eth.
4958	col. liq., 1.3960	0.875	-131.2	68.9	0.092 ^{12.3}	∞	∞ eth.
4959							
4960							
4960M							
4961							
4962							
4963	col. liq.	0.7616 ¹⁶ / ₄		122.5	sl. s.	∞	∞ eth.
4964	col. gas.	2.58 ²¹		16	i.	v. s.	v. s. eth.
4966	col. liq., 1.49597	1.605	-93.5	120.4	i.	∞	∞ eth.
4967	col. liq.	0.7873 ⁴	<-60	114-7	sl. s.	s.	s. eth.
4968							
4969							
4970	col. liq., 1.40130 ^{23.3}	1.0168 ²⁰ / ₂₀		122.9	i.	∞	∞ eth.
4971	liq., 1.37151 ^{22.1}	0.8702 ²⁰ / ₂₀		67	i.	s.	s. eth.
4972	1.415.	1.042 ²³		133-4 ¹⁹			
4973	col. liq.	0.8386 ¹⁶ / ₄		172-3	i.	v. s.	v. s. eth.
4974	col. liq., 1.37302	0.7938	-65.9	61.5-3.5	11	∞	∞ eth.
4975	col. oil, 1.43022 ^{20.5}	0.8943 ²⁰ / ₄	<-80	139	sl. s.		
4976							
4977	col. monoc. f. bz. or chl.	1.013	129 (123-4)	220	v. s.	v. s.	sl. s. eth.
4978	col. liq., 1.39300	0.949 ²⁰ / ₄	-47.0	154.4	20 ²⁰	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
4979	Isobutyric acid , allyl ester	allyl isobutyrate; 2-propenyl 2-methylpropanoate*	$(\text{CH}_3)_2\text{CH}-\text{COOC}_3\text{H}_5$	128.17
4980	—, amyl ester	pentyl 2-methylpropanoate*	$(\text{CH}_3)_2\text{CHCOO}-\text{C}_5\text{H}_{11}$	158.24
4981	—, ethyl ester	ethyl isobutyrate; ethyl 2-methylpropanoate*	$(\text{CH}_3)_2\text{CH}-\text{COOC}_2\text{H}_5$	116.16
4982	—, isoamyl ester	γ -methylbutyl 2-methylpropanoate*	$(\text{CH}_3)_2\text{CH}-\text{COOC}_5\text{H}_{11}$	158.24
4983	—, isobutyl ester	β -methylpropyl 2-methylpropanoate*	$(\text{CH}_3)_2\text{CHCOO}-\text{CH}_2\text{CH}(\text{CH}_3)_2$	144.21
4984	—, isopropyl ester		$(\text{CH}_3)_2\text{CHCOO}-\text{CH}(\text{CH}_3)_2$	130.18
4985	—, methyl ester	methyl 2-methylpropanoate*; methyl isobutyrate	$(\text{CH}_3)_2\text{CHCOO}-\text{CH}_3$	102.13
4986	—, piperazinium salt		$\text{C}_4\text{H}_{10}\text{N}_2 \cdot 2\text{C}_3\text{H}_7\text{COOH}$	262.35
4987	—, propyl ester	<i>n</i> -propyl isobutyrate	$(\text{CH}_3)_2\text{CH}-\text{COOC}_3\text{H}_7$	130.18
4988	—, α -amino-	2-amino-2-methylpropanoic acid*	$(\text{CH}_3)_2\text{C}(\text{NH}_2)-\text{COOH}$	103.12
4989	—, α -bromo-	2-bromo-2-methylpropanoic acid*	$(\text{CH}_3)_2\text{CBrCOOH}$	167.01
4990	—, —, ethyl ester	ethyl 2-bromo-2-methylpropanoate*	$(\text{CH}_3)_2\text{CBr}-\text{COOC}_2\text{H}_5$	195.07
4991	—, α -hydroxy-	2-hydroxy-2-methylpropanoic acid*; acetic acid	$(\text{CH}_3)_2\text{COHCOOH}$	104.10
4992	—, α -methoxy- 3- <i>p</i> -menthyl ester	menthol α -methoxyisobutyrate	$(\text{CH}_3)_2\text{C}(\text{OCH}_3)-\text{COOC}_{10}\text{H}_{19}$	256.38
4993	Isobutyric amide	See <i>Isobutyramide</i> .		
4994	Isobutyric anhydride		$[(\text{CH}_3)_2\text{CHCO}]_2\text{O}$	158.19
4995	Isobutyronitrile	2-methylpropanenitrile*; isopropyl cyanide	$(\text{CH}_3)_2\text{CHCN}$	69.10
4996	—, α -hydroxy-	2-hydroxy-2-methylpropanenitrile*; isopropyl cyanohydrin; acetone cyanohydrin	$(\text{CH}_3)_2\text{C}(\text{OH})\text{CN}$	85.10
4997	Isobutyrophenone	isopropyl phenyl ketone	$(\text{CH}_3)_2\text{CHCOC}_6\text{H}_5$	148.20
4998	—, α -bromo-2,4,6-trimethyl-	α -bromoisopropyl 2-mesityl ketone; α -bromoisobutyryl-mesitylene	$(\text{CH}_3)_2\text{CBrCOC}_6\text{H}_2(\text{CH}_3)_3$	269.18
4999	Isobutyryl bromide	2-methylpropanoyl bromide*	$(\text{CH}_3)_2\text{CHCOBr}$	151.01
5000	Isobutyryl chloride	2-methylpropanoyl chloride*	$(\text{CH}_3)_2\text{CHCOCl}$	106.55
5001	Isocalycanthine		$\text{C}_{11}\text{H}_{14}\text{N}_2 \cdot \frac{1}{2}\text{H}_2\text{O}$	183.25
5002	Isocamphane	2,2,3-trimethylnorcamphane; isohydrocamphene; 2,2,3-trimethylbicyclo(2,2,1)-heptane	$\text{C}_{10}\text{H}_{18}$	138.25
5003	<i>dl</i>-Isocamphoric acid	<i>dl-trans</i> -1,2,2-trimethyl-1,3-cyclopentanedicarboxylic acid	$\text{C}_8\text{H}_{14}(\text{COOH})_2$	200.23
5004	Isocaproic alcohol	See 1-Hexanol, 3-isopropyl-5-methyl-*		
5005	Isocaproic acid	4-methylpentanoic acid*; isobutylic acid	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_2\text{COOH}$	116.16
5006	—, α -amino-	See <i>Leucine</i> .		
5007	—, α -hydroxy-	See <i>Leucic acid</i> .		
5008	Isocaprone	See 5-Nonanone, 2,8-dimethyl-*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4979	liq. ....	.....	.....	133.5	v. sl. s.	∞	∞ eth.
4980	liq., 1.4076....	0.8592 ¹³	.....	155	sl. s.	∞	= eth.
4981	col. liq., 1.3903	0.86930 ²⁰ ₄	-88.2	111.7	sl. s.	∞	∞ eth.
4982	col. liq.	0.876 ⁰ ₄	.....	168.8	v. sl. s.	s.	s. eth.
4983	col. liq., 1.3999	0.875 ⁰ ₄	-80.7	148.7	v. sl. s.	s.	= eth.
4984	col. liq.	0.869 ⁰ ₄	.....	120.8	i.	s.	s. eth.
4985	col. liq., 1.3840	0.891	-84.7	92.6	sl. s.	∞	∞ eth.
4986	wh. cr. ....	.....	121-2	.....	s.	s.	i. eth.; s. h. dioxane
4987	col. liq.	0.884 ⁰ ₄	.....	135.4	v. sl. s.	.....	.....
4988	col. monoel. pl. or pr.	.....	203 d.	subl. 280	s.	sl. s.	i. eth.
4989	pl.	liq. 1.5255 ^{6H}	48	198-200	v. s.	s.	s. eth.
4990	col. liq.	1.311 ²⁵ ₄	.....	164 d.	i.	s.	∞ eth.
4991	col. hyg. pr. f. bz.	.....	79	212	v. s.	v. s.	v. s. eth.; v. sl. s. bz.
4992	liq.	0.9466	.....	124-6 ¹⁰	.....	s.	s. eth.
4993	col. liq.	0.950	-53.5	182.5	d.	d.	∞ eth.
4994	col. liq.	0.773	.....	107-8	sl. s.	v. s.	v. s. eth.
4995	col. liq., 1.3996	0.932 ¹⁹	-19	120 d.; 82 ²³	v. s.	v. s.	v. s. eth.; v. sl. s. pet. eth.
4996	col. liq., 1.51919 ^{18.6}	0.984	.....	217	i.	s.	s. eth.
4997	cr. ....	.....	27	160-70 ²⁴	.....	.....	s. eth.
4998	.....	1.4067 ¹⁵	.....	116-8	.....	.....	.....
4999	col. liq., 1.4079	1.017 ²⁰ ₄	-90.0	92	d.	d.	s. eth.
5000	rhomb. ....	.....	235	.....	.....	s.	.....
5001	.....	0.8276 ²⁰ ₄	64.5	164	.....	.....	.....
5002	.....	.....	.....	.....	.....	.....	.....
5003	cr. ....	.....	191	.....	.....	v. s.	v. s. eth.
5004	col. oily liq.	0.925 ²⁰ ₄	-35	207.7 (110-1 ²⁵)	sl. s.	s.	s. eth.
5005	.....	.....	.....	.....	.....	.....	.....
5006	.....	.....	.....	.....	.....	.....	.....
5007	.....	.....	.....	.....	.....	.....	.....
5008	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5009	Isocapronitrile	4-methylpentanenitrile*; isoamyl cyanide; isobutyl-acetonitrile	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_2\text{CN}$	97.16
5010	Isocaprophenone	isoamyl phenyl ketone.....	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_2\text{COC}_6\text{H}_5$	176.25
5011	Isocaprylic acid, α-hydroxy-	2-hydroxy-6-methylheptanoic acid*	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{CHOHCOOH}$	160.21
5012	Isocarbostyrl	1-isoquinolinol or 1(2)-isoquinolone	$\text{C}_9\text{H}_7\text{NO}$	145.15
5013	Isocholesterol	ischolesterin.....	$\text{C}_{27}\text{H}_{46}\text{OH}$	386.64
5014	—, benzoate.....		$\text{C}_6\text{H}_5\text{COOC}_{27}\text{H}_{45}$...	490.75
5015	Isochrysene	See <i>Triphenylene</i> .		
5016	Isocinchomeric acid	2,5-pyridinedicarboxylic acid*	$\text{C}_6\text{H}_3\text{N}(\text{COOH})_2\cdot\text{H}_2\text{O}$	185.13
5018	Isocinnamic acid (of Liebermann)	<i>cis</i> - β -phenylacrylic acid (one form); <i>cis</i> -benzene-propenoic acid (one form)	$\text{C}_6\text{H}_5\text{CH}:\text{CHCOOH}$	148.15
5019	Isocitric acid	1-hydroxy-1,2,3-propanetricarboxylic acid*; α -hydroxytricarballic acid	$\text{COOHCH}(\text{OH})\cdot\text{CH}(\text{COOH})\text{CH}_2\text{COOH}$	192.12
5020	Isocodeine		$\text{C}_{18}\text{H}_{21}\text{NO}_3$	299.36
5021	Isocorybulbine		$\text{C}_{21}\text{H}_{25}\text{NO}_4$	355.42
5022	Isocorydaline		$\text{C}_{22}\text{H}_{27}\text{NO}_4$	369.45
5023	Isocotoin	2,4-dihydroxy-6-methoxybenzophenone	$\text{C}_{14}\text{H}_{12}\text{O}_4$	244.24
5024	Isocoumarin	2,1-benzopyrone; α - β -hydroxyvinylbenzoic acid lactone	$\text{C}_9\text{H}_6\text{COOCH}:\text{CH}$	146.14
5025	Isocrotonic acid	<i>cis</i> (?) -2-butenic acid*; β - (or liquid) crotonic acid; allocrotonic acid; <i>cis</i> (?) - β -methylacrylic acid; quartenylic acid	$\text{CH}_3\text{CH}:\text{CHCOOH}$	86.09
5026	—, α -methyl-	See <i>Angellic acid</i> .		
5027	Isocyanic acid , ethyl ester		$\text{C}_2\text{H}_5\text{NCO}$	71.08
5027M	—, isobutyl ester.....	isobutyl isocyanate.....	$(\text{CH}_3)_2\text{CHCH}_2\text{NCO}$	99.13
5028	—, phenyl ester.....	phenyl isocyanate; phenyl-carbonimide; carbanil	$\text{C}_6\text{H}_5\text{N}:\text{CO}$	119.12
5029	—, <i>o</i> -tolyl ester.....	<i>o</i> -tolylcarbonimide.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NCO}$	133.14
	Isocyanides	See <i>Ethyl isocyanide</i> , <i>Methyl isocyanide</i> , etc.		
5030	Isocyanuric acid	See <i>Fulminuric acid</i> .		
5031	—, trimethyl ester.....	tricarbonimide trimethyl ester	$\text{C}_3\text{O}_3(\text{NCH}_3)_3$	171.16
5032	Isocymene	See <i>m-Cymene</i> .		
5033	Isoderritol		$\text{C}_{21}\text{H}_{20}\text{O}_6$	352.37
5034	Isodextrosamine	See <i>D-Fructosamine</i> .		
5035	Isodibutol	See <i>2-Pentanol</i> , <i>2,4,4-trimethyl</i>		
5036	Isodurene	1,2,3,5-tetramethylbenzene...	$(\text{CH}_3)_4\text{C}_6\text{H}_2$	134.21
5037	—, 4-amino-	See <i>Isoduridine</i> .		
5038	Isodureanol	2,3,4,6-tetramethylphenol(?); 4-hydroxyisodurene(?)	$(\text{CH}_3)_4\text{C}_6\text{HOH}$	150.21
5039	Isoduridine	2,3,4,6-tetramethylaniline; 4-aminoisodurene	$(\text{CH}_3)_4\text{C}_6\text{H}_2\text{NH}_2$...	149.23
5040	α - Isodurylic acid	3,4,5-trimethylbenzoic acid...	$(\text{CH}_3)_3\text{C}_6\text{H}_2\text{COOH}$	164.20
5041	β - Isodurylic acid	2,4,6-trimethylbenzoic acid; mesitylene- <i>iso</i> -carboxylic acid	$(\text{CH}_3)_3\text{C}_6\text{H}_2\text{COOH}$	164.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml		
					Water	Alcohol	Ether, etc.
5009	col. liq., 1.406.	$0.806\frac{20}{4}$	-51.1	155.5	i.	s.	∞ eth.
5010	col. liq.	$0.962\frac{15}{4}$	24.7	242.5	i.	v. s.	v. s. eth.
5011	need. f. eth....	.....	152-3 d. (110-1)	192-3 d.	sl. s.	s.	s. eth.
5012	col. monocl. f. bz.	.....	208-9	subl.	sl. s.	v. s.	sl. s. eth., bz.; s. chl.
5013	need. f. eth....	.....	138	.....	.....	s.	s. eth., h. ac. a.
5014	need. ....	.....	191-5	.....	.....	s.	v. s. eth.
5015	.....	.....	.....	.....	.....	.....	.....
5016	col. leaf. f. w.	.....	236-7 (anh.)	subl.	v. sl. s.	v. sl. s.	v. sl. s. eth.; s. h. HCl
5018	lng. monocl. pr. f. lgr.	.....	58 (42)	265→ <i>trans</i> form	0.937 ²⁵	s.	v. s. eth.; s. chl., lgr., ac. a.
5019	pr. ....	.....	d. 100	.....	v. sl. s.	v. sl. s.	v. sl. s. eth.
5020	1.607, 1.642, 1.675	.....	144	d.	.....	.....	.....
5021	col. leaf. ....	.....	180	.....	i.	s.	.....
5022	.....	.....	136	.....	.....	.....	.....
5023	.....	.....	162	.....	.....	.....	.....
5024	pl. f. bz. ....	.....	47	286	i.	s.	s. eth., CS ₂ ; v. s. bz.
5025	col. need. f. pet. eth., 1.4457	$1.0312\frac{15}{4}$	14-5	171.9 d.	40	s.	.....
5026	.....	.....	.....	.....	.....	.....	.....
5027	liq., 1.3794 _{H₂O}	$0.898\frac{20}{4}$	.....	60	i.	∞	∞ eth.
5027M	.....	.....	.....	101.5	.....	.....	.....
5028	liq., 1.53684 ^{19.6}	$1.095\frac{20}{4}$	.....	165.6	d.	d.	v. s. eth.
5029	liq. ....	.....	.....	186	i., d. h.	d. h.	s. eth.
5030	.....	.....	.....	.....	.....	.....	.....
5031	pr. ....	.....	175	295	.....	.....	.....
5032	.....	.....	.....	.....	.....	.....	.....
5033	.....	.....	149	.....	.....	.....	.....
5034	.....	.....	.....	.....	.....	.....	.....
5035	.....	.....	.....	.....	.....	.....	.....
5036	liq.	$0.896\frac{0}{4}$	-24	197	i.	s.	v. s. eth.
5037	.....	.....	.....	.....	.....	.....	.....
5038	cr. ....	.....	79-81	230-50	.....	s.	s. eth.
5039	cr.	$0.978\frac{24}{4}$	23-4	255	.....	s.	.....
5040	need. f. w. ....	.....	215	.....	v. sl. s. h.	m.	s. eth.
5041	col. cr. f. al. ...	.....	152	.....	v. sl. s.	v. s.	v. s. eth.; s. chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5042	γ-Isodurylic acid	2,3,5-trimethylbenzoic acid...	$(\text{CH}_3)_3\text{C}_6\text{H}_2\text{COOH}$	164.20
5043	Isoephedrine	See <i>Pseudoephedrine</i> .		
5044	Isoerucic acid	See <i>Brassicic acid</i> .		
5045	Isoeugenol	4-propenylguaiaicol.....	$\text{CH}_3\text{CH}:\text{CHC}_6\text{H}_3(\text{OCH}_3)\text{OH}$	164.20
5046	—, acetate.....		$\text{CH}_3\text{CH}:\text{CHC}_6\text{H}_3(\text{OCH}_3)\text{OOCCH}_3$	206.23
5047	—, benzyl ether.....	1-benzyl-2-methoxy-4-propenylbenzene	$\text{CH}_3\text{CH}:\text{CHC}_6\text{H}_3(\text{OCH}_3)\text{OC}_2\text{H}_5$	254.32
5048	—, ethyl ether.....	1-ethoxy-2-methoxy-4-propenylbenzene	$\text{CH}_3\text{CH}:\text{CHC}_6\text{H}_3(\text{OCH}_3)\text{OC}_2\text{H}_5$	192.25
5049	—, methyl ether.....	See <i>Veratrole</i> , 4-propenyl.		
5050	—, γ -hydroxy-.....	See <i>Coniferyl alcohol</i> .		
5051	l-Isenfenchyl alcohol ..	l-6-fenchanol.....	$\text{C}_{10}\text{H}_{17}\text{OH}$	154.25
5052	Isoferulic acid	3-hydroxy-4-methoxycinnamic acid; hesperetic acid	$\text{HO}(\text{CH}_2\text{O})\text{C}_6\text{H}_3\text{CH}:\text{CHCOOH}$	194.18
5052M	Isogeraniolene	See 1,3-Heptadiene, 2,6-dimethyl*.		
5053	Isoglucosamine	See D-Fructosamine.		
5054	α, β-Isoheptenic acid	See 2-Heptenoic acid, 5-methyl*.		
5055	Isoheptyl alcohol	See 1-Hexanol, 5-methyl*.		
5056	Isoheptylic acid	See Caproic acid, 6-methyl.		
5057	Isohexacosane	See Cerane.		
5058	α-Isohexenic acid	See 2-Pentenoic acid, 4-methyl*.		
5059	Isohexylamine	(4-methylamyl)amine; 1-amino-4-methylpentane	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{NH}_2$	101.19
5059M	Isohydroanisoin	p,p'-dimethoxyhydrobenzoin, (one form)	$(p\text{-CH}_3\text{OC}_6\text{H}_4\text{-CHOH})_2$	274.31
5060	Isohydrobenzoin	1,2-diphenyl-1,2-ethanediol (one form)	$\text{C}_{14}\text{H}_{12}(\text{OH})_2$	214.25
5061	Isohydrocamphene	See Isocamphane.		
5062	1,3-Isoidoleidione	See Phthalimide.		
5063	1-Isoidolinone	See Phthalimidine.		
5065	dl-Isoleucine	dl- α -amino- β -methylvaleric acid; dl-2-amino-3-methylpentanoic acid*	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{-CH}(\text{NH}_2)\text{COOH}$	131.17
5066	d-Isoleucine	d-2-amino-3-methylpentanoic acid*; d- α -amino- β -methylvaleric acid	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{-CH}(\text{NH}_2)\text{COOH}$	131.17
5067	d-allo-Isoleucine	d-allo- α -amino- β -methylvaleric acid	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{-CH}(\text{NH}_2)\text{COOH}$	131.17
5068	l-allo-Isoleucine	l-allo- α -amino- β -methylvaleric acid	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{-CH}(\text{NH}_2)\text{COOH}$	131.17
5069	α-Isomalic acid	2-hydroxy-2-methylpropanedioic acid*; α -hydroxyis succinic acid	$\text{CH}_3\text{C}(\text{OH})\text{-(COOH)}_2$	134.09
5070	Isomannide		$\text{C}_6\text{H}_{10}\text{O}_4$	146.14
5071	α-Isomorphine		$\text{C}_{17}\text{H}_{19}\text{NO}_3$	285.33
5072	Isonaphthazarin	2,3(or 3,4)-dihydroxy-1,4-naphthoquinone	$\text{C}_{10}\text{H}_4\text{O}_2(\text{OH})_2$...	190.15
5073	Isonicotene		$\text{C}_{10}\text{H}_{12}\text{N}_2$	160.21
5074	Isonicotine		$\text{C}_{10}\text{H}_{14}\text{N}_2$	162.23
5075	Isonicotinic acid	4-pyridinecarboxylic acid*	$\text{C}_6\text{H}_4\text{NCOOH}$	123.11
5076	Isonicotinic anhydride		$(\text{C}_6\text{H}_4\text{NCO})_2\text{O}$	228.20
5077	Isonitriles	See Ethyl isocyanide, Methyl isocyanide, etc.		
	Isooctane	See Heptane, 2-methyl*, Pentane, 2,2,4-trimethyl*.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5042	pl. f. lgr. ....	.....	127	.....	.....	s.	.....
5043							
5044							
5045	pa. yel. liq., 1.5680 ²⁵ ₂₅	1.0839 ²⁵ ₂₅ ; 1.0852 ²⁰ ₄	-10	267.5	sl. s.	s.	s. eth.
5046	need. f. bz. ....	.....	79-80	282-3	i.	.....	s. eth.
5047	need. f. al. ....	.....	58-9	.....	i.	s.	s. eth.
5048	cr. f. dil. al. ....	.....	64	.....	i.	s.	v. s. eth., bz.
5049							
5050							
5051	need.	0.961 ¹⁵ ₄	62	204	i.	v. s.	v. s. eth.
5052	wh. need. ....	.....	228	.....	sl. s. c., s. h.	s.	s. eth.; i. lgr.
5052M							
5053							
5054							
5055							
5056							
5057							
5058							
5059	wh.-yel. liq.	0.758 ²⁵ ₄	-94.4	123.9	sl. s.	∞	∞ eth.
5059M	col. pr. ....	.....	110	.....	.....	v. s.	v. s. eth.
5060	col. monocl. f. al.	.....	121	133 ^{0.02}	0.19 ¹⁵	v. s.	v. s. eth.
5061							
5062							
5063							
5065	rhomb. or monocl. pl. f. dil. al.	.....	292 d.	.....	2.19 ²⁵ , 4.83 ⁷⁵	s. h.	i. eth.; s. h. ac. a.
5066	greasy rhomb. leaf. f. al.	.....	283-4 d.	.....	4.12 ²⁵ , 6.08 ⁷⁵	i., sl. s. h.	i. eth.; s. h. ac. a.
5067	greasy leaf. ....	.....	280-1 d.	.....	2.9 ²⁰	.....	i. eth.
5068	greasy leaf. ....	.....	278 d.	.....	.....	0.82 ²⁰ 80% 0.12 ²⁰	.....
5069	col. cr. ....	.....	160 d. (142)	d. 170±	v. s.	v. s.	v. s. eth.
5070	col. monocl. ....	.....	87	274 d.	v. s.	sl. s.	i. eth.
5071			247	.....	.....	.....	.....
5072	or.-red leaf. ....	.....	280	subl.	sl. s.	s.	sl. s. eth., chl., bz.; s. alk., acet.
5073	liq., 1.5749.	1.098 ²⁰ ₄	.....	293	∞	.....	∞ eth.
5074	cr. ....	.....	78	260 d.	.....	.....	.....
5075	col. need. ....	.....	317	subl. d.	sl. s. c. v. s. h.	v. sl. s.	v. sl. s. eth.
5076			103-4	.....	.....	.....	.....
5077							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5078	Isopentane.	See <i>Butane, 2-methyl-*</i> .		
5079	Isophthalaldehyde	1,3-benzenedicarbonyl*; <i>m</i> -phthalic aldehyde	$C_6H_4(CHO)_2$	134.13
5080	Isophthalaldehydic acid	<i>m</i> -formylbenzoic acid	$CHOC_6H_4COOH$	150.13
5081	—, 2-hydroxy-	3-formyl-2-hydroxybenzoic acid	$CHOC_6H_3(OH)-COOH$	166.13
5082	—, 4-hydroxy-	3-formyl-4-hydroxybenzoic acid	$CHOC_6H_3(OH)-COOH$	166.13
5083	—, 6-hydroxy-	5-formyl-2-hydroxybenzoic acid	$CHOC_6H_3(OH)-COOH$	166.13
5084	Isophthalic acid	1,3-benzenedicarboxylic acid*; <i>m</i> -phthalic acid	$C_6H_4(COOH)_2$	166.13
5085	—, diethyl ester	ethyl <i>m</i> -phthalate	$C_6H_4(COOC_2H_5)_2$	222.23
5086	—, dimethyl ester	dimethyl 1,3-benzenedicarboxylate*; methyl isophthalate	$C_6H_4(COOCH_3)_2$	194.18
5087	—, 4,6-dimethyl-	See <i>α-Cumidic acid</i> .		
5088	—, 2-hydroxy-		$HOC_6H_3(COOH)_2$	182.13
5089	—, 4-hydroxy-		$HOC_6H_3(COOH)_2$	182.13
5090	—, 5-hydroxy-		$HOC_6H_3(COOH)_2$	182.13
5091	—, 5-methyl-	See <i>Uvitic acid</i> .		
5092	—, 5-nitro-		$NO_2C_6H_3-(COOH)_2 \cdot 1\frac{1}{2}H_2O$	238.15
5093	Isophthalonitrile	1,3-benzenedicarbonitrile*; 1,3-dicyanobenzene	$C_6H_4(CN)_2$	128.13
5094	Isophthalyl chloride	1,3-benzenedicarbonyl chloride*; <i>m</i> -phthalyl dichloride	$C_6H_4(COCl)_2$	203.03
5095	Isoprene	2-methyl-1,3-butadiene*; <i>β</i> -methylbivinyll; hemiterpene	$CH_2=CHC-(CH_3)=CH_2$	68.11
5096	Isopropenyl bromide.	See <i>Propene, 2-bromo-*</i> .		
5097	Isopropenyl chloride.	See <i>Propene, 2-chloro-*</i> .		
	Isopropyl. For isopropyl derivatives see the parent compounds (e.g., for isopropylben-			
5098	Isopropyl alcohol	2-propanol*; dimethylcarbinol	$CH_3CHOHCH_3$	60.09
5099	Isopropylamine		$(CH_3)_2CHNH_2$	59.11
5100	Isopropyl bromide	2-bromopropane*	$CH_3CHBrCH_3$	123.00
5101	Isopropyl chloride	2-chloropropane*	$CH_3CHClCH_3$	78.54
5102	Isopropyl cyanide.	See <i>Isobutyronitrile</i> .		
5103	Isopropyl ether	2-isopropoxypropane*; diisopropyl ether	$(CH_3)_2CHOCH-(CH_3)_2$	102.17
5104	Isopropyl fluoride	2-fluoropropane*	CH_3CHFCH_3	62.09
5105	Isopropylidene chloride	e. See <i>Propane, 2,2-dichloro-*</i> .		
5105M	Isopropylidene fluoride	. See <i>Propane, 2,2-difluoro-*</i> .		
5106	Isopropyl iodide	2-iodopropane*	CH_3CHICH_3	170.01
5107	Isopropyl isocyanide		$(CH_3)_2CHNC$	69.10
5108	Isopropyl mercaptan.	See <i>2-Propanethiol*</i> .		
5109	Isopropyl mustard oil.	See <i>Isothiocyanic acid, isopropyl ester</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5078							
5079	need.....	.....	89.5	.....	sl. s.	v. s.	i. pet. eth.
5080	need. f. w.....	.....	175 (164-6)	.....	4.94 ^{99,7}	v. s.	v. s. eth.
5081	need.....	.....	179	.....	6 ¹⁰⁰	s.	.....
5082	pr.....	.....	243-4	subl.	s. h.	s.	s. eth.
5083	need.....	.....	248-9	.....	0.7 ¹⁰⁰	s.	s. eth.
5084	col. need. f. h. w.	.....	330; 312-4	subl.	0.013 ²⁵ 0.22 h.	s.	i. bz.
5085	col. liq.....	.....	.....	285	.....	.....	.....
5086	col. need. f. dil. al.	.....	68	.....	i.	.....	.....
5087							
5088	col. need. f. w.	.....	hyd. 239; anh. 244	.....	0.14; 2.5 ¹⁰⁰	v. s.	v. s. eth.; sl. s. chl.
5089	col. need. f. w.	.....	310 (306)	d.	0.3 ²⁴	v. s.	v. s. eth.; s. h. ac. a.; i. chl.
5090	need. f. w.....	.....	hyd. -2H ₂ O 100; anh. 288	.....	0.06, 18 ¹⁰⁰	v. s.	v. s. eth.; s. bz.
5091							
5092	col.-grn. leaf...	.....	255 sl. d.	.....	0.22 ²⁵	v. s.	v. s. eth.
5093	col. need.....	.....	161	subl.	sl. s.	s. h.	s. eth.; i. lgr.
5094	cr.....	.....	41	276	d.	d.	s. eth.
5095	col. liq., 1.4221 ^{18,3}	0.6806 ²⁰ / ₄	-120	34	i.	∞	∞ eth.
5096							
5097	zene see Benzene, isopropyl-). For isopropyl esters of organic acids see the acids.						
5098	col. liq., 1.37757	0.7854 ²⁰ / ₄	-88.5 to -89.5	82.3	∞	∞	= eth.
5099	col. liq., 1.37698 ^{15,4}	0.694 ¹⁵ / ₄ ; 0.690 ²⁰ / ₄	-101.2	34	∞	∞	∞ eth.
5100	col. liq., 1.42508	1.310 ²⁰ / ₄	-89	59.6	0.32 ²⁰	∞	∞ eth.
5101	col. liq.....	0.8590 ²⁰ / ₄	-117	35.4 (34.8) (36.5)	0.344 ^{12,5}	∞	∞ eth.
5102							
5103	col. liq.....	0.7258 ²⁰ / ₄	-60	67.5 (68.5-9.0)	0.2	∞	= eth.
5104	col. gas, 1.3240 ⁻²⁰	0.7682 ^{-10,2}	-133.4	-10.1	.....	.....	.....
5105							
5105M							
5106	liq., 1.49969...	1.703 ²⁰ / ₄	-90.8	89.5	0.14 ²⁰	∞	= eth.
5107	col. liq.....	0.7596 ⁰ / ₄	.....	87	i.	∞	∞ eth.
5108							
5109							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5110	Isopropyl nitrate	2-propanol nitrate.....	$(\text{CH}_3)_2\text{CHNO}_3$	105.09
5111	Isopropyl nitrite	2-propanol nitrite.....	$(\text{CH}_3)_2\text{CHONO}$...	89.09
5112	Isopropyl sulfide	2-(isopropylthio)propane*; diisopropyl sulfide	$(\text{CH}_3)_2\text{CHSCH}(\text{CH}_3)_2$	118.23
5113	Isopurpurin	See <i>Anthrapurpurin</i> .		
5114	Isoquinoline	benzo[c]pyridine; 2-benzazine; leucoline	$\text{C}_6\text{H}_4\text{CH}=\text{NCH}=\text{CH}$	129.15
5115	—, nitro-		$\text{NO}_2\text{C}_9\text{H}_6\text{N}$	174.15
5116	—, 1,2,3,4-tetrahydr	o-6-methoxy-1-methyl-	7,8-methylenedioxy-	ioxy-
5117	1-Isoquinolinol, 1(2)-Is	quinolone . See <i>Isocarbo</i>	<i>ril</i> .	
5118	Isosaccharic acid	tetrahydro-3,4-dihydroxy-2,5-furandicarboxylic acid	$\text{COOH}-\text{CH}(\text{CHOH})_2\text{CH}-\text{O}-\text{CH}(\text{COOH})_2$	192.12
5119	Isosafrole	3,4-methylenedioxy-1-propenylbenzene	$\text{CH}_2(\text{O}_2)\text{C}_6\text{H}_3-\text{CH}:\text{CHCH}_3$	162.18
5120	Isosuccinic acid	2-methylpropanedioic acid*; methylmalonic acid	$\text{CH}_3\text{CH}(\text{COOH})_2$..	118.09
5121	—, α-hydroxy-	See <i>α-Isomalic acid</i> .		
5122	Isothebaine (d)		$\text{C}_{19}\text{H}_{21}\text{NO}_3$	311.37
5123	—, sulfate		$(\text{C}_{19}\text{H}_{21}\text{NO}_3)_2 \cdot \text{H}_2\text{SO}_4$	720.81
5124	Isothiocyanic acid, allyl ester	2-propenyl isothiocyanate*; allyl mustard oil	$\text{CH}_2:\text{CHCH}_2\text{NCS}$	99.15
5125	—, amyl ester	<i>n</i> -amyl mustard oil.....	$\text{CH}_3(\text{CH}_2)_4\text{NCS}$...	129.22
5126	—, benzyl ester	benzyl mustard oil.....	$\text{C}_6\text{H}_5\text{CH}_2\text{NCS}$	149.20
5127	—, <i>p</i>-biphenyl ester	See "xenyl ester," below.		
5128	—, butyl ester	butyl mustard oil.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}_2-\text{NCS}$	115.19
5129	—, <i>sec</i>-butyl ester	α -methylpropylisothiocyanate*; <i>sec</i> -butyl mustard oil	$\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)-\text{NCS}$	115.19
5130	—, <i>tert</i>-butyl ester	α , α -dimethylethylisothiocyanate*; <i>tert</i> -butyl mustard oil	$(\text{CH}_3)_3\text{CNCS}$	115.19
5131	—, ethyl ester	ethyl mustard oil.....	$\text{C}_2\text{H}_5\text{NCS}$	87.14
5132	—, isoamyl ester	γ -methylbutyl isothiocyanate*	$\text{C}_5\text{H}_{11}\text{NCS}$	129.22
5133	—, isobutyl ester	isobutyl mustard oil; β -methylpropyl isothiocyanate*	$(\text{CH}_3)_2\text{CHCH}_2-\text{NCS}$	115.19
5134	—, isopropyl ester	isopropyl mustard oil.....	$(\text{CH}_3)_2\text{CHNCS}$	101.16
5135	—, methyl ester	methyl mustard oil.....	CH_3NCS	73.11
5136	—, phenyl ester	phenyl mustard oil.....	$\text{C}_6\text{H}_5\text{NCS}$	135.18

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5110	liq.....	1.036 $\frac{20}{4}$	.....	102	.....	.....	.....
5111	liq.....	0.844 $\frac{25}{4}$	.....	45	.....	.....	.....
5112	liq.....	.....	.....	120.4	i.	s.	s. eth.
5113	.....	.....	.....	.....	.....	.....	.....
5114	col. pl. or liq., 1.62233 $\frac{25.1}{4}$	1.0986 $\frac{20}{4}$	23	243	v. sl. s.	.....	.....
5115	need. f. w.....	.....	110	.....	s. h.	s.	.....
5116	See Anhalonine.	.....	.....	.....	.....	.....	.....
5117	.....	.....	.....	.....	.....	.....	.....
5118	rhomb.....	.....	185	d.	s.	s.	v. sl. s. eth.
5119	(cis) 1.5632 $\frac{15}{4}$ (trans) 1.5736 $\frac{15}{4}$	1.107 $\frac{15}{4}$ 1.123 $\frac{15}{4}$	<-18	242-3 248-52	i. i.	s. s.	.....
5120	col. pr. or need.	1.455 $\frac{20}{4}$	135 d. (129)	.....	44.3 $\frac{30}{4}$, 66 $\frac{20}{4}$	v. s.	v. s. eth.
5121	.....	.....	.....	.....	.....	.....	.....
5122	rhomb. f. al. or eth.	.....	203-4	.....	.....	.....	.....
5123	.....	.....	120-1 d.	.....	.....	.....	.....
5124	col. oil, 1.52212 $\frac{24}{4}$	1.0155 $\frac{15}{4}$	-100	150.7	0.2	v. s.	v. s. eth.; s. bz., CS ₂
5125	liq.....	.....	.....	193.4	v. sl. s.	v. s.	v. s. eth.
5126	liq.....	1.125 $\frac{15}{4}$	.....	243; 125 $\frac{12}{4}$	i.	∞	s. eth.
5127	.....	.....	.....	.....	.....	.....	.....
5128	liq.....	0.946 $\frac{20}{4}$	.....	167	i.	v. s.	v. s. eth.
5129	liq. d: [α] 61.88 $\frac{20}{D}$	0.944 $\frac{12}{4}$ 0.943 $\frac{20}{4}$	.....	159.5 (159-63)	i.	s.	s. eth.
5130	liq.....	0.9187 $\frac{10}{4}$	10.5	140 $\frac{70}{4}$	i.	s.	s. eth.
5131	col. liq., 1.5134	1.004 $\frac{15}{4}$, 0.995 $\frac{20}{4}$	-5.9	132 (131.2 $\frac{733}{4}$)	i.	s.	s. eth.
5132	yel. liq.....	0.942 $\frac{20}{4}$	.....	182	v. sl. s.	v. s.	v. s. eth.
5133	liq., 1.5005 $\frac{14}{4}$	0.9638 $\frac{14}{4}$, 0.943 $\frac{20}{4}$	.....	162	i.	s.	∞ eth.
5134	liq.....	.....	.....	137-7.5	.....	.....	.....
5135	col. cr., 1.5258 $\frac{37.2}{4}$	1.069 $\frac{37}{4}$	35	119	v. sl. s.	∞	v. s. eth.
5136	col. liq., 1.64918 $\frac{23.4}{4}$	1.135 $\frac{16}{4}$, 1.1297 $\frac{24}{4}$	-21	218.5	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5137	Isothiocyanic acid, propyl ester	<i>n</i> -propyl mustard oil.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{NCS}..$	101.16
5138	—, <i>o</i> -tolyl ester.....	<i>o</i> -tolyl mustard oil.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NCS}....$	149.20
5139	—, <i>p</i> -tolyl ester.....	<i>p</i> -tolyl mustard oil.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NCS}....$	149.20
5140	—, xenyl ester.....	xenyl mustard oil; <i>p</i> -biphenyl isothiocyanate; <i>p</i> -biphenyl mustard oil	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{NCS}....$	211.27
5141	Isovaleraldehyde	3-methylbutanal*; isoamyl aldehyde	$(\text{CH}_3)_2\text{CHCH}_2\text{-CHO}$	86.13
5142	—, oxime.....	3-methylbutanal oxime*.....	$(\text{CH}_3)_2\text{CHCH}_2\text{-CH:OH}$	101.15
5142M	Isovaleramide	3-methylbutanamide*; isopropylacetamide.....	$(\text{CH}_3)_2\text{CHCH}_2\text{-CONH}_2$	101.15
5143	Isovaleric acid	3-methylbutanoic acid*; isopropylacetic acid	$(\text{CH}_3)_2\text{CHCH}_2\text{-COOH}$	102.13
5144	—, allyl ester.....	allyl isovalerate; 2-propenyl 3-methylbutanoate*	$(\text{CH}_3)_2\text{CHCH}_2\text{-CO}_2\text{C}_3\text{H}_5$	142.19
5145	—, ethyl ester.....	.....	$(\text{CH}_3)_2\text{CHCH}_2\text{-COOC}_2\text{H}_5$	130.18
5146	—, isoamyl ester.....	isoamyl isovalerate; γ -methylbutyl 3-methylbutanoate*	$(\text{CH}_3)_2\text{CHCH}_2\text{-COOC}_6\text{H}_{11}$	172.26
5147	—, isobutyl ester.....	isobutyl isovalerate; β -methylpropyl 3-methylbutanoate*	$(\text{CH}_3)_2\text{CHCH}_2\text{-COOCH}_2\text{CH}(\text{CH}_3)_2$	158.24
5148	—, methyl ester.....	methyl 3-methylbutanoate*; methyl isovalerate	$(\text{CH}_3)_2\text{CHCH}_2\text{-COOCH}_3$	116.16
5149	—, <i>p</i> -phenylphenacyl ester	.....	$(\text{CH}_3)_2\text{CHCH}_2\text{COOCH}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	296.35
5150	—, piperazinium salt.....	.....	$\text{C}_4\text{H}_{10}\text{N}_2\cdot 2\text{C}_4\text{H}_9\text{-COOH}$	290.40
5151	—, propyl ester.....	<i>n</i> -propyl isovalerate.....	$(\text{CH}_3)_2\text{CHCH}_2\text{-COOC}_3\text{H}_7$	144.21
5152	—, α -amino-.	See <i>Valine</i> .		
5153	—, β -amino-.....	3-amino-3-methylbutanoic acid*	$(\text{CH}_3)_2\text{C}(\text{NH}_2)\text{-CH}_2\text{COOH}$	117.15
5154	—, α -bromo-.....	2-bromo-3-methylbutanoic acid*	$(\text{CH}_3)_2\text{CHCHBr-COOH}$	181.04
5155	—, α -hydroxy-(<i>i</i>)....	2-hydroxy-3-methylbutanoic acid*	$(\text{CH}_3)_2\text{CHCHOH-COOH}$	118.13
5156	—, β -hydroxy-.....	3-hydroxy-3-methylbutanoic acid*	$(\text{CH}_3)_2\text{COHCH}_2\text{-COOH}$	118.13
5157	Isovalerone .	See 4-Heptanone, 2,6-dimethyl-.	*	
5158	Isovaleronitrile	3-methylbutanenitrile*; isobutyl cyanide	$(\text{CH}_3)_2\text{CHCH}_2\text{CN}$	83.13
5159	Isovalerophenone	isobutyl phenyl ketone; 3-methyl-1-phenyl-1-butanone	$(\text{CH}_3)_2\text{CHCH}_2\text{-COC}_6\text{H}_5$	162.22
5160	Isovaleryl chloride	3-methylbutanoyl chloride*	$(\text{CH}_3)_2\text{CHCH}_2\text{-COCl}$	120.58
5161	<i>dl</i>-Isovaline	<i>dl</i> - α -amino- α -methylbutyric acid; <i>dl</i> -2-amino-2-methylbutanoic acid*	$\text{CH}_3\text{CH}_2\text{C}(\text{NH}_2)\text{-(CH}_3\text{)COOH}$	117.15

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5137	liq.	0.9909 $\frac{0}{4}$; 0.978 $\frac{16}{4}$	.....	152.77 ⁴³	v. sl. s.	∞	∞ eth.
5138	col. oil.	1.104 $\frac{25}{25}$	.....	239	i.	v. s.	∞ eth.
5139	need. f. eth.	1.087 $\frac{25}{25}$	26	237	i., d. h.	v. s., d. h.	v. s. eth.
5140	need. f. eth. ....	.....	58	.....	.....	.....	v. s. eth.
5141	col. liq., 1.3902	0.803 $\frac{17}{4}$; 0.7845 $\frac{20}{20}$	-51	92.5	sl. s.	s.	s. eth.
5142	1.43645 ^{22.1}	0.8934 $\frac{20}{4}$	48.5	164-5	.....	.....	.....
5142M	monocl. pl. f. al.	0.965 $\frac{20}{4}$	135	230-2	s.	s.	s. eth.
5143	col. liq., 1.40178 ^{22.4}	0.937 $\frac{15}{4}$	-37.6 (-51)	176.7	4.2 ²⁰	∞	∞ eth.; s. chl.
5144	liq. ....	.....	.....	155	v. sl. s.	∞	∞ eth.
5145	col. liq., 1.39671 ^{18.3}	0.8657 $\frac{20}{4}$	-99.3	135	0.17 ²⁰	∞	∞ eth., bz.
5146	col. liq., 1.41311 ¹⁹	0.8584 $\frac{12}{0}$ (0.870 ⁰)	.....	194	v. sl. s.	s.	s. eth.
5147	col. liq., 1.4060	0.854 $\frac{20}{4}$	.....	168.5	i.	∞	∞ eth.
5148	col. liq.	0.881 $\frac{20}{4}$	.....	116.7	v. sl. s.	∞	∞ eth.
5149	.....	.....	76	.....	.....	.....	.....
5150	wh. cr. ....	.....	139-40	.....	∞	s.	i. eth.; s. h. acet.
5151	col. liq., 1.4036	0.863 $\frac{20}{4}$	.....	155.9	i.	∞	∞ eth.
5152	pr. ....	.....	217	subl. >180	s.	sl. s.	i. eth.
5153	col. pr. ....	.....	44	230; 150 ⁴⁰	70-80 c.	v. s.	s. eth.
5154	rhomb. ....	.....	86	subl.	v. s.	v. s.	v. s. eth.
5155	syrup. ....	.....	<-32	.....	v. s.	v. s.	v. s. eth.
5157	col. liq.	0.802	.....	129.3	sl. s.	∞	∞ eth.
5159	col. liq., 1.51385 ^{15.3}	0.967	.....	225	i.	∞	∞ eth.
5160	col. liq., 1.41361 ^{24.3}	0.989 $\frac{20}{4}$; 0.9854 $\frac{24}{4}$	.....	113	d.	d.	s. eth.
5161	monocl. pr. ....	.....	307-8 (closed tube)	subl. 300	39	6.6 h.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5162	Isovanillin.....	3-hydroxyanisaldehyde; protocatechualdehyde 4-methyl ether	$\text{CH}_3\text{O}(\text{OH})\text{C}_6\text{H}_3\text{-CHO}$	152.14
5163	Isoxylic acid.....	2,5-dimethylbenzoic acid; 2,5-xylic acid; <i>p</i> -xylic acid	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{COOH}$	150.17
5164	Isuretin.	See <i>Formamide, oxime</i> .		
5165	Itaconic acid.....	methylenebutanedioic acid*; methylenesuccinic acid	$\text{HOOC}(\text{CH}_2)\text{-CH}_2\text{COOH}$	130.10
5166	—, γ, γ -dimethyl-	See <i>Teraconic acid</i> .		
5167	Itamalic acid, γ -lactone.	See <i>Paraconic acid</i> .		
5168	Japaconine, acetylbenzoyl-	See <i>Japaconitine</i> .		
5169	Japaconitine.....	acetylbenzoyl, japaconine; same as aconitine?	$\text{C}_{34}\text{H}_{47}\text{NO}_{11}$	645.73
5170	Japan camphor.	See <i>d-Camphor</i> .		
5171	Jervine.....		$\text{C}_{26}\text{H}_{37}\text{NO}_3 \cdot 2\text{H}_2\text{O}$..	447.60
5172	Juglone.....	5-hydroxy-1,4-naphthoquinone; nucin	$\text{C}_{10}\text{H}_5\text{O}_2(\text{OH})$	174.15
5173	Kairoline.....	1-methyl-1,2,3,4-tetrahydroquinoline	$\text{C}_9\text{H}_{10}\text{NCH}_3$	147.21
5174	Ketazine, dimethyl-	See <i>Acetone, azine</i> .		
5175	Ketene.....	ethenone; carbomethene; keten	$\text{CH}_2\text{:CO}$	42.04
5176	Ketine.....	2,5-dimethylpyrazine.....	$\text{N:C}(\text{CH}_3)\text{CH:N-C}$ CH_3	108.14
5176H	Ketol, diethyl-	See <i>Propioin</i> .		
5176M	—, ethyl-	See 2-Butanone, 1-hydroxy-		
5176R	Ketone, aminodiphenyl-	See <i>Benzophenone, 2-amino-</i>		
5177	—, aminophenyl methyl-	See <i>Acetophenone, amino-</i>		
5178	—, aminophenyl phenyl-	See <i>Benzophenone, amino-</i>		
5179	—, amyl ethyl.	See 3-Octanone*.		
5180	—, amyl methyl.	See 2-Heptanone*.		
5181	—, <i>p</i> -anisyl methyl.	See <i>Acetophenone, p-methoxy-</i>		
5182	—, benzyl ethyl.	See 2-Butanone, 1-phenyl-		
5183	—, benzyl methyl.	See 2-Propanone, 1-phenyl-		
5184	—, benzyl 1-naphthyl	α -phenyl-1-acetonaphthone..	$\text{C}_6\text{H}_5\text{CH}_2\text{COC}_{10}\text{H}_7$	246.29
5185	—, benzyl 2-naphthyl		$\text{C}_6\text{H}_5\text{CH}_2\text{COC}_{10}\text{H}_7$	246.29
5186	—, benzyl phenyl.	See <i>Desoxybenzoin</i> .		
5187	—, bisaminophenyl.	See <i>Benzophenone, diamino-</i>		
5188	—, bischloromethyl.	See 2-Propanone, 1,3-dichloro-*		
5189	—, bishydroxyphenyl	See <i>Benzophenone, dihydroxy-</i>		
5190	—, α -bromoisopropyl	See <i>Isobutyroph</i>	$\text{CH}_3\text{COC}_4\text{H}_2\text{BrS}$...	205.08
5191	—, 5-bromo-2-thienyl methyl	2-acetyl-5-bromothiophene...		
5192	—, butyl methyl.	See 2-Hexanone*.		
5193	—, sec-butyl methyl	See 2-Pentanone, 3-methyl-*		
5194	—, tert-butyl methyl	See <i>Pinacolin</i> .		
5195	—, butyl phenyl.	See <i>Valerophenone</i> .		
5196	—, carvacryl methyl.	See <i>Acetophenone, 5-isopropyl-</i>		
5197	—, 5-chloro-2-thienyl methyl	2-acetyl-5-chlorothiophene...	$\text{CH}_3\text{COC}_4\text{H}_2\text{ClS}$...	160.62
5198	—, cinnamyl methyl	See <i>Acetone, benzylidene-</i>		
5199	—, cyclobutyl phenyl	benzoylcyclobutane; benzoyltetramethylene	$\text{C}_6\text{H}_5\text{COCH}(\text{CH}_2)_3$	160.21

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of								
					Water	Alcohol	Ether, etc.						
5162	monocl. pr. or pl.	1.196	116	179 ¹⁵	s. h.	s.	s. eth.; v. s. chl.; sl. s. CS ₂						
5163	col. need. f. al.	1.069 ²⁰ _D	132 (104)	268 (270-5) subl.	v. sl. s. h.	v. s.	s. eth., acet., bz.						
5164	rhomb.....	1.632	161 d.	d.	8.33 ²⁰	19.73 ¹⁵ , 88%	sl. s. eth.; v. sl. s. bz., chl., pet. eth.						
5165													
5166													
5167													
5168	col. need. f. al., eth., or chl., [α] +17.3° _D in chl.	204.2 d.	i.	s. h.	s. h. eth., chl. v. s. acet.; v. sl. s. pet. eth.						
5169													
5170													
5171													
5172	lng. grouped pr. red-br. pr. f. chl.	238-42	i.	s.	sl. s. eth.; s. chl., acet.						
5173	liq., 1.4802 ^{23.1}	1.021	245.5	v. s.	sl. s. eth.						
5174	col. gas.....	-151	-56 (-41)	d.	d.	s. eth., acet.						
5175													
5176	col. liq., 1.4992 ^{123.6}	0.990	15	155	∞	∞	∞ eth.						
5176H	pl. f. al.....	66-7	i.	s.	s. eth.						
5176M													
5176R													
5177													
5178													
5179													
5180													
5181													
5182													
5183													
5184													
5185													
5186													
5187													
5188													
5189													
5190	methyl-	94	sl. s. c., v. s. h.						
5191	col. need.....												
5192	pl.....												
5193													
5194													
5195													
5196													
5197	pl.....	52	v. s.	v. s. eth.						
5198	258						
5199													

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5200	Ketone, dibenzyl.	See 2-Propanone, 1,3-diphenyl-*	•	
5201	—, dibutyl.	See 5-Nonanone*		
5202	—, dichloromethyl	methyl. See 2-Propanone, 1, 1-dichloro-*		
5203	—, dicinnamyl.	See Styryl ketone.		
5204	—, diethyl.	See 3-Pentanone*		
5205	—, dihendecyl.	See 12-Tricosanone*		
5206	—, diheptadecyl.	See 18-Pentatriacontanone*		
5207	—, diheptyl.	See 8-Pentadecanone*		
5208	—, dihexyl.	See 7-Tridecanone*		
5209	—, 2,5-dihydroxyphenyl	phenyl. See Benzophenone, 2,5-dihydroxy-*		
5210	—, diisoamyl.	See 5-Nonanone, 2,8-dimethyl-*		
5211	—, diisobutyl.	See 4-Heptanone, 2,6-dimethyl-*		
5212	—, diisopropyl.	See 3-Pentanone, 2,4-dimethyl-*		
5213	—, dimethyl.	See Acetone.		
5214	—, dinaphthyl.	See Naphthyl ketone.		
5215	—, dinonyl.	See 10-Nonadecanone*		
5216	—, di-n-octyl.	See 9-Heptadecanone*		
5217	—, dipentadecyl.	See 16-Hentriacontanone*		
5218	—, dipentyl.	See 6-Hendecanone*		
5219	—, diphenyl.	See Benzophenone.		
5220	—, diphenylene.	See 9-Fluorenone*		
5221	—, dipropyl.	See 4-Heptanone*		
5222	—, distyryl.	See Styryl ketone.		
5223	—, 2,2'-dithienyl-	See 2-Thienyl ketone.		
5224	—, di-p-tolyl.	See Benzophenone, 4,4'-dimethyl-yl.		
5225	—, diundecyl.	See 12-Tricosanone*		
5226	—, ethyl butyl.	See 3-Heptanone*		
5227	—, ethyl heptyl.	See 3-Decanone*		
5228	—, ethyl hexyl.	See 3-Nonanone*		
5229	—, ethyl isoamyl.	See 3-Heptanone, 6-methyl-*		
5230	—, ethyl isobutyl.	See 3-Hexanone, 5-methyl-*		
5231	—, ethyl isopropyl.	See 3-Pentanone, 2-methyl-*		
5232	—, ethyl methyl.	See 2-Butanone*		
5233	—, ethyl naphthyl.	See Propionaphthone.		
5234	—, ethyl octyl.	See 3-Hendecanone*		
5235	—, ethyl phenyl.	See Propiophenone.		
5236	—, ethyl propyl.	See 3-Hexanone*		
5237	—, 2-furyl methyl...	2-acetylfuran.....	C ₄ H ₃ O·COCH ₃ ...	110.11
5238	—, 2-furyl phenyl	2-benzoylfuran.....	C ₆ H ₅ O·COC ₆ H ₅ ...	172.17
5239	—, hendecyl methyl.	See 2-Tridecanone*		
5239M	—, heptadecyl phenyl.	See Stearophenone.		
5240	—, heptyl methyl.	See 2-Nonanone*		
5241	—, hexyl methyl.	See 2-Octanone*		
5242	—, hexyl propyl.	See 4-Decanone*		
5243	—, 1-hydroxy-2-naphthyl methyl.	See 2-Acetonaphthone, 1-hydroxy-		
5244	—, 1-hydroxy-2-naphthyl propyl.	See 2-Butyronaphthone, 1-hydroxy-		
5245	—, 1-hydroxy-2-naphthyl styryl.	See 2-Acrylonaphthone, 1-hydroxy-β-phenyl-		
5246	—, hydroxyphenyl h	ydroxyphenyl. See Benzophenone, dihydroxy-		
5247	—, isoamyl methyl.	See 2-Hexanone, 5-methyl-*		
5248	—, isoamyl phenyl.	See Isocaprophenone.		
5249	—, isobutyl methyl.	See 2-Pentanone, 4-methyl-*		
5250	—, isobutyl phenyl.	See Isovalerophenone.		
5251	—, isobutyl propyl.	See 4-Heptanone, 2-methyl-*		
5252	—, α-isonitrosobutyl methyl.	See 2,3-Hexanedione, 3-ozime*.		
5253	—, α-isonitrosoethyl methyl.	See 2,3-Butanedione, mono-ozime*.		
5254	—, α-isonitrosopropyl methyl.	See 2,3-Pentanedione, 3-ozime*.		
5255	—, isopropyl methyl.	See 2-Butanone, 3-methyl-*		
5256	—, isopropyl phenyl.	See Isobutyrophenone.		
5257	—, methyl naphthyl.	See Acetonaphthone.		
5258	—, methyl nonyl.	See 2-Hendecanone*		
5259	—, methyl octyl.	See 2-Decanone*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5200							
5201							
5202							
5203							
5204							
5205							
5206							
5207							
5208							
5209							
5210							
5211							
5212							
5213							
5214							
5215							
5216							
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5218							
5219							
5220							
5221							
5222							
5223							
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5225							
5226							
5227							
5228							
5229							
5230							
5231							
5232							
5233							
5234							
5235							
5236							
5237	col. cr. f. pet. eth.	33	173	i.	s.	s. eth.
5238	liq.....	1.1839 ¹⁹ ₁₉	.....	285	i.	s.	s. eth.
5239M							
5240							
5241							
5242							
5243							
5244							
5245							
5246							
5247							
5248							
5249							
5250							
5251							
5252							
5253							
5254							
5255							
5256							
5257							
5258							
5259							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5260	Ketone, methyl phenyl	cyl. See <i>Acetone, benzoyl</i> .		
5261	—, methyl phenyl	See <i>Acetophenone</i> .		
5262	—, methyl propyl	See <i>2-Pentanone*</i> .		
5263	—, methyl styryl	See <i>Acetone, benzylidene</i> .		
5264	—, methyl 2-thienyl	2-acetylthiophene; α -aceto- thienone	$\text{CH}_3\text{COC}_4\text{H}_3\text{S} \dots$	126.17
5265	—, methyl p-tolyl	See <i>Acetophenone, p-methyl</i> .		
5266	—, 1-naphthyl phenyl	yl.	$\text{C}_{10}\text{H}_7\text{COC}_6\text{H}_5 \dots$	232.27
5267	—, 2-naphthyl phenyl		$\text{C}_{10}\text{H}_7\text{COC}_6\text{H}_5 \dots$	232.27
5268	—, nitrophenyl phenyl	nyl. See <i>Benzophenone, nitro</i> .		
5269	—, phenyl propyl	See <i>Butyrophenone</i> .		
5270	—, phenyl styryl	See <i>Chalcone</i> .		
5271	—, phenyl o-tolyl		$\text{C}_6\text{H}_5\text{COC}_6\text{H}_4\text{CH}_3 \dots$	196.24
5272	—, phenyl m-tolyl		$\text{C}_6\text{H}_5\text{COC}_6\text{H}_4\text{CH}_3 \dots$	196.24
5273	—, phenyl p-tolyl		$\text{C}_6\text{H}_5\text{COC}_6\text{H}_4\text{CH}_3 \dots$	196.24
5274	—, phenyl trityl	See β -Benzopinacol.		
5275	Ketoxime, methyl ethyl	1. See <i>2-Butanone*</i> , <i>oxime</i> .		
5276	—, methyl isopropyl	See <i>2-Butanone, 3-methyl*</i> , <i>oxime</i> .		
5277	—, methyl propyl	See <i>2-Pentanone*</i> , <i>oxime</i> .		
5278	Kojic acid	5-hydroxy-2-(hydroxymethyl)-1,4-pyrone	$\text{OC}(\text{CH}_2\text{OH})\text{:CH-}$ $\text{COC}(\text{OH})\text{:CH}$	142.11
5279	Kynurenic acid	4-hydroxyquinaldic acid	$\text{C}_9\text{H}_6\text{N}(\text{OH})\text{COOH}$	189.16
5280	Kynurine	See <i>4-Quinolinol</i> .		
5281	Labordin	See <i>Analgen</i> .		
5282	Lactamide	2-hydroxypropanamide*; lactic amide	$\text{CH}_3\text{CHOHCONH}_2$	89.09
5283	Lactic acid (dl)	ordinary lactic acid; lactic acid of fermentation; 2-hydroxypropanoic acid*; α -hydroxypropionic acid	$\text{CH}_3\text{CHOHCOOH}$	90.08
5284	—, benzoate	O-benzoyllactic acid	$\text{CH}_3\text{CH-}$ $(\text{OCC}_6\text{H}_5)\text{COOH}$	194.18
5285	—, butyl ester	butyl lactate	$\text{CH}_3\text{CHOH-}$ COOC_4H_9	146.18
5286	—, ethyl ester	ethyl 2-hydroxypropanoate*; ethyl lactate	$\text{CH}_3\text{CHOH-}$ COOC_2H_5	118.13
5287	—, methyl ester	methyl 2-hydroxypropanoate*; methyl lactate	$\text{CH}_3\text{CHOH-}$ COOCH_3	104.10
5288	—, p-phenylphenacyl ester		$\text{CH}_3\text{CHOHCOO-}$ $\text{CH}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	284.30
5289	—, piperazinium salt		$\text{C}_4\text{H}_{10}\text{N}_2 \cdot 2\text{C}_6\text{H}_5\text{O}_3 \dots$	266.29
5290	Lactic acid (d)	d-2-hydroxypropanoic acid*; d- α -hydroxypropionic acid; sarcolactic acid; paralactic acid	$\text{CH}_3\text{CHOHCOOH}$	90.08
5291	—, benzal	See <i>3-Butenoic acid, 2-hydroxy</i>	4-phenyl-	
5292	—, O-benzoyl	See <i>Lactic acid, benzoate</i> .		
5293	—, α-phenyl	See <i>Atrolactic acid</i> .		
5294	—, β, β, β-trichloro		$\text{CCl}_3\text{CHOHCOOH}$	193.43
5295	Lactic amide	See <i>Lactamide</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5260							
5261							
5262							
5263							
5264	1.5667	1.1709 ²⁰ / ₄	10.45	213.9	1.430	∞	∞
5265							
5266	rhomb. f. al.	.....	75.5	385	i.	2.41 ¹²	.....
5267	rhomb. need. f. al.	.....	82	398 ⁷⁶⁴	i.	2.01 ¹²	.....
5268							
5269							
5270							
5271	col. liq. ....	.....	< -18	316	i.	∞	∞ eth.
5272	col. liq.	1.088 ¹⁸	316.5	.....	i.	∞	∞ eth., chl., bz.
5273	monocl., 1.717, 1.563	.....	60	326.5	i.	s.	v. s. eth., bz.
5274							
5275							
5276							
5277							
5278	col. pris- matic need	.....	152-4	.....	3.95 ²⁰ , 6.90 ³⁵	s.	sl. s. eth.
5279	need. ....	.....	(-H ₂ O, 140-5) anh. 257-8	.....	0.91 ¹⁰⁰	s. h.	sl. s. eth.
5280							
5281							
5282	col. hyg. cr.	1.138 ⁸⁰ / ₄	74	.....	v. s.	v. s.	.....
5283	col. hyg. syrup, 1.4414	1.249 ¹⁵	18	122 ¹⁵	∞	∞	∞ eth.
5284	pl. ....	.....	112	.....	0.25 c., s. h.	s.	s. eth.; hyd. by h. dil. H ₂ SO ₄
5285	liq.	0.968	.....	160-90 (75-77 ⁶)	sl. m.	■	∞ eth.
5286	col. liq.	1.031 ²⁰ / ₄	.....	154 (150-2)	∞	v. s.	v. s. eth.
5287	col. liq., 1.4156 ¹⁶	1.118 ⁰ / ₄ ; 1.081 ⁶	.....	144.8	s. d.	s.	s. eth.
5288	.....	.....	145	.....	.....	.....	.....
5289	wh. cr. ....	.....	96-6.5	.....	s.	s. h.	i. eth.; s. h. cellosolve
5290	hyg. pr. or syrup liq.	1.2485	26	d.	∞	∞	∞ eth.
5291							
5292							
5293							
5294	pr. f. eth. ....	.....	124	170 ⁴⁵	v. s.	v. s.	v. s. eth.; s. chl.
5295							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5296	Lactic anhydride	2-hydroxypropanoic anhydride*	$(\text{CH}_3\text{CHOHCO})_2\text{O}$	162.14
5297	Lactide	3,6-dimethyl-2,5- <i>p</i> -dioxanedione	$\text{OCOCH}(\text{CH}_3)\text{-}$ $\text{OCOCH}(\text{CH}_3)$	144.12
5298	Lactobiose	See <i>Lactose</i> .		
5298M	Lactoflavin	See <i>p</i> -Riboflavin.		
5299	Lactonic acid	See <i>Galactonic acid</i> .		
5300	Lactonitrile	2-hydroxypropanenitrile*; acetaldehyde cyanohydrin; ethylidene cyanohydrin	$\text{CH}_3\text{CH}(\text{OH})\text{CN}\dots$	71.08
5301	Lactose	milk sugar; lactobiose.....	$\text{C}_{12}\text{H}_{22}\text{O}_{11}\cdot\text{H}_2\text{O}\dots$	360.31
5302	Lanthopine		$\text{C}_{20}\text{H}_{25}\text{NO}_4\dots$	343.41
5303	Lappaconatine		$\text{C}_{34}\text{H}_{48}\text{N}_2\text{O}_8$ or $\text{C}_{32}\text{H}_{42}\text{N}_2\text{O}_9$ (598.68)	612.74
5304	Laudanidine	<i>l</i> -laudanine; tritopine.....	$\text{C}_{20}\text{H}_{25}\text{NO}_4\dots$	343.41
5305	dl-Laudanine		$\text{C}_{20}\text{H}_{25}\text{NO}_4\dots$	343.41
5306	l-Laudanine	See <i>Laudanidine</i> .		
5307	d-Laudanosine		$\text{C}_{21}\text{H}_{27}\text{NO}_4\dots$	357.44
5308	Lauraldehyde	dodecanal*	$\text{CH}_3(\text{CH}_2)_{10}\text{CHO}\dots$	184.31
5309	Laurel camphor	See <i>d-Camphor</i> .		
5310	Laurent's acid	See 1-Naphthylamine-5-sulfonic acid.		
5311	Lauric acid	dodecanoic acid*	$\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$	200.31
5312	—, benzyl ester.....		$\text{C}_{11}\text{H}_{23}\text{COOCH}_2\text{-}$ C_6H_5	290.43
5313	—, ethyl ester.....	ethyl dodecanoate*; ethyl laurate	$\text{CH}_3(\text{CH}_2)_{10}\text{-}$ COOC_2H_5	228.37
5314	—, ethylene ester.....	See <i>Glycol, dilaurate</i> .		
5314M	—, phenyl ester.....	phenyl laurate.....	$\text{C}_{11}\text{H}_{23}\text{COOC}_6\text{H}_5\dots$	276.41
5315	—, <i>p</i> -phenylphenacyl ester.....		$\text{CH}_3(\text{CH}_2)_{10}\text{COOC-}$ $\text{H}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	394.54
5316	Lauric anhydride	dodecanoic anhydride*	$(\text{C}_{11}\text{H}_{23}\text{CO})_2\text{O}\dots$	382.61
5317	Laurin	See <i>Glycerol, trilaurate</i> .		
5318	Laurone	See 12-Tricosanone*.		
5319	Lauronitrile	dodecanenitrile*; <i>n</i> -undecyl cyanide	$\text{CH}_3(\text{CH}_2)_{10}\text{CN}\dots$	181.31
5319M	Lauroyl chloride	dodecanoyl chloride*; lauryl chloride	$\text{CH}_3(\text{CH}_2)_{10}\text{COCl}\dots$	218.76
5320	Lauryl alcohol	See 1-Dodecanol*.		
5321	Lauryl bromide	See <i>Dodecane, 1-bromo</i> *.		
5322	Lauryl chloride	See <i>Lauroyl chloride</i> .		
5323	Lauryl ketone	See 12-Tricosanone*.		
5324	Lauth's violet	See <i>Thionine</i> .		
5325	Lead, hexaethyl-di-	hexaethyldiplumbane; diplumbic hexaethyl; lead triethide	$\text{Pb}_2(\text{C}_2\text{H}_5)_6\dots$	588.78
5326	—, tetraethyl-*.....	lead tetraethide.....	$\text{Pb}(\text{C}_2\text{H}_5)_4\dots$	323.45

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5296	lt. yel. amor.	.....	260 d.	d.	v. sl. s.	v. s.	v. s. eth.
5297	col. monocl. tab. f. al.	0.862 ¹⁰ / ₄	125	255	v. sl. s. c.	v. sl. s.	.....
5298							
5298M							
5299							
5300	col. liq.	0.992	-40	182-4 sl. d.	s.	s.	s. eth.; i. pet. eth.
5301	col. rhomb., 1.517, 1.542, 1.555	1.525 ²⁰ / ₄	anh. 201.6	d.	17 c., 40 h.	i.	i. eth., chl.
5302	cr.		200	.....	.....	sl. s.	sl. s. eth.
5303	hex. cr.		205	.....	sl. s.	s.	s. eth.
5304	hex. pr. f. w. +al.		166	.....	i.	s.	sl. s. eth.; s. bz., chl.
5305	sm. trim. ylsb. wh. pr.		166	.....	.....	sl. s.	0.154 ¹⁸ eth.; s. chl., bz.
5306							
5307	need. f. bz., [α] + 103.23 ²¹⁵ _D		89-90	.....	i.	s.	5.18 ¹⁶ eth.; s. chl., h. bz.
5308	col. leaf.	0.8352 ¹⁵ / ₄	44.5	185 ¹⁰⁰	i.	s.	s. eth.
5309							
5310							
5311	col. need. f. al., 1.4183 ^{62.1}	0.883; 0.8679 ⁵⁰ / ₄	44 (48)	225 ¹⁰⁰	i.	26 ⁹ , 134 ²¹	v. s. eth.; s. bz., 142 ²¹ me. al.
5312	liq.	0.9457 ²⁵ / _{2.5}	8.5	209-11 ¹³	i.	s.	v. s. eth.
5313	oil, 1.4321	0.8615 ²⁰ / ₄	-10.7 (-1.68)	269	i.	v. s.	∞ eth.
5314							
5314M	col. cr.		84	159-161 ¹	i.	s.	s. eth.
5315							
5316	col. cr.		41	166	i., d.	s., d.	v. s. eth.
5317							
5318							
5319	oil.	0.8373 ¹⁵	4	198 ¹⁰⁰	i.	sl. s.	v. s. eth.
5319M	col. liq.		-17	145 ¹⁸	d.	d.	s. eth.
5320							
5321							
5322							
5323							
5324							
5325	liq.	1.471	.....	d.	i.	.....	.....
5326	col. liq., 1.5218 ¹⁸	1.659 ¹⁸	.....	198-202	i.	∞	∞ eth.,; s. in all org. solv.; i. dil. a., dil. alk.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5327	Lead, tetramethyl-*	tetramethylplumbane; lead tetramethyl	$\text{Pb}(\text{CH}_3)_4$	267.35
5328	—, tetraphenyl-*	tetraphenylplumbane.....	$(\text{C}_6\text{H}_5)_4\text{Pb}$	515.61
5329	Lead triethide.	See <i>Lead, hexaethylid-</i> .		
5330	Lecanoric acid, monomethyl ether.	See <i>Evernic acid</i> .		
5332	Lepidine	4-methylquinoline.....	$\text{CH}_3\text{C}_9\text{H}_6\text{N}$	143.18
5333	—, 2-(<i>p</i>-aminophenyl)-.	See <i>Flavaniline</i> .		
5334	2(1)-Lepidone.	See <i>Carbostyryl, 4-methyl-</i> .		
5335	<i>op</i>₂-Leucaniline	<i>o,p',p''</i> -methenyltrianiline; <i>o,p',p''</i> -triaminotriphenylmethane; 2,4',4''-triamino-tritan	$\text{CH}(\text{C}_6\text{H}_4\text{NH}_2)_3$...	289.37
5336	<i>mp</i>₂-Leucaniline	<i>m,p',p''</i> -methenyltrianiline; <i>m,p',p''</i> -triaminotriphenylmethane; 3,4',4''-triamino-tritan; pseudoleucaniline	$\text{CH}(\text{C}_6\text{H}_4\text{NH}_2)_3$...	289.37
5337	<i>p</i>₃-Leucaniline	paraleucaniline; <i>p,p',p''</i> -methenyltrianiline; <i>p,p',p''</i> -triaminotriphenylmethane; 4,4',4''-triamino-tritan	$\text{CH}(\text{C}_6\text{H}_4\text{NH}_2)_3$...	289.37
5338	—, <i>N,N,N',N'</i>-tetramethyl-	4-amino-4',4''-bisdimethylaminotriphenylmethane	$[(\text{CH}_3)_2\text{NC}_6\text{H}_4]_2\text{CHC}_6\text{H}_4\text{NH}_2$	345.47
5339	Leucaurin	<i>p,p',p''</i> -methenyltriphenol; leucaurin	$\text{CH}(\text{C}_6\text{H}_4\text{OH})_3$...	292.32
5340	<i>l</i>-Leucic acid	2-hydroxy-4-methylpentanoic acid*; α -hydroxyisocaproic acid; leucinic acid	$(\text{CH}_3)_2\text{CHCH}_2\text{CHOHCOOH}$	132.16
5341	<i>dl</i>-Leucine	<i>dl</i> - α -aminoisocaproic acid...	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{NH}_2)\text{COOH}$	131.17
5342	<i>l</i>-Leucine	<i>l</i> -2-amino-4-methylpentanoic acid*; <i>l</i> - α -aminoisocaproic acid	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{NH}_2)\text{COOH}$	131.17
5343	Leucoindigo.	See <i>Indigo white</i> .		
5344	Leucoline.	See <i>Isoquinoline</i> .		
5345	Leucomalachite green.	See <i>Aniline, p,p'-benzylidenebi</i>	<i>s-N,N</i> -dimethyl- $(\text{C}_6\text{H}_{10}\text{O}_6)_x$	(162-14) _x
5346	Levulin (synthetic)	fructosin; levulosin.....		
5347	Levulinaldehyde	4-oxopentanal*; levulinic aldehyde; γ -ketovaleraldehyde	$\text{CH}_3\text{COCH}_2\text{CH}_2\text{CHO}$	100.11
5348	Levulinic acid	4-oxopentanoic acid*; γ -ketovaleric acid; aceto-propionic acid	$\text{CH}_3\text{COCH}_2\text{CH}_2\text{COOH}$	116.11
5349	—, ethyl ester.....		$\text{CH}_3\text{CO}(\text{CH}_2)_2\text{COOC}_2\text{H}_5$	144.17
5350	Levulose.	See <i>D-Fructose</i> .		
5351	Levulosin.	See <i>Levulin (synthetic)</i> .		
5352	Licareol, esters.	See under <i>l-Linalool</i> .		
5353	Lichenin	moss starch	$(\text{C}_6\text{H}_{10}\text{O}_5)_x$	(162-14) _x
5354	Lignoceric acid		$\text{C}_{23}\text{H}_{47}\text{CO}_2\text{H}$	368.63
5355	<i>dl</i>-Limonene	dipentene; <i>dl</i> -1,8(9)- <i>p</i> -menthadiene	$\text{C}_{10}\text{H}_{16}$	136.23
5356	<i>d</i>-Limonene	<i>d</i> -1,8(9)- <i>p</i> -menthadiene; citrene; carvene; hesperidene	$\text{C}_{10}\text{H}_{16}$	136.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5327	col. liq., 1.5128	1.9951 ²⁰ / ₄	-27.5	110	i.	∞	∞ eth.
5328	wh. need.....	.....	227.7	.....	.....	.....	s. bz.
5329	.....	.....	.....	.....	.....	.....	.....
5330	col. liq.....	1.086 ²⁰ / ₄	<0	258-263	v. sl. s.	∞	∞ eth.; s. bz.
5332	.....	.....	.....	.....	.....	.....	.....
5333	col. cr. f. al....	.....	165	.....	v. sl. s. h.	v. s.	v. sl. s. eth.
5334	.....	.....	.....	.....	.....	.....	.....
5335	.....	.....	.....	.....	.....	.....	.....
5336	rosettes f. eth.	.....	150	.....	i.	s.	s. eth.; v. sl. s. lgr.
5337	col. leaf. f. w..	.....	148 (207)	.....	i.	s.	s. bz.
5338	glit. cr. f. al....	.....	151-2	.....	.....	v. sl. s.	.....
5339	col. need. f. ac. a.	.....	.....	.....	sl. s.	s.	s. ac. a., alk.
5340	need. or pl. f. eth. + pet. eth.	.....	72.5 (dl, 76-7)	subl. 109	v. s.	v. s.	v. s. eth.
5341	leaf. f. w.....	.....	332 d. (290)	.....	0.99 ²⁵ , 2.28 ⁷⁵	0.176 ²⁵ 75%, 0.13 ²⁵ 90%	.....
5342	hex. col. leaf. f. w., 1.525, 1.535, 1.560	1.293 ¹⁸ / ₄	295 (d. 280 d.)	subl.	2.43 ²⁵ , 3.82 ⁷⁵	0.072 ¹⁷ 99%	i. eth.; 10.9 gl. ac. a.
5343	.....	.....	.....	.....	.....	.....	.....
5344	.....	.....	.....	.....	.....	.....	.....
5345	deliq. amor....	.....	140-5 d.	.....	∞	10 ²² 84% v. sl. s.	i. eth.
5346	.....	.....	.....	.....	.....	.....	.....
5347	col. liq., 1.4263	1.018 ²⁰ / ₄	<-21	186-8 d.	∞	∞	= eth.
5348	col. leaf.....	1.1395 ²⁰ / ₄	37.2	246, 154 ¹⁴	v. s.	v. s.	v. s. eth.
5349	col. liq.....	1.01346 ²⁰ / ₄	.....	205.2 ⁷⁵⁶	v. s.	∞	∞ eth.
5350	.....	.....	.....	.....	.....	.....	.....
5351	.....	.....	.....	.....	.....	.....	.....
5352	.....	.....	.....	.....	.....	.....	.....
5353	wh. amor. powd.	.....	.....	.....	s. h.	i.	i. eth.; s. conc. HCl
5354	col. need. f. al.	0.8207	81	.....	.....	s.	s. eth. bz., CS ₂ , ac. a.
5355	col. liq., 1.473	0.865 ¹⁸ , 0.845 ²⁰	.....	176 (178-80)	i.	s.	s. eth.
5356	col. liq., 1.47489 ^{14.7}	0.842 ²⁰ / ₄	-96.9	177	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5357	d-Linaloöl	d-3,7-dimethyl-1,6-octadien-3-ol*; coriandrol	C ₁₀ H ₁₈ O.....	154.25
5358	l-Linaloöl , acetate.....	linalyl acetate; licareol acetate	CH ₃ COO(C ₁₀ H ₁₇)..	196.28
5359	—, formate.....	l-linalyl formate.....	HCOOC ₁₀ H ₁₇	182.26
5359M	Linaloölene .	See 1,6-Octadiene, 3,7-dimethyl	—*	—
5360	Linalyl esters .	See under <i>Linaloöl</i> .	—	—
5361	Linoleic acid	9,12-octadecadienoic acid*; linolic acid	C ₁₈ H ₃₂ O ₂	280.44
5362	—, ethyl ester.....	ethyl linoleate; ethyl linolate	C ₁₇ H ₃₁ COOC ₂ H ₅ ...	308.49
5363	—, methyl ester.....	methyl linolate.....	C ₁₇ H ₃₁ COOCH ₃ ...	294.47
5364	—, tetrabromide.	See <i>Stearic acid</i> , $\theta, \iota, \lambda, \mu$ -tetrabromo-	—	—
5365	Linolenic acid , ethyl ester	9,12,15-octadecatrienoic acid* (one form)	C ₁₇ H ₂₉ COOC ₂ H ₅ ...	306.48
5366	α-Linolenic acid	See <i>Stearic acid</i> , $\theta, \iota, \lambda, \mu, \xi, \sigma$ -hexabromo-	C ₁₇ H ₂₉ COOH.....	278.42
5367	—, hexabromide.	lithofellinic acid.....	C ₂₀ H ₃₆ O ₄	340.49
5369	Lithofellic acid	—	C ₂₁ H ₂₃ NO ₂	321.40
5370	Lobeline	—	—	—
5371	l-Lobeline	—	C ₂₂ H ₂₇ NO ₂ or C ₂₁ H ₂₃ NO ₂	337.45 (321.40)
5372	Lophine	2,4,5-triphenylimidazole	C ₂₁ H ₁₆ N ₂	296.36
5373	Luminal .	See <i>Phenobarbital</i> .	—	—
5374	Luminol	5-amino-2,3-dihydro-1,4-phthalazinedione; 3-aminophthalhydrazide	NH ₂ C ₆ H ₃ CONH-NHCO	177.16
5375	dL-Lupanine	—	C ₁₆ H ₂₄ N ₂ O.....	248.36
5376	d-Lupanine	—	C ₁₆ H ₂₄ N ₂ O.....	248.36
5377	Lupinidine .	See <i>Sparteine</i> .	—	—
5378	Lupinine	—	C ₂₁ H ₄₀ N ₂ O ₂	352.55
5379	—, hydrochloride.....	—	C ₁₀ H ₁₉ NO·HCl...	205.73
5380	—, methyl-.....	—	C ₁₀ H ₁₈ NO·CH ₃ ...	183.29
5381	2,4-Lutidine	2,4-dimethylpyridine*; $\alpha\gamma$ -lutidine	(CH ₃) ₂ C ₆ H ₃ N.....	107.15
5382	2,6-Lutidine	2,6-dimethylpyridine*; $\alpha\alpha'$ -lutidine	(CH ₃) ₂ C ₆ H ₃ N.....	107.15
5383	3,4-Lutidine	3,4-dimethylpyridine*; $\beta\gamma$ -lutidine	(CH ₃) ₂ C ₆ H ₃ N.....	107.15
5384	Lutidinic acid	2,4-pyridinedicarboxylic acid*	C ₆ H ₃ N(COOH) ₂ ...	167.12
5385	—, 6-methyl-	See <i>Uvonic acid</i> .	—	—
5387	Lyaconitine	—	C ₂₇ H ₃₄ N ₂ O ₆ ·2H ₂ O	518.59.
5388	Lycine .	See <i>Betaine</i> .	—	—
5389	l-Lycorine	—	C ₁₆ H ₁₇ NO ₄	287.31
5390	d-Lysine	d- α , ϵ -diaminocaproic acid, d-2,6-diaminohexanoic acid*	NH ₂ (CH ₂) ₄ CH-(NH ₂)COOH	146.19

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5357	col. liq., 1.4623	0.8622 $\frac{20}{4}$; d. 0.8702 $\frac{20}{4}$	.....	198.3	v. sl. s.	∞	∞ eth.
5358	col. liq., 1.4460	0.895 $\frac{20}{4}$	.....	220	v. sl. s.	∞	∞ eth.
5359	.....	.....	.....	100-3 ¹⁰	i.	s.	s. eth.
5359M	.....	.....	.....	.....	.....	.....	.....
5360	col.-yel. oil. . . .	0.9025 $\frac{20}{4}$	-11	230 ¹⁶	i.	∞	= eth.
5361	col.-yel. oil. . . .	0.8865 ²⁰	.....	270-5 ¹⁸⁰	i.	s.	s. eth.
5363	col.-yel. oil. . . .	0.889 ¹⁸	.....	207-8 ¹¹	i.	s.	v. s. eth.
5364	oil.	0.8919	.....	123-33. ⁰⁶¹	i.	s.	s. eth.
5365	col. liq.	0.905 $\frac{20}{4}$	.....	230-2 ¹⁷	i.	∞	∞ eth.
5367	micr. cr. . . . .	.....	206	d.	i.	s.	.....
5369	yel. syrup. . . . .	.....	.....	.....	sl. s.	v. s.	v. s. eth.; s. bz., chl.
5370	.....	.....	.....	.....	.....	.....	.....
5371	col. need. . . . .	.....	130-1	.....	d. h.	.....	.....
5372	need. . . . .	.....	275	.....	i.	0.88 ²¹	0.32 ²⁰ eth.
5373	.....	.....	.....	.....	.....	.....	.....
5374	yel. . . . .	.....	ca. 280	.....	i.	sl. s.	sl. s. eth.
5375	need. f. pet. eth. . . . .	.....	99	.....	v. s.	v. s.	v. s. eth.; s. chl.
5376	col. need. . . . .	.....	44	.....	s.	v. s.	v. s. eth.; s. chl., lgr.
5377	.....	.....	.....	.....	.....	.....	.....
5378	col. rhomb., [α]-190 ⁹¹⁷ _D	.....	68.5-9.2	256	s. c.	s.	s. eth., chl.
5379	lg. rhomb. cr., [α]-14 ⁰ _D	.....	212-3	.....	s.	s.	.....
5380	oily liq. ^D . . . . .	.....	.....	145-6 ¹⁵	.....	s.	s. eth.
5381	col. liq.	0.9493 $\frac{0}{4}$	.....	157.1 (159)	20	s.	s. eth.
5382	col. liq.	0.942 $\frac{0}{4}$	.....	143	∞ c., less s. h.	s.	s. eth.
5383	col. liq. . . . .	.....	.....	163.5-4.5	.....	s.	s. eth.
5384	leaf. or pr. f. w.	0.942	248-50	.....	s.	s.	i. eth.
5385	.....	.....	.....	.....	.....	.....	.....
5387	ylsh.-wh. resinous . . . . .	.....	112-5	.....	sl. s.	s.	sl. s. eth.; s. chl., CS ₂ , pet. eth.
5388	.....	.....	.....	.....	.....	.....	.....
5389	col. pr. . . . .	.....	250 d.	.....	i.	sl. s.	sl. s. eth., chl.; s. a.
5390	need. or hex. pl. f. al. . . . .	.....	224 d.	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5391	L-Lysine	<i>l</i> -2,6-diaminohexanoic acid*; <i>l</i> - α , ϵ -diaminocaproic acid	$\text{NH}_2(\text{CH}_2)_4\text{CH}(\text{NH}_2)\text{COOH}$	146.19
5392	—, picrate		$\text{C}_6\text{H}_{14}\text{N}_2\text{O}_2 \cdot \text{C}_6\text{H}_5\text{N}_3\text{O}_7$	375.30
5392H	D-Lyxosazone	See <i>D-Xylose</i> .		
5392R	D-Lyxose , (α)		$\text{C}_6\text{H}_{10}\text{O}_6$	150.13
5393	Maclurin	2,4,6,3',4'-pentahydroxybenzophenone; moringatanic acid; moringatanin	$\text{C}_{13}\text{H}_{10}\text{O}_6 \cdot \text{H}_2\text{O}$	280.23
5395	Malachite green, leuco	See <i>Aniline</i> , <i>p,p'</i> -benzylidenebi	<i>s</i> - <i>N,N</i> -dimethyl- $\text{C}_2\text{H}_3(\text{OH})(\text{CONH}_2)_2$	132.12
5396	Malamide	2-hydroxybutanediamide*; malic amide		
5397	Malay camphor	See <i>d-Borneol</i> .		
5398	Maleamic acid	maleamic acid, maleic acid monoamide	$\text{H}_2\text{NCOCH}:\text{CH}-\text{COOH}$	115.09
5399	Maleic acid	<i>cis</i> -butenedioic acid*; <i>cis</i> -1,2-ethylenedicarboxylic acid	$\text{HOOCCH}:\text{CH}-\text{COOH}$	116.07
5400	—, diethyl ester	diethyl maleate; ethyl maleate	$(:\text{CHCOOC}_2\text{H}_5)_2$..	172.18
5401	—, dimethyl ester	methyl maleate	$(:\text{CHCOOCH}_3)_2$..	144.12
5402	—, monoamide	See <i>Maleamic acid</i> .		
5403	—, <i>p</i> -phenylphenacyl ester		$(:\text{CHCOOCH}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5)_2$	504.51
5404	—, bromo-		$\text{BrC}(\text{COOH}):\text{CH}-\text{COOH}$	194.98
5405	—, chloro-		$\text{ClC}(\text{COOH}):\text{CH}-\text{COOH}$	150.52
5406	—, methyl-	See <i>Citraconic acid</i> .		
5407	Maleic anhydride	<i>cis</i> -butenedioic anhydride*; 2,5-furandione	$\text{OCOCH}:\text{CHCO}$..	98.06
5408	—, bromo-		$\text{OCOCBr}:\text{CHCO}$	176.96
5409	—, chloro-		$\text{OCOCCl}:\text{CHCO}$..	132.51
5410	—, methyl-	See <i>Citraconic anhydride</i> .		
5411	Malic acid (<i>dI</i>)		$\text{HOOCCH}(\text{OH})-\text{CH}_2\text{COOH}$	134.09
5412	Malic acid (<i>I</i>)	ordinary malic acid; <i>l</i> -hydroxybutanedioic acid*; <i>l</i> -hydroxysuccinic acid	$\text{HOOCCH}(\text{OH})-\text{CH}_2\text{COOH}$	134.09
5413	—, acetate	acetoxysuccinic acid; <i>O</i> -acetylmalic acid	$\text{CH}_3\text{COOCH}(\text{COOH})\text{CH}_2-\text{COOH}$	176.12
5414	—, diethyl ester	diethyl hydroxybutanedioate*; ethyl malate	$\text{CH}_2(\text{COOC}_2\text{H}_5)-\text{CHOHCOCOC}_2\text{H}_5$	190.19
5415	—, dimethyl ester	methyl malate; methyl hydroxysuccinate	$\text{CH}_3\text{OOCCH}(\text{OH})-\text{CH}_2\text{COOCH}_3$	162.14
5416	—, dipropyl ester	dipropyl hydroxybutanedioate*; propyl malate	$\text{C}_3\text{H}_7\text{OOCCH}(\text{OH})-\text{CH}_2\text{COOC}_3\text{H}_7$	218.25

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5391	flat need. f. w., hex. pl. f. al.	.....	224 d.	.....	v. s.	v. sl. s.	i. eth.
5392	need. ....	.....	266 exp.	.....	0.54 c.	i.	i. eth.
5392 H 5392 R	col. monocl., biaxial cr. (hygr.) 1.532 ²⁰ , 1.541 ²⁰ , 1.549 ²⁰ ; [α] _D ²⁰ + 5.5° init., -14° on standing	1.545 ²⁰ / ₄	106-7 (101)	.....	v. s.	2.11	.....
5393	col.-yel. pr. f. w.	.....	220 d.	d.	0.5 ¹⁵	s.	s. eth.
5395 5396	pr. f. w. ....	.....	156-8	.....	s.	.....	.....
5397 5398	pl. ....	.....	152-3	.....	v. s.	s. h.	i. eth.
5399	col. monocl. pr.	1.590 ²⁰ / ₄	130.5	135 d.	78.8 ²⁵ , 392.6 ^{97.5}	69.9 ^{29.7}	8 ²⁵ eth.; s. glac. ac. a., acet.; v. sl. s. bz.
5400	col. liq.	1.064 ^{25.2}	.....	225; 105-6 ¹⁴	i.	s.	s. eth.
5401 5402 5403	col. liq.	1.1606 ²⁰ / ₄	-19	205; 102 ¹⁷	i.	.....	s. eth.
5404	need. or pr. ....	.....	168	.....	.....	.....	.....
5405	col. pr. f. eth.-chl.	.....	128; 138-41	d.	v. s.	v. s.	v. s. eth.
5406 5407	col. rhomb. need. f. chl.	0.934 ²⁰ / ₄	108 (114); sinters 96	.....	s. h.	v. s.	v. s. eth.; s. ac. a.; sl. s. bz., chl.; i. pet. eth.
5408	liq. ....	.....	53 (57-60)	202 (196)	.....	v. sl. s.	v. sl. s. CCl ₄
5409	liq.	1.54 ²⁵ / ₂₅	33	215	.....	.....	.....
5410 5411	col. cr.	1.601 ²⁰ / ₄	196.3; 95 ²⁵	.....	.....	.....	.....
5412	col. need.	1.595	128.5	150 d.	144 ²⁶ , 411 ⁷⁹	v. s.	sl. s.
5413	cr. ....	.....	100	140 d.	v. s.	v. s.	6.0 c. eth.
5414	col. liq., 1.4362	1.128	134	d.	s., d. h.	.....	i. bz.
5415	col. liq., 1.4425	1.2226 ²⁰ / ₄	.....	253	s.	∞	= eth.
5416	liq., 1.4380....	1.075	.....	242	v. s.	∞	= eth.
			10.5	151 ¹⁰	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5417	Malic acid, O-acetyl-	See <i>Malic acid, acetate</i> .		
5418	—, α-methyl-	See <i>Citramalic acid</i> .		
5419	Malic amide.	See <i>Malamide</i> .		
5420	Malonamide	propanediamide*; malonic diamide	$\text{CH}_2(\text{CONH}_2)_2$...	102.09
5421	Malonic acid	propanedioic acid*; methanedicarboxylic acid	$\text{HOOCCH}_2\text{COOH}$	104.06
5422	—, diethyl ester.....	diethyl propanedioate*; ethyl malonate; malonic ester	$\text{CH}_2(\text{COOC}_2\text{H}_5)_2$...	160.17
5423	—, dimethyl ester.....	methyl malonate; dimethyl propanedioate*	$\text{CH}_2(\text{COOCH}_3)_2$...	132.11
5424	—, dipropyl ester.....	dipropyl propanedioate*; propyl malonate	$\text{CH}_2(\text{COOC}_3\text{H}_7)_2$...	188.22
5425	—, monoethyl ester, piperazinium salt	.....	$\text{C}_4\text{H}_{10}\text{N}_2 \cdot 2\text{HOOC}-\text{CH}_2\text{COOC}_2\text{H}_5$	350.37
5426	—, piperazinium salt.....	.....	$\text{C}_4\text{H}_{10}\text{N}_2 \cdot \text{C}_3\text{H}_4\text{O}_4$...	190.20
5427	—, acetyl- , diethyl ester	ethyl acetylmalonate; diethyl acetylpropanedioate*	$\text{CH}_3\text{COCH}-(\text{COOC}_2\text{H}_5)_2$	202.20
5428	—, allyl-	2-propenylpropanedioic acid*; 3-butene-1,1-dicarboxylic acid*	$\text{COOHCH}-(\text{CH}_2\text{CH}:\text{CH}_2)-\text{COOH}$	144.12
5429	—, —, diethyl ester.....	ethyl allylmalonate; diethyl (2-propenyl)propanedioate*; diethyl 3-butene-1,1-dicarboxylate*	$\text{CH}_2:\text{CHCH}_2\text{CH}-(\text{COOC}_2\text{H}_5)_2$	200.23
5430	—, amino	2-aminopropanedioic acid*...	$\text{COOHCH}(\text{NH}_2)-\text{COOH}$	119.08
5431	—, amyl- , diethyl ester	ethyl amylmalonate.....	$\text{CH}_3(\text{CH}_2)_4\text{CH}-(\text{COOC}_2\text{H}_5)_2$	230.30
5432	—, anilino- , ethyl ester	anilinomalonic ester; diethyl anilinomalonate	$\text{C}_6\text{H}_5\text{NHCH}-(\text{COOC}_2\text{H}_5)_2$	251.28
5433	—, benzylidene	2-phenyl-1,1-ethylenedicarboxylic acid	$\text{C}_6\text{H}_5\text{CH}:\text{C}-(\text{COOH})_2$	192.16
5434	—, benzyl- , diethyl ester	diethyl benzylpropanedioate*; ethyl benzylmalonate	$\text{C}_6\text{H}_5\text{CH}_2\text{CH}-(\text{COOC}_2\text{H}_5)_2$	250.29
5435	—, bromo	bromopropanedioic acid*...	$\text{BrCH}(\text{COOH})_2$...	182.97
5436	—, —, diethyl ester.....	diethyl bromopropanedioate*	$\text{BrCH}(\text{COOC}_2\text{H}_5)_2$	239.08
5437	—, butyl- , diethyl ester	ethyl <i>n</i> -butylmalonate.....	$\text{CH}_3(\text{CH}_2)_3\text{CH}-(\text{COOC}_2\text{H}_5)_2$	216.27
5438	—, sec-butyl- , diethyl ester	ethyl <i>sec</i> -butylmalonate.....	$\text{C}_2\text{H}_5(\text{CH}_3)\text{CHCH}-(\text{COOC}_2\text{H}_5)_2$	216.27
5439	—, chloro	chloropropanedioic acid*.....	$\text{CHCl}(\text{COOH})_2$...	138.51
5440	—, dibenzyl- , diethyl ester	diethyl 1,3-diphenyl-2,2-propanedicarboxylate	$(\text{C}_6\text{H}_5\text{CH}_2)_2\text{C}-(\text{COOC}_2\text{H}_5)_2$	340.40
5441	—, dibromo- , diethyl ester	diethyl dibromopropanedioate*	$\text{CBr}_2(\text{COOC}_2\text{H}_5)_2$...	317.98
5442	—, diethyl- , diethyl ester	diethyl diethylpropanedioate*	$(\text{C}_2\text{H}_5)_2\text{C}-(\text{COOC}_2\text{H}_5)_2$	216.27
5443	—, —, piperazinium salt	.....	$\text{C}_4\text{H}_{10}\text{N}_2 \cdot (\text{C}_2\text{H}_5)_2\text{C}(\text{COOH})_2$	246.30
5444	—, dihydroxy-	See <i>Mesozalic acid</i> .		
5445	—, dimethyl- , diethyl ester	diethyl dimethylpropanedioate*	$(\text{CH}_3)_2\text{C}-(\text{COOC}_2\text{H}_5)_2$	188.22

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5417							
5418							
5419							
5420	col. monoc. need.		170		8.3 ⁸	i.	i. eth.
5421	col. tricl.	1.631 $\frac{1.5}{4}$	135.6	d.	61.1 ¹⁰ , 73.5 ²⁰ , 92.6 ⁵⁰ 2.08 ²⁰	57 ²⁰	5.7 ¹⁵ eth.
5422	col. liq., 1.4143 ²⁰	1.055 $\frac{2.0}{4}$	-49.8	198.9 (94-6 ¹⁸)		∞	∞ eth.; s. chl., bz.
5423	col. liq., 1.41490 ¹⁷	1.1544 $\frac{2.0}{4}$	-62	181	v. sl. s.	∞	∞ eth.
5424	col. liq.	1.027 $\frac{0}{0}$		228.3			
5425	wh. cr.		144		s.	s. h.	i. eth.
5426	wh. cr.		180 (d.)		s.	s. h.	i. eth.
5427	liq.	1.080 ²³		240 (120 ¹⁷)			s. Na ₂ CO ₃ sol.
5428	tricl. f. eth.		103-5	d. 180	s.	s.	s. eth., bz.
5429	col. liq.	1.01475 ¹⁴		222-3 (110-2 ¹⁴)	i.	v. s.	v. s. eth.
5430	col. cr. (+1H ₂ O) f. w.		109 d.		sl. s.	sl. s.	
5431	col. liq., 1.4253		121-3 ⁶		i.	v. s.	v. s. eth.
5432	need.		44-5			v. s.	s. eth.
5433	pr. f. w.		d. 195 to cinnamic acid		s. h.	s.	sl. s. eth., CS ₂ , ac. a., chl., bz., lgr.; s. acet., et. acetate
5434	liq.	1.077 $\frac{1.5}{1.5}$		296-8	i.		
5435	need. f. eth.		112-3 d.			v. s.	v. s. eth.
5436	liq.	1.4022 $\frac{2.5}{4}$	-54	235 (125-7 ¹⁵)	i.	∞	∞ eth.
5437	col. liq., 1.425			235-40; 130-5 ²⁰	i.	v. s.	v. s. eth.
5438	col. liq., 1.4248	0.983 ¹⁵		224-5; 94-5 ³	v. sl. s.	v. s.	v. s. eth.
5439	pr.		133		v. s.	v. s.	v. s. eth.
5440	thk. oil.	1.093	13	243-6 ¹⁸		s.	s. eth.
5441	liq.			250-6 d. (103-6 ⁴)			
5442	col. liq., 1.42516 ^{16.6}	0.985 $\frac{2.0}{4}$ (0.990)		223	v. sl. s. (i)	∞	∞ eth.
5443	wh. cr.		80-1		s.	s.	i. eth.; s. h. acet.
5444							
5445	col. liq., 1.41049 ^{24.1}	0.9910 $\frac{2.5}{4}$		196.5 ⁷⁵³	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5446	Malonic acid, ethyl- ..	ethylpropanedioic acid*; 1, 1-propanedicarboxylic acid*	$C_2H_5CH(COOH)_2$	132.11
5447	—, —, diethyl ester.	ethyl ethylmalonate; ethyl-malonic ester	$C_2H_5CH-(COOC_2H_5)_2$	188.22
5448	—, ethylene- .	See <i>Vinaconic acid</i> .		
5449	—, (α-ethylpropyl)-, diethyl ester	ethyl <i>sec</i> -amylmalonate.	$(C_2H_5)_2CHCH-(COOC_2H_5)_2$	230.30
5450	—, heptyl-	heptylpropanedioic acid*; 1,1-octanedicarboxylic acid	$CH_3(CH_2)_6CH-(COOH)_2$	202.25
5451	—, hydroxy- .	See <i>Tartronic acid</i> .		
5452	—, isoamyl- , diethyl ester	ethyl isoamylmalonate.	$(CH_3)_2CH(CH_2)_2CH(COOC_2H_5)_2$	230.30
5453	—, isobutyl-	3-methyl-1,1-butanedicarboxylic acid*	$(CH_3)_2CHCH_2-CH(COOH)_2$	160.17
5454	—, —, diethyl ester.	ethyl isobutylmalonate.	$(CH_3)_2CHCH_2-CH(COOC_2H_5)_2$	216.27
5455	—, isopropyl- , diethyl ester	ethyl isopropylmalonate.	$(CH_3)_2CHCH-(COOC_2H_5)_2$	202.25
5456	—, keto- .	See <i>Mesoxalic acid</i> .		
5457	—, methyl- .	See <i>Isosuccinic acid</i> .		
5458	—, —, diethyl ester.	ethyl isosuccinate.	$CH_3CH-(COOC_2H_5)_2$	174.19
5459	—, —, dimethyl ester...	dimethyl methylpropanedioate*; methyl isosuccinate	$CH_3CH(COOCH_3)_2$	146.14
5459M	—, oxo- .	See <i>Mesoxalic acid</i> .		
5460	—, propyl-	propylpropanedioic acid*; 1, 1-butanedicarboxylic acid*	$C_3H_7CH(COOH)_2$	146.14
5461	—, —, diethyl ester. ....	.....	$C_3H_7CH-(COOC_2H_5)_2$	202.25
5462	Malonic anhydride (so-called).	See <i>Carbon suboxide</i> .		
5463	Malonic diamide .	See <i>Malonamide</i> .		
5464	Malonic dinitrile .	See <i>Malononitrile</i> .		
5465	Malonic ester, anilino- .	See <i>Malonic acid, anilino-, ethyl ester</i> .		
5466	—, ethyl- .	See <i>Malonic acid, ethyl-, diethyl ester</i> .		
5467	Malonic mononitrile .	See <i>Acetic acid, cyano-</i> .		
5468	—, methyl- .	See <i>Propionic acid, α-cyano-</i> .		
5469	Malononitrile	propanedinitrile*; methyl-ene cyanide; malonic dinitrile	$CH_2(CN)_2$	66.06
5470	Malourea .	See <i>Barbital</i> .		
5471	Maltobiose .	See <i>Maltose</i> .		
5472	Maltonic acid .	See <i>D-Gluconic acid</i> .		
5473	Maltose	malt sugar; maltobiose.	$C_{12}H_{22}O_{11} \cdot H_2O$...	360.31
5474	Malt sugar .	See <i>Maltose</i> .		
5475	Mandelic acid (<i>dl</i>).....	<i>dl</i> -phenylglycolic acid; <i>dl</i> - α -hydroxy- α -toluic acid	$C_6H_5CH(OH)-(COOH)$	152.14
5476	—, gentiobioside.	See <i>Amygdalic acid</i> .		
5477	—, <i>o</i>-amino- , lactam.	See <i>Oxindole, 3-hydroxy-</i> .		
5478	—, <i>p</i>-isopropyl- (<i>i</i>)	<i>i-p</i> -isopropylphenylglycolic acid	$(CH_3)_2CHC_6H_4-CHOHCOOH$	194.22
5479	Mandelonitrile (<i>dl</i>)....	<i>dl</i> -benzaldehyde cyanohydrin	$C_6H_5CH(OH)CN$..	133.14
5480	—, gentiobioside.	See <i>Amygdalin</i> .		
5481	D-Mannitol	<i>d</i> -mannite.....	$CH_2OH(CHOH)_4CH_2OH$	182.17
5482	—, hexanitrate.	nitromannite.....	$C_6H_8(NO_3)_6$	452.17
5483	D-Mannoheptitol .	See <i>Perseitol</i> .		
5484	D-Mannoheptose.....	.....	$C_6H_7(OH)_6CHO$...	210.18

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5446	col. rhomb. cr.		111.5	160 d.	s.	s.	s. eth., bz., chl., et. acetate.
5447	col. liq., 1.41802 ^{14.8} _α	1.004 ²⁰ ₂₀		211 ⁷⁴⁸ ; 95-7 ¹⁵	v. sl. s.	v. s.	v. s. eth.
5448							
5449	col. liq., 1.4275			242-5; 130 ¹⁶	v. sl. s.	v. s.	v. s. eth.
5450	cr. f. bz.		95		i.	v. s.	v. s. eth., acet.
5451							
5452	col. liq., 1.4255			240-2; 160-5 ⁴⁴	i.	v. s.	v. s. eth.
5453	cr.		107		v. s.	v. s.	v. s. eth.
5454	col. liq.	0.983 ¹⁷		225; 113-6 ¹	v. sl. s.	v. s.	v. s. eth.
5455	col. liq., 1.418	0.984 ^{2.5} ₄		211-5	v. sl. s.	v. s.	v. s. eth.
5456							
5457							
5458	col. liq., 1.41369 ^{18.7}	1.0192 ^{1.9} ₄		201.4	v. sl. s.	v. s.	v. s. eth.
5459	col. liq.	1.028 ^{2.5} _{2.5}		179	v. sl. s.	∞	eth.
5459M							
5460	pl. f. bz.		96	d.	45.6°	s.	s. eth., chl.; sl. s. bz.
5461	col. liq.	0.993		221	v. sl. s.	v. s.	v. s. eth.
5462							
5463							
5464							
5465							
5466							
5467							
5468							
5469	col. cr., 1.41463 ^{34.2}	1.049 ³⁴	32.1	220	13.3	40	20 eth.; 6.7 bz.
5470							
5471							
5472							
5473	fine col. need.	1.540	102.5 d.		108 ²⁵	v. sl. s. c.	i. eth.
5474							
5475	col. rhomb. f. bz.	1.361 ⁴ ; 1.300 ^{2.0} ₄	118.1	d.	16 ²⁰	53.6 ^{16.5}	s. eth.
5476							
5477							
5478			158				
5479	yel. oily liq.	1.124	-10 (22)	d. 170	i.	s.	s. eth.
5480							
5481	col. rhomb. need.	1.489 ^{2.0} ₄	166.1	295 ^{3.5}	15.6 ¹⁸	0.06 ¹⁴	i. eth.
5482	need.	1.604°	112	exp. 120	i.	2.9 ¹³	2.86° eth.
5483							
5484	need.		134-5		v. s.	sl. s.	

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5485	D-Mannose	seminose; carubiose	$\text{CH}_2\text{OH}(\text{CHOH})_4\text{CHO}$	180.16
5486	—, phenylhydrazone .....	.....	$\text{C}_6\text{H}_{12}\text{O}_5\text{NNHC}_6\text{H}_5$	270.28
5487	Margaric acid	heptadecanoic acid*; <i>n</i> -heptadecic acid; <i>n</i> -heptadecylic acid	$\text{CH}_3(\text{CH}_2)_{15}\text{COOH}$	270.45
5488	Margaronitrile	heptadecanenitrile*; cetyl cyanide; <i>n</i> -hexadecyl cyanide	$\text{CH}_3(\text{CH}_2)_{15}\text{CN}$...	251.45
5489	Marsh gas	See <i>Methane</i> .*		
5490	Meconic acid	3-hydroxy-4-keto-1,4-pyran-2,6-dicarboxylic acid	$\text{C}_7\text{H}_4\text{O}_7 \cdot 3\text{H}_2\text{O}$	254.15
5491	Meconidine .....	.....	$\text{C}_{21}\text{H}_{23}\text{NO}_4$	353.40
5492	Meconin	5,6-dimethoxyphthalide	$\text{C}_{10}\text{H}_{10}\text{O}_4$	194.18
5493	Melam .....	.....	$\text{C}_6\text{H}_9\text{N}_{11}$	235.22
5494	Melamine	2,4,6-triamino- <i>s</i> -triazine; cyanurotriamide	$\text{N}:\text{C}(\text{NH}_2)\text{N}:\text{C}-(\text{NH}_2)\text{N}:\text{C}(\text{NH}_2)$	126.13
5495	Melampyrin	See <i>Dulcitol</i> .		
5496	Melaniline	See <i>Guanidine</i> , diphenyl-.		
5497	Melene .....	.....	$\text{C}_{30}\text{H}_{60}$	420.79
5498	Meletin	See <i>Quercetin</i> .		
5498M	Melibiose .....	.....	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	342.30
5499	Melilotic acid	<i>o</i> -hydroxyhydrocinnamic acid; <i>o</i> -hydrocoumaric acid	$\text{HOC}_6\text{H}_4\text{CH}_2\text{CH}_2\text{COOH}$	166.17
5500	Melissic acid .....	.....	$\text{C}_{30}\text{H}_{61}\text{COOH}$	466.81
5501	Melissyl alcohol	See <i>Myricyl alcohol</i> .		
5502	Mellitic acid	benzenehexacarboxylic acid*	$\text{C}_6(\text{COOH})_6$	342.17
5503	—, hexahydro-.	See 1,2,3,4,5,6-Cyclohexanhexacarboxylic acid*.	$\text{C}_6\text{H}_2(\text{COOH})_4$	254.15
5504	Mellophanic acid	1,2,3,4-benzenetetracarboxylic acid*		
5505	1,8(9)-<i>m</i>-Menthadiene	See <i>Sylvestrene</i> .		
5506	1,3-<i>p</i>-Menthadiene	See <i>α-Terpinene</i> .		
5507	1,4(8)-<i>p</i>-Menthadiene	See <i>Terpinolene</i> .		
5508	1,5-<i>p</i>-Menthadiene	See <i>α-Phellandrene</i> .		
5509	1(7),2-<i>p</i>-Menthadiene	See <i>β-Phellandrene</i> .		
5510	1,8(9)-<i>p</i>-Menthadiene	See <i>Limonene</i> .		
5511	3,6-<i>p</i>-Menthadiene-2,5	-dione. See <i>Thymoquinone</i> .		
5512	6,8(9)-<i>p</i>-Menthadien-2	-one. See <i>Carvone</i> .		
5513	<i>p</i>-Menthane	4-isopropyl-1-methylcyclohexane; hexahydro- <i>p</i> -cymene; terpane; menthophthene	$\text{CH}_3\text{C}_6\text{H}_{10}\text{CH}-(\text{CH}_3)_2$	140.26
5514	—, 1,4-epoxy-.	See 1,4-Cineole.		
5515	—, 1,8-epoxy-.	See <i>Cineole</i> .		
5516	1,8-<i>p</i>-Menthenediol	See <i>Terpinol</i> .		
5517	2-<i>p</i>-Menthanol	See <i>Carvomenthol</i> .		
5518	3-<i>p</i>-Menthanol	See <i>Menthol</i> .		
5519	3-<i>p</i>-Menthانون	See <i>Menthone</i> .		
5520	<i>d</i>-Menthene	<i>d</i> -3- <i>p</i> -menthene; <i>d</i> -4-isopropyl-1-methyl-3-cyclohexene	$\text{C}_{10}\text{H}_{18}$	138.25
5521	1-<i>p</i>-Menthene	See <i>Carvomenthene</i> .		
5522	—, 6,8-epoxy-.	See <i>dl</i> -Pinol.		
5523	<i>i</i>-1-<i>p</i>-Menthene-6,8-di	ol. See <i>Pinol</i> , hydrate.		
5524	1-<i>p</i>-Menthen-8-ol	See <i>α-Terpineol</i> .		
5525	8(9)-<i>p</i>-Menthen-2-ol	See <i>Carveol</i> , dihydro-.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5485	col. rhomb. pr. f. al.	1.539	132	248 ¹⁷	v. sl. s.	i. eth.
5486	nearly col.	186-8	i.	s. h.
5487	col. pl.	0.8578 ⁶⁰ / ₄	60.66 (58-9)	227 ¹⁰⁰	i.	25.2 ²⁸	v. s. eth.
5488	col. cr.	1.4448 ²⁵ / ₀	34-35.5	i.	sl. s.	sl. s. eth.
5489	rhomb. tab.	-3H ₂ O, 100	d.	25 ¹⁰⁰	sl. s.	sl. s. eth.; v. sl. s. chl.
5490					i.
5491					0.14 c.; 4.5 h.	s.	s. eth., bz., chl., amyl al.
5492	yel. amor.	58	155 subl.	i.	sl. s.	s. KOH
5493	col. need.	101	sl. s.	v. sl. s. h.	i. eth.
5494	or. powd.	1.573 ²⁵⁰	d.	subl.
5495	monocl. pr., 1.490, 1.743, 1.872	<250
5496	col.	0.890	63	380	i.	3.6 ⁷⁸	v. sl. s. eth., bz.
5497							
5498							
5498M	cr.	85	5 ¹⁸	s.	s. eth.
5499	pr. f. w.	83
5500	col. sc. or need. f. al.	91.9-2.1	i.	sl. s. c., s. h.	v. sl. s. eth.
5501	col. need. f. al.	286	d.	v. s.	s.	s. H ₂ SO ₄
5502							
5503							
5504	cr. f. w.	238 d.	s.
5505	col. liq., 1.437.	0.793 ²⁰ / ₀	169-70 (164-7)	i.	v. s.	v. s. eth.
5506							
5507							
5508							
5509							
5510							
5511							
5512							
5513							
5514							
5515	col. liq., 1.44813 ^{20.4}	0.8073	168	s.	s. eth., bz.
5516							
5517							
5518							
5519							
5520							
5521							
5522							
5523							
5524							
5525							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5526	3-<i>p</i>-Menthen-2-one.	See <i>Carvenone</i> .		
5527	8(9)-<i>p</i>-Menthen-2-one.	See <i>Carvone, dihydro-</i> .		
5528	4(8)-<i>p</i>-Menthen-3-one.	See <i>Pulegone</i> .		
5529	1-Menthol	<i>l</i> -3- <i>p</i> -menthanol; <i>l</i> -hexahydrothymol	$C_{10}H_{19}OH$	156.26
5530	—, α -methoxyisobutyrate.	See <i>Isobutyric acid</i> α -methoxy-,	3- <i>p</i> -menthyl ester.	
5531	Menthonaphthene.	See <i>p</i> -Menthane.		
5532	1-Menthone	<i>l</i> -3- <i>p</i> -menthanone	$C_{10}H_{18}O$	154.25
5533	Merchurochrome 220 soluble	dibromohydroxymercurifluorescein disodium salt	$C_{20}H_{18}Br_2HgNa_2 \cdot O_6 \cdot 3H_2O$	804.75
5534	Mercury, diethyl-*	mercury diethyl; mercury ethyl	$Hg(C_2H_5)_2$	258.73
5535	—, di-2-furyl-	2,2'-mercuridifuran	$C_4H_3O \cdot Hg \cdot C_4H_3O$	334.74
5536	—, diisobutyl-		$[(CH_3)_2CHCH_2]_2Hg$	314.84
5537	—, dimethyl-*	mercury methyl	$Hg(CH_3)_2$	230.68
5538	—, di-1-naphthyl-*	mercury di- α -naphthyl	$Hg(C_{10}H_7)_2$	454.92
5539	—, diphenyl-*	mercury diphenyl; mercury phenyl	$(C_6H_5)_2Hg$	354.81
5540	—, dipropyl-*		$(CH_3CH_2CH_2)_2Hg$	286.78
5541	—, di-<i>o</i>-tolyl-		$(CH_3C_6H_4)_2Hg$	382.86
5542	—, di-<i>p</i>-tolyl-		$Hg(C_6H_4CH_3)_2$	382.86
5542M	Mercury chloride, <i>n</i>-butyl-	<i>n</i> -butylmercuric chloride . . .	$n-C_4H_9HgCl$	293.18
5543	—, ethyl-*	ethylmercuric chloride	C_2H_5HgCl	265.13
5544	—, methyl-*		CH_3HgCl	251.10
5545	—, phenyl-*	chloromercuribenzene	C_6H_5HgCl	313.17
5546	—, <i>p</i>-tolyl-	<i>p</i> -chloromercuritoluene	$CH_3C_6H_4HgCl$	327.19
5547	Mercury mercaptide		$Hg(SC_2H_5)_2$	322.85
5548	Mesaconic acid	methylfumaric acid	$HOOC(CH_3)-C:CHCOOH$	130.10
5549	Mescaline	mezcaline	$C_{11}H_{17}NO_3$	211.26
5550	Mesidine	2,4,6-trimethylaniline	$(CH_3)_3C_6H_2NH_2$	135.20
5551	Mesitol	2,4,6-trimethylphenol; 2-hydroxymesitylene	$(CH_3)_3C_6H_2OH$	136.19
5552	Mesitylene	1,3,5-trimethylbenzene; <i>sym</i> -trimethylbenzene	$(CH_3)_3C_6H_3$	120.19
5553	—, α-bromoisobutyl-	yl-. See <i>Isobutyrophenone</i> , α -b	romo-2,4,6-trimethyl-	
5554	—, 2,4-dihydroxy-	See <i>Mesorcinol</i> .		
5555	—, 2,4-dinitro-	1,3,5-trimethyl-2,4-dinitrobenzene	$(NO_2)_2C_6H(CH_3)_3$	210.19
5556	—, hexahydro-	See <i>Cyclohexane</i> , 1,3,5-trimethyl	<i>l</i> -	
5557	—, 2-hydroxy-	See <i>Mesitol</i> .		
5558	—, 2-nitro-	1,3,5-trimethyl-2-nitrobenzene	$(CH_3)_3C_6H_2NO_2$	165.19
5559	—, 2,4,6-tribromo-		$Br_3C_6(CH_3)_3$	356.91

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5526							
5527							
5528							
5529	col. trim.; liq., 1.460 ²² ; solid, 1.497, 1.476	0.890 ¹⁵ ₁₅	35.5; 42.5	215	0.04 c.	v. s.	v. s. eth.; s. chl., pet. eth., glac. ac. a.
5530							
5531							
5532	col. liq.	0.896	-6.6	207	sl. s.	∞	∞ eth., CS ₂ + bz.
5533	irid. grn. sc.				s.	0.015	i. eth., chl.
5534	1.53990 ^{23,2}	2.4660 ²⁰		159; 57 ¹⁶	i.	sl. s.	s. eth.
5535	col. cr. f. w.-acet.		114	156 ⁷	s. h. +acet.		
5536	col. liq.	1.835 ¹⁵	volat. 100	205-7	v. sl. s.	s.	s. eth.
5537	col. liq., 1.5327 ^{22,2}	2.95412 ^{22,2} ₄		95	i.	s.	s. eth., lgr.
5538	leaf. f. bz.	1.944	243	d.	i.	sl. s. h.	sl. s. eth.; m. chl., CS ₂
5539	rhomb. need.	2.318	121.8	204 ¹⁰ >306 d.	i.	sl. s. h.	sl. s. eth.; s. bz., chl., CS ₂
5540	col. mobile liq.	2.124 ¹⁶		189-91	i.	s.	v. s. eth.
5541	tricl. f. bz.		107	219 ¹⁴			s. h. bz.
5542	col. need. f. bz.		235-9	d.	i.	sl. s.	i. eth.; s. CS ₂ , h. bz.
5542M	wh. silv. irid. leaf.		127		i.	sl. s. c.	s. eth.
5543	silv. irid. leaf.	3.5	192.5		i.	sl. s. c., v. s. h.	s. eth.
5544	wh. cr., disagreeable odor	4.063	170	volat. 100			
5545	wh. satiny leaf.		251			sl. s. h.	sl. s. eth., bz., pyr.
5546	rhomb. silky tab.		233		i.	sl. s. h.	i. eth.; sl. s. bz., chl., acet., pyr.
5547	leaf. f. al.		76	d.	v. sl. s.	5.29 h.	6.7 ³⁶ eth.
5548	col. need. f. w. or al.	1.466	202-4	250 d.	2.7 ¹⁸ , 118 ¹⁰⁰	24.14 ¹⁷ 90%	s. eth.; v. sl. s. bz., chl., CS ₂ , pet. eth.
5549	col. alk. oil.			180 ¹²	s.	s.	i. eth.; s. chl., bz.
5550	liq.	0.963	<-15	233			
5551	need.		69 (72)	220	v. sl. s.	v. s.	v. s. eth.
5552	rhomb., col. liq., 1.4967	0.8634 ²⁰ ₄	-52.7	164.6	i.	s.	s. eth.
5553							
5554							
5555	rhomb. f. al.		86		i.	s. h.	
5556							
5557							
5558	rhomb. pr. f. al.		44	255		v. s. h.	
5559	tricl. need. f. al.		224		i.	v. sl. s. h.	s. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5560	Mesitylene, 2,4,6-tri-nitro-	.....	$(\text{NO}_2)_3\text{C}_6(\text{CH}_3)_3$	255.19
5561	Mesitylene-<i>eso</i>-carboxylic acid.	See <i>β-Isodurylic acid.</i>		
5562	Mesitylenic acid	3,5-dimethylbenzoic acid; 3,5-xylic acid; <i>sym-m</i> -xylic acid	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{COOH}$	150.17
5563	Mesityl oxide	4-methyl-3-penten-2-one*; isopropylideneacetone	$(\text{CH}_3)_2\text{C}:\text{CH}-\text{COCH}_3$	98.14
5564	Mesocystine.	See <i>Cystine, meso-</i> .		
5565	Mesorcinol	2,4,6-trimethylresorcinol; 2,4-dihydroxymesitylene	$(\text{CH}_3)_3\text{C}_6\text{H}(\text{OH})_2$	152.19
5566	Mesotartaric acid.	See <i>i-Tartaric acid.</i>		
5567	Mesoxalic acid	dihydroxy- or oxopropanedioic acid*; dihydroxy- or ketomalonic acid	$(\text{HO})_2\text{C}(\text{COOH})_2$ or $\text{OC}(\text{COOH})_2$	136.06 (118.05)
5568	—, diethyl ester	diethyl oxopropanedioate*; ethyl ketomalonate; ethyl mesoxalate	$\text{CO}(\text{COOC}_2\text{H}_5)_2$	174.15
5569	—, diethyl ester hydrate	diethyl dihydroxypropanedioate*; ethyl dihydroxymalonate	$(\text{HO})_2\text{C}-\text{COOC}_2\text{H}_5)_2$	192.17
5570	Metaacetaldehyde.	See <i>Metalddehyde.</i>		
5572	Metacrolein	.....	$(\text{C}_3\text{H}_4\text{O})_3$	168.19
5573	Metadiazine.	See <i>Pyrimidine.</i>		
5574	Metaformaldehyde.	See <i>Polyoxymethylene.</i>		
5575	Metalddehyde.	metaacetaldehyde	$(\text{C}_2\text{H}_4\text{O})_{4-6}$	(44-.05) ₄₋₆
5576	Metanilic acid	<i>m</i> -aminobenzenesulfonic acid; <i>m</i> -anilinesulfonic acid	$\text{NH}_2\text{C}_6\text{H}_4\text{SO}_3\text{H} \cdot \frac{1}{2}\text{H}_2\text{O}$	200.21
5577	Metastyrene	.....	$(\text{C}_8\text{H}_8)_2$	(104-.14) ₂
5578	Metathiazole.	See <i>Thiazole.</i>		
5579	Methacetin.	See <i>p-Acetaniside.</i>		
5579M	Methacrolein.	See <i>Acrolein, α-methyl-</i> .		
5580	Methacrylic acid	2-methylpropenoic acid*; α -methylacrylic acid	$\text{CH}_2:\text{C}(\text{CH}_3)-\text{COOH}$	86.09
5580D	—, butyl ester	<i>n</i> -butyl methacrylate	$\text{CH}_2:\text{C}(\text{CH}_3)-\text{COOC}_4\text{H}_9$	142.19
5580G	—, ethyl ester	ethyl methacrylate	$\text{CH}_2:\text{C}(\text{CH}_3)-\text{COOC}_2\text{H}_5$	114.14
5580K	—, isobutyl ester	isobutyl methacrylate	$\text{CH}_2:\text{C}(\text{CH}_3)\text{COO}-\text{CH}_2\text{CH}(\text{CH}_3)_2$	142.19
5580N	—, isopropyl ester	isopropyl methacrylate	$\text{CH}_2:\text{C}(\text{CH}_3)-\text{COOCH}(\text{CH}_3)_2$	128.17
5580R	—, methyl ester	methyl methacrylate	$\text{CH}_2:\text{C}(\text{CH}_3)-\text{COOCH}_3$	100.11
5580U	—, propyl ester	propyl methacrylate	$\text{CH}_2:\text{C}(\text{CH}_3)-\text{COOC}_3\text{H}_7$	128.17
5581	Methanal*	See <i>Formaldehyde.</i>		
5582	Methanamide*	See <i>Formamide.</i>		
5583	Methanamidine, amin	o-*. See <i>Guanidine.</i>		
5584	Methane*	marsh gas; methyl hydride	CH_4	16.04
5585	—, acetylbenzoyl-	See <i>Acetone, benzoyl-</i> .		
5586	—, amino-	See <i>Methylamine*</i> .		
5587	—, 4-amino-4',4''-bi	See <i>Aniline, benzyl-</i> .		
5588	—, aminodiphenyl-	See <i>Aniline, benzyl-</i> .		
5589	—, α -aminodiphenyl-	See <i>Benzohydrylamine.</i>		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5560	tricl. need. f. al.	.....	230-2	exp. 415	.....	i. c., sl. s. h.	sl. s. h. eth., acet.
5561	monocl. f. al.	.....	166	subl.	v. sl. s.	v. s.	v. s. eth.
5562							
5563	col. oily liq., 1.446 ¹⁶	0.8539 ²⁰ / ₄	-59	128.7 (131.4)	3.0	∞	= eth.
5564	leaf. ....	.....	150	275.5	sl. s. c.	v. s.	v. s. eth.
5565							
5566	col. deliq. need.	.....	121 sl. d.	.....	v. s.	s.	s. eth.
5567							
5568	lt. yel.-grn. oil, 1.41865 ^{15.6}	1.119 ²⁰ / ₂₀	ca.-30	ca.-220; 115 ²⁹	.....	s.	s. eth.
5569	col. pl. f. bz.	.....	57	ca. 200	i.	.....	.....
5570	need. ....	.....	46	170	v. sl. s. h.	s.	s. eth.
5572							
5573	col. tetr. need. or pr. f. al., 1.530, 1.430	.....	246.2 (sealed tube)	subl. 112-5	i.	1.8 ⁷⁰	0.535 eth.
5574							
5575	need (anh.); tricl. pr.	.....	d.	.....	0.67 ²⁰	2.92 ^{12.5}	v. sl. s. eth.
5576	vitreous.	1.054 ¹³	d.	.....	i.	i.	v. sl. s. eth.
5577							
5578	col. pr., 1.43143	1.015 ²⁰ / ₄	16	163	s.	∞	∞ eth.
5579							
5579M	col. liq., 1.425 ^{15.6}	0.895 ²⁰ / ₄	.....	163	i.	∞	∞ eth.
5580							
5580D	col. liq., 1.414 ²⁰	0.907 ²⁰ / ₄	.....	117	v. sl. s.	∞	∞ eth.
5580G	col. liq., 1.418 ²⁴	0.889 ^{16.6} / _{16.6}	.....	155	i.	∞	∞ eth.
5580K	col. liq., 1.412 ²⁴	0.890 ²⁰ / ₄	.....	127	i.	∞	∞ eth.
5580N	col. liq., 1.413 ²⁰	0.936 ²⁰ / ₄	ca.-50	100	v. sl. s.	∞	∞ eth.
5580R	col. liq., 1.420 ^{15.6}	0.902 ^{16.6} / _{16.6}	.....	141	i.	∞	∞ eth.
5580U	col. gas.	0.415 ⁻¹⁶⁴ ; 0.7168 ⁹ g/l	-184	-161.5	9 ²⁰ cm ³	60 cm ³	91 ²⁰ cm ³ eth.
5581							
5582	<i>N,N,N',N'</i> , tetra methyl.	.....	.....	.....	.....	.....	.....
5583							
5584							
5585							
5586							
5587							
5588							
5589							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5590	Methane, aminotriphenyl-	nyl-. See <i>Aniline, benzohydro-</i>	<i>l</i> -	
5591	—, amyldimethyl-	See <i>Heptane, 2-methyl-</i> *		
5592	—, amylethylmethyl-	— See <i>Octane, 3-methyl-</i> *		
5593	—, benzoyltriphenyl-	— See <i>β-Benzopinacolin</i> .		
5594	—, benzyltriphenyl-	See <i>Ethane, 1,1,1,2-tetraphenyl-</i> *		
5595	—, 4,4'-bisdimethylaminotriphenyl-	See <i>Aniline, p,p'-benzylidene</i>	<i>bis-N</i> ,	
5596	—, bis(2,4-dinitrophenyl)-	2,2',4,4'-tetranitroditan.....	$[(\text{NO}_2)_2\text{C}_6\text{H}_3]_2\text{CH}_2$	348.23
5597	—, bromo- *	See <i>Methyl bromide</i> .		
5598	—, bromotrichloro- *		CBrCl_3	198.30
5599	—, butylethylmethyl-	1. See <i>Heptane, 3-methyl-</i> *		
5600	—, sec-butylethylmethyl-	See <i>Hexane, 3,4-dimethyl-</i> *		
5601	—, tert-butyltrimethyl-	See <i>Butane, 2,2,3,3-tetramethyl-</i> *		
5602	—, isobutyltrimethylchloro- *	1-. See <i>Pentane, 2,2,4-trimethyl-</i> *		
5603	—, chloro- *	See <i>Methyl chloride</i> .		
5604	—, chloro(chloromethyl)- *	See <i>Ether, bischloromethyl-</i>	CHClF_2	86.48
5604M	—, chlorodifluoro- *	yl-. See <i>sec-Butyl chloride</i> .		
5605	—, chloroethylmethyl-	See <i>Ether, chloromethyl methyl-</i>		
5606	—, chloromethoxy- *		CClF_3	104.47
5606M	—, chlorotrifluoro- *	See <i>tert-Butyl chloride</i> .	$(\text{C}_6\text{H}_5)_3\text{CCl}$	278.77
5607	—, chlorotrimethyl-			
5608	—, chlorotriphenyl-			
5609	—, cyclohexyl-	See <i>Cyclohexane, methyl-</i>		
5610	—, 4,4'-diaminodiphenyl-	enyl-. See <i>Aniline, p,p'-methylene-</i>	$\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_4\text{NH}_2)_2$	274.35
5611	—, p,p'-diaminotriphenyl-	<i>p,p'</i> -benzaldianiline; 4,4'-diaminotritan	CH_2N_2	42.04
5613	—, diazo- *	azimethylene.....		
5614	—, dibenzoyl-	1,3-diphenyl-1,3-propanedione	$(\text{C}_6\text{H}_5\text{CO})_2\text{CH}_2$	224.25
5615	—, dibromo- *	See <i>Methylene bromide</i> .		
5616	—, dichloro- *	See <i>Methylene chloride</i> .		
5617	—, dichlorodifluoro- *	difluorodichloromethane*	CCl_2F_2	120.92
5618	—, dichlorodimethyl-	— See <i>Propane, 2,2-dichloro-</i> *	CHCl_2F	102.93
5619	—, dichlorofluoro- *			
5620	—, diethoxy-	formaldehyde diethylacetal; methylene diethyl ether; diethyl formal; ethylal	$\text{CH}_2(\text{OC}_2\text{H}_5)_2$	104.15
5621	—, diethyldimethyl-	See <i>Pentane, 3,3-dimethyl-</i> *		
5622	—, diethylisopropyl-	See <i>Pentane, 3-ethyl-2-methyl-</i> *		
5623	—, diethylmethyl-	See <i>Pentane, 3-methyl-</i> *		
5624	—, diethylpropyl-	See <i>Hexane, 3-ethyl-</i> *		
5624M	—, difluoro- *	See <i>Methylene fluoride</i> .		
5625	—, 4,4'-dihydroxydiphenyl-	<i>p,p'</i> -methylenediphenol.....	$\text{HOC}_6\text{H}_4\text{CH}_2\text{C}_6\text{H}_4\text{OH}$	200.23
5626	—, diisobutyl-	See <i>Heptane, 2,6-dimethyl-</i> *		
5627	—, diisopropyl-	See <i>Pentane, 2,4-dimethyl-</i> *		
5628	—, dimethoxy- *	formaldehyde dimethylacetal; methylene dimethyl ether; formal; methylal	$\text{CH}_2(\text{OCH}_3)_2$	76.09
5629	—, dimethyl-	See <i>Propane</i> *		
5630	—, dimethylene-	See <i>Propadiene</i> *		
5631	—, dimethylpropyl-	See <i>Pentane, 2-methyl-</i> *		
5632	—, di-1-naphthyl-		$(\text{C}_{10}\text{H}_7)_2\text{CH}_2$	268.34
5633	—, di-2-naphthyl-		$(\text{C}_{10}\text{H}_7)_2\text{CH}_2$	268.34
5634	—, dinitro- *		$\text{CH}_2(\text{NO}_2)_2$	106.04

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5590							
5591							
5592							
5593							
5594							
5595	<i>N</i> -dimethyl-						
5596	yel. pr. f. glac. ac. a.	.....	172	.....	.....	i.	i. eth.; s. alk.; sl. s. bz.
5597							
5598	col. liq., 1.5300	1.959 ¹⁵	-21	104.07	i.	∞	∞ eth.
5599							
5600							
5601							
5602							
5603							
5604							
5604M	col. gas.	3.87 ⁹	-146	-40.8	s. ....	.....	.....
5605							
5606							
5606M	col. gas. ....	.....	-181	-80	.....	.....	.....
5607							
5608	col. need. ....	.....	112 (106-9)	310	i., d.	sl. s.	sl. s. eth.; v. s. CS ₂ , bz.
5609							
5610							
5611	col. cr. f. eth. ....	.....	139 (136-7)	.....	v. sl. s.	v. s.	v. s. eth.; s. chl., lgr.
5613	yel. pois. gas at ord. temp.	.....	-145	-23; exp. 200	d.	s.	s. eth.
5614	rhomb. ....	.....	72-3; 78	219-21 ¹⁸	v. sl. s.	4.43 ^{19,5}	v. s. eth.; s. chl.
5615							
5616							
5617	col. gas.	1.486 ⁻³⁰	-160	-28	i.	s.	s. eth.
5618							
5619	col. liq. or gas.	1.421 ⁹	-127	8.9	i.	s.	s. eth.
5620	.....	0.83465 ¹⁵	-66.5	89	9.1 ¹⁸	.....	.....
5621							
5622							
5623							
5624							
5624M							
5625	leaf. or need. f. h. w.	.....	158	subl.	.....	s.	s. eth., alk., chl.; i. CS ₂
5626							
5627							
5628	col. liq., 1.35344	0.8560	-104.8	44	v. s.	∞	∞ eth.
5629							
5630							
5631							
5632	sm. pr. f. al. ....	.....	109 (107-8)	270 ¹⁴ ; dist. >360	0.83, 6.67 ⁷⁸	.....	s. eth., chl., bz.
5633	need. f. al. or eth.	.....	93	.....	i.	v. s.	s. bz.
5634	yel. unst. oil. ....	.....	liq. at -15	100 exp.	s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5635	Methane, diphenyl-	benzylbenzene; ditan.....	$(C_6H_5)_2CH_2$	168.23
5636	—, —, <i>o</i> -carboxylic acid.	See <i>Benzoic acid, o</i> -benzyl-.		
5637	—, diphenylene-	See <i>Fluorene</i> .		
5638	—, diphenyl-<i>m</i>-tolyl-	3-methyltritan.....	$CH_3C_6H_4CH-(C_6H_5)_2$	258.35
5639	—, diphenyl-<i>p</i>-tolyl-	4-methyltritan.....	$CH_3C_6H_4CH-(C_6H_5)_2$	258.35
5640	—, dipropoxy-*	formaldehyde dipropyl acetal; methylene dipropyl ether	$CH_2(OC_3H_7)_2$	132.20
5641	—, ethyl dimethyl-	See <i>Butane, 2-methyl-*</i> .		
5642	—, <i>p</i>-ethyl diphenyl-	See <i>Benzene, 1-benzyl-4-ethyl-</i> .		
5643	—, ethyl dipropyl-	See <i>Heptane, 4-ethyl-*</i> .		
5644	—, ethyl isobutyl-	See <i>Hexane, 2-methyl-*</i> .		
5645	—, ethyl isobutylmet	hyl-. See <i>Hexane, 2,4-dimethyl</i>	yl-*	
5646	—, ethyl isopropylme	thyl-. See <i>Pentane, 2,3-dimeth</i>	yl-*	
5647	—, ethyl methylprop	yl-. See <i>Hexane, 3-methyl-*</i> .		
5648	—, ethyl trimethyl-	See <i>Butane, 2,2-dimethyl-*</i> .		
5649	—, fluoro-*	See <i>Methyl fluoride</i> .		
5650	—, <i>p</i>-hydroxy diphen	yl-. See <i>Phenol, p</i> -benzyl-.		
5651	—, iodo-*	See <i>Methyl iodide</i> .		
5652	—, isopropyl dimeth	yl-. See <i>Butane, 2,3-dimethyl-*</i> .		
5653	—, isopropyl methyl	propyl-. See <i>Hexane, 2,3-dimethyl</i>	ethyl-*	
5654	—, isopropyl trimeth	yl-. See <i>Butane, 2,2,3-trimethyl</i>	yl-*	
5655	—, methoxy-*	See <i>Methyl ether</i> .		
5656	—, methyl dipropyl-	See <i>Heptane, 4-methyl-*</i> .		
5657	—, methyl dithio-*	See <i>Methyl disulfide</i> .		
5657H	—, methyl sulfinyl-*	See <i>Methyl sulfoxide</i> .		
5657R	—, methyl sulfonyl-*	See <i>Methyl sulfone</i> .		
5658	—, methyl thio-*	See <i>Methyl sulfide</i> .		
5659	—, 1-naphthyl-phenyl-	1-benzyl-naphthalene.....	$C_{10}H_7CH_2C_6H_5$	218.28
5660	—, 2-naphthyl-phenyl-	2-benzyl-naphthalene.....	$C_{10}H_7CH_2C_6H_5$	218.28
5661	—, nitro-*		CH_3NO_2	61.04
5662	—, oxo-	See <i>Formaldehyde</i> .		
5663	—, α-oxodiphenyl-	See <i>Benzophenone</i> .		
5664	—, phenyl-	See <i>Toluene</i> .		
5665	—, phenyl di- <i>p</i> -tolyl-	4,4'-dimethyltritan.....	$C_6H_5CH-(C_6H_4CH_3)_2$	272.37
5666	—, phenyl-<i>m</i>-tolyl-	<i>m</i> -benzyltoluene.....	$C_6H_5CH_2C_6H_4CH_3$	182.25
5667	—, phenyl-<i>p</i>-tolyl-	<i>p</i> -benzyltoluene.....	$C_6H_5CH_2C_6H_4CH_3$	182.25
5668	—, tetrabromo-*	See <i>Carbon tetrabromide</i> .		
5669	—, tetrachloro-*	See <i>Carbon tetrachloride</i> .		
5670	—, tetraethoxy-*	See <i>Orthocarbonic acid, tetraethyl ester</i> .		
5670M	—, tetrafluoro-*	See <i>Carbon tetrafluoride</i> .		
5671	—, tetraiodo-*	See <i>Carbon tetraiodide</i> .		
5672	—, tetramethyl-	See <i>Propane, 2,2-dimethyl-*</i> .		
5673	—, <i>p, p'</i>-tetramethyl	diaminodiphenyl-. See <i>Aniline, p, p'-methylenebis</i>	is [N, N-	
5674	—, <i>p</i>-tetramethyl di	aminotriphenyl-. See <i>Aniline, p, p'-benzylidenebis-N, N-</i>		
5675	—, tetranitro-*		$C(NO_2)_4$	196.04
5676	—, tetraphenyl-		$(C_6H_5)_4C$	320.41
5677	—, tetrapropoxy-	See <i>Orthocarbonic acid, tetrapropyl ester</i> .		
5678	—, triaminotriphenyl-	yl-. See <i>Leucaniline</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5635	col. rhomb. need., 1.57884 ¹⁷	1.0008 ²⁶ / ₄	26-7	261-2 (264.7)	i.	s.	s. eth., chl.
5636							
5637							
5638	pr. f. al.	1.07 ¹⁶	62	354 ⁷⁰⁸	.....	sl. s.	v. s. eth.; s. bz., chl., ac. a., lgr.
5639	pr. f. me. al. ....	.....	71	360	i.	s.	v. s. eth., bz., ac. a.; s. lgr.
5640	.....	0.835 ²⁰ / ₄	.....	137-40	.....	.....	.....
5641							
5642							
5643							
5644							
5645							
5646							
5647							
5648							
5649							
5650							
5651							
5652							
5653							
5654							
5655							
5656							
5657							
5657H							
5657R							
5658							
5659	monocl. leaf. f. al.	1.165 ⁰	59	350	.....	1.26 ¹⁶ 2.62 ⁷⁸	35.7 c. eth.; s. bz., CS ₂ , chl.
5660	monocl. pr. f. al.	1.176	35.5	350	i.	2.3 ¹⁵	v. s. bz.
5661	col. liq., 1.3818 ²⁰	1.130 ²⁰ / ₄	frz. -29	101	9-10 cc.	s.	s. eth., alk.
5662							
5663							
5664							
5665	need. f. me. al.	.....	56	.....	.....	s.	v. s. eth., CS ₂ , bz., chl.
5666	liq.	0.997 ^{17.5}	.....	275 ⁷⁴⁷	.....	s.	s. eth.
5667	liq.	0.995 ^{17.5}	-30	285-6 (279-80)	.....	s.	s. eth.; v.s. chl.
5668							
5669							
5670							
5670M							
5671							
5672							
5673	dimethyl-						
5674	dimethyl-						
5675	col. liq., 1.43976 ^{16.9} He	1.650 ¹³	13	125.7	i.	s.	s. eth.
5676	col. rhomb. f. bz.	.....	285	431	i.	i.	i. eth., lgr., ac. a.; s. h. bz.
5677							
5678							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5679	Methane, tribenzoyl-.....		(C ₆ H ₅ CO) ₃ CH.....	328.35
5680	—, tribromo-*	See Bromoform.		
5681	—, tribromonitro-*	See Bromopicrin.		
5682	—, trichloro-*	See Chloroform.		
5683	—, trichlorofluoro-*		CCl ₃ F.....	137.38
5684	—, trichloronitro-*	See Chloropicrin.		
5685	—, triethoxy-*	See Orthoformic acid, triethyl ester.		
5686	—, triethyl-.	See Pentane, 3-ethyl-*		
5687	—, triethylmethyl-.	See Pentane, 3-ethyl-3-methyl-*		
5688	—, trifluoro-*	See Fluoroform.		
5689	—, triiodo-*	See Iodoform.		
5690	—, triisopropoxy-.	See Orthoformic acid, triisopropyl ester.		
5691	—, trimethoxy-.	See Orthoformic acid, trimethyl ester.		
5692	—, trimethyl-.	See Isobutane.		
5693	—, trimethylpropyl-.	See Pentane, 2,2-dimethyl-*		
5694	—, trinitro-*	See Nitroform.		
5695	—, p ₃ -trinitrotriphenyl-.	See Methane, tris(p-nitrophenyl)-.		
5696	—, triphenoxy-.	See Orthoformic acid, triphenyl ester.		
5697	—, triphenyl-.....		(C ₆ H ₅) ₃ CH.....	244.32
5698	—, —, o-carboxylic acid.	See Benzoic acid, o-benzohydryl-.		
5699	—, tripropoxy-.	See Orthoformic acid, tripropyl ester.		
5699H	—, tris(hydroxymethyl)amino-.	See 1,3-Propanediol, 2-amino-2-hydroxy-.		
5699M	—, tris(hydroxymethyl)nitro-.	See 1,3-Propanediol, 2-hydroxymethyl-2-nitro-*		
5700	—, tris(p-nitrophenyl)-	p ₃ -trinitrotriphenylmethane..	(NO ₂ C ₆ H ₄) ₃ CH.....	379.32
5701	Methanearsonic acid..	methylarsinic acid.....	CH ₃ AsO(OH) ₂	139.96
5702	Methaneazobenzene.	See Benzeneazomethane.		
5703	Methanecarbothiolic acid.	See Acetic acid, thiol-.		
5704	Methanedicarboxylic acid.	See Malonic acid.		
5705	Methanediol*, esters.	See "methylene diester" under the different acids.		
5706	—, 2-furyl-, diacetate.	See Furfural, diacetate.		
5707	Methanedisulfonic acid.	See Methionic acid.		
5708	Methane oxide, diphenyl-.	See Xanthene.		
5709	Methanephosphonic acid	methylphosphinic acid.....	CH ₃ PO(OH) ₂	96.03
5710	Methanesiliconic acid.	silicoacetic acid.....	CH ₃ SiOOH.....	76.10
5711	Methanestannonic acid	methylstannonic acid; methylstannic acid	CH ₃ SnOOH.....	166.74
5712	Methanesulfonic acid*	methylsulfonic acid.....	CH ₃ SO ₃ H.....	96.10
5713	Methanesulfonyl chloride*		CH ₃ SO ₂ Cl.....	114.55
5714	Methanethial*.	See Formaldehyde, thio-.		
5715	Methanethiol*.....	methyl mercaptan.....	CH ₃ SH.....	48.10
5716	—, 2-furyl-.	See Furfuryl mercaptan.		
5717	Methanethiolic acid, amino-*, ethyl ester.	See Carbamic acid, thiol-, ethyl ester.		
5718	Methanoic acid*.	See Formic acid.		
5719	Methanol*.....	methyl alcohol; carbinol; wood alcohol	CH ₃ OH.....	32.04
5720	Methenamine.	See Hexamethylenetetramine.		
5721	Methenyl amidoxime.	See Formamide, oxime.		
5722	Methiononic acid.....	methanedisulfonic acid*; methylenedisulfonic acid	CH ₂ (SO ₃ H) ₂	176.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5679	need. f. al. ....	.....	224-5	subl.	.....	v. sl. s.	v. sl. s. eth.; sl. s. acet.; s. CS ₂
5680							
5681							
5682							
5683	col. liq.	1.494 ^{17.2}	-111	24.1	i.	s.	s. eth.
5684							
5685							
5686							
5687							
5688							
5689							
5690							
5691							
5692							
5693							
5694							
5695							
5696							
5697	col. rhomb. leaf., 1.5839 ⁹⁹	1.014 ^{9.9} ₄	92.5	359.2	.....	sl. s. c., v. s. h.	v. s. eth.; s. bz., chl.
5698							
5699							
5699H	<i>methyl-</i>						
5699M							
5700	sc. f. bz. ....	.....	212.5 (207)	.....	.....		v. sl. s. eth., bz., glac. ac. a.
5701	monocl. leaf. f. al.	.....	161	.....	s.	s.	.....
5702							
5703							
5704							
5705							
5706							
5707							
5708							
5709			105	.....	.....		.....
5710	amor. powd. ....	.....	.....	.....	i.	.....	s. eth., conc. KOH
5711	wh. amor. powd.	.....	infus.	.....	i.	.....	s. a., alk.; i. org. solv.
5712	col. liq.	1.481	.....	167 ¹⁰ d.	v. s.	s.	v. s. eth.
5713	liq.	1.51	.....	160	i.	s.	s. eth.
5714							
5715	liq. or gas.	0.868 ²⁰ ₄ ; 0.8599 ^{2.5} ₄	-123.1 (-121)	7.6; 5.8 ⁷⁵²	sl. s., d.	v. s.	v. s. eth.
5716							
5717							
5718							
5719	col. liq., 1.33118 ^{14.50}	0.79609 ¹⁵ ; 0.7928 ²⁰ ₄ (0.7917 ²⁰ ₄)	-97.8	64.65	∞	∞	∞ eth.
5720							
5721							
5722	hyg. need. ....	.....	.....	.....	s.	s.	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5723	dl-Methionine	<i>dl</i> - α -amino- γ -methylmercaptobutyric acid; <i>dl</i> -2-amino-4-methylthiobutanoic acid*	$\text{CH}_3\text{SCH}_2\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$	149.21
5724	l-Methionine		$\text{CH}_3\text{SCH}_2\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$	149.21
5725	Methoxyamine *	α -methylhydroxylamine	CH_3ONH_2	47.06
5726	Methyl. For methyl derivatives see the parent compounds	trityl	(e.g., for methylarsine see (C ₆ H ₅) ₃ C-	243.31
5727	Methylal.	See <i>Methane, dimethoxy</i> .*		
5728	Methyl alcohol.	See <i>Methanol</i> *.		
5729	Methylamine	aminomethane	CH_3NH_2	31.06
5730	—, hydrochloride		$\text{CH}_3\text{NH}_2\cdot\text{HCl}$	67.52
5731	—, <i>tert</i> -butyl	See <i>Propylamine, β, β-dimethyl</i> .*		
5732	—, <i>naphthyl</i>	See <i>Naphthylamine, N-methyl</i>		
5733	Methyl borate	trimethyl borate; trimethoxyboron	$\text{B}(\text{OCH}_3)_3$	103.92
5734	Methyl bromide	bromomethane*	CH_3Br	94.95
5735	—, <i>tert</i> -butyl	See <i>Propane, 1-bromo-2,2-dimethyl</i> .*		
5736	Methyl carbitol.	See <i>Diethylene glycol, monomethyl ether</i>		
5737	Methyl cellosolve.	See <i>Ethanol, 2-methoxy</i> .*		
5738	Methyl chloride	chloromethane*	CH_3Cl	50.49
5739	Methyl cyanide.	See <i>Acetonitrile</i>		
5740	—, <i>allyl</i>	See <i>4-Pentenitrile</i> *		
5741	Methyl disulfide	methyldithiomethane*; dimethyl disulfide	CH_3SSCH_3	94.19
5742	Methylene blue	3,9-bisdimethylaminophenazothionium chloride	$\text{C}_{16}\text{H}_{18}\text{N}_3\text{S}\cdot\text{Cl}\cdot 3\text{H}_2\text{O}$	373.90
5743	Methylene bromide	dibromomethane*	CH_2Br_2	173.86
5744	Methylene chloride	dichloromethane*	CH_2Cl_2	84.94
5745	Methylene cyanide.	See <i>Malononitrile</i>		
5746	Methylenedisulfonic acid.	See <i>Methionic acid</i>		
5746M	Methylene esters.	See "methylene diester" under difluoromethane*	the different acids.	
5747	Methylene fluoride	diiodomethane*	CH_2F_2	52.03
5747	Methylene iodide		CH_2I_2	267.87
5748	Methylenimine, bis(p-Methyl ether)	dimethylaminophenylmethoxymethane*; dimethyl ether	See <i>Auramine (base)</i>	
5749			$(\text{CH}_3)_2\text{O}$	46.07
5750	Methyl fluoride	fluoromethane*	CH_3F	34.03
5751	Methyl hydride.	See <i>Methane</i> *		
5752	Methyl iodide	iodomethane*	CH_3I	141.95
5753	—, <i>tert</i> -butyl	See <i>Propane, 1-iodo-2,2-dimethyl</i> .*		
5754	Methyl isocyanide	methylcarbarylamine; methyl isonitrile	CH_3NC	41.05
5755	Methyl mercaptan.	See <i>Methanethiol</i> *		
5756	—, perchloro	thiocarbonyl tetrachloride; trichloromethylsulfur chloride	CCl_3SCl	185.90
5757	Methyl mustard oil.	See <i>Isothiocyanic acid, methyl ester</i>		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5723	.....	.....	281	.....	3.38 ²⁵ , 10.52 ⁷⁵	.....	.....
5724	hex. pl. ....	.....	283 d.	.....	s. c.	.....	i. eth.
5725	cr. ....	.....	.....	49-50	.....	.....	.....
5726	Arsine, methyl- col.-yel. trans. cr.	.....	For methyl esters of organic acids 145-7	d.	see the acids. i.	v. sl. s.	sl. s. eth.; v. s. chl., CS ₂
5727	.....	.....	.....	.....	.....	.....	.....
5728	.....	.....	.....	.....	.....	.....	.....
5729	col. gas, 1.432 ^{17.5} deliq. leaf. f. al.	0.7691 ⁻⁷⁰ ₄	-92.5	-6.5	1153.9 ml ^{12.50} v. s.	s.	∞ eth.
5730	.....	.....	226	230 ¹⁵	.....	23 ⁷⁸	i. eth.
5731	.....	.....	.....	.....	.....	.....	.....
5732	.....	.....	.....	.....	.....	.....	.....
5733	col. liq.	0.915	.....	65	d.	∞	∞ eth.
5734	col. liq. or gas.	1.732 ⁰ ₀	-93.66	3.56	0.09	v. s.	v. s. eth.; s. chl., CS ₂ , bz.
5735	.....	3.974 ²⁵ g/l	.....	.....	.....	.....	.....
5736	.....	.....	.....	.....	.....	.....	.....
5737	.....	.....	.....	.....	.....	.....	.....
5738	col. gas.	0.991 ⁻²⁵ ; 2.319 g/l	-97.7	-24.22	400 cm ³	3500 cm ³	s. eth., chl., ac. a.
5739	.....	.....	.....	.....	.....	.....	.....
5740	.....	.....	.....	.....	.....	.....	.....
5741	liq.	1.057 ¹⁶ ₄	.....	116-8	i.	∞	∞ eth.
5742	grn. cr. powd.	.....	-2H ₂ O 100; -3H ₂ O 150	.....	s.	s.	.....
5743	col. liq.	2.4953 ²⁰ ₄	-52.8	98.2	1.15 ²⁰	∞	∞ eth.
5744	col. liq., 1.4237	1.336	-96.7	40.1	2 ²⁰	∞	∞ eth.
5745	.....	.....	.....	.....	.....	.....	.....
5746	.....	.....	.....	.....	.....	.....	.....
5746M	col. gas. ....	.....	.....	-51.6	i.	s.	.....
5747	col. liq., leaf. at 0°C, 1.7559 ^{10.5}	3.325	5-6	180 d.	1.42 ²⁰	∞	s. eth.
5748	.....	.....	.....	.....	.....	.....	.....
5749	col. gas.	2.091 g/l	-138.5	-23.65	3700 ¹⁸ cm ³	s.	s. eth.
5750	col. gas.	0.8774 ^{-78.6} ₄	-141.8	-78.6	166 ¹⁵ cm ³	v. s.	v. s. eth.
5751	.....	.....	.....	.....	.....	.....	.....
5752	col.-br. liq., 1.5293 ^{21.0}	2.279	-66.1	42.5	1.4 ²⁰	∞	∞ eth.
5753	.....	.....	.....	.....	.....	.....	.....
5754	col. liq.	0.7564; 0.7464 ²⁰ ₄	-45	59.6	10 ¹⁵	s.	∞ eth.
5755	.....	.....	.....	.....	.....	.....	.....
5756	yel. liq.	1.700	.....	149 sl. d.	i.	.....	.....
5757	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5758	Methyl nitrate.....		CH_3NO_3	77.04
5759	Methyl nitrite.....		CH_3ONO	61.04
5760	Methyloglycolic acid.....	See <i>Acetic acid, methoxy-</i> .		
5761	Methyl orange.....	<i>p</i> -(<i>p</i> -dimethylaminophenyl-azo)benzenesulfonic acid, sodium salt	$(\text{CH}_3)_2\text{NC}_6\text{H}_4\text{-N:NC}_6\text{H}_4\text{SO}_3\text{Na}$	327.33
5762	Methyl phosphate.....	trimethyl phosphate.....	$(\text{CH}_3)_3\text{PO}_4$	140.08
5763	Methyl selenide.....	dimethyl selenide.....	$(\text{CH}_3)_2\text{Se}$	109.03
5764	Methyl sulfate.....	dimethyl sulfate.....	$(\text{CH}_3)_2\text{SO}_4$	126.13
5765	—, acid.....	See <i>Methylsulfuric acid</i> .		
5766	Methyl sulfide.....	methylthiomethane*; dimethyl sulfide	$(\text{CH}_3)_2\text{S}$	62.13
5767	Methyl sulfit.....	dimethyl sulfit.....	$(\text{CH}_3)_2\text{SO}_2$	110.13
5767M	Methyl sulfone.....	methylsulfonylmethane*; dimethyl sulfone	$\text{CH}_3\text{SO}_2\text{CH}_3$	94.13
5768	Methylsulfonic acid.....	See <i>Methanesulfonic acid*</i> .		
5768M	Methyl sulfoxide.....	methylsulfinylmethane*; dimethyl sulfoxide	CH_3SOCH_3	78.13
5769	Methylsulfuric acid.....	hydrogen methyl sulfate; acid methyl sulfate	CH_3HSO_4	112.10
5770	Methyl telluride.....	dimethyl telluride.....	$(\text{CH}_3)_2\text{Te}$	157.68
5771	Metol.....	See <i>Phenol, p-methylamino-, sulfate</i> .		
5772	Mezcaline.....	See <i>Mescaline</i> .		
5773	Miazine.....	See <i>Pyrimidine</i> .		
5774	Michler's hydrol.....	See <i>Benzohydrol, p,p'-bisdimethylamino-</i> .		
5775	Michler's ketone.....	See <i>Benzophenone, p,p'-bisdimethylamino-</i> .		
5776	Milk sugar.....	See <i>Lactose</i> .		
5777	Monoacetin.....	See <i>Glycerol, monoacetate</i> .		
5778	α -Monolaurin.....	See <i>Glycerol, 1-monolaurate</i> .		
5778M	Monoölein.....	See <i>Glycerol, 1-monoöleate</i> .		
5779	α -Monopalmitin.....	See <i>Glycerol, 1-monopalmitate</i> .		
5780	Monosilane.....	See <i>Silicane</i> .		
5781	α -Monostearin.....	See <i>Glycerol, 1-monostearate</i> .		
5782	Morin.....	3,5,7,2',4'-pentahydroxyflavone	$\text{C}_{15}\text{H}_{10}\text{O}_7$	302.23
5783	Moringatannic acid, Moringatannin.....	See <i>Maclurin</i> .		
5784	Morphine.....		$\text{C}_{17}\text{H}_{19}\text{NO}_3\cdot\text{H}_2\text{O}$	303.35
5785	—, acetate (<i>D</i>).....		$\text{C}_{17}\text{H}_{19}\text{NO}_3\cdot\text{C}_2\text{H}_4\text{O}_2\cdot 3\text{H}_2\text{O}$	399.43
5786	—, hydrochloride.....		$\text{C}_{17}\text{H}_{19}\text{NO}_3\cdot\text{HCl}\cdot 3\text{H}_2\text{O}$	375.85
5787	—, methyl ether.....	See <i>Codeine</i> .		
5789	—, sulfate.....		$(\text{C}_{17}\text{H}_{19}\text{NO}_3)_2\cdot\text{H}_2\text{SO}_4\cdot 5\text{H}_2\text{O}$	758.82
5790	—, diacetyl-.....	heroin.....	$\text{C}_{17}\text{H}_{17}(\text{OOCCH}_3)_2\text{-NO}$	369.40

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5758	liq.	1.217 ¹⁵ ; 1.206 ²⁰ / ₄	.....	65 exp.	sl. s.	s.	s. eth.
5759	gas.	0.991 ¹⁵	-17.0	-12	.....	s.	s. eth.
5760	or. yel. powd. ....	.....	.....	.....	v. s.	s.	i. eth.
5761							
5762	liq.	1.220 ¹⁵	.....	193	100 ²⁵	s.	s. eth.
5763	liq.	1.4077 ^{14.6} / ₄	.....	58.2	i.	v. s.	v. s. eth.
5764	col. liq., 1.3874 ²⁰	1.3322 ²⁰ / ₄	-31.8; frz. -27	188; 76 ¹⁵	v. sl. s.	∞	s. eth., bz.
5765	col. liq.	0.8458 ²¹ / ₄	-83.2	37.5-38	i.	s.	s. eth.
5766							
5767	col. liq.	1.242 ⁰ / ₀	.....	126 (122)	s. d.	s.	s. eth.
5767M	pr., 1.4226. ....	.....	109	238	s.	s.	s. bz.
5768	oil or thick syrup	.....	6	d. 100	s.	s.	s. eth.
5769							
5769	oil. ....	.....	<-30	d.	v. s.	s.	∞ eth.
5770	ylsh. liq. ....	.....	.....	82	i.	v. s.	v. s. eth.
5771							
5772							
5773							
5774							
5775							
5776							
5777							
5778							
5778M							
5779							
5780							
5781	col. need. ....	.....	(anh.) 285	.....	0.025	s.	sl. s. eth.; s. ac. a., alk.
5782							
5783	col. rhomb. pr., fine need. or cr. powd., 1.580, 1.625, 1.645; [α] -130.9 ²³ / _D	1.317	anh. 254 d.	191-3 vac.	0.03	0.39	0.02 eth.; s. chl.
5784							
5785	cr. or amor. powd. ....	.....	200 d.	.....	44.4	4.63	i. eth.; s. chl.
5786	silky need. f. w., [α] -111.5 ²⁵ / _D	.....	250 d.	.....	5.72	2.38	i. eth., chl.; s. glyc.
5787	wh. need., cubic f. w.	.....	d. 250	.....	6.66	0.22	i. eth., chl.
5789							
5790	wh. cr. powd., 1.560, 1.600, 1.610	.....	171-2	.....	0.058	4.0	1.4 eth.; s. chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5791	Morphine, diacetyl- , hydrochloride	.....	$C_{21}H_{23}NO_5 \cdot HCl \cdot H_2O$	423.89
5792	—, ethyl- , hydrochloride	dionin.....	$C_{19}H_{23}NO_3 \cdot HCl \cdot 2H_2O$	385.88
5793	Morphol.	3,4-phenanthrenediol.....	$C_{14}H_9(OH)_2$	210.22
5794	—, dimethyl ether.	See <i>Phenanthrene, 3,4-dimethoxy-</i> .		
5795	Morpholine.	tetrahydro-1,4-oxazine; diethylenimine oxide	$OCH_2CH_2NH \cdot CH_2CH_2$	87.12
5796	—, 4-(β-ethoxy-ethyl)-	ethyl β -4-morpholyethyl ether	$O(CH_2CH_2)_2 \cdot NCH_2CH_2OC_2H_5$	159.23
5797	4-Morpholineethanol.	diethylene oxide 2-iminoethyl alcohol	$O(CH_2CH_2)_2 \cdot NCH_2CH_2OH$	131.17
5798	Moss starch	See <i>Lichenin</i> .		
5799	Mucic acid	2,3,4,5-tetrahydroxyhexanedioic acid* (one form)	$COOH(CHOH)_4 \cdot COOH$	210.14
5800	—, <i>p</i> -phenylphenacyl ester		$C_{34}H_{30}O_{10}$	598.58
5801	Muconic acid	2,4-hexadienedioic acid*	$HOOCCH:CH \cdot CH:CHCOOH$	142.11
5802	Murexan.	See <i>Uramil</i> .		
5803	Murexide	ammonium purpurate.....	$C_8H_5O_8N_6NH_4 \cdot H_2O$	302.21
5804	Musk, artificial.	See <i>Toluene, 3-tert-butyl-2,4,6-trinitro-</i> .		
5805	Musk C, Musk ketone.	See <i>Acetophenone, 4-tert-butyl-</i> .	2-methyl-3,6-dinitro-	
5806	Musk xylene.	See <i>Benzene, 1-tert-butyl-3,5-di-</i> .	methyl-2,4,6-trinitro-	
5807	Mustard gas.	See <i>Sulfide, β, β'-dichloroethyl.</i>		
5808	Mustard oil acetic acid	See <i>Acetic acid, isothiocyano-</i> .		
5809	Mustard oils.	See the different esters under I		
5810	Myrcene	2-methyl-6-methylene-2,7-octadiene*	isothiocyanic acid. $(CH_3)_2C:CHCH_2 \cdot CH_2C:(CH_2) \cdot CH:CH_2$	136.23
5810M	—, dihydro-	See 2,6-Octadiene, 2,6-dimethyl melissyl alcohol.....		
5811	Myricyl alcohol	See <i>Palmitic acid, myricyl ester</i> .	$C_{31}H_{63}OH$	452.83
5812	—, palmitate.			
5813	Myristaldehyde, oxime.	tetradecanal oxime*; myristinaldoxime	$C_{13}H_{27}CH:NOH$	227.38
5814	Myristamide	tetradecanamide*; myristic amide	$CH_3(CH_2)_{12} \cdot CONH_2$	227.38
5815	Myristic acid	tetradecanoic acid*.....	$CH_3(CH_2)_{12}COOH$	228.37
5816	—, benzyl ester.....		$C_{13}H_{27}COOCH_2 \cdot C_6H_5$	318.49
5817	—, ethyl ester.....	ethyl tetradecanoate*.....	$CH_3(CH_2)_{12} \cdot COOC_2H_5$	256.42
5818	—, ethylene ester.	See <i>Glycol, dimyristate</i> .		
5819	—, glyceryl ester.	See <i>Glycerol, trimyristate</i> .		
5820	Myristic alcohol.	See 1-Tetradecanol*.		
5821	Myristic anhydride	tetradecanoic anhydride*.....	$(C_{13}H_{27}CO)_2O$	438.72
5822	Myristicin	5-methoxysafrole.....	$C_9H_8O_2$	152.15
5823	Myristinaldoxime.	See <i>Myristaldehyde, oxime</i> .		
5824	Myristonitrile	tetradecanenitrile*.....	$C_{13}H_{27}CN$	209.37
5825	Myristoyl chloride	tetradecanoyl chloride*; myristyl chloride	$CH_3(CH_2)_{12}COCl$	246.82
5826	Napelline.	See <i>Benzaconine</i> .		
5827	Naphthacetyl.	See 1-Naphthol, 4-acetamido-		
5828	Naphthalane.	See <i>Naphthalene, decahydro-</i> *		
5829	1-Naphthaldehyde	1-naphthalenecarbonal; α -naphthoic aldehyde	$C_{10}H_7CHO$	156.17

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5791	wh. cr. powd.		230-1		50	s.	i. eth., chl.
5792	wh. micr.-cr. powd.		125 d.		14.3	50	i. eth.; sl. s. chl.
5793	col. need.		143		i.	s.	s. eth., alk.
5794							
5795	col. hydr. oil.	0.9998		126-30	∞	s.	s. eth.; = ord. solv.
5796	col. liq.	0.963		206	=		
5797	col. liq.	1.071		225.5	∞		
5798							
5799	col. cr. or wh. powd.		206 d. (213-4)	255	0.33 ¹⁴	i.	v. sl. s. eth.; s. dil. alk.
5800			149.5 d.				
5801	need. f. w.		298 d.	ca. 320	0.02	sl. s.	sl. s. eth.; s. h. ac. a.
5802							
5803	purp. powd.				sl. s.	i.	i. eth.
5804							
5805							
5806							
5807							
5808							
5809							
5810	liq.	0.802		167			
5810M							
5811	col. need. f. eth.	0.777 ⁹⁵	88		i.	s. h.	s. eth.; v. s. bz.
5812							
5813	need. f. al.		82		i.	s.	v. s. eth., chl.
5814	leaf.		103	217 ¹²	i.	sl. s.	sl. s. eth.
5815	col. leaf., 1.4308 ⁶⁰	0.858 ⁶⁰	58	250.5 ¹⁰⁰	i.	44.9 ²¹	sl. s. eth.; s. chl., glac. ac. a.
5816	liq.	0.9321 ^{$\frac{25}{25}$}	20.5	229.31 ¹¹	i.	s.	v. s. eth.
5817	col. cr.	0.8589 ^{$\frac{20}{4}$}	10.5 (11.93)	295	i.	s.	sl. s. eth.
5818							
5819							
5820							
5821	col. cr.	0.8502 ⁷⁰	53.4	198	i.	s.	s. eth.
5822	pa. yel. oil.	1.1425 ¹⁹	<-20	149.5 ¹⁵		s.	s. eth.
5823							
5824	liq. or cr.	0.8281 ^{$\frac{19}{4}$}	19	226.5 ¹⁰⁰	i.	sl. s.	v. s. eth.
5825	liq.		-1	168 ¹⁵ (159-61 ¹¹)	d.	d.	s. eth.
5826							
5827							
5828							
5829	liq., 1.65464 ^{19.3}	1.148 ^{$\frac{20}{4}$}		291.6	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5830	1-Naphthaldehyde, 2-hydroxy-	2-hydroxy-1-naphthalene-carbonyl*; β -naphthol-1-aldehyde	$\text{HOC}_{10}\text{H}_6\text{CHO}$	172.17
5831	2-Naphthaldehyde	2-naphthalenecarbonyl; β -naphthoic aldehyde	$\text{C}_{10}\text{H}_7\text{CHO}$	156.17
5832	—, 1-hydroxy-	1-hydroxy-2-naphthalene-carbonyl*; α -naphthol-2-aldehyde	$\text{HOC}_{10}\text{H}_6\text{CHO}$	172.17
5833	Naphthalene		C_{10}H_8	128.16
5834	—, hexahydride.	See <i>Naphthalene, hexahydro-</i> .		
5835	—, tetrachloride.	See <i>Naphthalene, 1,2,3,4-tetrachloro-</i> .		
5836	—, 1,1'-azoxydi- .	See <i>1,1'-Azoxy-naphthalene</i> .		
5837	—, 1-benzyl- .	See <i>Methane 1-naphthylphenyl-</i> .		
5838	—, 2-benzyl- .	See <i>Methane, 2-naphthylphenyl-</i> .		
5839	—, 2-benzoyloxy* .	See <i>Ether, benzyl 2-naphthyl-</i> .		
5840	—, 1-bromo*		$\text{C}_{10}\text{H}_7\text{Br}$	207.07
5841	—, 2-bromo*		$\text{C}_{10}\text{H}_7\text{Br}$	207.07
5842	—, 1-chloro*		$\text{C}_{10}\text{H}_7\text{Cl}$	162.61
5843	—, 2-chloro*		$\text{C}_{10}\text{H}_7\text{Cl}$	162.61
5844	—, 1-chlorodecahydro*	1-chlorodecalin.....	$\text{C}_{10}\text{H}_{17}\text{Cl}$	172.69
5845	—, 1-chloro-4-nitro*		$\text{C}_{10}\text{H}_6\text{Cl}(\text{NO}_2)$	207.61
5846	—, 7-chloro-1-nitro*		$\text{C}_{10}\text{H}_6\text{Cl}(\text{NO}_2)$	207.61
5847	—, decahydro*	"Decalin"; bicyclo [4,4,0]-decane; naphthalane; naphthane	$\text{C}_{10}\text{H}_{18}$	138.25
5848	—, diamino- .	See <i>Naphthylenediamine</i> .		
5849	—, diazoamino- .	See <i>Diazoaminonaphthalene</i> .		
5850	—, 1,2-dichloro*		$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5851	—, 1,3-dichloro*	δ -dichloronaphthalene.....	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5852	—, 1,4-dichloro*	β -dichloronaphthalene.....	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5853	—, 1,5-dichloro*	γ -dichloronaphthalene.....	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5854	—, 1,6-dichloro*	η -dichloronaphthalene.....	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5855	—, 1,7-dichloro*	δ' -dichloronaphthalene.....	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5856	—, 1,8-dichloro*	peri-dichloronaphthalene; ξ -dichloronaphthalene	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5857	—, 2,3-dichloro*	ϵ -dichloronaphthalene.....	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5858	—, 2,6-dichloro*	ϵ -dichloronaphthalene.....	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5859	—, 2,7-dichloro*	δ -dichloronaphthalene.....	$\text{C}_{10}\text{H}_6\text{Cl}_2$	197.06
5860	—, 1,4-dihydro*		$\text{C}_{10}\text{H}_{10}$	130.18
5861	—, dihydrodiketo- .	See <i>Naphthoquinone</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5830	br. need. ....	.....	82	192	i.	s.	s. eth.
5831	col. leaf. f. w., 1.6211 ^{99.4}	1.078 ⁹⁹	60.5	.....	s. h.	v. s.	v. s. eth.
5832	yel. grn. need..	.....	59-60	.....	i.	s.	s. eth.
5833	col. monocl., 1.58218 ^{99.6}	1.145	80.22	217.9	0.003	4.18 c.	v. s. eth., chl., CS ₂ ; 40.21 ^{15.6} bz.
5834							
5835							
5836							
5837							
5838							
5839							
5840	col. oil or pr., 1.65876 ^{19.4}	1.4875 ²⁰ ₄	6.2; 0.2-0.7	281.1 (146-9 ¹⁶)	s. h.	∞	∞ eth., bz.
5841	rhomb. leaf. f. al.	1.605 ⁹	59 (56-7)	281-2	i.	6	s. eth., CS ₂ , chl., bz.
5842	col. liq., 1.63321 ²⁰	1.1938 ²⁰ ₄	.....	263 (250-2)	i.	s.	s. eth., bz., CS ₂
5843	col. leaf. f. al.	liq. 1.138 ⁷⁰ ₄	55-6	264-6	i.	s.	s. eth., chl., CS ₂ , bz.
5844	.....	.....	.....	114-6 ²⁰	.....	.....	.....
5845	brnsh.-yel. need. f. al.	.....	85	.....	i.	s.	s. eth.
5846	yel. need. f. al.	.....	116	.....	i.	s.	s. eth.
5847	col. liq., (cis) 1.4828 (trans) 1.46994 ¹⁸	0.8963 0.8699	-43.26 -31.47	194.6 185.5	i.	s.	s. eth.
5848							
5849							
5850	monocl. pl. f. al., 1.63375 ^{48.5}	liq., 1.315 ^{48.5} ₄	37	282	.....	s.	s. eth.
5851	need. f. al. ....	.....	61.5	291 ⁷⁵⁵	.....	s.	.....
5852	need. f. al., 1.62282 ^{75.9}	1.300 ⁷⁶	67-8	287 ⁷⁴⁰	i.	sl. s.	s. eth., acet., ac. a.
5853	leaf. f. al. or ac. a.	.....	107	subl.	i.	sl. s.	s. eth.
5854	need. f. al.; volat. in steam	.....	48-9	subl.	.....	.....	.....
5855	need. f. ac. a., 1.60921 ^{99.5}	1.261 ¹⁰⁰ ₄	63-4	286	.....	v. s.	s. eth., ac. a., bz.
5856	rhomb. cr. f. al., 1.62357 ^{99.8}	1.292 ¹⁰⁰ ₄	88 (83)	d.	.....	.....	.....
5857	col. lust. sc. f. al.	.....	120	.....	.....	s. h.	s. eth.
5858	col. monocl. need. or leaf. f. al.	.....	140-41 (135)	285	.....	sl. s.	v. s. eth., chl., bz.
5859	col. pl. f. al.	1.62845 ⁹	114	.....	.....	s. h.	.....
5860	col. liq., 1.58317 ^{18.3}	0.998	24.5-25 (15.5)	212 (94.5 ¹⁷)	i.	v. s.	v. s. eth.
5861							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5862	Napthalene, dihydroxy	-. See <i>Naphthalenediol</i> .		
5863	—, 1,4-dimethyl-*	α -dimethylnapthalene.	$C_{10}H_8(CH_3)_2$	156.22
5864	—, 2,3-dimethyl-*	See <i>Guaiene</i> .		
5865	—, 1,3-dinitro-*		$C_{10}H_6(NO_2)_2$	218.16
5866	—, 1,5-dinitro-*		$C_{10}H_6(NO_2)_2$	218.16
5867	—, 1,8-dinitro-*		$C_{10}H_6(NO_2)_2$	218.16
5868	—, ethoxy-*	See <i>Ether, ethyl naphthyl</i> .		
5869	—, 1-ethyl-	α -naphthylethane; α -ethyl-napthalene	$C_{10}H_7C_2H_5$	156.22
5870	—, 2-ethyl-	β -naphthylethane; β -ethyl-napthalene	$C_{10}H_7C_2H_5$	156.22
5870K	—, 1-fluoro-*	α -fluoronapthalene.	$C_{10}H_7F$	146.16
5870M	—, 2-fluoro-*	β -fluoronapthalene.	$C_{10}H_7F$	146.16
5871	—, hexahydro-	napthalene hexahydride	$C_{10}H_{14}$	134.21
5872	—, hydrazodi-	See <i>Hydrazine, dinaphthyl</i> .		
5873	—, hydroxy-	See <i>Naphthol</i> .		
5874	—, 1-iodo-*		$C_{10}H_7I$	254.08
5875	—, 2-iodo-*		$C_{10}H_7I$	254.08
5876	—, methoxy-	See <i>Ether, methyl naphthyl</i> .		
5877	—, 1-methyl-	α -methylnapthalene.	$C_{10}H_7CH_3$	142.19
5878	—, 2-methyl-	β -methylnapthalene.	$C_{10}H_7CH_3$	142.19
5879	—, 1-(γ-methylbutoxy)-*	See <i>Ether, isoamyl 1-naphthyl</i> .		
5880	—, 2-(γ-methylbutoxy)-*	See <i>Ether, isoamyl 2-naphthyl</i> .		
5881	—, naphthoxy-	See <i>Naphthyl ether</i> .		
5882	—, 1-(2-naphthoyl)-	See <i>1,2'-Naphthyl ketone</i> .		
5883	—, 1-nitro-*	α -nitronapthalene.	$C_{10}H_7NO_2$	173.16
5884	—, 2-nitro-*	β -nitronapthalene.	$C_{10}H_7NO_2$	173.16
5885	—, 1-phenyl-		$C_6H_5C_{10}H_7$	204.26
5886	—, 2-phenyl-		$C_6H_5C_{10}H_7$	204.26
5887	—, 2-(2-propenoxy)-*	*. See <i>Ether, allyl 2-naphthyl</i> .		
5888	—, propoxy-*	See <i>Ether, naphthyl propyl</i> .		
5889	—, 1,2,3,4-tetrachloro-1,2,3,4-tetrahydro-*	napthalene tetrachloride.	$C_{10}H_8Cl_4$	269.99
5890	—, 1,2,3,4-tetrahydro-*	"Tetralin" napthalene 1,2,3,4-tetrahydride	$C_{10}H_{12}$	132.20
5891	—, 1,3,5,8-tetranitro-*	γ -tetranitronapthalene.	$C_{10}H_4(NO_2)_4$	308.16
5892	—, 1,3,6,8-tetranitro-*	β -tetranitronapthalene.	$C_{10}H_4(NO_2)_4$	308.16
5893	—, 1,5,?,?-tetranitro-*	α -tetranitronapthalene.	$C_{10}H_4(NO_2)_4$	308.16
5894	—, 1,2,5-trinitro-*		$C_{10}H_5(NO_2)_3$	263.16
5895	—, 1,3,5-trinitro-*		$C_{10}H_5(NO_2)_3$	263.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5862	liq., 1.61567 ¹⁵	1.016 ²⁰ / ₄	<-18	264.3	i.	v. s.	∞ eth.
5863							
5864	ylsh. need. f. bz.		144-5	subl.	i.	s.	
5865	hex. need. f.		217.5	subl.	i.	sl. s.	v. s. eth.; s. h. bz., h. pyr., ac. a.; v. sl. s. CS ₂
5866	ac. a.		(216)				0.72 ¹⁹ bz.; s. pyr.; sl. s. chl.
5867	yel. rhomb. pl. f. chl.		173-3.5 (170)	d.	i.	0.188 ¹⁹ 88%	
5868							
5869	col. liq.	1.018 ²⁰ / ₄	<-14	258 d.	i.	∞	∞ eth.
5870	col. liq.	1.098 ⁰	-19	251	i.	∞	∞ eth.
5870 K	col. liq., 1.59389 ^{19.5}	1.1340	-13 (-9)	212	i.	s.	s. eth.
5870 M	wh. need.		61	211.5 ⁷³⁷	i.	s.	s. eth.
5871	col. liq., 1.53311 ^{18.4}	0.934		205.5			
5872							
5873							
5874	oil, 1.70540 ¹⁴	1.7344 ¹⁵ / ₄		305	i.	∞	∞ eth.
5875	cr. leaf., 1.6617 ^{99.4}		54.5	308-10	i.	v. s.	v. s. eth.
5876							
5877	col. liq., 1.618	1.025	-22	240-3	i.	v. s.	v. s. eth.
5878	col. monoc. f. al., 1.60263 ^{39.9}	1.029 ²⁰ / ₄	35.1	245	i.	v. s.	v. s. eth.
5879							
5880							
5881							
5882							
5883	yel. need. f. al.	1.331 ⁴ / ₄	58.8 (56-7)	304	i.	s.	v. s. eth., chl., CS ₂
5884	col. rhomb. need. f. al.		79	165 ¹⁵	i.	v. s.	v. s. eth.
5885	col. liq. or waxy solid		ca. 45	325	i.	v. s.	v. s. eth., bz.
5886	col. leaf. f. al.		102.5	345		v. s.	v. s. eth., bz.
5887							
5888							
5889	cr. f. eth.		182-3		i.	v. sl. s. h.	s. h. eth.
5890	col. liq., 1.5461 ^{420.2}	0.971	-30	207.2	i.	v. s.	v. s. eth.
5891	yel. tetr. f. acet.		195			sl. s.	v. s. acet.; s. HNO ₃ ; sl. s. chl.
5892	long need. f. al.		203	exp.	i.	sl. s.	
5893	lt. yel. need. f. chl.		259	exp.	v. sl. s.	v. sl. s.	v. sl. s. eth.
5894	col. need. f. al.		113			s.	
5895	yel. rhomb. (monocl.) f. chl.		123		i.	v. s.	sl. s. eth.; v. s. acet.; s. chl., ac. a.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5896	Naphthalene, 1, 3, 8-tri- nitro-*	.....	$C_{10}H_5(NO_2)_3$	263.16
5897	—, 1, 4, 5-trinitro-*	.....	$C_{10}H_5(NO_2)_3$	263.16
5898	Naphthalenecarbonal.	See Naphthaldehyde.		
5899	α -Naphthalenecarboxy- lic acid.	See 1-Naphthoic acid.		
5900	β -Naphthalenecarboxy- lic acid.	See 2-Naphthoic acid.		
5901	Naphthalenediamine*.	See Naphthylenediamine.		
5902	1, 2-Naphthalenedi- carboxylic acid	.....	$C_{10}H_6(COOH)_2$	216.18
5903	1, 4-Naphthalenedicarbo- xylic acid.	1, 2, 3, 4-tetrahydro-1-phenyl- oxylic acid. See Naphthalic acid.	$C_{10}H_6(OH)_2$	See α - 160.16
5904	1, 8-Naphthalenedicarb- oxylic acid.	1, 2-dihydroxynaphthalene; β -hydronaphthoquinone; β -naphthohydroquinone		
5905	1, 2-Naphthalenediol*.	.....	
5906	1, 3-Naphthalenediol*.	1, 3-dihydroxynaphthalene; naphthoresorcinol	$C_{10}H_6(OH)_2$	160.16
5907	1, 4-Naphthalenediol*.	1, 4-dihydroxynaphthalene; α -hydronaphthoquinone; α -naphthohydroquinone	$C_{10}H_6(OH)_2$	160.16
5908	1, 5-Naphthalenediol*.	1, 5-dihydroxynaphthalene	$C_{10}H_6(OH)_2$	160.16
5909	1, 6-Naphthalenediol*.	1, 6-dihydroxynaphthalene....	$C_{10}H_6(OH)_2$	160.16
5910	1, 7-Naphthalenediol*.	1, 7-dihydroxynaphthalene....	$C_{10}H_6(OH)_2$	160.16
5911	1, 8-Naphthalenediol*.	1, 8-dihydroxynaphthalene....	$C_{10}H_6(OH)_2$	160.16
5912	2, 3-Naphthalenediol*.	2, 3-dihydroxynaphthalene....	$C_{10}H_6(OH)_2$	160.16
5913	2, 6-Naphthalenediol*.	2, 6-dihydroxynaphthalene....	$C_{10}H_6(OH)_2$	160.16
5914	2, 7-Naphthalenediol*.	2, 7-dihydroxynaphthalene....	$C_{10}H_6(OH)_2$	160.16
5915	1, 3-Naphthalenedisulf- onic acid.	7-amino-. See Naphthylamine-6, 8- disulfonic acid.	$C_{10}H_6(SO_3H)_2$	disul- 288.28
5916	1, 5-Naphthalenedi- sulfonic acid	.....	
5917	—, 3-amino-.	See 2-Naphthylamine-4, 8-disul- fonic acid.		
5918	—, 4-amino-.	See 1-Naphthylamine-4, 8-disul- fonic acid.		
5919	1, 6-Naphthalenedisul- fonic acid	.....	$C_{10}H_6(SO_3H)_2$	288.28
5920	2, 7-Naphthalenedisul- fonic acid	α -naphthalenedisulfonic acid.	$C_{10}H_6(SO_3H)_2$	288.28
5921	—, 4, 5-dihydroxy-.	See Chromotropic acid.		
5922	Naphthalenesulfonic a- cid, amino-.	See Naphthylamine-6, 8-disul- fonic acid.	$C_{10}H_6(SO_3H)_2$	288.28
5923	1-Naphthalenesulfonic acid	α -naphthalenesulfonic acid	$C_{10}H_7SO_3H \cdot H_2O$	226.24
5924	—, 4-amino-.	See Naphthionic acid.		
5925	2-Naphthalenesul- fonic acid	β -naphthalenesulfonic acid...	$C_{10}H_7SO_3H$	208.22
5926	1-Naphthalenesul- fonyl chloride	.....	$C_{10}H_7SO_2Cl$	226.67
5927	2-Naphthalenesul- fonyl chloride	.....	$C_{10}H_7SO_2Cl$	226.67
5928	Naphthalenethiol*.	See Naphthol, thio-.		
5929	Naphthalic acid.....	1, 8-naphthalenedicarboxylic acid	$C_{10}H_6(COOH)_2$	216.18
5930	1-Naphthamide.....	1-naphthalenecarbonamide*; α -naphthoamide	$C_{10}H_7CONH_2$	171.19

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5896	monocl. f. chl.	.....	218	.....	i.	0.046 ²³ 88%	v. sl. s. eth., chl.
5897	yel. leaf.	.....	247 (154)	.....	i.	0.12 ¹⁸	0.88 ¹⁸ eth.; s. bz.; 0.64 chl.
5898							
5899							
5900							
5901							
5902	need. f. al.	.....	175 d.	.....	s. h.	i.	i. eth.
5903	<i>Isatropic acid.</i>						
5904							
5905	col. leaf. or need. f. CS ₂ ; leaf. (+1H ₂ O) f. w.	.....	anh. 103-4; +1H ₂ O, 58-60	.....	sl. s.	s.	s. eth., alk.
5906	leaf. f. w.	.....	124	.....	s.	s.	s. eth., ac. a.; sl. s. bz., lgr.; yel. in alk. sol.
5907	lng. monocl. col. need.	.....	176	.....	s. h.	s.	s. eth., ac. a. v. sl. s. CS ₂ , lgr., c. bz.
5908	sm. pr. f. w.	.....	265 (258)	d.	sl. s.	s.	s. eth., acet., ac. a.; i. bz., pet. eth.
5909	col. pr. f. bz.	.....	138 (135)	.....	sl. s.	sl. s.	v. s. eth.; s. bz., acet.
5910	col. need. f. bz.	.....	178	.....	s.	v. s.	v. s. eth.; s. bz.
5911	leaf. or need. f. w.	.....	140	.....	sl. s. h.	s. h.	v. s. eth.; s. bz.; sl. s. lgr.
5912	monocl. (rhomb.) leaf. f. w.	.....	160-1	.....	s. h.	v. s.	v. s. eth.; s. bz., lgr.
5913	rhomb. pl. f. w.	.....	218	subl.	sl. s.	s.	s. eth., me. al., acet.; sl. s. bz.; i. lgr.
5914	need. f. w.	.....	190	subl.	s.	s.	s. eth., chl., bz.; i. lgr.
5915	<i>fonic acid.</i>						
5916	leaf., 1.493, 1.675, 1.739	.....	d.	.....	102 ²⁰	s.	i. eth.
5917							
5918							
5919	cr.	.....	125 d.	.....	164 ²⁰	s.	i. eth.
5920	hyg. need.	.....			s.	.....	sl. s. c. HCl
5921							
5922							
5923	cr.	.....	90	.....	v. s.	s.	sl. s. eth.
5924							
5925	col.-wh. deliq. pl.	.....	102	d.	76.96 ³⁰	s.	s. eth.; 0.2 h. bz.
5926	leaf. f. eth.	.....	68	195 ¹³	i.	s.	v. s. eth.
5927	wh. cr. powd. or leaf.	.....	76	201 ¹³	i.	s.	v. s. eth.; s. bz., chl., CS ₂
5928							
5929	col. need. f. al.	.....	270 d.	.....	v. sl. s.	sl. s.	sl. s. eth.
5930	col. need. f. al.	.....	202	.....	v. sl. s.	v. sl. s.	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5931	2-Naphthamide	2-naphthalenecarbonamide*; β -naphthoamide	$C_{10}H_7CONH_2$	171.19
5932	Naphthane	See <i>Naphthalene, decahydro</i> .*		
5933	Naphthazarin	5,8-dihydroxy-1,4-naphthoquinone	$C_{10}H_4O_2(OH)_2$	190.15
5934	Naphthionic acid	1-naphthylamine-4-sulfonic acid; 4-amino-1-naphthalenesulfonic acid	$NH_2C_{10}H_6SO_3H \cdot \frac{1}{2}H_2O$	232.25
5935	α -Naphthoamide	See 1-Naphthamide.		
5936	β -Naphthoamide	See 2-Naphthamide.		
5937	α -Naphthohydroquinone	See 1,4-Naphthalenediol*.		
5938	β -Naphthohydroquinone	See 1,2-Naphthalenediol*.		
5939	1,2-Naphthohydroquinone	See 1,2-Naphthalenediol*.		
5940	1,4-Naphthohydroquinone	See 1,4-Naphthalenediol*.		
5941	1-Naphthoic acid	α -naphthalenecarboxylic acid; α -naphthoic acid	$C_{10}H_7COOH$	172.17
5942	—, 2-hydroxy -		$HOC_{10}H_6COOH$	188.17
5943	—, 5-hydroxy -		$HOC_{10}H_6COOH$	188.17
5944	—, 6-hydroxy -		$HOC_{10}H_6COOH$	188.17
5945	—, 7-hydroxy -		$HOC_{10}H_6COOH$	188.17
5946	—, 8-hydroxy -		$HOC_{10}H_6COOH$	188.17
5947	—, 8-nitro -		$NO_2C_{10}H_6COOH$	217.17
5948	2-Naphthoic acid	β -naphthalenecarboxylic acid; β -naphthoic acid	$C_{10}H_7COOH$	172.17
5949	—, 1-hydroxy -		$HOC_{10}H_6COOH$	188.17
5950	—, 3-hydroxy -		$HOC_{10}H_6COOH$	188.17
5951	—, 5-hydroxy -		$HOC_{10}H_6COOH$	188.17
5952	—, 7-hydroxy -		$HOC_{10}H_6COOH$	188.17
5953	α -Naphthoic aldehyde	See 1-Naphthaldehyde.		
5954	β -Naphthoic aldehyde	See 2-Naphthaldehyde.		
5955	1-Naphthol	α -naphthol; 1-hydroxy-naphthalene	$C_{10}H_7OH$	144.16
5956	—, acetate	α -naphthyl acetate	$CH_3COOC_{10}H_7$	186.20
5957	—, 4-acetamido -	N-(4-hydroxy-1-naphthyl)-acetamide; naphthacetol	$CH_3CONHC_{10}H_6OH$	201.22
5958	—, 2-aceto -	See 2-Acetonaphthone, 1-hydroxy-		
5959	—, 2-acetyl-4-bromo -	See 2-Acetonaphthone, 4-bromo-1-hydroxy-		
5960	—, 2-amino -	1-hydroxy-2-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5961	—, 4-amino -	4-hydroxy-1-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5962	—, 5-amino -	5-hydroxy-1-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5963	—, 7-amino -	8-hydroxy-2-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5964	—, 8-amino -	8-hydroxy-1-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5965	—, 4-bromo-2-propionyl -	See 2-Propionaphthone, 4-bromo-1-hydroxy-		
5966	—, 2-butyryl -	See 2-Butyronaphthone, 1-hydroxy-		
5967	—, 2-cinnamyl -	See 2-Acrylonaphthone, 1-hydroxy- β -phenyl-		
5968	—, 2,4-dibromo -		$Br_2C_{10}H_6OH$	301.98
5969	—, 2,4-dichloro -		$Cl_2C_{10}H_6OH$	213.06
5970	—, 2,4-dinitro -		$(NO_2)_2C_{10}H_6OH$	234.16
5971	—, 2-nitro -		$NO_2C_{10}H_6OH$	189.16
5972	—, 4-nitro -		$NO_2C_{10}H_6OH$	189.16
5973	—, 2-nitroso -	1,2-naphthoquinone 2-oxime	$NOC_{10}H_6OH$	173.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5931	col. tab. f. al.		192		sl. s.	sl. s.	s. eth., bz., chl.
5932							
5933	red br. need. f. al.		276-80	subl.	sl. s. h.	s.	v. sl. s. eth., bz.; s. alk.
5934	col. need. f. w.		d.		0.026 ⁹ , 0.22 ¹⁰⁰	v. sl. s.	v. sl. s. eth.
5935							
5936							
5937							
5938							
5939							
5940							
5941	col. need. f. dil. al.		160	300	v. sl. s. h.	v. s. h.	s. eth., chl., NH ₄ OH
5942	need. f. al. and eth.		156-7 d.		sl. s. h.	v. s.	v. s. eth.; s. bz.
5943	lng. need. f. w.		234-7	subl.	sl. s. h.	v. s.	s. eth., ac. a.
5944	sm. need. f. w.		187		s. h.	v. s.	
5945	need. f. w.		245-7 d.		s. h.	s.	
5946	need. f. eth.		169		s. h.	v. s.	s. eth.
5947	pr. f. al.		215		0.04c.	4.6	sl. s. eth., bz.
5948	col. monocl. need. f. lgr.	1.077 ¹⁰⁰ / ₄	185	>300	0.0068 ²⁵	v. s.	v. s. eth.; s. NaOH sol.
5949	need. f. al. or eth.		186-8		sl. s.	s.	s. eth., bz.
5950	yel. rhomb. need. f. w.		216 (211-4)		s. h.	s.	s. eth., bz., chl.
5951	need. f. w. or al.		211-2		s. h.	s.	
5952	leaf		262		s.	s.	s. eth.
5953							
5954							
5955	yel. monocl., 1.6206 ^{98.7}	1.224 ⁴ ; 1.099 ⁹⁹	96	288 (280)	sl. s. h., i. c.	v. s.	v. s. eth.; s. bz.
5956	need. or pl. f. al.		44.8		sl. s. h.	s.	v. s. eth.
5957	need. f. al.		187		s. h.	s.	s. NH ₄ OH, Na ₂ CO ₃
5958							
5959							
5960	need.				sl. s.		
5961	need.				sl. s.	s.	s. eth.
5962	cr.		170 d.		sl. s.	s.	s. eth.
5963	cr. (sc.) f. chl.		158		sl. s.	s.	s. eth.
5964	wh. need.		95-7 d.		v. s. h., sl. s. c.		s. alk., HCl
5965							
5966							
5967							
5968	wh. need. f. al.		105 (111)		i.	s.	s. eth., ac. a.
5969	wh. need. f. al. or bz.		107	d. 180	i.	s.	s. eth., bz.
5970	yel. need. f. h. al. or chl.		138		v. sl. s. h.	sl. s.	sl. s. eth., bz.; s. ac. a.
5971	yel. need. or leaf. f. al.		128		v. sl. s.	sl. s.	
5972	yel. need. f. w.		164		s. h.	v. s.	v. s. ac. a.
5973	yel. need. f. bz.		152		v. sl. s. c.	v. s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
5974	1-Naphthol, 4-nitroso-	1,4-naphthoquinone 1-oxime	$\text{NOC}_{10}\text{H}_6\text{OH}$	173.16
5975	—, 1,2,3,4-tetrahydro-	α -naphthol 1,2,3,4-tetrahydride; <i>ac</i> -tetrahydro- α -naphthol	$\text{C}_6\text{H}_4\cdot\text{C}_4\text{H}_7\text{OH}$	148.20
5976	—, 5,6,7,8-tetrahydro-	α -naphthol 5,6,7,8-tetrahydride; <i>ar</i> -tetrahydro- α -naphthol	$\text{C}_4\text{H}_8\cdot\text{C}_6\text{H}_3\text{OH}$	148.20
5977	—, thio-	1-naphthalenethiol*; α -naphthyl mercaptan	$\text{C}_{10}\text{H}_7\text{SH}$	160.22
5978	2-Naphthol	β -naphthol; 2-hydroxynaphthalene	$\text{C}_{10}\text{H}_7\text{OH}$	144.16
5979	—, acetate	β -naphthyl acetate	$\text{CH}_3\text{COOC}_{10}\text{H}_7$	186.20
5980	—, benzoate	β -naphthyl benzoate	$\text{C}_{10}\text{H}_7\text{OOCOC}_6\text{H}_5$	248.27
5981	—, 1-acetamido-	<i>N</i> -(2-hydroxy-1-naphthyl)-acetamide	$\text{CH}_3\text{CONHC}_{10}\text{H}_6\text{OH}$	201.22
5982	—, 1-amino-	2-hydroxy-1-naphthylamine	$\text{NH}_2\text{C}_{10}\text{H}_6\text{OH}$	159.18
5983	—, 3-amino-	3-hydroxy-2-naphthylamine	$\text{NH}_2\text{C}_{10}\text{H}_6\text{OH}$	159.18
5984	—, 5-amino-	6-hydroxy-2-naphthylamine	$\text{NH}_2\text{C}_{10}\text{H}_6\text{OH}$	159.18
5985	—, 6-amino-	6-hydroxy-2-naphthylamine	$\text{NH}_2\text{C}_{10}\text{H}_6\text{OH}$	159.18
5986	—, 7-amino-	7-hydroxy-2-naphthylamine	$\text{NH}_2\text{C}_{10}\text{H}_6\text{OH}$	159.18
5987	—, 8-amino-	7-hydroxy-1-naphthylamine	$\text{NH}_2\text{C}_{10}\text{H}_6\text{OH}$	159.18
5988	—, 1-bromo- . . . . .	. . . . .	$\text{BrC}_{10}\text{H}_6\text{OH}$	223.07
5989	—, 6-bromo-1-methyl-	. . . . .	$\text{CH}_3\text{C}_{10}\text{H}_5\text{BrOH}$	237.10
5990	—, 1-chloro- . . . . .	. . . . .	$\text{ClC}_{10}\text{H}_6\text{OH}$	178.61
5991	—, 1,6-dibromo- . . . . .	. . . . .	$\text{Br}_2\text{C}_{10}\text{H}_5\text{OH}$	301.98
5992	—, 1,6-dinitro- . . . . .	. . . . .	$(\text{NO}_2)_2\text{C}_{10}\text{H}_5\text{OH}$	234.16
5993	—, 1-methyl- . . . . .	. . . . .	$\text{CH}_3\text{C}_{10}\text{H}_6\text{OH}$	158.19
5994	—, 1-nitro- . . . . .	. . . . .	$\text{NO}_2\text{C}_{10}\text{H}_6\text{OH}$	189.16
5995	—, 5-nitro- . . . . .	. . . . .	$\text{NO}_2\text{C}_{10}\text{H}_6\text{OH}$	189.16
5996	—, 8-nitro- . . . . .	. . . . .	$\text{NO}_2\text{C}_{10}\text{H}_6\text{OH}$	189.16
5997	—, 1-nitroso-	1,2-naphthoquinone 1-oxime	$\text{NOC}_{10}\text{H}_6\text{OH}$	173.16
5998	—, 1-<i>p</i>-phenylazo-	<i>p</i> -nitrobenzeneazo- β -naphthol; paranitraniline red	$\text{NO}_2\text{C}_6\text{H}_4\text{N}:\text{NC}_{10}\text{H}_6\text{OH}$	293.27
5999	—, 1,2,3,4-tetrahydro-	β -naphthol 1,2,3,4-tetrahydride; <i>ac</i> -tetrahydro- β -naphthol	$\text{C}_6\text{H}_4\cdot\text{C}_4\text{H}_7\text{OH}$	148.20
6000	—, 5,6,7,8-tetrahydro-	β -naphthol 5,6,7,8-tetrahydride; <i>ar</i> -tetrahydro- α -naphthol	$\text{C}_4\text{H}_8\cdot\text{C}_6\text{H}_3\text{OH}$	148.20
6001	—, thio-	2-naphthalenethiol*; β -naphthyl mercaptan	$\text{C}_{10}\text{H}_7\text{SH}$	160.22
6002	Naphtholaldehyde.	See <i>Naphthaldehyde, hydroxy-</i>	. . . . .	. . . . .
6003	β-Naphtholdisulfonic acid	<i>R</i> . See 2- <i>Naphthol</i> -3,6-di	<i>sulfonic acid.</i>	. . . . .
6004	1-Naphthol-3,6-disulfonic acid, 8-amino-	<i>H</i> acid.	$\text{H}_2\text{N}(\text{OH})\text{C}_{10}\text{H}_4(\text{SO}_3\text{H})_2$	319.30
6005	2-Naphthol-3,6-disulfonic acid	β -naphtholdisulfonic acid <i>R</i> ; β -naphthol- α -disulfonic acid; <i>R</i> acid	$\text{HOC}_{10}\text{H}_5(\text{SO}_3\text{H})_2$	304.28
6006	2-Naphthol-6,8-disulfonic acid	β -naphthol- γ -disulfonic acid; <i>G</i> acid	$\text{HOC}_{10}\text{H}_5(\text{SO}_3\text{H})_2$	304.28
6007	β-Naphthol-α-monosulfonic acid.	See <i>Croceic acid.</i>	. . . . .	. . . . .
6008	1-Naphthol-2-sulfonic acid	α -naphtholsulfonic acid of Schaeffer	$\text{HOC}_{10}\text{H}_6\text{SO}_3\text{H}$	224.22

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5974	yel. need.....			194 d.	i.	v. s.	v. s. eth.
5975	col. liq., 1.5671 ¹⁷	1.090		140 ¹⁷	v. sl. s.	v. s.	v. s. eth.
5976	wh. monoc. pl.		68	265.3	sl. s. h.	v. s.	v. s. eth.
5977	liq.....	1.155 ²⁰ ₄		161 ²⁰ ; 285 d.	i.	v. s.	v. s. eth.
5978	col. monoc. leaf.	1.217 ⁴	122	294.85 (286)	0.074 ²⁵	12.5 ²⁵	76.9 ²⁵ eth.; s. chl., oils, alk., glyc.
5979	sm. need. f. al.		68.5		i.	s.	s. eth., chl.
5980	need. f. al.		110 (107-8)		i.	v. s. h.	sl. s. eth.
5981	leaf. f. w., al.		235 d.	subl.		s.	s. eth., h. ac. a.; v. s. NaOH; sl. s. bz.
5982	leaf. unst.				sl. s. h.		sl. s. fluores. eth.
5983	need. f. w.		234		s.	v. s.	sl. s. eth., bz.
5984	need. or sc. f. w.		186		s.	s.	s. eth.
5985	sc. f. h. w.		190-5 d.		s.	s.	
5986	need. f. al.		201		sl. s.	v. s.	v. s. eth.
5987	need. f. w. or eth.		205-7		s.	s.	sl. s. eth.
5988	rhomb. pr.		84	d. 130	i.	s.	s. eth.
5989	need.		129		i.	s.	s. eth.
5990	pl. f. w., or need. f. lgr.		70		sl. s.	s.	s. eth., chl., bz., ac. a.; sl. s. c. lgr.
5991	need. f. ac. a.		106		i.	s.	s. eth.
5992	pa. yel. need.		195 d.		v. sl. s.	s.	s. eth., chl.
5993	need.		112		sl. s.	s.	s. eth.
5994	yel. need. f. al.		103 (98-100)		v. sl. s.	sl. s.	v. s. eth.
5995	yel. need. f. w.		147		v. s. h.	v. s.	v. s. eth.
5996	yel. need. f. w.		145		s.	v. s.	s. eth., bz., chl.
5997	yel. need. f. bz.		110 (105-7)		0.02 c.	2.4 ¹³ v. s. h.	v. s. eth.; s. bz., glac. ac. a.
5998	or. to br. pl.		252		i.	i.	
5999	oil	1.071		265.5	v. sl. s.	v. s.	v. s. eth.
6000	need. f. al.		57.5	276	v. sl. s.	v. s.	v. s. eth.
6001	glit. sc. f. al.	1.550	81	288 d.	sl. s.	v. s.	v. s. eth.
6002							
6003							
6004	col. cr.				sl. s.		
6005	deliq. col. need.		d.		v. s.	v. s.	i. eth.
6006					s.		
6007							
6008	col. rhomb. tab. f. w.		>250		s.	s.	i. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6009	1-Naphthol-3-sulfonic acid	.....	$\text{HOC}_{10}\text{H}_6\text{SO}_3\text{H}$..	224.22
6010	1-Naphthol-4-sulfonic acid	Neville-Winther acid.....	$\text{HOC}_{10}\text{H}_6\text{SO}_3\text{H}$	224.22
6011	1-Naphthol-5-sulfonic acid	α -naphtholsulfonic acid L....	$\text{HOC}_{10}\text{H}_6\text{SO}_3\text{H}$	224.22
6012	—, 8-amino-	S acid.....	$\text{C}_{10}\text{H}_9\text{NO}_4\text{S}$..	239.24
6013	1-Naphthol-7-sulfonic acid	.....	$\text{HOC}_{10}\text{H}_6\text{SO}_3\text{H}$	224.22
6014	1-Naphthol-8-sulfonic acid	α -naphtholsulfonic acid S....	$\text{HOC}_{10}\text{H}_6\text{SO}_3\text{H}$	224.22
6015	—, inner anhydride.....	naphthosulfone.....	$\text{C}_{10}\text{H}_6\text{OSO}_2$	206.21
6016	2-Naphthol-6-sulfonic acid	Schäffer's acid; β -naphthol-sulfonic acid S	$\text{C}_{10}\text{H}_6(\text{OH})\text{SO}_3\text{H}$..	224.22
6017	—, 1-amino- , sodium salt	eikonogen.....	$\text{H}_2\text{N}(\text{OH})\text{C}_{10}\text{H}_6\text{SO}_3\text{Na}$	261.23
6018	2-Naphthol-7-sulfonic acid	β -naphtholsulfonic acid F....	$\text{C}_{10}\text{H}_6(\text{OH})\text{SO}_3\text{H}$..	224.22
6019	2-Naphthol-8-sulfonic acid	See <i>Croceic acid</i> .		
6020	1-Naphthonitrile	1-naphthalenecarbonitrile*; α -naphthyl cyanide	$\text{C}_{10}\text{H}_7\text{CN}$	153.17
6021	2-Naphthonitrile	2-naphthalenecarbonitrile*; β -naphthyl cyanide	$\text{C}_{10}\text{H}_7\text{CN}$	153.17
6022	α β -Naphthophenazine	e. See <i>Benzo[a]phenazine</i> .		
6023	α -Naphthoquinaldine.	See <i>Benzo[h]quinoline, 2-methyl</i> ..		
6024	β -Naphthoquinaldine.	See <i>Benzo[f]quinoline, 3-methyl</i> ..		
6025	Naphtho(2,3-f)quinoline	α -anthraquinoline.....	$\text{C}_{17}\text{H}_{11}\text{N}$	229.27
6026	α -Naphthoquinoline.	See <i>Benzo[h]quinoline</i> .		
6027	β -Naphthoquinoline.	See <i>Benzo[f]quinoline</i> .		
6028	1,2-Naphthoquinone ..	1,2-dihydro-1,2-diketonaphthalene; β -naphthoquinone	$\text{C}_{10}\text{H}_6\text{O}_2$	158.15
6029	—, 1-oxime.	See <i>2-Naphthol, 1-nitroso</i> ..		
6030	—, 2-oxime.	See <i>1-Naphthol, 2-nitroso</i> ..		
6031	—, 6-hydroxy-.....	.....	$\text{HOC}_{10}\text{H}_5\text{O}_2$	174.15
6032	—, 7-hydroxy-.....	.....	$\text{HOC}_{10}\text{H}_5\text{O}_2$	174.15
6033	1,4-Naphthoquinone ..	1,4-dihydro-1,4-diketonaphthalene; α -naphthoquinone	$\text{C}_{10}\text{H}_6\text{O}_2$	158.15
6034	—, 1-oxime.	See <i>1-Naphthol, 4-nitroso</i> ..		
6035	—, 2,3(or 3,4)-dihydroxy-	oxy- See <i>Isonaphthazarin</i> .		
6036	—, 5,8-dihydroxy- ..	See <i>Naphthazarin</i> .		
6037	—, 2-hydroxy-.....	.....	$\text{HOC}_{10}\text{H}_5\text{O}_2$	174.15
6038	—, 5-hydroxy- ..	See <i>Juglone</i> .		
6038M	—, 2-hydroxy-3-methyl-	hyl- See <i>Phthiocol</i> .		
6039	2,6-Naphthoquinone ..	2,6-dihydro-2,6-diketonaphthalene; <i>amphi</i> -naphthoquinone	$\text{C}_{10}\text{H}_6\text{O}_2$	158.15
6040	Naphthoresorcinol .	See <i>1,3-Naphthalenediol*</i> .		
6041	Naphthosulfone .	See <i>1-Naphthol-8-sulfonic acid, inner anhydride</i> .		
6042	Naphthylamine, hydroxy-	See <i>Naphthol, amino-</i> .		
6043	1-Naphthylamine	α -naphthylamine.....	$\text{C}_{10}\text{H}_7\text{NH}_2$	143.18
6044	—, hydrochloride.....	.....	$\text{C}_{10}\text{H}_7\text{NH}_2\text{HCl}$..	179.65
6045	—, N-acetyl-	<i>N</i> -1-naphthylacetamide; 1-acetonaphthalide	$\text{C}_{10}\text{H}_7\text{NHCOCOCH}_3$..	185.22
6046	—, N-acetyl-N-methyl-	<i>N</i> -methyl- <i>N</i> -1-naphthylacetamide	$(\text{CH}_3\text{CO})(\text{CH}_3)\text{NC}_{10}\text{H}_7$	199.24

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6009	need. ....	.....	.....	.....	s.	.....	.....
6010	col. pl. f. w. ....	.....	170 d.	.....	v. s.	.....	.....
6011	wh. hyg. cr. ....	.....	120	.....	s.	.....	.....
6012	wh. need. ....	.....	.....	.....	sl. s.	i.	i. eth.
6013	cr. ....	.....	.....	.....	v. s.	v. s.	.....
6014	cr. ....	.....	107	-H ₂ O, 180	v. s.	.....	.....
6015	pr. f. bz. ....	.....	154	360	sl. s.	sl. s.	v. s. chl.; s. bz.; sl. s. CS ₂
6016	col. leaf. ....	.....	125	.....	v. s.	v. s.	i. eth.
6017	wh. powd. ....	.....	.....	.....	s.	.....	.....
6018	need. f. HCl. ....	.....	89	d. 150	v. s.	v. s.	i. eth., bz.
6019	col. need. f.	1.117 ⁵ ₅	33.5	296.5	i.	v. s.	v. s. eth.; s. lgr.
6020	lgr. ....	.....	.....	.....	.....	.....	.....
6021	col. leaf. f. lgr.	1.094 ⁶⁰ ₆₀	66.5	305	i.	s.	s. eth., lgr.
6022	.....	.....	.....	.....	.....	.....	.....
6023	.....	.....	.....	.....	.....	.....	.....
6024	.....	.....	.....	.....	.....	.....	.....
6025	col. leaf. or tab. ....	.....	170	446	i.	v. s.	v. s. eth.; s. bz.
6026	.....	.....	.....	.....	.....	.....	.....
6027	.....	.....	.....	.....	.....	.....	.....
6028	yel.-red need. f. eth. ....	.....	d. 115-120	.....	s.	s.	s. eth., H ₂ SO ₄ , bz.
6029	.....	.....	.....	.....	.....	.....	.....
6030	.....	.....	.....	.....	.....	.....	.....
6031	brick red lvs. f. acet. ....	.....	165 d.	.....	s.	s.	s. eth.
6032	br.-red need. ....	.....	194	.....	.....	s.	i. eth., bz.; s. ac. a.
6033	yel. tricl. f. lgr.	1.422	125	subl. 100	sl. s.	s.	v. s. eth., CS ₂ , glac. ac. a.; s. bz., chl.
6034	.....	.....	.....	.....	.....	.....	.....
6035	.....	.....	.....	.....	.....	.....	.....
6036	.....	.....	.....	.....	.....	.....	.....
6037	yel. need. ....	.....	190 d.	subl.	sl. s. h.	s.	s. eth.
6038	.....	.....	.....	.....	.....	.....	.....
6038M	.....	.....	.....	.....	.....	.....	.....
6039	or. pr. ....	.....	135	.....	.....	s.	v. sl. s. eth.; s. alk.
6040	.....	.....	.....	.....	.....	.....	.....
6041	.....	.....	.....	.....	.....	.....	.....
6042	.....	.....	.....	.....	.....	.....	.....
6043	col. rhomb. need. f. dil. al., 1.6703 ^{21.2}	1.131	50	301	0.17	v. s.	v. s. eth.
6044	sm. need. ....	.....	.....	.....	3.77 ²⁰	v. s.	s. eth.
6045	col. cr. ....	.....	159-60	.....	s.	4 ²⁵	v. sl. s. eth.
6046	pr. ....	.....	95	.....	sl. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6047	1-Naphthylamine, <i>N</i>,		$C_{10}H_7N(C_2H_5)_2$	199.29
6048	—, <i>N,N</i> -dimethyl-		$C_{10}H_7N(CH_3)_2$	171.23
6049	—, <i>N</i> -ethyl-		$C_{10}H_7NHC_2H_5$	171.23
6050	—, <i>N</i> -methyl-	α -naphthylmethylamine	$C_{10}H_7NHCH_3$	157.21
6051	—, 4-(1-naphthyl-azo)-	4-amino-1,1'-azonaphthalene	$C_{10}H_7N:NC_{10}H_6-NH_2$	297.35
6052	—, 6-nitro-		$NO_2C_{10}H_6NH_2$	188.18
6053	—, <i>N</i> -phenyl-		$C_{10}H_7NHC_6H_5$	219.27
6054	—, 4-phenylazo-	4-benzeneazo- α -naphthylamine	$C_6H_5N_2C_{10}H_6NH_2$	247.29
6055	—, <i>N</i> -propyl-		$C_{10}H_7NHCH_2CH_2CH_3$	185.26
6056	—, 5,6,7,8-tetrahydro-	α -naphthylamine 5,6,7,8-tetrahydride; <i>ar</i> -tetrahydro- α -naphthylamine	$C_4H_8:C_6H_3NH_2$	147.21
6057	—, <i>N</i> - <i>o</i> -tolyl-	<i>N</i> -1-naphthyl- <i>o</i> -toluidine	$C_{10}H_7NHC_6H_4CH_3$	233.30
6058	—, <i>N</i> - <i>p</i> -tolyl-	<i>N</i> -1-naphthyl- <i>p</i> -toluidine	$C_{10}H_7NHC_6H_4CH_3$	233.30
6059	2-Naphthylamine	β -naphthylamine	$C_{10}H_7NH_2$	143.18
6060	—, hydrochloride		$C_{10}H_7NH_2 \cdot HCl$	179.65
6061	—, <i>N</i> -acetyl-	<i>N</i> -2-naphthylacetamide; 2-acetonaphthalide	$C_{10}H_7NHCOC_2H_5$	185.22
6062	—, <i>N,N</i> -dimethyl-		$C_{10}H_7N(CH_3)_2$	171.23
6063	—, <i>N</i> -ethyl-		$C_{10}H_7NHC_2H_5$	171.23
6064	—, <i>N</i> -methyl-	β -naphthylmethylamine	$C_{10}H_7NHCH_3$	157.21
6065	—, 1-nitro-		$NO_2C_{10}H_6NH_2$	188.18
6066	—, 5-nitro-		$NO_2C_{10}H_6NH_2$	188.18
6067	—, 8-nitro-		$NO_2C_{10}H_6NH_2$	188.18
6068	—, 1-nitroso-		$NOC_{10}H_6NH_2$	172.18
6069	—, <i>N</i> -phenyl-		$C_{10}H_7NHC_6H_5$	219.27
6070	—, 1,2,3,4-tetrahydro-	β -naphthylamine 1,2,3,4-tetrahydride; <i>ac</i> -tetrahydro- β -naphthylamine	$C_6H_8:C_4H_7NH_2$	147.21
6071	—, <i>N</i> - <i>o</i> -tolyl-	<i>N</i> -2-naphthyl- <i>o</i> -toluidine	$C_{10}H_7NHC_6H_4CH_3$	233.30
6072	—, <i>N</i> - <i>p</i> -tolyl-	<i>N</i> -2-naphthyl- <i>p</i> -toluidine	$C_{10}H_7NHC_6H_4CH_3$	233.30
6073	1-Naphthylamine-4,8-disulfonic acid	4-amino-1,5-naphthalenedisulfonic acid; α -naphthylaminedisulfonic acid S	$NH_2C_{10}H_6(SO_3H)_2$	303.30
6074	2-Naphthylamine-4,8-disulfonic acid	3-amino-1,5-naphthalenedisulfonic acid; β -naphthylaminedisulfonic acid; C acid; acid IV	$H_2NC_{10}H_6(SO_3H)_2$	303.30
6075	2-Naphthylamine-6,8-disulfonic acid	amino G acid; 7-amino-1,3-naphthalenedisulfonic acid	$H_2NC_{10}H_6(SO_3H)_2$	303.30
6076	α -Naphthylaminemonosulfonic acid S. See 1-Naphthylamine-8-sulfonic acid.			
6077	β -Naphthylaminemonosulfonic acid I (of Dahl). See 2-Naphthylamine-8-sulfonic acid.			
6078	α -Naphthylaminesulfonic acid. See 1-Naphthylamine-5-sulfonic acid.			

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6047	col.-br. oil, 1.5933 ^{18.1}	1.005	.....	290 (285)	i.	s.	s. eth., bz.
6048	col. liq. with vlt. fluores.	1.0446 ¹⁵ ₁₅	59.5-67	274.5	i.	s.	s. eth.
6049	col. oil, 1.64773 ^{15.1}	1.060 ²⁰ ₄	.....	305 (187-90 ²⁰)	i.	s.	s. eth.
6050	red oil.....	.....	.....	293	i.	v. s.	v. s. eth.; s. CS ₂
6051	redsh.-br. need.	.....	175 (183)	.....	i.	sl. m.	sl. s. eth., bz.
6052	yel. pr. f. al.	.....	143	.....	.....	s.	.....
6053	col. leaf. or pr. f. al.	.....	62	335 ²⁵⁸	1.44 ²⁵	s.	v. s. eth.; s. bz., chl., ac.a.
6054	red need. f. al.	.....	120 (123)	.....	.....	s.	s. eth., bz.
6055	oil.....	.....	.....	ca. 317	i.	.....	.....
6056	oil, 1.58964 ^{23.1}	1.054 ²³	.....	276.8	v. sl. s.	s.	s. eth., dil. a.
6057	need. f. lgr.	.....	94-5	.....	i.	v. s.	v. s. eth., bz.
6058	pr. f. al.	.....	79	230 ¹⁰	i.	s.	v. s. eth.; s. bz.; sl. m. h. pet. eth.
6059	leaf. f. w., 1.64927 ^{38.4}	1.061 ^{9.8} ₄	110.2	306.1	i.	s.	s. eth., bz.
6060	leaf.....	.....	.....	.....	v. s.	v. s.	s. eth.; sl. s. HCl
6061	lng. flat need. f. w.	.....	132	.....	s.	s.	sl. s. eth.
6062	dk. red need., 1.64432 ^{53.2}	1.029 ^{5.5} ₄	52-53	305; 212.5 ⁶⁹	i.	s.	s. eth.
6063	col. oil, 1.65440 ^{21.3}	1.057	<-15	315-6 (305-7)	i.	s.	s. eth.
6064	oil.....	.....	.....	308-10 ⁷⁶¹ (298)	.....	.....	.....
6065	or. -yel. need. f. al.	.....	127 (123-4)	.....	s. h.	v. s.	s. ac. a.
6066	red need. f. al.	.....	143	.....	.....	v. s. h.	s. bz.; i. lgr.
6067	red need.	.....	105	.....	.....	v. s.	s. eth.; i. lgr.
6068	grn. need. f. al.	.....	150-2	.....	sl. s. h.	v. s.	v. s. eth.
6069	rhomb. need. f. me. al.	.....	108	399.5	i.	s.	s. eth., h. bz.; v. s. chl.
6070	liq., 1.56039 ^{22.2}	1.029 ²²	38	278.5	s. h.	v. s.	v. s. eth.
6071	leaf. f. lgr.	.....	95-6	400-5	.....	s.	s. eth.; v. s. bz., lgr., chl., acet.
6072	red leaf. f. al.	.....	102-3	.....	.....	sl. s.	s. eth., bz.; sl. s. lgr.
6073	rhomb. cr.	.....	.....	.....	v. s.	.....	.....
6074	.....	.....	.....	.....	s.	.....	.....
6075	monocl. need.	.....	.....	.....	s.	.....	.....
6076	sulfonic acid.	.....	.....	.....	.....	.....	.....
6077		.....	.....	.....	.....	.....	.....
6078		.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6079	β-Naphthylaminesulfonic acid F.	See 2-Naphthylamine-7-sulfonic acid.		
6080	β-Naphthylaminesulfonic acid III.	See 2-Naphthylamine-5-sulfonic acid.		
6081	1-Naphthylamine-2-sulfonic acid	1-amino-2-naphthalenesulfonic acid	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H}$	223.24
6082	1-Naphthylamine-4-sulfonic acid	lionic acid. See <i>Naphthionic acid</i> .		
6083	1-Naphthylamine-5-sulfonic acid	5-amino-1-naphthalenesulfonic acid; α -naphthylaminesulfonic acid; Laurent's acid	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H} \cdot \text{H}_2\text{O}$	241.26
6084	1-Naphthylamine-6-sulfonic acid	5-amino-2-naphthalenesulfonic acid	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H}$	223.24
6085	1-Naphthylamine-7-sulfonic acid	8-amino-2-naphthalenesulfonic acid	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H} \cdot \text{H}_2\text{O}$	241.26
6086	1-Naphthylamine-8-sulfonic acid	8-amino-1-naphthalenesulfonic acid; α -naphthylaminemonosulfonic acid S; Schöllkopf's acid	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H} \cdot \text{H}_2\text{O}$	241.26
6087	2-Naphthylamine-1-sulfonic acid	Tobias' acid; 2-amino-1-naphthalenesulfonic acid	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H}$	223.24
6088	2-Naphthylamine-4-sulfonic acid	3-amino-1-naphthalenesulfonic acid	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H} \cdot \text{H}_2\text{O}$	241.26
6089	2-Naphthylamine-5-sulfonic acid	6-amino-1-naphthalenesulfonic acid; β -naphthylaminesulfonic acid III	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H}$	223.24
6090	2-Naphthylamine-6-sulfonic acid	6-amino-2-naphthalenesulfonic acid; Brönner's acid	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H} \cdot \text{H}_2\text{O}$	241.26
6091	2-Naphthylamine-7-sulfonic acid	7-amino-2-naphthalenesulfonic acid; β -naphthylaminesulfonic acid F	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H} \cdot \text{H}_2\text{O}$	241.26
6092	2-Naphthylamine-8-sulfonic acid	7-amino-1-naphthalenesulfonic acid; β -naphthylaminemonosulfonic acid I (of Dahl)	$\text{NH}_2\text{C}_{10}\text{H}_6\text{SO}_3\text{H}$	223.24
6093	α-Naphthyl cyanide.	See 1-Naphthonitrile.		
6094	β-Naphthyl cyanide.	See 2-Naphthonitrile.		
6095	1,2-Naphthylenediamine	1,2-naphthalenediamine*; 1,2-diaminonaphthalene	$\text{C}_{10}\text{H}_6(\text{NH}_2)_2$	158.20
6096	1,4-Naphthylenediamine	1,4-naphthalenediamine*; 1,4-diaminonaphthalene	$\text{C}_{10}\text{H}_6(\text{NH}_2)_2$	158.20
6097	1,5-Naphthylenediamine	1,5-naphthalenediamine*; 1,5-diaminonaphthalene	$\text{C}_{10}\text{H}_6(\text{NH}_2)_2$	158.20
6098	1,6-Naphthylenediamine	1,6-naphthalenediamine*; 1,6-diaminonaphthalene	$\text{C}_{10}\text{H}_6(\text{NH}_2)_2$	158.20
6099	1,7-Naphthylenediamine	1,7-naphthalenediamine*; 1,7-diaminonaphthalene	$\text{C}_{10}\text{H}_6(\text{NH}_2)_2$	158.20
6100	1,8-Naphthylenediamine	1,8-naphthalenediamine*; 1,8-diaminonaphthalene	$\text{C}_{10}\text{H}_6(\text{NH}_2)_2$	158.20
6101	2,3-Naphthylenediamine	2,3-naphthalenediamine*; 2,3-diaminonaphthalene	$\text{C}_{10}\text{H}_6(\text{NH}_2)_2$	158.20
6102	2,6-Naphthylenediamine	2,6-naphthalenediamine*; 2,6-diaminonaphthalene	$\text{C}_{10}\text{H}_6(\text{NH}_2)_2$	158.20
	Naphthyl esters.	See "naphthyl ester," under the names of the acids.		
6103	1-Naphthyl ether	1-(1-naphthoxy)naphthalene*; α -dinaphthyl ether	$(\text{C}_{10}\text{H}_7)_2\text{O}$	270.31
6104	1,2'-Naphthyl ether	α, β' -dinaphthyl ether; 1-(2-naphthoxy)naphthalene	$\text{C}_{10}\text{H}_7\text{OC}_{10}\text{H}_7$	270.31
6105	2-Naphthyl ether	2-(2-naphthoxy)naphthalene*; β -dinaphthyl ether	$(\text{C}_{10}\text{H}_7)_2\text{O}$	270.31

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6079							
6080							
6081	need. f. w. ....	.....	272 d.	.....	0.41 ²⁰ , 3.1 ¹⁰⁰	i.	i. bz.
6082							
6083	sm. pl. ....	.....	189.5	.....	sl. s.	v. sl. s.	v. sl. s. eth.
6084	col. pl. f. w. ....	.....	d.	.....	0.03 ²⁰	i.	i. eth.
6085	col. need. f. w. ....	.....		.....	0.464 ²⁵	v. sl. s.	v. sl. s. eth.
6086	need. ....	.....	-H ₂ O, 130	.....	0.42 ¹⁰⁰ , 0.02 ²¹	v. sl. s.	v. sl. s. eth.; s. ac. a.
6087	leaf. f. h. w. ....	.....		.....	sl. s. c., s. h.	v. sl. s.	v. sl. s. eth.
6088	need. f. w. ....	.....		.....	sl. s. c.	v. sl. s.	v. sl. s. eth.
6089	need. f. w. ....	.....		.....	0.033 ²⁰	v. sl. s.	v. sl. s. eth.
6090	leaf. ....	.....		.....	0.013 ²⁰ , 0.16 ¹⁰⁰	v. sl. s.	v. sl. s. eth.
6091	col. need. ....	.....		.....	0.02 ²⁰ , 0.28 ¹⁰⁰	v. sl. s.	v. sl. s. eth.
6092	pr. f. w. ....	.....		.....	0.06 ²⁰	sl. s.	v. sl. s. eth.
6093							
6094							
6095	leaf. f. w. ....	.....	96	150-1 ^{0.5}	s. h.	v. s.	v. s. eth.
6096	pr. f. h. w. ....	.....	120	.....	sl. s.	v. s.	v. s. eth.
6097	col. pr. f. eth. ....	.....	189.5	subl.	v. sl. s. c.	s. h.	v. s. eth., chl.
6098	need. f. w., 1.7083 ^{99.4}	1.147 ⁹⁹	78	.....	v. sl. s. c., s. h.	s. h.	sl. s. eth.
6099	leaf. f. bz.; need. f. w.	.....	117.5	.....	sl. s.	v. s.	v. sl. s. eth.
6100	col. cr. f. al., 1.6828 ^{99.4}	1.127 ⁹⁹	66.5	subl. 205 ¹²	sl. s.	v. s.	v. s. eth.
6101	leaf. f. eth. ....	.....	191	.....	.....	v. s.	s. eth.
6102	need. f. w. ....	.....	216	.....	v. sl. s. h.	v. sl. s.	v. sl. s. eth.
6103	col. leaf. ....	.....	110	>360	i.	s. h.	s. eth., bz., h. ac. a.
6104	need. f. al. + eth.	.....	81	264 ¹⁵	i.	sl. s.	s. eth., bz., chl.
6105	col. need. f. al. ....	.....	105	250 ²⁰ sl. d.	i.	s. h.	v. s. eth.; s. bz., h. ac. a.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6106	1-Naphthyl ketone. . . .	α , α -dinaphthyl ketone.	$C_{10}H_7COC_{10}H_7$	282.32
6107	1,2'-Naphthyl ketone. . .	α , β' -dinaphthyl ketone.	$C_{10}H_7COC_{10}H_7$	282.32
6108	2-Naphthyl ketone. . . .	β , β' -dinaphthyl ketone.	$C_{10}H_7COC_{10}H_7$	282.32
6109	Naphthyl mercaptan.	See <i>Naphthol</i> , <i>thio</i> .		
6110	2-Naphthyl salicylate.	See <i>Betol</i> .		
6111	Narceine.		$C_{23}H_{27}NO_8 \cdot 3H_2O$. .	499.51
6112	—, bisulfate.		$C_{23}H_{27}NO_8 \cdot H_2SO_4 \cdot 10H_2O$	723.69
6113	—, hydrochloride.		$C_{23}H_{27}NO_8 \cdot HCl \cdot 3H_2O$	535.97
6114	Narcotine.		$C_{22}H_{23}NO_7$	413.41
6115	—, hydrochloride.		$C_{22}H_{23}NO_7 \cdot HCl \cdot H_2O$	467.90
6116	dI-Narcotine.	See <i>Gnoscopine</i> .		
6117	Narcotine hemipic acid.	d. See <i>Hemipic acid</i> .		
6118	Naringin.		$C_{23}H_{25}O_{12}(?)$	496-.46(?)
6119	Neohexane.	See <i>Butane</i> , 2,2-dimethyl-*		
6120	Neopentane.	See <i>Propane</i> , 2,2-dimethyl-*		
6121	Neopentyl alcohol.	See 1- <i>Propanol</i> , 2,2-dimethyl-*		
6122	Neral.	See <i>Citral</i> b.		
6122M	Nerol.	3,7-dimethyl-2,6-octadien-1-ol*	$C_{10}H_{17}OH$	154.25
6123	Nerolin (new).	See <i>Ether</i> , ethyl 2-naphthyl.		
6124	Nerolin (old).	See <i>Ether</i> , methyl 2-naphthyl.		
6125	Neurine.	trimethylvinylammonium hydroxide	$CH_2:CHN(CH_3)_3 \cdot OH$	103.16
6126	Nevile-Winther acid.	See 1- <i>Naphthol</i> -4-sulfonic acid.		
6127	Ngai camphor.	See <i>l-Borneol</i> .		
6128	Nicotine.		$C_{10}H_{12}N_2$	160.21
6128M	Nicotinamide.	nicotinic amide; 3-pyridine-carboxamide*; pellagra-preventive vitamin; P.P. factor	$C_6H_4NCONH_2$	122.12
6129	Nicotine.		$C_{10}H_{14}N_2$	162.23
6130	—, hydrochloride (d)		$C_{10}H_{14}N_2 \cdot 2HCl$. . .	235.16
6131	—, picrate.		$C_{10}H_{14}N_2 \cdot 2C_6H_3N_3O_7$	620.45
6132	—, salicylate.		$C_{10}H_{14}N_2 \cdot C_7H_5O_3$. .	300.35
6133	—, tartrate.	nicotine bitartrate	$C_{10}H_{14}N_2 \cdot 2C_4H_6O_6 \cdot 2H_2O$	498.44
6134	Nicotinic acid.	3-pyridinecarboxylic acid*; pellagra-preventive vitamin; P. P. factor	C_6H_4NCOOH	123.11
6135	—, N-methylbetaine.	See <i>Trigonelline</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6106	need. f. eth....	.....	104	subl.	.....	s. h.	sl. s. eth., h. ac. a., lgr.; v. s. bz.; s. chl., H ₂ SO ₄
6107	col. need. f. al. ....	.....	136-7 (135)	subl.	.....	1.3 ¹⁴	v. s. eth.; s. bz.
6108	(1) need. f. eth. ....	.....	125.5	.....	i.	0.37 ¹⁹	.....
	(2) leaf. f. chl.+eth. ....	.....	164.5	.....	i.	0.08 ¹⁹	sl. s. eth.; s. chl.
6109							
6110							
6111	col. pr. f. w....	.....	anh. 170	.....	0.078 ¹³	0.1	i. eth., bz.; s. alk., NH ₄ OH; sl. s. chl.; 0.011 ¹⁷ CCl ₄
6112	cr. powd. or need. ....	.....	d. → yel.	.....	s.	s. h.	s. chl.
6113	yel. cr. f. HCl. ....	.....	anh. 192	.....	sl. s.	s.	s. me. al.
6114	col. rhomb. need. f. al., [α] _D -207.35 °b	1.374	175	d.	0.004 ²⁰	1 ²⁰	0.8 ⁴ , 2.1 ³⁵ eth.; v. s. chl.; s. bz., CS ₂ , eth. ac., acet., pet. eth.
6115	wh. lust. cr....	.....	197-8	.....	s.	.....	s. chl.
6116							
6117							
6118	sm. pr. ....	.....	anh. 171	.....	sl. s. c., s. h.	v. s. h.	i. eth.
6119							
6120							
6121							
6122							
6122M	oil.	0.881 ¹⁵⁰	.....	224-5 ⁷⁴⁵	.....	.....	.....
6123							
6124							
6125	syrup. ....	.....	.....	.....	s.	s.	s. eth.
6126							
6127							
6128		1.078 ¹²	.....	267	.....	.....	.....
6128M	wh. cr. powd. ....	.....	129-31	.....	100	66.6	sl. s. eth., bz.; 10 glyc.
6129	col. oil., 1.5239 ^{22.4} [α] _D -161.55 °	1.00924 ²⁰ / ₄	<-80	247.3	s.	∞	∞ eth.; v. s. chl., pet. eth., oils
6130	deliq. cr. ....	.....	.....	.....	■.	s.	.....
6131	yel. need. or pr. ....	.....	218	.....	.....	.....	.....
6132	wh. pl. ....	.....	117.5	.....	s.	■.	s. eth.
6133	reddish-wh. cr. ....	.....	88-90	.....	v. s.	s.	s. eth.
6134	col. need. ....	.....	234-37	subl.	sl. s. c., s. h.	0.73 ²⁵	v. sl. s. eth.
6135							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6136	Nicotinic acid, 2-hydroxy-	.....	$C_5H_3N(OH)COOH$	139.11
6137	—, 1,2,5,6-tetrahydr	o-1-methyl-. See <i>Arecaidin e.</i>		
6137M	Nicotinic amide.	See <i>Nicotinamide.</i>		
6138	Nicotyrine.....	3-(1-methyl-2-pyrryl)pyridine; dipyridine	$C_{10}H_{10}N_2$	158.20
6139	Niobe oil.	See <i>Benzoic acid, methyl ester.</i>		
6140	Nitramine diethyl-	See <i>Diethylamine, N-nitro-</i>		
6141	—, dimethyl-	See <i>Dimethylamine, N-nitro-</i>		
6142	—, methylpicryl-	See <i>Tetrayl.</i>		
6143	—, phenyl-	See <i>Aniline, N-nitro-</i>		
6144	—, n-propyl-	See <i>Propylamine, N-nitro-</i>		
6145	Nitranilic acid.....	2,5-dihydroxy-3,6-dinitroquinone	$(NO_2)_2C_6O_2(OH)_2$	230.09
6146	Nitranilide.	See <i>Aniline, N-nitro-</i>		
6147	Nitric diethylamide.	See <i>Diethylamine, N-nitro-</i>		
6148	Nitric dimethylamide.	See <i>Dimethylamine, N-nitro-</i>		
6149	Nitric ether.	See <i>Ethyl nitrate.</i>		
6150	Nitro-. See the parent com	pounds (e.g., for nitrobenzene s	ee <i>Benzene, nitro-</i>).	
6150	Nitroerythrite.	See <i>Erythritol, tetranitrate.</i>		
6151	Nitroform.....	trinitromethane*.....	$CH(NO_2)_3$	151.04
6152	Nitroglycerin.....	glycerol trinitrate; glyceryl nitrate; trinitrin; glonoin; etc.	$C_3H_5(ONO_2)_3$	227.09
6153	Nitrolic acid, ethyl-	See <i>Acetonitrolic acid.</i>		
6154	—, methyl-	See <i>Formonitrolic acid.</i>		
6155	Nitromannite.	See <i>Mannitol, hexanitrate.</i>		
6156	Nitron.....	4,5-dihydro-1,4-diphenyl-3,5-phenylimino-1,2,4-triazole	$C_{20}H_{16}N_4$	312.36
6157	Nitrosamine, diethyl-	See <i>Diethylamine, N-nitroso-</i>		
6158	—, diisopropyl-	See <i>Diisopropylamine, N-nitro-</i>	so-	
6159	—, dimethyl-	See <i>Dimethylamine, N-nitroso-</i>		
6160	—, diphenyl-	See <i>Diphenylamine, N-nitroso-</i>		
6161	—, dipropyl-	See <i>Dipropylamine, N-nitroso-</i>		
6162	—, methylphenyl-	See <i>Aniline, N-methyl- N-nitro-</i>	so-	
6163	Nitroso-. See the parent co	mpounds (e.g., for nitrosobenze	ne see <i>Benzene, nitroso-</i>).	
6163	Nitrosodiethylamide.	See <i>Diethylamine, N-nitroso-</i>		
6164	Nitrous diisopropylam	ide. See <i>Diisopropylamine, N-</i>	nitroso-	
6165	Nitrous dimethylamid	e. See <i>Dimethylamine, N-nitros</i>	o-	
6166	Nitrous diphenylamid	e. See <i>Diphenylamine, N-nitros</i>	o-	
6167	Nitrous dipropylamide	. See <i>Dipropylamine, N-nitroso-</i>		
6168	Nitrous ether.	See <i>Ethyl nitrite.</i>		
6168M	1-Nonacosanol*	n-nonacosyl alcohol.....	$n-C_{29}H_{59}OH$	424.78
6168R	n-Nonacosyl alcohol.	See 1-Nonacosanol.*		
6169	Nonadecane*.....	n-nonadecane.....	$CH_3(CH_2)_{17}CH_3$...	268.51
6170	Nonadecanoic acid*...	n-nonadecylic acid.....	$CH_3(CH_2)_{17}COOH$	298.50
6171	1-Nonadecanol*.....	n-nonadecyl alcohol.....	$CH_3(CH_2)_{18}OH$...	284.51
6172	10-Nonadecanone*...	caprinone; dinonyl ketone...	$(C_9H_{19})_2CO$	282.50
6173	n-Nonadecyl alcohol.	See 1-Nonadecanol*.		
6174	n-Nonadecylic acid.	See <i>Nonadecanoic acid*.</i>		
6175	Nonamethylene glycol.	See 1,9-Nonanediol*.		
6176	Nonanal, oxime.	See <i>Pelargonaldehyde, oxime.</i>		
6177	Nonanamide*.	See <i>Pelargonamide.</i>		
6178	Nonane*.....	n-nonane.....	$CH_3(CH_2)_7CH_3$...	128.25
6178M	—, 1-amino-	See <i>Nonylamine*(n).</i>		
6179	Nonanedioic acid*.	See <i>Azelaic acid.</i>		
6180	1,9-Nonanediol*.....	nonamethylene glycol; en-neamethylene glycol	$CH_2OH(CH_2)_7CH_2OH$	160.25

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6136	need. f. w. ....	.....	α 256; β 301-2 d.	subl.	sl. s. h.	sl. s.	sl. s. eth.; v. sl. s. chl.
6137							
6137M							
6138	need. f. h. w. . .	1.124 ¹³	108	286-90 ⁷³⁵ (280-1)	sl. s. c., s. h.	s.	s. eth.
6139							
6140							
6141							
6142							
6143							
6144							
6145	lng. yel. pl. f. acet.	.....	100	170 d.	v. s.	v. s.	i. eth.
6146							
6147							
6148							
6149							
6150							
6151	col. oil or wh. cr.	1.5967 ^{24.3} 4	15	45-7 ²² exp.	s.	.....	s. alk.
6152	col.-yel. liq., 1.482 ^{18.6}	1.601	2.9; 13.2	exp. 260	0.18 ²⁰	25	∞ eth.; 7 me. al.
6153							
6154							
6155							
6156	yel. need. ....	.....	189 d.	.....	i.	s.	sl. s. eth.; s. bz., acet., chl., et. ac.
6157							
6158							
6159							
6160							
6161							
6162							
6163							
6164							
6165							
6166							
6167							
6168							
6168M	.....	.....	84.6-85.0	.....	.....	.....	.....
6168R							
6169	leaf., 1.436 ^{34.6}	0.777 ³²	32	330	i.	sl. s.	s. eth.
6170	glit. leaf. f. al.	.....	66.5	299 ¹⁰⁰	i.	sl. s.	s. eth.
6171	opaque cr.	.....	62	.....	.....	.....	.....
6172	leaf. f. al.	.....	58	>350	i.	s. h.	s. eth.
6173							
6174							
6175							
6176							
6177							
6178	col. liq., 1.4056	0.7177 ²⁰	-53.7 (-51.0)	150.72	i.	v. s.	v. s. eth.
6178M							
6179							
6180	.....	.....	.....	147-50 ²	sl. s.	s.	i. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6181	Nonanenitrile* .	See <i>Pelargononitrile</i> .		
6182	Nonanoic acid* .	See <i>Pelargonic acid</i> .		
6183	1-Nonanol*	<i>n</i> -nonyl alcohol.....	$\text{CH}_3(\text{CH}_2)_7\text{CH}_2\text{OH}$	144.25
6184	—, 2-methyl*	2-heptyl-2-methylethanol....	$\text{CH}_3(\text{CH}_2)_6\text{CH}-$ $(\text{CH}_3)\text{CH}_2\text{OH}$	158.28
6185	2-Nonanol*	heptylmethylcarbinol.....	$\text{CH}_3\text{CHOH}-$ $(\text{CH}_2)_6\text{CH}_3$	144.25
6186	3-Nonanol*	ethylhexylcarbinol.....	$\text{CH}_3\text{CH}_2\text{CHOH}-$ $(\text{CH}_2)_5\text{CH}_3$	144.25
6187	4-Nonanol*	amylpropylcarbinol.....	$\text{CH}_3(\text{CH}_2)_2\text{CH}-$ $\text{OH}(\text{CH}_2)_4\text{CH}_3$	144.25
6188	5-Nonanol*	dibutylcarbinol.....	$(\text{C}_4\text{H}_9)_2\text{CHOH}$	144.25
6189	—, 2,8-dimethyl* ...	diisoamylcarbinol.....	$[(\text{CH}_3)_2\text{CH}-$ $(\text{CH}_2)_2]_2\text{CHOH}$	172.30
6190	2-Nonanone*	heptyl methyl ketone.....	$\text{CH}_3\text{CO}(\text{CH}_2)_6\text{CH}_3$	142.24
6191	3-Nonanone*	ethyl hexyl ketone.....	$\text{C}_2\text{H}_5\text{CO}(\text{CH}_2)_5-$ CH_3	142.24
6192	5-Nonanone*	dibutyl ketone.....	$(\text{CH}_3\text{CH}_2\text{CH}_2-$ $\text{CH}_2)_2\text{CO}$	142.24
6193	—, 2,8-dimethyl* ...	diisoamyl ketone; isocap- rone; diisopentyl ketone	$[(\text{CH}_3)_2\text{CH}-$ $(\text{CH}_2)_2]_2\text{CO}$	170.29
6194	Nonanoyl chloride* .	See <i>Pelargonyl chloride</i> .		
6195	1-Nonene*	α -nonylene.....	$\text{CH}_3(\text{CH}_2)_6-$ $\text{CH}:\text{CH}_2$	126.24
6196	1-Nonine.	See 1- <i>Nonyne*</i> .		
6197	<i>n</i>-Nonyl alcohol.	See 1- <i>Nonanol*</i> .		
6198	Nonylamine*(<i>n</i>)	1-aminononane.....	$\text{CH}_3(\text{CH}_2)_7\text{CH}_2-$ NH_2	143.27
6199	<i>n</i>-Nonyl cyanide.	See <i>Caprinitrile</i> .		
6200	α-Nonylene.	See 1- <i>Nonene*</i> .		
6201	<i>n</i>-Nonylic acid.	See <i>Pelargonic acid</i> .		
6202	Nonylone.	See 9- <i>Heptadecanone*</i> .		
6203	Nonyl sulfate	di- <i>n</i> -nonyl sulfate.....	$[(\text{CH}_3(\text{CH}_2)_8)_2\text{SO}_4]$	350.55
6204	1-Nonyne*	1-nonine; <i>n</i> -heptylacetylene..	$\text{CH}:\text{C}(\text{CH}_2)_6\text{CH}_3$..	124.22
6205	Norcamphane, 2,2-dimethyl-2-	ethyl-3-methylene- . See <i>Camphene</i> .		
6206	—, 7,7-dimethyl-2-	methylene- . See α - <i>Fenchon e</i> .		
6207	—, 2-keto-1,7,7-trimethyl-	ethyl- . See <i>Camphor</i> .		
6208	—, 1,7,7-trimethyl-	See <i>Camphane</i> .		
6209	—, 2,2,3-trimethyl-	See <i>Isocamphane</i> .		
6210	2-Norcamphanone, 1,3	3-trimethyl- . See <i>Fenchon e</i> .		
6211	<i>dl</i>-Norleucine	<i>dl</i> - α -aminocaproic acid; <i>dl</i> - glycoleucine; <i>dl</i> -2-amino- hexanoic acid*	$\text{CH}_3(\text{CH}_2)_3\text{CH}-$ $(\text{NH}_2)\text{COOH}$	131.17
6212	<i>d</i>-Norleucine	<i>d</i> - α -aminocaproic acid; <i>d</i> - 2-aminohexanoic acid*; <i>d</i> -glycoleucine	$\text{CH}_3(\text{CH}_2)_3\text{CH}-$ $(\text{NH}_2)\text{COOH}$	131.17
6213	<i>l</i>-Norleucine	<i>l</i> - α -aminocaproic acid; <i>l</i> -2- aminohexanoic acid*; <i>l</i> -glycoleucine	$\text{CH}_3(\text{CH}_2)_3\text{CH}-$ $(\text{NH}_2)\text{COOH}$	131.17
6214	Normenthane.	See <i>Cyclohexane, isopropyl-</i> .		
6215	3-Nortropanol, 8-methyl-	yl- . See <i>Tropine</i> .		
6216	Nosophen.	See <i>Phenolphthalein, 3',3'',5',5''</i> -tetraiodo-		
6217	Novocain.	See <i>Procaine, hydrochloride</i> .		
6218	Nucin.	See <i>Juglone</i> .		
6219	Ocimene	3,7-dimethyl-1,3,6-octa- triene* (one form)	$(\text{CH}_3)_2\text{C}:\text{CHCH}_2-$ $\text{CH}:\text{C}(\text{CH}_3)-$ $\text{CH}:\text{CH}_2$	136.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6181							
6182							
6183	col. liq., 1.43347 ²⁰	0.8274 ²⁰ ₄	-5	213	i.	∞	∞ eth.
6184	liq.	0.849 ⁰ ₄	.....	118 ¹⁵	i.	s.	s. eth.
6185	col. liq., 1.4290 ²⁵	0.8190 ²⁵ ₄ ; 0.8471 ²⁰ ₄	-35	193-4 (198.3)	i.	s.	s. eth.
6186	liq.	0.825 ²⁰ ₄	-22	194-5 ⁵⁰	i.	s.	s. eth.
6187	liq.	0.8282	.....	192-3	i.	s.	s. eth.
6188	thick oil. 1.4289 ¹⁸	0.823 ¹⁸	.....	194	i.	∞	∞ eth.
6189	liq.	0.8305 ^{12.6} ₄	.....	105 ⁹	i.	s.	s. eth.
6190	liq.	0.8317	-8.2 (-19)	194-6	i.	s.	s. eth.
6191	pr.	0.840 ⁶	-8	190	.....	s.	s. eth.
6192	col. liq., 1.421 ¹⁵	0.8270 ¹³ ₄	-5.9	186-7 (181-2)	v. sl. s.	s.	s. eth.; v. s.
6193	yel. oil.	0.8208 ²⁵ ₄	14.6	226	i.	s.	s. eth.
6194							
6195	col. liq., 1.416	0.7302 ²⁰	.....	149.9	i.	s.	s. eth.
6196							
6197							
6198	col. liq. ....	.....	.....	202.2	sl. s.	s.	s. eth.
6199							
6200							
6201							
6202							
6203			41.9-2.1				
6204	col. liq.	0.7924	-36	160 ⁷⁴⁵	i.	s.	s. eth.
6205							
6206							
6207							
6208							
6209							
6210							
6211	shiny leaf. ....	.....	327 d.	.....	1.18 ²⁵ , 2.88 ⁷⁵	0.267 ²⁵ 75%	.....
6212	hex. leaf. f. w. ....	.....	301 d.	.....	1.5 ²⁵	i.	.....
6213	leaf. f. w. ....	.....	301 d.	.....	1.6 ¹⁹	.....	.....
6214							
6215							
6216							
6217							
6218							
6219	liq., 1.4883 ¹⁴ ...	0.801 ¹⁵	.....	176-8	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6219B	<i>allo</i> -Ocimene (stereomer of preceding)		$C_{10}H_{16}$	136.23
6219M	1-Octacosanol*	<i>n</i> -octacosyl alcohol.	$n-C_{28}H_{57}OH$	410.75
6219R	<i>n</i> -Octacosyl alcohol.	See 1-Octacosanol.		
6220	9,12-Octadecadienoic acid*	See <i>Eleostearic acid</i> .		
6221	9,13-Octadecadienoic acid*	See <i>Eleomargaric acid</i> .		
6222	Octadecanal*	See <i>Stearaldehyde</i> .		
6223	Octadecanamide*	See <i>Stearamide</i> .		
6224	Octadecane*	<i>n</i> -octadecane.	$CH_3(CH_2)_{16}CH_3$	254.49
6224F	—, 1-amino-.	See <i>Octadecylamine</i> *(<i>n</i>).		
6224M	—, 1-bromo-*	<i>n</i> -octadecyl bromide.	$CH_3(CH_2)_{17}Br$	333.40
6224T	—, 1-iodo-*	<i>n</i> -octadecyl iodide.	$CH_3(CH_2)_{17}I$	380.40
6225	Octadecanenitrile*	See <i>Stearonitrile</i> .		
6226	Octadecanoic acid*	See <i>Stearic acid</i> .		
6227	Octadecanoic anhydride*	See <i>Stearic anhydride</i> .		
6228	1-Octadecanol*	<i>n</i> -octadecyl alcohol.	$CH_3(CH_2)_{16}CH_2OH$	270.49
6228M	1-Octadecanone, 1-phenyl-	See <i>Stearophenone</i> .		
6229	Octadecanoyl chloride*	See <i>Stearoyl chloride</i> .		
6230	9,12,15-Octadecatrienoic acid*	See α - <i>Linolenic acid</i> .		
6231	Octadecenamide*	See <i>Oleamide</i> .		
6232	9-Octadecenoic acid*	See <i>Elaidic acid</i> ; <i>Oleic acid</i> .		
6233	—, 12-hydroxy-*	See <i>Ricinoleic acid</i> .		
6233M	9-Octadecen-1-ol*, <i>cis</i> -	<i>cis</i> -9-octadecenyl alcohol; <i>oleyl alcohol</i>	$CH_3(CH_2)_7CH:CH-(CH_2)_8OH$	268.47
6233T	9-Octadecenyl alcohol.	See 9-Octadecen-1-ol*.		
6234	<i>n</i> -Octadecyl alcohol.	See 1-Octadecanol*.		
6234H	Octadecylamine*(<i>n</i>)	1-amino-octadecane.	$CH_3(CH_2)_{17}NH_2$	269.50
6234R	<i>n</i> -Octadecyl bromide.	See <i>Octadecane</i> , 1-bromo-*		
6235	<i>n</i> -Octadecylic acid.	See <i>Stearic acid</i> .		
6235M	<i>n</i> -Octadecyl iodide.	See <i>Octadecane</i> , 1-iodo-*		
6236	Octadecyl sulfate	di- <i>n</i> -octadecyl sulfate.	$[CH_3(CH_2)_{17}]_2SO_4$	603.02
6236M	1-Octadecyne*	hexadecylacetylene.	$CH_3C(CH_2)_{16}CH_3$	250.46
6237	9-Octadecynoic acid*	See <i>Stearolic acid</i> .		
6238	Octadiene.	See <i>Conylene</i> .		
6238F	1,6-Octadiene, 3,7-dimethyl-*	<i>linaloolene</i> .	$C_{10}H_{18}$	138.25
6238M	2,6-Octadiene, 2,6-dimethyl-	dihydromyrcene.	$C_{10}H_{18}$	138.25
6238T	2,4-Octadiene, 7-methyl-*		C_9H_{16}	124.22
6239	2,7-Octadiene, 2-methyl-	yl-6-methylene-*. See <i>Myrcene</i> .		
6240	2,6 (and 2,7)-Octadienoic acid, 3,7-dimethyl-*	See <i>Geranic acid</i> .		
6241	1,6-Octadien-3-ol, 3,7-dimethyl-*	See <i>Linalool</i> .		
6241H	2,6-Octadien-1-ol, 3,7-dimethyl-*	See <i>Geraniol</i> ; <i>Nerol</i> .		
6242	Octamethylene glycol.	See 1,8-Octanediol*.		
6243	Octanal*	See <i>Caprylaldehyde</i> .		
6244	Octanamide*	See <i>Caprylamide</i> .		
6245	Octane*	<i>n</i> -octane.	$CH_3(CH_2)_6CH_3$	114.23
6246	—, 1-amino-.	See <i>Octylamine</i> *.		
6247	—, 2-amino-.	See <i>Heptylamine</i> , α -methyl-.		
6248	—, 1-bromo-*	<i>n</i> -octyl bromide.	$CH_3(CH_2)_6CH_2Br$	193.13
6249	—, 2-bromo-*(<i>I</i>)	<i>l-sec-n</i> -octyl bromide.	$CH_3CHBr(CH_2)_5CH_3$	193.13
6250	—, 1-chloro-*	<i>n</i> -octyl chloride.	$CH_3(CH_2)_6CH_2Cl$	148.67

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6219B	liq., 1.5447 ²¹ ...	0.8133	.....	188 ⁷⁵⁰ ; 81 ¹²	.....	.....	.....
6219M	.....	.....	83.2-83.4	.....	.....	.....	.....
6219R	.....	.....	.....	.....	.....	.....	.....
6220	.....	.....	.....	.....	.....	.....	.....
6221	.....	.....	.....	.....	.....	.....	.....
6222	.....	.....	.....	.....	.....	.....	.....
6223	.....	.....	.....	.....	.....	.....	.....
6224	cr. f. al., 1.4349 ^{85,2}	0.7768 ²⁸ / ₄	28	317	i.	sl. s.	s. eth.
6224F	.....	.....	.....	.....	.....	.....	.....
6224M	col. cr. ....	.....	28.5	.....	i.	s.	s. eth.
6224T	col. cr. ....	.....	34	169 ^{0.5}	i.	sl. s.	sl. s. eth.
6225	.....	.....	.....	.....	.....	.....	.....
6226	.....	.....	.....	.....	.....	.....	.....
6227	.....	.....	.....	.....	.....	.....	.....
6228	leaf. f. al.	0.8124 ⁵⁹ / ₄	59 (57.85)	210.5 ¹⁵	i.	s.	s. eth.
6228M	.....	.....	.....	.....	.....	.....	.....
6229	.....	.....	.....	.....	.....	.....	.....
6230	.....	.....	.....	.....	.....	.....	.....
6231	.....	.....	.....	.....	.....	.....	.....
6232	.....	.....	.....	.....	.....	.....	.....
6233	.....	.....	.....	.....	.....	.....	.....
6233M	col. liq.	0.8489 ²⁰ / ₄	.....	205-10 ¹⁵	i.	s.	s. eth.
6233T	.....	.....	.....	.....	.....	.....	.....
6234	.....	.....	.....	.....	.....	.....	.....
6234H	col. cr. ....	.....	.....	232.0 ³² ; 176.1 ²	i.	s.	s. eth.
6234R	.....	.....	.....	.....	.....	.....	.....
6235	.....	.....	.....	.....	.....	.....	.....
6235M	.....	.....	.....	.....	.....	.....	.....
6236	.....	.....	70.2-0.7	.....	.....	.....	.....
6236M	cr.	0.796 ³⁰	26	180 ¹⁵	.....	.....	.....
6237	.....	.....	.....	.....	.....	.....	.....
6238	.....	.....	.....	.....	.....	.....	.....
6238F	liq.	0.788 ²⁰	.....	165-8	.....	.....	.....
6238M	liq.	0.775 ²¹ / ₄	.....	171.5-3.5	.....	.....	.....
6238T	liq.	0.752 ¹⁸ / ₄	.....	149	i.	.....	.....
6239	.....	.....	.....	.....	.....	.....	.....
6240	.....	.....	.....	.....	.....	.....	.....
6241	.....	.....	.....	.....	.....	.....	.....
6241H	.....	.....	.....	.....	.....	.....	.....
6242	.....	.....	.....	.....	.....	.....	.....
6243	.....	.....	.....	.....	.....	.....	.....
6244	.....	.....	.....	.....	.....	.....	.....
6245	col. liq., 1.3975	0.7036	-56.5	125.8 (124.6)	0.0015 ¹⁶	sl. s.	s. eth.
6246	.....	.....	.....	.....	.....	.....	.....
6247	.....	.....	.....	.....	.....	.....	.....
6248	liq., 1.4503 ²⁵	1.1160 ¹⁵ / ₄ ; 1.118 ²⁰ / ₄	-55	202-3 (201.5)	i.	∞	= eth.
6249	liq.	1.099 ²²	.....	191 (91-3 ²⁰)	i.	∞	= eth.
6250	liq.	0.8745 ²⁰ / ₄	.....	184.6	i.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6251	Octane, 2-chloro-* . . .	<i>sec</i> -octyl chloride	$\text{CH}_3(\text{CH}_2)_6\text{CHCl}-$ CH_3	148.67
6252	—, 2,7-dimethyl-* . . .	biisoamyl	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_4-$ $\text{CH}(\text{CH}_3)_2$	142.28
6253	—, 1-ethoxy-* . . .	See <i>Ether, ethyl octyl</i> .		
6254	—, 1-iodo-*	<i>pri</i> - <i>n</i> -octyl iodide	$\text{CH}_3(\text{CH}_2)_7\text{I}$	240.14
6255	—, 3-methyl-*, (d)- . . .	<i>d</i> -amylethylmethylmethane . .	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)-$ $(\text{CH}_2)_4\text{CH}_3$	128.25
6256	—, 1-octyloxy-* . . .	See <i>Octyl ether</i> .		
6257	—, 1-phenoxy-* . . .	See <i>Ether, octyl phenyl</i> .		
6258	1,1-Octanedicarboxylic acid. See <i>Malonic acid, heptyl-</i> .			
6259	Octanedioic acid*. See <i>Suberic acid</i> .			
6260	1,8-Octanediol*	octamethylene glycol	$\text{CH}_2\text{OH}(\text{CH}_2)_6-$ CH_2OH	146.23
6261	4,5-Octanediol*	octylene glycol (one form) . .	$[\text{CH}_3(\text{CH}_2)_2\text{CHOH}]_2$	146.23
6262	Octanenitrile*. See <i>Caprylonitrile</i> .			
6263	Octanoic acid*. See <i>Caprylic acid</i> .			
6264	Octanoic anhydride*. See <i>Caprylic anhydride</i> .			
6265	1-Octanol*	heptylcarbinol; <i>pri</i> - <i>n</i> -octyl alcohol	$\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{OH}$	130.23
6266	—, acetate	<i>n</i> -octyl acetate	$\text{CH}_3\text{COO}(\text{CH}_2)_7-$ CH_3	172.26
6267	—, esters of other organic acids. See "octyl ester" under the corresponding acids.			
6268	—, nitrate. See <i>Octyl nitrate</i> .			
6269	—, nitrite. See <i>Octyl nitrite</i> .			
6270	—, 3,7-dimethyl-*(i) . . .	tetrahydrogeraniol	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3-$ $\text{CH}(\text{CH}_3)\text{CH}_2-$ CH_2OH	158.28
6271	2-Octanol*	methylhexylcarbinol; <i>sec</i> - <i>n</i> -octyl alcohol	$\text{CH}_3\text{CHOH}-$ $(\text{CH}_2)_6\text{CH}_3$	130.23
6272	—, 2-methyl-*	hexyldimethylcarbinol	$(\text{CH}_3)_2\text{COH}-$ $(\text{CH}_2)_6\text{CH}_3$	144.25
6273	3-Octanol, 3-ethyl-* . . .	amyl-diethylcarbinol; <i>tert</i> -decyl alcohol	$(\text{C}_2\text{H}_5)_2\text{COH}-$ $(\text{CH}_2)_4\text{CH}_3$	158.28
6274	2-Octanone*	hexylmethyl ketone	$\text{CH}_3\text{COC}_6\text{H}_{13}$	128.21
6275	3-Octanone*	amyl ethyl ketone	$\text{C}_2\text{H}_5\text{CO}(\text{CH}_2)_4-$ CH_3	128.21
6276	Octanoyl chloride*. See <i>Caprylyl chloride</i> .			
6277	1,3,6-Octatriene, 3,7-dimethyl-*, See <i>Ocimene</i> .			
6278	6-Octen-1-ol, 3,7-dimethyl-*, See <i>Rhodinol</i> .			
6279	Octine. See <i>Octyne</i> .			
6280	<i>n</i>-Octoic acid. See <i>Caprylic acid</i> .			
6281	<i>n</i>-Octoic anhydride. See <i>Caprylic anhydride</i> .			
6282	<i>n</i>-Octyl acetate. See <i>1-Octanol*</i> , acetate.			
6283	<i>pri</i>-<i>n</i>-Octyl alcohol. See <i>1-Octanol*</i> .			
6284	<i>sec</i>-<i>n</i>-Octyl alcohol. See <i>2-Octanol*</i> .			
6285	<i>n</i>-Octyl aldehyde. See <i>Caprylaldehyde</i> .			
6286	Octylamine*(n)	1-amino-octane; <i>pri</i> - <i>n</i> -octylamine	$\text{CH}_3(\text{CH}_2)_6\text{CH}_2-$ NH_2	129.24
6287	<i>sec</i>-<i>n</i>-Octylamine. See <i>Heptylamine, α-methyl-*</i> .			
6288	<i>n</i>-Octyl bromide. See <i>Octane, 1-bromo-*</i> .			
6289	<i>sec</i>-<i>n</i>-Octyl bromide. See <i>Octane, 2-bromo-*</i> .			
6290	<i>n</i>-Octyl chloride. See <i>Octane, 1-chloro-*</i> .			
6291	<i>sec</i>-<i>n</i>-Octyl chloride. See <i>Octane, 2-chloro-*</i> .			
6292	<i>n</i>-Octyl cyanide. See <i>Pelargononitrile</i> .			

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6251	liq.	0.871 ¹⁵ ₄	.....	173	i.	v. s.	s. eth.
6252	mobile liq., 1.40924 ^{18,1} ; 1.41049 ¹⁵	0.7479 ²⁰	-52.5	159.66	i.	s.	s. eth., ac. a.
6253							
6254	liq., 1.489.....	1.341 ¹⁵ (1.3531 ¹⁵)	-45.9	255.5	i.	s.	s. eth.
6255	col. liq.	0.7206 ¹⁷	.....	142-3	i.	i.	s. eth.
6256							
6257							
6258							
6259							
6260	need. ....	.....	63	172 ²⁰	sl. s.	s.	i. eth.
6261	(α) liq. ....	.....	.....	112-5 ¹⁰	i.	.....	.....
	(β) .....	.....	123-4	115-8	i.	s.	sl. s. eth.
6262							
6263							
6264							
6265	col. liq., 1.42920 ²⁰	0.8246 ²⁰ ₄	-16.3	195	s.	∞	∞ eth.
6266	col. liq.	0.885 ⁰ ₄	-38.5	210	i.	s.	s. eth.
6267							
6268							
6269							
6270	liq.	0.8333 ¹⁵	.....	221-3	i.	s.	s. eth.
6271	col. oily liq., 1.4260	0.8193	-38.6	178.5 (179)	i.	s.	s. eth.
6272	liq. ....	.....	.....	178	i.	s.	s. eth.
6273	col. oil.	0.8360 ¹⁵ ₄	.....	199	i.	s.	.....
6274	col. liq., 1.41613	0.818	-20.9	173.5	i.	∞	∞ eth.
6275	col. liq.	0.850 ⁰ ₄	.....	168	i.	∞	∞ eth.
6276							
6277							
6278							
6279							
6280							
6281							
6282							
6283							
6284							
6285							
6286	col. liq., 1.430.	0.777 ²⁷	.....	179.6	sl. s.	v. s.	v. s. eth.
6287							
6288							
6289							
6290							
6291							
6292							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6293	Octylene	caprylene.....	C_8H_{16}	112.21
6294	Octylene glycol	See 4,5-Octanediol*.		
6295	Octyl ether	1-octyloxyoctane*; di-n-octyl ether	$(C_8H_{17})_2O$	242.44
6296	n-Octylic acid	See Caprylic acid.		
6297	pri-n-Octyl iodide	See Octane, 1-iodo*.		
6298	Octyl nitrate	n-octyl nitrate.....	$CH_3(CH_2)_7NO_3$...	175.23
6299	Octyl nitrite	n-octyl nitrite.....	$CH_3(CH_2)_7ONO$...	159.23
6300	Octyl sulfate	di-n-octyl sulfate.....	$[CH_3(CH_2)_7]_2SO_4$...	322.50
6301	1-Octyne *.....	1-octine; n-hexylacetylene; caprylidene	$CH:C(CH_2)_6CH_3$...	110.19
6301F	2-Octyne *.....	2-octine; amylmethylacetylene	$CH_3C:C-C_6H_{11}$...	110.19
6301J	3-Octyne *.....	3-octine; butylethylacetylene	$C_2H_5C:C(CH_2)_3CH_3$	110.19
6301M	4-Octyne *.....	4-octine; dipropylacetylene...	$C_3H_7C:C-C_3H_7$...	110.19
6302	2-Octynoic acid *, methyl ester	"methyl heptinecarbonate" ..	$CH_3(CH_2)_4C:C-COOCH_3$	154.20
6303	Oenanth-	See Enanth-.		
6303	Oil of wintergreen , artif	cial. See Salicylic acid, methyl ester.		
6304	Oleamide	9-octadecenamide* (one form); oleic acid amide	$C_{17}H_{33}CONH_2$...	281.47
6305	Oleic acid	9-octadecenoic acid* (cis form)	$C_8H_{17}CH:CH-(CH_2)_7COOH$	282.46
6306	—, benzyl ester.....		$C_{17}H_{33}COOCH_2C_6H_5$	372.57
6307	—, butyl ester.....	butyl 9-octadecenoate* (one form)	$C_8H_{17}CH:CHC_4H_9COOC_4H_9$	338.56
6308	—, diethylene glycol ester.	See under Diethylene glycol.		
6309	—, ethyl ester.....		$C_8H_{17}CH:CH-(CH_2)_7COOC_2H_5$	310.51
6310	—, isoamyl ester.....		$C_{17}H_{33}COO(CH_2)_2CH(CH_3)_2$	352.59
6311	—, methyl ester.....	methyl oleate.....	$C_{17}H_{33}COOCH_3$...	296.48
6312	—, p-phenylphenacyl ester		$C_{17}H_{33}COOCH_2COC_6H_4C_6H_5$	476.68
6313	Olein	See Glycerol, trioleate.		
6313M	Oleyl alcohol	See 9-Octadecen-1-ol*, cis-.		
6314	Opianic acid	5,6-dimethoxyphthalaldehydic acid	$(CH_3O)_2C_6H_2-(CHO)COOH$	210.18
6315	Orcein		$C_{28}H_{24}N_2O_7$	500.49
6316	Orcinol	5-methyl-1,3-benzenediol*; 5-methylresorcinol; 3,5-dihydroxytoluene	$CH_3C_6H_3(OH)_2$...	124.13
6317	—, 2,4,6-trinitro-....		$(NO_2)_3C_6(CH_3)-(OH)_2$	259.13
6318	β-Orcinol	See Resorcinol, 2,5-dimethyl-.		
6319	Orcinolphthalein		$C_{22}H_{16}O_6$	360.35
6320	Orexin	See Quinazoline, 3,4-dihydro-3-		
6321	Ornithine	α, δ-diaminovaleric acid; 2,5-diaminopentanoic acid*	phenyl- $CH_2(NH_2)(CH_2)_2CH(NH_2)COOH$	132.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6293	col. liq., 1.4087	0.722 ¹⁷ ; 0.7155 ^{$\frac{20}{4}$}	104	123	i.	s.	s. eth.
6294	liq.	0.820 ^{$\frac{0}{4}$};	.....	291.8	sl. s.	s.	s. eth.
6295		0.805 ^{$\frac{17}{17}$}					
6296		0.8419 ^{$\frac{17}{17}$}					
6297	liq.	0.862 ¹⁷	.....	110-220	.....	.....	.....
6298	grn. liq.	0.862 ¹⁷	.....	174-5	.....	.....	.....
6300	1.4408 ²⁵	0.9661 ^{$\frac{2.5}{2.5}$}	20.3	166.1 ²	.....	.....	.....
6301	col. liq., 1.4140 ²⁵	0.743 ²⁵	.....	126; 50.8 ⁵⁰	i.	s.	s. eth.
6301F	col. liq., 1.4285 ²⁵	0.761 ²⁵	.....	137.2; 60.2 ⁵⁰	i.	s.	s. eth.
6301J	col. liq., 1.4230 ²⁵	0.7501 ²⁵	.....	133; 56.7 ⁵⁰	i.	s.	s. eth.
6301M	col. liq., 1.4225 ²⁵	0.7474 ²⁵	.....	131; 55 ⁵⁰	i.	s.	s. eth.
6302	.....	0.9524 ⁰	.....	107 ²⁰	i.	.....	.....
6303	cr. ....	.....	76	.....	i.	s.	s. eth.
6304		.....				
6305		0.895 ^{$\frac{18}{4}$}					
6306	col. need., 1.463 ^{17.7}	0.9330 ^{$\frac{2.5}{2.5}$}	14	286 ¹⁰⁰	i.	∞	∞ eth.; s. bz., chl.
6307	.....	0.868 ²⁵	.....	237 ⁷	i.	s.	v. s. eth.
6308	liq.	0.868 ²⁵	.....	180-95 ² ; 173-235 ⁷⁵	i.	s.	s. eth.
6309	liq.	0.871 ¹⁵ ; 0.8671 ²⁵	.....	205-8 ¹⁰	i.	∞	∞ eth.
6310	col. liq. ....	.....	.....	223-4 ¹⁰	i.	s.	v. s. eth.
6311	oil.	0.875 ¹³	.....	216-7 ²⁰ (189-91 ¹⁰)	i.	∞	∞ eth.
6312	.....	.....	60.5	.....	.....	.....	.....
6313	need. f. w. ....	.....	150	160 d.	0.25, 1.7 ¹⁰⁰	s.	s. eth.
6313M		.....			.....	s.	i. eth., bz., chl., CS ₂ ; s. acet., alk., ac. a.
6314	red-br. powd. .	.....	.....	.....	.....	s.	v. s. eth.
6316	col. monocl. cr. f. chl.	1.290 ⁴	+1H ₂ O, 58; anh. 107-8	289-90	s.	v. s.	v. s. eth.
6317	lng. yel. need.	.....	163.5	exp.	i.	sl. s.	sl. s. eth.; v. s. h. bz.
6318	col. pr. f. acet.	.....	230 d.	.....	i.	s.	i. eth., bz.; s. h. ac. a., alk.
6319	.....	.....	.....	.....	.....	.....	.....
6320	.....	.....	.....	.....	.....	.....	.....
6321	syrup. ....	.....	.....	.....	v. s.	v. s.	sl. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6322	Ornithine, <i>N</i>⁵-guanyl-	. See <i>Arginine</i> .		
6323	Orsellinic acid, 4-evernin	ate. See <i>Evernic acid</i> .		
6324	—, 4-methyl ether.	See <i>Evernic acid</i> .		
6325	<i>o</i>-Orsellinic acid	4,6-dihydroxy- <i>o</i> -toluic acid; orsellinic acid	(HO) ₂ C ₆ H ₂ (CH ₃)- COOH	168.14
6326	Orthanilic acid	<i>o</i> -aminobenzenesulfonic acid, <i>o</i> -anilinesulfonic acid	NH ₂ C ₆ H ₄ SO ₃ H· $\frac{1}{2}$ H ₂ O	182.19
6327	Orthoacetic acid, triethyl ester	1,1,1-triethoxyethane*	CH ₃ C(OC ₂ H ₅) ₃	162.23
6328	Orthocarbonic acid, tetraethyl ester	tetraethoxymethane*	C(OC ₂ H ₅) ₄	192.25
6329	—, tetrapropyl ester	<i>n</i> -propyl orthocarbonate; tetrapropoxymethane	C(OC ₃ H ₇) ₄	248.36
6330	Orthodiazine.	See <i>Pyridazine</i> .		
6331	Orthoformic acid, triethyl ester	triethoxymethane*	HC(OC ₂ H ₅) ₃	148.20
6332	—, triisopropyl ester	isopropyl orthoformate; tri- isopropoxymethane	HC[OCH(CH ₃) ₂] ₃	190.28
6333	—, trimethyl ester	trimethoxymethane	HC(OCH ₃) ₃	106.12
6334	—, triphenyl ester	triphenoxymethane	CH(OC ₆ H ₅) ₃	292.32
6335	—, tripropyl ester	<i>n</i> -propyl orthoformate; tri- propoxymethane	HC(OC ₃ H ₇) ₃	190.28
6335H	Oryzanin.	See <i>Vitamin B₁</i> .		
6335R	Ovoflavin.	See <i>D-Riboflavin</i> .		
6336	7-Oxabicyclo[2,2,1]hept-	ane-2,3-dicarboxylic anhydride, 2,3-di-	meth	
6337	6-Oxabicyclo[3,2,1]oct-	3-ene, 4,7,7-trimethyl-	See <i>Pinol</i> .	
6338	Oxalacetic acid, diethyl ester	diethyl oxobutanedioate*; diethyl hydroxybutene- dioate*	C ₂ H ₅ OOCOCH ₂ - COOC ₂ H ₅	188.18
6339	Oxalaldehyde.	See <i>Glyoxal</i> .		
6340	Oxalaldehydic acid.	See <i>Glyoxylic acid</i> .		
6341	Oxalamide.	See <i>Oxamide</i> .		
6342	Oxalan.	See <i>Oxaluramide</i> .		
6343	Oxalic acid	ethanedioic acid*	COOHCOOH·2H ₂ O	126.07
6344	—, diallyl ester	di-2-propenyl ethanedioate*; allyl oxalate	(COOC ₃ H ₅) ₂	170.16
6345	—, dianilide.	See <i>Oxanilide</i> .		
6346	—, dibutyl ester	dibutyl ethanedioate*; butyl oxalate	(COOCH ₂ CH ₂ - CH ₂ CH ₃) ₂	202.25
6347	—, diethyl ester	diethyl ethanedioate*; ethyl oxalate; oxalic ester	(COOC ₂ H ₅) ₂	146.14
6348	—, diisoamyl ester	isoamyl oxalate; bis(γ - methylbutyl)ethanedioate*	(COOC ₆ H ₁₁) ₂	230.30
6349	—, diisobutyl ester	bis(β -methylpropyl)ethane- dioate*; isobutyl oxalate	(COOC ₄ H ₉) ₂	202.25
6350	—, dimethyl ester	dimethyl ethanedioate*; methyl oxalate	(COOCH ₃) ₂	118.09
6351	—, dipropyl ester	propyl oxalate; dipropyl oxalate	(COOCH ₂ CH ₂ - CH ₃) ₂	174.19
6352	—, ethyl methyl ester		CH ₃ OOCOOC ₂ - H ₅	132.11
6353	—, monoamide.	See <i>Oxamic acid</i> .		
6354	—, monoanilide.	See <i>Oxanilic acid</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6322							
6323							
6324							
6325	need. f. acet.		-H ₂ O, 100; 176 d.		s.	s.	15.7 ²⁰ eth.; s. glyc.; sl. s. bz.
6326	col. pr.		d.		1.57 ¹⁹	v. sl. s.	v. sl. s. eth.
6327	col. liq.	0.8847 ²⁵ ₄		142		∞	= eth.
6328	col. liq., 1.393.	0.9197 ¹⁸ ₄		159		∞	∞ eth.
6329	col. liq.	0.911 ⁸		224.2			
6330							
6331	col. liq.	0.8971 ¹⁹ ₄	-76.1	145.9 (143-5)	s. d.	s.	s. eth.
6332	liq.	0.8621		166-8			
6333		0.974 ²³		101-2			
6334	cr.		71	265 ⁵⁰		s.	s. eth.
6335	liq.	0.8805		105 ³⁰	2.1 ²²		
6335H							
6335R							
6336	yl-. See <i>Cantharidin</i> .						
6337							
6338	col. liq., 1.45614 ^{16.6}	1.159		132 ²⁴	i.	∞	= eth., bz.
6339							
6340							
6341							
6342							
6343	col. monocl.; 1.440, 1.475, 1.625	1.653	101; 189 anh.	subl. 150	9.5 ¹⁵ , 120 ³⁰	23.7 ¹⁵	1.37, anh. 16.9 eth.; i. chl., pet. eth., bz.
6344	oil.	1.055		217	i.	s.	
6345							
6346	col. liq.	1.011		243.4	i.	s.	s. eth.
6347	col. liq., 1.41011	1.08426 ¹⁵ ; 1.0785 ²⁰ ₄	-40.6	185.4	sl. s.	∞	∞ eth., ord. org. solv.
6348	liq.	0.968 ¹¹ ₁₁		265	i.	v. s.	v. s. eth.
6349	col. liq.	1.002 ¹⁴		229	i.	s.	s. eth.
6350	col. monocl. tab., 1.379 ^{82.1}	1.120 ⁸² ; 1.1479 ⁵⁴ ; 1.422 ²⁰ ₄	54	163.3	6.18	s.	s. me. al.
6351	col. liq.	1.02; 1.038 ⁰ ₀		214-5	sl. s.	∞	s. eth.
6352	col. liq.	1.156 ⁰		173.7	i.	v. s.	v. s. eth.
6353							
6354							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6355	Oxalic acid , monoureide.	See <i>Oxaluric acid</i> .		
6356	—, <i>p</i> -phenylphenacyl ester	.....	$(\text{COOCH}_2\text{COC}-\text{H}_4\text{C}_6\text{H}_5)_2$	478.48
6357	—, piperazinium salt	.....	$\text{C}_4\text{H}_{10}\text{N}_2\cdot\text{C}_2\text{H}_2\text{O}_4$	176.17
6357M	—, urea salt.	See <i>Urea, oxalate</i> .		
6358	Oxalic ester.	See <i>Oxalic acid, diethyl ester</i> .		
6359	Oxalimide.	See <i>Oximide</i> .		
6360	Oxalonitrile.	See <i>Cyanogen</i> .		
6361	Oxaluramide	oxamic acid ureide; oxalan...	$\text{NH}_2\text{CONHCO}-\text{CONH}_2$	131.09
6362	Oxaluric acid	carbamyloxamic acid; oxalic monoureide	$\text{NH}_2\text{CONHCO}-\text{COOH}$	132.08
6363	Oxalyl chloride	ethanedioyl chloride*	COCICl	126.93
6364	Oxamethan.	See <i>Oxamic acid, ethyl ester</i> .		
6365	Oxamic acid	oxalic acid monoamide	NH_2COCOOH	89.05
6366	—, ethyl ester.....	ethyl oxamate; oxamethan...	$\text{NH}_2\text{COCOOC}_2\text{H}_5$	117.10
6367	—, ureide.	See <i>Oxaluramide</i> .		
6368	—, <i>N</i> -acetyl-, ethyl ester	ethyl acetyloxamate.....	$\text{CH}_3\text{CONHCO}-\text{COOC}_2\text{H}_5$	159.14
6369	—, carbamyl-.	See <i>Oxaluric acid</i> .		
6370	—, phenyl-.	See <i>Oxanilic acid</i> .		
6371	Oxamide	ethanediamide*; oxalamide...	$\text{NH}_2\text{COCOCONH}_2$	88.07
6372	—, <i>N,N'</i> -diethyl-....	<i>N,N'</i> -diethylethanediamide*; sym-diethyloxamide	$(\text{CONHC}_2\text{H}_5)_2$	144.17
6373	—, <i>N,N</i> -dimethyl-....	unsym-dimethyloxamide	$(\text{CH}_3)_2\text{NCOCONH}_2$	116.12
6374	—, <i>N,N'</i> -dimethyl-....	sym-dimethyloxamide.....	$(\text{CONHCH}_3)_2$	116.12
6375	—, <i>N,N'</i> -diphenyl-.	See <i>Oxanilide</i> .		
6376	Oxanilic acid	phenyloxamic acid; oxalic acid monoanilide	$\text{C}_6\text{H}_5\text{NHCOCOOH}$	165.14
6377	Oxanilide	<i>N,N'</i> -diphenyloxamide; oxalic acid dianilide	$(\text{CONHC}_6\text{H}_5)_2$	240.25
6378	Oxanthranol	9,10-anthradiol or 10-hydroxyanthrone; anthrahydroquinone	$\text{C}_6\text{H}_4(\text{COH})_2\text{C}_6\text{H}_4$	210.22
6379	1,2-Oxathietan-4-one,	2,2-dihydro-2,2-dimethyl-. See <i>Thetin, d.m</i>		
6380	1,4-Oxazine, tetrahydra-	See <i>Morpholine</i> .		
6381	Oxazole, triphenyl-	benzilam; azobenzil.....	$\text{OC}(\text{C}_6\text{H}_5)_2\text{NC}-\text{C}(\text{C}_6\text{H}_5)_2$	297.34
6382	Oximide	oxalimide.....	NCOHCO	71.04
6383	Oxindole	2(3) indolone; <i>o</i> -amino- α -toluic acid lactam	$\text{C}_6\text{H}_4\text{NHCOCOCH}_2$	133.14
6384	—, 3-hydroxy-	dioxindole; <i>o</i> -aminomandelic acid lactam	$\text{C}_6\text{H}_4\text{NHCOCOCHOH}$	149.14
6385	—, 3-imino- .	See <i>Imesatin</i> .		
6386	Oxirane.	See <i>Ethylene oxide</i> .		
6387	—, (chloromethyl)-.	See <i>Epichlorohydrin</i> .		
6388	—, (iodomethyl)-.	See <i>Epiiodohydrin</i> .		
6389	—, methyl-.	See <i>Propene oxide</i> .		
6390	Oxiraneacetonitrile.	See <i>Epicyanohydrin</i> .		
6391	Ox rene, methyl- .	See <i>Propene, 1,2 epoxy-*</i> .		
6392	Oxyacanthine	vinetine.....	$\text{C}_{19}\text{H}_{21}\text{NO}_3$	311.37

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6355							
6356	.....		165.5 d.	.....	.....	.....	.....
6357	wh. cr. ....	.....	>300	.....	s. h.	v. sl. s.	i. eth.
6357M							
6358							
6359							
6360							
6361	cr. ....	.....	d.	.....	i.	s.	s. H ₂ SO ₄ , KOH
6362	cr. powd. ....	.....	187	.....	v. sl. s.	.....	.....
6363	col. fum. liq., 1.433 _D ¹³ 5 ^{12.5}	1.488 ¹³	-12	64	d.	d.	s. eth.
6364							
6365	col. cr. ....	.....	210 d.	.....	1.4 ¹⁴	v. sl. s.	v. sl. s. eth.
6366	rhomb. leaf.	0.808 ¹⁹	115	.....	s. h.	s.	s. eth.; v. sl. s. bz.
6367							
6368	need. ....	.....	54	.....	i., d. h.	s.	s. eth.
6369							
6370							
6371	wh. powd. monocl.	1.667	419 d.	.....	0.047 ³	v. sl. s.	v. sl. s. eth.
6372	col. need. f. al.	1.169 ⁴	190	179	sl. s.	s.	v. sl. s. eth.
6373	col. pl. f. bz. ....	.....	104	.....	v. s.	v. s.	v. sl. s. eth.
6374	col. leaf. or need. f. w.	1.3 ⁴	217 (209-10)	subl.	2.5 ^{9.4}	sl. s.	v. sl. s. eth.
6375							
6376	rhomb. need. f. bz.	.....	150	.....	s. h.	v. s.	v. s. eth.
6377	lust. sc. f. bz. ....	.....	250 (246-7)	320	i.	v. sl. s. h.	i. (sl. s. h.) eth.
6378	ylsh. need. unst.	.....	180	.....	i.	s. (grn. fluores.)	s. alk.
6379							
6380							
6381	rhomb. pr. f. al.-eth.	.....	115	.....	.....	sl. s.	sl. s. eth.
6382	col. pr. ....	.....	.....	.....	v. sl. s. d. h.	.....	sl. s. NH ₄ OH
6383	col. need. f. w.	.....	120	d.	v. s. h.	s.	s. eth., alk.
6384	rhomb. pr. f. al.	.....	180	195 d.	7.7 c., 16.7 h	6.6	s. alk.
6385							
6386							
6387							
6388							
6389							
6390							
6391							
6392	wh. need. f. al. or eth., [α] _D ²⁵ +131.6	.....	202-14	.....	s.	s.	s. eth., chl., bz., pet. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6393	Oryacanthine , hydrochloride		$C_{19}H_{21}NO_3 \cdot HCl \cdot 2H_2O$	383.87
6394	—, nitrate.		$C_{19}H_{21}O_3N \cdot HNO_3 \cdot 2H_2O$	410.42
6395	Oxynarcotine		$C_{22}H_{23}NO_8$	429.41
6396	Oxyneurine	See <i>Betaine</i> .		
6397	Oxysparteine		$C_{15}H_{24}N_2O$	248.36
6398	—, hydrochloride		$C_{15}H_{24}N_2O \cdot HCl \cdot 4H_2O$	356.89
6399	Paeonol	See <i>Peonol</i> .		
6400	Palmitaldehyde , oxime	hexadecanal oxime*	$CH_3(CH_2)_{14}CH=NOH$	255.44
6401	Palmitamide	hexadecanamide*; palmitic amide	$CH_3(CH_2)_{14}CONH_2$	255.44
6402	Palmitic acid	hexadecanoic acid*; <i>n</i> -hexadecylic acid	$CH_3(CH_2)_{14}COOH$	256.42
6403	—, benzyl ester		$C_{15}H_{31}COOCH_2C_6H_5$	346.54
6404	—, cetyl ester	cetyl palmitate; hexadecyl hexadecanoate*	$C_{15}H_{31}COOC_{16}H_{33}$	480.84
6405	—, ethyl ester	ethyl hexadecanoate*	$CH_3(CH_2)_{14}COOC_2H_5$	284.47
6406	—, ethylene ester.	See <i>Glycol, dipalmitate</i> .		
6407	—, glyceryl ester.	See <i>Glycerol, tripalmitate</i> .		
6408	—, methyl ester	methyl hexadecanoate*; methyl palmitate	$C_{15}H_{31}COOCH_3$	270.45
6409	—, myricyl ester		$C_{15}H_{31}COOC_{31}H_{63}$	691.23
6410	Palmitic amide	See <i>Palmitamide</i> .		
6411	Palmitin	See <i>Glycerol, tripalmitate</i> .		
6412	Palmitolic acid	7-hexadecynoic acid*	$CH_3(CH_2)_7C \equiv C(CH_2)_5COOH$	252.39
6413	Palmitone	See 16- <i>Hentriacontanone</i> *		
6414	Palmitonitrile	hexadecanenitrile*	$CH_3(CH_2)_{14}CN$	237.42
6415	Palmitoyl chloride	hexadecanoyl chloride*	$CH_3(CH_2)_{14}COCl$	274.87
6415M	Palmityl chloride			
6415M	Pantothenic acid	<i>N</i> -(α , γ -dihydroxy- β , β -dimethylbutyryl)- β -alanine; chick antidermatitis factor	$C_9H_{17}NO_5$	219.24
6416	Papaverine		$C_{20}H_{21}NO_4$	339.38
6417	—, hydrochloride		$C_{20}H_{21}NO_4 \cdot HCl$	375.84
6418	Paraacetaldehyde	See <i>Paraldehyde</i> .		
6419	Parabanic acid	oxalylurea	$NHCONHCOCO$	114.06
6420	—, dimethyl-	See <i>Cholestrophan</i> .		
6421	Parabutyraldehyde		$(C_3H_7CHO)_3$	216.31
6422	Paraconic acid	tetrahydro-5-oxo-3-furan-carboxylic acid; itamalic acid γ -lactone	$CH_2COOCH_2CH(COOH)$	130.10
6423	—, 2,2-dimethyl-	See <i>Terebic acid</i> .		
6425	Paracyanogen		$(CN)_x$	(26.02) _x
6426	Paradiazine	See <i>Pyrazine</i> .		
6427	Paraformaldehyde	See <i>Polyoxymethylene</i> .		
6428	Paralactic acid	See <i>d-Lactic acid</i> .		
6429	Paraldehyde	2,4,6-trimethyl-1,3,5-trioxane; paraacetaldehyde	$OCH(CH_3)OCH(CH_3)OCH(CH_3)$	132.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6393	sm. need., [α]-163.6 _D ²¹⁵	.....	.....	.....	.....	.....	.....
6394	need. ....	.....	195-200	.....	sl. s.	.....	.....
6395	need. ....	.....	.....	.....	.....	s.	.....
6396	.....	.....	.....	.....	.....	.....	.....
6397	wh. hyg. need.	.....	84	.....	v. s.	v. s.	v. s. eth.; s. chl.
6398	wh. cr. ....	.....	48-50	.....	s.	s.	.....
6399	.....	.....	.....	.....	.....	.....	.....
6400	need. f. al. ....	.....	89.5	.....	i.	s.	v. s. eth.
6401	col. leaf. ....	.....	106	236 ¹²	i.	sl. s.	sl. s. eth.
6402	col. need., 1.4273 ^{79.8}	liq. 0.853 ⁶²	64	339-56 d.	i.	9.3 ²⁰	s. eth.
6403	cr.	0.9136 ³⁸ ₂₅	36.0	.....	i.	s.	v. s. eth.
6404	pl. f. eth. or ac. a., 1.4398 ⁷⁰	0.832 ⁵⁰	55.5	d.	i.	i. c., s. h.	s. eth., acet., bz., chl., CS ₂
6405	col. need. 1.4347 ^{34.3}	0.8577 ²⁵ ₄	24.2 (19-20)	185.5 ¹⁰	i.	s.	s. eth.
6406	.....	.....	.....	.....	.....	.....	.....
6407	.....	.....	.....	.....	.....	.....	.....
6408	col., 1.4175 ^{80.7}	.....	29.5	196 ¹⁵	i.	s.	s. eth.
6409	feath. cr. ....	.....	72	.....	i.	i.	s. eth.
6410	.....	.....	.....	.....	.....	.....	.....
6411	.....	.....	.....	.....	.....	.....	.....
6412	col. need. f. w.	.....	47	240 ¹⁵	i.	v. s.	v. s. eth.
6413	.....	.....	.....	.....	.....	.....	.....
6414	col. hex. tab. .	liq. 0.822 ³¹	31	251.5 ¹⁰⁰	i.	s.	s. eth.
6415	col. liq. or cr. .	.....	11-2	194.5 ¹⁷	d.	d.	v. s. eth.
6415M	.....	.....	.....	.....	.....	.....	.....
6416	col. rhomb. need. f. al., α 1.625, γ 1.690	1.337	147	d.	v. sl. s. c., s. h.	v. s.	0.39 ¹⁰ eth.; s. h. chl., h. bz.
6417	monocl. pl. ....	.....	231	.....	2.7 ¹⁸	s.	.....
6418	.....	.....	.....	.....	.....	.....	.....
6419	col. monocl. pl. f. w.	.....	243 (227) d.	.....	4.7 ⁸	v. s.	sl. s. eth.
6420	.....	.....	.....	.....	.....	.....	.....
6421	.....	0.918	.....	98-100 ⁸⁵	.....	.....	.....
6422	deliq. cr. ....	.....	58	.....	s.	.....	.....
6423	.....	.....	.....	.....	.....	.....	.....
6425	br. powd. ....	.....	.....	subl.	i.	i.	s. KOH
6426	.....	.....	.....	.....	.....	.....	.....
6427	.....	.....	.....	.....	.....	.....	.....
6428	.....	.....	.....	.....	.....	.....	.....
6429	col. hq., 1.40486	0.9943 ²⁰ ₄	12.6 (10.5)	124.4 ⁷⁵²	5.88 ¹⁰⁰ 12 ¹³	∞	∞ eth., chl., oils

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6430	Paraldol		(C ₄ H ₈ O ₂) ₂	176.21
6431	Paraleucaniline	See <i>ps-Leucaniline</i> .		
6432	Param.	See <i>Guanidine</i> , 1-cyano-.		
6433	Paramorphine	See <i>Thebaine</i> .		
6434	Paranitrilaniline red.	See 2-Naphthol, 1- <i>p</i> -phenylazo-		
6435	Pararosaniline	tris(<i>p</i> -aminophenyl)carbinol; <i>p,p',p''</i> -triamino-triphenylcarbinol	(H ₂ NC ₆ H ₄) ₃ COH	305.37
6436	—, hexamethyl-.	See <i>Crystal violet</i> (base).		
6437	Pararosolic acid	See <i>Aurin</i> .		
6438	Paraxylic acid	See 3,4- <i>Xylic acid</i> .		
6439	Parsley camphor	See <i>Apiole</i> .		
6440	α-Parvoline	2-ethyl-3,5-dimethylpyridine	C ₉ H ₁₃ N	135.20
6441	β-Parvoline	tetramethylpyridine; parvuline	C ₆ H(CH ₃) ₄ N	135.20
6442	Parvuline	See <i>β-Parvoline</i> .		
6443	Paucine		C ₂₇ H ₃₉ N ₅ O ₅ ·6½H ₂ O	630.73
6444	Pectinose	See <i>dl-Arabinose</i> .		
6445	Pelargonaldehyde , oxime	nonanal oxime*	CH ₃ (CH ₂) ₇ -CH:NOH	157.25
6446	Pelargonamide	nonanamide*	CH ₃ (CH ₂) ₇ CONH ₂	157.25
6447	Pelargone	See 9- <i>Heptadecanone</i> *.		
6448	Pelargonic acid	nonanoic acid*; <i>n</i> -nonylic acid	CH ₃ (CH ₂) ₇ COOH	158.24
6449	—, ethyl ester	ethyl nonanoate*; ethyl nonoate	CH ₃ (CH ₂) ₇ CO-OC ₂ H ₅	186.29
6450	—, methyl ester	methyl nonanoate*; methyl pelargonate	CH ₃ (CH ₂) ₇ CO-OCH ₃	172.26
6451	Pelargononitrile	nonanenitrile*; <i>n</i> -octyl cyanide	CH ₃ (CH ₂) ₇ CN	139.24
6452	Pelargonyl chloride	nonanoyl chloride*	CH ₃ (CH ₂) ₇ COCl	176.68
6452M	Pellagra-preventive vitamin	amin. See <i>Nicotinamide</i> ; <i>Nicotinic acid</i> .		
6453	Pelletierine	punicine	C ₈ H ₁₅ NO	141.21
6454	—, sulfate		(C ₈ H ₁₅ NO) ₂ ·H ₂ SO ₄	380.50
6455	Pellotine		C ₁₃ H ₁₉ NO ₃	237.29
6456	Pentadecanal , oxime*		CH ₃ (CH ₂) ₁₃ -CH:NOH	241.41
6457	Pentadecane *	<i>n</i> -pentadecane	CH ₃ (CH ₂) ₁₃ CH ₃	212.41
6457H	—, 1-amino-.	See <i>Pentadecylamine</i> *(<i>n</i>).		
6457R	—, 2,5,8,11,14-pentaoxa*.	See <i>Tetraethyleneglycol</i> , dimethyl ether.		
6458	1-Pentadecanol *	<i>n</i> -pentadecyl alcohol	CH ₃ (CH ₂) ₁₄ OH	228.41
6459	8-Pentadecanone *	diheptyl ketone; caprylone	[CH ₃ (CH ₂) ₆] ₂ CO	226.39
6460	<i>n</i>-Pentadecyl alcohol	See 1- <i>Pentadecanol</i> *.		
6460M	Pentadecylamine *(<i>n</i>)	1-aminopentadecane	CH ₃ (CH ₂) ₁₄ NH ₂	227.43
6461	1,2-Pentadiene *	ethylallene	CH ₂ :C:CHCH ₂ -CH ₃	68.11
6462	1,3-Pentadiene *	piperylene; α-methylbiviny	CH ₂ :CHCH:CH-CH ₃	68.11
6463	1,4-Pentadiene *		CH ₂ :CHCH ₂ -CH:CH ₂	68.11
6464	2,3-Pentadiene *		CH ₃ CH:C:CHCH ₃	68.11
6465	2,4-Pentadienoic acid *	β-vinylacrylic acid; αγ-pentadienic acid	CH ₂ :CHCH:CH-COOH	98.10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6430	wh. tricl. cr. . .	1.345 ^{15.6} / ₄	82	90 ¹⁵	s.	20.5 ²⁵	3.6 ²³ eth.
6431							
6432							
6433							
6434							
6435	col.-red leaf. . .	.....	189	.....	i.	s.	s. eth.
6436							
6437							
6438							
6439							
6440	liq.	0.9338 ⁹	.....	188	sl. s.	s.	.....
6441	liq.	0.916	.....	220	.....	.....	.....
6442							
6443	yel. leaf. ....	.....	d. 126	.....	i.	i.	i. eth.
6444							
6445	leaf. f. dil. al. . .	.....	63	.....	i.	s.	s. eth.
6446	col.		99-100	.....	i.	sl. s.	sl. s. eth.
6447							
6448	col. oily liq., 1.4330	0.9055 ²⁰ / ₄	12	254	v. sl. s.	s.	s. eth., chl.
6449	col. liq., 1.42200 ²⁰	0.8657 ²⁰ / ₄	-36.7 (-44.5)	227.5	i.	s.	∞ eth.
6450	liq.	0.877 ¹⁸	.....	214	i.	s.	s. eth.
6451	col. liq.	0.8331 ⁹ ; 0.786 ¹⁶	-34.2	224.0	i.	sl. s.	s. eth.
6452	col. liq., 1.4380 ¹⁵	0.9590 ⁰ / ₄ ; 0.946 ²⁰ / ₄	-60.5	215.35 (108-10 ²²)	d.	d.	s. eth.
6452M							
6453	col. oil.	0.988 ^{15.5}	.....	195 d.	5	∞	∞ eth.; s. chl.
6454	br. syrupy liq. or cr. mass, [α]-30°D	.....	.....	.....	v. s.	s.	.....
6455	pl. f. al.		110	.....	i.	v. s.	v. s. eth.
6456	need. f. dil. al.		86	.....	i.	sl. s.	v. s. eth.; sl. s. bz.
6457	col. liq.	0.7689 ²⁰ / ₄	10	270.5	i.	v. s.	v. s. eth.
6457H							
6457R							
6458	cr.		43.84 (45-6)	.....	.....	.....	.....
6459	cr. f. al.		40	178	.....	s.	.....
6460							
6460M	col. cr. ....		.....	307.6; 132.3 ²	i.	s.	s. eth.
6461				45	.....	.....	.....
6462	liq., 1.4402 ^{16.5}	0.696	.....	43 (42-4)	.....	.....	.....
6463	1.3380.	0.6594 ²⁰ / ₄	.....	25.8-6.2	.....	.....	.....
6464	liq.	0.702 ²⁰ / ₀	.....	49-51	.....	.....	.....
6465	pr. f. eth.		80	d. 110-5	s. h.	v. s.	v. s. eth.; sl. s. net. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6466	2,4-Pentadienoic acid*	5-(3,4-methylenedioxy	phenyl)-. See Pipe	ric acid.
6467	1,4-Pentadien-3-one, 1	5-diphenyl-*. See Styryl k	etone.	
6468	Pentaerythritol.	pentaerythrite; 2,2-bishydroxymethyl-1,3-propanediol*	$C(CH_2OH)_4$	136.15
6469	Pentaglycerine, Penta	glycerol. See 1,3-Propanediol,	2-hydroxymethyl-2-m	ethyl-*. See Cyclopentane*.
6470	Pentamethylene.	See Cyclopentane*.		
6471	—, keto-.	See Cyclopentanone*.		
6472	Pentamethylenediamine.	See Cadaverine.		
6473	Pentamethylene dibromide.	See Pentane, 1,5-dibromide.	See Pentane, 1,5-dichloride.	
6474	Pentamethylene dichloride.	See 1,5-Pentanediol*.		
6475	Pentamethylene glycol.	See Pyran, tetrahydro-.		
6476	Pentamethylene oxide.	See Piperidine.		
6477	Pentamethylenimine.	See Valeraldehyde.		
6478	Pentanal*.	See Levulinic aldehyde.		
6479	—, 4-oxo-*.	See Valeramide.		
6480	Pentanamide*.	n-pentane.	$CH_3(CH_2)_3CH_3$	72.15
6481	Pentane*.			
6482	—, 1-amino-.	See Amylamine.		
6483	—, 2-amino-.	See Butylamine, α -methyl-.		
6484	—, 3-amino-.	See Propylamine, α -ethyl-.		
6485	—, 1-amino-4-methyl-.	See Isohexylamine.		
6486	—, 3,3-bisethylsulfonyl-.	See Tetronal.		
6487	—, 1-bromo-*.	See Amyl bromide.		
6488	—, 1-chloro-*.	See Amyl chloride.		
6489	—, 2-chloro-*.		$CH_3CHClCH_2CH_2CH_3$	106.60
6490	—, 3-chloro-*.		$CH_3CH_2CHClCH_2CH_3$	106.60
6490M	—, 3-cyano-.	See Butyronitrile, α -ethyl-.		
6491	—, 1,5-dibromo-*.	pentamethylene dibromide	$CH_2Br(CH_2)_3CH_2Br$	229.96
6492	—, 1,5-dichloro-*.	pentamethylene dichloride	$Cl(CH_2)_5Cl$	141.05
6493	—, 2,2-dimethyl-*.	trimethylpropylmethane	$(CH_3)_3CCH_2CH_2CH_3$	100.20
6494	—, 2,3-dimethyl-*.	ethylisopropylmethylmethane	$CH_3CH(CH_3)CH(CH_3)CH_2CH_3$	100.20
6495	—, 2,4-dimethyl-*.	diisopropylmethane	$(CH_3)_2CHCH_2CH(CH_3)_2$	100.20
6496	—, 3,3-dimethyl-*.	diethyldimethylmethane	$CH_3CH_2C(CH_3)_2CH_2CH_3$	100.20
6497	—, 1-ethoxy-*.	See Ether, amyl ethyl.		
6498	—, 3-ethyl-*.	triethylmethane	$(C_2H_5)_3CH$	100.20
6499	—, 3-ethyl-2-methyl-*	diethylisopropylmethane	$(CH_3)_2CHCH(CH_3)CH_2CH_3$	114.23
6500	—, 3-ethyl-3-methyl-*	triethylmethylmethane	$CH_3CH_2C(CH_3)_2CH_2CH_3$	114.23
6500M	—, 1-fluoro-*.	See Amyl fluoride (n).		
6501	—, 1-iodo-*.	See Amyl iodide.		
6502	—, 1-methoxy-*.	amyl methyl ether	$CH_3(CH_2)_4OCH_3$	102.17
6503	—, 2-methyl-*.	dimethylpropylmethane	$(CH_3)_2CH(CH_2)_2CH_3$	86.17
6504	—, 3-methyl-*.	diethylmethylmethane	$CH_3CH_2CH(CH_3)CH_2CH_3$	86.17
6505	—, 3-methylene-*.	See 1-Butene, 2-ethyl-*.		
6506	—, 2-methyl-3-methylene-.	See 1-Butene, 2-ethyl-3-methyl-*.		
6506M	—, 3-methylol-.	See 1-Butanol, 2-ethyl-*.		
6507	—, 4-methyl-1-phenyl-.	See Benzene, isohexyl-.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6466	tetrag. cr., 1.559, 1.548	253 (260.5)	5.56 ¹⁵
6467							
6468							
6469							
6470							
6471							
6472							
6473							
6474							
6475							
6476							
6477							
6478							
6479							
6480							
6481	col. liq., 1.3570 ^{15.7}	0.626 ²⁰ / ₄ ; 0.6214 ²⁵ / ₄	-131.5 (-129.9)	36.2 (34-5.5)	0.036 ¹⁶	∞	= eth.
6482	liq., 1.4060.....	0.870 ²⁰ / ₄	96-7	i.	s.	s. eth.
6483							
6484							
6485							
6486							
6487							
6488							
6489							
6490							
6490M							
6491	col. arom. liq.	1.702 ¹⁸ / ₀	-35	224	i.
6492	1.0940 ²⁵ / ₄	178	i.	s.	s. eth.
6493	col. liq.	0.6737	-125	78.9	i.	s.	s. eth.
6494	col. liq.	0.6959	89.4	i.	s.	s. eth.
6495	col. liq.	0.6745	-123.4	80.8	i.	s.	s. eth.
6496	col. liq.	0.6934	86.0	i.	s.	s. eth.
6497	col. liq.	0.6984	-94.5 (-125.6)	93.3	i.	s.	s. eth.
6498							
6499							
6500							
6500M							
6501							
6502							
6503							
6504							
6505							
6506	col. liq., 1.372	0.654	60	i.	s.	s. eth.
6507	col. liq.	0.676 ²⁰ / ₄	64	i.	∞	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6508	Pentane, pentyloxy-*	See <i>Amyl ether</i> .		
6509	—, 1-phenyl-	See <i>Benzene, amyl-</i> .		
6510	—, 2-phenyl-	See <i>Benzene, (α-methylbutyl)-</i> .		
6511	—, 2,2,4-trimethyl-*	isobutyltrimethylmethane; "isoöctane"	$(\text{CH}_3)_2\text{CCH}_2\text{CH}(\text{CH}_3)_2$	114.23
6512	3-Pentanecarboxylic acid	id. See <i>Butyric acid, α-ethyl-</i> .		
6513	1,5-Pentanediamine*	See <i>Cadaverine</i> .		
6514	Pentanedinitrile*	See <i>Glutaronitrile</i> .		
6515	Pentanedioic acid*	See <i>Glutaric acid</i> .		
6516	—, 3-oxo-*	See <i>Acetonedicarboxylic acid</i> .		
6517	1,2-Pentanediol	α-n-amyleneglycol.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{OH}$	104.15
6518	1,4-Pentanediol	γ-pentylene glycol.....	$\text{CH}_3\text{CHOHCH}_2\text{CH}_2\text{CH}_2\text{OH}$	104.15
6519	1,5-Pentanediol	pentamethylene glycol.....	$\text{CH}_2\text{OHCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$	104.15
6520	2,3-Pentanediol	methylethylethylene glycol; β-n-amylene glycol	$\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}_3$	104.15
6521	2,4-Pentanediol, 2-methyl-*	α,α,α'-trimethyltrimethylene glycol	$(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$	118.17
6522	1,4-Pentanedione, 1-pentyl-	See <i>Valerophenone, γ-oxo-</i> .		
6523	1,5-Pentanedione, 1,2,3,4,5-pentaphenyl-	See <i>Benzamaron; Isobenzamaron</i> .		
6524	2,3-Pentanedione, 3-oxime*	α-isonitrosopropyl methyl ketone	$\text{CH}_3\text{COC}(\text{:NOH})\text{CH}_2\text{CH}_3$	115.13
6525	2,4-Pentanedione*	acetylacetone.....	$\text{CH}_3\text{COCH}_2\text{COCH}_3$	100.11
6526	Pentanenitrile*	See <i>Valeronitrile</i> .		
6527	—, 4-methyl-*	See <i>Isocaproitrile</i> .		
6528	1,2,3,4,5-Pentanepentol*	See <i>Arabitol</i> .		
6529	1-Pentanethiol*	amyl mercaptan.....	$\text{CH}_3(\text{CH}_2)_4\text{SH}$	104.21
6530	Pentanoic acid*	See <i>Valeric acid</i> .		
6531	—, 4-methyl-*	See <i>Isocaproic acid</i> .		
6532	—, 4-oxo-*	See <i>Levulinic acid</i> .		
6533	Pentanoic anhydride*	See <i>Valeric anhydride</i> .		
6534	1-Pentanol*	butylcarbinol; pri-n-amyl alcohol	$\text{CH}_3(\text{CH}_2)_4\text{OH}$	88.15
6535	—, 2-methyl-*	2-methyl-2-propylethanol...	$\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{CH}_3)\text{CH}_2\text{OH}$	102.17
6536	—, 3-methyl-*	active hexyl alcohol.....	$(\text{C}_2\text{H}_5)(\text{CH}_3)\text{CHCH}_2\text{CH}_2\text{OH}$	102.17
6537	—, 4-methyl-*	isoamylcarbinol.....	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_2\text{CH}_2\text{OH}$	102.17
6538	2-Pentanol*	methylpropylcarbinol; sec-act-amyl alcohol	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CHOHCH}_3$	88.15
6539	—, 2,4-dimethyl-*	isobutylidimethylcarbinol....	$(\text{CH}_3)_2\text{COHCH}_2\text{CH}(\text{CH}_3)_2$	116.20
6540	—, 2-methyl-*	dimethylpropylcarbinol.....	$(\text{CH}_3)_2\text{COH}(\text{CH}_2)_2\text{CH}_3$	102.17
6541	—, 4-methyl-*	isobutylmethylcarbinol.....	$(\text{CH}_3)_2\text{CHCH}_2\text{CHOHCH}_3$	102.17
6542	—, —, acetate	α, γ-dimethylbutylacetate...	$\text{CH}_3\text{CH}(\text{OOCCH}_3)\text{CH}_2\text{CH}(\text{CH}_3)_2$	144.21
6543	—, —, butyrate	α-methylisoamyl butyrate...	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{OOCCH}_2\text{CH}_2\text{CH}_3)\text{CH}_3$	172.26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6508							
6509							
6510							
6511	col. liq., 1.3916	0.6918	f. p. -107.4	99.3	i.	sl. s.	s. eth.
6512							
6513							
6514							
6515							
6516							
6517	col. liq.....	0.980 $\frac{20}{20}$	.....	211.8	∞	=	∞ eth.
6518	liq.....	0.9954 $\frac{18}{18}$	.....	131-3 ¹⁸	∞	∞	v. sl. s. eth.
6519	thick liq., 1.4499	0.994 $\frac{20}{20}$	.....	239.4	∞	∞	sl. s. eth.
6520	liq.....	0.9945 ⁰	.....	187	s.	s.	.....
6521	liq.....	0.9240 $\frac{17}{4}$	.....	196; 96-8 ¹⁰	s.	s.	s. eth.
6522							
6523							
6524	leaf. f. lgr.....	.....	56-7	183-7	sl. s.	v. s.	v. s. eth., chl.
6525	col. inflam. liq., 1.45178 ^{18.5}	0.976	-23.2	139 ⁷⁴⁶	12.5, 51.5 ⁸⁰	=	∞ eth.; s. bz., chl., acet., glac. ac. a.
6526							
6527							
6528							
6529	liq., 1.44366...	0.857	-75.7	126	i.	∞	∞ eth.
6530							
6531							
6532							
6533							
6534	col. liq., 1.40994 ²⁰	0.8144 $\frac{20}{4}$	-78.5	138	2.7 ²²	∞	∞ eth.
6535	.....	0.831 $\frac{15.6}{15.6}$	.....	148	.....	.....	.....
6536	liq.....	0.8262; 0.8205 $\frac{25}{4}$	.....	153.7-54.1	i.	s.	s. eth.
6537	liq., 1.4490....	0.8243 ⁰ ; 0.8156 $\frac{20}{4}$	.....	147-8; 151.8-2.8	v. sl. s. (i.)	s.	s. eth.
6538	col. liq., 1.4053	0.809 $\frac{20}{4}$	.....	119.28	5.3 ³⁰	∞	∞ eth.
6539	col. liq., 1.4172	0.8158	<-20	132.8-3.4 (129-30)	i.	s.	s. eth.
6540	liq.....	.....	4 (<-38)	122.5-3.5	v. sl. s.	s.	∞ eth.
6541	col. liq., 1.409.	0.806 (0.813 $\frac{20}{4}$)	.....	131.4	1.8	∞	∞ eth.
6542	col. liq.....	0.8580 $\frac{20}{4}$	.....	146	0.082 ²⁵	.....	.....
6543	col. liq.....	0.853	-48	183	0.8 ³⁵	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6544	2-Pentanol, 2,4,4-trimethyl-(?)	isodibutol.....	$(\text{CH}_3)_3\text{CCH}_2\text{COH}-$ $(\text{CH}_3)_2$	130.23
6545	3-Pentanol*	diethylcarbinol.....	$\text{CH}_3\text{CH}_2\text{CHOH}-$ CH_2CH_3	88.15
6546	—, 2,3-dimethyl-* ...	ethylisopropylmethylcarbinol	$(\text{CH}_3)_2\text{CHCOH}-$ $(\text{CH}_3)\text{CH}_2\text{CH}_3$	116.20
6547	—, 2,4-dimethyl-* ...	diisopropylcarbinol.....	$(\text{CH}_3)_2\text{CHCHOH}-$ $\text{CH}(\text{CH}_3)_2$	116.20
6548	—, 2,4-dimethyl-3-phenyl-	diisopropylphenylcarbinol	$[(\text{CH}_3)_2\text{CH}]_2-$ COHC_6H_5	192.29
6549	—, 3-ethyl-*	triethylcarbinol.....	$(\text{C}_2\text{H}_5)_3\text{COH}$	116.20
6550	—, 3-ethyl-2-methyl-*	diethylisopropylcarbinol....	$(\text{CH}_3)_2\text{CHCOH}-$ $(\text{C}_2\text{H}_5)\text{CH}_2\text{CH}_3$	130.23
6551	—, 2-methyl-*	ethylisopropylcarbinol.....	$(\text{CH}_3)_2\text{CHCHOH}-$ CH_2CH_3	102.17
6552	—, 3-methyl-*	diethylmethylcarbinol.....	$\text{CH}_3\text{CH}_2\text{COH}-$ $(\text{CH}_3)\text{CH}_2\text{CH}_3$	102.17
6553	2-Pentanone*	methyl propyl ketone.....	$\text{CH}_3\text{CO}(\text{CH}_2)_2\text{CH}_3$	86.13
6554	—, oxime.....	methyl propyl ketoxime....	$\text{CH}_3\text{C}(:\text{NOH})-$ $(\text{CH}_2)_2\text{CH}_3$	101.15
6555	—, 4-hydroxy-4-methyl-*	diacetone alcohol.....	$\text{CH}_3\text{COCH}_2\text{C}-$ $(\text{OH})(\text{CH}_3)_2$	116.16
6556	—, 3-methyl-*	<i>sec</i> -butyl methyl ketone; <i>asym</i> -ethylmethylacetone	$\text{CH}_3\text{COCH}(\text{CH}_3)-$ CH_2CH_3	100.16
6557	—, 4-methyl-*	isobutyl methyl ketone.....	$\text{CH}_3\text{COCH}_2\text{CH}-$ $(\text{CH}_3)_2$	100.16
6558	3-Pentanone*	diethyl ketone; <i>sym</i> -dimethylacetone; propione; ethyl ketone	$\text{C}_2\text{H}_5\text{COC}_2\text{H}_5$	86.13
6559	—, 2,4-dimethyl-* ...	diisopropyl ketone.....	$(\text{CH}_3)_2\text{CHCOCH}-$ $(\text{CH}_3)_2$	114.18
6560	—, 2-methyl-*	ethyl isopropyl ketone.....	$\text{C}_2\text{H}_5\text{COCH}(\text{CH}_3)_2$	100.16
6561	Pentanoyl chloride* ...	See <i>Valeryl chloride</i> .		
6562	Pentatriacontane*	<i>n</i> -pentatriacontane.....	$\text{CH}_3(\text{CH}_2)_{33}\text{CH}_3$	492.93
6563	18-Pentatriacontanone*	diheptadecyl ketone; stearone	$(\text{C}_{17}\text{H}_{35})_2\text{CO}$	506.92
6564	1-Pentene*	propylethylene; α - <i>n</i> -amylene	$\text{CH}_3\text{CH}_2\text{CH}_2-$ $\text{CH}:\text{CH}_2$	70.13
6565	—, 2,3-dimethyl-* ...	1- <i>sec</i> -butyl-1-methylethylene	$\text{CH}_2:\text{C}(\text{CH}_3)\text{CH}-$ $(\text{CH}_3)\text{CH}_2\text{CH}_3$	98.18
6566	—, 2,4-dimethyl-* ...	1-isobutyl-1-methylethylene	$\text{CH}_2:\text{C}(\text{CH}_3)\text{CH}_2-$ $\text{CH}(\text{CH}_3)_2$	98.18
6567	—, 3,3-dimethyl-*...	.....	$\text{CH}_2:\text{CHC}(\text{CH}_3)_2-$ CH_2CH_3	98.18
6568	—, 2-ethyl-*	1-ethyl-1-propylethylene; 3-methylenehexane*	$\text{CH}_2:\text{C}(\text{C}_2\text{H}_5)\text{CH}_2-$ CH_2CH_3	98.18
6569	—, 2-methyl-*	1-methyl-1-propylethylene...	$\text{CH}_2:\text{C}(\text{CH}_3)\text{CH}_2-$ CH_2CH_3	84.16
6570	—, 3-methyl-*	<i>sec</i> -butylethylene.....	$\text{CH}_2:\text{CHCH}-$ $(\text{CH}_3)\text{CH}_2\text{CH}_3$	84.16
6571	—, 4-methyl-*	isobutylethylene.....	$\text{CH}_2:\text{CHCH}_2\text{CH}-$ $(\text{CH}_3)_2$	84.16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6544	col. liq., 1.42085	0.8417 ⁰ ; 0.8228 ²⁰ / ₄	-20	147.5 (152-4)	i.	sl. s.	s. eth.
6545	col. liq., 1.4077 ²⁵	0.815 ²⁵	.....	115.6	sl. s.	s.	s. eth.
6546	liq.	0.8329 ²¹	<-30	138-40 ⁷⁵	i.	s.	s. eth.
6547	col. liq., 1.42259	0.8288 ²⁰ / ₄	<70	140	v. sl. s.	s.	s. eth.
6548	yel. liq.	0.959	60.5	157 ⁶⁰ ; 229 ⁷⁵⁵	sl. s.	i.	s. eth.
6549	col. oil, 1.4314	0.83892	.....	140-2	i.	s.	s. eth.
6550	liq.	0.8463 ⁰ ; 0.8295 ²⁰ / ₄	.....	159-61 ⁷⁵⁰	i.	s.	s. eth.
6551	liq.	0.826 ¹⁸ / ₄	.....	127.5 ⁷²¹	v. sl. s.	∞	∞ eth.
6552	col. liq., 1.4196	0.824; 0.8233 ²⁵ / ₄	-22 (<-38)	122.8-3.0	sl. s.	∞	∞ eth.
6553	col. liq., 1.38946 ^{20.2}	0.812 ¹⁵ / ₁₅	-77.8	101.7	v. sl. s.	∞	∞ eth.
6554	col. liq., 1.4450	0.909	.....	168	s.	∞	∞ eth.
6555	col. liq., 1.4300 ⁹	0.9306 ²⁵ / ₄ ; 0.938 ²⁰ / ₄	-54 to -57	164-6	∞	∞	∞ eth.
6556	col. liq.	0.818 ¹⁴ / ₄	.....	118	sl. s.	∞	∞ eth.
6557	col. liq.	0.8017 ²⁰ / ₄	-84.7	119 (115-8)	1.9	∞	∞ eth., bz.
6558	col. inflam. liq., 1.3939 ^{16.6}	0.8159 ¹⁹ / ₄	-42	102.7	4.7 ²⁰ ; 3.8 ¹⁰⁰	∞	∞ eth.
6559	col. liq.	0.8062 ²⁰ / ₄	.....	123.7	i.	∞	∞ eth.; s. bz.
6560	col. liq.	0.830 ⁰	.....	114.5	v. sl. s.	v. s.	∞ eth.
6561	.....	.....	.....	.....	.....	.....	.....
6562	cr.	0.782 ⁷⁵ / ₄	74.7	331 ¹⁵	.....	.....	.....
6563	leaf. f. lgr.	liq. 0.793 ⁹⁵	88	.....	i.	sl. s. h.	sl. s. h. eth.
6564	col. liq.	0.6454 ²⁵ / ₄	-138	40 (32-7)	i.	∞	∞ eth.; v. s. dil. H ₂ SO ₄
6565	.....	0.7054	.....	84.1-4.3	.....	.....	.....
6566	.....	0.6937	.....	80.9-1.3	.....	.....	.....
6567	1.3991.	0.6961	.....	76.9	.....	.....	.....
6568	.....	0.7079	.....	93.9-4.3	.....	.....	.....
6569	.....	0.6817	.....	61.5-2.0	.....	.....	.....
6570	.....	0.6709	.....	53.6-4.0	.....	.....	.....
6571	.....	0.6646	.....	53.6-3.9	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6572	2-Pentene*	<i>sym</i> -methylethylethylene; <i>β</i> - <i>n</i> -amylene	$\text{CH}_3\text{CH}_2\text{CH}:\text{CH}-\text{CH}_3$	70.13
6573	—, 2,3-dimethyl-*	ethyltrimethylethylene	$(\text{CH}_3)_2\text{C}:\text{C}(\text{CH}_3)-\text{CH}_2\text{CH}_3$	98.18
6574	—, 2,4-dimethyl-*	isopropyl-dimethylethylene	$(\text{CH}_3)_2\text{C}:\text{CHCH}-\text{CH}_2\text{CH}_3$	98.18
6575	—, 3,4-dimethyl-*	1-isopropyl-1,2-dimethyl-ethylene	$\text{CH}_3\text{CH}:\text{C}(\text{CH}_3)-\text{CH}(\text{CH}_3)_2$	98.18
6576	—, 1,4-dimethyl-* . . . . .	.....	$\text{CH}_3\text{CH}:\text{CHC}-\text{CH}_2\text{CH}_3$	98.18
6577	—, 3-ethyl-*	1,1-diethyl-2-methyl-ethylene	$\text{CH}_3\text{CH}:\text{C}(\text{C}_2\text{H}_5)_2$	98.18
6578	—, 2-methyl-*	2-ethyl-1,1-dimethylethylene	$(\text{CH}_3)_2\text{C}:\text{CHCH}_2-\text{CH}_3$	84.16
6579	—, 3-methyl-*	1-ethyl-1,2-dimethylethylene	$\text{CH}_3\text{CH}:\text{C}(\text{CH}_3)-\text{CH}_2\text{CH}_3$	84.16
6580	—, 4-methyl-*	1-isopropyl-2-methylethylene	$\text{CH}_3\text{CH}:\text{CHCH}-\text{CH}_2\text{CH}_3$	84.16
6582	2-Pentene-3-carboxylic	acid* . See <i>Crotonic acid</i> , <i>α</i> -ethyl-	$\text{CH}_2:\text{CHCH}_2\text{CH}_2-\text{CN}$	81.11
6583	4-Pentenitrile*	allylacetonitrile; allylmethyl cyanide	$(\text{CH}_3)_2\text{CHCH}:\text{CH}-\text{COOH}$	114.14
6584	2-Pentenoic acid, 4-methyl-*	<i>β</i> -isopropylacrylic acid; <i>α</i> -isohexenic acid	$\text{CH}_2:\text{CHCH}_2\text{CH}_2-\text{COOH}$	100.11
6585	4-Pentenoic acid*	allylacetic acid	$\text{CH}_2:\text{CHCHOH}-\text{CH}_2\text{CH}_3$	86.13
6586	1-Penten-3-ol*	ethylvinylcarbinol	$\text{C}_6\text{H}_{11}\text{OH}$	100.16
6587	3-Penten-2-ol, 2-methyl-*	dimethylpropenylcarbinol	$\text{CH}_2:\text{CHCH}_2\text{CH}_2-\text{CH}_2\text{OH}$	86.13
6588	4-Penten-1-ol*	<i>β</i> -allylethyl alcohol	$\text{CH}_2:\text{CHCH}_2-\text{CHOHCH}_3$	86.13
6589	4-Penten-2-ol*	allylmethylcarbinol	$\text{CH}_2:\text{CHCH}_2-\text{COH}(\text{CH}_3)_2$	100.16
6590	—, 2-methyl-* . . . . .	.....	$\text{CH}_3\text{CH}:\text{CH}-\text{COCH}_3$	84.11
6591	3-Penten-2-one*	ethylideneacetone	See <i>Mesityl oxide</i> .	
6592	—, 4-methyl-*	See <i>Mesityl oxide</i> .	5-amino-4-methyl-1-hexene	
6592M	4-Pentenylamine, 1,2-dimethyl-	.....	$\text{CH}_2:\text{CHCH}_2\text{CH}-\text{CH}_2\text{CH}_3$	113.20
6593	Pentine, Pentyl*	See <i>Pentyne*</i> .		
6594	1-Pentyne*	See <i>Amyl</i> . 1-pentine; <i>n</i> -propylacetylene	$\text{HC}:\text{CCH}_2\text{CH}_2\text{CH}_3$	68.11
6595	2-Pentyne*	2-pentine; ethylmethylacetylene; valerylene	$\text{CH}_3\text{C}:\text{CCH}_2\text{CH}_3$	68.11
6596	2-Pentynoic acid*	ethylpropionic acid; ethylacetylenecarboxylic acid	$\text{CH}_3\text{CH}_2\text{C}:\text{CCOOH}$	98.10
6596H	1-Pentyn-3-ol, 3,4-dimethyl-*	ethynyl isopropylmethyl carbinol	$\text{HC}:\text{C}(\text{OH})-\text{CH}_2\text{CH}(\text{CH}_3)_2$	112.17
6596R	—, 3-methyl-*	ethylethynylmethylcarbinol	$\text{HC}:\text{C}(\text{OH})-\text{CH}_2\text{CH}_2\text{CH}_3$	98.14
6597	Peonol	2-hydroxy-4-methoxyacetophenone; resacetophenone 4-methyl ether; paeonol	$\text{CH}_3\text{COC}_6\text{H}_4-\text{OCH}_3$	166.17
6598	Perbenzoic acid	benzoyl hydroperoxide	$\text{C}_6\text{H}_5\text{COO}_2\text{H}$	138.12
6599	Perchloromethyl formate . See <i>Diphosgene</i>.	.....	$\text{C}_19\text{H}_{24}\text{N}_2\text{O}$	296.40
6600	Pereirine . . . . .	.....	

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	•Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6572	col. inflam. liq.	0.651	-139	36.4	i.	∞	∞ eth.; v. s. dil. H ₂ SO ₄
6573	liq.	0.719	.....	95.1	i.	s.	s. eth.
6574	liq., 1.4020	0.6947 ²⁰ / ₄	.....	82.6	i.	s.	s. eth.
6575	1.4052	0.7126 ²⁰ / ₄	.....	86.2-6.4	.....	.....	.....
6576	1.3986	0.6881 ²⁰ / ₄	.....	76.0	.....	.....	.....
6577	.....	0.7172	.....	94.8-4.9	.....	.....	.....
6578	.....	0.6904	.....	67.2-7.5	.....	.....	.....
6579	.....	(1) 0.6956	.....	67.6-8.2	.....	.....	.....
6580	.....	(2) 0.6940	.....	65.7-6.2	.....	.....	.....
		(1) 0.6709	.....	57.7-8.5	.....	.....	.....
6582	.....	(2) 0.6702	.....	54.2-5.2	.....	.....	.....
6583	liq.	1.181 ³	.....	140	i.	∞	∞ eth.
6584	liq., 1.4506 ¹⁶	0.959	.....	108 ¹³	.....	s.	.....
6585	col. liq., 1.4341 ^{7.5}	0.984 ¹⁸	<-18	189	sl. s.	v. s.	v. s. eth.
6586	.....	0.840 ²⁰ / ₄	.....	114-5	sl. s.	=	∞ eth.
6587	col. liq., 1.4295	0.8343 ²⁰ / ₄	.....	121.6-122	10 ¹⁰	∞	∞ eth.
6588	col. liq.	0.863 ⁰ / ₄	.....	140-2	.....	.....	.....
6589	col. liq.	0.834 ²⁰ / ₄	.....	116.4	12.5	∞	∞ eth.
6590	liq.	0.8430 ⁰	.....	119.5	sl. s.	.....	.....
6591	col. liq., 1.43903 ^{19.6}	0.856	.....	122-4	s.	.....	.....
6592	.....	.....	.....	.....	.....	.....	.....
6592M	.....	0.793 ¹⁵	.....	133.6	s.	.....	.....
6593	.....	.....	.....	.....	.....	.....	.....
6594	col. liq., 1.4079 ¹⁸	0.7221 ⁰ ; 0.6882 ^{2.5} / ₄	-95	40	i.	v. s.	∞ eth.
6595	liq., 1.40044	0.687; 0.7127 ^{17.2}	-101	56	i.	v. s.	∞ eth.
6596	cr. ....	.....	50	.....	v. s.	.....	.....
6596H	col. liq., 1.459 ¹⁵	0.876 ¹⁵	.....	133	s.	s.	s. eth.
6596R	col. liq., 1.4310 ²⁰	0.8688 ²⁰	.....	118-21	s.	s.	s. eth.
6597	.....	.....	50	.....	i.	s.	s. eth.
6598	leaf. ....	.....	42	exp. 80-100	sl. s.	s.	s. eth.
6599	.....	.....	.....	.....	.....	.....	.....
6600	br. amor. powd.	.....	118-24	.....	i.	v. s.	v. s. eth.; s. chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6601	Peroxide, dibenzoyl.	See <i>Benzoyl peroxide</i> .		
6602	Perseitol	<i>d</i> -mannoheptitol; perseite. . .	$C_7H_9(OH)_7$	212.20
6603	Peucedanin	imperatorin	$C_{16}H_{16}O_4$	272.29
6604	Phaseomannitol.	See <i>i</i> -Inositol.		
6605	α-Phellandrene	1,5- <i>p</i> -menthadiene; 5-isopropyl-2-methyl-1,3-cyclohexadiene	$C_{10}H_{16}$	136.23
6606	β-Phellandrene	1(7).2- <i>p</i> -menthadiene; 3-isopropyl-6-methylene-cyclohexene	$C_{10}H_{16}$	136.23
6607	Phenacetin.	See <i>p</i> -Acetophenetide.		
6608	Phenacyl alcohol.	See <i>Acetophenone</i> , α -hydroxy-.		
6609	Phenacyl bromide.	See <i>Acetophenone</i> , α -bromo-.		
6610	Phenacyl chloride.	See <i>Acetophenone</i> , α -chloro-.		
6611	Phenanthrahydroquinone.	one. See 9,10-Phenanthrene-diol.		
6612	Phenanthraquinone.	See <i>Phenanthrenequinone</i> .		
6613	Phenanthrene .....	.....	$C_{14}H_{10}$	178.22
6614	—, amino-	See <i>Phenanthrylamine</i> .		
6615	—, ?-benzyl- .....	.....	$C_6H_5CH_2C_{14}H_9$	268.34
6616	—, 9,10-dihydro-9,10-dioxo-	See <i>Phenanthrenequinone</i> .		
6617	—, 3,4-dimethoxy-	morphol dimethyl ether. . .	$C_{14}H_9(OCH_3)_2$	238.27
6618	—, 9,10-dimethyl- .....	.....	$C_{14}H_8(CH_3)_2$	206.27
6619	—, 9,10-diphenyl- .....	.....	$C_{14}H_8(C_6H_5)_2$	330.41
6620	—, hydroxy-	See <i>Phenanthrol</i> .		
6621	—, 7-isopropyl-1-methyl-	See <i>Retene</i> .		
6622	—, 1-methyl- .....	.....	$CH_3C_{14}H_9$	192.25
6623	—, 3-methyl- .....	.....	$CH_3C_{14}H_9$	192.25
6624	—, 3,4,5-trihydroxy-	See 3,4,5-Phenanthrenetriol.		
6625	3,4-Phenanthrenediol.	See <i>Morphol</i> .		
6626	9,10-Phenanthrene-diol	phenanthrahydroquinone. . .	$C_{14}H_8(OH)_2$	210.22
6627	Phenanthrenequinone	9,10-dihydro-9,10-dioxo-phenanthrene; phenanthraquinone	$C_6H_4COCOC_6H_4$	208.20
6628	—, 2,7-dinitro- .....	.....	$NO_2C_6H_3(CO)_2$	298.20
6629	—, 2-nitro- .....	.....	$C_6H_3NO_2$	253.20
6630	3,4,5-Phenanthrenetriol	3,4,5-trihydroxyphenanthrene	$NO_2C_6H_3(CO)_2$	226.22
6631	2-Phenanthrol	2-hydroxyphenanthrene. . .	$C_{14}H_9OH$	194.22
6632	3-Phenanthrol	3-hydroxyphenanthrene. . .	$C_{14}H_9OH$	194.22
6633	4-Phenanthrol	4-hydroxyphenanthrene. . .	$C_{14}H_9OH$	194.22
6634	9-Phenanthrol .....	.....	$C_{14}H_9OH$	194.22
6635	2-Phenanthrylamine ..	2-aminophenanthrene. . .	$C_{14}H_9NH_2$	193.24
6636	3-Phenanthrylamine ..	3-aminophenanthrene. . .	$C_{14}H_9NH_2$	193.24
6637	9-Phenanthrylamine ..	9-aminophenanthrene. . .	$C_{14}H_9NH_2$	193.24
6638	Phenazine .....	.....	$C_6H_4NC_6H_4N$	180.20
6639	—, 5,10-dihydro-	hydrazophenylene. . .	$C_6H_4NHC_6H_4NH$	182.22

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6601							
6602	col. need.		188		5.5 ¹⁸	sl. s. c.	
6603	rhomb. pr.		75		i.	s. h.	s. eth., pet. eth., KOH
6604							
6605	liq.	0.843		175		i.	s. eth.
6606	liq., 1.4788....	0.852		171.2	i.	i.	s. eth.
6607							
6608							
6609							
6610							
6611							
6612							
6613	col. monoc. leaf. f. al., 1.6567 ¹²⁹	1.025; liq. 1.063 ¹⁰⁰	100 (97.5-8.5)	340.2	i.	2 ¹⁴ , 10.0 ⁷⁸	8.93 ^{15.5} eth.; s. bz., chl., ac. a., CS ₂
6614							
6615	need. f. bz. or leaf. f. al.		91-2 (155-6)		i.	sl. s.	sl. s. bz.
6616	leaf. f. al.		44	298-303 ¹¹²	i.	v. s.	v. s. eth.
6617	+w.						
6618	pr. f. dil. ac. a.		139	subl.		v. sl. s.	v. s. bz., chl.; s. ac. a.
6619	col. need. f. al.		235	270 subl.	i.	v. sl. s.	s. eth., bz.
6620							
6621							
6622	leaf. f. al.		123		i.	s.	
6623	cr. f. al.		65		i.	s.	
6624							
6625							
6626	col. need.		147-8		s. h.	v. s.	v. s. eth., bz.
6627	yel.-or. need.	1.405	207 (203-5)	360	sl. s.	v. s.	v. s. eth.; 0.54 ²⁰ bz.
6628	yel. gold		301-3		i.	v. sl. s.	sl. s. ac. a.
6629	need. f. ac. a.						
6629	yel. leaf. f. ac. a.		257			i.	sl. s. ac. a.
6630	leaf. f. w.		148		i.	v. s.	v. s. eth.
6631	leaf. f. dil. al.		168		sl. s.	v. s.	v. s. eth.
6632	need. f. dil. al.		122 (118-9)		i. c., sl. s. h.	v. s.	v. s. eth.
6633	cr.		108		i.	s.	s. eth.
6634	col. need. f. lgr.		153		i.	v. s.	v. s. eth., chl., bz., h. lgr.
6635	lt. yel. cr. f. lgr.		85		i.	s.	s. eth.
6636	cr. f. lgr.		α, 143; β, 87.5		sl. s.	v.s.(vlt. fluores.)	s. dil. HCl
6637	lt. yel. pr.		137-8; 104	subl.		v. s.	v. s. eth., bz., chl.
6638	yel. need.		171	>360 subl.	v. sl. s.	2 c.	sl. s. eth.
6639	rhomb. leaf.		d.		i.	v. sl. s. h.	i. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6640	Phenazine, 2-methyl-		$C_8H_4:N_2:C_6H_3CH_3$	194.23
6641	2(10)-Phenazinone, 10-	phenyl- . See <i>Aposafranone</i> .		
6642	Phenazone.	See <i>Antipyrine</i> .		
6643	Phenazothionium chlor	ide, 3,9-bisdimethylam	ino- . See <i>Methylene blue</i> .	
6644	Phene*	See <i>Benzene*</i> .		
6645	Phenethyl alcohol	2-phenylethanol; benzyl-carbinol	$C_6H_5CH_2CH_2OH$	122.16
6646	Phenethylamine	β -phenylethylamine; 1-amino-2-phenylethane	$C_6H_5CH_2CH_2NH_2$	121.18
6647	—, <i>p</i> -hydroxy-	See <i>Tyramine</i> .		
6648	—, <i>p</i> -hydroxy- <i>N,N</i> -d	methyl- . See <i>Holdenine</i> .		
6649	Phenetidine, <i>N</i>-acetyl-	See <i>Acetophenetide</i> .		
6650	<i>o</i>-Phenetidine	<i>o</i> -ethoxyaniline; <i>o</i> -aminophenetole	$C_2H_5OC_6H_4NH_2$	137.18
6651	<i>m</i>-Phenetidine	<i>m</i> -ethoxyaniline	$C_2H_5OC_6H_4NH_2$	137.18
6652	<i>p</i>-Phenetidine	<i>p</i> -ethoxyaniline	$C_2H_5OC_6H_4NH_2$	137.18
6653	—, <i>N,N</i> -diacetyl-	See <i>Diacetanilide, p-ethoxy-</i> .		
6654	—, 2-nitro-(NH₂=1)	4-ethoxy-2-nitroaniline; 4-amino-3-nitrophenetole	$NO_2(C_2H_5O)C_6H_3NH_2$	182.18
6655	Phenetole	ethoxybenzene*; ethyl phenyl ether	$C_2H_5OC_6H_5$	122.16
6656	—, <i>o, m</i> , or <i>p</i> -amino-	See <i>Phenetidine</i> .		
6657	—, azodi-	See <i>Azophenetole</i> .		
6658	—, β-bromo-	β -bromoethyl phenyl ether	$C_6H_5OCH_2CH_2Br$	201.07
6659	—, <i>o</i>-chloro-	1-chloro-2-ethoxybenzene*; <i>o</i> -chlorophenyl ethyl ether	$ClC_6H_4OC_2H_5$	156.61
6660	—, <i>p</i>-chloro-	1-chloro-4-ethoxybenzene*; <i>p</i> -chlorophenyl ethyl ether	$ClC_6H_4OC_2H_5$	156.61
6661	—, <i>o</i>-nitro-	ethyl <i>o</i> -nitrophenyl ether	$NO_2C_6H_4OC_2H_5$	167.16
6662	—, <i>m</i>-nitro-		$NO_2C_6H_4OC_2H_5$	167.16
6663	—, <i>p</i>-nitro-		$NO_2C_6H_4OC_2H_5$	167.16
6664	Pheniazine.	See <i>Quinazoline</i> .		
6665	Phenobarbital	5-ethyl-5-phenylbarbituric acid; luminal	$NHCONHCCC-(C_2H_5)(C_6H_5)CO$	232.23
6666	Phenocoll	α -amino- <i>p</i> -acetophenetide	$NH_2CH_2CONH-C_6H_4OC_2H_5$	194.23
6667	Phenol	carbolic acid; hydroxybenzene	C_6H_5OH	94.11
6668	—, acetate	phenyl acetate; acetylphenol	$CH_3COOC_6H_5$	136.14
6669	—, acetamido-	See <i>Acetanilide, hydroxy-</i> .		
6670	—, acetyl-	See <i>Phenol, acetate</i> .		
6671	—, acetylamino-	See <i>Acetanilide, hydroxy-</i> .		
6672	—, <i>o</i>-(acetylmethylamino)-	See <i>Acetanilide, o-hydroxy-N-methyl-</i> .		
6673	—, <i>p</i>-allyl-	See <i>Charicol</i> .		
6674	—, <i>o</i>-amino-	<i>o</i> -hydroxyaniline	$NH_2C_6H_4OH$	109.12
6675	—, <i>m</i>-amino-	<i>m</i> -hydroxyaniline	$NH_2C_6H_4OH$	109.12
6676	—, <i>p</i>-amino-	<i>p</i> -hydroxyaniline; rodinal	$NH_2C_6H_4OH$	109.12
6677	—, 2-amino-4,6-dinitro-	See <i>Picramic acid</i> .		
6678	—, <i>p</i>-(β-aminoethyl)-	See <i>Tyramine</i> .		
6679	—, 2-amino-3-nitro-		$NH_2(NO_2)C_6H_3OH$	154.12
6680	—, 2-amino-4-nitro-		$NH_2(NO_2)C_6H_3OH$	154.12

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6640	need. ....	.....	117	350 d.	sl. s. h.	sl. s.	sl. s. eth.; s. chl., H ₂ SO ₄
6641							
6642							
6643							
6644							
6645	col. liq., 1.5240	1.0235 ¹⁵	-27	219-21	1.6 ²⁰	∞	∞ eth.
6646	liq., 1.575.	0.958 ²⁴	.....	195 (198)	s.	v. s.	v. s. eth.
6647							
6648							
6649							
6650	liq. ....	.....	<-21	229.2	v. sl. s.	s.	s. eth.
6651	liq. ....	.....	.....	248	v. sl. s.	s.	s. eth.
6652	liq.	1.0613 ¹⁵	2.4	254.2	v. sl. s.	s.	s. eth.
6653							
6654	red pr. f. al. ....	.....	112-3	.....	.....	v. sl. s. c., s. h.	s. eth.
6655	col. liq., 1.5076 ²¹	0.9666 ^{20, 2} #	-30.2	172; 60 ^{9, 12}	i.	s.	∞ eth.
6656							
6657							
6658	.....	.....	35 (30-1)	240-50 d.	v. v. sl. s.	s.	s. eth.
6659	col. liq. ....	.....	.....	208	.....	s.	s. eth., bz.
6660	cr., 1.5227 ¹⁹ ..	.....	21	212	.....	s.	s. eth.
6661	yel. liq., 1.5425 ²⁰	1.19 ¹⁵	2.1 (5-6)	268 (275); 149.3 ⁶	i.	s.	s. eth.
6662	yel. need. ....	.....	34 (31-2)	284; 169 ⁷⁰	i.	s.	s. eth.
6663	col. monocl. pr. f. eth.	1.18 ¹⁵	60	283	i.	s. h.	v. s. eth.
6664							
6665	wh. lust. ....	.....	174	.....	s. h.	s.	s. eth.
6666	col. need. ....	.....	anh. 100.5	.....	sl. s.	s.	s. eth.
6667	col. rhomb. need., 1.54247 ^{40, 6}	1.072	41	182	6.7 ¹⁶ ; ∞ ⁶⁶	∞	v. s. eth.; s. chl., glyc., CS ₂
6668	col. liq., 1.503.	1.077 ²⁰ 4	.....	195.5	0.0318	∞	∞ eth., chl., glac. ac. a.
6669							
6670							
6671							
6672							
6673							
6674	col. rhomb. pl. or need.	.....	170 (174)	subl.	1.7 ⁰	4.4 ⁰	sl. s. eth.
6675	col. pr. f. tol. ....	.....	122-3	.....	2.6	v. s.	v. s. eth.; sl. s. bz., lgr.
6676	wh. leaf. ....	.....	184 d.	subl.	1.1 ⁰	4.5 ⁰	sl. s. eth.; i. bz.
6677							
6678	red need. ....	.....	216-7	subl.	#	.....	.....
6679	or. pr. ....	.....	143	.....	sl. s.	v. s.	v. s. eth.
6680							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6681	Phenol, 2-amino-5-nitro-	.....	$\text{NH}_2(\text{NO}_2)\text{C}_6\text{H}_3\text{OH}$	154.12
6682	—, 2-amino-6-nitro-	.....	$\text{NH}_2(\text{NO}_2)\text{C}_6\text{H}_3\text{OH}$	154.12
6683	—, 3-amino-4-nitro-	.....	$\text{NH}_2(\text{NO}_2)\text{C}_6\text{H}_3\text{OH}$	154.12
6684	—, 3-amino-5-nitro-	.....	$\text{NH}_2(\text{NO}_2)\text{C}_6\text{H}_3\text{OH}$	154.12
6685	—, 4-amino-2-nitro-	.....	$\text{NH}_2(\text{NO}_2)\text{C}_6\text{H}_3\text{OH}$	154.12
6686	—, 4-amino-3-nitro-	.....	$\text{NH}_2(\text{NO}_2)\text{C}_6\text{H}_3\text{OH}$	154.12
6687	—, 5-amino-2-nitro-	3-amino-6-nitrophenol.....	$\text{NH}_2(\text{NO}_2)\text{C}_6\text{H}_3\text{OH}$	154.12
6688	—, o-aminothio-	2-aminobenzenethiol*; o-aminophenyl mercaptan; o-mercaptoaniline	$\text{NH}_2\text{C}_6\text{H}_4\text{SH}$	125.18
6689	—, m-aminothio-	3-aminobenzenethiol*; m-aminophenyl mercaptan; m-mercaptoaniline	$\text{NH}_2\text{C}_6\text{H}_4\text{SH}$	125.18
6690	—, p-aminothio-	4-aminobenzenethiol*; p-aminophenyl mercaptan; p-mercaptoaniline	$\text{NH}_2\text{C}_6\text{H}_4\text{SH}$	125.18
6691	—, o-amoxy-	pyrocatechol monoamyl ether	$\text{CH}_3(\text{CH}_2)_4\text{OC}_6\text{H}_4\text{-OH}$	180.24
6692	—, m-amoxy-	resorcinol monoamyl ether	$\text{CH}_3(\text{CH}_2)_4\text{OC}_6\text{H}_4\text{-OH}$	180.24
6693	—, p-amoxy-	hydroquinone monoamyl ether	$\text{CH}_3(\text{CH}_2)_4\text{OC}_6\text{H}_4\text{-OH}$	180.24
6694	—, p-amyl-	.....	$\text{CH}_3(\text{CH}_2)_4\text{C}_6\text{H}_4\text{-OH}$	164.24
6695	—, p-tert-amyl-	p-(α, α -dimethylpropyl)-phenol	$\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2\text{-C}_6\text{H}_4\text{OH}$	164.24
6696	—, o-anilino-	o-hydroxydiphenylamine	$\text{C}_6\text{H}_5\text{NHC}_6\text{H}_4\text{OH}$..	185.22
6697	—, m-anilino-	m-hydroxydiphenylamine	$\text{C}_6\text{H}_5\text{NHC}_6\text{H}_4\text{OH}$..	185.22
6698	—, p-anilino-	p-hydroxydiphenylamine	$\text{C}_6\text{H}_5\text{NHC}_6\text{H}_4\text{OH}$..	185.22
6699	—, azodi-	See <i>Azophenol</i> .		
6700	—, p-benzal-amino-	See <i>Phenol, p-benzylideneamin</i> o-		
6701	—, benzenylaminothio-	See <i>Benzothiazole, 2-phenyl l-</i>		
6702	—, o-benzyl-	.....	$\text{C}_6\text{H}_5\text{CH}_2\text{C}_6\text{H}_4\text{OH}$	184.23
6703	—, p-benzyl-	p-hydroxydiphenylmethane	$\text{C}_6\text{H}_5\text{CH}_2\text{C}_6\text{H}_4\text{OH}$	184.23
6704	—, p-benzyl-amino-	.....	$\text{C}_6\text{H}_5\text{CH}_2\text{NHC}_6\text{H}_5\text{-OH}$	200.25
6704M	—, p-benzylidene-amino-	N-benzal-p-hydroxyaniline	$\text{C}_6\text{H}_5\text{CH:N:C}_6\text{H}_4\text{-OH}$	197.23
6705	—, o-bromo-	.....	$\text{BrC}_6\text{H}_4\text{OH}$	173.02
6706	—, m-bromo-	.....	$\text{BrC}_6\text{H}_4\text{OH}$	173.02
6707	—, p-bromo-	.....	$\text{BrC}_6\text{H}_4\text{OH}$	173.02
6708	—, o-butoxy-	pyrocatechol monobutyl ether	$\text{CH}_3(\text{CH}_2)_3\text{OC}_6\text{H}_4\text{-OH}$	166.21
6709	—, m-butoxy-	resorcinol monobutyl ether	$\text{CH}_3(\text{CH}_2)_3\text{OC}_6\text{H}_4\text{-OH}$	166.21
6710	—, p-butoxy-	hydroquinone monobutyl ether	$\text{CH}_3(\text{CH}_2)_3\text{OC}_6\text{H}_4\text{-OH}$	166.21
6711	—, o-butyl-	.....	$\text{C}_4\text{H}_9\text{C}_6\text{H}_4\text{OH}$	150.21
6712	—, m-butyl-	.....	$\text{C}_4\text{H}_9\text{C}_6\text{H}_4\text{OH}$	150.21

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6681	br. need. f. w.		202			s. h.	
6682	red need. f. al.		111		sl. s. h.	v. s.	v. s. eth., bz., chl.
6683	or. need.		185-6		sl. s. h.	s.	v. s. eth., bz., chl.
6684	yel. cr.		165			v. s.	v. s. eth.; v. sl. s. bz., chl.
6685	red need. f. al.		131 (142-3)				
6686	red pr. f. eth.		154		s.	s.	s. eth.
6687	or.-yel. need.		163				
6688	need.		26	234			
6689	oily liq.			180-90 ¹⁶	s.	s.	i. eth.
6690	wh. gran. cr. mass		46	140-5 ¹⁶	s.	s.	s. eth.
6691				104-6 ⁴			
6692				140 ⁵			
6693			49-50				
6694	col. liq.		<0	262	v. sl. s. h.	s.	s. eth., NaOH
6695	col. need.		92-3	248-50; 138-9 ¹⁵	v. sl. s.	v. s.	v. s. eth.
6696	pr. f. w.		69-70	180-9 ²⁰	sl. s. h.	s.	s. eth.; sl. s. bz.
6697	leaf. f. w.		32	340	sl. s. h.	s.	s. eth., alk.; sl. s. lgr.
6698	leaf. f. w.		70	330	s. h.	s.	s. eth., chl., alk.
6699							
6700							
6701							
6702			21	312	v. s. h.	v. s.	v. s. eth.
6703	col. need. f. al.		83-4	320-2 (308)	s. h.	s.	s. eth.
6704	leaf.		90 (84-5)		i.	v. s.	v. s. bz.
6704M	leaf. f. dil. al.		183 (185-6)		i.	v. s.	
6705	col. oily liq.	1.4924 ²⁰ ₄	5.6 (4-6)	194-5	v. sl. s.	s.	s. eth., alk.
6706	leaf.		33	236.5; 135-40 ¹²	v. sl. s.	v. s.	v. s. eth.; s. chl., alk.
6707	tetr.	1.840 ¹⁵ ; 1.588 ³⁰	63.5	238	1.42 ¹⁵	v. s.	v. s. eth.; s. chl., ac. a.
6708	1.5113 ²⁵	1.026 ²⁵		231-4; 159 ⁶⁹			
6709				130 ⁵			
6710			64-5				
6711	col., 1.496 ¹⁵	0.975 ²⁰ ₄		234-7	v. sl. s.	s.	s. eth.
6712	col.	0.974 ²⁰ ₄		247-9 ⁷⁵⁸	v. sl. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6713	Phenol, <i>p</i>-butyl-		$C_4H_9C_6H_4OH$	150.21
6714	—, <i>p</i> - sec-butyl-		$C_2H_5(CH_3)CHC_6H_4OH$	150.21
6715	—, <i>p</i> - tert-butyl-	4-(α,α -dimethylethyl)-phenol	$(CH_3)_3CC_6H_4OH$..	150.21
6716	—, o-chloro-	1-chloro-2-hydroxybenzene..	ClC_6H_4OH	128.56
6717	—, <i>m</i> - chloro-	1-chloro-3-hydroxybenzene..	ClC_6H_4OH	128.56
6718	—, <i>p</i> - chloro-	1-chloro-4-hydroxybenzene..	ClC_6H_4OH	128.56
6719	—, 2-chloro-4-nitro-		$Cl(NO_2)C_6H_3OH$..	173.56
6720	—, 2-chloro-5-nitro-	6-chloro-3-nitrophenol.....	$Cl(NO_2)C_6H_3OH$..	173.56
6721	—, 4-chloro-2-nitro-		$Cl(NO_2)C_6H_3OH$..	173.56
6722	—, 5-chloro-2-nitro-	3-chloro-6-nitrophenol.....	$Cl(NO_2)C_6H_3OH$..	173.56
6723	—, <i>p</i> - cyclohexyl-		$C_6H_{11}C_6H_4OH$..	176.25
6724	—, 2,4-diamino-		$(NH_2)_2C_6H_3OH$...	124.14
6725	—, —, dihydrochloride	diamol; amidol (one form)...	$(NH_2)_2C_6H_3OH \cdot 2HCl$	197.07
6726	—, 2,5-diamino-		$(NH_2)_2C_6H_3OH$..	124.14
6727	—, 3,4-diamino-		$(NH_2)_2C_6H_3OH$..	124.14
6728	—, 3,5-diamino-		$(NH_2)_2C_6H_3OH$..	124.14
6729	—, 2,4-dibromo-		$Br_2C_6H_3OH$	251.92
6730	—, 2,6-dibromo-		$Br_2C_6H_3OH$	251.92
6731	—, 2,6-dibromo-4-nitro-		$Br_2(NO_2)C_6H_2OH$	296.92
6732	—, 2,3-dichloro-		$Cl_2C_6H_3OH$	163.01
6733	—, 2,4-dichloro-		$Cl_2C_6H_3OH$	163.01
6734	—, 2,5-dichloro-		$Cl_2C_6H_3OH$	163.01
6735	—, 2,6-dichloro-		$Cl_2C_6H_3OH$	163.01
6736	—, 3,4-dichloro-		$Cl_2C_6H_3OH$	163.01
6737	—, 3,5-dichloro-		$Cl_2C_6H_3OH$	163.01
6738	—, 2,6-dichloro-4-nitro-		$Cl_2(NO_2)C_6H_2OH$..	208.01
6739	—, <i>m</i> - diethylamino-		$(C_2H_5)_2NC_6H_4OH$..	165.23
6740	—, 2,4-diiodo-		$I_2C_6H_3OH$	345.93
6741	—, 2,6-diiodo-		$I_2C_6H_3OH$	345.93
6742	—, 2,3-dimethoxy- ..	pyrogallol 1,2-dimethyl ether	$(CH_3O)_2C_6H_3OH$..	154.16
6743	—, 2,6-dimethoxy- ..	pyrogallol 1,3-dimethyl ether	$(CH_3O)_2C_6H_3OH$..	154.16
6744	—, 3,5-dimethoxy- ..	phloroglucinol dimethyl ether	$(CH_3O)_2C_6H_3OH$..	154.16
6745	—, dimethyl-	See <i>Xylenol</i> .		
6746	—, <i>m</i> - dimethyl-amino-	<i>m</i> -hydroxy- <i>N,N</i> -dimethylaniline	$(CH_3)_2NC_6H_4OH$..	137.18
6747	—, <i>p</i> -(α,α -dimethyl propyl-)..	See <i>Phenol, p-tert-amyl-</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6713	col. liq.....	0.978 ²⁰ / ₄	.....	246-50 ⁷⁵¹	v. sl. s.	s.	s. eth.
6714	col. need.....	.....	59	240.5 ⁷⁵⁰	v. sl. s.	s.	v. s. eth.
6715	need. f. w.....	0.9081 ¹¹⁴ / ₄	99	236-8	s.	s.	s. eth.
6716	col. liq., 1.5473 ⁴⁰	1.241 ¹⁸ / ₁₅	α 7; β 0; γ 4.1	175.6	2.85 ²⁰	s.	s. eth.
6717	col. liq. or need. 1.5565 ⁴⁰	liq. 1.245 ⁴⁵ ; 1.268 ²⁵	32.8	214	2.60 ²⁰	s.	s. eth.; 512 ²⁰ bz.
6718	need. f. al., 1.5579 ⁴⁰	1.306	43 (39-40)	217	2.71 ²⁰	v. s.	v. s. eth.; 272 ²⁰ bz.; s. alk.
6719	lng. col. need. f. al. or w.	.....	111	.....	s. h.	v. s.	v. s. eth.; s. chl.
6720	yel. need. f. w.	.....	118-9	.....	sl. s.	.....	s. chl.
6721	yel. monoc. need. f. al.	.....	87	.....	v. sl. s.	s.	s. eth., chl.
6722	yel. pr. f. w.	.....	38.9	subl.	sl. s.	s.	s. eth., ac. a.
6723	col. need.....	.....	133	.....	i.	sl. s.	s. eth.
6724	col. leaf.....	.....	78-80 d.	.....	.....	s.	sl. s. eth., chl.; s. acet., alk., ac. a.
6725	gray-wh. cr...	.....	168-70	.....	s.	sl. s.	sl. s. eth.
6726	need.....	.....	68	.....	v. s.	.....	.....
6727	cr.....	.....	167-8 d.	.....	.....	.....	.....
6728	pr.....	.....	168-70	.....	s.	.....	sl. s. eth.
6729	col. need.....	.....	40 (35-6)	177 ¹⁷ ; 238-9	0.19 ¹⁵	v. s.	v. s. eth.; s. CS ₂ , bz., alk.
6730	col. need. f. h. w.	.....	56-7	162 ²¹	sl. s.	v. s.	v. s. eth.
6731	yel. pr. f. al.	.....	144	d. >144	v. sl. s.	s. h.	s. eth., CS ₂ , et. ac., chl.; sl. s. ac. a.
6732	col. cr. f. pet. eth.	.....	57	.....	.....	s.	s. eth.
6733	col. need. f. bz.	.....	45	210	0.46 ²⁰	s.	s. eth., chl., bz.
6734	col. pr. f. pet. eth.	.....	58	211 ⁷⁴⁴	sl. s.	s.	s. eth., bz.
6735	col. need.....	.....	67	219-20	.....	s.	s. eth.
6736	col. need. f. bz.	.....	68	253.5 ⁷⁶⁷	.....	.....	.....
6737	.....	.....	68	233-4	.....	s.	.....
6738	yel. monoc. leaf. f. al.	1.822	125 d.	subl. <100 exp.	sl. s.	s. h.	s. eth., chl., bz.
6739	rhomb. f. CS ₂ +lgr.	.....	78	276-80; 201 ²⁵	s.	s.	s. eth., CS ₂ ; i. lgr.
6740	col. need. f. w.	.....	72	subl. 100	sl. s.	s.	s. eth.; sl. s. chl., bz.
6741	col. cr.....	.....	68	.....	.....	s.	.....
6742	col. liq.....	.....	.....	233-4; 124-5 ¹⁷	.....	.....	.....
6743	monocl. pr. f. w.	.....	55-56	258 (262.7)	1.75 ¹⁵	v. s.	v. s. eth.
6744	cr.....	.....	36-8	172-5 ¹⁷	.....	.....	.....
6745	.....	.....	.....	.....	.....	.....	.....
6746	need. f. lgr.	.....	85-7	265-8	v. sl. s. h.	v. s.	v. s. eth.; s. bz., acet., alk., min. a.
6747	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6748	Phenol, 2,3-dinitro-	1-hydroxy-2,3-dinitrobenzene	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{OH} \dots$	184.11
6749	—, 2,4-dinitro-		$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{OH} \dots$	184.11
6750	—, —, dimethylthiolthio	nocarbamate. See Carbamic acid, dimethylthiolthio		
6751	—, 2,6-dinitro-		$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{OH} \dots$	184.11
6752	—, 3,4-dinitro-		$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{OH} \dots$	184.11
6753	—, 3,5-dinitro-		$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{OH} \dots$	184.11
6754	—, ethenylamino-	See Benzoxazole, 2-methyl-		
6755	—, ethenylaminothi-	o-. See Benzothiazole, 2-methyl-		
6756	—, o-ethoxy-	pyrocatechol monoethyl ether; guaethol; catechol monoethyl ether	$\text{C}_2\text{H}_5\text{OC}_6\text{H}_4\text{OH} \dots$	138.16
6757	—, m-ethoxy-	resorcinol monoethyl ether	$\text{C}_2\text{H}_5\text{OC}_6\text{H}_4\text{OH} \dots$	138.16
6758	—, p-ethoxy-	hydroquinone monoethyl ether	$\text{C}_2\text{H}_5\text{OC}_6\text{H}_4\text{OH} \dots$	138.16
6759	—, o-ethyl-	See Phlorol.		
6760	—, m-ethyl-		$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{OH} \dots$	122.16
6761	—, p-ethyl-		$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{OH} \dots$	122.16
6762	—, o-ethylamino-	N-ethyl-2-hydroxyaniline	$\text{C}_2\text{H}_5\text{NHC}_6\text{H}_4\text{OH} \dots$	137.18
6763	—, m-ethylamino-	N-ethyl-3-hydroxyaniline	$\text{C}_2\text{H}_5\text{NHC}_6\text{H}_4\text{OH} \dots$	137.18
6764	—, p-ethylamino-	N-ethyl-4-hydroxyaniline	$\text{C}_2\text{H}_5\text{NHC}_6\text{H}_4\text{OH} \dots$	137.18
6765	—, p-heptyloxy-	hydroquinone monoheptyl ether	$\text{CH}_3(\text{CH}_2)_5\text{OC}_6\text{H}_4\text{OH}$	208.29
6766	—, hexahydro-	See Cyclohexanol.		
6767	—, p-hexyloxy-	hydroquinone monohexyl ether	$\text{CH}_3(\text{CH}_2)_5\text{OC}_6\text{H}_4\text{OH}$	194.27
6768	—, o-iodo-		$\text{IC}_6\text{H}_4\text{OH} \dots$	220.02
6769	—, m-iodo-		$\text{IC}_6\text{H}_4\text{OH} \dots$	220.02
6770	—, p-iodo-		$\text{IC}_6\text{H}_4\text{OH} \dots$	220.02
6771	—, p-isoamyl-		$\text{C}_6\text{H}_{11}\text{C}_6\text{H}_4\text{OH} \dots$	164.24
6772	—, o-isopropyl-	o-cumenol	$(\text{CH}_3)_2\text{CHC}_6\text{H}_4\text{OH}$	136.19
6773	—, p-isopropyl-		$(\text{CH}_3)_2\text{CHC}_6\text{H}_4\text{OH}$	136.19
6774	—, p,p',p''-methenyl tri-	See Leucaurin.		
6775	—, o-methoxy-	See Guaiacol.		
6776	—, m-methoxy-	resorcinol monomethyl ether	$\text{CH}_3\text{OC}_6\text{H}_4\text{OH} \dots$	124.13
6777	—, p-methoxy-	hydroquinone monomethyl ether	$\text{CH}_3\text{OC}_6\text{H}_4\text{OH} \dots$	124.13
6778	—, 2-methoxy-4-methyl-	See Cresol.		
6779	—, methyl-	See Cresol.		
6780	—, o-methylamino-		$\text{CH}_3\text{NHC}_6\text{H}_4\text{OH} \dots$	123.15
6781	—, p-methylamino- , sulfate	metol; photol; pictol.	$(\text{CH}_3\text{NHC}_6\text{H}_4\text{OH}) \cdot \text{H}_2\text{SO}_4$	344.38
6782	—, p,p'-methylenedi-	See Methane, 4,4'-dihydroxydiphenyl-		
6783	—, o-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{OH} \dots$	139.11
6784	—, m-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{OH} \dots$	139.11
6785	—, p-nitro-		$\text{NO}_2\text{C}_6\text{H}_4\text{OH} \dots$	139.11

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6748	yel. monocl. need. f. w.	1.681 ²⁰	144	.....	sl. s.	v. s. h.	v. s. eth.
6749	yel rhomb. pl. f. w.	1.683 ²⁴	111.6; 114	.....	0.56 ¹⁸ , 4.3 ¹⁰⁰	3.9 ¹⁹	3.065 ¹⁵ eth.; s. bz., chl.
6750	dinitrophenyl ester.						
6751	pa. yel. rhomb. need. or leaf. f. w.		63-4 (61.8)	.....	v. sl. s. c., v. s. h.	v. s. h.	v. s. eth.; s. bz., chl.
6752	col. tricr. need. f. w.	1.672	134	.....	.....	s.	s. eth.
6753	monocl. leaf. f. dil. HCl	1.702	123	.....	.....	s.	s. eth., chl., bz.; sl. s. pet. eth.
6754							
6755							
6756	oily liq.		29	217	sl. s.	∞	∞ eth.
6757	col.-pa. yel. liq.			246-7	i.	s.	s. eth.
6758	leaf. f. w.		66	247	sl. s. c., s. h.	v. s.	v. s. eth.
6759							
6760	liq.	1.025 ⁰	-4	214 ⁷⁵²	sl. s.	v. s.	v. s. eth.
6761	col. need.		46	219	sl. s.	v. s.	v. s. eth.
6762	rhomb. pl.		107.5 (108-9)	.....	i.	s.	sl. s. eth.; s. h. bz.
6763	cr. f. bz.		62	176 ¹²	s. h.	s.	s. eth.; v. s. chl.; sl. s. lgr.
6764	need. f. w.		100	.....	s. h.	s.	s. eth.
6765			60	.....		
6766							
6767			48	.....		
6768	need. or pl.	1.8757 ⁸⁰	43 (40.4)	186-7 ¹⁶⁰	s. h.	v. s.	v. s. eth.; m. CS ₂
6769	need. f. lgr.		40	d.	sl. s.	s.	s. eth.
6770	col. need. f. w.	1.857 ¹¹²	94	d.	sl. s.	v. s.	v. s. eth.
6771	need. f. h. w.		93	255	v. sl. s. h.	v. s.	v. s. eth.
6772	col.	1.028 ¹⁸	16	204	sl. s.	s.	s. eth.
6773	need.		61	229.3 ⁷⁵⁸	sl. s.	s.	.....
6774							
6775							
6776	liq.	>1	<-17.5	244.3	sl. m.	∞	∞ eth.
6777	rhomb. leaf. f. w.		53	243	s.	v. s.	v. m. eth., bz.
6778							
6779							
6780	pl. f. bz.		86-7	.....	i.	s.	s. bz.
6781	wh. cr. powd.		250-60 d.	.....	5 c., 16.67 h.	s.	.....
6782							
6783	lt. yel. monocl. need. or pr.	1.657 ²⁰	45	214.5 (217.25)	0.21 ²⁰ , 1.08 ¹⁰⁰	46.0 ²⁵	v. s. eth.; s. alk.
6784	col.-yel. monocl. f. eth.	1.485	96	194 ⁷⁰	1.35 ²⁵ , 13.3 ⁹⁰	195.0 ²⁵	v. s. eth.; s. bz., alk.
6785	col.-ylsh. monocl. pr.	1.479 ²⁰	114	279 d.	1.6 ²⁵ , 26.9 ⁹⁰	189.5 ²⁵	v. s. eth.; s. chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6786	Phenol, <i>p</i>-nitroso-	quinone monoxime.....	$\text{NOC}_6\text{H}_4\text{OH}$ or $\text{HON}:\text{C}_6\text{H}_4:\text{O}$	123.11
6787	—, <i>p</i> -octyloxy-.....	hydroquinone monoöctyl ether	$\text{CH}_3(\text{CH}_2)_7\text{OC}_6\text{H}_4\text{OH}$	222.32
6788	—, pentabromo-.....	.....	$\text{C}_6\text{Br}_5\text{OH}$	488.65
6789	—, pentachloro-.....	.....	$\text{Cl}_5\text{C}_6\text{OH}$	266.35
6790	—, pentamethyl-.....	.....	$(\text{CH}_3)_5\text{C}_6\text{OH}$	164.24
6791	—, <i>o</i> -phenyl-.....	<i>o</i> -hydroxybiphenyl.....	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{OH}$	170.20
6792	—, <i>m</i> -phenyl-.....	<i>m</i> -hydroxybiphenyl.....	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{OH}$	170.20
6793	—, <i>p</i> -phenyl-.....	<i>p</i> -hydroxybiphenyl.....	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{OH}$	170.20
6794	—, phenylazo-.....	See <i>Azobenzene, hydroxy-</i> .		
6795	—, <i>p</i> -propenyl-.....	See <i>Anol</i> .		
6796	—, <i>o</i> -propoxy-.....	pyrocatechol monopropyl ether	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OC}_6\text{H}_4\text{OH}$	152.19
6797	—, <i>m</i> -propoxy-.....	resorcinol monopropyl ether	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OC}_6\text{H}_4\text{OH}$	152.19
6798	—, <i>p</i> -propoxy-.....	hydroquinone monopropyl ether	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OC}_6\text{H}_4\text{OH}$	152.19
6799	—, <i>o</i> -propyl-.....	.....	$\text{C}_3\text{H}_7\text{C}_6\text{H}_4\text{OH}$	136.19
6800	—, <i>m</i> -propyl-.....	.....	$\text{C}_3\text{H}_7\text{C}_6\text{H}_4\text{OH}$	136.19
6801	—, <i>p</i> -propyl-.....	.....	$\text{C}_3\text{H}_7\text{C}_6\text{H}_4\text{OH}$	136.19
6802	—, <i>p</i> -salicyloyl-.....	See <i>Benzophenone, 2,4'-dihydroxy-</i> .		
6803	—, 2,3,4,6-tetra-nitro-.....	.....	$(\text{NO}_2)_4\text{C}_6\text{HOH}$	274.11
6804	—, thio-.....	benzenethiol*; phenyl mercaptan	$\text{C}_6\text{H}_5\text{SH}$	110.17
6805	—, 2,4,6-triamino-.....	.....	$(\text{NH}_2)_3\text{C}_6\text{H}_2\text{OH}$	139.16
6806	—, 2,4,6-tribromo-.....	<i>sym</i> -tribromophenol.....	$\text{Br}_3\text{C}_6\text{H}_2\text{OH}$	330.83
6807	—, 2,3,5-trichloro-.....	.....	$\text{Cl}_3\text{C}_6\text{H}_2\text{OH}$	197.46
6808	—, 2,4,6-trichloro-.....	<i>sym</i> -trichlorophenol.....	$\text{Cl}_3\text{C}_6\text{H}_2\text{OH}$	197.46
6809	—, 2,4,6-triiodo-.....	.....	$\text{I}_3\text{C}_6\text{H}_2\text{OH}$	471.84
6810	—, 2,4,5-trimethyl-.....	See <i>Pseudocumenol</i> .		
6811	—, 2,4,6-trimethyl-.....	See <i>Mesitol</i> .		
6812	—, 2,3,6-trinitro-.....	γ -trinitrophenol.....	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{OH}$	229.11
6813	—, 2,4,5-trinitro-.....	β -trinitrophenol.....	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{OH}$	229.11
6814	—, 2,4,6-trinitro-.....	See <i>Picric acid</i> .		
6815	—, <i>o</i> -vinyl-.....	<i>o</i> -hydroxystyrene.....	$\text{CH}_2:\text{CHC}_6\text{H}_4\text{OH}$	120.14
6816	—, <i>m</i> -vinyl-.....	<i>m</i> -hydroxystyrene.....	$\text{CH}_2:\text{CHC}_6\text{H}_4\text{OH}$	120.14
6817	Phenolphthalein	2,2-bis(<i>p</i> -hydroxyphenyl)-phthalide	$\text{C}_{20}\text{H}_{14}\text{O}_4$	318.31
6818	—, 3',3'',5',5''-tetra-iodo-.....	nosophen; iodophen.....	$\text{C}_{20}\text{H}_{10}\text{I}_4\text{O}_4$	821.96
6819	1-Phenol-2-sulfonic acid	<i>o</i> -phenolsulfonic acid; aseptol; sozolic acid	$\text{HOC}_6\text{H}_4\text{SO}_3\text{H}$	174.17

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6786	yel. rhomb. need.	.....	126 d.	.....	s.	v. s.	v. s. eth.; s. acet., dil. alk. sol.
6787	.....	.....	60-1	.....	.....	.....	.....
6788	col. monoc. need. f. al.	.....	225	d. subl.	i.	s. h.	sl. s. eth.; s. h. bz.
6789	monoc. pr.	1.978	191	310 d.	i.	v. s.	v. s. eth.
6790	need. f. al. ....	.....	125	267	0.15 h.	s.	.....
6791	need. f. pet. eth.	.....	56	275	sl. s.	v. s.	v. s. eth.; s. lgr.
6792	need. f. pet. eth. or h. w.	.....	78 (76-7)	>300	sl. s.	v. s.	s. KOH, hz.
6793	col. need. or leaf. f. dil. al.	.....	165	308	sl. s.	s.	s. eth., chl., NH ₄ OH
6794	.....	.....	.....	.....	.....	.....	.....
6795	.....	.....	.....	.....	.....	.....	.....
6796	1.5176 ²⁵	1.0523 ²⁵	.....	223-6; 140 ⁶⁸	.....	.....	.....
6797	.....	.....	.....	120 ⁵	.....	.....	.....
6798	.....	.....	56-7	.....	.....	.....	.....
6799	liq.	1.015 ⁰ ; 1.000 ¹⁵ / ₁₅	.....	220 (226.6)	sl. s.	s.	s. eth.
6800	col. liq. ....	.....	26	228	v. sl. s.	s.	s. eth.
6801	cr.	1.009	22 (61)	232.6 ⁷⁵⁸	sl. s.	s.	.....
6802	.....	.....	.....	.....	.....	.....	.....
6803	yel. need. f. chl.	.....	140 d.	exp.	v. s.	.....	v. sl. s. bz., lgr.
6804	col. liq., 1.58313 ^{23.2}	1.078 ²⁰ / ₄	.....	169.5	i.	v. s.	∞ eth.
6805	need. unst. ....	.....	.....	257	v. s.	v. s.	v. s. eth.
6806	col. monoc. pr. f. dil. al. or bz.	2.55 ²⁰ / ₂₀	96	subl.	0.007	v. s.	s. eth., glyc., chl.
6807	lng. col. need. f. al.	.....	62	253	sl. s. h.	s.	s. eth., lgr.
6808	rhomb. need.	1.490 ⁷⁵ / ₄	68	244.5	0.08 ²⁵ ; 0.243 ³⁶	v. s.	v. s. eth.
6809	col. need. f. al.	.....	156-8	subl. d.	i.	1.58	s. eth., acet.
6810	.....	.....	.....	.....	.....	.....	.....
6811	.....	.....	.....	.....	.....	.....	.....
6812	need. ....	.....	118	.....	sl. s.	v. s.	v. s. eth.; s. bz.
6813	need. ....	.....	96	.....	sl. s.	v. s.	v. s. eth.; s. bz.
6814	.....	.....	.....	.....	.....	.....	.....
6815	need.	1.061 ^{19.2} / ₄	29	108 ¹⁵	s.	v. s.	v. s. eth.
6816	oil. ....	.....	.....	114-6 ¹⁶	.....	.....	.....
6817	rhomb. need. f. dil. al.	1.277 ³² ; 1.306 ²⁰ / ₄	261	.....	0.018 ²⁰	20.9	5.92 eth.
6818	cr. or amor. grn. powd.	.....	225 d.	.....	i.	v. sl. s.	s. eth., chl., alk.; i. a.
6819	col. liq.	1.155 ¹⁵	50	.....	s.	s.	s. glyc.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6820	1-Phenol-4-sulfonic acid	<i>p</i> -phenolsulfonic acid.....	$\text{HOC}_6\text{H}_4\text{SO}_3\text{H} \dots$	174.17
6821	—, 2-amino-	aminophenolsulfonic acid II..	$\text{HO}(\text{NH}_2)\text{C}_6\text{H}_3\text{SO}_3\text{H}$	189.18
6822	—, 2-amino-6-nitro-.....	.....	$\text{HO}(\text{NH}_2)(\text{NO}_2)\text{C}_6\text{H}_2\text{SO}_3\text{H}$	234.18
6823	—, 2-nitro-.....	.....	$\text{HOC}_6\text{H}_3(\text{NO}_2)\text{SO}_3\text{H}$	219.17
6824	Phenol-2,4,6-tricarboxylic acid.	See <i>Trimesic acid</i> .	<i>hydroxy-</i>	
6825	Phenosuccin.	See <i>Succinamide, N-p-phenetyl</i>		
6826	Phenothiazine	phenothiazine; thiodiphenylamine	$\text{C}_6\text{H}_4\text{NHC}_6\text{H}_4\text{S} \dots$	199.26
6827	Phenyl. For phenyl derivatives see the parent compounds	See <i>Aniline</i> .	(e.g., for phenylacridine see	
6828	Phenylamine.	See <i>Benzene, bromo-*</i> .		
6828M	Phenyl cellosolve.	See <i>Ethanol, 2-phenoxy-</i> .		
6829	Phenyl chloride.	See <i>Benzene, chloro-*</i> .		
6830	Phenyl cyanide.	See <i>Benzonitrile</i> .		
6831	Phenyl disulfide	phenyldithiobenzene*; diphenyl disulfide	$(\text{C}_6\text{H}_5)_2\text{S}_2 \dots$	218.32
6832	Phenylene, diphenyl-	See <i>Terphenyl</i> .		
6833	<i>p</i>-Phenylene cyanide.	See <i>Terephthalonitrile</i> .		
6834	<i>p</i>-Phenylene diacetate.	See <i>Hydroquinone, diacetate</i> .		
6835	Phenylenediamine, <i>N</i>-acetyl-	See <i>Acetanilide, amino-</i>		
6836	<i>o</i>-Phenylenediamine ..	1,2-benzenediamine*; 1,2-diaminobenzene	$\text{C}_6\text{H}_4(\text{NH}_2)_2 \dots$	108.14
6837	—, <i>N,N'</i>-diacetyl- ...	1,4-diacetamidobenzene.....	$\text{C}_6\text{H}_4(\text{NHCOCH}_3)_2$	192.21
6838	—, <i>N,N</i>-dimethyl- ...	<i>o</i> -amino- <i>N,N</i> -dimethylaniline; 1-amino-2-dimethylaminobenzene	$(\text{CH}_3)_2\text{NC}_6\text{H}_4\text{NH}_2$	136.19
6839	—, <i>N</i>-phenyl-	<i>o</i> -aminodiphenylamine.....	$\text{NH}_2\text{C}_6\text{H}_4\text{NHC}_6\text{H}_5$	184.23
6840	<i>m</i>-Phenylenediamine	1,3-benzenediamine*; 1,3-diaminobenzene	$\text{C}_6\text{H}_4(\text{NH}_2)_2 \dots$	108.14
6841	—, 4-(3-amino-phenylazo)-	2,4,3'-triaminoazobenzene...	$\text{NH}_2\text{C}_6\text{H}_4\text{N}_2\text{C}_6\text{H}_3(\text{NH}_2)_2$	227.27
6842	—, <i>N,N</i>-dimethyl- ...	<i>m</i> -amino- <i>N,N</i> -dimethylaniline; 1-amino-3-dimethylaminobenzene	$(\text{CH}_3)_2\text{NC}_6\text{H}_4\text{NH}_2$	136.19
6843	—, <i>N,N'</i>-di-<i>p</i>-tolyl-	.....	$\text{C}_6\text{H}_4(\text{NHC}_6\text{H}_4\text{CH}_3)_2$	288.38
6844	—, 4-phenylazo-	See <i>Chrysoidine (base)</i> .		
6845	<i>p</i>-Phenylenediamine ..	1,4-benzenediamine*; 1,4-diaminobenzene	$\text{C}_6\text{H}_4(\text{NH}_2)_2 \dots$	108.14
6846	—, <i>N,N</i>-diethyl-	<i>p</i> -amino- <i>N,N</i> -diethylaniline; 1-amino-4-diethylaminobenzene	$(\text{C}_2\text{H}_5)_2\text{NC}_6\text{H}_4\text{NH}_2$	164.25
6847	—, <i>N,N</i>-dimethyl- ...	<i>p</i> -amino- <i>N,N</i> -dimethylaniline; 1-amino-4-dimethylaminobenzene	$(\text{CH}_3)_2\text{NC}_6\text{H}_4\text{NH}_2$	136.19
6848	—, <i>N</i>-methyl-	<i>p</i> -methylanilinoaniline; <i>p</i> -amino- <i>N</i> -methylaniline	$\text{CH}_3\text{NHC}_6\text{H}_4\text{NH}_2$	122.17
6849	—, <i>N</i>-phenyl-	<i>p</i> -aminodiphenylamine.....	$\text{C}_6\text{H}_5\text{NHC}_6\text{H}_4\text{NH}_2$	184.23
6850	—, <i>N,N,N',N'</i>-tetramethyl-	.....	$\text{C}_6\text{H}_4[\text{N}(\text{CH}_3)_2]_2 \dots$	164.25
6851	<i>m</i>-Phenylene dimercap	tan. See <i>Resorcinol, dithio-</i>		
6852	<i>p</i>-Phenylene dimercap	tan. See <i>Hydroquinone, dithio-</i>		
6853	Phenyl ether	phenoxybenzene*; diphenyl ether	$(\text{C}_6\text{H}_5)_2\text{O} \dots$	170.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6820	deliq. need. ....	.....	.....	.....	s.	s.	.....
6821	rhomb. ....	.....	d.	.....	0.7 ¹⁴	i.	i. eth.
6822					s.		
6823	need. f. w. ....	.....	141	d.	■.	v. s.	v. s. chl.
6824							
6825							
6826	yel. rhomb. leaf. f. al. ....	.....	180	371 d.	.....	sl. s.	sl. s. eth.; s. bz.
6827	<i>Acridine, phenyl</i>	-). For phenyl esters of organic acids			s see the	acids.	
6828							
6828M							
6829							
6830							
6831	need. f. al. ....	.....	61	310 d.	i.	s.	s. eth., CS ₂ , bz.
6832							
6833							
6834							
6835							
6836	brnsh. yel. monocl. cr. or tab. f. chl. ....	.....	102	252 (256-8)	4.15 ⁸⁵ , 733 ⁸¹	v. s.	v. s. eth.; s. chl.
6837	need. f. w. ....	.....	186	.....	v. s. h.	v. s.	v. sl. s. eth.
6838	col. oil. ....	.....	.....	218 ⁷⁵¹	sl. s.	v. s.	v. s. eth.
6839	need. f. w. ....	.....	79-80	.....	s.	.....	s. bz., acet., chl.; sl. s. lgr. s. eth.
6840	col. rhomb. need., 1.63390 ^{57.7}	1.1389 ⁵ ; 1.107 ⁵⁸	62.8	287 (282-4)	35.1 ²⁵	s.	
6841	or.-red. monocl. f. w. ....	.....	143.5	.....	i.	v. s.	v. s. eth.
6842	oil.	0.995 ²⁵	<-20	268-70 (258)	sl. s.	v. s.	v. s. eth.
6843	lng. need. f. al.	.....	138-9	d.	i.	sl. s.	sl. s. eth., bz., ac. a.
6844							
6845	col. monocl. f. w. or eth. ....	.....	139.7 (139-41)	267	3.8 ²⁴ , 669 ¹⁰⁷	s.	s. eth., chl.
6846	liq. ....	.....	.....	261-2	s.	v. s.	v. s. eth.
6847	col. need.	1.036 ²⁰ / ₄ ; liq., 1.0168 ⁹⁰	53 (41)	262	s.	v. s.	v. s. eth.; s. chl.
6848	leaf. ....	.....	35.5°	259.5	v. s.	v. s.	v. s. eth.
6849	need. f. al. ....	.....	66-7; 75	354 in H ₂	sl. s.	v. s.	v. s. eth.
6850	leaf. f. dil. al.	.....	51	260	v. sl. s. h.	v. s.	v. s. eth., chl.
6851							
6852							
6853	col. monocl. (rhombic) 1.5826 ²⁴	1.0728 ²⁰	28	259	v. sl. s.	4.97 ¹⁰ 87%	s. eth., ac. a., bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6853M	Phenyl fluoride.	See <i>Benzene, fluoro</i> .*		
6854	Phenyl iodide.	See <i>Benzene, iodo</i> .*		
6855	Phenyl isocyanide.	phenylcarbylamine.....	C_6H_5NC	103.12
6856	Phenyl ketone.	See <i>Benzophenone</i> .		
6857	Phenyl mercaptan.	See <i>Phenol, thio</i> ..		
6858	Phenyl mustard oil.	See <i>Isothiocyanic acid, phenyl ester</i> .		
6859	p-Phenylphenacyl ester.	See under the corresponding acids.		
	Phenyl sulfide.	diphenyl sulfide; phenylthiobenzene*; benzene sulfide	$(C_6H_5)_2S$	186.26
6859M	Phenylsulfonamide	See <i>Benzenesulfonamide</i> .		
6860	Phenyl sulfone.	diphenyl sulfone; phenylsulfonylbenzene*; benzene sulfone; sulfolbenzide	$(C_6H_5)_2SO_2$	218.26
6861	Phenzoline.	See <i>Quinazoline, 3,4-dihydro-3-</i>		
6862	Phloretic acid.	p-hydroxyhydrocinnamic acid; α , β -dihydro-p-coumaric acid	phenyl- $HOC_6H_4CH_2CH_2COOH$	166.17
6863	—, phloroglucinol monoester.	See <i>Phloretin</i> .		
6864	Phloretin.	phloroglucinol monophloretate	$C_{15}H_{14}O_5$	274.26
6865	Phlorizin.	phloridzin.....	$C_{21}H_{24}O_{10} \cdot 2H_2O$...	472.44
6866	Phloroglucinol.	1,3,5-benzenetriol; sym-trihydroxybenzene	$C_6H_3(OH)_3$	126.11
6867	—, dimethyl ether.	See <i>Phenol, 3,5-dimethoxy</i> .		
6867M	—, monomethyl ether.	See <i>Resorcinol, 5-methoxy</i> .		
6868	—, monophloretate.	See <i>Phloretin</i> .		
6869	—, triethyl ether.	See <i>Benzene, 1,3,5-triethoxy</i> .*		
6870	—, trimethyl ether.	See <i>Benzene, 1,3,5-trimethoxy</i> .*		
6871	—, trioxime.	See <i>1,3,5-Cyclohexanetrione, trioxime</i> .		
6872	Phloroglucinolcarboxylic acid.	See <i>Benzoic acid, 2,4,6-trihydroxy</i> .		
6873	Phlorol.	o-ethylphenol.....	C_8H_8O	122.16
6874	Phlorone.	p-xyloquinone; 2,5-dimethylquinone	$(CH_3)_2C_6H_2O_2$	136.14
6874M	—, 3,6-dibromo-		$(CH_3)_2C_6Br_2O_2$	293.96
6875	Phorone.	diisopropylideneacetone; 2,6-dimethyl-2,5-heptadien-4-one*	$CO[CH:C(CH_3)_2]_2$	138.20
6876	Phosgene.	carbonyl chloride; chloroformyl chloride	$COCl_2$	98.92
6877	—, phenylimino-	See <i>Aniline, N-(dichloromethylene)-</i> .		
6878	—, thio-	thiocarbonyl chloride.	$CSCl_2$	114.98
6879	Phosphaniline.	See <i>Phosphine, phenyl</i> .		
6880	Phosphényl chloride.	See <i>Phosphine, dichlorophenyl</i> .		
6881	Phosphine, dichlorophenyl-	phenylphosphényl chloride.	$C_6H_5PCl_2$	178.99
6882	—, diethyl-*		$(C_2H_5)_2PH$	90.11
6883	—, dimethyl-*		$(CH_3)_2PH$	62.06
6884	—, ethyl-*	phosphinoethane.....	$C_2H_5PH_2$	62.06
6885	—, ethyldiphenyl-		$(C_6H_5)_2PC_2H_5$	214.24
6886	—, methyl-*		CH_3PH_2	48.03
6887	—, phenyl-	phosphaniline.....	$C_6H_5PH_2$	110.10
6888	—, triethyl-*		$(C_2H_5)_3P$	118.16
6889	—, —, oxide.....		$(C_2H_5)_3PO$	134.16
6890	—, —, sulfide.....		$(C_2H_5)_3PS$	150.22
6891	—, trimethyl-*		$(CH_3)_3P$	76.08

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6853M 6854 6855 6856 6857 6858	col.-grnsh. liq.	0.9775 ¹⁵	.....	166 d.	d.	d.	s. eth.
6859	col. liq., 1.635 ¹⁸	1.1185 ¹⁵ 1.6	<-40	296	i.	s.	∞ eth., CS ₂ , bz.
6859M 6860	monocl. pr. f. bz.; pl. f. al.; need. f. w.	1.252 ²⁰ 4	125	377.8; 232 ¹⁸	i. c., sl. s. h.	s. h.	s. eth., bz.
6861 6862	monocl. f. eth.	.....	129	.....	s. h.	s.	s. eth.
6863 6864	sm. leaf.....	.....	255 d.	.....	sl. s. h.	∞	0.81 eth.; ∞ ac. a.
6865	silky need.....	1.4298 ¹⁹	2H ₂ O 108-9; anh. 170d.	.....	0.1 c., v. s. h.	25	v. sl. s. eth.; i. chl.
6866	rhomb.....	.....	anh. 219	subl. d.	1.13 ²⁵	v. s.	v. s. eth.
6867 6867M 6868 6869 6870 6871 6872 6873	col. liq.....	1.0374 ¹²	<-18	207.5	sl. s.	v. s.	v. s. eth.; s. bz.
6874	yel. tricl. f. al.	.....	125	subl.	sl. s. h.	s.	s. eth., bz., chl.
6874M 6875	yel. sc..... yel. cr., 1.49982	0.885	185-86 28	..... 198.5	i. sl. s. (i.)	s. s.	s. eth. s. eth.
6876	pois. gas.....	1.392 ¹⁹ 4	-118 (-104)	8.3	d.	d.	v. s. eth.; s. bz., ac. a., tol.
6877 6878 6879 6880 6881	red liq., 1.5442.	1.5085 ¹⁵	.....	73.5	d.	d.	s. eth.
6882 6883 6884 6885 6886 6887	fum. liq., 1.6053 ⁷ col. liq..... col. liq., ign... col. liq..... liq..... col. gas..... liq.....	1.319 <1 <1 <1 1.001 ¹⁵	..... ..... ..... ..... ..... ..... .....	224.6 85 25 25 293 -14 160	d. i. i. d. sl. s. .....	..... s. s. s. sl. s.	∞ bz., CS ₂ ∞ eth. s. eth. s. bz. v. s. eth.
6888	col. liq., 1.446.	0.801 ²⁰ 4	.....	128	i.	s.	s. eth.
6889 6890	col. deliq. need. hex. pr., 1.590, 1.650	..... .....	52.9 94	242.9 subl.; ign. 70	s. h. s. h.	s. s.	s. eth.; i. KOH s. eth.
6891	col. liq.....	<1	.....	42	i.	.....	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6892	Phosphine, triphenyl-		$(C_6H_5)_3P$	262.28
6892M	—, —, oxide		$(C_6H_5)_3PO$	278.28
6893	Phosphinic acid, dimethyl-, methyl-		$(CH_3)_2POOH$	94.06
6894	Phosphoric acid, diethyl-	See <i>Methanephosphonic acid</i> .		
6895	Phosphorobenzene	See <i>Diethylphosphoric acid</i> .		
6896		phosphobenzene	$C_6H_5P:PC_6H_5$	216.16
6896M	Photoanethole.	See <i>Stilbene, 4,4'-dimethoxy-</i> .		
6897	Photol.	See <i>Phenol, p-methylamino-, sulfate</i> .		
6898	Phthalaldehyde	1,2-benzenedicarbonyl*; o-phthalic aldehyde	$C_6H_4(CHO)_2$	134.13
6899	Phthalaldehydic acid	o-formylbenzoic acid	$CHOC_6H_4COOH$	150.13
6900	—, 5,6-dimethoxy-	See <i>Opianic acid</i> .		
6901	Phthalamide	phthalic diamide	$C_6H_4(CONH_2)_2$	164.16
6902	Phthalandione	See <i>Phthalic anhydride</i> .		
6903	Phthalanil	N-phenylphthalimide	$C_6H_4(CO)_2NC_6H_5$	223.22
6904	1,4-Phthalazinedione	5-amino-2,3-dihydro- See <i>Luminol</i> .		
6905	Phthalhydrazide, 3-amino-	See <i>Luminol</i> .		
6906	Phthalic acid	1,2-benzenedicarboxylic acid*; o-phthalic acid	$C_6H_4(COOH)_2$	166.13
6907	—, dibenzyl ester		$C_6H_4(COOCH_2C_6H_5)_2$	346.37
6908	—, dibutyl ester	dibutyl 1,2-benzenedicarboxylate*; butyl phthalate	$C_6H_4(COOC_4H_9)_2$	278.34
6909	—, diethyl ester		$C_6H_4(COOC_2H_5)_2$	222.23
6910	—, dimethyl ester	dimethyl 1,2-benzenedicarboxylate*; methyl phthalate	$C_6H_4(COOCH_3)_2$	194.18
6911	—, diphenyl ester	phenyl phthalate	$C_6H_4(COOC_6H_5)_2$	318.31
6912	—, monoethyl ester	ethyl hydrogen 1,2-benzenedicarboxylate*	$C_6H_4(COOC_2H_5)(COOH)$	194.18
6913	—, 3-benzoyl-	2,3-benzophenonedicarboxylic acid	$C_6H_5COC_6H_3(COOH)_2$	270.23
6914	—, 4-benzoyl-	3,4-benzophenonedicarboxylic acid	$C_6H_5COC_6H_3(COOH)_2$	270.23
6915	—, 3-bromo-	3-bromo-1,2-benzenedicarboxylic acid*	$BrC_6H_3(COOH)_2$	245.04
6916	—, 4-chloro-	4-chloro-1,2-benzenedicarboxylic acid*	$ClC_6H_3(COOH)_2$	200.58
6917	—, 1,6-dihydro-	2,4-cyclohexadiene-1,2-dicarboxylic acid*	$C_6H_6(COOH)_2$	168.14
6918	—, 3,6-dihydro-	1,4-cyclohexadiene-1,2-dicarboxylic acid*	$C_6H_6(COOH)_2$	168.14
6919	—, 4,5-dihydro-	2,6-cyclohexadiene-1,2-dicarboxylic acid*	$C_6H_6(COOH)_2$	168.14
6920	—, 3,4-dimethoxy-	See <i>Hemipic acid</i> .		
6921	—, hexahydro-	See 1,2-Cyclohexanedicarboxylic acid.		
6922	—, 3-hydroxy-		$HOC_6H_3(COOH)_2$	182.13
6923	—, 4-hydroxy-		$HOC_6H_3(COOH)_2$	182.13
6924	—, 3-nitro-		$NO_2C_6H_3(COOH)_2$	211.13
6925	—, 4-nitro-		$NO_2C_6H_3(COOH)_2$	211.13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6892	monocl. pr. f. eth.	1.194	79	>360	i.	s.	v. s. eth.; s. HCl, bz.
6892M	wh. cr.	1.2124 ^{22.6}	156 (153)	>360	sl. s. h.	v. s.	v. s. bz.; sl. s. eth., lgr. s. eth.
6893	cr.		76	subl.	s.	s.	
6894							
6895							
6896	pa. yel. powd.		149		i.	i.	i. eth.; v. s. h. bz.
6896M							
6897	yel. need.		56		0.62 ²⁵ 1.63 ⁵⁰	s.	s. eth.
6898					9.48 ⁴⁶	v. s.	v. s. eth.
6899	monocl. f. w.	1.404	97 (98-9)	d.			
6900	col. rhbdr.		220		i.	i.	i. eth.
6902	col. need. f. al.		207	subl.	i.	i.	∞ chl.
6903							
6904	col. rhomb. or monocl. f. w.	1.593	206-8 d.	d. >191	0.54 ¹⁴ 18 ⁹⁹	11.7 ¹⁸	0.69 ¹⁵ eth., i. chl.
6905					i.	v. s.	v. s. eth.
6906	col. oily liq.	1.0465		340	0.04 ²⁵	∞	∞ eth., acet., bz.
6907			42-4	277 ¹⁵			
6908							
6909	col. liq., 1.5019	1.123 ²⁵ ₄		296.1	i.	∞	∞ eth.; s. bz.
6910	col. liq., 1.51546 ^{20.8}	1.189 ²⁵ _{2.5}		282	0.5		
6911	col. rhomb.		69-70 (73-5)		i.	sl. m.	sl. s. eth.
6912	liq.		2	d.	sl. s.	s.	s. eth.
6913	pl. or need. (+1H ₂ O) f. w.		-H ₂ O 100; 145-50 → anh.		s. h.	s.	v. sl. s. bz.
6914	cr.		189		s.	s.	
6915	need. f. w.		-H ₂ O, 178.5; anh. 188		s.	s.	s. eth.; i. chl.
6916	need. f. al.		150	-H ₂ O, >150	s.	s.	s. eth.
6917	monocl. pr. f. w. or al.		179-80		0.2 ¹⁰ 2 ¹⁰⁰	s.	sl. s. eth.
6918	monocl. pr. f. w.		153		1.7 ⁶		
6919	tricl.		215		0.3 ²⁵	s.	m. acet.
6920							
6921							
6922	pr. f. w.		244		0.14 ²⁴ 2.5 ¹⁰⁰	v. s.	v. s. eth.
6923	col. rosettes f. w.		181 d.		3 ¹⁰	v. s.	s. eth.
6924	yel. monocl. f. eth.		220 (206)		2.05 ²⁵	v. s.	v. s. eth.
6925	lt. yel. need.		164 (161)		s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6926	Phthalic acid, tetra-chloro-	.....	$C_6Cl_4(COOH)_2$...	303.92
6927	—, Δ^1 -tetrahydro-	See 1-Cyclohezene-1, 2-dicarboxylic acid.		
6928	m-Phthalic acid.	See <i>Isophthalic acid</i> .		
6929	p-Phthalic acid.	See <i>Terephthalic acid</i> .		
6930	Phthalic aldehyde.	See <i>Phthalaldehyde</i> .		
6931	m-Phthalic aldehyde.	See <i>Isophthalaldehyde</i> .		
6932	p-Phthalic aldehyde.	See <i>Terephthalaldehyde</i> .		
6933	Phthalic anhydride	phthalandione.....	$C_6H_4(CO)_2O$	148.11
6934	Phthalic diamide.	See <i>Phthalamide</i> .		
6935	Phthalic imide.	See <i>Phthalimide</i> .		
6936	Phthalide	1(3)-isobenzofuranone; α -hydroxy- <i>o</i> -toluic acid lactone	$C_6H_4COOCH_2$...	134.13
6937	—, benzal- .	See <i>Phthalide, benzylidene-</i> .		
6938	—, benzylidene-	benzalphthalide.....	$C_6H_5COOC:CH-C_6H_5$	222.23
6939	—, 2,2-bis(p-hydroxy	phenyl)- See <i>Phenolphthalein</i> .		
6940	—, 5,6-dimethoxy- .	See <i>Meconin</i> .		
6941	—, 3,3-diphenyl-	triphenylcarbinol <i>o</i> -carboxylic anhydride; "phthalophenone"	$C_6H_4COOC(C_6H_5)_2$	286.31
6942	—, 6-nitro-.....	.....	$NO_2C_6H_3COOCH_2$	179.13
6943	Phthalimide	1,3-isoindoledione; <i>o</i> -phthalic imide	$C_6H_4(CO)_2NH$...	147.13
6944	—, N-isobutyl	2-isobutyl-1,3-isoindoledione	$C_6H_4CON(C_4H_9)CO$	203.23
6945	—, N-phenyl- .	See <i>Phthalanil</i> .		
6946	Phthalimidine	1-isindolinone.....	$C_6H_4CONHCH_2$...	133.14
6947	Phthalonic acid	<i>o</i> -carboxyphenylglyoxylic acid	$C_6H_4(COOCOHO)-COOH$	194.14
6948	Phthalophenone.	See <i>Phthalide, 3,3-diphenyl-</i> .		
6949	Phthalyl alcohol.	See <i>o-Xylylene glycol</i> .		
6950	Phthalyl chloride	1,2-benzenedicarbonyl chloride*; <i>o</i> -phthalyl dichloride	$C_6H_4(COCl)_2$	203.03
6951	m-Phthalyl dichloride.	See <i>Isophthalyl chloride</i> .		
6952	p-Phthalyl dichloride.	See <i>Terephthalyl chloride</i> .		
6952M	Phthiocol	2-hydroxy-3-methyl-1,4-naphthoquinone; vitamin K (one form)	$C_{11}H_9O_3$	188.17
6953	Phycitol.	See <i>i-Erythritol</i> .		
6954	Physostigmine	eserine.....	$C_{15}H_{21}N_3O_2$	275.34
6955	—, hydrochloride.....	.....	$C_{15}H_{21}N_3O_2 \cdot HCl$	311.81
6956	—, salicylate.....	.....	$C_{15}H_{21}N_3O_2 \cdot C_7H_5O_3$	413.46
6957	—, sulfate.....	.....	$(C_{15}H_{21}N_3O_2)_2 \cdot H_2SO_4$	648.76
6957M	Phytadiene.....	.....	$C_{20}H_{38}$	278.51
6958	Phytol	3,7,11,15-tetramethyl-2-hexadecen-1-ol*	$C_{20}H_{39}OH$	296.52
6959	Piazine.	See <i>Pyrazine</i> .		
6960	Picene	dibenzo[<i>a,t</i>]phenanthrene.....	$C_{22}H_{14}$	278.33
6961	2-Picoline	2-methylpyridine; α -picoline	$CH_3C_5H_4N$	93.12

*Name approved by the International Union of Chemistry,

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6926	leaf. or need. f. w.	.....	250 d.	.....	0.57 ¹⁴ , 3 ⁹⁹	v. s.	v. s. eth., acet.; v. sl. s. chl.
6927							
6928							
6929							
6930							
6931							
6932							
6933	col. rhomb. need.	1.527 ⁴	130.8	284.5 subl.	v. sl. s.	s.	sl. s. eth.
6934							
6935							
6936	need. f. w., 1.53560 ^{99.1}	.....	73	290	v. sl. s.	v. s.	.....
6937							
6938	col. monoc. pr. f. al.	.....	108 (99)	.....	i.	s. h.	.....
6939							
6940							
6941	leaf. f. al. ....	.....	115	419-28 sl. d.	d. h.	s.	s. H ₂ SO ₄
6942	need. f. al. ....	.....	141	.....	i. c.	s.	s. eth.; v. s. h. chl.; i. alk. carb.
6943	hex. pr. f. eth.	.....	238 (234)	subl.	0.06 ²⁵	s.	sl. s. eth.; s. caustic alk., ac. a.; v. sl. s. bz., chl.
6944			93	293-5	.....	.....	.....
6945							
6946	need. ....	.....	150	337 ⁷³⁰	s.	v. s.	v. s. eth., chl.
6947	pr. f. bz. or al.	.....	138-40	.....	115 ¹⁵	s.	s. eth.; sl. s. chl.
6948							
6949							
6950	col. oily liq., 1.57099 ^{15.5}	1.408	(sym.) 16; (uns.) 89	281 275	d.	d.	s. eth.
6951					.....	.....	.....
6952							
6952M	yel. pr. ....	.....	173	.....	.....	.....	.....
6953							
6954	col. hyg. trim. f. bz., β 1.602	.....	unst. 86-7; stab. 105-6	.....	sl. s.	v. s.	s. eth., bz., chl.
6955	wh. cr. ....	.....			s.	.....	.....
6956	col.-yel. acicular cr.	.....	178.9	.....	1.33	7.71	0.57 eth.; s. chl.
6957	micro-cr. powd.	.....	140	.....	v. s.	v. s.	0.083 eth.; s. chl.
6957M	liq.	0.826 $\frac{0}{4}$	.....	185-8 ²²	∞ me. al., ac. a., pet. eth.
6958	col. oil. 1.46380	0.864 $\frac{0}{4}$; 0.852 $\frac{20}{4}$	.....	145-03-.04; 203-4 ⁹⁻¹⁰	i.	∞	∞ eth., me. al.
6959							
6960	col. leaf. ....	.....	364	520	i.	v. sl. s.	v. sl. s. eth.; sl. s. chl., h. bz.
6961	col. liq., 1.50293 ^{16.7}	0.950 $\frac{15}{4}$	-69.9	128	v. s.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6962	3-Picoline	3-methylpyridine; β -picoline	$\text{CH}_3\text{C}_5\text{H}_4\text{N}$	93.12
6963	4-Picoline	4-methylpyridine; γ -picoline	$\text{CH}_3\text{C}_5\text{H}_4\text{N}$	93.12
6964	2-Picoline-4,6-dicarboxylic acid . See <i>Uvitonic acid</i> .			
6965	Picolinic acid	2-pyridinecarboxylic acid*	$\text{C}_5\text{H}_4\text{NCOOH}$	123.11
6966	Picraconitine .	See <i>Benzaconine</i> .		
6967	Picramic acid	2-amino-4,6-dinitrophenol*	$\text{NH}_2(\text{NO}_2)_2\text{C}_6\text{H}_2\text{OH}$	199.12
6968	Picramide .	See <i>Aniline</i> , 2,4,6-trinitro-		
6969	Picric acid	2,4,6-trinitrophenol	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{OH}$	229.11
6970	—, methyl ether.	See <i>Anisole</i> , 2,4,6-trinitro-		
6971	Picryl chloride	2-chloro-1,3,5-trinitrobenzene*	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{Cl}$	247.56
6972	Pictol .	See <i>Phenol</i> , <i>p</i> -methylanino-, sulfate.		
6973	Pilocarpidine (<i>d</i>)		$\text{C}_{10}\text{H}_{14}\text{N}_2\text{O}_2$	194.23
6974	—, chloroplatinate		$(\text{C}_{10}\text{H}_{14}\text{N}_2\text{O}_2 \cdot \text{HCl})_2\text{PtCl}_4 \cdot 4\text{H}_2\text{O}$	870.51
6975	—, nitrate		$\text{C}_{10}\text{H}_{14}\text{N}_2\text{O}_2 \cdot \text{HNO}_3$	257.25
6976	Pilocarpine		$\text{C}_{11}\text{H}_{16}\text{N}_2\text{O}_2$	208.26
6977	—, hydrochloride		$\text{C}_{11}\text{H}_{16}\text{N}_2\text{O}_2 \cdot \text{HCl}$	244.72
6978	—, nitrate		$\text{C}_{11}\text{H}_{16}\text{N}_2\text{O}_2 \cdot \text{HNO}_3$	271.27
6979	—, salicylate		$\text{C}_{11}\text{H}_{16}\text{N}_2\text{O}_2 \cdot \text{C}_7\text{H}_6\text{O}_3$	346.37
6980	—, sulfate		$(\text{C}_{11}\text{H}_{16}\text{N}_2\text{O}_2)_2 \cdot \text{H}_2\text{SO}_4$	514.59
6981	<i>d</i>-Pimaric acid		$\text{C}_{20}\text{H}_{30}\text{O}_2$	302.44
6982	Pimelic acid	heptanedioic acid*	$\text{COOH}(\text{CH}_2)_5\text{COOH}$	160.17
6983	—, diethyl ester	ethyl pimelate	$\text{CH}_2(\text{CH}_2\text{CH}_2\text{COOC}_2\text{H}_5)_2$	216.27
6984	—, γ -keto-	See <i>Acetonediacetic acid</i> .		
6985	Pimelic ketone .	See <i>Cyclohexanone</i> *.		
6986	Pinacol	2,3-dimethyl-2,3-butanediol*; tetramethylethylene glycol; pinacone	$(\text{CH}_3)_2\text{C}(\text{OH})\text{COH}(\text{CH}_3)_2$	118.17
6987	Pinacolin	3,3-dimethyl-2-butanone*; <i>tert</i> -butyl methyl ketone	$\text{CH}_3\text{COC}(\text{CH}_3)_3$	100.16
6988	Pinacolyl alcohol	3,3-dimethyl-2-butanol*; methyl- <i>tert</i> -butylcarbinol	$(\text{CH}_3)_3\text{CCHOHCH}_3$	102.17
6989	Pinacone .	See <i>Pinacol</i> .		
6990	Pinene , hydrochloride.	See <i>Bornyl chloride</i> .		
6991	<i>dl</i>-Pinene	<i>dl</i> -2,6,6-trimethylbicyclo-[3,1,1] hept-2-ene; <i>dl</i> - α -pinene	$\text{C}_{10}\text{H}_{16}$	136.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6962	col. liq., 1.5043 ^{24.0}	0.9613 ^{$\frac{15}{4}$}	.....	143.5	■	∞	∞ eth.
6963	col. liq.....	0.9571 ^{$\frac{15}{4}$}	.....	143.1	∞	■	∞ eth.
6964	need. f. w.....	.....	137	subl.	v. s.	5.44 ²⁵	v. sl. s. eth., bz., chl.
6965							
6966	red monocl. f. chl., 1.54, >1.95, 1.505	.....	168-9	.....	0.14 ²²	s.	sl. s. eth.; s. bz., glac. ac. a., aniline
6967							
6968	yel. rhomb. leaf. f. w.	1.763	121.8	exp. >300	1.42 ²⁰ , 6.8 ¹⁰⁰	4.91 ²⁰	1.43 c. eth.; s. bz.
6969							
6970	yel. monocl. pr. f. eth.	1.797	83	d.	0.018 ¹⁵	4.48 ¹⁷	7.23 ¹⁷ eth.
6971							
6972	viscid oil, [α]+81.3° _D	.....	.....	.....	s.	v. s.	sl. s. eth.
6973							
6974	or yel. leaf. or dk. red pyr.	.....	88-9; anh. 187 d.	.....	.....	i.	.....
6975	wh. cr.....	.....	137	.....	50	s.	.....
6976	col. oil or need., [α]+106° ¹⁸ _D in w.	.....	34	.....	v. s.	v. s.	sl. s. eth.; v. s. chl.; v. sl. s. bz.; i. pet. eth.
6977	deliq. pr. or need., [α]+91.74° _D	.....	anh. 196.7	.....	333	37 ²⁵	i. eth.; sl. s. chl.
6978	pr. f. al. or w., [α]+82.9° _D	.....	176-8 (173)	.....	16 ²⁰	6.2° ⁶⁰	i. eth., chl.
6979	wh. cr., [α]+62.5° _D	.....	120	.....	s.	s.	.....
6980	wh. cr. f. al. +eth., [α]+84.72° _D	.....	132 (120)	.....	s.	s.	.....
6981	cr.....	.....	212	282 ²⁰	i.	s.	s. eth.
6982	monocl. pr. f. w.	1.329 ¹⁵	103	272 ¹⁰⁰	2.52 ¹³ , 5 ²⁰	v. m.	v. s. eth.
6983	col. liq.....	0.999 ^{$\frac{15}{16}$}	.....	subl. 252-57 ⁴⁸	i.	s.	s. eth.
6984	col. need.....	0.9672 ¹⁵	33 (41-3)	172.8	s. c., v. s. h.	v. s.	v. s. eth.; sl. s. CS ₂
6985							
6986							
6987	col. liq.....	0.811; 0.8208 ^{$\frac{0}{4}$}	-52.5	106.2	2.51 ¹⁵	s.	s. eth.; v. s. acet.
6988	liq. or silky need.	0.812 ²⁵	5.5	121-3	v. sl. s.	s.	∞ eth.
6989	col. liq., 1.4658	0.8582 ^{$\frac{20}{4}$}	-55 (-50)	154 (158-61)	v. sl. s.	∞	∞ eth., chl.
6990							
6991							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
6992	Pinole (<i>dl</i>).....	6,8-epoxy-1- <i>p</i> -menthene; 4, 7,7-trimethyl-6-oxabicyclo-[3,2,1]oct-3-ene; <i>dl</i> -sobre-rone	$C_{10}H_{16}O$	152.23
6993	—, hydrate.....	1-1- <i>p</i> -menthene-6,8-diol	$C_{10}H_{16}(OH)_2$	170.25
6994	2-Pipecoline	2-methylpiperidine; α -pipecoline	$CH_3C_6H_9NH$	99.17
6995	3-Pipecoline	3-methylpiperidine; β -pipecoline	$CH_3C_6H_9NH$	99.17
6996	4-Pipecoline	4-methylpiperidine; γ -pipecoline	$CH_3C_6H_9NH$	99.17
6997	Piperazine	hexahydropyrazine; diethylenediamine	$NHCH_2CH_2$ | $NHCH_2CH_2$	86.14
6998	—, dihydrobromide.....		$C_4H_{10}N_2 \cdot 2HBr$	247.99
6999	—, dihydrochloride.....		$C_4H_{10}N_2 \cdot 2HCl$	159.07
7000	—, hexahydrate.....		$C_4H_{10}N_2 \cdot 6H_2O$	194.23
7001	—, salts of organic acids. See under the acids.			
7002	—, 1,4-bis(hydrocinnamyl)-		$(C_6H_5CH_2CH_2CO)_2C_4H_8N_2$	350.45
7003	—, α, γ -diaci-.....	See <i>Glycine anhydride</i> .		
7004	—, 1,4-dianisoyl -.....		$(CH_3OC_6H_4CO)_2C_4H_8N_2$	354.39
7005	—, 2,5-dimethyl- (<i>trans</i>).....		$(CH_3)_2C_4H_8N_2$	114.19
7006	—, 1,4-dinitroso -.....		$C_4H_8N_2(NO)_2$	144.14
7007	—, 1,4-di-α-toluyl -.....		$(C_6H_5CH_2CO)_2C_4H_8N_2$	322.39
7008	—, 1-phenyl -.....		$C_4H_9N_2C_6H_5$	162.23
7009	2,5-Piperazinedione	See <i>Glycine anhydride</i> .		
7010	Piperethylalkine	See <i>Piperidineethanol</i> .		
7011	Piperic acid	5-(3,4-methylenedioxyphenyl)-2,4-pentadienoic acid*; β -(3,4-methylenedioxyethyl)acrylic acid	$(CH_2O)_2C_6H_3CH$ $CHCH:CHCOOH$	218.20
7012	Piperidic acid	See <i>Butyric acid, γ-amino</i> .		
7013	Piperidine	hexahydropyridine; pentamethylenimine	$(CH_2)_5NH$	85.15
7014	—, 1-acetyl -.....	acetic acid piperidide; <i>N</i> -acetylpiperidine	$CH_3CON(CH_2)_5$	127.13
7015	—, 2-allyl -.....	See <i>β-Coniceine</i> .		
7015M	—, 1-amyl -.....	<i>N</i> - <i>n</i> -pentylpiperidine.....	$C_5H_{10}NC_5H_{11}$	155.28
7016	—, 4-benzoxy-2,2,6-trimethyl -, lactate. See <i>β-Eucaine, lactate</i> .			
7017	—, 1-benzoyl -.....		$C_6H_5CONC_5H_{10}$	189.25
7017M	—, 1-butyl -.....		$C_5H_{10}NC_4H_9$	141.25
7018	—, 1,2-dimethyl -.....	<i>N, α</i> -dimethylpiperidine.....	$C_5H_9N(CH_3)_2$	113.20
7018M	—, 1-dodecyl -.....		$C_5H_{10}N(CH_2)_{11}CH_3$	253.46
7019	—, ethoxyl -.....	See <i>Piperidineethanol</i> .		
7020	—, 1-ethyl -.....	<i>N</i> -ethylpiperidine.....	$C_2H_5NC_5H_{10}$	113.20
7021	—, 2-ethyl -(<i>dl</i>).....	<i>dl</i> - α -ethylpiperidine.....	$NHCH(CH_2H_5)-$ | $(CH_2)_4$	113.20
7022	—, 3-ethyl -(<i>dl</i>).....	<i>dl</i> - β -ethylpiperidine.....	$NHCH_2CH-$ | $(C_2H_5)(CH_2)_3$	113.20
7023	—, 1-formyl -.....	<i>N</i> -formylpiperidine.....	$HCONC_5H_{10}$	113.16
7023H	—, 1-heptyl -.....		$C_5H_{10}N(CH_2)_6CH_3$	183.33

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6992	1.4715.....	0.9420 ²⁰ ₄	.....	184	.....	s.	s. eth.
6993	col.....	.....	150	270-1	3.3 ¹⁵	v. s.	v. s. eth.
6994	liq., 1.44627 ^{24.3}	0.844 ²⁴	9	119	s.	.....	i. dil. KOH
6995	liq., 1.43779 ^{21.6}	0.845 ²⁴	.....	126	v. s.	.....	.....
6996	liq.....	0.867 ⁰	.....	129	s.	.....	.....
6997	col. rhomb. f. al., 1.446 ¹¹³	.....	104	145	s.	v. v. s.	.....
6998	wh. need.....	.....	d.	.....	v. s.	i. c.	i. eth.
6999	wh. need.....	.....	d.	.....	v. s.	i. c.	i. eth.
7000	wh. cr.....	.....	44	.....	v. s.	s.	v. sl. s. eth.
7001	.....	.....	.....	.....	.....	.....	.....
7002	wh. cr.....	.....	122.5-3.0	.....	i.	s. h.	sl. s. eth.
7003	.....	.....	.....	.....	.....	.....	.....
7004	wh. cr.....	.....	192.5-3.5	.....	i.	s. h.	i. eth.
7005	monocl. pr.....	.....	(cis) 114 (trans) 118	162	v. s.	v. s.	sl. s. eth.
7006	wh. pl.....	.....	157-8	.....	s. h.	i. c.	i. eth.
7007	wh. cr.....	.....	150-1	.....	v. sl. s.	s. h.	sl. s. eth.
7008	pa. yel. oil....	1.0621 ²⁰ ₄	.....	156-7 ¹⁰	i.	■	∞ eth.
7009	.....	.....	.....	.....	.....	.....	.....
7010	.....	.....	.....	.....	.....	.....	.....
7011	yel. need. f. al.	.....	217	220 d. subl.	v. sl. s.	2.84 c.	s. eth.
7012	.....	.....	.....	.....	.....	.....	.....
7013	col. liq., 1.4534 ²⁰	0.8622 ²⁰	-9 (-17)	106.3	∞	∞	∞ eth.
7014	lt. liq.....	1.0111	107-9	227-8 (224)	∞	s.	.....
7015	.....	.....	.....	.....	.....	.....	.....
7015M	1.4498 ²⁰	0.8282 ²⁰	.....	198.2 ¹⁶⁰	.....	.....	.....
7016	.....	.....	.....	.....	.....	.....	.....
7017	col. need.....	.....	48 (29-33)	184 ¹⁷	i.	s.	s. eth.
7017M	1.4467 ²⁰	0.8245 ²⁰	.....	175.8	.....	.....	.....
7018	liq.....	.....	.....	127.9	.....	.....	.....
7018M	1.4569 ²⁵	0.8348 ²⁵	.....	139-40 ²	.....	.....	.....
7019	.....	.....	.....	.....	.....	.....	.....
7020	liq., 1.4440 ²⁰ ...	0.8249 ²⁰	.....	130.8	.....	.....	.....
7021	.....	0.867 ⁰	.....	143	5	.....	.....
7022	liq.....	0.8658 ⁰	.....	152.6 (155)	v. sl. s.	.....	.....
7023	wh.-yel. liq....	1.0205 ²⁵ ₄	.....	218-22	∞	∞	∞ eth.
7023H	1.4531 ²⁰	0.8316 ²⁰	.....	239.5	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7023R	Piperidine, 1-hexyl-		$C_6H_{10}N(CH_2)_6CH_3$	169.30
7024	—, β -hydroxyethyl-	See <i>Piperidineethanol</i> .		
7025	—, 1-methyl-.....		$C_6H_{10}NCH_3$	99.17
7026	—, 2-methyl-	See 2- <i>Pipecoline</i> .		
7027	—, 3-methyl-	See 3- <i>Pipecoline</i> .		
7028	—, 4-methyl-	See 4- <i>Pipecoline</i> .		
7028H	—, 1-nonyl-.....		$C_6H_{10}N(CH_2)_8CH_3$	211.38
7028M	—, 1-octyl-.....		$C_6H_{10}N(CH_2)_7CH_3$	197.36
7028R	—, <i>N-n</i> -pentyl-	See <i>Piperidine, 1-amyl</i> -.		
7029	—, 1-piperyl-	See <i>Piperine</i> .		
7030	—, 1-propyl-.....	<i>N-n</i> -propylpiperidine.....	$CH_3CH_2CH_2NC_6H_{11}$	127.23
7031	—, 2-propyl-	See <i>Coniine</i> .		
7032	—, 2-(3-pyridyl)-.	See <i>Anabesine</i> .		
7033	1-Piperidinecarbodi-thioic acid, piperidin-ium salt	piperidinium cyclopentamethylenedithiocarbamate	$C_6H_{10}NCSSNH_2$ C_5H_{10}	246.42
7034	—, zinc salt.....		$(C_6H_{10}NCSS)_2Zn$	385.92
7035	Piperidineethanol	β -hydroxyethylpiperidine; ethoxypiperidine; piperethylalkine	$C_6H_{10}NCH_2CH_2OH$	129.20
7036	4-Piperidone, 2,2,6,6-tetramethyl-	See <i>Triacetone</i> .		
7037	Piperine	1-piperylpiperidine.....	$C_{17}H_{19}NO_3$	285.33
7038	—, hydriodide diiodide.....		$(C_{17}H_{19}NO_3)_2 \cdot HI \cdot I_2$	952.43
7039	Piperolidine	octahydropyrrocoline; δ -coniceine	$C_8H_{15}N$	125.21
7040	Piperonal	3,4-methylenedioxybenzaldehyde; protocatechualdehyde methylene ether; heliotropin	$CH_2(O_2)C_6H_3CHO$	150.13
7041	Piperonyl alcohol	3,4-methylenedioxybenzyl alcohol	$CH_2(O_2)C_6H_3CH_2OH$	152.14
7042	Piperonylic acid	3,4-methylenedioxybenzoic acid; protocatechuic acid methylene ether	$CH_2(O_2)C_6H_3COOH$	166.13
7043	Piperylene	See 1,3- <i>Pentadiene</i> *.		
7044	Pivalaldehyde	2,2-dimethylpropanal*; trimethylacetaldehyde	$(CH_3)_3CCHO$	86.13
7045	—, oxime.....	trimethylacetaldoxime.....	$(CH_3)_3CCH:NOH$	101.15
7046	Pivalic acid	2,2-dimethylpropanoic acid*; α,α -dimethylpropionic acid; trimethylacetic acid	$(CH_3)_3CCOOH$	102.13
7047	—, methyl ester.....	methyl pivalate.....	$(CH_3)_3CCOOCH_3$	116.16
7048	Plumbane, tetramethyl-	See <i>Lead, tetramethyl</i> -*.		
7049	—, tetraphenyl-	See <i>Lead, tetraphenyl</i> -*.		
7050	Polyoxymethylene	trioxymethylene; paraformaldehyde; metaformaldehyde. See also <i>sym-Trioxane</i> .	$(CH_2O)_x$	(30.03) $_x$
7051	Populin	benzoysalicin.....	$C_{20}H_{22}O_8 \cdot 2H_2O$	426.41
7052	—, (anhydrous synthetic)	benzoysalicin	$C_{20}H_{22}O_8$	390.38
7052M	P. P. factor.	See <i>Nicotinamide</i> ; <i>Nicotinic acid</i> .		
7053	Prehnitene	1,2,3,4-tetramethylbenzene; prehnitole	$(CH_3)_4C_6H_2$	134.21

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7023R	1.4517 ²⁰	0.830 ²⁰		219.2			
7024							
7025	liq., 1.4378 ²⁰	0.8207 ²⁰		105.9	14.8 ⁴⁹ ; 5.5 ⁷⁷	∞	∞ eth.
7026							
7027							
7028							
7028H	1.4538 ²⁵	0.8313 ²⁵		135.7 ¹¹			
7028M		0.834 ²⁰		142 ²⁵			
7028R							
7029							
7030	col. liq., 1.4446 ²⁰	0.8231 ²⁰		152.1	2.774 ^{0.5} ; 0.606 ³²	v. s.	v. s. eth.
7031							
7032							
7033	pa. yel. pl.		171-2		v. s.	v. s.	v. sl. s. eth.
7034	wh. powd.		223-5		i.	i.	i. eth.; sl. s. chl.
7035	liq.			199	s.	s.	
7036							
7037	col. monocl. need. f. al.	1.193	128-9.5		v. sl. s. c.	6.7, 23 ⁶⁰	2.8 eth.; s. chl.
7038	steel bl. need.		145		s.		v. s. chl.
7039	liq.	0.904 ^{1.5} ₄		(d _l) 161; (l) 158			
7040	wh.-yel. cr. f. w.		37	263	0.2 c., ∞ ⁷⁸	s. c., ∞ h.	∞ eth.
7041	cr.		51	d.	sl. s.	∞	∞ eth.
7042	need. f. w. or al.		228	subl.	sl. s. h.	s. h.	sl. s. eth.; s. alk.
7043							
7044	liq.	0.793 ¹⁷	3	75		s.	s. eth.
7045	cr.		41	65 ²⁰		s.	
7046	col. need., 1.3931 ^{30.5}	0.905 ⁵⁰	35.5	163.8	2.2	v. s.	v. s. eth.
7047							
7048	col. liq.	1.044 ⁰		102	sl. s.	∞	∞ eth.
7049							
7050	wh. need.		64 (60)	subl.	17.2 ¹³ , 21.1 ²⁵	s.	s. eth.
7051	col. need.		anh. 180		0.04 ¹⁵ , 2.4 ¹⁰⁰	s.	s. eth., dil. a., alk.
7052	pr.		178-9				
7052M							
7053	col., 1.52031 ^{16.0}	0.901 ²⁰ ₄ , 1.801 ²⁰ ₄	-4	204	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7054	Prehnitic acid	1,2,3,5-benzenetetracarboxylic acid*	$C_6H_2(COOH)_4$. . .	254.15
7055	Prehnitylic acid	2,3,4-trimethylbenzoic acid . . .	$(CH_3)_3C_6H_2COOH$	164.20
7056	Procaine , hydrochloride	β -diethylaminoethyl <i>p</i> -aminobenzoate hydrochloride; novocain; ethocain	$NH_2C_6H_4COOC_2H_4N(C_2H_5)_2 \cdot HCl$	272.77
7057	Proline , hydroxy-(<i>l</i>) . . . . .	.....	$C_4H_7N(OH)COOH$	131.13
7058	—, 4-hydroxy-(<i>d</i>)	4-hydroxy-2-pyrrolidinecarboxylic acid	$C_4H_7N(OH)COOH$	131.13
7059	<i>dl</i> -Proline	<i>dl</i> -2-pyrrolidinecarboxylic acid	$C_4H_8N \cdot COOH$. . .	115.13
7060	<i>d</i> -Proline	<i>d</i> -2-pyrrolidinecarboxylic acid	C_4H_8NCOOH	115.13
7061	<i>l</i> -Proline	<i>l</i> -2-pyrrolidinecarboxylic acid	$C_4H_8N \cdot COOH$. . .	115.13
7061M	Prontosil album .	See <i>Sulfanilamide</i> .		
7062	Propadiene *	allene; dimethylenemethane	$CH_2:C:CH_2$	40.06
7063	—, dioxo-	See <i>Carbon suboxide</i> .		
7064	—, tetraphenyl-	tetraphenylallene	$(C_6H_5)_2C:C:C \cdot (C_6H_5)_2$	344.43
7065	Propanal *	See <i>Propionaldehyde</i> .		
7066	—, 2,2-dimethyl-*	See <i>Pivaldehyde</i> .		
7067	—, 2-methyl-*	See <i>Isobutyraldehyde</i> .		
7068	—, 2-oxo-*	See <i>Pyruvaldehyde</i> , <i>aldoxime</i> .		
7069	—, 3-phenyl-	See <i>Hydrocinnamaldehyde</i> .		
7070	Propanamide *	See <i>Propionamide</i> .		
7071	—, 2-hydroxy-*	See <i>Lactamide</i> .		
7072	—, 2-methyl-*	See <i>Isobutyramide</i> .		
7073	Propane *	dimethylmethane	$CH_3CH_2CH_3$	44.09
7074	—, 1-amino-2,2-dimethyl-	ethyl-. See <i>Propylamine</i> , β .	β -dimethyl*	
7075	—, 1-amino-2-methyl-	yl-. See <i>Isobutylamine</i> .		
7076	—, 2,2-bis(ethylsulfonyl)*	acetone diethylsulfone; sulfonmethane; sulfonal	$(CH_3)_2C(SO_2 \cdot C_2H_5)_2$	228.32
7077	—, 1-bromo-*	See <i>Propyl bromide</i> .		
7078	—, 2-bromo-*	See <i>Isopropyl bromide</i> .		
7079	—, 1-bromo-2-chloro-* . . . . .	.....	$CH_3CHClCH_2Br$. . .	157.45
7080	—, 2-bromo-1-chloro-* . . . . .	.....	$CH_3CHBrCH_2Cl$. . .	157.45
7081	—, 1-bromo-2,2-dimethyl-*	<i>tert</i> -butylmethyl bromide	$(CH_3)_3CCH_2Br$. . .	151.06
7082	—, 1-bromo-2-methyl-	yl*. See <i>Isobutyl bromide</i> .		
7083	—, 2-bromo-2-methyl-	yl*. See <i>tert</i> -Butyl bromide.		
7084	—, 1-chloro-*	See <i>Propyl chloride</i> .		
7085	—, 2-chloro-*	See <i>Isopropyl chloride</i> .		
7086	—, 1-chloro-2-(β -chloroisopropoxy)*	See <i>Ether, bis-β-chloroisopropyl</i> .		
7087	—, 1-chloro-2,2-dimethyl-* . . . . .	.....	$(CH_3)_3CCH_2Cl$. . .	106.60
7088	—, 1-chloro-2,3-epoxy-	yl*. See <i>Epichlorohydrin</i> .		
7089	—, 1-chloro-2-methyl-	yl*. See <i>Isobutyl chloride</i> .		
7090	—, 2-chloro-2-methyl-	yl*. See <i>tert</i> -Butyl chloride.		
7091	—, 1,1-dibromo-*	propylidene bromide	$CH_3CH_2CHBr_2$. . .	201.91
7092	—, 1,2-dibromo-*	propylene bromide; propylene dibromide	$CH_2BrCHBrCH_3$. .	201.91

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7054	pr. (+2H ₂ O) f. w.	.....	237 d.	d.	s.	.....	s. eth.
7055	pr. f. al. ....	.....	167.5	.....	s.	s.	s. eth.
7056	col. need. f. al.	0.707 ¹⁷	156	.....	0.6 ²⁵	30 ²⁵	v. sl. s. eth.; sl. s. chl.
7057	rhomb. pl. or fine need.	.....	274; (238-41) d.	.....	25 ⁰	v. sl. s.	i. eth.
7058	.....	.....	(a) 274; (b) 238-41 d.	.....	.....	.....	.....
7059	.....	.....	205 d.	.....	■.	s.	i. eth.; sl. s. chl., acet., bz.
7060	pr. ....	.....	215-20 d.	.....	.....	.....	.....
7061	flat need. f. al.; pr. f. w.	.....	220-2 d.	.....	v. s.	1.55 ¹⁹	i. eth., butyl al., propyl al.
7061M	.....	.....	.....	.....	.....	.....	.....
7062	gas.	1.787 g/l	-146	-32	.....	.....	.....
7063	.....	.....	.....	.....	.....	.....	.....
7064	need. or pr. f. dil. al. or acet.	.....	166	.....	i.	sl. s. c.	s. eth.
7065	.....	.....	.....	.....	.....	.....	.....
7066	.....	.....	.....	.....	.....	.....	.....
7067	.....	.....	.....	.....	.....	.....	.....
7068	.....	.....	.....	.....	.....	.....	.....
7069	.....	.....	.....	.....	.....	.....	.....
7070	.....	.....	.....	.....	.....	.....	.....
7071	.....	.....	.....	.....	.....	.....	.....
7072	.....	.....	.....	.....	.....	.....	.....
7073	col. gas.	liq. $\frac{-44.5}{4}$; 0.5853 2.014 ⁰ g/l	-189.9; frz. -187.1	-42.17	6.5 ¹⁸ cm ³	790 ¹⁷ cm ³	926 ¹⁷ cm ³ eth.
7074	.....	.....	.....	.....	.....	.....	.....
7075	.....	.....	.....	.....	.....	.....	.....
7076	col. monoc. pr. f. al.	1.260 ²⁵ ₄	128	300 d.	2 ¹⁵ , 6.7 ¹⁰⁰	1.2 c., 39 h.	0.54 c. eth.
7077	.....	.....	.....	.....	.....	.....	.....
7078	.....	.....	.....	.....	.....	.....	.....
7079	liq., 1.47449...	1.531 ²⁰ ₄	.....	118.0	.....	.....	.....
7080	liq., 1.47763...	1.537 ²⁰ ₄	.....	117.0 ⁷⁵⁶	.....	.....	.....
7081	col. liq.	1.2604 ²⁰ ₀	.....	89-91 ⁷⁴⁹	i.	s.	s. eth.
7082	.....	.....	.....	.....	.....	.....	.....
7083	.....	.....	.....	.....	.....	.....	.....
7084	.....	.....	.....	.....	.....	.....	.....
7085	.....	.....	.....	.....	.....	.....	.....
7086	.....	.....	.....	.....	.....	.....	.....
7087	.....	.....	.....	84.4	.....	.....	.....
7088	.....	.....	.....	.....	.....	.....	.....
7089	.....	.....	.....	.....	.....	.....	.....
7090	.....	.....	.....	.....	.....	.....	.....
7091	liq. ....	.....	.....	ca. 130	.....	.....	.....
7092	col. liq., 1.5203	1.9333 ²⁰ ₄	-55.5	141.6 (140)	0.25 ²⁰	s.	v. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol Wt.
7093	Propane, 1,3-di-bromo-*	trimethylene bromide; tri-methylene dibromide	$\text{BrCH}_2\text{CH}_2\text{CH}_2\text{Br}$	201.91
7094	—, 2,2-dibromo-*	bromacetol	$\text{CH}_3\text{CBr}_2\text{CH}_3$	201.91
7095	—, 1,2-dibromo-2-methyl-*	isobutylene bromide	$(\text{CH}_3)_2\text{CBrCH}_2\text{Br}$	215.94
7096	—, 1,1-dichloro-*	propylidene chloride	$\text{CH}_3\text{CH}_2\text{CHCl}_2$	112.90
7097	—, 1,2-dichloro-*	propylene chloride; propylene dichloride	$\text{CH}_2\text{ClCHClCH}_3$	112.90
7098	—, 1,3-dichloro-*	trimethylene chloride; tri-methylene dichloride	$\text{ClCH}_2\text{CH}_2\text{CH}_2\text{Cl}$	112.99
7099	—, 2,2-dichloro-*	acetone dichloride; isopropylidene chloride	$\text{CH}_3\text{CCl}_2\text{CH}_3$	112.99
7099M	—, 2,2-difluoro-*	isopropylidene fluoride; acetone fluoride; fluoroacetol; difluorodimethylmethane	$\text{CH}_3\text{CF}_2\text{CH}_3$	80.08
7100	—, 1,2-diiodo-*	propylene diiodide; propylene iodide	$\text{CH}_3\text{CHICH}_2\text{I}$	295.92
7101	—, 2,2-dimethyl-*	tetramethylmethane; neopentane	$(\text{CH}_3)_4\text{C}$	72.15
7102	—, 1,3-diphenoxy-*	trimethylene glycol diphenyl ether	$\text{C}_6\text{H}_5\text{OCH}_2\text{CH}_2\text{CH}_2\text{OC}_6\text{H}_5$	228.28
7103	—, 1,2-epoxy-	See <i>Propene oxide</i> .		
7104	—, 1,2-epoxy-3-iodo-	See <i>Episiodohydrin</i> .		
7105	—, 1,2-epoxy-2-methyl-	See <i>Ethylene oxide, α, α-dimethyl-</i> .		
7106	—, 1-ethoxy-*	See <i>Ether, ethyl propyl</i> .		
7107	—, 2-ethoxy-*	See <i>Ether, ethyl isopropyl</i> .		
7108	—, 1-ethoxy-2-methyl-	See <i>Ether, ethyl isobutyl</i> .		
7109	—, 2-ethoxy-2-methyl-	See <i>Ether, tert-butyl ethyl</i> .		
7110	—, 1-fluoro-*	See <i>Propyl fluoride</i> .		
7111	—, 2-fluoro-*	See <i>Isopropyl fluoride</i> .		
7112	—, 1-fluoro-2-methyl-	See <i>Isobutyl fluoride</i> .		
7113	—, 1-iodo-*	See <i>Propyl iodide</i> .		
7114	—, 2-iodo-*	See <i>Isopropyl iodide</i> .		
7115	—, 1-iodo-2,2-dimethyl-*	<i>tert</i> -butylmethyl iodide	$(\text{CH}_3)_3\text{CCH}_2\text{I}$	198.06
7116	—, 1-iodo-2-methyl-	See <i>Isobutyl iodide</i> .		
7117	—, 2-iodo-2-methyl-	See <i>tert-Butyl iodide</i> .		
7118	—, 2-(isopropylthio)	See <i>Isopropyl sulfide</i> .		
7119	—, 2-isopropoxy-*	See <i>Isopropyl ether</i> .		
7120	—, 1-methoxy-*	See <i>Ether, methyl propyl</i> .		
7121	—, 2-methoxy-*	See <i>Ether, isopropyl methyl</i> .		
7122	—, 1-methoxy-2-methyl-	See <i>Ether, isobutyl methyl</i> .		
7123	—, 2-methyl-*	See <i>Isobutane</i> .		
7124	—, 1-methyl-1-(methylpropylthio)-*	See <i>sec-Butyl sulfide</i> .		
7125	—, 2-methyl-1-(β-methylpropoxy)-*	See <i>Isobutyl ether</i> .		
7126	—, 2-methyl-1-(β-methylpropylthio)-*	See <i>Isobutyl sulfide</i> .		
7127	—, 2-methyl-1-nitro-*	nitroisobutane	$(\text{CH}_3)_2\text{CHCH}_2\text{NO}_2$	103.12
7128	—, 2-methyl-1-phenoxy-	See <i>Ether, isobutyl phenyl</i> .		
7129	—, 2-methyl-1-phenyl-	See <i>Benzene, isobutyl-</i> .		
7130	—, 2-methyl-2-phenyl-	See <i>Benzene, tert-butyl-</i> .		
7131	—, 1-nitro-*		$\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2$	89.09
7131F	—, 2-nitro-*	<i>sec</i> -nitropropane	$(\text{CH}_3)_2\text{CHNO}_2$	89.09

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7093	col. liq., 1.523	1.979 ²⁰ ₁₁ ; 1.987 ¹⁷ ₄	-34.4	167	0.168 ³⁰	s.	s. eth.
7094	.....	1.7825 ²⁰	.....	114-5 ⁷⁴⁰	.....	.....	.....
7095	liq., 1.509.....	1.759	-70.3	149.0	.....	.....	.....
7096	liq., 1.4467....	1.143 ¹⁰	.....	87	.....	.....	.....
7097	col. liq., 1.4388	1.1593 ²⁰ ₂₀ ; 1.1656 ¹⁴	.....	96.8	0.27 ²⁰	v. s.	v. s. eth.
7098	col. liq., 1.4469	1.201 ¹⁵ ; 1.1896 ¹⁸ ₄	.....	125; 119 ⁷⁴⁰	0.287 ³⁰	v. s.	v. s. eth.
7099	liq., 1.4471....	1.093 ²⁰ ₂₀	-34.6	69.7	i.	s.	∞ eth., CS ₂
7099M	col. gas.....	0.92 ⁹	.....	-0.6 (-0.2)	.....	.....	.....
7100	liq.....	2.490	.....	d.	.....	.....	.....
7101	gas.....	0.613 ⁰ ₀	-20	9.5	i.	s.	s. eth.
7102	shiny leaf. f. al.	.....	61	338-40	i.	s.	s. eth.
7103	.....	.....	.....	.....	.....	.....	.....
7104	.....	.....	.....	.....	.....	.....	.....
7105	.....	.....	.....	.....	.....	.....	.....
7106	.....	.....	.....	.....	.....	.....	.....
7107	.....	.....	.....	.....	.....	.....	.....
7108	.....	.....	.....	.....	.....	.....	.....
7109	.....	.....	.....	.....	.....	.....	.....
7110	.....	.....	.....	.....	.....	.....	.....
7111	.....	.....	.....	.....	.....	.....	.....
7112	.....	.....	.....	.....	.....	.....	.....
7113	.....	.....	.....	.....	.....	.....	.....
7114	.....	.....	.....	.....	.....	.....	.....
7115	col. oil.....	1.5317 ¹³	.....	127-9 d.	i.	s.	s. eth.
7116	.....	.....	.....	.....	.....	.....	.....
7117	.....	.....	.....	.....	.....	.....	.....
7118	.....	.....	.....	.....	.....	.....	.....
7119	.....	.....	.....	.....	.....	.....	.....
7120	.....	.....	.....	.....	.....	.....	.....
7121	.....	.....	.....	.....	.....	.....	.....
7122	.....	.....	.....	.....	.....	.....	.....
7123	.....	.....	.....	.....	.....	.....	.....
7124	.....	.....	.....	.....	.....	.....	.....
7125	.....	.....	.....	.....	.....	.....	.....
7126	.....	.....	.....	.....	.....	.....	.....
7127	col. liq.	0.9625 ²⁵ ₂₅	.....	140.8 (158-9)	v. sl. s.	∞	∞ eth.
7128	.....	.....	.....	.....	.....	.....	.....
7129	.....	.....	.....	.....	.....	.....	.....
7130	.....	.....	.....	.....	.....	.....	.....
7131	col. liq., 1.40027 ^{24.3} ; 1.4015	1.003 ²⁰ ₂₀	frz. -108	132	1.4 cc	∞	∞ eth.
7131F	w. wh. liq., 1.3941 ²⁰	0.992 ²⁰ ₂₀	frz. -93	120	1.7 cc	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7132	Propane, 2-phenoxy-	See <i>Ether, isopropyl phenyl</i> .		
7133	—, 1-phenyl-	See <i>Benzene, propyl-</i> .		
7134	—, 2-phenyl-	See <i>Cumene</i> .		
7135	—, 1-propoxy-*	See <i>Propyl ether</i> .		
7135M	—, 1-(propylsulfinyl)-*	See <i>Propyl sulfoxide</i> .		
7136	—, 1-propylsulfonyl-	See <i>Propyl sulfone</i> .		
7137	—, 1-propylthio-*	See <i>Propylsulfide</i> .		
7138	—, 1,2,3-tribromo-*	glycerol tribromohydrin; tribromohydrin; allyl tribromide	$\text{CH}_2\text{BrCHBrCH}_2\text{Br}$	280.82
7139	—, 1,2,3-trichloro-*	glycerol trichlorohydrin; allyl trichloride; trichlorohydrin	$\text{CH}_2\text{ClCHClCH}_2\text{Cl}$	147.44
7140	—, 1,1,1-triphenyl-	α -ethyltritan.....	$(\text{C}_6\text{H}_5)_3\text{CCH}_2\text{CH}_3$	272.37
7140M	1-Propaneboronic acid	See <i>Boric acid, propyl-</i> .		
7141	Propanediamide*	See <i>Malonamide</i> .		
7142	dl-1,2-Propanediamine*	dl-propylenediamine.....	$\text{CH}_3\text{CH}(\text{NH}_2)\text{CH}_2\text{NH}_2$	74.13
7143	1,3-Propanediamine*	trimethylenediamine.....	$\text{NH}_2(\text{CH}_2)_3\text{NH}_2$	74.13
7144	Propanedinitrile*	See <i>Malononitrile</i> .		
7145	Propanedioic acid*	See <i>Malonic acid</i> .		
7146	—, 2-propenyl-*	See <i>Malonic acid, allyl-</i> .		
7147	1,2-Propanediol*	propylene glycol.....	$\text{CH}_2\text{OHCHOHCH}_3$	76.09
7148	—, 3-chloro-*	α -chlorohydrin; glycerol α -chlorohydrin	$\text{CH}_2\text{ClCHOHCH}_2\text{OH}$	110.54
7149	—, 3-mercapto-*	See <i>Glycerol, 1-thio-</i> .		
7150	—, 2-methyl-*	isobutylene glycol; <i>as</i> -dimethylethylene glycol	$(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{OH}$	90.12
7151	—, 3-octadecyloxy-*	glycerol 1-octadecyl ether....	$\text{CH}_3(\text{CH}_2)_{17}\text{OCH}_2\text{CHOHCH}_2\text{OH}$	344.57
7152	1,3-Propanediol*	trimethylene glycol.....	$\text{HOCH}_2\text{CH}_2\text{CH}_2\text{OH}$	76.09
7152H	—, 2-amino-2-ethyl-		$\text{HOCH}_2\text{C}(\text{NH}_2)(\text{C}_2\text{H}_5)\text{CH}_2\text{OH}$	119.16
7152M	—, 2-amino-2-hydroxymethyl-	tris(hydroxymethyl)aminomethane	$\text{H}_2\text{NC}(\text{CH}_2\text{OH})_3$	121.14
7152R	—, 2-amino-2-methyl-		$\text{HOCH}_2\text{C}(\text{NH}_2)(\text{CH}_3)\text{CH}_2\text{OH}$	105.14
7153	—, 2,3-bishydroxymethyl-	ethyl-. See <i>Pentaerythritol</i> .		
7154	—, 2,2-dimethyl-*	dimethyltrimethylene glycol	$(\text{CH}_3)_2\text{C}(\text{CH}_2\text{OH})_2$	104.15
7154M	—, 2-ethyl-2-nitro-*	2-nitro-2-methylol-1-butanol	$\text{HOCH}_2\text{C}(\text{C}_2\text{H}_5)(\text{NO}_2)\text{CH}_2\text{OH}$	149.15
7155	—, 2-hydroxymethyl-2-methyl-*	pentaglycerol; pentaglycerin	$\text{CH}_3\text{C}(\text{CH}_2\text{OH})_3$	120.15
7155H	—, 2-hydroxymethyl-2-nitro-*	tris(hydroxymethyl)nitromethane	$\text{NO}_2\text{C}(\text{CH}_2\text{OH})_3$	151.12
7155R	—, 2-methyl-2-nitro-*		$\text{HOCH}_2\text{C}(\text{CH}_3)(\text{NO}_2)\text{CH}_2\text{OH}$	135.12
7156	1,3-Propanedione, 1,3-	diphenyl-. See <i>Methane, dibenzoyl-</i> .		
7157	Propanenitrile*	See <i>Propionitrile</i> .		
7158	—, 2-hydroxy-*	See <i>Lactonitrile</i> .		
7159	—, 2-methyl-*	See <i>Isobutyronitrile</i> .		
7160	—, 2-oxo-*	See <i>Pyruxonitrile</i> .		
7161	—, 3-oxo-3-phenyl-	See <i>Acetonitrile, benzoyl-</i> .		
7162	1-Propanethiol*	<i>n</i> -propyl mercaptan.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{SH}$	76.15
7163	—, 2-methyl-*	isobutyl mercaptan.....	$(\text{CH}_3)_2\text{CHCH}_2\text{SH}$	90.18
7164	2-Propanethiol*	isopropyl mercaptan.....	$\text{CH}_3\text{CHSHCH}_3$	76.15

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7132							
7133							
7134							
7135							
7135M							
7136							
7137							
7138	pr., 1.584.....	2.433 ²³	16	220	i.	v. s.	v. s. eth.
7139	col. liq.....	1.417 ¹⁵ / ₄	-14.7	156-8	i.	s.	s. eth.
7140	col. cr. f. me. al.	.....	51-1.5	.....	i.	s.	v. s. eth.
7140M							
7141							
7142	col. liq.....	0.878 ¹⁵	.....	119	.....	.....	.....
7143	col. liq.....	0.884 ²⁵ / ₄	.....	135.5	s.	∞	∞ eth.
7144							
7145							
7146							
7147	col. liq.....	1.040	.....	189	∞	∞	s. eth.
7148	ylsh. liq.....	1.326 ¹⁸ / ₁₅	.....	213 d. (115-20 ¹⁵)	∞	s.	s. eth.
7149							
7150	liq.....	1.003	.....	177	s.	.....	.....
7151	col. cr.....	.....	70-1	.....	i.	s. h.	s. eth.
7152	visc. liq., 1.4398	1.0526 ¹⁸ / ₄	.....	214 d.	∞	∞	v. s. eth.
7152H	1.490 ²⁰	1.099	37.5-38.5	152-3 ¹⁰	∞	.....	.....
7152M			170.5- 171.5	219-220 ¹⁰	80	.....	.....
7152R			109-111	151-2 ¹⁰	250	.....	.....
7153							
7154	need. f. bz.....	.....	127	203 ⁷⁸⁸	i.	v. s.	v. s. eth.
7154M			56-57	d.	400 ²⁰	.....	.....
7155	need. f. al.....	.....	199	subl.	s.	v. s.	i. eth.
7155H			165-70	d.	220 ²⁰	.....	.....
7155R			147-9	d.	80 ²⁰	.....	.....
7156							
7157							
7158							
7159							
7160							
7161							
7162	liq.....	0.8357 ²⁵ / ₄	-111.5	68	v. sl. s.	s.	s. eth.
7163	liq., 1.43859...	0.8357 ²⁰ / ₄	< -79	88	sl. s.	v. s.	v. s. eth.
7164	col. liq.....	0.8055 ²⁵ / ₄	-130.7	60	sl. s.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7165	1,2,3-Propanetricarboxylic acid* . See <i>Tricarballic acid</i> .			
7166	1,2,3-Propanetriol* . See <i>Glycerol</i> .			
7167	Propanetrione, diphenyl-* . See <i>Propionic acid</i> .	diphenyl triketone.....	$C_6H_5(CO)_2C_6H_5...$	238.23
7168	Propanoic acid* . See <i>Propionic acid</i> .			
7169	—, 2-amino-3-mercaptopro- . See <i>Cysteine</i> .			
7170	—, 3,3'-dithiobis(2-amino-) . See <i>Cystine</i> .			
7171	—, 2-hydroxy- . See <i>Lactic acid</i> .			
7172	—, 2-methyl-* . See <i>Isobutyric acid</i> .			
7173	1-Propanol* . See <i>Propyl alcohol</i> .			
7173M	—, 2-amino-2-methyl-		$(CH_3)_2C(NH_2)-CH_2OH$	89.14
7174	—, 3-bromo-*	trimethylene bromohydrin...	$BrCH_2CH_2CH_2OH$	139.00
7175	—, 2-chloro-* , acetate	β -chloropropyl acetate; 2-chloropropyl ethanoate*	$CH_3COOCH_2CHClCH_3$	136.58
7176	—, 3-chloro-*	trimethylene chlorohydrin...	$ClCH_2CH_2CH_2OH$	94.54
7177	—, 2,3-dibromo-* ...	β , γ -dibromopropyl alcohol; β -dibromohydrin; allyl alcohol dibromide	$CH_2BrCHBrCH_2OH$	217.91
7178	—, 2,3-dichloro-* ...	β -dichlorohydrin; <i>asym</i> -glycerol dichlorohydrin; β , γ -dichloropropyl alcohol; allyl alcohol dichloride	$CH_2ClCHClCH_2OH$	128.99
7178H	—, —, nitrate.....	β , γ -dichloropropyl nitrate...	$ClCH_2CHClCH_2NO_2$	173.99
7179	—, 2,2-dimethyl-* ...	<i>tert</i> -butylcarbinol; neopentyl alcohol	$(CH_3)_3CCH_2OH$	88.15
7180	—, 2,2-dimethyl-1-phenyl-	<i>tert</i> -butylphenylcarbinol.....	$C_6H_5CHOHC(CH_3)_3$	164.24
7181	—, 2,3-epoxy-* . See <i>Glycidol</i> .			
7182	—, 2-methyl-* . See <i>Isobutyl alcohol</i> .			
7183	—, 2-methylamino-1-phenyl- . See <i>Pseudoephedrine</i> .			
7183M	—, 2-methyl-2-nitro-*	β -nitroisobutyl alcohol.....	$(CH_3)_2C(NO_2)-CH_2OH$	119.12
7184	—, 1-phenyl-	ethylphenylcarbinol.....	$C_2H_5CHOHC_6H_5...$	136.19
7185	—, 3-phenyl-	hydrocinnamyl alcohol.....	$C_6H_5CH_2CH_2CH_2OH$	136.19
7186	2-Propanol* . See <i>Isopropyl alcohol</i> .			
7187	—, nitrate. See <i>Isopropyl nitrate</i> .			
7188	—, nitrite. See <i>Isopropyl nitrite</i> .			
7189	—, 1-chloro-*	propylene chlorohydrin.....	$CH_2ClCHOHCH_3$	94.54
7190	—, —, acetate.....	β -chloroisopropyl ethanoate*	$CH_3COOCH(CH_3)CH_2Cl$	136.58
7191	—, 1,3-dichloro-* ...	α -dichlorohydrin; <i>sym</i> -glycerol dichlorohydrin; <i>sym</i> -dichloroisopropyl alcohol	$CH_2ClCHOHCH_2Cl$	128.99
7192	—, —, nitrate.....	β , β' -dichloroisopropyl nitrate; dichloronitrohydrin	$CH_2ClCH(NO_2)CH_2Cl$	173.99
7193	—, 2-methyl-* . See <i>tert-Butyl alcohol</i> .			
7193M	—, 1,1'-oxydi-	dipropylene glycol; β , β' -dihydroxydi- <i>n</i> -propyl ether	$(CH_3CHOHCH_2)_2O$	134.17
7194	—, 2-phenyl-	α , α -dimethylbenzyl alcohol; dimethylphenylcarbinol	$C_6H_5(CH_3)_2COH...$	136.19
7195	—, 1,1,1-trichloro-2-methyl-* . See <i>Chloretone</i> .			
7196	1-Propanone, 1-phenyl- . See <i>Propiophenone</i> .			
7197	2-Propanone* . See <i>Acetone</i> .			
7198	—, 1-amino-*	aminoacetone; acetonylamine	$CH_3COCH_2NH_2...$	73.09

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7165							
7166							
7167	yel. need.....	.....	68-70	.....	i.	sl. s.	s. eth.
7168							
7169							
7170							
7171							
7172							
7173							
7173M	1.449 ²⁰	0.934	25-26	165; 67.4 ¹⁰	∞	.....	.....
7174	liq.....	1.5710 ²⁰ ₄	.....	98-112 ¹⁸⁵	16.6 c.	∞	∞ eth.
7175	col. liq.....	1.098	.....	152-37 ⁵⁰	i.	s.	s. eth.
7176	liq.....	1.1309 ²⁰ ₄	.....	160-2	50 c.	s.	s. eth.
7177	col. liq.....	2.1682 ⁶ ; 2.1259 ²⁵	.....	219 sl. d.; 118 ¹⁷	sl. s.	s.	s. eth., acet., bz.
7178	col. liq.....	1.3681 ¹¹ ; 1.355 ^{17.5}	.....	182; 81-81.5 ^{13.5}	s.	s.	s. eth.
7178H	liq.....	1.3 ⁷	.....	180	.....	.....	.....
7179	col. cr.....	0.812	53	114; 111.5 ⁷³⁸	sl. s.	v. s.	v. s. eth.
7180	need.....	.....	45	114-6 ¹⁶	i.	s.	.....
7181							
7182							
7183							
7183M	.....	.....	90-95.5	94.5-95.5	350 ²⁰	.....	.....
7184	liq.....	0.9962 ¹⁷ ₄	.....	219 (212)	i.	s.	s. eth.
7185	liq., 1.53565...	1.008	<-18	235.6 (237.4)	s.	∞	∞ eth.
7186							
7187							
7188							
7189	col. liq.....	1.103 ²⁰	.....	127.0	∞	∞	∞ eth.
7190	liq.....	.....	.....	149-50	.....	.....	.....
7191	col. liq., 1.480245 ¹⁷	1.367 ²⁰ ₄ ; 1.3506 ¹⁷ ₄	.....	174	11 ¹⁹	∞	∞ eth.
7192	col. liq.....	1.459	.....	180	i.	s.	s. eth.
7193							
7193M	col. liq.....	1.0224 ²⁰ ₂₀	.....	229.2	∞	s.	.....
7194	pr., 1.5314 ¹⁹ ...	0.9724 ¹⁹ ₄	35-7	202 (215-20 d.)	i.	s.	s. eth.
7195							
7196							
7197							
7198	need. f. al.....	.....	189 d.	.....	v. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7199	2-Propanone, 1-bromo-*	bromoacetone	$\text{CH}_2\text{BrCOCH}_3$. . .	136.99
7200	—, 1-chloro-*	chloroacetone	$\text{CH}_3\text{COCH}_2\text{Cl}$	92.53
7201	—, 1,1-dichloro-*	<i>uns</i> -dichloroacetone; di-chloromethyl methyl ketone	$\text{CH}_3\text{COCHCl}_2$	126.98
7202	—, 1,3-dichloro-*	<i>sym</i> -dichloroacetone; bis-chloromethyl ketone	$\text{CH}_2\text{ClCOCH}_2\text{Cl}$. . .	126.98
7202M	—, 1,3-dihydroxy-*	dihydroxyacetone	$\text{CO}(\text{CH}_2\text{OH})_2$	90.08
7203	—, 1,3-diphenyl-*	dibenzyl ketone; diphenyl-acetone	$(\text{C}_6\text{H}_5\text{CH}_2)_2\text{CO}$. . .	210.26
7204	—, 1-hydroxy-*	See <i>Acetol</i> .		
7205	—, 1-phenyl-	benzyl methyl ketone	$\text{CH}_3\text{COCH}_2\text{C}_6\text{H}_5$. . .	134.17
7206	—, 1,1,3,3-tetra-chloro-*	<i>sym</i> -tetrachloroacetone	$\text{CHCl}_2\text{COCHCl}_2$. . .	231.91
7207	—, 1-ureido-	See <i>Urea, acetonyl-</i> .	$2\text{H}_2\text{O}$	
	Propanoyl*	See <i>Propionyl</i> .		
7208	Propargyl acetate.	See <i>2-Propyn-1-ol, acetate</i> .		
7209	Propargyl alcohol.	See <i>2-Propyn-1-ol*</i> .		
7210	Propargylaldehyde.	See <i>Propiolaldehyde</i> .		
7211	Propargyl bromide.	See <i>Propyne, 3-bromo-*</i> .		
7212	Propargyl chloride.	See <i>Propyne, 3-chloro-*</i> .		
7213	Propargylic acid.	See <i>Propiolic acid</i> .		
7214	Propargyl iodide.	See <i>Propyne, 3-iodo-*</i> .		
7215	Propenal*	See <i>Acrolein</i> .		
7215M	—, 2-methyl-*	See <i>Acrolein, α-methyl-</i> .		
7216	—, 3-phenyl-	See <i>Cinnamaldehyde</i> .		
7216M	Propenamide.	See <i>Acrylamide</i> .		
7217	Propene*	methylethylene; propylene . .	$\text{CH}_2:\text{CHCH}_3$	42.08
7218	—, 1-bromo-*	propenyl bromide	$\text{CH}_3\text{CH}:\text{CHBr}$	120.99
7219	—, 2-bromo-*	isopropenyl bromide	$\text{CH}_3\text{CBr}:\text{CH}_2$	120.99
7220	—, 3-bromo-*	See <i>Allyl bromide</i> .		
7221	—, 1-chloro-*	propenyl chloride; α-chloropropylene	$\text{CH}_3\text{CH}:\text{CHCl}$	76.53
7222	—, 2-chloro-*	isopropenyl chloride; β-chloropropylene	$\text{CH}_3\text{CCl}:\text{CH}_2$	76.53
7223	—, 3-chloro-*	See <i>Allyl chloride</i> .		
7224	—, 3-chloro-1-phenyl-*	(γ-chloropropenyl)benzene; cinnamyl chloride	$\text{C}_6\text{H}_5\text{CH}:\text{CHCH}_2\text{Cl}$. . .	152.62
7225	—, 2,3-dibromo-*	α-bromoallyl bromide; α-epidibromohydrin	$\text{CH}_2\text{BrCBr}:\text{CH}_2$. . .	199.89
7226	—, 1,2-dichloro-*	allylene dichloride	$\text{CHCl}:\text{CClCH}_3$	110.98
7227	—, 2,3-dichloro-*	α-epidichlorohydrin; α-chloroallyl chloride	$\text{CH}_2:\text{CClCH}_2\text{Cl}$	110.98
7228	—, 1,1-diphenyl-	See <i>Stilbene</i> .	$(\text{C}_6\text{H}_5)_2\text{C}:\text{CHCH}_3$. . .	194.26
7229	—, 1,2-epoxy-*	allylene oxide; methyl-oxirene	$\text{CH}_3\text{C}:\text{CH}\text{O}$	56.06
7230	—, 3-ethoxy-*	See <i>Ether, allyl ethyl</i> .		
7231	—, 3-fluoro-*	See <i>Allyl fluoride</i> .		
7232	—, 3-iodo-*	See <i>Allyl iodide</i> .		
7233	—, 3-methoxy-*	See <i>Ether, allyl methyl</i> .		
7234	—, 2-methyl-*	<i>uns</i> -dimethylethylene; isobutylene; γ-butylene	$\text{CH}_2:\text{C}(\text{CH}_3)\text{CH}_3$. . .	56.10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7199	pois. liq.....	1.634 ²³	-54	136.5 ⁷²⁵	sl. s.	sl. s.	s. acet.
7200	col. liq.....	1.15 ²⁰	-44.5	119	s.	s.	s. eth., chl.
7201	col. liq.....	1.234 ¹⁵	.....	120	sl. s.	s.	∞ eth.
7202	pl. or need., 1.47144 ⁴⁶	1.383 ⁴⁶	45	173.4	s.	v. s.	v. s. eth.
7202M	crystallizes as dimeride (C ₃ H ₆ O ₃) ₂	.....	80	.....	s. h.	s. h.	s. h. eth., acet.; i. lgr.
7203	cr. f. dil. al....	.....	34-5	330.5	i.	v. s.	v. s. eth.
7204	col. cr.....	1.019 ⁶ ;	-15.4	216.7	i.	v. s.	v. s. eth.
7205		1.003 ²⁰					
7206	tricl.....	.....	48	.....	.....	.....	.....
7207	.....	.....	.....	.....	.....	.....	.....
7208	.....	.....	.....	.....	.....	.....	.....
7209	.....	.....	.....	.....	.....	.....	.....
7210	.....	.....	.....	.....	.....	.....	.....
7211	.....	.....	.....	.....	.....	.....	.....
7212	.....	.....	.....	.....	.....	.....	.....
7213	.....	.....	.....	.....	.....	.....	.....
7214	.....	.....	.....	.....	.....	.....	.....
7215	.....	.....	.....	.....	.....	.....	.....
7215M	.....	.....	.....	.....	.....	.....	.....
7216	.....	.....	.....	.....	.....	.....	.....
7216M	.....	.....	.....	.....	.....	.....	.....
7217	col. gas.....	liq. 0.6095 ⁻⁴⁷ / ₄ ; 1.937 ⁹ g/l	-185.2	-47.0	44.6 cm ³	1250 cm ³	524.5 cm ³ ac. a.
7218	liq., 1.4554....	1.428 ^{19.5}	-116.6	60.2	.....	.....	.....
7219	liq.....	1.362	-124.8	48.4	.....	.....	.....
7220	.....	.....	.....	.....	.....	.....	.....
7221	liq.....	.....	.....	35-6	.....	.....	.....
7222	liq.....	0.918 ⁹	.....	23 ⁷³⁸	.....	.....	.....
7223	.....	.....	.....	.....	.....	.....	.....
7224	col. liq.....	.....	.....	213-5	i.	∞	∞ eth.
7225	liq.....	1.934 ²⁰ / ₄	.....	140	.....	.....	.....
7226	liq.....	.....	.....	75 (84-6)	.....	.....	.....
7227	col. liq.....	1.205 ²⁵ / ₄ ; 1.236 ⁰ / ₄	.....	94	i.	∞	∞ eth.
7228	leaf. f. al.....	0.984 ⁶⁰	51.5-52	284.5	i.	v. s.	v. s. eth.; s. bz.
7229	liq.....	.....	.....	63	sl. s.	∞	∞ eth.
7230	.....	.....	.....	.....	.....	.....	.....
7231	.....	.....	.....	.....	.....	.....	.....
7232	.....	.....	.....	.....	.....	.....	.....
7233	.....	.....	.....	.....	.....	.....	.....
7234	col. gas.....	.....	.....	-6	i.	v. s.	v. s. eth.; s. H ₂ SO ₄

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7235	Propene, 1-phenyl- .	See <i>Benzene, propenyl-</i> .		
7236	—, 2-phenyl- .	See <i>Benzene, isopropenyl-</i> .		
7237	—, 3-(2-propenoxy)- .	*. See <i>Allyl ether</i> .		
7238	—, 3-(2-propenylthio)- .	o)-*. See <i>Allyl sulfide</i> .		
7239	Propenenitrile* .	See <i>Acrylonitrile</i> .		
7240	Propene oxide	1,2-epoxypropane; propylene oxide; methyloxirane	$\text{OCH}_2\text{CHCH}_3$	58.08
7241	2-Propene-1-thiol*	allyl mercaptan.....	$\text{CH}_2\text{:CHCH}_2\text{SH}$...	74.14
7242	1,2,3-Propenetetracarboxylic acid* .	See <i>Aconitic acid</i> .		
7243	Propenoic acid* .	See <i>Acrylic acid</i> .		
7244	2-Propen-1-ol* .	See <i>Allyl alcohol</i> .		
7245	—, 2-bromo-*	β -bromoallyl alcohol.....	$\text{CH}_2\text{:CBr:CH}_2\text{OH}$	136.99
7246	—, 2-chloro-*	β -chloroallyl alcohol.....	$\text{CH}_2\text{:CClCH}_2\text{OH}$	92.53
7246C	—, 3-chloro-*	γ -chloroallyl alcohol.....	$\text{CHCl:CHCH}_2\text{OH}$	92.53
7248	—, 3-(4-hydroxy-3-methoxyphenyl)- .	See <i>Coniferyl alcohol</i> .		
7249	—, 3-phenyl- .	See <i>Cinnamic alcohol</i> .		
7251	2-Propen-1-one, 1,3-diphenyl- .	See <i>Chalcone</i> .		
7251M	Propenoyl chloride* .	See <i>Acrylyl chloride</i> .		
7252	2-Propenylamine* .	See <i>Allylamine</i> .		
7253	Propenyl bromide .	See <i>Propene, 1-bromo-*</i> .		
7254	Propenyl chloride .	See <i>Propene, 1-chloro-*</i> .		
7254H	Propenyl cyanide .	See <i>Crotononitrile</i> .		
7255	2-Propenyl sulfide* .	See <i>Allyl sulfide</i> .		
7256	Propine .	See <i>Propyne*</i> .		
7256M	Propioin	4-hydroxy-3-hexanone; diethylketol	$\text{C}_2\text{H}_5\text{COCHOH-C}_2\text{H}_5$	116.16
7257	Propiolaldehyde	propynal*; propargylaldehyde	$\text{CH}_3\text{:CCHO}$	54.05
7258	Propiolic acid	propynoic acid*; propargylic acid	$\text{CH}_3\text{:CCOOH}$	70.05
7259	—, ethyl ester.....		$\text{CH}_3\text{:CCOOC}_2\text{H}_5$...	98.10
7260	—, ethyl- .	See <i>2-Pentynoic acid*</i> .		
7261	—, methyl- .	See <i>Tetrolic acid</i> .		
7262	—, o-nitrophenyl-		$\text{NO}_2\text{C}_6\text{H}_4\text{:C-COOH}$	191.14
7263	—, p-nitrophenyl-		$\text{NO}_2\text{C}_6\text{H}_4\text{:C-COOH}$	191.14
7264	—, phenyl-	phenylpropynoic acid.....	$\text{C}_6\text{H}_5\text{:C:CCOOH}$...	146.14
7264M	—, —, ethyl ester.....		$\text{C}_6\text{H}_5\text{:C:CCOOC}_2\text{H}_5$	174.19
7265	Propiolic alcohol .	See <i>2-Propyn-1-ol*</i> .		
7266	Propionaldehyde	propanal*; methylacetaldehyde	$\text{CH}_3\text{CH}_2\text{CHO}$	58.08
7267	—, oxime	propanal oxime*; propionaldoxime	$\text{CH}_3\text{CH}_2\text{CH:NOH}$	73.09
7269	—, α, β-dihydroxy- .	See <i>Glyceraldehyde</i> .		
7270	Propionaldoxime .	See <i>Propionaldehyde, oxime</i>		
7271	Propionamide	propanamide*; propionic acid amide	$\text{CH}_3\text{CH}_2\text{CONH}_2$...	73.09
7272	—, N-phenyl- .	See <i>Propionanilide</i> .		
7273	Propionanilide	N-phenylpropionamide.....	$\text{CH}_3\text{CH}_2\text{CONH-C}_6\text{H}_5$	149.19
7274	2-Propionaphthone, 4-bromo-1-hydroxy- .	4-bromo-2-propionyl-1-naphthol	$\text{CH}_3\text{CH}_2\text{COC}_{10}\text{H}_6\text{-BrOH}$	279.14
7275	—, 1-hydroxy-	ethyl 1-hydroxy-2-naphthyl ketone	$\text{CH}_3\text{CH}_2\text{COC}_{10}\text{H}_6\text{-OH}$	200.23
7276	Propione .	See <i>3-Pentanone*</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7235							
7236							
7237							
7238							
7239							
7240	col. liq.....	0.859 $\frac{0}{4}$; 0.8313 $\frac{20}{20}$	.....	35	65 ³⁰	∞	∞ eth.
7241	liq.....	.....	.....	90	i.	∞	∞ eth.
7242							
7243							
7244							
7245	liq.....	1.6 ¹⁵	.....	152	.....	.....	.....
7246	liq.....	.....	.....	136-40	.....	.....	.....
7246C	liq.....	.....	.....	153	.....	.....	.....
7248							
7249							
7251							
7251M							
7252							
7253							
7254							
7254H							
7255							
7256							
7256M	1.4340 ²¹	0.956 $\frac{21}{4}$	.....	57-78 ¹⁰	.....	.....	.....
7257	oil.....	.....	.....	61	v. s.	.....	.....
7258	col. liq.....	1.139 $\frac{15}{15}$	9	144 d.	s.	s.	s. eth.
7259	col. liq.....	0.968 $\frac{15}{15}$	.....	119.5	i.	v. s.	v. s. eth., chl.
7260							
7261							
7262	need. f. h. w....	.....	155.5 d.	exp. 155-6	v. s. h.	s.	s. eth., alk.; sl. s. chl.; i. CS ₂
7263	need. f. al.....	.....	181 d.	d.	sl. s.	s. h.	s. eth.; i. pet. eth.
7264	col. trim. need. f. w.	.....	137	subl.	v. sl. s.	v. s.	v. s. eth.; 3.32 CCl ₄
7264M	oil.....	1.063 $\frac{13}{4}$	.....	260-70 sl. d.	.....	.....	.....
7265							
7266	col. liq., 1.36356	0.807 $\frac{20}{4}$	-81	48.8	20 ²⁰	∞	∞ eth.
7267	liq.....	0.926 $\frac{20}{4}$	21.5	131-5	.....	.....	.....
7269							
7270							
7271	col. rhomb. leaf. f. chl., 1.4161 ^{107.8}	1.042	79	213	s.	s.	s. eth.
7272							
7273	col. leaf. f. al..	1.175	104	222.2	0.42 ²⁴	v. s.	v. s. eth.
7274	yel. need.....	.....	98	.....	i.	s.	s. eth.
7275	yel.-grn. leaf...	.....	81	.....	i.	s.	s. eth.
7276							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7277	Propionic acid	propanoic acid*; methyl-acetic acid	$\text{CH}_3\text{CH}_2\text{COOH}$. . .	74.08
7278	—, amide.	See <i>Propionamide</i> .		
7279	—, amyl ester	amyl propionate; pentyl propanoate*	$\text{CH}_3\text{CH}_2\text{COO}-(\text{CH}_2)_4\text{CH}_3$	144.21
7280	—, butyl ester	butyl propionate; butyl propanoate*	$\text{CH}_3\text{CH}_2\text{COOC}_4\text{H}_9$	130.18
7281	—, ethylene ester.	See <i>Glycol, dipropionate</i> .		
7282	—, ethyl ester		$\text{CH}_3\text{CH}_2\text{COOC}_2\text{H}_5$	102.13
7283	—, furfuryl ester.	See <i>Furfuryl alcohol, propionate</i> e.		
7284	—, isoamyl ester	isoamyl propionate; γ -methylbutyl propanoate*	$\text{CH}_3\text{CH}_2\text{COOC}_5\text{H}_{11}$	144.21
7285	—, isobutyl ester	β -methylpropyl propanoate*	$\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}(\text{CH}_3)_2$	130.18
7286	—, isopropyl ester		$\text{CH}_3\text{CH}_2\text{COOCH}(\text{CH}_3)_2$	116.16
7287	—, methyl ester	methyl propanoate*; methyl propionate	$\text{CH}_3\text{CH}_2\text{COOCH}_3$	88.10
7288	—, <i>p</i> -phenylphenacyl ester		$\text{CH}_3\text{CH}_2\text{COOCH}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	268.30
7289	—, piperazinium salt		$\text{C}_4\text{H}_{10}\text{N}_2\cdot 2\text{C}_2\text{H}_5\text{COOH}$	234.29
7290	—, propyl ester	propyl propanoate*; <i>n</i> -propyl propionate	$\text{CH}_3\text{CH}_2\text{COOC}_3\text{H}_7$	116.16
7290M	—, α -amino-.	See <i>Alanine</i> .		
7291	—, β -amino-.	See β - <i>Alanine</i> .		
7292	—, α -amino- β -hydroxy-.	See <i>Serine</i> .		
7293	—, α -benzal-.	See <i>Cinnamic acid, α-methyl-</i> .		
7294	—, β -benzal-.	See <i>3-Butenoic acid, 4-phenyl-</i> .		
7295	—, α -benzamido-.	See <i>Alanine, N-benzoyl-</i> .		
7296	—, β -benzoyl-	γ -keto- γ -phenylbutyric acid; 4-oxo-4-phenylbutanoic acid	$\text{C}_6\text{H}_5\text{COCH}_2\text{CH}_2\text{COOH}$	178.18
7296H	—, α -benzylidene-.	See <i>Cinnamic acid, α-methyl-</i> .		
7296R	—, β -benzylidene-.	See <i>3-Butenoic acid, 4-phenyl-</i> .		
7297	—, α -bromo-(<i>dl</i>)	<i>dl</i> -2-bromopropanoic acid*	$\text{CH}_3\text{CHBrCOOH}$. .	152.99
7298	—, α -bromo-, ethyl ester	ethyl 2-bromopropanoate* . . .	$\text{CH}_3\text{CHBrCOOC}_2\text{H}_5$	181.04
7299	—, β -bromo-	3-bromopropanoic acid*	$\text{CH}_2\text{BrCH}_2\text{COOH}$	152.99
7300	—, β -carbamyl-.	See <i>Succinamic acid</i> .		
7301	—, α -chloro-	2-chloropropanoic acid*	$\text{CH}_3\text{CHClCOOH}$. .	108.53
7302	—, —, ethyl ester	ethyl 2-chloropropanoate* . . .	$\text{CH}_3\text{CHClCOOC}_2\text{H}_5$	136.58
7303	—, β -chloro-	3-chloropropanoic acid*	$\text{CH}_2\text{ClCH}_2\text{COOH}$. .	108.53
7304	—, —, ethyl ester	ethyl 3-chloropropanoate* . . .	$\text{CH}_2\text{ClCH}_2\text{COOC}_2\text{H}_5$	136.58
7305	—, α -cyano-	2-cyanopropanoic acid*; methylmalonic mononitrile; methylecyanoacetic acid	$\text{CH}_3\text{CH}(\text{CN})\text{COOH}$	99.09
7306	—, α, β -dibromo-	2,3-dibromopropanoic acid* . .	$\text{CH}_2\text{BrCHBrCOOH}$	231.89
7307	—, β, β -diethyl-.	See <i>Valeric acid, β-ethyl-</i> .		
7308	—, α, β -dihydroxy-.	See <i>Glyceric acid</i> .		
7309	—, α, α -dimethyl-.	See <i>Pivalic acid</i> .		
7310	—, α -hydroxy-.	See <i>Lactic acid</i> .		
7311	—, β -hydroxy-.	See <i>Hydracrylic acid</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7277	col. liq., 1.38736 ^{19.9}	0.992	-22	141.1	∞	∞	∞ eth., chl.
7278							
7279	.....	0.8761 ¹⁵ / ₄	-73.1	164-6	i.	∞	∞ eth.
7280	col. liq.....	0.8828 ¹⁵	-89.55	145.4	v. sl. s.	∞	∞ eth.
7281							
7282	col. liq., 1.38385 ^{20.2}	0.89574 ¹⁵ ; 0.8846 ²⁵	-73.9 (-72.6)	99.10	2.4 ²⁰	∞	∞ eth.
7283							
7284	col. liq., 1.4065	0.870	.....	160.2	0.09 ²⁵	s.	s. eth.
7285	col. liq.....	0.8876 ⁰	-71.4	136.8	v. sl. s.	s.	s. eth.
7286	col. liq.....	0.893 ⁰	.....	111.3	0.6 ²⁵	∞	∞ eth.
7287	col. liq., 1.37767 ^{18.5}	0.9148 ²⁰ / ₄	-87.5	79.9	6.5 ²⁰	∞	∞ eth.
7288	.....		102	.....			.....
7289	wh. cr.....		124-5	.....	s.	s.	i. eth.; s. h. dioxane
7290	col. liq., 1.3935	0.883	-75.9	123.4; 122-5	0.5	∞	∞ eth.
7290M							
7291							
7292							
7293							
7294							
7295							
7296	leaf. f. al.....		116	d.	s. h.	s.	s. eth., chl., CS ₂ , bz.; i. lgr.
7296H							
7296R							
7297	col. pr., 1.4753	1.700	25.7	203.5	v. s.	v. s.	s. eth.
7298	col. liq.....	1.394 ²⁰ / ₄	.....	159-61 d. (160-5)	i.	∞	∞ eth.
7299	col. leaf.....	1.48	62.5	.....	s.	s.	s. eth.
7300							
7301	col. liq., [α] -2.36 ²¹⁷ / _D	1.28 ⁰	.....	186	∞	∞	∞ eth.
7302	col. liq., 1.41850	1.087	.....	146	v. sl. s.	∞	∞ eth.
7303	col. leaf. f.w...	hyg.	41 (61)	204	s.	s.	∞ eth.
7304	col. liq.....	1.1086 ²⁰ / ₄	.....	162-3 ⁷⁶⁵	v. sl. s.	∞	∞ eth.
7305	oil.....	1.14 ²⁰ / ₄	.....	142-5 ¹¹	s.	s.	.....
7306	monocl. need. or pl.	.....	51; 64	220-40 d.; 160 ²⁰	1945 ¹¹	160 ²⁰	304 ¹⁰ eth.; s. bz., CS ₂
7307							
7308							
7309							
7310							
7311							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7312	Propionic acid, α-iodo-	2-iodopropanoic acid*.....	$\text{CH}_3\text{CHICOOH}$...	199.99
7313	—, β-iodo-	3-iodopropanoic acid*.....	$\text{CH}_2\text{ICH}_2\text{COOH}$...	199.99
7314	—, α-keto-	See <i>Pyruvic acid</i> .		
7315	—, α-methyl-	See <i>Isobutyric acid</i> .		
7316	—, α-phenyl-	See <i>Hydratropic acid</i> .		
7317	—, β-phenyl-	See <i>Hydrocinnamic acid</i> .		
7318	Propionic anhydride ...	propanoic anhydride*.....	$(\text{CH}_3\text{CH}_2\text{CO})_2\text{O}$...	130.14
7319	Propionitrile	propanenitrile*; ethyl cyanide	$\text{CH}_3\text{CH}_2\text{CN}$	55.08
7320	—, α, α-dimethyl- ...	2,2-dimethylpropanenitrile*; <i>tert</i> -butyl cyanide; trimethylacetoneitrile	$(\text{CH}_3)_3\text{CCN}$	83.13
7321	—, β-hydroxy-	See <i>Hydracrylonitrile</i> .		
7322	Propionyl bromide	propanoyl bromide*.....	$\text{CH}_3\text{CH}_2\text{COBr}$	136.99
7323	—, α-methyl-	See <i>Isobutyryl bromide</i> .		
7324	Propionyl chloride	propanoyl chloride*.....	$\text{CH}_3\text{CH}_2\text{COCl}$	92.53
7325	—, α-methyl-	See <i>Isobutyryl chloride</i> .		
7325M	Propionyl fluoride	propanoyl fluoride*.....	$\text{CH}_3\text{CH}_2\text{COF}$	76.07
7326	Propionyl iodide	propanoyl iodide*.....	$\text{CH}_3\text{CH}_2\text{COI}$	183.99
7327	Propiophenone	ethyl phenyl ketone; 1-phenyl-1-propanone	$\text{C}_2\text{H}_5\text{COC}_6\text{H}_5$	134.17
7328	—, β-acetyl-	See <i>Valerophenone, γ-oxo-</i> .		
7329	—, 2,4-dihydroxy- ...	4-propionylresorcinol.....	$\text{CH}_3\text{CH}_2\text{COC}_6\text{H}_3(\text{OH})_2$	166.17
7330	Propional	See <i>Barbituric acid, 5,5-dipropyl-</i> .		
	Propyl . For propyl derivatives see the parent compounds (e.g., for propylbenzene see			
7331	Propyl alcohol (n)	1-propanol*; ethylcarbinol...	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$...	60.09
7332	—, derivatives.	See under 1- <i>Propanol</i> *.		
7333	Propylamine*(n)		$\text{CH}_3(\text{CH}_2)_2\text{NH}_2$...	59.11
7334	—, α, α-dimethyl-	See <i>tert-Amylamine</i> .		
7335	—, α, β-dimethyl- ...	3-amino-2-methyl- <i>n</i> -butane; methylisopropylcarbinylamine	$(\text{CH}_3)_2\text{CHCH}(\text{CH}_3)\text{NH}_2$	87.16
7336	—, β, β-dimethyl- ...	<i>tert</i> -butylmethylamine; 1-amino-2,2-dimethylpropane	$(\text{CH}_3)_3\text{CCH}_2\text{NH}_2$...	87.16
7337	—, α-ethyl-	diethylcarbinylamine; <i>sec-n</i> -amylamine; 3-aminopentane	$\text{CH}_3\text{CH}_2\text{CH}(\text{C}_2\text{H}_5)\text{NH}_2$	87.16
7338	—, α-methyl-	See <i>sec-Butylamine</i> .		
7339	—, β-methyl-	See <i>Isobutylamine</i> .		
7340	—, <i>N</i>-methyl-		$\text{CH}_3\text{NHC}_3\text{H}_7$	73.14
7341	—, <i>N</i>-nitro-	<i>n</i> -propylnitramine.....	$\text{C}_3\text{H}_7\text{NHN}\text{O}_2$	104.11
7341M	—, α, α, β-trimethyl-	2-amino-2,3-dimethyl- <i>n</i> -butane	$(\text{CH}_3)_2\text{CHC}(\text{CH}_3)_2\text{NH}_2$	101.19
7341P	—, α, β, β-trimethyl-		$(\text{CH}_3)_3\text{CCH}(\text{CH}_3)\text{NH}_2$	101.19
7342	Propyl borate	tripropyl borate; tripropoxyboron	$\text{B}(\text{OC}_3\text{H}_7)_3$	188.08
7343	Propyl bromide (n)	1-bromopropane*.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$...	123.00
7344	Propyl chloride (n)	1-chloropropane*.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$...	78.54

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7312	pr. or need....	.....	45.5	105 ^{0.3}	sl. s.	v. s.	v. s. eth.
7313	leaf.....	.....	82	.....	8 ²⁵	*v. s.	v. s. eth.
7314							
7315							
7316							
7317							
7318	col. liq., 1.4038	1.0336 $\frac{0}{4}$; 1.010 $\frac{20}{4}$	-45	169.3 (166)	d.	d.	∞ eth.
7319	col. liq., 1.36888 ^{14.6}	0.783 $\frac{21}{4}$	-91.9 (-104)	97.1 (96-7)	11.9 ⁴⁰ , 28 ¹⁰⁰	∞	s. eth.
7320	cr.....	.....	15-6	105-6	.....	.....	.....
7321							
7322	liq.....	1.521 ¹⁶	.....	103.5	d.	d.	s. eth.
7323							
7324	col. liq., 1.40507	1.065	-94	80	d.	d.	s. eth.
7325							
7325M	col. liq.....	0.972 ¹⁵	.....	44	.....	.....	.....
7326	liq.....	.....	.....	127	d.	d.	.....
7327	col. leaf. or liq. 1.52900 ^{15.9}	1.012 $\frac{20}{4}$	21	218	i.	s.	s. eth.
7328							
7329	.....	.....	97.5	.....	sl. s.	s.	s. eth.
7330	<i>Benzene, propyl-</i>). For propyl esters of organic acids see the acids.						
7331	col. liq., 1.38543	0.8044 $\frac{20}{4}$; 0.7998 $\frac{25}{4}$	-127	97.19 (97.8)	=	∞	∞ eth.
7332							
7333	col. liq., 1.39006 ^{16.6}	0.719	-83	48.7	s.	∞	∞ eth.
7334							
7335	liq., 1.40959 ^{17.9}	0.7574 ¹⁹	.....	84-87	v. s.	s.	.....
7336	liq.....	.....	.....	82-3	.....	.....	.....
7337	oil.....	0.7487 $\frac{20}{4}$	.....	91	.....	s.	.....
7338							
7339							
7340	col. liq.....	0.720 ¹⁷	.....	62-4	s.	s.	.....
7341	col. liq.....	1.103 ¹⁵	-21	128 ⁴⁰	sl. s.	v. s.	v. s. eth.
7341M	1.4096 ¹⁷	0.7683 $\frac{0}{0}$	.....	104-5	.....	.....	.....
7341P	.....	.....	-20	103	v. s. c.	.....	.....
7342	col. liq.....	0.867 ¹⁶	.....	175	d.	∞	∞ eth.
7343	liq., 1.43414...	1.353 $\frac{20}{4}$	-110	70.9	0.25 ²⁰	∞	= eth.
7344	col. liq., 1.38856	0.890 $\frac{20}{4}$	-122.8	47.2 (45-7)	0.27 ²⁰	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7345	n-Propyl cyanide.	See <i>Butyronitrile</i> .		
7346	Propylene.	See <i>Propene</i> *.		
7347	Propylene aldehyde.	See <i>Crotonaldehyde</i> .		
7348	Propylene bromide.	See <i>Propane</i> , 1,2-dibromo*.		
7349	Propylene chloride.	See <i>Propane</i> , 1,2-dichloro*.		
7350	Propylene chlorohydrin.	See 2- <i>Propanol</i> , 1-chloro*.		
7351	Propylenediamine.	See 1,2- <i>Propanediamine</i> *.		
7352	Propylene glycol.	See 1,2- <i>Propanediol</i> *.		
7353	Propylene iodide.	See <i>Propane</i> , 1,2-diiodo*.		
7354	Propylene oxide.	See <i>Propene oxide</i> .		
7355	—, γ -chloro-.	See <i>Epichlorohydrin</i> .		
7356	—, γ -cyano-.	See <i>Epicyanohydrin</i> .		
7357	—, γ -iodo-.	See <i>Epiiodohydrin</i> .		
7358	Propyl ether	di-n-propyl ether; 1-propoxypropane*	$(\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{O}$. .	102.17
7359	Propyl fluoride (n)	1-fluoropropane*	$\text{CH}_3\text{CH}_2\text{CH}_2\text{F}$	62.09
7360	Propylidene bromide.	See <i>Propane</i> , 1,1-dibromo*.		
7361	Propylidene chloride.	See <i>Propane</i> , 1,1-dichloro*.		
7362	Propyl iodide (n)	1-iodopropane*	$\text{CH}_3\text{CH}_2\text{CH}_2\text{I}$	170.01
7363	Propyl isocyanide (n) . . .	propylcarbylamine	$\text{CH}_3(\text{CH}_2)_2\text{NC}$	69.10
7364	n-Propyl mercaptan.	See 1- <i>Propanethiol</i> *.		
7365	n-Propyl mustard oil.	See <i>Isothiocyanic acid</i> , propyl ester.		
7366	Propyl nitrate (n)		$\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_3$. .	105.09
7367	Propyl nitrite (n)		$\text{CH}_3\text{CH}_2\text{CH}_2\text{ONO}$. .	89.09
7368	Propyl sulfate	di-n-propyl sulfate	$(\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{SO}_4$	182.23
7369	Propyl sulfide	1-propylthiopropene*; di-n-propyl sulfide	$(\text{C}_3\text{H}_7)_2\text{S}$	118.23
7370	Propyl sulfone	1-propylsulfonylpropane*; dipropyl sulfone	$(\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{SO}_2$	150.23
7370M	Propyl sulfoxide	1-(propylsulfinyl)propane*; di-n-propyl sulfoxide	$(\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{SO}$	134.23
7371	Propynal *.	See <i>Propionaldehyde</i> .		
7372	Propyne *	propine; methylacetylene . . .	$\text{CH}_3\text{C}:\text{CH}$	40.06
7373	—, 3-bromo*	propargyl bromide; γ -bromoallylene	$\text{CH}:\text{CCH}_2\text{Br}$	118.97
7374	—, 3-chloro*	propargyl chloride	$\text{CH}:\text{CCH}_2\text{Cl}$	74.51
7374M	—, 1,3-dibromo*		$\text{BrC}:\text{CCH}_2\text{Br}$	197.88
7375	—, 3-ethoxy*	ethyl propargyl ether	$\text{CH}:\text{CCH}_2\text{OC}_2\text{H}_5$. .	84.11
7375T	—, 1-iodo*		$\text{Cl}:\text{CCH}_3$	165.97
7376	—, 3-iodo*	propargyl iodide	$\text{CH}:\text{CCH}_2\text{I}$	165.97
7377	—, 3-methoxy*	methyl propargyl ether	$\text{CH}:\text{CCH}_2\text{OCH}_3$. . .	70.09
7378	—, 1-phenyl-	methylphenylacetylene; 1-propynylbenzene; phenylallylene	$\text{C}_6\text{H}_5\text{C}:\text{CCH}_3$	116.15
7379	Propynoic acid *.	See <i>Propiolic acid</i> .		
7380	2-Propyn-1-ol *	propargyl alcohol; ethynylcarbinol; acetylenylcarbinol; propiolic alcohol	$\text{CH}:\text{CCH}_2\text{OH}$	56.06
7381	—, acetate	propargyl acetate	$\text{CH}_3\text{COOCH}_2\text{C}:\text{CH}$	98.10
7382	Propytal.	See <i>Barbituric acid</i> , 5,5-dipropyl-.		
7383	Protocatechualdehyde	3,4-dihydroxybenzaldehyde; 3,4-dihydroxybenzenecarbonyl*	$(\text{HO})_2\text{C}_6\text{H}_3\text{CHO}$. . .	138.12
7384	—, dimethyl ether.	See <i>Veratraldehyde</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7345							
7346							
7347							
7348							
7349							
7350							
7351							
7352							
7353							
7354							
7355							
7356							
7357							
7358	col. liq., 1.3807	0.7360 ²⁰ ₄	-122	91	0.25 ²⁵	∞	∞ eth.
7359	col. gas, 1.3326 ⁻²⁰	0.7788 ^{-3.2}	-159	-3.2	sl. s.	v. s.	∞ eth.
7360							
7361							
7362	col. liq., 1.50508	1.747	-101.4	102.4	.0867 ²⁰	∞	∞ eth.
7363	liq.	.....	.....	99.5	i.	∞	∞ eth.
7364							
7365							
7366	liq., 1.3972....	1.058 ²⁰ ₄	.....	100.5	v. sl. s.	s.	s. eth.
7367	liq., 1.3613....	0.935	.....	57	.....	s.	s. eth.
7368	col. oil, 1.4139 ²⁰ φ	1.11 ^{22.5}	d. 140-70	120 ²⁰ ;	i.; sl. d.	.....	.....
7369	liq.	0.814 ¹⁷	frz. -101.9	141-2	i.	s.	s. eth.
7370	sc. ....	.....	29-30	.....	sl. s.	s.	s. eth.
7370M		.....	15	not dist.	sl. s.	s.	s.
7371							
7372	gas.	liq. 0.6785 ⁻²⁷ ₄ ; 1.787 ⁰ g/l	-104.7; frz. -110	-23.3	v. sl. s.	v. s.	2142 ¹⁶ cm ³ eth.
7373	liq.	1.520	.....	88-90	.....	.....	.....
7374	liq.	1.0454 ⁵	.....	65	i.	∞	∞ eth.
7374M	liq.	2.137 ⁰	.....	73-4 ³⁰	.....	.....	.....
7375	liq., 1.40390....	0.8326	.....	80	i.	s.	s. eth.
7375T	need. f. w.	1.857 ¹¹²	93-4	d.	sl. s.	v. s.	v. s.
7376	liq.	2.018 ⁰	.....	115	.....	.....	s. eth.
7377	col. liq.	0.83 ¹³	.....	62	sl. s.	∞	∞ eth.
7378	arom. oil. ....	.....	.....	185	i.	.....	s. eth.
7379							
7380	col. liq., 1.43064	0.9715 ²⁰ ₄	-17	114-115	s.	∞	∞ eth.
7381	col. liq., 1.42047	1.005	.....	125	sl. s.	s.	s. eth.
7382							
7383	col. tab. f. w. ....	.....	154	d.	5	78.9 h.	v. s. eth.
7384							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7385	Protocatechualdehyde , —, methylene ether.	4-ethyl 3-methyl ether. See <i>Benzaldehyde</i> . See <i>Piperonal</i> .	4-ethoxy-3-meth	
7386	—, 3-methyl ether.	See <i>Vanillin</i> .		
7387	—, 4-methyl ether.	See <i>Isovanillin</i> .		
7388	Protocatechuic acid ...	3,4-dihydroxybenzoic acid; 3,4-dihydroxybenzenecarboxylic acid*	(OH) ₂ C ₆ H ₃ COOH	154.12
7390	—, dimethyl ether.	See <i>Veratric acid</i> .		
7391	—, methylene ether.	See <i>Piperonylic acid</i> .		
7392	Protopine		C ₂₀ H ₁₉ NO ₅	353.36
7393	Protoveratrine		C ₃₂ H ₅₁ NO ₁₁	625.74
7373M	Provitamin A .	See <i>β-Carotene</i> .		
7394	Prussic acid .	See <i>Hydrocyanic acid</i> .		
7395	Prussite .	See <i>Cyanogen</i> .		
7396	Pseudoaconine, acetylbenzoyl- .	See <i>Indaconitine</i> .		
7397	—, acetylveratryl-	See <i>Pseudoaconitine</i> .		
7398	Pseudoaconitine	acetylveratrylpseudoaconine..	C ₃₆ H ₄₉ NO ₁₂	687.76
7399	Pseudobutylene .	See <i>2-Butene*</i> .		
7400	Pseudobutylene glycol .	See <i>2,3-Butanediol*</i> .		
7401	Pseudocinchonine .	See <i>Cinchotine</i> .		
7402	Pseudocodeine		C ₁₈ H ₂₁ NO ₃	299.36
7403	Pseudoconhydrine ...	ψ-conhydrine	C ₈ H ₁₇ NO.....	143.23
7404	Pseudoconiceine		C ₈ H ₁₅ N.....	125.21
7405	Pseudocumene	1,2,4-trimethylbenzene; <i>as</i> -trimethylbenzene	(CH ₃) ₃ C ₆ H ₃	120.19
7406	—, 5-nitro-.....		NO ₂ C ₆ H ₂ (CH ₃) ₃ ...	165.19
7407	—, 6-nitro-.....	1,2,4-trimethyl-6-nitrobenzene	NO ₂ C ₆ H ₂ (CH ₃) ₃ ...	165.19
7408	—, 3,5,6-trinitro-....		(NO ₂) ₃ C ₆ (CH ₃) ₃ ...	255.19
7409	Pseudocumenol	2,4,5-trimethylphenol.....	(CH ₃) ₃ C ₆ H ₂ OH...	136.19
7410	Pseudocumidine	2,4,5-trimethylaniline.....	(CH ₃) ₃ C ₆ H ₂ NH ₂ ...	135.20
7411	Pseudoephedrine (d) ..	2-methylamino-1-phenyl-1-propanol (one form); <i>d</i> -isoeephedrine	C ₆ H ₅ CHOHCH-(NHCH ₃)CH ₃	165.23
7412	—, hydrochloride.....		C ₁₀ H ₁₅ NO·HCl...	201.69
7413	Pseudoheptyl alcohol .	See <i>1-Butanol</i> , 2-ethyl-*		
7414	Pseudohyoscyamine ...		C ₁₇ H ₂₃ NO ₃	289.36
7415	3-Pseudoindolone, 2-chloro- .	See <i>Isatin chloride</i> .		
7416	Pseudoisatin, 1-acetyl-	acetylisatin.....	C ₆ H ₄ N(COCH ₃)- COCO	189.16
7417	Pseudoleucaniline .	See <i>mp-Leucaniline</i> .		
7418	Pseudomorphine		C ₂₄ H ₃₅ N ₂ O ₆	568.65
7419	—, hydrochloride (<i>l</i>)....		C ₂₄ H ₃₅ N ₂ O ₆ ·2HCl·2H ₂ O	677.61
7420	Pseudopelletierine	methylgranatonine; ψ-pelletierine	C ₉ H ₁₆ NO.....	153.22
7421	Pseudotropine, benzo-	yl-. See <i>Tropacocaine</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7385	oxy-						
7386							
7387							
7388							
7389	monocl. need.	1.542 ⁴	199 d.	.....	1.82 ¹⁴ , 27 ⁸⁰	v. s.	s. eth.
7390							
7391							
7392	monocl. cr. ....	.....	207	.....	i.	v. sl. s.	v. sl. s. eth.; s. acet.; sl. s. NH ₄ OH, bz. sl. s. eth., chl.
7393	rect. tab. ....	.....	245-50	.....	.....	sl. s.	sl. s. eth., chl.
7393.M							
7394							
7395							
7396							
7397							
7398	rhomb. f. chl. + eth.	.....	211-2 d.	.....	v. sl. s.	s.	s. eth., chl.
7399							
7400							
7401							
7402	col. need., 1.574, 1.602, 1.647	1.315; 1.290 ¹⁸⁰	181	.....	sl. s.	s.	.....
7403	slend. col. need., [α] _D ¹⁵ + 11	.....	105-6	236.5	s.	s.	s. eth., bz.
7404	oily liq.	0.8776 ¹⁵	.....	171-2	.....	.....	.....
7405	col. liq., 1.50672 ^{15.3}	0.876	-57.4 (-61)	169.8 (162-5)	i.	s.	s. eth.
7406	lng. col. or grn.-yel. need.	.....	65; 45-6 (71)	265	.....	s.	s. pet. eth.
7407	grn. pr. ....	.....	20	.....	.....	s.	.....
7408	pr. ....	.....	185	.....	i.	v. sl. s. h.	s. h. bz.
7409	need. f. w. ....	.....	72	235	v. v. sl. s.	v. s.	v. s. eth.
7410	col. need. f. al.	0.957	66-8	234-5	0.12 ¹⁹	s.	s. eth., chl.
7411	col. rhomb. tab. f. eth.	.....	116-7	.....	sl. s. c.	s.	s. eth., chl.
7412	ylsh. need. ....	.....	176	.....	s.	s.	.....
7413							
7414	ylsh. need. ....	.....	133-4	.....	sl. s.	v. s.	s. eth., chl.
7415							
7416	yel. need. f. bz.	.....	141	.....	sl. s.	s.	s. bz.; d. h. HCl
7417							
7418	crusts or need.	.....	327 d.	.....	i.	i.	i. eth., chl.; s. alk., NH ₄ OH
7419	cr. powd. ....	.....	.....	.....	70 ¹⁰	.....	.....
7420	pl. f. pet. eth., 1.47596 ^{99.5}	1.001 ¹⁰⁰	48-9	246	s.	v. s.	v. s. eth.; s. chl., bz.; sl. s. pet. eth.
7421							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7422	Pseudotropine.....		$C_8H_{15}NO$	141.21
7423	Pukateine (I).....		$C_{17}H_{17}NO_3$	283.32
7424	Pulegone.....	4(8)- <i>p</i> -menthen-3-one.....	$C_{10}H_{16}O$	152.23
7425	Punicine.....	See <i>Pelletierine</i> .		
7426	Purine.....	imidazo[4,5- <i>d</i>]pyrimidine....	$C_5H_4N_4$	120.11
7427	—, 6-amino-.	See <i>Adenine</i> .		
7428	—, 2,6-dioxy-.	See <i>Xanthine</i> .		
7429	—, 2,6,8-trioxy-.	See <i>Uric acid</i> .		
7430	2,6(1,3)-Purinedione.	See <i>Xanthine</i> .		
7431	2,6,8(1,3,9)-Purinetrio	ne. See <i>Uric acid</i> .		
7432	6(1)-Purinone.	See <i>Hypoxanthine</i> .		
7433	Purpuric acid, ammoniu	m salt. See <i>Murexide</i> .		
7434	Purpurin.....	1,2,4-trihydroxyanthraquinone	$C_6H_4(CO)_2C_6H(OH)_3$	256.20
7435	Purpuroxanthin.....	1,3-dihydroxyanthraquinone	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.20
7436	Putrescine.....	1,4-butanediamine*; tetramethylenediamine	$NH_2(CH_2)_4NH_2$...	88.15
7437	Pyraconitine.....		$C_{32}H_{43}NO_9$	585.68
7438	Pyran, tetrahydro-....	pentamethylene oxide.....	$O(CH_2)_4CH_2$	86.13
7439	1,4-Pyran, 4-oxo-.	See 1,4-Pyrone.		
7440	1,2-Pyran-5-carboxylic	acid, 2-oxo-. See <i>Coumalic acid</i> .		
7441	1,4-Pyran-2,5-dicarbox	ylic acid, tetrahydro-2,6	6,6-trimethyl-*. See <i>Cin-</i>	
7442	1,4-Pyran-2,6-dicarbox	ylic acid, 3-hydroxy-4-k	eto-. See <i>Meconic acid</i> .	
7443	2,4-Pyrandione, 3-acet	yl-6-methyl-. See <i>Dehydro-</i>		
7444	Pyrantin.	See <i>Succinamide, N-p-phenetyl-</i>		
7445	Pyrazine.....	1,4-diazine; paradiazine; piazine	$N:CHCH:NCH:CH$	80.09
7446	—, 2,5-dimethyl-.	See <i>Ketine</i> .		
7447	—, hexahydro-.	See <i>Piperazine</i> .		
7448	—, tetraphenyl-.	See <i>Amaron</i> .		
7449	Pyrazole.....	1,2-diazole; α -pyrromonazole	$NHN:CHCH:CH$	68.08
7450	—, 4,5-dihydro-.	See 2-Pyrazoline.		
7451	—, 4,5-dihydro-5-ox	o-. See 5-Pyrazolone.		
7452	2-Pyrazoline.....	Δ^2 -pyrazoline; 4,5-dihydropyrazole; pyrazoline	$NHN:CHCH_2CH_2$	70.09
7453	—, 1-phenyl-.....		$C_6H_5NN:CHCH_2CH_2$	146.19
7454	3-Pyrazolone, 1,5-dime	thyl-2-phenyl-. See <i>Antipyrine</i> .		
7455	—, 1,5-dimethyl-2-p	henyl-3-thio-. See <i>Thiopyrine</i> .		
7456	5-Pyrazolone.....	4,5-dihydro-5-oxopyrazole....	$NHN:CHCH_2CO$..	84.08
7457	—, 3-methyl-1-phenyl-		$N(C_6H_5)N:C(CH_3)CH_2CO$	174.20
7458	Pyrene.....	benzo[<i>def</i>]phenanthrene.....	$C_{16}H_{10}$	202.24
7459	Pyridazine.....	1,2-diazine; orthodiazine....	$N:NCH:CHCH:CH$	80.09
7460	Pyridine.....		$N:CHCH:CH-CH:CH$	79.10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7422	rhbdr. tab. or pr. f. eth.	108	243	v. s.	v. s.	sl. s. eth.; s. chl.
7423	cr. f. al.	s.	0.6 eth.; s. chl., pyr., alk.
7424	col. liq., 1.48705 ^{18.3}	0.9323 ²⁰	224	i.	∞	∞ eth.
7425	need. f. al.	217	d.	v. s.	s.	v. sl. s. eth.; s. tol.
7426							
7427							
7428							
7429							
7430							
7431							
7432							
7433							
7434	red. need. f. al.	256	d. subl.	s.	s.	s. eth.
7435	yel. need. f. ac. a.	262-3	subl.	i.	sl. s.	s. h. ac. a., acet.
7436	leaf	27	158	v. s.	v. s.	v. s. eth.
7437	need.	167-8	sl. s.	v. s.	v. s. eth.
7438	0.8540	81-2	s.	∞	∞ eth.
7439	<i>eolic acid.</i>
7440							
7441							
7442							
7443							
7444							
7445	col. pr. f. w., 1.49526 ^{60.9}	1.031 ⁶¹ / ₄	53	118	∞	v. s.	v. s. eth.; s. chl., HCl, H ₂ SO ₄
7446	need. f. al., 1.47027 ^{99.8} H ₂ O	70	158	v. s.	v. s.	v. s. eth.; s. bz.
7447							
7448							
7449							
7450							
7451	col. liq.	144	∞	∞	sl. s. eth.
7452							
7453							
7454							
7455							
7456	need. f. tol.	165	subl. d.	s.	s.	sl. s. eth.
7457	pr., β 1.637	127	287 ²⁰⁵	s. h.	s. h.	v. sl. s. eth.; sl. s. bz.
7458	lt. yel. monocl. tab.	150	>330	i.	1.4	v. s. eth.
7459	col. liq., 1.52311 ^{23.5}	1.107	-8	208	∞	v. s.	v. s. eth.; s. HCl, bz., H ₂ SO ₄ ; i. lgr.
7460	col. liq., 1.50919 ²¹	0.982	-42	115.3	∞	∞	∞ eth.; s. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7461	Pyridine, 2-allyl-		$C_3H_5C_5H_4N$	119.16
7462	—, 2-amino-	α -pyridylamine	$NH_2C_5H_4N$	94.11
7463	—, 3-amino-	β -pyridylamine	$NH_2C_5H_4N$	94.11
7464	—, 4-amino-	γ -pyridylamine	$NH_2C_5H_4N$	94.11
7465	—, 2-benzyl-		$C_6H_5CH_2C_5H_4N$	169.22
7466	—, 3-benzyl-		$C_6H_5CH_2C_5H_4N$	169.22
7467	—, 3-bromo-*		BrC_5H_4N	158.01
7468	—, 2-chloro-*	α -chloropyridine	ClC_5H_4N	113.55
7469	—, 3-chloro-*	β -chloropyridine	ClC_5H_4N	113.55
7470	—, 4-chloro-*	γ -chloropyridine	ClC_5H_4N	113.55
7471	—, 3,5-dibromo-*		$C_5H_3Br_2N$	236.91
7472	—, dihydroxy-	See <i>Pyridinediol</i> .		
7473	—, dimethyl-	See <i>Lutidine</i> .		
7474	—, 2-ethyl-	α -ethylpyridine	$C_2H_5C_5H_4N$	107.15
7475	—, 3-ethyl-	β -ethylpyridine	$C_2H_5C_5H_4N$	107.15
7476	—, 4-ethyl-	γ -ethylpyridine	$C_2H_5C_5H_4N$	107.15
7477	—, 2-ethyl-3,5-dimethyl-	See α - <i>Parvoline</i> .		
7478	—, 3-ethyl-4-methyl-	See β - <i>Collidine</i> .		
7479	—, 4-ethyl-2-methyl-	See α - <i>Collidine</i> .		
7480	—, 5-ethyl-2-methyl-	See <i>Aldehydine</i> .		
7481	—, hexahydro-*	See <i>Piperidine</i> .		
7482	—, hydroxy-	See <i>Pyridol</i> .		
7483	—, 2-isopropyl-		$(CH_3)_2CHC_5H_4N$	121.18
7484	—, 4-isopropyl-		$(CH_3)_2CHC_5H_4N$	121.18
7485	—, 4-methoxy-*		$N:CH_3C_5H_4N$ $(OCH_3)CH:CH$	109.12
7486	—, methyl-	See <i>Picoline</i> .		
7487	—, 3-(1-methyl-2-pyrryl)-	See <i>Nicotyrine</i> .		
7488	—, 2-phenyl-		$C_6H_5C_5H_4N$	155.19
7489	—, 3-phenyl-		$C_6H_5C_5H_4N$	155.19
7490	—, 4-phenyl-		$C_6H_5C_5H_4N$	155.19
7491	—, 2-propyl-	See <i>Conyrrine</i> .		
7491M	—, 2-sulfanilamido-	See <i>Sulfapyridine</i> .		
7491T	—, 2-(sulfanilylamino)-	See <i>Sulfapyridine</i> .		
7492	—, 1,2,3,4-tetrahydro-6-propyl-	See γ - <i>Coniceine</i> .		
7493	—, tetramethyl-	See β - <i>Parvoline</i> .		
7494	—, 2,4,6-trihydroxy-	See 2,4,6- <i>Pyridinetriol</i> .		
7495	—, 2,4,6-trimethyl-	See γ - <i>Collidine</i> .		
7495M	3-Pyridinecarboxamide.	See <i>Nicotinamide</i> .		
7496	2-Pyridinecarboxylic acid*	See <i>Picolinic acid</i> .		
7497	3-Pyridinecarboxylic acid*	See <i>Nicotinic acid</i> .		
7498	4-Pyridinecarboxylic acid*	See <i>Isonicotinic acid</i> .		
7498M	3,4-Pyridinedicarbinol, 6-methyl-	See <i>Vitamin B₆</i> .		
7499	2,3-Pyridinedicarboxylic acid*	See <i>Quinolinic acid</i> .		
7500	2,4-Pyridinedicarboxylic acid*	See <i>Lutidinic acid</i> .		
7501	2,5-Pyridinedicarboxylic acid*	See <i>Isocinchomeronic acid</i> .		
7502	2,6-Pyridinedicarboxylic acid*	See <i>Dipicolinic acid</i> .		
7503	3,4-Pyridinedicarboxylic acid*	See <i>Cinchomeronic acid</i> .		
7504	3,5-Pyridinedicarboxylic acid*	See <i>Dinicotinic acid</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7461	liq.	0.959 ⁰	.....	190	sl. s.	∞	= eth.
7462	leaf. f. lgr. ....	.....	56	204	s.	v. s.	s. eth.; sl. s. lgr.
7463	leaf. f. bz. ....	.....	64	252	v. s.	v. s.	v. s. eth.; i. lgr.
7464	col. need. f. bz. ....	.....	158	.....	s.	s.	s. eth., alk., bz.; sl. s. lgr.
7465	need.	1.067 ⁰ ₀	139	276 ⁷⁴²	i.	s.	s. eth.
7466	need.	1.061 ²⁰ ₀	34	286 ⁷⁴⁰	i.	s.	s. eth.
7467	oil.	1.632 ¹⁰ ; 1.645 ⁰ ₄	.....	169-70 (173)	v. sl. s.	v. s.	v. s. eth.
7468	oily liq.	1.205 ¹⁵	.....	170 (166 ⁷¹⁴)	v. sl. s.	.....	s. eth.
7469	liq. ....	.....	.....	148 ⁷⁴⁴	s.	.....	.....
7470	liq. ....	.....	.....	147-8	s.	.....	.....
7471	col. need. f. al. ....	.....	112 (110-1)	222; subl. 100	sl. s. h.	s. h.	v. s. eth.; s. H ₂ SO ₄
7472	.....	.....	.....	.....	.....	.....	.....
7473	.....	.....	.....	.....	.....	.....	.....
7474	liq., 1.50214 ^{22.5}	0.950 ⁰	.....	148.8	sl. s.	∞	v. s. eth.
7475	col. liq.	0.945 ¹⁵	.....	165.3	v. sl. s.	s.	s. eth.
7476	col. liq.	0.936	.....	166	.....	.....	s. dil. a.
7477	.....	.....	.....	.....	.....	.....	.....
7478	.....	.....	.....	.....	.....	.....	.....
7479	.....	.....	.....	.....	.....	.....	.....
7480	.....	.....	.....	.....	.....	.....	.....
7481	.....	.....	.....	.....	.....	.....	.....
7482	.....	.....	.....	.....	.....	.....	.....
7483	liq.	0.934 ⁰	.....	159	sl. s.	∞	∞ eth.
7484	liq.	0.944 ⁰	.....	178	sl. s.	∞	∞ eth.
7485	liq. ....	.....	.....	191	s.	.....	.....
7486	.....	.....	.....	.....	.....	.....	.....
7487	.....	.....	.....	.....	.....	.....	.....
7488	liq.	>1	.....	270	i.	v. s.	v. s. eth.
7489	oil.	>1	.....	270.4	i.	v. s.	v. s. eth.
7490	leaf. f. w. ....	.....	78	275	v. sl. s. h.	s.	s. eth.
7491	.....	.....	.....	.....	.....	.....	.....
7491M	.....	.....	.....	.....	.....	.....	.....
7491T	.....	.....	.....	.....	.....	.....	.....
7492	.....	.....	.....	.....	.....	.....	.....
7493	.....	.....	.....	.....	.....	.....	.....
7494	.....	.....	.....	.....	.....	.....	.....
7495	.....	.....	.....	.....	.....	.....	.....
7495M	.....	.....	.....	.....	.....	.....	.....
7496	.....	.....	.....	.....	.....	.....	.....
7497	.....	.....	.....	.....	.....	.....	.....
7498	.....	.....	.....	.....	.....	.....	.....
7498M	.....	.....	.....	.....	.....	.....	.....
7499	.....	.....	.....	.....	.....	.....	.....
7500	.....	.....	.....	.....	.....	.....	.....
7501	.....	.....	.....	.....	.....	.....	.....
7502	.....	.....	.....	.....	.....	.....	.....
7503	.....	.....	.....	.....	.....	.....	.....
7504	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7505	2,4-Pyridinediol	2,4-dihydroxypyridine.....	$C_5H_3N(OH)_2$	111.10
7506	2,6-Pyridinediol	2,6-dihydroxypyridine.....	$C_5H_3N(OH)_2 \cdot H_2O$	129.11
7507	Pyridinepentacarboxylic acid*	.....	$C_5N(COOH)_5 \cdot 2H_2O$	335.18
7508	3-Pyridinesulfonic acid*	.....	$C_5H_4NSO_3H$	159.16
7508M	2,3,4,5-Pyridinetetracarboxylic acid*(anh.)	.....	$C_5HN(COOH)_4$...	255.14
7508P	2,3,4,6-Pyridinetetracarboxylic acid*(anh.)	.....	$C_5HN(COOH)_4$...	255.14
7508R	2,3,5,6-Pyridinetetracarboxylic acid*(anh.)	.....	$C_5HN(COOH)_4$...	255.14
7509	2,3,4-Pyridinetricarboxylic acid*	.....	.....	.....
7509H	2,3,5-Pyridinetricarboxylic acid*(anh.)	yllic acid* . See <i>Carbocinchomeronic acid</i> . carbodinicotinic acid.....	$C_5H_2N(COOH)_3$	211.13
7509K	2,3,6-Pyridinetricarboxylic acid*(anh.)	.....	$C_5H_2N(COOH)_3$...	211.13
7510	2,4,5-Pyridinetricarboxylic acid*	yllic acid* . See <i>Berberonic acid</i>.	.....	.....
7511	2,4,6-Pyridinetricarboxylic acid*	yllic acid* . See <i>Trimesitic acid</i>.	.....	.....
7512	3,4,5-Pyridinetricarboxylic acid*	β -carbocinchomeronic acid...	$C_5H_2N(COOH)_3$...	211.13
7513	2,4,6-Pyridinetriol	2,4,6-trihydroxypyridine.....	$C_5H_2N(OH)_3$	127.10
7514	2-Pyridol	2(1)-pyridone; α -pyridone...	HOC_5H_4N	95.10
7515	3-Pyridol	3-hydroxypyridine.....	HOC_5H_4N	95.10
7516	4-Pyridol	4(1)-pyridone; γ -pyridone...	HOC_5H_4N	95.10
7517	α-Pyridone .	See 2-Pyridol.	.....	.....
7518	γ-Pyridone .	See 4-Pyridol.	.....	.....
7519	2(1)-Pyridone .	See 2-Pyridol.	.....	.....
7520	4(1)-Pyridone .	See 4-Pyridol.	.....	.....
7520M	Pyridoxin .	See <i>Vitamin B₆</i>.	.....	.....
7521	α-Pyridylamine .	See <i>Pyridine, 2-amino</i>.	.....	.....
7522	β-Pyridylamine .	See <i>Pyridine, 3-amino</i>.	.....	.....
7523	γ-Pyridylamine .	See <i>Pyridine, 4-amino</i>.	.....	.....
7524	Pyrimidine	1,3-diazine; <i>m</i> -diazine; miazine	$N:CHN:CHCH:CH$	80.09
7525	2,4(1,3)-Pyrimidinedione .	ne. See <i>Uracil</i>.	.....	.....
7526	Pyrimidinetetraone .	See <i>Alloxan</i>.	.....	.....
7527	Pyrimidinetrione .	See <i>Barbituric acid</i>.	.....	.....
7528	Pyrocatechol	1,2-benzenediol*; catechol; pyrocatechin	$C_6H_4(OH)_2$	110.11
7529	—, dibutyl ether.	See <i>Benzene, 1,2-dibutoxy*</i>
7530	—, diethyl ether.	See <i>Benzene, 1,2-diethoxy*</i>
7531	—, dimethyl ether.	See <i>Veratrole</i>.	.....	.....
7532	—, dipropyl ether.	See <i>Benzene, 1,2-dipropoxy*</i>
7533	—, monoamyl ether.	See <i>Phenol, o-amoxy*</i>
7534	—, monobutyl ether.	See <i>Phenol, o-butoxy*</i>
7535	—, monoethyl ether.	See <i>Phenol, o-ethoxy*</i>
7536	—, monomethyl ether.	See <i>Guaiacol</i>.	.....	.....
7537	—, monopropyl ether.	See <i>Phenol, o-propoxy*</i>
7538	—, 3-methoxy-.....	pyrogallol 1-methyl ether....	$CH_3OC_6H_3(OH)_2$...	140.13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7505	yel. rhomb. cr. f. w. or al.	.....	265	.....	sl. s.	sl. s.	v. sl. s. eth.
7506	yel. need. f. w.	.....	195	.....	sl. s.	sl. s.	v. sl. s. eth.
7507	cr. f. eth., 2H ₂ O; f. w. 3H ₂ O	.....	220 d. -H ₂ O, 100	d.	v. s.	.....	v. sl. s. eth.
7508	need. or leaf.	.....	d.	.....	v. s.	v. sl. s.	i. eth.
7508M	cr. with 2 or 3H ₂ O	.....	-H ₂ O, 115; d. 160	.....	s.	.....	.....
7508P	need. with 2H ₂ O	.....	dried at 115: 227 d. (235) dried at 100: 187 d. (192)	.....	v. s.	v. sl. s.	v. sl. s. eth.; s. ac. a.
7508R	cr. with 2H ₂ O f. w.	.....	d. 150	.....	v. s.	.....	.....
7509							
7509H	cr. with 1.5 or 2H ₂ O	.....	sl. d. 150	.....	s. h.	s.	.....
7509K	cr. with 2H ₂ O f. dil. al.	.....	ca. 130 d.	.....	v. s.	i.	i. eth., acetic anhydride
7510							
7511							
7512	leaf. or pl.	.....	-H ₂ O, 115; anh. 261	.....	s. h.	.....	.....
7513	need. or powd.	.....	230 d.	.....	sl. s.	s.	s. eth.
7514	col. need. f. bz.	.....	107	281	v. s.	v. s.	s. eth.; sl. s. lgr.
7515	need.	.....	129	.....	v. s.	v. s.	sl. s. eth.
7516	col. monoc.	.....	+H ₂ O, 92; anh. 148.5	>350	100 ¹⁵	v. s.	v. sl. s. eth., chl.; i. bz.
7517							
7518							
7519							
7520							
7520M							
7521							
7522							
7523							
7524	cr.	.....	22	124	s.	s.	.....
7525							
7526							
7527							
7528	col. monoc. leaf. f. bz., 1.604, 1.615, 1.650	1.371 ¹⁵	105	240 (240-5)	45.1 ²⁰	v. s.	s. eth., bz., chl., alk.
7529							
7530							
7531							
7532							
7533							
7534							
7535							
7536							
7537							
7538	need.	.....	38-41	146-7 ¹⁵⁻¹⁶	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7539	Pyrocatechol, 3-methyl-	3-methyl-1,2-benzenediol*; isohomopyrocatechol; 2, 3-dihydroxytoluene	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})_2$...	124.13
7540	—, 4-methyl-	See 4-Homopyrocatechol.		
7541	Pyrocatechol-o-acid.	See Benzoic acid, 2,3-dihydroxy-		
7542	o-Pyrocatechuic acid.	See Benzoic acid, 2,3-dihydroxy-		
7543	Pyrocoll	5,10-dipyrrolo[1,2-a,1,2-d]-pyrazinedione	$\text{C}_4\text{H}_3\text{N}(\text{CO})_2\text{NC}_4\text{H}_3$	186.16
7544	Pyrodin.	See Hydrazine, 1-acetyl-2-phenyl-	$\text{C}_6\text{H}_3(\text{OH})_3$	126.11
7545	Pyrogallol	1,2,3-benzenetriol*; ν -tri-hydroxybenzene		
7546	—, 1,2-dimethyl ether.	See Phenol, 2,3-dimethoxy-		
7547	—, 1,3-dimethyl ether.	See Phenol, 2,6-dimethoxy-		
7548	—, 1-methyl ether.	See Pyrocatechol, 3-methoxy-		
7549	—, 2-methyl ether.	See Resorcinol, 2-methoxy-		
7550	—, triacetate.....		$\text{C}_6\text{H}_3(\text{OOCCH}_3)_3$..	252.22
7551	—, trimethyl ether.	See Benzene, 1,2,3-trimethoxy-*		
7552	—, 4-acetyl-	See Gallacetophenone.		
7553	—, 4-benzoyl-	See Benzophenone, 2,3,4-trihydroxy-		
7554	—, 5-methyl-	3,4,5-trihydroxytoluene.....	$\text{CH}_3\text{C}_6\text{H}_2(\text{OH})_3$...	140.13
7555	4-Pyrogallolcarboxylic acid.	See Benzoic acid, 2,3,4-trihydroxy-		
7556	Pyrogallolphthalein.	See Gallein.		
7557	Pyromellitic acid	1,2,4,5-benzenetetracarboxylic acid*	$\text{C}_6\text{H}_2(\text{COOH})_4$	254.15
7558	Pyromucic acid.	See 2-Furoic acid.		
7559	—, amyl ester.....	<i>n</i> -amyl furoate; pentyl 2-furancarboxylate	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_5\text{H}_{11}$	182.21
7560	—, butyl ester.....	<i>n</i> -butyl furoate.....	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_4\text{H}_9$..	168.19
7561	—, <i>sec</i> -butyl ester.....	<i>sec</i> -butyl furoate.....	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_4\text{H}_9$..	168.19
7562	—, ethyl ester.....	ethyl pyromucate; ethyl furoate	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_2\text{H}_5$..	140.13
7563	—, furfuryl ester.	See Furfuryl alcohol, 2-furoate.		
7564	—, heptyl ester.....	<i>n</i> -heptyl furoate.....	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_7\text{H}_{15}$..	210.27
7565	—, hexyl ester.....	<i>n</i> -hexyl furoate.....	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_6\text{H}_{13}$..	196.24
7566	—, isoamyl ester.....	isoamyl furoate.....	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_5\text{H}_{11}$	182.21
7567	—, methyl ester.....	methyl furoate.....	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_2\text{H}_5$..	126.11
7568	—, octyl ester.....		$\text{C}_4\text{H}_3\text{O}-\text{COOC}_8\text{H}_{17}$..	224.29
7569	—, propyl ester.....	<i>n</i> -propyl furoate.....	$\text{C}_4\text{H}_3\text{O}-\text{COOC}_3\text{H}_7$..	154.16
7570	—, 3-bromo-	3-bromofuroic acid.....	$\text{C}_4\text{H}_2\text{BrO}-\text{COOH}$...	190.99
7571	—, 5-bromo-		$\text{BrC}_4\text{H}_2\text{O}-\text{COOH}$..	190.99
7572	—, —, ethyl ester.....		$\text{BrC}_4\text{H}_2\text{O}-\text{COOC}_2\text{H}_5$	219.04
7573	—, 3-chloro-	3-chloro-2-furancarboxylic acid*; 3-chlorofuroic acid	$\text{C}_4\text{H}_2\text{ClO}-\text{COOH}$..	146.53
7574	—, 5-chloro-	5-chloro-2-furancarboxylic acid*; 5-chlorofuroic acid	$\text{C}_4\text{H}_2\text{ClO}-\text{COOH}$..	146.53
7575	—, 5-methyl-		$\text{CH}_3\text{C}_4\text{H}_2\text{O}-\text{COOH}$	126.11
7576	—, —, methyl ester.....		$\text{CH}_3\text{C}_4\text{H}_2\text{O}-\text{COO}-\text{CH}_3$	140.13
7577	—, 5-nitro-		$\text{NO}_2\text{C}_4\text{H}_2\text{O}-\text{COOH}$	157.08
7578	—, tetrahydro-	tetrahydrofuroic acid.....	$\text{C}_4\text{H}_7\text{O}-\text{COOH}$	116.11

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7539	leaf. f. bz. ....	.....	68 (47)	241	s.	s.	s. eth., chl., bz.
7540							
7541							
7542							
7543	yel. monocl. leaf.	.....	269	subl.	i.	v. sl. s.	v. sl. s. eth.; s. ac. a.
7544							
7545	need. or leaf ..	1.453 ⁴ / ₄	133-4	309 (293 d.)	62.5 ²⁵	100 ²⁵	83.3 ²⁵ eth.; sl. s. bz., chl., CS ₂
7546							
7547							
7548							
7549							
7550	wh. cr. powd. .	.....	165	.....	v. v. sl. s.	.....	s. dil. alk.
7551							
7552							
7553							
7554	need. f. bz. ....	.....	129	.....	.....	.....	.....
7555							
7556							
7557	tricl. tab. (+2H ₂ O) f. w.	.....	264 (269-71)	.....	1.42 ¹⁶	v. s.	sl. s. eth.
7558							
7559	col. liq.	1.0335	.....	95-7 ¹	i.	∞	.....
7560	col. liq.	1.0555	.....	118-20 ²⁵ ; 83-4 ¹	i.	∞	∞ eth.
7561	col. liq.	1.0465	.....	67-9 ¹	i.	∞	∞ eth.
7562	wh. cr. leaf., 1.4699 ⁴⁰	1.0974 ⁴⁰ / ₄ ; 1.1774 ²¹ / ₄	34 (30-3)	195 ⁷⁰⁶	i.	∞	s. eth.
7563							
7564	col. liq.	1.0005 ²⁰ / ₄	.....	116-7 ¹	i.	s.	.....
7565	col. liq.	1.0170 ²⁰ / ₄	.....	105-7 ¹	i.	s.	.....
7566	col. liq. ....	.....	.....	135-7 ²⁵	i.	∞	.....
7567	liq.	1.178	.....	181.3	i. (sl. s.)	∞	∞ eth.
7568	col. liq.	0.9885	.....	126-7 ¹	i.	s.	.....
7569	col. liq.	1.075	.....	211	i. (sl. s.)	s.	∞ eth.
7570	wh. need. f. w.	.....	127-9	.....	1.3 ²⁰	s.	s. eth.; v. sl. s. lgr., CS ₂
7571	wh. leaf. f. w.	.....	186	.....	v. sl. s. c.	s.	v. s. eth.
7572	pr.	1.528 ²⁰	17	235 ⁷⁶⁷	i.	s.	s. eth.
7573	wh. cr. ....	.....	148.5-9.5	.....	i.	s.	.....
7574	wh. leaf. ....	.....	179-80	.....	0.3 ²⁰	s.	.....
7575	pl. or need. f. w.	.....	108-9	.....	v. s. h.	v. s.	v. s. eth.
7576	col. liq. ....	.....	.....	98 ¹⁵	.....	.....	s. eth.
7577	wh. cr. f. w. ....	.....	185.0-5.5	subl.	s. h.	s.	s. eth.
7578	wh. cr.	1.1933	21	131-2 ¹⁴	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7579	Pyromucyl chloride.	See <i>Furoyl chloride</i> .		
7580	1,4-Pyrone	4-oxo-1,4-pyran; α -pyrone...	OCH:CH- COCH:CH	96.08
7581	—, 5-hydroxy-2-hydroxymethyl- .	See <i>Kojic acid</i> .		
7582	Pyroracemic acid.	See <i>Pyruvic acid</i> .		
7583	Pyrotartaric acid	methylbutanedioic acid*; methylsuccinic acid	$\text{COOHCH}_2\text{CH-}$ $(\text{CH}_3)\text{COOH}$	132.11
7584	—, α-hydroxy- .	See <i>Citramalic acid</i> .		
7585	Pyrotritaric acid	2,5-dimethyl-3-furancarboxylic acid; uvic acid; uvinic acid	$(\text{CH}_3)_2\text{C}_4\text{HO-}$ COOH	140.13
7587	Pyrrocoline, octahydro-	See <i>Piperolidine</i> .		
7588	Pyrr[ab]diazole.	See 1,2,4-Triazole.		
7589	Pyrrrole	azole.....	NHCH:CH- CH:CH	67.09
7590	—, 1-acetyl-	<i>N</i> -acetylpyrrole.....	$\text{CH}_3\text{CONC}_4\text{H}_4\text{...}$	109.12
7591	—, dihydro-* .	See <i>Pyrroline*</i> .		
7592	—, 2,4-dimethyl-		$\text{NHC}(\text{CH}_3):\text{CHC-}$ $(\text{CH}_3):\text{CH}$	95.14
7593	—, 2,5-dimethyl-		$\text{NHC}(\text{CH}_3):\text{CH-}$ $\text{CH:C}(\text{CH}_3)$	95.14
7594	—, 1-ethyl-	<i>N</i> -ethylpyrrole.....	$\text{C}_2\text{H}_5\text{NC}_4\text{H}_4\text{...}$	95.14
7595	—, 1-methyl-	<i>N</i> -methylpyrrole.....	$\text{N}(\text{CH}_3)\text{CH:CH-}$ CH:CH	81.11
7596	—, 2-methyl-	α -methylpyrrole.....	$\text{NCH}(\text{CH}_3):\text{CH-}$ CH:CH	81.11
7597	—, 3-methyl-	β -methylpyrrole.....	$\text{NCH:CH}(\text{CH}_3)-$ CH:CH	81.11
7598	—, 1-propyl-	<i>N-n</i> -propylpyrrole.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{NC}_4\text{H}_4$	109.17
7599	—, tetrahydro-* .	See <i>Pyrrolidine*</i> .		
7600	—, tetrahydro-2-oxo-	See 2-Pyrrolidone.		
7601	—, 2,3,4,5-tetraiodo-*	iodol.....	$\text{C}_4\text{I}_4\text{NH}$	570.74
7602	2-Pyrrrolecarboxylic acid*		$\text{C}_4\text{H}_4\text{N-COOH}$...	111.10
7603	Pyrrolidine*	tetrahydropyrrole; tetramethylenimine	$\text{NHCH}_2\text{CH}_2\text{CH}_2\text{C-}$ H_2	71.12
7604	—, 2-keto- .	See 2-Pyrrolidone.		
7605	—, 1-methyl-	<i>N</i> -methylpyrrolidine.....	$\text{CH}_3\text{NC}_4\text{H}_9\text{...}$	85.15
7605M	—, 2-oxo- .	See 2-Pyrrolidone.		
7606	2-Pyrrolidinecarboxylic acid* .	See <i>Proline</i> .		
7607	2,5-Pyrrolidinedione.	See <i>Succinimide</i> .		
7608	2-Pyrrolidone	2-oxopyrrolidine; α -pyrrolidone	$\text{NHCOCH}_2\text{CH}_2\text{C-}$ H_2	85.10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7579							
7580	pr., 1.5238 ^{40.3}	1.190 ^{40.3}	32.5	217.7	v. sl. s.	s.	v. s. eth.
7581							
7582							
7583	tricl., 1.43025 ^{15.3}	1.410	111	d.	66.7 ²⁰	71	s. eth.; 110 ¹⁹ me. al.
7584							
7585	col. need. f. w.	.....	135 (136-7)	subl.	0.25 ¹⁰⁰	v. s.	v. s. eth.
7587							
7588							
7589	col. liq., 1.5035	0.948 ²⁰ ₄ ; (0.9669 ²¹ ₄)	.....	131	i.	v. s.	v. s. eth.; s. bz., dil. a.; i. dil. alk.
7590	liq. ....	.....	.....	181-2	sl. s.	.....	d. HCl
7591							
7592	pa. bl. fluores. liq.	0.927 ¹⁴ ₄	.....	165 ⁷⁴³ (171)	sl. s.	v. s.	v. s. eth.; s. bz.
7593	oil, 1.50357....	0.935	.....	165 (169)	v. sl. s.	s.	s. eth.
7594							
7595	col. liq., 1.4888 ¹⁶	0.888 ¹⁶ 0.9203 ¹⁰	.....	130-1 114-5 ⁷⁴⁸	i. i.	∞ ∞	∞ eth. ∞ eth.
7596	liq.	0.945	.....	148	i.	∞	∞ eth.
7597	liq. ....	.....	.....	143	.....	.....	sl. s. dil. a.
7598	liq. ....	.....	.....	145.5-6.5	.....	.....	.....
7599							
7600							
7601	yel. need. f. dil. al.	.....	d. 150	.....	0.02	5.8 ¹⁵ 90%	50 eth.; s. bz., chl.
7602	monocl. pr. ....	.....	191.5 d.	d. 208.5	s.	s.	s. eth.
7603	col. liq.	0.871 ¹⁰ ; 0.8520 ²²	.....	88.5	∞	∞	∞ eth.
7604							
7605	liq. ....	.....	.....	81-3	s.	.....	.....
7605M							
7606							
7607							
7608	cr.	1.116 ²⁵	24.6	245 (250.8)	v. s.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7609	Pyrroline*	dihydropyrrole*.....	C_4H_7N	69.10
7610	Pyrrolylene.	See 1,3-Butadiene*.		
7611	α-Pyrromonazole.	See Pyrazole.		
7612	Pyruvaldehyde, aldoxime	2-oxopropanal 1-oxime*; isonitrosoacetone	$CH_3COCH:NHOH$..	87.08
7613	Pyruvic acid	2-oxopropanoic acid*; α -ketopropionic acid; pyro-racemic acid; acetyl-formic acid	$CH_3COCOOH$	88.06
7614	—, ethyl ester.....	ethyl pyruvate.....	$CH_3COCOOC_2H_5$..	116.11
7615	—, methyl ester.....	methyl 2-oxopropanoate*; methyl pyruvate	$CH_3COCOCH_3$...	102.09
7616	Pyruvonnitrile	2-oxopropanenitrile*; acetyl cyanide	CH_3COCN	69.06
7617	Quercetin	3,3',4',5,7-pentahydroxy-flavone; meletin; sophoretin	$C_{15}H_{10}O_7$	302.23
7618	d-Quercitol	cyclohexanepentol* (one form); d-quercite	$C_6H_7(OH)_5$	164.16
7619	Quercitrin		$C_{21}H_{28}O_{11}$	448.37
7620	Quinacetophenone.	See Acetophenone, 2,5-dihydrox		
7620M	Quinaldic acid (anh.) ...	2-quinolinecarboxylic acid*...	C_9H_6NCOOH	173.16
7621	—, 4-hydroxy-.	See Kynurenic acid.		
7622	Quinaldine	2-methylquinoline.....	$CH_3C_9H_6N$	143.18
7623	—, hydroxy-.	See Quinolinol, 2-methyl-.		
7624	—, methyl-.	See Quinoline, dimethyl-.		
7625	Quinalgen.	See Analgen.		
7626	Quinalizarin	1,2,5,8-tetrahydroxyanthra-quinone; alizarin bordeaux	$(HO)_2C_6H_2(CO)_2-C_6H_2(OH)_2$ $C_{19}H_{24}N_2O_2$	272.20 312.40
7627	Quinamine	See Quinoline, 6-methoxy-.		
7628	p-Quinanisoie.	See Quinoxaline.		
7629	Quinazine.	benzo[a]pyrimidine; 1,3-benzodiazine; phenmiazine	$C_6H_4N:CHN:CH$	130.14
7630	Quinazoline	orexin; phenzoline; cedra-rine	$C_6H_4N:CHN-$ $(C_6H_5)CH_2$	208.25
7631	—, 3,4-dihydro-3-phenyl-			
7632	Quinhydrone	benzoquinhydrone.....	$C_6H_4O_2 \cdot C_6H_4(OH)_2$	218.20
7633	Quinic acid	1,2,4,5-tetrahydroxycyclo-hexanecarboxylic acid*	$(HO)_4C_6H_7COOH$	192.17
7634	Quinicine		$C_{20}H_{24}N_2O_2$	324.41
7635	—, oxalate (d).....		$(C_{20}H_{24}N_2O_2)_2 \cdot H_2C_2O_4 \cdot 9H_2O$	901.00
7636	Quinidine	conquinine.....	$C_{20}H_{24}N_2O_2 \cdot 2\frac{1}{2}H_2O$	369.45
7637	—, bisulfate.....		$C_{20}H_{24}N_2O_2 \cdot H_2SO_4 \cdot 4H_2O$	494.55

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7609	liq.....	0.910 ²⁰ ₄	.....	90	v. s.	∞	∞ eth.
7610							
7611							
7612	leaf. f. eth....	1.074 ^{67.5}	69	subl.	v. s.	.....	v. s. eth.; v. sl. s. pet. eth.
7613	col. liq.....	1.267	13.6	165 sl. d.	∞	∞	∞ eth.
7614	col. liq.....	1.060 ¹⁶ ₄	.....	144; 55 ¹⁷	sl. s.	∞	∞ eth.
7615	col. liq.....	1.154 ⁰	.....	137	sl. s.	∞	= eth.
7616	rhomb.....	.....	.....	93	d.	.....	s. eth.
7617	yel. need.....	.....	anh. 310 d.	subl.	0.35	0.48	v. sl. s. eth.; s. alk.
7618	col. monocl....	1.585 ¹³	234	d.	10 c.	sl. s.	i. eth.
7619	yel. need. or leaf.	.....	250-2; 185; (168 d.)	.....	0.04 ²⁰ , 0.69 ¹⁰⁰	25.6 ⁷⁸	0.8 eth.; s. alk. sol., amyl. al., ac. a.
7620							
7620M	need. with 2H ₂ O. f. w.; anh., cr. f. bz.	.....	156 anh.	.....	sl. s. c.; s. h.	.....	v. s. h. bz.
7621							
7622	col. liq.....	1.1013	.....	246-7	v. sl. s.	s.	s. eth., chl.
7623							
7624							
7626	red rhomb. need.	.....	>275	subl.	i.	v. sl. s.	v. sl. s. eth.
7627	need.....	.....	172	.....	i.	v. s. h.	s. h. eth.
7628							
7629							
7630	pl. f. pet. eth..	.....	48	243	v. s.	s.	s. eth.
7631	hex. pl.....	1.290 ⁴	95	.....	.....	s.	s. eth.
7632	dk. grn. rhomb. pr.	1.401 ²⁰ ₁₁	171	subl.	s. h.	v. s.	v. s. eth.; s. NH ₄ OH; d. chl.
7633	col. monocl. f. w.	1.637	163	d.	40 ⁹	s.	v. sl. s. eth.; s. ac. a.
7634	yel. oil.....	.....	60	.....	sl. s.	s.	s. eth., chl.
7635	pr. f. chl. or need. f. al.	.....	149	.....	s. h.	s.	s. chl.
7636	pr. f. al., [α] _D ²⁰ -274.7 ⁵¹⁷ in al. + chl.	.....	171.5 d.	.....	0.05 ¹⁵	4 ²⁰ 80%	4.5 ²⁰ eth.; s. chl.
7637	hair-like need.; bl. fluores. in sol., [α] _D ^{184.17} 3% sol. in chl.	.....	.....	.....	1 ¹⁵	12	v. sl. s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7638	Quinidine , hydrochloride (d)		$C_{20}H_{24}N_2O_2 \cdot HCl \cdot H_2O$	378.89
7639	—, sulfate (d)		$(C_{20}H_{24}N_2O_2)_2 \cdot H_2SO_4 \cdot 2H_2O$	782.93
7640	Quinine (anhydrous)		$C_{20}H_{24}N_2O_2$	324.41
7641	Quinine (hydrate)		$C_{20}H_{24}N_2O_2 \cdot 3H_2O$	378.46
7642	—, arsenate		$(C_{20}H_{24}N_2O_2)_2 \cdot H_3AsO_4 \cdot 8H_2O$	934.88
7643	—, bisulfate		$C_{20}H_{24}N_2O_2 \cdot H_2SO_4 \cdot 7H_2O$	548.60
7644	—, dihydrochloride		$C_{20}H_{24}N_2O_2 \cdot 2HCl$	397.34
7645	—, formate		$C_{20}H_{24}N_2O_2 \cdot HCOOH$	370.44
7646	—, hydrobromide		$C_{20}H_{24}N_2O_2 \cdot HBr \cdot H_2O$	423.35
7647	—, (mono)hydrochloride		$C_{20}H_{24}O_2N_2 \cdot HCl$	360.88
7648	—, (mono)hydrochloride (hydrate)		$C_{20}H_{24}O_2N_2 \cdot HCl \cdot 2H_2O$	396.91
7649	—, iodosulfate	herapathite	$4C_{20}H_{24}N_2O_2 \cdot 3H_2SO_4 \cdot 2HI \cdot I_4 \cdot 6H_2O$	2463.50
7650	—, salicylate		$C_{20}H_{24}N_2O_2 \cdot C_7H_6O_3 \cdot H_2O$	480.55
7651	—, sulfate		$(C_{20}H_{24}N_2O_2)_2 \cdot H_2SO_4$	746.90
7652	—, sulfate (hydrate)		$(C_{20}H_{24}N_2O_2)_2 \cdot H_2SO_4 \cdot 2H_2O$	782.93
7653	—, urea-hydrochloride		$C_{20}H_{24}O_2N_2 \cdot HCl \cdot CO(NH_2)_2 \cdot HCl \cdot 5H_2O$	547.48
7654	—, valerate		$C_{20}H_{24}N_2O_2 \cdot C_6H_{10}O_2 \cdot H_2O$	444.56
7655	Quinizarin	1,4-dihydroxyanthraquinone	$C_{14}H_8(OH)_2$	240.20
7656	Quinol	See <i>Hydroquinone</i> .		
7657	Quinoline	benzo[b]pyridine; 1-benzazine	$C_8H_4N \cdot CHCH : CH$	129.15

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7638	asbestos-like pr., $[\alpha]$ 2.212-2.562° _D 97% al.	.....	anh. 258-9 d.	.....	1.6 ¹⁰	v. s.	v. sl. s. eth.; v. s. chl.
7639	pr. or need.; sol. fluores. bl., $[\alpha]$ + 184.17° _D 3% sol. in chl.	.....	.....	.....	1 ¹⁵	12	v. sl. s. eth.; s. chl.
7640	amor. powd. ....	.....	174.9	.....	0.0571	166	22.2 eth.
7641	flaky or micro. cr. powd. efflor., 1.620, 1.625, 1.630; $[\alpha]$ -145.2° ¹⁵ _D	.....	57	.....	0.064	154	73.8 eth.; s. chl., bz., CS ₂ , oils, glyc.
7642	wh. cr. ....	.....	.....	.....	s. h.	.....	.....
7643	sm. ortho-rhomb. need. efflor.	.....	160 d.	.....	11.1	5.36	0.056 eth.; s. chl.
7644	wh. powd. or need.	.....	.....	.....	166.6	10.3	v. sl. s. eth.; sl. s. chl.
7645	cr. powd. ....	.....	109	.....	3	s.	v. sl. s. eth.; s. chl.
7646	silky efflor. need.	.....	152-200	.....	2.5	149.2	6.25 eth.; s. chl.
7647	silky efflor. need., $[\alpha]$ -144.98° ¹⁵ _D	.....	158-60	259 d.	5.6 ²⁵	166 ²⁵	0.42 ²⁵ eth.; s. CS ₂ , bz., oils, glyc., NH ₄ OH, KOH sol., a.
7648	silky efflor. need., $[\alpha]$ -144.98° ¹⁵ _D	.....	156-90	.....	5.55	166	0.415 eth.; s. chl., glyc.
7649	red-grn. dichroic cr. or olive grn. powd.	.....	.....	.....	d.	0.12 c., s. h.	.....
7650	col. need. ....	.....	185 d.	.....	1.3	8.8	0.88 eth.; s. chl., glyc.
7651	silky efflor. need.	.....	anh. 235	.....	0.14 ²⁵	1.16 ²⁵	sl. s. eth.; s. CS ₂ , bz., oils, glyc., KOH sol., NH ₄ OH, a.; sl. s. chl.
7652	silky cr. or need., efflor.	.....	205	.....	0.139	1.16	sl. s. eth., chl.; s. glyc.
7653	wh. pr. or powd.	.....	70-5	.....	111.1	51.4	.....
7654	cr. powd. ....	.....	90	.....	0.8	50	7 eth.
7655	red need. f. al.	.....	194-5	subl. sl. d.	.....	s.	s. eth., bz., KOH, H ₂ SO ₄
7656	col. liq., 1.62450 ^{24.9}	1.095 ²⁰ _D	-19.5	237.7	6	∞	∞ eth., CS ₂

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7658	Quinoline, 2-amino-	α -quinolylamine.....	$\text{NH}_2\text{C}_9\text{H}_6\text{N}$	144.17
7659	—, 4-amino-	γ -quinolylamine.....	$\text{NH}_2\text{C}_9\text{H}_6\text{N}$	144.17
7660	—, 5-benzamido-8-e	thoxy- . See <i>Analgen</i> .		
7661	—, 2-chloro-*	α -chloroquinoline.....	$\text{ClC}_9\text{H}_6\text{N}$	163.60
7662	—, 3-chloro-*	β -chloroquinoline.....	$\text{ClC}_9\text{H}_6\text{N}$	163.60
7663	—, 4-chloro-*	γ -chloroquinoline.....	$\text{ClC}_9\text{H}_6\text{N}$	163.60
7664	—, decahydro-*		$\text{C}_9\text{H}_{17}\text{N}$	139.24
7665	—, 2,3-dichloro-*		$\text{C}_9\text{H}_5\text{Cl}_2\text{N}$	198.05
7666	—, 5,8-dichloro-*		$\text{C}_9\text{H}_5\text{Cl}_2\text{N}$	198.05
7667	—, 6,8-dichloro-*		$\text{C}_9\text{H}_5\text{Cl}_2\text{N}$	198.05
7668	—, 7,8-dichloro-*		$\text{C}_9\text{H}_5\text{Cl}_2\text{N}$	198.05
7670	—, 2,3-dimethyl-	3-methylquinaldine.....	$(\text{CH}_3)_2\text{C}_9\text{H}_6\text{N}$	157.21
7671	—, 2,4-dimethyl-	4-methylquinaldine.....	$(\text{CH}_3)_2\text{C}_9\text{H}_6\text{N}$	157.21
7672	—, 2,6-dimethyl-	<i>p</i> -toluquinaldine; 6-methyl-quinaldine.....	$(\text{CH}_3)_2\text{C}_9\text{H}_6\text{N}$	157.21
7673	—, 3,4-dimethyl-		$(\text{CH}_3)_2\text{C}_9\text{H}_6\text{N}$	157.21
7674	—, 5,8-dimethyl-		$(\text{CH}_3)_2\text{C}_9\text{H}_6\text{N}$	157.21
7675	—, 6,8-dimethyl-	β -cytisolidine.....	$(\text{CH}_3)_2\text{C}_9\text{H}_6\text{N}$	157.21
7676	—, 2-homopiperonyl-	4-methoxy- . See <i>Cusparine</i> .		
7677	—, 6-methoxy-	<i>p</i> -quinaniso; methyl 6-quinolyl ether See <i>Quinaldine</i> .	$\text{C}_9\text{H}_6\text{N}\cdot\text{OCH}_3$	159.18
7678	—, 2-methyl-	See <i>Quinaldine</i> .		
7679	—, 3-methyl-	β -methylquinoline.....	$\text{CH}_3\text{C}_9\text{H}_6\text{N}$	143.18
7680	—, 4-methyl-	See <i>Lepidine</i> .		
7681	—, 6-methyl-		$\text{CH}_3\text{C}_9\text{H}_6\text{N}$	143.18
7682	—, 7-methyl-		$\text{CH}_3\text{C}_9\text{H}_6\text{N}$	143.18
7683	—, 8-methyl-		$\text{CH}_3\text{C}_9\text{H}_6\text{N}$	143.18
7684	—, 1-methyl-1,2,3,4-	tetrahydro- . See <i>Kairoline</i> .		
7685	—, 5-nitro-*		$\text{NO}_2\text{C}_9\text{H}_6\text{N}$	174.15
7686	—, 6-nitro-*		$\text{NO}_2\text{C}_9\text{H}_6\text{N}$	174.15
7687	—, 7-nitro-*		$\text{NO}_2\text{C}_9\text{H}_6\text{N}$	174.15
7688	—, 8-nitro-*		$\text{NO}_2\text{C}_9\text{H}_6\text{N}$	174.15
7689	—, 2-phenyl-		$\text{C}_6\text{H}_5\text{C}_9\text{H}_6\text{N}$	205.25
7690	—, 6-phenyl-		$\text{C}_6\text{H}_5\text{C}_9\text{H}_6\text{N}$	205.25
7691	—, 8-phenyl-		$\text{C}_6\text{H}_5\text{C}_9\text{H}_6\text{N}$	205.25
7692	—, 1,2,3,4-tetrahydro-*		$\text{C}_9\text{H}_{11}\text{N}$	133.19
7693	—, 1,2,3,4-tetrahydro-	o-6-methoxy- . See <i>Thalline</i> .		
7694	—, 2,3,4-trimethyl-		$\text{C}_9\text{H}_4\text{N}(\text{CH}_3)_3$	171.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7658	leaf. f. w. ....	.....	129	.....	v. sl. a. c., s. h.	v. s.	v. s. eth.; s. chl.; sl. s. bz., lgr.
7659	need. (+1H ₂ O) f. w. ....	.....	anh. 154; +1H ₂ O, 69-70	-H ₂ O, 100	s.	s.	v. s. chl.; sl. s. lgr., CS ₂
7660	.....	.....	.....	.....	.....	.....	.....
7661	need. f. dil. al.	1.275 ¹⁷	37-8	266-7 (276)	i.	s.	s. eth., bz., lgr.
7662	hyg. ....	.....	.....	255 ⁷⁴⁸	.....	.....	.....
7663	cr.	1.251	34	261 ⁷⁴⁴	.....	v. s.	v. s. eth.; s. dil. HCl
7664	(cis) col. liq. ...	0.9426 ²⁰ ₄	-40	205-6 (83-3, 5 ¹⁶)	sl. s.	s.	s. eth.
	(trans) wh. cr.	0.9021 ^{5.5.5} ₄	48	203 ⁷³⁵	s. h.	v. s.	v. s. eth.
7665	cr. f. dil. al. ....	.....	104-5	.....	i.	s.	s. eth., bz.; sl. s. lgr.
7666	sh. need. f. al. ....	.....	92-3	.....	.....	s.	s. eth.
7667	need. f. eth. or al. ....	.....	104-5	volat. >100	.....	s.	s. eth.
7668	need. ....	.....	85.5	.....	.....	s.	s. eth.
7670	yel. need. or leaf.	1.1013 ¹⁰	08-9	261 (247)	sl. a.	s.	s. eth., lgr.
7671	liq.	1.061 ¹⁵ ₄	.....	264	v. sl. s.	v. s.	v. s. eth.
7672	trim. f. eth. ....	.....	60	266-7 (259-61)	sl. s. h.	s.	s. eth.
7673	cr. ....	.....	73-4 (65)	290 ⁷³⁷	i.	s.	s. eth.
7674	liq.	1.070 ^{2.1} ₄	4-5	265 ⁷³⁶	sl. s.	s.	s. eth.
7675	liq.	1.0665 ⁴	.....	269	sl. s.	s.	s. eth.
7676	.....	.....	.....	.....	.....	.....	.....
7677	liq.	1.665 ⁰ ; 1.154 ²⁰	<-18	186 ³⁵	.....	s.	.....
7678	.....	.....	.....	.....	.....	.....	.....
7679	col. liq. or cr., 1.60695 ^{23.3}	1.074	14	250	i.	s.	s. eth.
7680	.....	.....	.....	.....	.....	.....	.....
7681	1.6141 ²³	1.066	10-4	255	v. sl. s. (i.)	s.	s. eth.
7682	yel. oil.	1.072	<-20	252.5	v. sl. s. (i.)	s.	s. eth.
7683	liq.	1.073	.....	247.3-8.3 ⁷⁵¹	v. sl. s. (i.)	s.	s. eth.
7684	.....	.....	.....	.....	.....	.....	.....
7685	need. f. w. ....	.....	72	subl.	sl. s. h.	.....	s. bz.
7686	need. ....	.....	150	subl.	v. sl. s. c., s. h.	v. sl. s.	v. sl. s. eth.; v. s. bz.; sl. s. lgr.
7687	need. f. al. ....	.....	133	.....	.....	v. sl. s.	v. s. eth.
7688	monocl. need. f. al. ....	.....	89	.....	v. sl. s. c.	s.	s. eth., bz.
7689	need. f. al. ....	.....	86	363	sl. s.	v. s. h.	v. s. eth.
7690	trim. f. eth. or al.	1.195	111	260 ⁷⁷	v. sl. s.	s.	s. eth.
7691	thk. fluores. oil.	.....	.....	283 ¹⁸⁷	.....	s.	s. eth., bz.
7692	col.-yel. cr., 1.59331 ^{23.9}	1.055	20	251	v. sl. s.	∞	∞ eth.
7693	.....	.....	.....	.....	.....	.....	.....
7694	cr. ....	.....	ca. 65	285	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7695	Quinoline, 2,4,5-trimethyl-	.....	$C_9H_4N(CH_3)_3$	171.23
7696	—, 2,5,7-trimethyl-	tetracoline.....	$C_9H_4N(CH_3)_3$	171.23
7697	—, 2,6,7-trimethyl-	.....	$C_9H_4N(CH_3)_3$	171.23
7698	—, 2,6,8-trimethyl-	.....	$C_9H_4N(CH_3)_3$	171.23
7698H	2-Quinolinecarboxylic acid* . See <i>Quinaldic acid</i>.	.....	.....	.....
7698K	3-Quinolinecarboxylic acid*	.....	C_9H_6NCOOH	173.16
7698M	4-Quinolinecarboxylic acid* . See <i>Cinchoninic acid</i>.	.....	.....	.....
7698P	5-Quinolinecarboxylic acid*	.....	C_9H_6NCOOH	173.16
7698R	6-Quinolinecarboxylic acid*	.....	C_9H_6NCOOH	173.16
7698T	7-Quinolinecarboxylic acid*	.....	C_9H_6NCOOH	173.16
7698V	8-Quinolinecarboxylic acid*	.....	C_9H_6NCOOH	173.16
7699	Quinolinic acid	2,3-pyridinedicarboxylic acid*.....	$C_8H_5N(COOH)_2$...	167.12
7700	2-Quinolinol .	See <i>Carbostyryl</i>.	.....	.....
7701	4-Quinolinol	kynurine.....	$HOC_9H_6N \cdot 3H_2O$...	199.20
7702	—, 2-methyl-	4-hydroxyquinaldine.....	$C_{10}H_9NO$	159.18
7703	5-Quinolinol.....	.....	HOC_9H_6N	145.15
7704	6-Quinolinol.....	.....	HOC_9H_6N	145.15
7705	—, 2-methyl-	6-hydroxyquinaldine.....	$C_{10}H_9NO$	159.18
7706	7-Quinolinol.....	.....	HOC_9H_6N	145.15
7707	—, 2-methyl-	7-hydroxyquinaldine.....	$C_{10}H_9NO$	159.18
7708	8-Quinolinol.....	.....	HOC_9H_6N	145.15
7709	—, 2-methyl-	8-hydroxyquinaldine.....	$C_{10}H_9NO$	159.18
7710	2(1)-Quinolone .	See <i>Carbostyryl</i>.	.....	.....
7711	—, 3,4-dihydro- .	See <i>Hydrocarbostyryl</i>.	.....	.....
7712	α-Quinolylamine .	See <i>Quinoline, 2-amino-</i>.	.....	.....
7713	γ-Quinolylamine .	See <i>Quinoline, 4-amino-</i>.	.....	.....
7714	Quinone (para or ordinary)	<i>p</i> -benzoquinone; 1,4-cyclohexadienedione*	$O:C_6H_4:O$	108.09
7715	—, bischloroimide	<i>p</i> -benzoquinone bischloroimide.....	$C_6H_4(:NCl)_2$	175.02
7716	—, chloroimide	<i>p</i> -benzoquinone monochloroimide.....	$O:C_6H_4:NCl$	141.56
7717	—, dioxime	<i>p</i> -benzoquinone dioxime.....	$C_6H_4(:NOH)_2$	138.12
7718	—, monoxime .	See <i>Phenol, p-nitroso-</i>.	.....	.....
7719	—, 2,6-dichloro-	2,6-dichloro- <i>p</i> -benzoquinone..	$C_6H_2Cl_2O_2$	176.99
7720	—, 2,5-dichloro-3,6-	dihydroxy- . See <i>Chloranilic acid</i>.	.....	.....
7721	—, 2,5-dihydroxy- ...	2,5-dihydroxy- <i>p</i> -benzoquinone	$C_6H_2O_2(OH)_2$	140.09
7722	—, 2,5-dihydroxy-3,6-	dinitro- . See <i>Nitrilanilic acid</i>.	.....	.....
7723	—, 2,3-dimethyl- .	See <i>o-Xyloquinone</i>.	.....	.....
7724	—, 2,5-dimethyl- .	See <i>Phlorone</i>.	.....	.....
7725	—, 2,6-dimethyl- .	See <i>m-Xyloquinone</i>.	.....	.....
7726	—, 2-methyl- .	See <i>Toluquinone</i>.	.....	.....

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7695	need. f. w.		63-4	.....	s.	.....	.....
7696	pr.		43	285-7	v. s.	v. s.	v. s. eth.
7697	monocl.		46	260 ⁷¹⁹	i.	v. s.	v. s. lgr.
7698	monocl. pr. f. lgr.						
7698H							
7698K	tab. f. dil. al.		275 sl. d.	.....	sl. s. c.; s. h.	s.	.....
7698M							
7698P	cr. by subl.		338-40	subl.	v. sl. s.	v. sl. s.	i. eth., bz., CS ₂ ; s. min. a., alk.
7698R	pr. by subl.		290-1	subl.	v. sl. s.	s. h.	s. min. a., alk.
7698T	need. f. w. or al.		248.5-50	subl.	v. sl. s. c.	s.	i. eth.
7698V	need. f. w.		186-7.5	subl.	s. h.	s. h.	s. min. a., alk.
7699	monocl. pr.		190 d. (195)	.....	0.55 ^{6,5}	sl. s.	v. sl. s. eth.
7700							
7701	col. monocl. need. f. w.		3H ₂ O, 52; -H ₂ O, 110; anh. 201	>300 d.	0.47 ¹⁵	s.	sl. s. eth.
7702	pr. f. w.		231	d.	1 c., 10 h.	s.	v. sl. s. eth., bz.
7703	pr. or leaf. f. al.		224	subl.	sl. s.	s.	sl. s. eth.; v. s. h. Na ₂ CO ₃ ; i. lgr.
7704	sm. pr. f. al.		193	360	v. sl. s.	sl. s.	v. sl. s. eth.; s. alk.
7705	cr.		213	sl. d.	v. sl. s.	s.	s. eth.
7706	pr. f. al.		235-8 d.	subl.	sl. s.	v. s.	s. alk.
7707	leaf. f. al.		232-4	sl. d.	i.	s. h.	s. eth.
7708	pr. f. dil. al.		76 (73-4)	266.9	v. sl. s.	v. s.	sl. s. eth.; s. dil. alk.
7709	tricl. pr. f. al.		74	267	.....	.....	.....
7710							
7711							
7712							
7713							
7714	yel. monocl. pr. f. w.	1.318 ²⁰ / ₄	115.7	subl.	sl. s.	s.	s. eth., h. lgr., alk.
7715	need. f. w.		124 d.	.....	sl. s. h.	s. h.	s. eth.; v. s. bz.
7716	yel. cr. f. lgr.		84.7-5.0	exp.	s. h.	v. s. h.	v. s. eth., chl.; s. a.
7717	col. or yel. need.		240 d.	.....	s. h.	.....	s. NH ₄ OH
7718							
7719	yel. rhomb. pr. f. lgr. or bz.		121	subl. <120	sl. s.	s. h.	s. chl.
7720							
7721	dk. yel. need. f. et. al.		.....	subl. 215-220 d.	v. sl. s.	s.	v. sl. s. eth.; s. ac. a.
7722							
7723							
7724							
7725							
7726							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7727	Quinone, nitro-		$\text{NO}_2\text{C}_6\text{H}_3\text{O}_2$	153.09
7728	—, tetrachloro-	See <i>Chloranil</i> .		
7729	—, tetrahydro-	See 1,4-Cyclohexanedione*.		
7730	—, tetrahydroxy-		$(\text{HO})_4\text{C}_6\text{O}_2$	172.09
7731	—, trichloro-		$\text{Cl}_3\text{C}_6\text{H}_3\text{O}_2$	211.44
7732	Quinovic acid		$\text{C}_{32}\text{H}_{48}\text{O}_6$	528.71
7733	Quinoxaline	benzopyrazine; 1,4-benzodiazine; quiazine	$\text{C}_6\text{H}_4\text{N}:\text{CHCH}:\text{N}$	130.14
7734	Racemic acid.	See <i>dl-Tartaric acid</i> .		
7735	R acid.	See 2-Naphthol-3,6-disulfonic acid.		
7736	Raffinose		$\text{C}_{18}\text{H}_{32}\text{O}_{16} \cdot 5\text{H}_2\text{O}$...	594.52
7737	Resacetophenone	2,4-dihydroxyacetophenone..	$\text{CH}_3\text{COC}_6\text{H}_3(\text{OH})_2$	152.14
7738	—, 4-methyl ether.	See <i>Peonol</i> .		
7739	Resodiacetophenone ..	4,6-diacetylresorcinol.....	$(\text{CH}_3\text{CO})_2\text{C}_6\text{H}_2(\text{OH})_2$	194.18
7740	Resorcinol	1,3-benzenediol*; resorcin...	$\text{C}_6\text{H}_4(\text{OH})_2$	110.11
7741	—, diethyl ether.	See <i>Benzene, 1,3-diethoxy-</i> *.		
7742	—, diisomyl ether.	See <i>Benzene, 1,3-diisomaxy-</i> .		
7743	—, dimethyl ether.	See <i>Benzene, 1,3-dimethoxy-</i> *.		
7744	—, dipropyl ether.	See <i>Benzene, 1,3-dipropoxy-</i> *.		
7745	—, monoamyl ether.	See <i>Phenol, m-amoxy-</i> .		
7746	—, monobutyl ether.	See <i>Phenol, m-butoxy-</i> .		
7747	—, monoethyl ether.	See <i>Phenol, m-ethoxy-</i> .		
7748	—, monomethyl ether.	See <i>Phenol, m-methoxy-</i> .		
7749	—, monopropyl ether.	See <i>Phenol, m-propoxy-</i> .		
7750	—, 4-amyl-	1-n-amyl-2,4-dihydroxybenzene	$\text{CH}_3(\text{CH}_2)_4\text{C}_6\text{H}_3(\text{OH})_2$	180.24
7751	—, 4-benzoyl-	See <i>Benzophenone, 2,4-dihydroxy-</i> .		
7752	—, 4-butyl-	1-n-butyl-2,4-dihydroxybenzene	$\text{CH}_3(\text{CH}_2)_3\text{C}_6\text{H}_3(\text{OH})_2$	166.21
7753	—, 4-caproyl-	See <i>Caprophenone, 2,4-dihydroxy-</i> .		
7754	—, 4,6-diacetyl-	See <i>Resodiacetophenone</i> .		
7755	—, dihydro-	See 1,3-Cyclohexanedione*.		
7756	—, 2,4-dimethyl-	2,4-dimethyl-1,3-benzenediol*; 2,4-dihydroxy-m-xylene	$(\text{CH}_3)_2\text{C}_6\text{H}_2(\text{OH})_2$	138.16
7757	—, 2,5-dimethyl-	2,5-dimethyl-1,3-benzenediol*; p-xylorcinol; β-orcinol; 2,6-dihydroxy-p-xylene; betorcinol	$(\text{CH}_3)_2\text{C}_6\text{H}_2(\text{OH})_2$	138.16
7758	—, 4,5-dimethyl-	4,5-dimethyl-1,3-benzenediol*; 3,5-dihydroxy-o-xylene	$(\text{CH}_3)_2\text{C}_6\text{H}_2(\text{OH})_2$	138.16
7759	—, 4,6-dimethyl-	4,6-dimethyl-1,3-benzenediol*; m-xylorcinol; 4,6-dihydroxy-m-xylene	$(\text{CH}_3)_2\text{C}_6\text{H}_2(\text{OH})_2$	138.16
7760	—, 2,4-dinitro-	2,4-dinitro-1,3-benzenediol*; α-dinitroresorcin	$(\text{NO}_2)_2\text{C}_6\text{H}_2(\text{OH})_2$	200.11
7761	—, dithio-	1,3-benzenedithiol*; m-phenylene dimercaptan	$\text{C}_6\text{H}_4(\text{SH})_2$	142.23
7762	—, 4-ethyl-	1,3-dihydroxy-4-ethylbenzene	$\text{C}_2\text{H}_5\text{C}_6\text{H}_3(\text{OH})_2$...	138.16
7763	—, 4-hexyl-	1-n-hexyl-2,4-dihydroxybenzene; caprokol	$\text{CH}_3(\text{CH}_2)_5\text{C}_6\text{H}_3(\text{OH})_2$	194.27
7764	—, 4-isoamyl-	2,4-dihydroxy-1-isoamylbenzene	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_2\text{C}_6\text{H}_3(\text{OH})_2$	180.24

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7727	yel.....	.....	d. ca. 206	.....	v. s. h.	s.	sl. s. eth.
7728							
7729							
7730	bl. cr.....	.....	d.	.....	s. h.	v. s.	sl. s. eth.
7731	yel. leaf. f. w.	.....	168-9	subl.	i.	sl. s.	v. s. eth.
7732	wh. cr. powd.	.....	.....	.....	i.	sl. s. h.	i. eth.; s. chl., NH ₄ OH
7733	wh. cr., 1.62311 ^{48.0}	1.133 ⁴⁸	30.5	226	s.	s.	s. eth.; ∞ bz.
7734							
7735							
7736	need. f. w....	1.465 ⁰	anh. 118-9	130 d.	14 ²⁰ , ∞ h.	v. sl. s.	i. eth.; s. me. al.
7737	need.....	.....	147	.....	i.	s.	s. eth.
7738							
7739	wh. need....	.....	180	.....	i.	sl. s.	s. eth.
7740	col. rhomb. tab. f. w. or bz.	1.285 ¹⁵	110	276.5 (281.4)	229 ⁵⁰	243 ²⁵	v. s. eth.; s. glyc., bz., amyl. al.
7741							
7742							
7743							
7744							
7745							
7746							
7747							
7748							
7749							
7750	col.....	.....	71.5-3.0	168-70 ⁶	v. sl. s.	s.	s. eth.
7751							
7752	col. ....	.....	47-8	196-200 ²⁴	v. sl. s.	s.	s. eth.
7753							
7754							
7755							
7756	need. by subl.	.....	149-50	.....	s.	v. s.	v. s. eth.
7757	tetr. f. w. or bz.	.....	163	277-80	s.	s.	s. eth.
7758	need. f. bz.; pr. (+1H ₂ O) f. w.	.....	+1H ₂ O, 115-7; anh. 136-7	subl.	s.	v. s.	v. s. eth.; s. ac. a.; sl. s. chl., bz.; v. sl. s. CS ₂
7759	monocl. cr. f. w., chl. or bz.	.....	124.5-5	276-9 subl.	s.	s.	s. eth.
7760	yel. leaf.....	.....	147-8	subl.; exp.	sl. s.	v. s.	v. s. eth.; s. chl.
7761	col. shiny cr...	.....	27 (25)	243-5	i.	s.	s. eth., alk.
7762	col. pr.....	.....	98-9	131 ¹⁵	s.	s.	s. eth.
7763	col. need.....	.....	68-70	178-80 ⁷	0.05	v. s.	v. s. eth., acet.; s. bz.; sl. s. pet. eth.
7764	col.....	.....	61-2.5	177-8 ⁶	v. sl. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7765	Resorcinol, 4-isobutyl-	2,4-dihydroxy-1-isobutylbenzene	$(\text{CH}_3)_2\text{CHCH}_2\text{-C}_6\text{H}_3(\text{OH})_2$	166.21
7766	—, 4-isohexyl-	2,4-dihydroxy-1-isohexylbenzene	$(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{-C}_6\text{H}_3(\text{OH})_2$	194.27
7767	—, 4-isopropyl-	2,4-dihydroxy-1-isopropylbenzene	$(\text{CH}_3)_2\text{CHC}_6\text{H}_3(\text{OH})_2$	152.19
7768	—, 2-methoxy-	pyrogallol 2-methyl ether.	$\text{CH}_3\text{OC}_6\text{H}_3(\text{OH})_2$	140.13
7769	—, 5-methoxy-	phloroglucinol monomethyl ether	$\text{CH}_3\text{OC}_6\text{H}_3(\text{OH})_2$	140.13
7770	—, 2-methyl-	2-methyl-1,3-benzenediol*; 2,6-dihydroxytoluene	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})_2$	124.13
7771	—, 4-methyl-	See <i>Cresorcinol</i> .		
7772	—, 5-methyl-	See <i>Orcinol</i> .		
7773	—, 4-propionyl-	See <i>Propiophenone</i> , 2,4-dihydroxy-		
7774	—, 4-propyl-	2,4-dihydroxy-1-propylbenzene	$\text{CH}_3(\text{CH}_2)_2\text{C}_6\text{H}_3(\text{OH})_2$	152.19
7775	—, 2-salicylyl-	See <i>Benzophenone</i> , 2,2',6-trihydroxy-		
7776	—, 2,4,6-tribromo-	See <i>Mesorcinol</i> .	$\text{Br}_3\text{C}_6\text{H}(\text{OH})_2$	346.83
7777	—, 2,4,6-trimethyl-	See <i>Styphnic acid</i> .		
7778	—, 2,4,6-trinitro-	See <i>Fluorescein</i> .		
7779	Resorcinolphthalein.	2,4-dihydroxybenzaldehyde;	$(\text{HO})_2\text{C}_6\text{H}_3\text{CHO}$	138.12
7780	β-Resorcylaldehyde	2,4-dihydroxybenzenecarbal* See <i>Benzaldehyde</i> , 2,4-dimethoxy-		
7781	—, dimethyl ether.	3,5-dihydroxybenzoic acid;	$(\text{HO})_2\text{C}_6\text{H}_3\text{COOH}$	181.14
7782	α-Resorcylic acid	3,5-dihydroxybenzenecarboxylic acid*	$1\frac{1}{2}\text{H}_2\text{O}$	
7783	β-Resorcylic acid	2,4-dihydroxybenzoic acid;	$(\text{HO})_2\text{C}_6\text{H}_3\text{COOH}$	208.17
7784	γ-Resorcylic acid	2,4-dihydroxybenzenecarboxylic acid*	$3\text{H}_2\text{O}$	
7785	Retene	2,6-dihydroxybenzoic acid;	$(\text{HO})_2\text{C}_6\text{H}_3\text{COOH}$	181.14
7786	Rhamnitol	2,6-dihydroxybenzenecarboxylic acid*	$1\frac{1}{2}\text{H}_2\text{O}$	
7787	β-Rhamnose	7-isopropyl-1-methylphenanthrene	$\text{C}_{15}\text{H}_{18}$	234.33
7788	Rheadine	1,2,3,4,5-hexanepentol* (one form); rhamnite	$\text{CH}_3(\text{CHOH})_4\text{-CH}_2\text{OH}$	166.17
7789	Rheum emodin.		$\text{C}_6\text{H}_2\text{O}_5\text{-H}_2\text{O}$	182.17
7789M	Rhodanates.	rheadine	$\text{C}_{21}\text{H}_{21}\text{NO}_6$	383.39
7790	Rhodinal.	See <i>Emodin</i> .		
7791	Rhodinol	See under <i>Thiocyanic acid</i> .		
7792	Rheadine.	See <i>Citronellal</i> .		
7792M	D-Riboflavin	3,7-dimethyl-6-octen-1-ol*(?) See <i>Rheadine</i> .	$\text{C}_{10}\text{H}_{19}\text{OH}$	156.26
7792T	D-Ribose	vitamin B ₂ ; vitamin G; lactoflavin; ovoflavin; hepatoflavin; 6,7-dimethyl-9-(1-D-ribityl)isoxaloxazine	$\text{C}_{17}\text{H}_{20}\text{N}_4\text{O}_6$	376.36
7793	Ricinine		$\text{C}_8\text{H}_{10}\text{O}_5$	150.13
7794	Ricinoleic acid	12-hydroxy-9-octadecenoic acid* (one form); ricinolic acid	$\text{CH}_3(\text{CH}_2)_5\text{CHOH-CH}_2\text{CH:CH-(CH}_2)_7\text{COOH}$	298.46

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7765	col. ....	.....	63.5	166-8 ⁶	sl. s.	s.	s. eth.
7766	col. ....	.....	70-1.5	182-3 ⁶	v. sl. s.	s.	s. eth.
7767	col. ....	.....	105	265-81	sl. m.	s.	s. eth.
7768	cr. f. bz. ....	.....	85-7	154-5 ²⁴	.....	.....	.....
7769	tab. f. bz. ....	.....	78-81	213 ¹⁶	sl. m.	v. s.	v. s. eth.
7770	col. need. ....	.....	116-21	264	s.	s.	s. eth., bz.
7771							
7772							
7773							
7774	col. pr. f. bz. ....	.....	107-8 (82-3)	172-4 ¹⁴⁻⁵	s.	s.	s. eth.
7775							
7776	col. need. f. w. ....	.....	111	.....	sl. s.	v. s.	s. eth.
7777							
7778							
7779							
7780	yel. need. f. w. ....	.....	135	220-8 ²²	v. s.	v. s.	v. s. eth.; sl. s. c. bz.
7781							
7782	col. pr. ....	.....	232-3; anh. 237	.....	s.	v. s.	v. s. eth.
7783	col. need. f. eth. ....	.....	ca. 213 (226-7 d.)	d.	0.26 ¹⁷	v. s.	v. s. eth.
7784	col. need. f. w. ....	.....	anh. 167 d.	.....	v. s. h.	.....	s. alk.
7785	leaf. f. al.	1.13 ¹⁶	98.5	394	i.	2.13 c., 69 ⁷⁸	s. eth., bz., CS ₂
7786	tricl. pr. ....	.....	121	.....	v. s.	v. s.	v. sl. s. eth.; sl. s. acet., chl. i. eth.
7787	col. monoc. f. w., 1.523, 1.531, 1.534	1.471	126	.....	57 ¹⁸ , 109 ⁴⁰	sl. s.	i. eth.
7788	sm. pr. ....	.....	245-7 d.	.....	sl. s.	sl. s.	sl. s. eth., chl.; i. bz.
7789							
7789M							
7790							
7791	col. oily liq. ....	.....	.....	113-4 ¹⁵	.....	.....	.....
7792							
7792M	fine or.-yel. need. ....	.....	275-80 d.	.....	0.012 ^{27.5} , 0.019 ⁴⁰	0.045 ^{27.5}	i. eth., acet., chl., bz.
7792T	[α] _D H ₂ O, -21.5° (-19.5°)	.....	95; dl -86-7	.....	s.	sl. s.	.....
7793	pr. or tab. f. al. or w. ....	.....	201 subl.	.....	s. h.	s. h.	sl. s. eth., bz.
7794	col. liq., or cr. mass	0.945 ¹⁵	17	250 ¹⁵	i.	=	∞ eth.; s. chl.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No:	Name	Synonyms	Formula	Mol. Wt.
7795	Ricinoleic acid , butyl ester	butyl ricinoleate; butyl 12-hydroxy-9-octadecenoate* (one form)	$C_{18}H_{32}O_3C_4H_9$	354.56
7796	—, glycerol esters.	See under <i>Glycerol</i> .		
7797	—, isobutyl ester.....	isobutyl ricinoleate; β -methylpropyl 12-hydroxy-9-octadecenoate* (one form)	$C_{22}H_{42}O_3$	354.56
7798	Rodinal .	See <i>Phenol</i> , <i>p</i> -amino-.		
7799	Rosaniline	bis- <i>p</i> -aminophenyl-4-amino- <i>m</i> -tolylcarbinol	$H_2NC_7H_5(H_2NC_6H_4)_2COH$	319.39
7800	Rosinduline	5,8-dihydro-8-imino-5-phenylbenzo[<i>b</i>]phenazine	$HN:C_{10}H_5:NC_6H_4NC_6H_5$	321.37
7801	Rosolic acid .	See <i>Aurin</i> .		
7802	Rotenone		$C_{23}H_{22}O_6$	394.41
7803	Rufigallic acid	1,2,3,5,6,7-hexahydroxy-anthraquinone; rufigallol	$C_{14}H_{12}O_2(OH)_6$...	304.20
7804	Rufigallol .	See <i>Rufigallic acid</i> .		
7805	Rufopin	1,2,5,6-tetrahydroxyanthraquinone	$C_{14}H_4(OH)_4O_2$...	272.20
7806	Rufol	1,5-anthracediol*; 1,5-anthradial	$HOCH_2CH_3(CH)_2C_6H_3OH$	210.22
7807	Rutaecarpine		$C_{18}H_{13}N_3O$	287.31
7807M	Rutylidene .	See 1- <i>Hendecyne</i> .*		
7808	Sabadine		$C_{29}H_{51}NO_8$	541.71
7809	Sabinane , 6-keto-.	See α - <i>Thujone</i> .		
7810	Sabinene	1-isopropyl-4-methylenebicyclo[3,1,0]hexane	$C_{10}H_{16}$	136.23
7811	D-Saccharic acid	2,3,4,5-tetrahydroxyhexanedioic acid* (one form)	$COOH(CHOH)_4COOH$	210.14
7812	Saccharin	<i>o</i> -sulfobenzoic imide; benzoic sulfonide; glucide	$C_6H_4SO_2NHCO$...	183.18
7813	Saccharose .	See <i>Sucrose</i> .		
7814	S acid .	See 1- <i>Naphthol</i> -5-sulfonic acid,		
7815	Safrole	1-allyl-3,4-methylenedioxybenzene; shikimole	8-amino- $CH_2(O_2)C_6H_3CH_2CH:CH_2$	162.18
7816	—, 2,5-dimethoxy-.	See <i>Apiole</i> .		
7817	—, 5-methoxy-.	See <i>Myristicin</i> .		
7818	Salazolon .	See <i>Salipyrine</i> .		
7819	Salicin		$C_6H_{11}O_5OC_6H_4CH_2OH$	286.28
7820	—, benzoyl-.	See <i>Populin</i> .		
7821	Salicyl alcohol .	See <i>Saligenin</i> .		
7822	Salicylaldehyde	<i>o</i> -hydroxybenzaldehyde; salicylic aldehyde	HOC_6H_4CHO	122.12
7823	—, glucoside.	See <i>l-Helicin</i> .		
7824	—, methyl ether.	See <i>Benzaldehyde</i> , <i>o</i> -methoxy-.		
7825	Salicylamide	<i>o</i> -hydroxybenzamide; salicylic amide	$HOC_6H_4CONH_2$...	137.13
7826	—, <i>N</i> -phenyl-.	See <i>Salicylanilide</i> .		
7827	Salicylanilide	<i>N</i> -phenylsalicylamide.....	$HOC_6H_4CONH-C_6H_5$	213.23
7828	Salicylic- O-acetic acid .	See <i>Benzoic acid</i> , <i>o</i> -(carboxymethoxy)-.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7795	liq.	0.906 ²²	.....	275 ¹³	i.	.....	s. eth.
7796							
7797	liq., 1.4538 ²²	0.903 ²²	.....	262 ⁹	i.	.....	s. eth.
7798							
7799	col. need. f. w.	.....	186 d.	d.	sl. s.	s.	i. eth.; s. a., aniline
7800	br. leaf. f. al. or need. f. eth.	.....	199	.....	i.	v. s.	v. s. eth.; s. bz.
7801							
7802	hex. pl. f. al. or eth.; need. f. bz., chl., or CCl ₄	.....	163	.....	i.	0.2 ²⁰	0.4 eth.; 8.5 bz.; 0.6 CCl ₄ ; 7.34 chl.
7803	or. red cr.	.....	subl. sl. d.	.....	i.	.....	s. eth., alk., conc. H ₂ SO ₄
7804							
7805	yel.-red need.	.....	subl.	d.	sl. s. h.	s.	sl. s. eth.; s. ac. a., H ₂ SO ₄
7806	cr. f. bz.	.....	280-5 d. (265)	.....	v. s.	s. (vlt. fluores.)	s. alk.
7807	yel. pl.; need f. et. ac.	.....	257-8	.....		sl. s.	
7807M							sl. s. eth.
7808	need. f. eth.	.....	238-40 d.	.....	sl. s.	v. s.	∞ eth.
7809							
7810	col. liq., 1.46738 ^{17.0}	0.842	.....	165	i.	∞	i. eth.
7811	syrup.	.....	125-6 d.	.....	v. s.	v. s.	sl. s. eth., chl., acet., glyc.; s. alk., bz., amyl ac., et. ac., xylol
7812	col. monocl. f. acet.	.....	228 d. (224-6)	subl.	0.43 ²⁵	3.1	v. s. eth.; ∞ chl.
7813							
7814							
7815	col. liq. or monocl., 1.5420 ¹³	1.096	11	234.5	i.	v. s.	i. eth., chl.
7816							
7817							
7818							
7819	col. rhomb. need. or leaf.	1.434 ²⁶	198-202	240 d.	3.6 ¹⁵	1.13 ²⁵ , 3.33 ⁶⁰	∞ eth.; 64.6 ¹³ bz.
7820							
7821							
7822	col. liq., 1.57358 ^{19.7}	1.1669 ³⁰ / ₄	-7 (1.6)	196.5	1.72 ²⁵	∞	sl. s. eth.; s. Na ₂ CO ₃ sol.
7823							
7824	leaf. f. w.	.....	140 (137-8)	270 d.	sl. s.	s.	s. eth.; sl. s. CS ₂
7825							
7826	pr. f. al.	.....	135	d.	sl. s. h.	s.	
7827							
7828							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7829	Salicylic acid	<i>o</i> -hydroxybenzoic acid.	$\text{HOC}_6\text{H}_4\text{COOH}$. . .	138.12
7830	—, acetate.	See <i>Aspirin</i> .		
7831	—, amyl ester.	amyl salicylate; pentyl <i>o</i> -hydroxybenzoate	$\text{HOC}_6\text{H}_4\text{CO}_2\text{C}_5\text{H}_{11}$	208.25
7832	—, ethyl ester.		$\text{HOC}_6\text{H}_4\text{COOC}_2\text{H}_5$	166.17
7833	—, ethyl ether.	See <i>Benzoic acid, o-ethoxy</i> .		
7834	—, isoamyl ester.	isoamyl salicylate; isoamyl <i>o</i> -hydroxybenzoate	$\text{HOC}_6\text{H}_4\text{COOC}_5\text{H}_{11}$	208.25
7835	—, isobutyl ester.		$\text{HOC}_6\text{H}_4\text{COOC}_4\text{H}_9$	194.22
7836	—, methyl ester.	methyl salicylate; artificial oil of wintergreen	$\text{HOC}_6\text{H}_4\text{COOCH}_3$	152.14
7837	—, methyl ether.	See <i>Benzoic acid, o-methoxy</i> .		
7838	—, 1-naphthyl ester.	α -naphthyl salicylate.	$\text{HOC}_6\text{H}_4\text{COOC}_{10}\text{H}_7$	264.27
7839	—, 2-naphthyl ester.	See <i>Betol</i> .		
7840	—, nicotine salt.	See <i>Nicotine, salicylate</i> .		
7841	—, phenyl ester.	salol.	$\text{HOC}_6\text{H}_4\text{COOC}_6\text{H}_5$	214.21
7842	—, phenyl ether.	See <i>Benzoic acid, o-phenoxy</i> .		
7843	—, propyl ester.	<i>n</i> -propyl salicylate.	$\text{HOC}_6\text{H}_4\text{COOC}_3\text{H}_7$	180.20
7844	—, acetyl-.	See <i>Aspirin</i> .		
7845	—, 5-allyl-3-methoxy-	See <i>Eugetie acid</i> .		
7846	—, 3-amino-.	3-amino-2-hydroxybenzoic acid	$\text{NH}_2\text{C}_6\text{H}_3(\text{OH})\text{COOH}$	153.13
7847	—, 4-amino-.	4-amino-2-hydroxybenzoic acid	$\text{NH}_2\text{C}_6\text{H}_3(\text{OH})\text{COOH}$	153.13
7848	—, 5-amino-.	5-amino-2-hydroxybenzoic acid	$\text{NH}_2\text{C}_6\text{H}_3(\text{OH})\text{COOH}$	153.13
7849	—, 3,5-dinitro-.	3,5-dinitro-2-hydroxybenzoic acid	$(\text{NO}_2)_2(\text{HO})\text{C}_6\text{H}_2\text{COOH}$	228.12
7850	—, hexahydro-.	See <i>Cyclohexanecarboxylic acid</i> .		
7851	—, 3-nitro-.	2-hydroxy-3-nitrobenzoic acid	$\text{NO}_2\text{C}_6\text{H}_3(\text{OH})\text{COOH} \cdot \text{H}_2\text{O}$	201.13
7852	—, 5-nitro-.	2-hydroxy-5-nitrobenzoic acid	$\text{NO}_2\text{C}_6\text{H}_3(\text{OH})\text{COOH}$	183.12
7853	—, 6-nitro-.	2-hydroxy-6-nitrobenzoic acid	$\text{NO}_2\text{C}_6\text{H}_3(\text{OH})\text{COOH}$	183.12
7854	—, <i>O</i> -phenyl-.	See <i>Benzoic acid, o-phenoxy</i> .		
7855	—, thio-.	See <i>Benzoic acid, o-mercapto</i> .		
7856	Salicylic anhydride	<i>o,o'</i> -dihydroxybenzoic anhydride	$(\text{HOC}_6\text{H}_4\text{CO})_2\text{O}$. . .	258.22
7857	Saligenin	<i>o</i> -hydroxybenzyl alcohol; salicyl alcohol; α ,2-toluenediol	$\text{HOC}_6\text{H}_4\text{CH}_2\text{OH}$. . .	124.13
7858	—, 2-methyl ether.	See <i>Benzyl alcohol, o-methoxy</i> .		
7859	Salipyrzolon	See <i>Salipyrine</i> .		
7860	Salipyrine	antipyrine salicylate; salazolon; salipyrzolon; etc.	$\text{C}_{11}\text{H}_{12}\text{N}_2\text{O} \cdot \text{C}_7\text{H}_5\text{O}_3$	326.34
7861	Salol	See <i>Salicylic acid, phenyl ester</i> .		
7862	Salvarsan	See <i>Arsphenamine</i> .		
7863	Sanguinarine		$\text{C}_{20}\text{H}_{16}\text{NO}_4 \cdot \text{H}_2\text{O}$. . .	351.35
7864	Santalal acid			
7865	Santonin lactone	See <i>Santonin</i> .	$\text{C}_{15}\text{H}_{14}\text{O}_5$	274.26
7866	Santonin	santonin lactone.	$\text{C}_{15}\text{H}_{18}\text{O}_3$	246.30

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7829	monocl. col. need, f.w., 1.565	1.443 ²⁰ ₄	159 (155-7)	subl. 76	0.18 ²⁰ ₇ 1.76 ⁷⁵	39.2 ¹⁵	50.5 ¹⁵ eth.; s. chl.
7830							
7831	col.-ylsh. liq...	1.065 ¹⁵	.....	265	i.	∞	∞ eth.; s. chl.
7832	col. liq., 1.52511 ^{14.4}	1.1362 ¹⁵ ₄	1.3	234.0 (231.5)	i.	∞	∞ eth.
7833							
7834	col.-ylsh. liq...	1.042 ²⁵ ₄	.....	273 (128-30 ¹²)	0.004 ²²	33 90%	∞ eth.; s. chl.
7835	.....	1.075	.....	259	i.	s.	s. eth.
7836	col. liq., 1.5369	1.1840 ^{20.2} ₄	-8.6	223.3	0.074 ³⁰	∞	∞ eth.; s. glac. ac. a., CS ₂
7837							
7838	wh. cr. powd...	.....	83	.....	i.	s.	s. eth., fixed oils
7839							
7840							
7841	col. rhomb. f. al.	1.250	43	173 ¹²	0.015 ²⁵	21.5 ²⁵	v. s. eth., bz., chl.; v. sl. s. glyce.
7842							
7843	col. liq.....	1.099 ¹⁵	.....	240	v. sl. s.	∞	∞ eth.
7844							
7845							
7846	cr.....	.....	235 d.	.....	.....	v. sl. s.	.....
7847	redsh. br. cr. powd.	.....	220 d.	.....	s.	s.	s. eth.
7848	wh. need.....	.....	283 (280 d.)	.....	sl. s. h.	i.	s. CS ₂
7849	need. or pl. (+1H ₂ O) f. w.	.....	anh. 174 (170-2)	subl. d.	v. s. h.	v. s.	v. s. eth.
7850							
7851	rhomb. need. f. w.	.....	hyd. 125; anh. 144	.....	0.13 ¹⁵	v. s.	v. s. eth.
7852	need. f. w.....	1.650 ²⁰	228	.....	0.18 ²²	v. s.	v. s. eth.
7853	yel. need.....	.....	130	.....	.....	sl. s.	v. s. eth.; s. acet.
7854							
7855							
7856	yel. amor.....	.....	200-20	d.	i.	v. s.	v. s. eth.
7857	rhomb. f. w...	1.161 ²⁵	86	subl.	6.7 ²²	v. s.	v. s. eth.
7858							
7859							
7860	cr. powd.....	.....	92	.....	0.5 ¹⁵ 4.0 ¹⁰⁰	.....	s. eth., bz.; v. s. chl.
7861							
7862	bl. fluores. need.	.....	213	.....	i.	s.	s. eth.
7863	red micr. pr...	.....	226 (104)	195 ⁹	i.	s.	s. eth., alk.
7864							
7865	col. rhomb. pr., 1.590, 1.630, 1.640	1.187	170	subl.	0.02 ¹⁷ 0.4 ¹⁰⁰	2.0 ²² 37 ⁸⁰	sl. s. eth.; s. chl., alk.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7867	Sarcine.	See <i>Hypoanthine</i> .		
7868	Sarcolactic acid.	See <i>d-Lactic acid</i> .		
7869	Sarcosine	<i>N</i> -methylglycine.....	$\text{CH}_3\text{NHCH}_2\text{-COOH}$	89.09
7870	—, hydrochloride.....	.....	$\text{HCl}\cdot\text{NH}(\text{CH}_3)\text{-CH}_2\text{COOH}$	125.56
7871	Schäffer's acid.	See 2- <i>Naphthol-6-sulfonic acid</i> .		
7872	Schöllkopf's acid.	See <i>Naphthionic acid</i> .		
7873	i-Scopolamine	atrosine.....	$\text{C}_{17}\text{H}_{21}\text{NO}_4$	303.35
7874	l-Scopolamine.	See <i>Hyoscyne</i> .		
7875	Sebacic acid	decanedioic acid*.....	$\text{COOH}(\text{CH}_2)_8\text{-COOH}$	202.25
7876	—, diethyl ester.....	ethyl sebacate.....	$[(\text{CH}_2)_4\text{COOC}_2\text{H}_5]_2$	258.35
7877	—, piperazinium salt.....	.....	$\text{C}_4\text{H}_{10}\text{N}_2\cdot\text{C}_{10}\text{H}_{18}\text{O}_4$	288.38
7878	Selenide, diethyl.	See <i>Ethyl selenide</i> .		
7879	—, dimethyl.	See <i>Methyl selenide</i> .		
7880	Semicarbazide	aminourea; carbamylhydrazine	$\text{NH}_2\text{NHCONH}_2$...	75.07
7881	—, hydrochloride.....	.....	$\text{NH}_2\text{NHCONH}_2\cdot\text{HCl}$	111.54
7882	—, 1-phenyl-.....	1-carbamyl-2-phenylhydrazine	$\text{C}_6\text{H}_5\text{NHNHCONH}_2$	151.17
7884	—, thio-.....	.....	$\text{NH}_2\text{NHCSNH}_2$...	91.13
7885	Seminose.	See <i>D-Mannose</i> .		
7886	Septentrionaline.....	.....	$\text{C}_{31}\text{H}_{46}\text{N}_2\text{O}_9(?)$...	590.70
7887	dl-Serine.....	.....	$\text{CH}_2\text{OHCH}(\text{NH}_2)\text{-COOH}$	105.09
7888	d-Serine	<i>d</i> - β -hydroxyalanine.....	$\text{CH}_2\text{OHCH}(\text{NH}_2)\text{-COOH}$	105.09
7889	l-Serine	<i>l</i> - α -amino- β -hydroxypropionic acid; <i>l</i> - β -hydroxyalanine	$\text{HOCH}_2\text{CH}(\text{NH}_2)\text{-COOH}$	105.09
7890	Shikimole.	See <i>Safrole</i> .		
7891	Silanol (mono).	See <i>Silicol</i> .		
7892	Silicane, dimethyl	dimethylmonosilane.....	$(\text{CH}_3)_2\text{SiH}_2$	60.14
7893	—, ethoxytriethyl-...	triethylsilicol ethyl ether....	$(\text{C}_2\text{H}_5)_3\text{SiOC}_2\text{H}_5$...	160.30
7894	—, hydroxy-.	See <i>Silicol</i> .		
7895	—, methyl-.....	methylmonosilane.....	CH_3SiH_3	46.12
7896	—, tetraethyl-.....	silicon tetraethyl.....	$(\text{C}_2\text{H}_5)_4\text{Si}$	144.30
7897	—, tetramethyl-....	silicon tetramethyl; tetramethylsilicon	$(\text{CH}_3)_4\text{Si}$	88.20
7898	—, trichlorophenyl-	phenylsilicon trichloride....	$\text{C}_6\text{H}_5\text{SiCl}_3$	211.53
7899	—, triethyl-.....	triethylsilicon hydride.....	$(\text{C}_2\text{H}_5)_3\text{SiH}$	116.25
7900	Silicoheptyl alcohol.	See <i>Silicol, triethyl</i> ..		
7901	Silicol, triethyl	silicoheptyl alcohol.....	$(\text{C}_2\text{H}_5)_3\text{SiOH}$	132.25
7902	—, —, ethyl ether.	See <i>Silicane, ethoxytriethyl</i> ..		
7903	Silicon, tetramethyl ..	See <i>Silicane, tetramethyl</i> ..		
7904	Silicon hydride, triethyl ..	See <i>Silicane, triethyl</i> ..		
7905	Silicon oxide, triethyl ..	See <i>Silicyl oxide, hexaethyl</i> ..		
7906	Silicon tetraethyl ..	See <i>Silicane, tetraethyl</i> ..		
7907	Silicon trichloride, phenyl ..	See <i>Silicane, trichlorophenyl</i> ..		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7867							
7868							
7869	deliq. col. rhomb. f. dil. al.	.....	210 d.	d.	v. s.	sl. s.	i. eth.
7870	need. f. al.....	.....	170-2	d.	v. s.	v. sl. s.	v. sl. s. eth.
7871							
7872							
7873	cr., [α]-33.1°D.	.....	82-3 (50-9)	.....	10.52 ¹⁵	v. s.	v. s. eth.; s. chl.; sl. s. bz.
7874							
7875	thin col. leaf, 1.422 ^{133.3}	.....	133	295 ¹⁰⁰	0.11 ¹⁷ , 2.0 ¹⁰⁰	v. s.	v. s. eth.
7876	col. liq.....	0.9646 ²⁰ / ₄	1	308	0.008 ²⁰	s.	s. eth.
7877	wh. cr.....	.....	166-8	.....	s. h.	s. h.	i. eth.
7878							
7879							
7880	pr. f. al.....	.....	96	.....	v. s.	s.	i. eth., bz., chl
7881	pr. f. dil. al....	.....	173 d.	.....	v. s.	i.	i. eth.
7882	leaf. f. dil. al..	.....	172	.....	s. h., sl. s. c.	s.	sl. s. eth.; s. chl., acet.
7884	need. f. w.....	.....	183	.....	s.	s.	.....
7885							
7886	wh. powd.....	.....	129	.....	1.7	58	50 eth.
7887	monocl. pr. f. w.	.....	246 d.	.....	5.02 ²⁵ , 19.21 ⁷⁵	0.187 75% i. abs.	i. eth.
7888	hex. tab., 1.515, 1.575, 1.586	.....	228 d.	.....	ca. 25 ²⁰	i.	i. eth.
7889	hex. pl. or pr..	.....	228 d.	.....	25 ²⁰	.....	.....
7890							
7891							
7892		0.68 ⁻⁸⁰	-150	-20.1	.....	.....	.....
7893	liq.....	0.8403 ⁹	.....	153	i.	∞	∞ eth.; s. H ₂ SO ₄
7894							
7895		0.62 ⁻⁶⁷	-156.5	-56.8	.....	.....	.....
7896	col. liq.....	0.7682	.....	153	i.	.....	.....
7897	liq. ign. in air..	0.645 ²⁰ / ₄	.....	26-77 ⁶¹	i.	v. s.	v. s. eth.; i. H ₂ SO ₄
7898	liq.....	.....	.....	197	d.	d.	s. eth.
7899	liq.....	0.751 ⁰ / ₄	.....	107 (95-6)	i.	.....	i. H ₂ SO ₄
7900							
7901	liq.....	0.8709 ⁹	.....	154	i.	∞	∞ eth.
7902							
7903							
7904							
7905							
7906							
7907							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7908	Silicyl oxide, hexa-ethyl-	triethylsilicon oxide.....	$[(C_2H_5)_3Si]_2O$	246.48
7909	Silvan	See <i>Furan, 2-methyl-</i> .		
7911	Sinapine, bisulfate		$C_{16}H_{24}NO_6HSO_4 \cdot 3H_2O$	477.48
7912	—, thiocyanate.....		$C_{16}H_{24}NO_6SCN \cdot H_2O$	386.46
7913	Sincaline	See <i>Choline</i> .		
7914	Skatole	3-methylindole.....	C_9H_9N	131.17
7915	Sneezing gas.	See <i>Arsine, chlorodiphenyl-</i> .		
7916	dl-Sobrerone	See <i>Pinole (dl)</i> .		
7917	Sodium glycerolate.	See <i>Glycerol, 1-sodium derivative</i> .		
7918	Sodium mercaptide.	See <i>Ethanethiol, sodium derivative</i> .		
7919	Sodium thioethylate.	See <i>Ethanethiol, sodium derivative</i> .		
7920	Solanidine		Mixt.....	
7921	Solanine		Mixt. (?).....	
7922	Sophoretin	See <i>Quercetin</i> .		
7923	Sophorine	See <i>Cytisine</i> .		
7924	Sorbic acid	2,4-hexadienoic acid*.....	$CH_3CH:CH-CH:CHCOOH$	112.12
7925	D-Sorbitol	1,2,3,4,5,6-hexanehexol* (one form); D-sorbite; D-sorbol	$C_6H_{14}O_6 \cdot \frac{1}{2}H_2O$	191.18
7926	D-Sorbose	1,3,4,5,6-pentahydroxy-2-hexanone* (one form); D-sorbinose	$C_6H_{12}O_6$	180.16
7927	Sozolic acid	See 1-Phenol-2-sulfonic acid.		
7928	Sparteine	lupinidine.....	$C_{15}H_{25}N_2$	234.38
7929	—, bisulfate.....		$C_{15}H_{25}N_2 \cdot H_2SO_4 \cdot 5H_2O$	422.53
7930	Spirit of wine	See <i>Ethyl alcohol</i> .		
7931	Stachydrine		$C_7H_{13}NO_2 \cdot H_2O$	161.20
7932	—, oxalate.....		$C_7H_{13}NO_2 \cdot H_2C_2O_4$	233.22
7933	Stannane, diethyldimethyl-	See <i>Tin, diethyldimethyl-</i> .		
7934	—, tetraethyl-	See <i>Tin, tetraethyl-</i> *		
7935	—, tetramethyl-	See <i>Tin, tetramethyl-</i> *		
7936	Stannone, diethyl-	See <i>Tin oxide, diethyl-</i> *		
7937	Stannonic acid, methyl-	See <i>Methanestannonic acid</i> .		
7938	Starch		$(C_6H_{10}O_5)_n$	(162-14)±
7938M	—, triacetate.....	acetyl starch; triacetyl starch	$[C_6H_7O_5(C_2H_3O)_3]_{18}$	5188.49
7939	—, animal.	See <i>Glycogen</i> .		
7940	Starch gum	See <i>Dextrin</i> .		
7941	Stearaldehyde	octadecanal*.....	$C_{17}H_{35}CHO$	268.47
7942	Stearamide	octadecanamide*.....	$CH_3(CH_2)_{16}CO-NH_2$	283.49
7942H	—, N-phenyl-	See <i>Stearanilide</i> .		
7942R	Stearanilide	N-phenylstearamide.....	$C_{17}H_{35}CONHC_6H_5$	359.58
7943	Stearic acid	octadecanoic acid*; n-octadecylic acid	$CH_3(CH_2)_{16}COOH$	284.47

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7908	liq.	0.859 ⁹	.....	231	i.	s.	s. eth., H ₂ SO ₄
7909							
7911	leaf. f. al. ....	.....	127; 186 dry	.....	s.	s. h.	i. eth.
7912	pa. yel. need. f. w.	.....	178	.....	sl. s.	sl. s.	.....
7913							
7914	leaf. f. lgr. ....	.....	95	266.2	0.05 c.	v. s.	s. eth., bz., chl., lgr.
7915							
7916							
7917							
7918							
7919							
7920	need. f. eth. ....	.....	191	.....	v. sl. s.	s. h.	sl. s. eth.; s. chl.
7921	slend. need. f. al.	.....	244-50 (262)	d.	v. sl. s.	s. h.	i. eth., chl., bz.
7922							
7923							
7924	col. need. f. w.	.....	134.5	228 d.	sl. s.	v. s.	v. s. eth.
7925	col. need. ....	.....	anh. 110 (89-93)	.....	s.	v. sl. s.	i. eth.
7926	col. rhomb.	<i>d</i> 1.612; (<i>dl</i> 1.64)	165	.....	55 ¹⁷	v. sl. s. h., 0.26 ¹⁷	i. eth.; sl. s. me. al.
7927							
7928	col. oil, [α] _D -14.6° _D in al.	1.023 ²⁰ ₄	.....	325 ⁷⁵⁴ in H ₂ ; 150-1 ²⁰	0.304 ²²	v. s.	v. s. eth.; s. chl.; i. bz.
7929	col. hyg. rhbdr. cr. or powd., 1.5289 ¹⁹	.....	136; anh. 150-2	.....	91 ²⁵	32 ²⁵	i. eth., chl.
7930							
7931	deliq. cr. ....	.....	210 dry	.....	s.	s.	i. eth., chl.
7932	need. ....	.....	105-7	.....	.....	i. c.	.....
7933							
7934							
7935							
7936							
7937							
7938	wh. amor., 1.53	1.50 ²¹	d.	.....	i.	i.	i. eth.
7938M	fine wh. powd. [α] _D ²⁸ 170.2 (chl.); 160.4 (ac. a.); [α] _D ¹⁴ 159.6 (pyr.)	.....	sinters 258; sl. d. >270	.....	v. sl. s.	sl. s.	sl. s. eth., bz., CHCl ₃ ; s. acet., toluene
7939							
7940							
7941	sc. f. eth. ....	.....	63.5	261 ¹⁰⁰	i.	s.	s. eth.
7942	col. leaf. ....	.....	109	251 ¹²	i.	sl. s.	sl. s. eth.
7942H							
7942R	col. cr. ....	.....	94	153.5 ¹⁰	i.	s.	s. eth.
7943	col. monocl. leaf., 1.4299 ^{80,2}	0.847 ⁹⁹	69.4	383	0.034 ²⁵ , 0.1 ³⁷	2.5 c.	v. s. eth.; s. chl., CCl ₄ , CS ₂

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7944	Stearic acid , amyl ester.		$C_{17}H_{35}COO-(CH_2)_4CH_3$	354.60
7945	—, benzyl ester.		$C_{17}H_{35}COOCH_2C_6H_5$	374.59
7946	—, butyl ester.	butyl stearate; butyl octadecanoate*	$C_{17}H_{35}COOC_4H_9$	340.58
7947	—, diethylene glycol ester.	See <i>Diethylene glycol, distearate</i> .		
7948	—, ethylene ester.	See <i>Glycerol distearate</i> .		
7949	—, ethyl ester.	ethyl octadecanoate*	$C_{17}H_{35}COOC_2H_5$	312.52
7950	—, glycerol ester.	See <i>Glycerol, tristearate</i> .		
7951	—, isoamyl ester.	isoamyl stearate; γ -methyl-butyl octadecanoate*	$CH_3(CH_2)_{16}COOC_5H_{11}$	354.60
7952	—, methyl ester.	methyl octadecanoate*; methyl stearate	$C_{17}H_{35}COOCH_3$	298.50
7952M	—, phenyl ester.	phenyl stearate.	$C_{17}H_{35}COOC_6H_5$	360.56
7953	—, <i>p</i> -phenylphenacyl ester		$C_{17}H_{35}COOCH_2COC_6H_4C_6H_5$	478.69
7954	—, θ , ι -dibromo-.	See <i>Elaidic acid, dibromide</i> .		
7955	—, α , β -dihydroxy-.	2,3-dihydroxyoctadecanoic acid*	$C_{17}H_{33}(OH)_2COOH$	316.47
7956	—, θ , ι -dihydroxy-.	9,10-dihydroxyoctadecanoic acid*	$CH_3(CH_2)_7CH(OH)CH(OH)(CH_2)_7COOH$	316.47
7957	—, θ , ι -dioxo-.	See <i>Stearoxylic acid</i> .		
7958	—, θ , ι , λ , μ , ξ , σ -hexabromo-.	9,10,12,13,15,16-hexabromooctadecanoic acid*; α -linolenic acid hexabromide	$C_{17}H_{29}Br_6COOH$	757.92
7959	—, —, ethyl ester.		$C_{17}H_{29}Br_6COOC_2H_5$	785.97
7960	—, α -hydroxy-.	2-hydroxyoctadecanoic acid*	$CH_3(CH_2)_{16}CHOHCOOH$	300.47
7961	—, β -hydroxy- (<i>dl</i>).	<i>dl</i> -3-hydroxyoctadecanoic acid*	$CH_3(CH_2)_{14}CHOHCH_2COOH$	300.47
7962	—, ι -hydroxy-.	10-hydroxyoctadecanoic acid*	$CH_3(CH_2)_7CHOH(CH_2)_6COOH$	300.47
7963	—, κ -hydroxy-.	11-hydroxyoctadecanoic acid*	$CH_3(CH_2)_5CHOH(CH_2)_9COOH$	300.47
7964	—, λ -hydroxy-.	12-hydroxyoctadecanoic acid*	$CH_3(CH_2)_6CHOH(CH_2)_{10}COOH$	300.47
7965	—, θ , ι , λ , μ -tetrabromo-.	9,10,12,13-tetrabromooctadecanoic acid*; linoleic acid tetrabromide	$C_{17}H_{31}Br_4COOH$	600.10
7966	—, —, ethyl ester.		$C_{17}H_{31}Br_4COOC_2H_5$	628.16
7967	—, —, methyl ester.		$C_{17}H_{31}Br_4COOCH_3$	614.13
7968	Stearic anhydride	octadecanoic anhydride*	$(C_{17}H_{35}CO)_2O$	550.93
7969	Stearin	See <i>Glycerol, tristearate</i> .		
7970	Stearolic acid	9-octadecynoic acid*	$CH_3(CH_2)_7C\equiv C(CH_2)_7COOH$	280.44
7971	Stearone	See 18- <i>Pentatriacontanone</i> *.		
7972	Stearonitrile	octadecanenitrile*	$C_{17}H_{35}CN$	265.47
7972M	Stearophenone	heptadecyl phenyl ketone; 1-phenyl-1-octadecanone	$C_{17}H_{35}COC_6H_5$	344.56
7973	Stearoxylic acid	9,10-dioxooctadecanoic acid*; θ , ι -diketostearic acid	$CH_3(CH_2)_7COCO(CH_2)_7COOH$	312.44
7974	Stearoyl chloride	octadecanoyl chloride*; stearyl chloride	$C_{17}H_{35}COCl$	302.92
7975	Stibine, triethyl-	antimony triethyl.	$Sb(C_2H_5)_3$	208.94

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7944	pl.	0.860	30	360	i.	s.	v. s. eth.
7945	cr.	0.9075 $\frac{50}{25}$	45.8	.....	i.	s.	v. s. eth.
7946	col. liq.	0.855-75 ²⁵	19.5 (27.5)	220-5 ²⁵	0.29 ²⁵	s.	s. eth.
7947							
7948							
7949	col. cr.		33.7	213-15 ¹⁵	i.	s.	s. eth.
7950							
7951	cr.	0.855 $\frac{20}{4}$	23	185-90 ¹	i.	sl. s.	s. eth.
7952	col. cr. f. eth.		38 (35-7)	215 ¹⁵	i.	s.	s. eth.
7952M	col. cr.		51.5-53	267 ¹⁵	i.	s.	s. eth.
7953			91	.....			.....
7954							
7955	(a) leaf. f. al. (b) leaf. or pl. f. w.		132 (136.5) 99	.....	..... s.	0.47 c. 2.8 ¹⁸	sl. s. eth. s. eth.
7956	leaf.		131.5 (136.5)	.....	v. sl. s. c.	2.84 ¹⁸	sl. s. eth.
7957							
7958	need.		180-1	.....	i.	.....	i. eth., chl., bz.; s. h. xylene
7959	fine need.		151.5-2.5	.....	i.	i.	i. eth.; sl. s. glac. ac. a.
7960	need. f. chl.		93; 85	.....	.....	6.94 c.	1.64 c. eth.; v. s. h. bz.
7961	pl. f. chl.		89	.....	.....	s. h.	s. eth., chl.
7962	hex. pl.		81-1.5	.....	i.	8.78	2.3 eth.
7963	tab. f. al.		84 (77-9)	.....	i.	0.58	1.71 ²⁰ eth.
7964	cr. f. al.		81-2	.....	i.	s.	s. eth., chl.
7965	wh. pl.		114-5	.....	i.	v. s.	v. s. chl.; sl. s. pet. eth.
7966	need.		58-8.5	.....	i.	s.	s. pet. eth., glac. ac. a.
7967	leaf.		50-6	.....	i.	s.	s. pet. eth., glac. ac. a.
7968	col. cr.	0.8368 $\frac{82}{4}$	71.5	.....	i., d.	d.	s. eth.
7969							
7970	col. pr. f. al.		48	260	i.	sl. s. c.	v. s. eth.
7971							
7972	col. cr.	0.817 $\frac{41}{4}$	42.5-43	214 ¹³	i.	sl. s.	sl. s. eth.
7972M	col. waxy cr.		64-65	.....	i.	s.	s. eth.
7973	yel. leaf.		86	.....	i.	v. s. h.	v. s. h. eth.; sl. s. lgr.
7974	col. cr.		23	215 ¹⁵	d.	d.	v. s. eth.
7975	col. liq.	1.324 ¹⁶	<-29	159.5	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
7976	Stibine, trimethyl- ...	antimony trimethyl.....	$\text{Sb}(\text{CH}_3)_3$	166.86
7977	Stilbene	<i>trans</i> -1,2-diphenylethylene; <i>trans-sym</i> -diphenylethylene; toluylene	$\text{C}_6\text{H}_5\text{CH}:\text{CHC}_6\text{H}_5$	180.24
7978	—, diamino-	See <i>Stilbenediamine</i> .		
7979	—, 2,2'-diamino- (<i>cis</i>).....		$\text{NH}_2\text{C}_6\text{H}_4\text{CH}:\text{CH}-$ $\text{C}_6\text{H}_4\text{NH}_2$	210.27
7979M	—, 4,4'-dimethoxy- ...	bianisal; photoanethole.....	$[\text{p}-\text{CH}_3\text{OC}_6\text{H}_4\text{CH}:\text{CH}]_2$	240.29
7980	—, α-phenyl-	See <i>Ethylene, triphenyl-</i> .		
7981	2,2'-Stilbenediamine ...	<i>o,o'</i> -diaminostilbene.....	$\text{NH}_2\text{C}_6\text{H}_4\text{CH}:\text{CH}-$ $\text{C}_6\text{H}_4\text{NH}_2$	210.27
7982	4,4'-Stilbenediamine ...	<i>p,p'</i> -diaminostilbene.....	$\text{NH}_2\text{C}_6\text{H}_4\text{CH}:\text{CH}-$ $\text{C}_6\text{H}_4\text{NH}_2$	210.27
7983	Strychnine		$\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2$	334.40
7984	—, hydrochloride.....		$\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2\cdot\text{HCl}\cdot$ $2\text{H}_2\text{O}$	406.90
7985	—, nitrate.....		$\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2\cdot\text{HNO}_3$	397.42
7986	—, sulfate.....		$(\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2)_2\cdot\text{H}_2\text{SO}_4\cdot 5\text{H}_2\text{O}$	856.97
7987	Styphnic acid	2,4,6-trinitroresorcinol.....	$(\text{NO}_2)_3\text{C}_6\text{H}(\text{OH})_2$..	245.11
7988	Stypticin	See <i>Cotarnine, hydrochloride</i> .		
7989	Styptol	See <i>Cotarnine, phthalate</i> .		
7990	Styracin	γ -phenylallyl cinnamate; cinnamyl cinnamate	$\text{C}_{18}\text{H}_{16}\text{O}_2$	264.31
7991	Styrene	vinylbenzene; phenylethyl- ene; cinnamene	$\text{C}_6\text{H}_5\text{CH}:\text{CH}_2$	104.14
7992	—, α-bromo-	1-bromo-1-phenylethylene; α -bromostyrol; (α -bromo- vinyl)benzene	$\text{C}_6\text{H}_5\text{CBr}:\text{CH}_2$	183.05
7993	—, β-bromo-	1-bromo-2-phenylethylene; (β -bromovinyl)benzene; ω -bromostyrene	$\text{C}_6\text{H}_5\text{CH}:\text{CHBr}$...	183.05
7994	—, α-chloro-	1-chloro-1-phenylethylene...	$\text{C}_6\text{H}_5\text{CCl}:\text{CH}_2$	138.59
7995	—, β-chloro-	1-chloro-2-phenylethylene; ω -chlorostyrene	$\text{C}_6\text{H}_5\text{CH}:\text{CHCl}$...	138.59
7996	—, <i>o</i>, <i>m</i> or <i>p</i>-hydrox	y-. See <i>Phenol, vinyl-</i> .		
7997	—, 3-hydroxy-4-met	hoxo-. See <i>Hesperetol</i> .		
7998	—, <i>o</i>, <i>m</i> or <i>p</i>-methox	y-. See <i>Anisole, vinyl-</i> .		
7999	—, <i>o</i>-nitro-	1-nitro-2-vinylbenzene.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}:\text{CH}_2$	149.14
8000	—, <i>m</i>-nitro-	1-nitro-3-vinylbenzene.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}:\text{CH}_2$	149.14
8001	—, <i>p</i>-nitro-	1-nitro-4-vinylbenzene.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}:\text{CH}_2$	149.14
8002	<i>o</i>, β-Styrenedicarboxyli	c acid. See <i>Cinnamic acid, o-</i>	carboxy-.	
8003	<i>p</i>, β-Styrenedicarboxyli	c acid. See <i>Cinnamic acid, p-</i>	carboxy-.	
8004	Styrone	See <i>Cinnamic alcohol</i> .		
8005	Styryl ketone	1,5-diphenyl-1,4-pentadien- 3-one*; dibenzalacetone; cinnamone; dicinnamyl ketone; distyryl ketone	$(\text{C}_6\text{H}_5\text{CH}:\text{CH})_2$ CO	234.28
8006	Suberane	See <i>Cycloheptane*</i> .		
8007	Suberene	See <i>Cycloheptene*</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7976	col. monoc. liq. f. w.	1.523 ¹⁵	.....	80.6	sl. s.	i.	s. eth.
7977	col. monoc. tab. f. al.	liq. 0.970 ^{12.5} ₁₃ ; 1.164 ⁰ ₄	124	307	i.	0.88 ¹⁷	5.59 ¹³ eth.; s. bz.
7978							
7979	red need. f. w.	.....	123	.....	.....	.....	.....
7979M	col. leaf. ....	.....	214	.....	.....	s.	s. bz., ac. a.
7980							
7981	(cis) red need. f. w. (trans) gold- yel. pr. f. al.	.....	123 176 (168)	.....	.....	s.	s. eth., bz.
7982	yel. need. or leaf. f. al.	.....	227-8	subl.	s. h.	s.	s. eth., me. al.; sl. s. bz., chl., CS ₂
7983	col. rhomb. f. al.	1.359 ¹⁸	268	270 ⁵	0.016 ²⁵	0.9	0.018 eth.; s. chl.; sl. s. bz.
7984	col. trim. efflor.	.....	.....	.....	2.9 c.	1.7	i. eth., HCl
7985	col. need., [α]-46° _D	.....	d.	.....	2.4 ²⁵	0.83 ²⁵	i. eth.; 0.64 ²⁵ chl.; s. glyc.
7986	col. monoc. pr., 1.6137, 1.5988	.....	anh. 200	.....	3.2 ²⁵	1.5 ²⁵	i. eth.; s. chl., glyc.
7987	yel. hex. pr. f. acet.	1.829	180 (176-7)	subl.	0.6 ¹⁴	s.	sl. s. eth.
7988							
7989							
7990	need. or pr.	1.085 ^{16.5}	44	.....	i.	3.95 c.	v. s. eth.; s. bz.
7991	col. liq., 1.5434 ¹⁷	0.9074 ²⁰ ₄	.....	146	v. sl. s.	∞	∞ eth.
7992	oil., 1.5881 ^{19.5}	1.4057	-43.5	160 ⁷⁵ (86-7 ¹⁴)	.....	.....	.....
7993	(1) 1.6094 ^{20.5} (2) 1.5990 ²²	1.4269 ¹⁶ 1.4322 ¹⁶	+7 -8 to -7	219 sl. d. 71 ⁶	i.	∞	∞ eth.
7994	liq., 1.5623 ¹⁷	1.1016 ¹³ ₄	-23	199	i.	s.	s. eth.
7995	liq.	1.112 ¹⁵ ₄	.....	199	i.	s.	s. eth.
7996							
7997							
7998							
7999	col. liq. ....	.....	13.5	.....	.....	.....	s. conc. H ₂ SO ₄
8000	yel. oil. ....	.....	-5	.....	.....	v. s.	s. eth., lgr., chl.
8001	pr. f. lgr. ....	.....	29	d.	.....	v. s. h.	v. s. eth., bz., s. lgr.
8002							
8003							
8004							
8005	yel. monoc. leaf. f. acet. or eth.	.....	112	d.	v. sl. s. c.	sl. s.	sl. s. eth.; s. acet.
8006							
8007							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8008	Suberic acid	octanedioic acid*	$\text{COOH}(\text{CH}_2)_6\text{COOH}$	174.19
8009	—, diethyl ester	ethyl suberate	$(\text{CH}_3\text{CH}_2\text{CH}_2\text{COOC}_2\text{H}_5)_2$	230.30
8010	Suberol	See <i>Cycloheptanol</i> *		
8011	Suberone	See <i>Cycloheptanone</i> *		
8012	Suberyl alcohol	See <i>Cycloheptanol</i> *		
8013	Suberylene	See <i>Cycloheptene</i> *		
8014	Succinaldehyde	butanedial*	$\text{CHO}(\text{CH}_2)_2\text{CHO}$	86.09
8015	Succinamic acid	β -carbamylpropionic acid; succinic acid monoamide	$\text{NH}_2\text{COCH}_2\text{CH}_2\text{COOH}$	117.10
8016	—, α -amino-	See <i>Asparagine</i>		
8016M	—, <i>N</i> -phenyl-	See <i>Succinamic acid</i>		
8017	Succinamide	butanediamide*	$\text{NH}_2\text{COCH}_2\text{CH}_2\text{CONH}_2$	116.12
8018	—, α -hydroxy-	See <i>Malamide</i>		
8019	—, <i>N</i> - <i>p</i> -phenetyl-	pyrantin; phenosuccin	$(\text{CH}_2\text{CO})_2\text{NC}_6\text{H}_4\text{OC}_2\text{H}_5$	219.23
8019H	Succinanil	<i>N</i> -phenylsuccinimide	$(\text{CH}_2\text{CO})_2\text{NC}_6\text{H}_5$	175.18
8019R	Succinanilic acid	<i>N</i> -phenylsuccinamic acid	$\text{C}_6\text{H}_5\text{NHOC}(\text{CH}_2)_2\text{COOH}$	193.20
8020	Succinic acid	butanedioic acid*	$\text{COOH}(\text{CH}_2)_2\text{COOH}$	118.00
8021	—, dibenzyl ester		$(\text{CH}_2\text{COOCH}_2\text{C}_6\text{H}_5)_2$	298.33
8022	—, diethyl ester	ethyl succinate	$(\text{CH}_2\text{COOC}_2\text{H}_5)_2$	174.19
8023	—, dimethyl ester	dimethyl butanedioate*; methyl succinate	$\text{CH}_3\text{OOC}(\text{CH}_2)_2\text{COOCH}_3$	146.14
8024	—, monoamide	See <i>Succinamic acid</i>		
8025	—, <i>p</i> -phenylphenacyl ester		$(\text{CH}_2\text{COOCH}_2\text{COC}_6\text{H}_4\text{C}_6\text{H}_5)_2$	506.53
8026	—, piperazinium salt		$\text{C}_4\text{H}_{10}\text{N}_2\cdot\text{C}_4\text{H}_6\text{O}_4$	204.23
8027	—, acetoxy-	See <i>Malic acid, acetate</i>		
8028	—, acetyl- , diethyl ester	ethyl acetylsuccinate; diethyl acetylbutanedioate*	$\text{CH}_3\text{COCH}(\text{COOC}_2\text{H}_5)\text{CH}_2\text{COOC}_2\text{H}_5$	216.23
8029	—, α -amino-	See <i>Aspartic acid</i>		
8030	—, bromo-(dl)	<i>dl</i> -2-bromobutanedioic acid*	$\text{CH}_2\text{CHBr}(\text{COOH})_2$	197.00
8031	—, α, β -dibromo-	2,3-dibromobutanedioic acid*	$\text{C}_2\text{H}_2\text{Br}_2(\text{COOH})_2$	275.90
8032	—, α, β -dihydroxy-	See <i>Tartaric acid</i>		
8033	—, ethyl-	2-ethylbutanedioic acid*; 1, 2-butanedicarboxylic acid	$(\text{COOH})\text{CH}(\text{C}_2\text{H}_5)\text{CH}_2\text{COOH}$	146.14
8034	—, —, methyl ester		$\text{C}_2\text{H}_5\text{OOC}(\text{CH}_2)_2\text{COOCH}_3$	160.17
8035	—, ethylene-	See 1,2-Cyclobutanedicarboxylic acid*		
8036	—, formyl- , lactone	See <i>Aconic acid</i>		
8037	—, hydroxy-	See <i>Malic acid</i>		
8038	—, α -hydroxy- α -methyl-	See <i>Citramalic acid</i>		
8039	—, isopropylidene-	See <i>Tetraconic acid</i>		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8008	col. need. f. w.	.....	140	279 ¹⁰⁰	0.14 ¹⁵	s.	v. sl. s. eth.
8009	col. liq.....	0.982 ²⁰ ₄	.....	282-6	i.	s.	s. eth.
8010							
8011							
8012							
8013							
8014	liq., 1.4254....	1.064 ²⁰ ₄	.....	169-70 sl. d. (201-3)	s.	s.	s. eth.
8015	col. need. or tab.	.....	157	.....	s.	v. sl. s.	i. bz.
8016							
8016M							
8017	col. need. f. w.	.....	243	.....	0.45 ¹⁵ , 11 ¹⁰⁰	i.	i. eth.
8018							
8019	pr. f. al.....	.....	155	.....	0.75 ¹⁷ , 1.2 ¹⁰⁰	v. s. h.	i. eth.
8019H	col. need.....	.....	156	ca. 400	sl. s. h.	s. h.	s. eth.
8019R	col. need.....	.....	144.5-45.5	.....	s. h.	s.	s. eth.
8020	col. monoc., 1.450, 1.534, 1.610	1.564 ¹⁵ ₄	185 (189-90)	235 d.	6.8 ²⁰ , 121 ¹⁰⁰	7.5 ^{21.5}	0.3 eth.; i. bz., chl.
8021	leaf. f. al.....	.....	44-6	238 ¹⁴	i.	v. s.	v. s. eth.
8022	col. liq., 1.42007	1.0402 ²⁰ ₄	-21	217.7	i.	∞	∞ eth.
8023	col., 1.41976 ^{19.3}	1.1202 ¹⁸ ₄	19.5	192.8	2.8	s.	.....
8024							
8025			208	.....	.....	.....	.....
8026	wh. cr.....	.....	205-6, d.	.....	s.	s. h.	i. eth.
8027							
8028	col., liq., 1.438 ¹⁵	1.081 ²⁰ ₄	.....	256 d.	i.	s.	s. eth., bz., CS ₂
8029							
8030	col. cr.....	2.073	159	.....	19 ¹⁵	v. m.	i. eth.
8031	(d) [α] +126.3 ²⁴ _D in et. ac. (l) need. f. bz., [α] -148 ²¹³ _D in et. ac. (dl).....	.....	151-3 157-8 d. (152-4) 166-7; 255-6 d.	..... ..... ..... .....	..... s. s. h.	..... s. s.	..... s. me. al., acet., et. ac.; sl. s. chl., CCl ₄ , pet. eth. s. eth.
8032							
8033	col. pr. ....	.....	98	.....	v. s.	v. s.	v. s. eth.; 1.06 chl.
8034	col. liq.....	1.093 ⁹	<-20	208.2	i.	v. s.	v. s. eth.
8035							
8036							
8037							
8038							
8039							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8040	Succinic acid, methyl-	. See <i>Pyrotartaric acid</i> .		
8041	—, methylene-	See <i>Itaconic acid</i> .		
8042	—, tetrahydroxy-	tetrahydroxybutanedioic acid*; dihydroxytartaric acid	$(\text{COOH})\text{C}(\text{OH})_2\text{C}(\text{OH})_2\text{COOH}$	182.09
8043	—, tetramethyl-	tetramethylbutanedioic acid*; 2,3-dimethyl-2,3-butanedicarboxylic acid	$\text{HOOC}(\text{CH}_3)_2\text{C}(\text{CH}_3)_2\text{COOH}$	174.19
8044	Succinic anhydride	butanedioic anhydride*	$(\text{CH}_2\text{CO})_2\text{O}$	100.07
8045	Succinimide	butanimide*; 2,5-pyrrolidinedione	$(\text{CH}_2\text{CO})_2\text{NH}$	99.09
8045M	—, N-phenyl-	See <i>Succinamil</i> .		
8046	Succinonitrile	butanedinitrile*; ethylene cyanide	$\text{CNCH}_2\text{CH}_2\text{CN}$...	80.09
8047	Succinyl chloride	butanedioyl chloride*.....	$(\text{CH}_2\text{COCl})_2$	154.99
8048	Sucrose	cane sugar; saccharose.....	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	342.30
8048M	—, octaacetate.....	octaacetylsucrose.....	$\text{C}_{28}\text{H}_{38}\text{O}_{19}$	678.59
8049	Sulfanilamide	p-aminobenzenesulfonamide; p-anilinesulfonamide; pron-tosil album	$\text{H}_2\text{NC}_6\text{H}_4\text{SO}_2\text{NH}_2$ (p)	172.20
8049M	—, N1-2-pyridyl-	See <i>Sulfapyridine</i> .		
8050	Sulfanilic acid	p-aminobenzenesulfonic acid; p-anilinesulfonic acid	$\text{NH}_2\text{C}_6\text{H}_4\text{SO}_3\text{H}$ H_2O	191.20
8050M	Sulfapyridine	N1-2-pyridylsulfanilamide; p-amino-N-2-pyridylbenzenesulfonamide; 2-sulfanilamidopyridine	$\text{H}_2\text{NC}_6\text{H}_4\text{SO}_2\text{NHC}_5\text{H}_4\text{N}$	249.28
8051	Sulfide, 2-benzothiazyl	2,4-dinitrophenyl. See Benzothiazole, 2-(2,4-di-	nitro-	
8052	—, bis-β-chloroethyl	See <i>Sulfide, β, β'-dichloroethyl</i> .		
8053	—, bis(dimethylthiocarbamyl)	tetramethylthiuram (mono)-sulfide	$[(\text{CH}_3)_2\text{NCS}]_2\text{S}$...	208.35
8054	—, bis-β-hydroxyethyl	See <i>Ethanol, 2,2'-thiodi-di-act-amyl sulfide</i> ; 2-methyl-1-(β-methylbutylthio)-butane*	$[\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2]_2\text{S}$	174.34
8055	—, bis(β-methylbutyl)			
8056	—, bis(1-piperidylthiocarbonyl)	dicyclopentamethylenethiuram monosulfide	$(\text{C}_5\text{H}_{10}\text{NCS})_2\text{S}$...	288.48
8057	—, 4,4'-diaminodiphenyl	See <i>Aniline, p,p'-thiodi-</i> .		
8058	—, di-act-amyl	See <i>Sulfide, bis(β-methylbutyl)</i> .		
8059	—, dibenzyl	See <i>Benzyl sulfide</i> .		
8060	—, dibutyl	See <i>Butyl sulfide</i> .		
8061	—, β,β'-dichloroethyl	1-chloro-2-(β-chloroethylthio)ethane*; bis-β-chloroethyl sulfide; 2,2'-dichlorodiethyl sulfide; mustard gas; yperite; yellow cross liquid	$(\text{ClCH}_2\text{CH}_2)_2\text{S}$	159.08
8062	—, diethyl	See <i>Ethyl sulfide</i> .		
8063	—, diisoamyl	See <i>Isoamyl sulfide</i> .		
8064	—, diisobutyl	See <i>Isobutyl sulfide</i> .		
8065	—, diisopropyl	See <i>Isopropyl sulfide</i> .		
8066	—, dimethyl	See <i>Methyl sulfide</i> .		
8067	—, diphenyl	See <i>Phenyl sulfide</i> .		
8068	—, dipropyl	See <i>Propyl sulfide</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8040							
8041							
8042	wh. cr.		114-5		v. s., d. h.		
8043	cr.		190-2	subl.	0.48 ^{13,5}	v. s.	s. eth.; i. lgr.
8044	col. need. f. al.	1.104	119.6	261	v. sl. s.	s.	v. sl. s. eth.
8045	octahdr. col. need. f. acet.	1.412 ¹⁶	124-6	288	23 ²⁰ , 152 ⁷⁰	4.1 ²⁰ , 16 ⁵⁰	v. sl. s. eth.
8045M							
8046	col., 1.41645 ^{63,1}	0.985 ⁶³ / ₄ ; 1.023 ⁴⁵	54.5	267	v. s.	v. s.	s. eth.
8047	col. fum. liq. or cr., 1.47348 ^{15,2}	1.395 ²⁰ / ₄	17	102	d.	d.	v. s. eth.; s. bz.; i. pet. eth.
8048	col. monocl., 1.5376, 1.5651, 1.5705	1.588 ¹⁵	186 d.	d.	179 ⁰ , 487 ¹⁰⁰	0.9	i. eth., chl.; sl. s. me. al.
8048M	wh. need. f. al.	1.27 ¹⁶	72.3		v. sl. s.	s.	s. eth., common org. solv.
8049	col. leaf. or need.		163; 164.5-6.5		0.4 ¹⁵	3	s. c. acet.; i. bz.
8049M							
8050	col. rhomb pl. or monocl. cr. (+2H ₂ O)		288 d.		1.08 ²⁰ , 6.67 ¹⁰⁰	v. sl. s.	v. sl. s. eth.
8050M	wh. cr.		190-3		0.03	0.2	
8051	<i>phenylthio</i>)-.						
8052							
8053	yel. cr.	1.40	107		i.	s. h.	sl. s. eth.; s. chl.
8054							
8055	[α] _D +24.5 ²⁰	0.8362 ²⁰ / ₀	95-8 ¹³				
8056	yel. cr.		121		i.	sl. s. c., s. h.	sl. s. eth.; s. chl.
8057							
8058							
8059							
8060							
8061	col. oily liq. or col. pr.	sld. 1.338 ¹⁵ , 1.2741 ²⁰	13-14	215-7; 98 ¹⁰	0.048	s.	s. eth., ord. org. solv.
8062							
8063							
8064							
8065							
8066							
8067							
8068							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8069	Sulfide, divinyl.	See <i>Vinyl sulfide</i> .		
8070	—, ethyl methyl. . . .	methylthioethane*	$\text{CH}_3\text{SC}_2\text{H}_5$	76.15
8071	Sulfobenzide.	See <i>Phenyl sulfone</i> .		
8072	Sulfocyanic acid.	See <i>Thiocyanic acid</i> .		
8073	Sulfonal.	See <i>Propane, 2,2-bis(ethylsulfonyl)-</i> *		
8074	Sulfone, dibenzyl.	See <i>Benzyl sulfone</i> .		
8074M	—, di- <i>n</i> -butyl.	See <i>Butyl sulfone</i> .		
8075	—, diethyl.	See <i>Ethyl sulfone</i> .		
8075M	—, dimethyl.	See <i>Methyl sulfone</i> .		
8076	—, diphenyl.	See <i>Phenyl sulfone</i> .		
8077	—, dipropyl.	See <i>Propyl sulfone</i> .		
8078	—, ethylenebisphenyl.	See <i>Ethane, 1,2-bisphenylsulfonyl</i> -*		
8079	—, ethyl phenyl. . . .	ethylsulfonylbenzene*	$\text{C}_2\text{H}_5\text{SO}_2\text{C}_6\text{H}_5$	170.22
8080	—, pentane- γ , γ -diethyl.	See <i>Tetronal</i> .		
8081	Sulfonmethane.	See <i>Propane, 2,2-bis(ethylsulfonyl)-</i> *		
8082	Sulfoxide, dibenzyl.	See <i>Benzyl sulfoxide</i> .		
8082M	—, di- <i>n</i> -butyl.	See <i>Butyl sulfoxide</i> .		
8083	—, diethyl.	See <i>Ethyl sulfoxide</i> .		
8083H	—, dimethyl.	See <i>Methyl sulfoxide</i> .		
8083M	—, di- <i>n</i> -propyl.	See <i>Propyl sulfoxide</i> .		
8084	Sulfur chloride, trichloromethyl.	See <i>Methyl mercaptan, perchloro-</i> .		
8085	Sulfuric ether.	See <i>Ethyl ether</i> .		
8086	Sumatra camphor.	See <i>d-Borneol</i> .		
8087	Superpalite.	See <i>Diphosgene</i> .		
8088	Suprarenine.	See <i>Adrenaline</i> .		
8089	Sylvan.	See <i>Furan, 2-methyl-</i>		
8090	d-Sylvestrene	d-1,8(9)- <i>m</i> -menthadiene	$\text{C}_{10}\text{H}_{16}$	136.23
8091	Sylvic acid.	See <i>Abietic acid</i> .		
8091M	D-Talose		$\text{C}_6\text{H}_{12}\text{O}_6$	180.16
8092	Tannin.	See <i>m-Digallic acid</i> .		
8093	Tartaric acid, dihydroxy-	See <i>Succinic acid, tetrahydroxy-</i> .		
8094	dl-Tartaric acid	racemic acid	$\text{HOOC}(\text{CHOH})_2\text{COOH} \cdot \text{H}_2\text{O}$	168.10
8094M	—, diethyl ester	diethyl tartrate (<i>dl</i> -); diethyl racemate	$\text{C}_8\text{H}_{14}\text{O}_6$	206.19
8095	—, dimethyl ester	dimethyl <i>dl</i> -2,3-dihydroxybutanedioate*; methyl racemate	$(\text{COOCH}_3)_2\text{-(CHOH)}_2\text{COOCH}_3$	178.14
8096	d-Tartaric acid	d-2,3-dihydroxybutanedioic acid*; d- α , β -dihydroxy-succinic acid	$\text{HOOC}(\text{CHOH})_2\text{COOH}$	150.09
8097	—, dibutyl ester	dibutyl d-2,3-dihydroxybutanedioate*	$(\text{CHOHCOOC}_4\text{H}_9)_2$	262.30
8098	—, diethyl ester	diethyl d-2,3-dihydroxybutanedioate*; ethyl d-tartrate	$(\text{CHOH} \cdot \text{CO}_2\text{C}_2\text{H}_5)_2$	206.19
8099	—, diethyl ester diacetate . .	ethyl diacetyl-d-tartrate; ethyl d-diacetoxysuccinate	$[\text{CH}(\text{OOCCH}_3)\text{COOC}_2\text{H}_5]_2$	290.27
8100	—, dimethyl ester	methyl d-tartrate	$(\text{COOCH}_3)_2\text{-(CHOH)}_2\text{COOCH}_3$	178.14
8101	—, dinitrate	dinitrotartaric acid	$\text{COOH}(\text{CHNO}_2)_2\text{COOH}$	240.09

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8069	liq.	0.837	-104.8	66	i.	∞	∞ eth.
8070							
8071							
8072							
8073							
8074							
8074M							
8075							
8075M							
8076							
8077							
8078							
8079	monocl. pl. f. eth.	1.010 ²²	42	>300	sl. s. c.	s.	s. eth.
8080							
8081							
8082							
8082M							
8083							
8083H							
8083M							
8084							
8085							
8086							
8087							
8088							
8089							
8090	liq., 1.47717 ^{17.2}	0.863 ²⁰ / ₄	177	i.	∞	∞ eth.
8091	cr.	128-30
8091M							
8092							
8093							
8094	col. tricl.	1.697	-H ₂ O, 100; anh. 204-6	20.6 ²⁰ 9.23 ⁰ 185 ¹⁰⁰	1.66 c.	0.87 c. eth.
8094M	1.4454 ²⁵ , [α] +7.45 ²⁰ / _D	1.2036 ²⁰ / ₄	17	280	sl. s.	∞	∞ eth.; s. ord. org. solv.
8095	monocl. f. al.	stable 90; metastable 84; meso 111	282	s.
8096	col. monocl., 1.4955, 1.5352, 1.6045	1.7598 ²⁰ / ₄	170	139 ²⁰ , 343 ¹⁰⁰	19.85 ¹⁵	0.44 c. eth.; s. acet.; i. bz., chl.
8097	pr.	1.087 ²¹	22.5	203 ¹⁸
8098	col. hyg. liq., 1.4454 ²⁵ , [α] ²⁰ +7.45° _D	1.2036 ²⁰ / ₄	17	280	s.	s.	∞ eth.; s. ord. org. solv.
8099	monocl. cr.	1.109 ⁷¹	67	291-27 ²⁷	sl. s.	s.	v. s. eth.
8100	col., [α] +9.32 ²⁰ in me. al. _D	1.3046 ⁵⁰ / ₄	(1)48; (2) 50; (3)61	280	s.	v. s.	s. chl., bz.
8101	need.	d.	d.	s.	s. eth.; i. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8102	d-Tartaric acid , dipropyl ester	dipropyl <i>d</i> -2,3-dihydroxybutanedioate*; propyl tartrate	$(\text{CHOHCOOC}_3\text{H}_7)_2$	234.25
8103	—, monoethyl ester.....	ethyl hydrogen <i>d</i> -tartrate....	$\text{COOH}(\text{CHOH})_2\text{COOC}_2\text{H}_5$	178.14
8104	—, nicotine salt.....	See <i>Nicotine, tartrate</i> .		
8105	—, dinitro-.....	See <i>d-Tartaric acid, dinitrate</i> .		
8105M	l-Tartaric acid , diethyl ester	ethyl <i>l</i> -tartrate.....	$\text{C}_8\text{H}_{14}\text{O}_6$	206.19
8106	i-Tartaric acid	mesotartaric acid.....	$\text{HOOC}(\text{CHOH})_2\text{COOH}$	150.09
8106M	—, diethyl ester.....	diethyl tartrate (meso).....	$\text{C}_8\text{H}_{14}\text{O}_6$	206.19
8107	Tartronic acid	2-hydroxypropanedioic acid*; hydroxymalonic acid	$\text{HOCH}(\text{COOH})_2$...	120.06
8108	—, benzyl-.....	1-hydroxy-2-phenyl-1,1-ethanedicarboxylic acid	$\text{C}_6\text{H}_5\text{CH}_2\text{C}(\text{OH})(\text{COOH})_2$	210.18
8109	Taurine	2-aminoethanesulfonic acid...	$\text{H}_2\text{NCH}_2\text{CH}_2\text{SO}_3\text{H}$	125.14
8110	Taurocholic acid		$\text{C}_{26}\text{H}_{46}\text{NO}_7\text{S}\cdot\text{H}_2\text{O}$...	533.71
8111	Telluride, diethyl	See <i>Ethyl telluride</i> .		
8112	—, dimethyl.....	See <i>Methyl telluride</i> .		
8113	Tellurium ethyl	See <i>Ethyl telluride</i> .		
8114	Teraconic acid	2-isopropylidenebutanedioic acid*; isopropylidenesuccinic acid; γ , γ -dimethylitaconic acid	$(\text{CH}_3)_2\text{C}:\text{C}-(\text{COOH})\text{CH}_2\text{COOH}$	158.15
8116	Terebic acid	2,2-dimethylparaconic acid...	$\text{C}_7\text{H}_{10}\text{O}_4$	158.15
8117	Terephthalaldehyde	1,4-benzenedicarbonyl*	$\text{C}_6\text{H}_4(\text{CHO})_2$	134.13
8118	Terephthalaldehydic acid	<i>p</i> -formylbenzoic acid.....	$\text{CHOC}_6\text{H}_4\text{COOH}$...	150.13
8119	—, 3-hydroxy-.....	4-formyl-3-hydroxybenzoic acid	$\text{CHOC}_6\text{H}_3(\text{OH})\text{COOH}$	166.13
8120	Terephthalic acid	1,4-benzenedicarboxylic acid*; <i>p</i> -phthalic acid	$\text{C}_6\text{H}_4(\text{COOH})_2$...	166.13
8121	—, diethyl ester.....	ethyl <i>p</i> -phthalate.....	$\text{C}_6\text{H}_4(\text{COOC}_2\text{H}_5)_2$	222.23
8122	—, dimethyl ester.....	dimethyl 1,4-benzenedicarboxylate*	$\text{C}_6\text{H}_4(\text{COOCH}_3)_2$...	194.18
8123	—, mononitrile.....	See <i>Benzoic acid, p-cyano</i> .		
8124	—, benzoyl-.....	2,5-benzophenonedicarboxylic acid	$\text{C}_6\text{H}_5\text{COC}_6\text{H}_3(\text{COOH})_2$	270.23
8125	—, 2,3-dihydro-.....	See 1,3-Cyclohexadiene-1,4-dicarboxylic acid.	$(\text{HO})_2\text{C}_6\text{H}_2(\text{COOH})_2$	198.13
8126	—, 2,5-dihydroxy-...	2,5-dihydroxy-1,4-benzenedicarboxylic acid*; 2,5-hydroquinone dicarboxylic acid		
8127	—, hexahydro-.....	See 1,4-Cyclohexanedicarboxylic acid*.		
8128	—, 2-nitro-.....	$\text{NO}_2\text{C}_6\text{H}_3(\text{COOH})_2$		211.13
8129	Terephthalonitrile	1,4-benzenedicarbonitrile*; <i>p</i> -phenylene cyanide	$\text{C}_6\text{H}_4(\text{CN})_2$	128.13
8130	Terephthalyl chloride	1,4-benzenedicarbonyl chloride*; <i>p</i> -phthalyl dichloride	$\text{C}_6\text{H}_4(\text{COCl})_2$...	203.03
8131	Terpane	See <i>p-Menthane</i> .		
8132	Terphenyl	1,4-diphenylbenzene; <i>p</i> -phenylbiphenyl; triphenyl; diphenylphenylene	$(\text{C}_6\text{H}_5)_2\text{C}_6\text{H}_4$	230.29
8133	m-Terphenyl	See <i>Benzene, 1,3-diphenyl</i> .		
8134	α-Terpinene	1,3- <i>p</i> -menthadiene.....	$\text{C}_{10}\text{H}_{16}$	136.23
8135	dl-α-Terpineol	<i>dl</i> -1- <i>p</i> -menthen-8-ol.....	$\text{C}_{10}\text{H}_{17}\text{OH}$	154.25
8136	Terpin hydrate	See <i>Terpinol, hydrate</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8102	liq.	1.139	.....	303	i.	v. s.	v. s. eth.
8103	col. rhomb. ....	.....	90	.....	s.	s.	s. eth.
8104 8105 8105M	[α]-7.55 ^{c_{19.7}} _D	1.2054 ^{19.7} ₄	.....	162 ¹⁹	.....	.....	.....
8106	col. tab., 1.495, 1.536, 1.605	1.666	anh. 140	.....	125 ¹⁵	s.	sl. s. eth.
8106M	.....	.....	55	.....	.....	.....	.....
8107	col. pr. f. eth. ....	.....	158 d.	d.; subl. 110-20	v. s.	v. s.	sl. s. eth.
8108	pr. ....	.....	153 (147 d.)	.....	s.	s.	s. eth.
8109	tetr. need. ....	.....	328-9 d.	d.	6.5 ¹²	0.0032 ¹⁷	i. eth.
8110	deliq. need. ....	.....	180 d.	.....	v. s.	v. s.	sl. s. eth.
8111	.....	.....	.....	.....	.....	.....	.....
8112	.....	.....	.....	.....	.....	.....	.....
8113	.....	.....	.....	.....	.....	.....	.....
8114	tricl. f. eth. ....	.....	161 d.	.....	v. s.	v. s.	v. s. eth.; v. sl. s. bz.
8116	monocl. f. al.	0.8155 ²⁴ ₄	174	d.	sl. s.	s.	1.21 c. eth.
8117	need. f. w. ....	.....	116	248	1.5 ¹⁰⁰	v. s.	v. sl. s. eth.
8118	need. f. w. ....	.....	256 (248-50)	subl.	s. h.	v. s.	sl. s. eth., chl.
8119	need. ....	.....	234	.....	sl. s. h.	s.	s. eth.
8120	need. or amor.	1.510	subl.	subl. ca. 300	0.0016	v. sl. s.	v. sl. s. eth., chl.; s. alk.
8121	col. ....	.....	44	.....	.....	.....	.....
8122	rhomb. f. al. ....	.....	140	subl. >300	0.33 h.	s. h.	s. eth.
8123	.....	.....	.....	.....	.....	.....	.....
8124	need. ....	.....	285	.....	i.	s.	s. eth.; i. tol.
8125	.....	.....	.....	.....	.....	.....	.....
8126	yel. cr. f. al. or eth.	.....	d.	.....	s. (grn. fluor- es.)	s. (bl. fluor- es.)	s. eth.
8127	.....	.....	.....	.....	.....	.....	.....
8128	.....	.....	270 (263)	.....	v. s. h.	s. h.	.....
8129	col. need. f. bz.	.....	222	.....	i.	sl. s.	sl. s. eth.; s. h. ac. a.
8130	need. ....	.....	78	259	d.	d.	s. eth.
8131	.....	.....	.....	.....	.....	.....	.....
8132	col. leaf. f. al.	1.234 ⁰ ₄	213	subl. 427	.....	v. sl. s.	sl. s. eth., ac. a., CS ₂ ; s. h. bz. (bl. fluor- es.)
8133	.....	.....	.....	.....	.....	.....	.....
8134	col. liq., 1.4846	(α)0.846 (β)0.838	.....	180 173	i.	∞	= eth.
8135	col. liq., 1.4827	0.9357 ²⁰ ₄	35; d. 40	219.8	i.	v. s.	v. s. eth.; s. chl.
8136	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8138	<i>cis</i> -Terpinol, hydrate....	<i>cis</i> -1,8- <i>p</i> -menthane-1,8-diol hydrate; <i>cis</i> -terpin hydrate	$C_{10}H_{18}(OH)_2 \cdot H_2O$	190.28
8139	Terpinolene.....	1,4(8)- <i>p</i> -menthadiene.....	$C_{10}H_{16}$	136.23
8140	Tetracoline.....	See Quinoline, 2,5,7-trimethyl-		
8141	Tetracosane*(<i>n</i>).....		$CH_3(CH_2)_{22}CH_3$	338.65
8142	Tetradecanal*, oxime.	See Myristaldehyde, oxime.		
8143	Tetradecanamide*.	See Myristamide.		
8144	Tetradecane*.....	<i>n</i> -tetradecane.....	$CH_3(CH_2)_{12}CH_3$	198.38
8145	—, 1-amino-.	See Tetradecylamine*.		
8146	Tetradecanenitrile*.	See Myristonitrile.		
8147	Tetradecanoic acid*.	See Myristic acid.		
8148	Tetradecanoic anhydride*.	See Myristic anhydride.		
8149	1-Tetradecanol*.....	<i>n</i> -tetradecyl alcohol; myristic alcohol	$CH_3(CH_2)_{12}CH_2OH$	214.38
8150	Tetradecanoyl chloride	*. See Myristoyl chloride.		
8151	1-Tetradecene*.....	α -tetradecylene.....	$CH_2:CH(CH_2)_{11}CH_3$	196.37
8152	<i>n</i> -Tetradecyl alcohol.	See 1-Tetradecanol*.		
8153	Tetradecylamine*(<i>n</i>)..	1-aminotetradecane; <i>prim</i> - <i>n</i> -tetradecylamine	$CH_3(CH_2)_{13}NH_2$	213.40
8154	Tetradecyl sulfate.....	<i>di-n</i> -tetradecyl sulfate.....	$[CH_3(CH_2)_{13}]_2SO_4$	490.81
8154M	2-Tetradecyne*.....		$CH_3C:C(CH_2)_{10}CH_3$	194.35
8154T	Tetraethylene glycol, dimethyl ether	2,5,8,11,14-pentoxapentadecane*	$(CH_2OC_2H_4OC_2H_4)_2O$	222.28
8155	Tetrahydro-. See the parent compounds (e.g., for tetrahydronaphthalene see Naphthalene, 1,2,3,4-tetrahydro-.			
8156	"Tetralin".	See Naphthalene, 1,2,3,4-tetrahydro-.		
8157	Tetramethylene.	See Cyclobutane*.		
8157	Tetramethylenediamine.	See Putrescine.		
8158	Tetramethylene glycol.	See 1,4-Butanediol*.		
8159	Tetramethylene oxide.	See Furan, tetrahydro-.		
8160	Tetramethylenimine.	See Pyrrolidine.		
8160M	1-Tetratriacontanol*..			
8161	<i>s</i> -Tetrazine.....	1,2,4,5-tetrazine.....	$n-C_{34}H_{69}OH$ $N:NCH:NN:CH$	494.91 82.07
8162	<i>s</i> -Tetrazinedione, tetrahydro-. See <i>p</i> -Urazine.			
8163	2,1,3,5-Tetrazole.....	1,2,3,5-tetrazole.....	$NHN:NCH:N$	70.06
8164	Tetrolic acid.....	2-butynoic acid*; methylpropionic acid	$CH_3C:CCOOH$	84.07
8165	Tetronal.....	3,3-bisethylsulfonylpentane*; pentane γ , γ -diethyl sulfone	$(C_2H_5)_2C-(SO_2C_2H_5)_2$	256.37
8166	Tetryl.....	<i>N</i> -methyl- <i>N</i> -2,4,6-tetra-nitroaniline; methylpicrylnitramine	$(NO_2)_3C_6H_2N-(NO_2)CH_3$	287.15
8167	Thalline.....	1,2,3,4-tetrahydro-6-methoxyquinoline	$C_{10}H_{13}NO$	163.21
8168	Thebaine.....	paramorphine.....	$C_{19}H_{21}NO_3$	311.37
8169	—, hydrochloride.....		$C_{19}H_{21}NO_3 \cdot HCl \cdot H_2O$	365.85
8170	Theine.	See Caffeine.		
8171	α -Thenyl alcohol.	See 2-Thiophenecarbinol.		
8172	Theobromine.....	3,7-dimethylxanthine.	$C_7H_8N_4O_2$	180.17

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8138	col. rhomb., 1.505, 1.512, 1.524	.....	anh. 117.1	subl. 100	0.36 ²⁰	7.94 ¹⁵	0.714 ¹⁵ eth.; 0.745 ¹⁵ chl.
8139	col. liq., 1.4823	0.855	.....	185	i.	∞	= eth.
8140	cr.	0.7786 ⁵¹ / ₄	51.1	324.1; 243 ¹⁵	i.	v. s.	v. s. eth.
8142							
8143							
8144	col. liq., 1.4459	0.765	5.5	252.5	i.	v. s.	v. s. eth.
8145							
8146							
8147							
8148	opaque leaf. f. al.	0.8355; liq. 0.8236 ³⁸ / ₄	37.62	263.2; 167 ¹⁵	.02 ²⁰	sl. s.	s. eth.
8149							
8150							
8151	col. liq.,	0.775	-12	246	i.	v. s.	v. s. eth.
8152							
8153	col. cr. ....	.....	37	291.2; 162 ¹⁵	v. sl. s.	s.	s. eth.
8154			57.8-8.0	.....	.....	.....	.....
8154M	col. liq.,	0.765 ²⁰ / ₄	5.5	252.5	i.	v. s.	v. s. eth.
8154T	col. liq.,	1.0132 ²⁰ / ₂₀	.....	275.8	∞	s.	.....
	alene, tetrahydro-).						
8155							
8156							
8157							
8158							
8159							
8160							
8160M			91.9-92.2	.....		
8161	red. ....	.....	99	subl.	s.	.....	.....
8162							
8163	leaf. f. al., ....	.....	155	subl.	s.	s.	i. eth.; s. ac. a.; sl. s. bz.
8164	col. tab. f. eth. or CS ₂	.....	76.5	203	v. s.	v. s.	v. s. eth.; 8.33 CS ₂
8165	glit. leaf. f. w	.....	85	.....	0.22 c.	4.3 ¹⁵	7.1 ¹⁵ eth.
8166	yel. monocl. f. al.	1.57 ¹⁹	130	exp. 187	i.	0.422 ¹⁸	v. s. eth.; s. bz., ac. a.
8167	rhomb., ....	.....	43	283.8	s. h.	v. s.	v. s. eth., bz.
8168	glit. pr. f. al., [α]-218.64 ²¹⁵ / _D in al.	1.305	193	.....	v. sl. s.	10 c.	0.71 ¹⁰ eth.; v. s. chl.; s. bz.
8169	rhomb., [α]-168.32° _D	.....	.....	.....	s. h.	6.3 ¹⁰	s. eth.
8170							
8171							
8172	wh. rhomb. f. w.	.....	337	subl. 290-5	0.03 ¹⁸ 0.67 ¹⁰⁰	0.023 ¹⁷	sl. s. eth., amyl. al.; v. sl. s. bz.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8173	Theophylline	1,3-dimethylxanthine.	$C_7H_8N_4O_2$	180.17
8174	Thetin, dimethyl-	2,2-dihydro-2,2-dimethyl-1,2-oxathietan-4-one	$OS(CH_3)_2CH_2CO$	120.16
8175	Thialdine	5,6-dihydro-2,4,6-trimethyl-1,3,5-dithiazine	$SCH(CH_3)SCH-(CH_3)NHCHCH_3$	163.29
8175M	Thiamin , chloride; Thia	mine , hydrochloride. See V	<i>itamin B₁</i>	
8176	Thianthrene	dibenzo- <i>p</i> -dithiin; diphenylene disulfide	$C_8H_6S_2$	216.30
8177	Thiazole	thio[<i>b</i>]monazole; metathiazole	$SCH:NCH:CH$	85.12
8178	—, 2-amino-	2-thiazolylamine	$C_3H_2NS-NH_2$	100.14
8179	2-Thiazolylamine	See <i>Thiazole</i> , 2-amino-		
8180	2-Thienyl ketone	2,2'-dithienyl ketone; thienone	$(C_4H_3S)_2CO$	194.26
8180M	Thiirane	See <i>Ethylene sulfide</i>		
8181	Thioacetic acid	See <i>Acetic acid</i> , <i>thio-</i>		
8182	Thioaniline	See <i>Aniline</i> , <i>p,p'</i> - <i>thiodi-</i>		
8183	Thiocarbonyl chloride	See <i>Phosgene</i> , <i>thio-</i>		
8184	Thiocarbonyl tetrachl	oride . See <i>Methyl mercaptan</i> , <i>perchloro-</i>		
8185	Thiocyanic acid	sulfoeyanic acid	$CNSH$	59.09
8186	—, allyl ester	2-propenyl thiocyanate*; allyl sulfoeyanide	$CH_2:CHCH_2CNS$	99.15
8188	—, butyl ester	<i>n</i> -butyl sulfoeyanate; <i>n</i> -butyl rhodanate	$CH_3(CH_2)_3SCN$	115.19
8190	—, <i>tert</i> -butyl ester	<i>tert</i> -butyl sulfoeyanate; <i>tert</i> -butyl rhodanate	$(CH_3)_3CSCN$	115.19
8191	—, cyanogen ester	cyanogen sulfide; cyanogen thiocyanate	$N:CSC:N$	84.10
8192	—, ethylene ester	See <i>Glycol</i> , <i>dithiocyanate</i>		
8193	—, ethyl ester		C_2H_5SCN	87.14
8194	—, isoamyl ester	isoamyl sulfoeyanate; isoamyl rhodanate	$(CH_3)_2CH(CH_2)_2SCN$	129.22
8195	—, isobutyl ester	isobutyl sulfoeyanate; isobutyl rhodanate	$(CH_3)_2CHCH_2SCN$	115.19
8196	—, isopropyl ester	isopropyl sulfoeyanate; isopropyl rhodanate	$(CH_3)_2CHSCN$	101.16
8197	—, methyl ester	methyl thiocyanate; methyl sulfoeyanate	CH_3SCN	73.11
8198	—, phenyl ester	phenyl sulfoeyanate; phenyl rhodanate	C_6H_5SCN	135.18
8199	—, propyl ester	<i>n</i> -propyl sulfoeyanate; <i>n</i> -propyl rhodanate	$CH_3CH_2CH_2SCN$	101.16
8200	Thiocyanuric acid	trithiocyanuric acid	$C_3H_3N_3S_3$	177.26
8201	Thiodiglycol	See <i>Ethanol</i> , 2,2'- <i>thiodi-</i>		
8202	Thiodiphenylamine	See <i>Phenothiazine</i>		
8203	Thiofuran	See <i>Thiophene</i>		
8204	Thioglycolic acid	See <i>Acetic acid</i> , <i>mercapto-</i>		
8205	Thiohydantoin	See <i>Hydantoin</i> , 2- <i>thio-</i>		
8206	Thioisatin	See <i>Thionaphthenequinone</i>		
8207	Thio[<i>b</i>]monazole	See <i>Thiazole</i>		
8208	Thionaphthene	benzothioephene; benzothiofuran	$C_6H_4SCH:CH$	134.19
8209	Thionaphthenequi-	1,2-thionaphthenedione; thioisatin	C_6H_4SCOCO	164.17
8210	Thionine	Lauth's violet	$C_{12}H_9N_3S$	227.27
8211	Thiophene	thiofuran	$SCH:CHCH:CH$	84.13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8173	monocl. need. f. w.	.....	269-72	.....	0.44 ¹⁵ 1.3 ⁸⁷	1.25	sl. s. eth.; s. alk., NH ₄ OH
8174	deliq. cr.	.....	d., -H ₂ O	.....	s.	s.	.....
8175	monocl.	1.191	43	d.	sl. s.	s.	v. s. eth.
8175M							
8176	monocl. pr. f. al.	.....	158-60	353-4 d.; 204 ¹¹	i.	0.25 c.	s. h. eth., CS ₂ , H ₂ SO ₄ , bz.
8177	col. liq.	1.198	.....	116.8	.....	s.	s. eth.
8178	yel. cr. f. al.	.....	90	d.	sl. s.	sl. s.	sl. s. eth.
8179							
8180	col. need. f. al.	.....	87-8	326	i.	s. h.	s. ord. org. solv.
8180M							
8181							
8182							
8183							
8184							
8185	col. liq.	.....	5	d.	∞, d.	v. s.	v. s. eth.
8186	oil	1.056 ¹⁵ ; (1.071 ⁰)	.....	161	v. sl. s.	∞	∞ eth.
8188	col. liq., 1.4636 ^{21.5}	0.9563 ²⁵	.....	184.5-5.5 ⁷⁴³	i.	s.	s. eth.
8190	oil	.....	.....	d.	.....	.....	.....
8191	rhomb. pl. or leaf.	.....	65 (60)	d., subl. 30-40	s.	s.	s. eth.
8192							
8193	col. liq., 1.4666	0.996 ²⁵ / ₄	-85.5	144.4	i.	∞	∞ eth.
8194	col. liq.	.....	.....	197; 193.5-5 ⁷⁴⁰	v. sl. s.	s.	s. eth.
8195	col. liq.	.....	.....	174-6	∞	.....	.....
8196		0.963 ²⁰	.....	149-51 (152-3)	i.	∞	∞ eth.
8197	col. liq., 1.46801 ^{23.8}	1.068	-51	133	i. (v. sl. s.)	∞	∞ eth.
8198	liq.	1.1228 ^{23.5}	.....	232	i.	s.	s. eth.
8199	col. liq.	.....	.....	163	.....	.....	.....
8200	yel. need.	.....	d. 200	.....	v. s. h.	v. sl. s.	v. sl. s. eth.
8201							
8202							
8203							
8204							
8205							
8206							
8207							
8208	leaf., 1.63324 ^{36.2}	1.165 ²⁰ / ₄	32	221 volat.	i.	v. s.	v. s. eth.
8209	yel. pr.	.....	121	247	i.	s.	.....
8210	grn. powd. or br.-blk. leaf.	.....	.....	.....	v. v. sl. s. c.	sl. s.	s. eth.
8211	liq. 1.5287	1.0644 ²⁰ / ₄	-38.30	84.12	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8212	Thiophene, 2-acetyl-	See <i>Ketone, methyl 2-thienyl</i> .		
8213	—, 2-acetyl-5-bromo-	See <i>Ketone, 5-bromo-2-thienyl methyl</i> .		
8214	—, 2-acetyl-5-chloro-	See <i>Ketone, 5-chloro-2-thienyl methyl</i> .		
8215	—, 2-amino-	See <i>Thiophenine</i> .		
8216	—, 2-bromo-		SCBr:CHCH:CH	163.04
8217	—, 2-chloro-		SCCl:CHCH:CH	118.58
8218	—, 2,5-dibromo-		SCBr:CHCH:CBR	241.95
8219	—, 2,5-dibromo-3,4-dinitro-		(NO ₂) ₂ C ₄ Br ₂ S	331.95
8220	—, 2,5-dichloro-		SCCl:CHCH:CCl	153.03
8221	—, 2,3-dihydro-2-imino-	See <i>Thiophenine</i> .		
8222	—, 2,5-diiodo-		SCI:CHCH:Cl	335.96
8223	—, 2,3-dimethyl-	2,3-thioxene	(CH ₃) ₂ C ₄ H ₂ S	112.18
8224	—, 2,4-dimethyl-	2,4-thioxene	(CH ₃) ₂ C ₄ H ₂ S	112.18
8225	—, 2,5-dimethyl-	2,5-thioxene	(CH ₃) ₂ C ₄ H ₂ S	112.18
8226	—, 2,5-dinitro-		(NO ₂) ₂ C ₄ H ₂ S	174.13
8227	—, 2-ethyl-		C ₂ H ₅ C ₄ H ₃ S	112.18
8228	—, 3-ethyl-		C ₂ H ₅ C ₄ H ₃ S	112.18
8229	—, 2-formyl-	See <i>2-Thiophenecarbal.</i>		
8230	—, 2-iodo-		C ₄ H ₃ IS	210.04
8231	—, 2-iodo-5-nitro-		NO ₂ C ₄ H ₂ IS	255.04
8232	—, 2-methyl-	α-thiotolene	CH ₃ C ₄ H ₃ S	98.16
8233	—, 3-methyl-	β-thiotolene	CH ₃ C ₄ H ₃ S	98.16
8234	—, 2-methyl-5-phenyl-		CH ₃ C ₄ H ₂ S-C ₆ H ₅	174.25
8235	—, 2-nitro-		NO ₂ C ₄ H ₃ S	129.13
8236	—, tetrabromo-		C ₄ Br ₄ S	399.76
8237	—, tetrachloro-		C ₄ Cl ₄ S	221.93
8238	—, 2,3,5-tribromo-		C ₄ HBr ₃ S	320.86
8239	—, 2,3,5-tribromo-4-nitro-		NO ₂ C ₄ Br ₃ S	365.86
8240	—, 2,3,5-trichloro-		C ₄ HCl ₃ S	187.48
8241	—, 2,3,5-trichloro-4-nitro-		NO ₂ C ₄ Cl ₃ S	232.48
8242	—, 2,3,5-trimethyl-		(CH ₃) ₃ C ₄ HS	126.21
8243	2-Thiopheneacetic acid	2-thienylacetic acid	C ₄ H ₃ S-CH ₂ COOH	142.17
8244	—, α-oxo-	2-thienylglyoxylic acid; 2-thienylformic acid	C ₄ H ₃ SCOCO ₂ H	156.15
8245	Thiophene aldehyde.	See <i>Thiophenecarbal.*</i>		
8246	2-Thiophenecarbinol.	α-thienylcarbinol; α-thienyl alcohol	C ₄ H ₃ S-CH ₂ OH	114.16
8247	2-Thiophenecarbal.*	2-thiophenealdehyde; α-thienylformaldehyde; 2-formylthiophene	C ₄ H ₃ S-CHO	112.14
8248	—, oxime.	2-thiophenealdoxime	C ₄ H ₃ S-CH:NOH	127.16
8249	—, phenylhydrazone.	2-thienylformaldehyde phenylhydrazone	C ₄ H ₃ S-CH:NNH-C ₆ H ₅	202.27

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8212							
8213							
8214							
8215							
8216	col.	1.652 $\frac{23}{23}$	.....	149.5-50.5	i.	v. s.	v. s. eth.
8217	col., 1.5487	1.2863 $\frac{20}{4}$	-71.91	128.32	i.	∞	∞ eth.
8218	col.	2.147 $\frac{23}{23}$	.....	210.5-1.0	i.	v. s.	v. s. eth.
8219	pa. yel. ....	.....	139-40	.....	.....	v. s. h.	.....
8220	col., 1.5626	1.4422 $\frac{20}{4}$	-40.46	162.08	i.	∞	∞ eth.
8221							
8222	col. fluores. ....	.....	40.5	.....	i.	v. s.	.....
8223	col. liq.	0.9938 $\frac{20}{26}$	.....	136-7	i.	v. s.	v. s. eth.
8224	liq.	0.9956 $\frac{20}{4}$	.....	138	i.	s.	s. eth.
8225	liq., 1.51418...	0.9859 $\frac{19}{4}$	.....	137.5	i.	s.	s. eth.
8226	yel. pl. ....	.....	52	290	sl. s.	s.	v. s. eth.
8227	col.	0.990 $\frac{24}{24}$	.....	132-4	i.	v. s.	v. s. eth.
8228	col.	1.0012 $\frac{16}{16}$	.....	135-6	i.	v. s.	v. s. eth.
8229							
8230	col. ....	.....	.....	182; 73 ¹⁵	.....	.....	v. s. eth.
8231	lem. yel., shiny	.....	74	.....	.....	s.	.....
8232	col., 1.5203	1.0194 $\frac{20}{4}$	-63.5	112.5	i.	∞	∞ eth.
8233	col. oil, 1.5204	1.0216 $\frac{23}{4}$	-68.9	115.4	i.	∞	∞ eth.
8234	col. need. ....	.....	49-51	.....	.....	v. s.	v. s. eth.
8235	monocl. f. al. ....	.....	46.5	225	i.	v. s.	v. s. eth.; i. alk.
8236	wh. need. ....	.....	116	326	i.	s. h.	v. s. eth.
8237	sp., 1.5915 $\frac{30}{D}$	1.7036 $\frac{30}{4}$	29.09	233.39	i.	v. s.	∞ eth.
8238	shiny spears. ....	.....	29	259.60	i.	sl. s. h.	v. s. eth.
8239	red-yel. need. ....	.....	106	.....	.....	.....	v. s. eth.
8240	col. oil, 1.5791	1.5856 $\frac{20}{4}$	-16.06	198.66	i.	∞	∞ eth.
8241	red-yel. need. ....	.....	86	.....	.....	s.	v. s. eth., bz.
8242	col. ....	.....	.....	160-3	.....	.....	.....
8243	col. ....	.....	76	.....	s. h.	s.	s. eth.
8244	cr. + H ₂ O. ....	.....	+ 1H ₂ O 58-59; anh. 91.5	.....	v. s.	.....	v. s. eth.
8245							
8246	col. liq. ....	.....	.....	207	i.	v. s.	v. s. eth.
8247	yel. oil.	1.215 $\frac{21}{21}$	.....	198	i.	v. s.	s. eth.
8248	wh. need. ....	.....	128	.....	.....	.....	v. s. eth.
8249	yel. need. ....	.....	134.5	.....	i.	s.	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8250	2-Thiophenecarboxylic acid*	α -thiophenic acid.....	$C_4H_3S \cdot COOH$	128.14
8251	—, 3-methyl-.....	.....	$CH_3C_4H_2S \cdot COOH$	142.17
8252	—, 5-methyl-	<i>o,o</i> -thiotolonic acid.....	$CH_3C_4H_2S \cdot COOH$	142.17
8253	3-Thiophenecarboxylic acid*	β -thiophenic acid.....	$C_4H_3S \cdot COOH$	128.14
8254	2,3-Thiophenedicarboxylic acid*	.....	$C_4H_2S(COOH)_2$...	172.15
8255	2,4-Thiophenedicarboxylic acid*	.....	$C_4H_2S(COOH)_2$...	172.15
8256	2,5-Thiophenedicarboxylic acid*	.....	$C_4H_2S(COOH)_2$...	172.15
8257	—, diethyl ester.....	.....	$C_4H_2S(COOC_2H_5)_2$	228.26
8258	2-Thiophen-ol, 5-methyl-	2,5-thiolenol.....	$CH_3C_4H_2S \cdot OH$	114.16
8259	2-Thiophenesulfonamide	.....	$C_4H_3S \cdot SO_2NH_2$...	163.21
8260	3-Thiophenesulfonamide	.....	$C_4H_3S \cdot SO_2NH_2$...	163.21
8261	α -Thiophenic acid.	See 2-Thiophenecarboxylic acid *		
8262	β -Thiophenic acid.	See 3-Thiophenecarboxylic acid *		
8263	Thiophenine	2-aminothiophene or 2,3-dihydro-2-iminothiophene See <i>Acetamide, N-2-thienyl-</i> .	$C_4H_3S \cdot NH_2$ or $C_4H_4S(:NH)$	99.15
8264	—, <i>N</i> -acetyl-	.....	
8265	—, <i>N</i> -methyl-	.....	$CH_3NHC_4H_3S$	113.17
8266	Thiophenol .	See <i>Phenol, thio-</i> .		
8267	Thiopyrine	1,5-dimethyl-2-phenyl-3-thio-3-pyrazolone.....	$CH_3NN(C_6H_5)-$ $CSCH:CCH_3$	204.28
8268	Thiosalicylic acid.	See <i>Benzoic acid, o-mercapto-</i> .		
8269	Thiosinamine.	See <i>Urea, allylthio-</i> .		
8270	2,5-Thiolenol.	See 2-Thiophen-ol, 5-methyl-		
8271	α -Thiotolene.	See <i>Thiophene, 2-methyl-</i> .		
8272	β -Thiotolene.	See <i>Thiophene, 3-methyl-</i> .		
8273	<i>o,o</i> -Thiotolonic acid.	See 2-Thiophenecarboxylic acid, 5-methyl-		
8274	Thiourea.	See <i>Urea, thio-</i> .		
8275	Thioxene.	See <i>Thiophene, dimethyl-</i> .		
8276	Thiuram disulfide, dicyclopentamethylene-	See <i>Disulfide, bis(1-piperidyl-)</i> .		
8277	—, diethyldimethyl-	See <i>Disulfide, bis(ethylmethylthiocarbamyl)</i> .		
8278	—, tetrabenzyl-	See <i>Disulfide, bis(tetrabenzylthiocarbamyl)</i> .		
8279	—, tetrabutyl-	See <i>Disulfide, bis(dibutylthiocarbamyl)</i> .		
8280	—, tetraethyl-	See <i>Disulfide, bis(diethylthiocarbamyl)</i> .		
8281	—, tetramethyl-	See <i>Disulfide, bis(dimethylthiocarbamyl)</i> .		
8282	—, dicyclopentamethylene-	See <i>Sulfide, bis(1-piperidylthiocarbonyl)</i> .		
8283	Thiuram sulfide, tetramethyl-	See <i>Sulfide, bis(dimethylthiocarbamyl)</i> .		
8283M	D-Threose	<i>l</i> -threose, formerly.....	$C_4H_8O_4$	120.10
8284	α - Thujone	6-ketosabinane (one form)...	$C_{10}H_{16}O$	152.23
8286	Thymine	5-methyluracil.....	$NHCONHCOC-$ $(CH_3):CH$	126.11

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8250	need. f. w.		126.5	260 d.	0.75 ²⁵ , v.s.h.	v. s.	v. s. eth.; sl. s. lgr.
8251	col. need.		140; 144		sl. s. c., v.s.h.	v. s.	v. s. eth.
8252	col. need.		137 subl.		sl. s. c., v. s. h.	v. s.	v. s. eth.
8253	need. f. w.		136	subl.	0.43 ²⁵		
8254	need. f. w.		270 d.		sl. s. h.		v. s. eth.
8255	cr.		280 subl. d.		sl. s. h.		
8256	wh. cr.		subl. > 350		sl. s. h.	s.	s. eth.
8257	need. or pr.		50			v. s.	
8258	col. oil.			85 ⁴⁰ unst.	sl. s.	v. s.	v. s. eth.
8259	wh.		141-2		sl. s.		
8260	shiny pl.		152-3		sl. s.		
8261							
8262							
8263	yel. resin. oil.			61-2 ¹ d.	v. s.	v. s.	i. eth.
8264							
8265	col.			88-92 ¹⁵			
8266							
8267	col. cr.		166		sl. s. c., s.h.	s.	s. eth.
8268							
8269							
8270							
8271							
8272							
8273							
8274							
8275							
8276	thiocarbonyl).						
8277							
8278							
8279							
8280							
8281							
8282							
8283							
8283M	micr. col. need., v. hydr.; [α] _D ²² +29.09 to +19.59, [α] _D ²⁰ -12.5		126-32		v. s.	v. sl. s.	i. eth., pet. eth.
8284	col. liq., 1.4540 ^{13.5}	0.913 ²⁰		200	v. sl. s.	∞	∞ eth.
8286	need. f. al.		d. 270		0.74 ²³	sl. s.	v. sl. s. eth.; s. alk., H ₂ SO ₄

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8287	Thymohydroquinone.	2,5- <i>p</i> -cymenediol.....	$\text{CH}_3(\text{C}_6\text{H}_7)\text{C}_6\text{H}_2(\text{OH})_2$	166.21
8288	Thymol.....	3- <i>p</i> -cymenol.....	$\text{CH}_3(\text{C}_6\text{H}_7)\text{C}_6\text{H}_3\text{OH}$	150.21
8289	——, 1-hexahydro-.	See <i>L</i> -Menthol.		
8290	——, 6-nitroso-.....	thymoquinone 2-oxime.....	$\text{C}_{10}\text{H}_{13}\text{O}(\text{:NOH})$...	180.22
8291	Thymolphthalein.....		$\text{OCOC}_6\text{H}_4\text{C}-$ $(\text{C}_{10}\text{H}_{13}\text{O})_2$	430.52
8292	Thymoquinone.....	3,6- <i>p</i> -menthadiene-2,5-dione; 2-isopropyl-5-methylhydroquinone	$(\text{CH}_3)_2\text{CHC}_6\text{H}_2(\text{CH}_3)_2\text{O}_2$	164.20
8293	——, 2-oxime.	See <i>Thymol</i> , 6-nitroso-.		
8294	<i>o</i> -Thymotic acid.....	3-hydroxy-2- <i>p</i> -cymenecarboxylic acid	$\text{CH}_3(\text{C}_6\text{H}_7)\text{C}_6\text{H}_2(\text{OH})\text{COOH}$	194.22
8295	Thymylamine.....	3- <i>p</i> -cymylamine; 2-isopropyl-5-methylaniline	$\text{C}_3\text{H}_7(\text{CH}_3)\text{C}_6\text{H}_3\text{NH}_2$	149.23
8296	Thyronine, tetraiodo-.	See <i>Thyroxine</i> .		
8297	<i>d</i> -Thyroxine.....	β -(3,5-diiodo-4-hydroxyphenoxy)-3,5-diiodophenyl- <i>d</i> -alanine	$\text{HOC}_6\text{H}_2\text{I}_2\text{OC}_6\text{H}_2\text{I}_2\text{CH}(\text{NH}_2)\text{COOH}$	776.93
8298	<i>l</i> -Thyroxine.....	<i>l</i> -tetraiodothyronine.....	$\text{C}_{16}\text{H}_{11}\text{I}_4\text{NO}_4$	776.93
8299	Tiglaldehyde.....	2-methyl-2-butenal*; α , β -dimethylacrolein; guaiole	$\text{CH}_3\text{CH}:\text{C}(\text{CH}_3)\text{CHO}$	84.11
8300	Tiglic acid.....	2-methyl-2-butenic acid* (one form); α , β -dimethylacrylic acid	$\text{CH}_3\text{CH}:\text{C}(\text{CH}_3)\text{COOH}$	100.11
8301	Tin, diethyl-*	tin diethyl.....	$\text{Sn}(\text{C}_2\text{H}_5)_2$	176.82
8302	——, diethyldimethyl-*	diethyldimethylstannane.....	$(\text{C}_2\text{H}_5)_2\text{Sn}(\text{CH}_3)_2$...	206.89
8303	——, hexaethyldi-.....	triethyltin.....	$(\text{C}_2\text{H}_5)_3\text{SnSn}-$ $(\text{C}_2\text{H}_5)_3$	411.76
8304	——, tetraethyl-*	tetraethylstannane; tin tetraethyl.....	$\text{Sn}(\text{C}_2\text{H}_5)_4$	234.94
8305	——, tetraisoamyl-.....	tetraisoamylstannane.....	$[(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2]_4\text{Sn}$	403.26
8306	——, tetramethyl-*	tin tetramethyl; tetramethylstannane	$\text{Sn}(\text{CH}_3)_4$	178.84
8307	——, tetraphenyl-*	tetraphenylstannane.....	$(\text{C}_6\text{H}_5)_4\text{Sn}$	427.10
8308	——, tetrapropyl-*	tetrapropylstannane.....	$(\text{CH}_3\text{CH}_2\text{CH}_2)_4\text{Sn}$	291.05
8309	——, tetra- <i>o</i> -tolyl-.....	tetra- <i>o</i> -tolylstannane.....	$(\text{CH}_3\text{C}_6\text{H}_4)_4\text{Sn}$...	483.21
8310	——, tetra- <i>p</i> -tolyl-.....	tetra- <i>p</i> -tolylstannane.....	$(\text{CH}_3\text{C}_6\text{H}_4)_4\text{Sn}$...	483.21
8311	——, triethyl-.	See <i>Tin</i> , hexaethyldi-.		
8312	Tin chloride, tribenzyl-*	.....	$(\text{C}_6\text{H}_5\text{CH}_2)_3\text{SnCl}$	427.54
8313	——, triethyl-*	.....	$(\text{C}_2\text{H}_5)_3\text{SnCl}$	241.34
8314	——, triisoamyl-.....	.....	$[(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2]_3\text{SnCl}$	367.57
8315	——, triphenyl-*	.....	$(\text{C}_6\text{H}_5)_3\text{SnCl}$	385.46
8316	Tin dichloride, diethyl-*	.....	$(\text{C}_2\text{H}_5)_2\text{SnCl}_2$	247.74

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8287	pr. ....	.....	143 (139)	290	s. h.	s.	s. eth.
8288	col. hex. pl. 1.51893 ^{24,4} , 1.525, 1.609	0.969 ²⁰ / ₄ ; 0.978 ¹⁵ / ₄	51.5	233.5	0.085 ²⁰ , 0.132 ³⁷	357 ²⁰ 91%	360 ²⁰ eth.; a. chl., CS ₂ , glac. ac. a.; sl. s. glyc.
8289	need. ....	.....	160	.....	i.	v. s.	v. s. eth.
8290	col. need. ....	.....	245-6	.....	.....	s.	s. eth., acet. caustic alk., chl.
8292	yel. tricl. tab.	.....	45.5	232	v. sl. s.	v. s.	v. s. eth.; s. chl.
8293	.....	.....	.....	.....	.....	.....	.....
8294	monocl. f. w. or bz.	.....	127	subl.	0.01 c.	s.	s. eth., bz.
8295	oil. ....	.....	.....	230	v. sl. s.	s.	s. eth.
8296	.....	.....	.....	.....	.....	.....	.....
8297	need. ....	.....	237 d.	.....	.....	.....	.....
8298	wh. or sl. yel. need.	.....	235-6 d.	.....	0.001	i.	i. eth.
8299	liq., 1.4495....	0.865	.....	116.5	40-50	∞	∞ eth.
8300	col. tricl. pr., 1.4342 ⁸¹	0.872 ²⁰ / ₄ ; 0.964 ⁷⁶ / ₄	64	198.5	sl. s. c., v. s. h.	s.	s. eth.
8301	yel. oil.	1.558 ¹⁵	.....	d.	i.	s.	s. eth.
8302	col. liq.	1.2319 ¹⁹	<-13	144-6	i.	i.	s. org. solv.
8303	liq.	1.4115 ⁰ / ₄	.....	270 d.	i.	i.	s. eth., bz.
8304	col. liq., 1.5143	1.187 ²³	-112	181	i.	s.	s. eth.
8305	liq.	1.035 ^{19,6}	.....	188 ²⁴	.....	.....	.....
8306	col. liq., 1.5201	1.314 ⁰ / ₄	.....	78	i.	s.	s. eth.
8307	col. tetr. f. xylene	1.490 ⁰ / ₄	226	>420	i.	sl. s.	s. h. bz., pyr., CCl ₄ , chl., ac. a.
8308	col. liq.	1.1065 ^{20,2}	.....	222-5	i.	.....	s. org. solv.
8309	col. liq. ....	.....	158-9 (215)	.....	i.	i.	s. eth., bz.
8310	col. need. ....	.....	230-3	.....	i.	sl. s.	sl. s. eth.; s. bz., chl., CS ₂ , pyr.
8311	.....	.....	.....	.....	.....	.....	.....
8312	wh. need. ....	.....	142-4	d.	i.	i.	s. eth., ac. a., acet., bz., chl., pyr.
8313	col. liq.	1.428 ⁸	10(15.5)	208-10	i. c.	.....	s. org. solv.
8314	.....	1.1290 ^{34,3}	-30.2	114 ¹³	.....	.....	.....
8315	col. cr. ....	.....	106	240 ^{12,5}	i.	.....	s. org. solv.
8316	wh. need. ....	.....	84-5	220	s.	.....	s. HCl, org. solv.

For explanations and abbreviations — beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8317	Tin difluoride, diethyl-*	.....	$(C_2H_5)_2SnF_2$	214.82
8318	Tin oxide, diethyl-*	diethylstannone.....	$(C_2H_5)_2SnO$	192.82
8319	Tin trichloride, methyl-*	.....	CH_3SnCl_3	240.11
8320	T.N.A.	See <i>Aniline, 2,4,6-trinitro-</i> .		
8321	T.N.T.	See <i>Toluene, 2,4,6-trinitro-*</i> .		
8322	Tobias' acid.	See <i>2-Naphthylamine-1-sulfonic acid</i> .		
8322M	α-Tocopherol	one factor of vitamin E.....	$C_{29}H_{50}O_2$	430.70
8323	Tolan.	See <i>Acetylene, diphenyl-</i> .		
8324	<i>o</i>-Tolidine	4,4'-bi- <i>o</i> -toluidine ($NH_2=1$); 4,4'-diamino-3,3'-dimethylbiphenyl	$[NH_2(CH_3)C_6H_3]_2$..	212.29
8325	<i>m</i>-Tolidine	4,4'-bi- <i>m</i> -toluidine ($NH_2=1$); 4,4'-diamino-2,2'-dimethylbiphenyl	$[NH_2(CH_3)C_6H_3]_2$..	212.29
8326	<i>p</i>-Tolidine		$[NH_2(CH_3)C_6H_3]_2$..	212.29
8327	<i>o</i>-Tolualdehyde	2-methylbenzenecarbonyl*; <i>o</i> -methylbenzaldehyde	$CH_3C_6H_4CHO$	120.14
8328	<i>m</i>-Tolualdehyde	<i>m</i> -methylbenzaldehyde.....	$CH_3C_6H_4CHO$	120.14
8329	<i>p</i>-Tolualdehyde	<i>p</i> -methylbenzaldehyde.....	$CH_3C_6H_4CHO$	120.14
8330	α-Tolualdehyde	phenylacetaldehyde.....	$C_6H_5CH_2CHO$	120.14
8331	<i>o</i>-Toluamide	<i>o</i> -methylbenzamide.....	$CH_3C_6H_4CONH_2$..	135.16
8332	<i>m</i>-Toluamide	<i>m</i> -methylbenzamide.....	$CH_3C_6H_4CONH_2$..	135.16
8333	<i>p</i>-Toluamide	<i>p</i> -methylbenzamide.....	$CH_3C_6H_4CONH_2$..	135.16
8334	α-Toluanilide	α -phenylacetanilide.....	$C_6H_5CH_2CONH-C_6H_5$	211.25
8335	Tolubenzyl alcohol.	See <i>Carbinol, tolyl-</i> .		
8336	Toluene	methylbenzene; phenylmethane	$C_6H_5CH_3$	92.13
8337	—, α-amino-	See <i>Benzylamine</i> .		
8338	—, ω-azido-	See <i>Toluene, α-triazol-</i> .		
8339	—, benzyl-	See <i>Methane, phenyltolyl-</i> .		
8340	—, α-(benzylthio)-	See <i>Benzyl disulfide</i> .		
8341	—, <i>o</i>-bromo-	<i>o</i> -tolyl bromide.....	$CH_3C_6H_4Br$	171.04
8342	—, <i>m</i>-bromo-	<i>m</i> -tolyl bromide.....	$BrC_6H_4CH_3$	171.04
8343	—, <i>p</i>-bromo-	<i>p</i> -tolyl bromide.....	$BrC_6H_4CH_3$	171.04
8344	—, α-bromo-	See <i>Benzyl bromide</i> .		
8345	—, α-bromo-<i>o</i>-nitro-	<i>o</i> -nitrobenzyl bromide.....	$NO_2C_6H_4CH_2Br$...	216.04
8346	—, α-bromo-<i>m</i>-nitro-	<i>m</i> -nitrobenzyl bromide.....	$NO_2C_6H_4CH_2Br$...	216.04
8347	—, α-bromo-<i>p</i>-nitro-	<i>p</i> -nitrobenzyl bromide.....	$NO_2C_6H_4CH_2Br$...	216.04
8348	—, butoxy-	See <i>Ether, butyl tolyl</i> .		
8349	—, <i>o</i>-butyl-	1-butyl-2-methylbenzene.....	$CH_3C_6H_4(CH_2)_3-CH_3$	148.24

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8317	sq. pl. or lng. rhomb. tab. f. me. at.		229			0.45 ³¹	2.64 ³¹ me. al.; 0.047 ³¹ bz.
8318	wh. powd.		infus.		i.		s. HCl, dil. a., conc. alk.; i. org. solv.
8319	col. cr.		43		s. c.		s. org. solv.; hyd. by alk.
8320							
8321							
8322							
8322M	pa. yel. oily liq.			d. 350	i.	s.	s. eth.
8323							
8324	col. sc. f. h. w.		126.5-9		sl. s.	v. s.	v. s. eth.
8325	pr. f. h. w.		107-8		s. h.	v. s.	v. s. eth.
8326	leaf.		103		s. h.	v. s.	v. s. eth.
8327	liq., 1.5485 ^{219.0}	1.039		195.5	sl. s.	s.	s. eth.
8328	liq., 1.54068 ^{21.4}	1.019		199(195.5)	sl. s.	∞	∞ eth.
8329	liq., 1.54693 ^{16.6}	1.020		204	sl. s.	∞	∞ eth.
8330	col. liq., 1.52546 ^{19.6}	1.027	<-10	194	v. sl. s.	∞	∞ eth.
8331	col. need. f. w.		147 (139-40)		sl. s. c., v. s. h.	v. s.	v. s. eth.
8332	need. f. eth.		97 (94)		sl. s.	s.	sl. s. eth.; v. sl. s. bz.
8333	col. need. f. w.		165 (159-60)		sl. s. c., v. s. h.	v. s.	v. s. eth.
8334	wh. pr. f. al.		117		i.	3.3	1.1 eth.; i. H ₂ SO ₄ , dil. KOH
8335							
8336	col. liq., 1.49782 ^{16.35}	0.866 ²⁰ / ₄ ; 0.86234 ²⁵ / ₄	-95	110.8	0.047 ¹⁶	∞	∞ eth.; s. chl., glac. ac. a., acet., CS ₂ , bz.
8337							
8338							
8339							
8340							
8341	col. liq.	1.422	-27 (-26 to -29)	181.75	i.	v. s.	v. s. eth., bz.
8342	col. liq., 1.551	1.4099 ²⁰ / ₄	-39.8	183.7	i.	s.	∞ eth.
8343	rhomb. cr. f. al., 1.5490	1.3898 ²⁰ / ₄	28	184-5	i.	s.	s. eth., bz.
8344							
8345	cr. f. dil. al.		46-7		i.	v. s.	s. bz.
8346	need.		58		v. sl. s.	s.	
8347	need. f. al.		100 (97-8)		sl. s. (i.)	2 ¹⁹ / ₃₇₅	v. s. eth.
8348							
8349	oil.	0.8702 ¹⁸ / ₄		200-1	i.	sl. s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8350	Toluene, <i>m</i>-butyl- ...	1-butyl-3-methylbenzene....	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_4\text{H}_9$...	148.24
8351	—, <i>p</i>-butyl-	1-butyl-4-methylbenzene....	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_4\text{H}_9$...	148.24
8352	—, 3-<i>tert</i>-butyl-	artificial musk.....	$[(\text{CH}_3)_3\text{C}](\text{CH}_3)-$	283.24
8353	—, 2,4,6-trinitro-		$\text{C}_6\text{H}(\text{NO}_2)_3$	
	—, <i>o</i>-chloro-	2-chloro-1-methylbenzene....	$\text{ClC}_6\text{H}_4\text{CH}_3$	126.58
8354	—, <i>m</i>-chloro-	3-chloro-1-methylbenzene....	$\text{ClC}_6\text{H}_4\text{CH}_3$	126.58
8355	—, <i>p</i>-chloro-	4-chloro-1-methylbenzene....	$\text{ClC}_6\text{H}_4\text{CH}_3$	126.58
8356	—, α-chloro-	See <i>Benzyl chloride</i> .		
8357	—, α-chloro-α,α-difluoro-	benzodifluorochloride.....	$\text{C}_6\text{H}_5\text{CF}_2\text{Cl}$	162.57
8358	—, chloromercuri-	See <i>Mercury chloride, tolyl-</i> .		
8359	—, α-chloro-<i>o</i>-nitro-	<i>o</i> -nitrobenzyl chloride.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_2\text{Cl}$...	171.58
8360	—, α-chloro-<i>m</i>-nitro-	<i>m</i> -nitrobenzyl chloride.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_2\text{Cl}$...	171.58
8361	—, α-chloro-<i>p</i>-nitro-	<i>p</i> -nitrobenzyl chloride.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_2\text{Cl}$...	171.58
8362	—, diamino-	See <i>Tolylenediamine</i> .		
8363	—, α,α-dibromo-	See <i>Benzylidene bromide</i> .		
8364	—, α,α-dibromo-<i>p</i>-nitro-	<i>p</i> -nitrobenzal bromide.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CHBr}_2$...	294.95
8365	—, α,α-dichloro-	See <i>Benzylidene chloride</i> .		
8366	—, α,α-dichloro-	See <i>Benzyl chloride, p-chloro-</i> .		
8366M	—, α,α-dichloro-α-fluoro-	benzofluoride dichloride.....	$\text{C}_6\text{H}_5\text{CCl}_2\text{F}$	179.02
8367	—, α,α-dichloro-<i>m</i>-nitro-	<i>m</i> -nitrobenzal chloride.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CHCl}_2$...	206.03
8368	—, α,α-dichloro-<i>p</i>-nitro-	<i>p</i> -nitrobenzal chloride.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CHCl}_2$...	206.03
8369	—, 3,5-diethyl-	1,3-diethyl-5-methylbenzene*	$(\text{C}_2\text{H}_5)_2\text{C}_6\text{H}_3\text{CH}_3$...	148.24
8370	—, <i>o</i>-diethylamino-	See <i>o-Toluidine, N, N-diethyl-</i> .		
8371	—, <i>p</i>-diethylamino-	See <i>p-Toluidine, N, N-diethyl-</i> .		
8371M	—, α,α-difluoro-	See <i>Benzal fluoride</i> .		
8372	—, 1,2-dihydro-		$\text{C}_6\text{H}_7\text{CH}_3$	94.15
8373	—, 2,3-dihydroxy-	See <i>Pyrocatechol, 3-methyl-</i> .		
8374	—, 2,4-dihydroxy-	See <i>Cresorcinol</i> .		
8375	—, 2,5-dihydroxy-	See <i>Toluydroquinone</i> .		
8376	—, 2,6-dihydroxy-	See <i>Resorcinol, 2-methyl-</i> .		
8377	—, 3,5-dihydroxy-	See <i>Orcinol</i> .		
8378	—, 2,4-dinitro-	1-methyl-2,4-dinitrobenzene	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CH}_3$...	182.13
8379	—, 2,5-dinitro-	2-methyl-1,4-dinitrobenzene	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CH}_3$...	182.13
8380	—, 2,6-dinitro-	2-methyl-1,3-dinitrobenzene	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CH}_3$...	182.13
8381	—, 3,4-dinitro-	4-methyl-1,2-dinitrobenzene..	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CH}_3$...	182.13
8382	—, 3,5-dinitro-	1-methyl-3,5-dinitrobenzene..	$(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CH}_3$...	182.13
8383	—, <i>o</i>, <i>m</i> or <i>p</i>-ethoxy-	See <i>Ether, ethyl tolyl</i> .		
8384	—, α-ethoxy-	See <i>Ether, benzyl ethyl</i> .		
8385	—, <i>o</i>-ethyl-	1-ethyl-2-methylbenzene....	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_2\text{H}_5$...	120.19

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8350	oil.....	0.8624 ¹⁸ / ₄	.....	197-8	i.	sl. s.	s. eth.
8351	oil.....	0.86132 ¹⁴ / ₄	.....	198-9	i.	sl. s.	s. eth.
8352	wh. need. f. al.	.....	85(97)	.....	i.	s.	s. eth., bz.
8353	col. liq., 1.5238	1.0817 ²⁰ / ₄	-34(-36)	159	i.	s.	∞ eth.; s. bz., chl.
8354	col. liq., 1.5214 ¹⁹	1.0722 ²⁰ / ₄	-47.8	162	i.	s.	∞ eth.; s. bz., chl.
8355	col. liq., 1.5199 ¹⁹	1.0697 ²⁰ / ₄	7.5	162	i.	s.	∞ eth.; s. bz., chl.
8356							
8357	col. liq.....	1.254 ¹³	.....	142.6 ⁷⁷⁰	i.	s.	s. eth.
8358							
8359	cr. f. lgr., 1.5557 ^{61.5}	.....	49	.....	i.	s.	v. s. h. eth.
8360	yel. need. f. lgr., 1.5577 ^{61.5}	.....	44.5	183 ³⁵	i.	s.	s. eth.
8361	leaf. or need. f. w. 1.5647 ^{61.5}	.....	71	.....	i.	7.10 ²⁵	s. eth.; 8.87 ²⁵ me. al.; 69.7 ²⁵ bz.
8362							
8363							
8364	need. f. al. ....	.....	82.0-2.5	.....	i.	v. s.	v. s. eth.
8365							
8366							
8366M	col. liq., 1.5180 ¹¹	1.3138 ¹¹	.....	178-180	d.	s. d.	.....
8367	monocl. cr. f. al.	.....	65	.....	i.	v. s. h.	v. s. h. eth.
8368	pr. f. al.....	.....	46	.....	i.	s.	s. eth.
8369	col. liq.....	0.879 ²⁰ / ₄	.....	198-200	i.	∞	∞ eth.
8370							
8371							
8371M	liq., 1.4763....	0.8354 ²⁰ / ₄	.....	110.1	i.	v. s.	s. eth.
8372							
8373							
8374							
8375							
8376							
8377							
8378	yel. need. f. al. or CS ₂ , 1.442, 1.662, 1.756	1.521 ¹⁵ ; 1.321 ⁷¹	69.5-70.5	300 sl. d.	0.027 ²²	3.04 ¹⁵	9.4 ²² eth.; s. bz., CS ₂
8379	need. f. al.	1.282 ¹¹¹	52.5(50.5)	.....	v. s.		v. s. bz., CS ₂
8380	rhomb. need., 1.479, 1.669, 1.734	1.283 ¹¹¹	66(61)	.....	s.		.....
8381	yel. need. f. CS ₂	1.259 ¹¹¹	59.8 (59-61)	.....	i.	s.	s. eth.; 2.2 ¹⁷ CS ₂
8382	yel. monocl. need. f. w.	1.277 ¹¹¹	93	subl.	sl. m.	s.	v. s. eth.; s. CS ₂ , chl., bz.; sl. s. lgr.
8383							
8384							
8385	col. liq., 1.50569 ^{16.05}	0.873	<-17	162	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8386	Toluene, <i>m</i>-ethyl-	1-ethyl-3-methylbenzene.	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_2\text{H}_5$	120.19
8387	—, <i>p</i> -ethyl-.....	1-ethyl-4-methylbenzene.	$\text{CH}_3\text{C}_6\text{H}_4\text{C}_2\text{H}_5$	120.19
8388	—, <i>o</i> -fluoro-.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{F}$	110.13
8389	—, <i>m</i> -fluoro-.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{F}$	110.13
8390	—, <i>p</i> -fluoro-.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{F}$	110.13
8390M	—, <i>o</i> -fluoro-.....	See <i>Benzyl fluoride</i>.	.....	.....
8391	—, hexahydro-.....	See <i>Cyclohexane, methyl-</i>.	.....	.....
8392	—, <i>o</i> , <i>m</i> or <i>p</i> -hydroxy-.....	See <i>Cresol</i>.	.....	.....
8393	—, <i>o</i> -hydroxy-.....	See <i>Benzyl alcohol</i>.	.....	.....
8394	—, <i>o</i> -iodo-.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{I}$	218.05
8395	—, <i>m</i> -iodo-.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{I}$	218.05
8396	—, <i>p</i> -iodo-.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{I}$	218.05
8397	—, <i>o</i> -iodo-.....	See <i>Benzyl iodide</i>.	.....	.....
8398	—, isopropyl-.....	See <i>Cymene</i>.	.....	.....
8399	—, <i>o</i> , <i>m</i> or <i>p</i> -methoxy-.....	See <i>Ether, methyl tolyl</i>.	.....	.....
8400	—, <i>o</i> -methoxy-.....	See <i>Ether, benzyl methyl</i>.	.....	.....
8402	—, <i>o</i> -nitro-.....	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_3$	137.13
8403	—, <i>m</i> -nitro-.....	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_3$	137.13
8404	—, <i>p</i> -nitro-.....	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_3$	137.13
8405	—, <i>o</i> -nitroso-.....	.....	$\text{NOC}_6\text{H}_4\text{CH}_3$	121.13
8406	—, <i>m</i> -nitroso-.....	.....	$\text{NOC}_6\text{H}_4\text{CH}_3$	121.13
8407	—, <i>p</i> -nitroso-.....	.....	$\text{NOC}_6\text{H}_4\text{CH}_3$	121.13
8408	—, <i>o</i> , <i>m</i> or <i>p</i> -phenyl-.....	See <i>Biphenyl, methyl-</i>.	.....	.....
8408M	—, <i>o</i> -phenyl-.....	See <i>Methane, diphenyl-</i>.	.....	.....
8409	—, (2-propenoxy)-.....	See <i>Ether, allyl tolyl</i>.	.....	.....
8410	—, propoxy-.....	See <i>Ether, propyl tolyl</i>.	.....	.....
8411	—, <i>o</i> -propyl-.....	1-methyl-2-propylbenzene....	$\text{CH}_3\text{C}_6\text{H}_4(\text{CH}_2)_2\text{CH}_3$	134.21
8412	—, <i>m</i> -propyl-.....	1-methyl-3-propylbenzene....	$\text{CH}_3\text{C}_6\text{H}_4(\text{CH}_2)_2\text{CH}_3$	134.21
8413	—, <i>p</i> -propyl-.....	1-methyl-4-propylbenzene....	$\text{CH}_3\text{C}_6\text{H}_4(\text{CH}_2)_2\text{CH}_3$	134.21
8414	—, 1,2,3,6-tetrahydro-.....	See <i>Cyclohexene, 4-methyl-</i>.	.....	.....
8415	—, <i>o</i> -triazole-.....	benzyl azide; <i>o</i> -azido-toluene	$\text{C}_6\text{H}_5\text{CH}_2\text{N}_3$	133.15
8416	—, <i>o</i> -trichloro-.....	benzotrichloride; phenylchloroform	$\text{C}_6\text{H}_5\text{CCl}_3$	195.48
8417	—, <i>o</i> -trifluoro-.....	benzotrifluoride; phenylfluoroform	$\text{C}_6\text{H}_5\text{CF}_3$	146.11
8417M	—, <i>o</i> -trifluoro- <i>m</i> -nitro-.....	<i>m</i> -nitrobenzotrifluoride.....	$\text{CF}_3\text{C}_6\text{H}_4\text{NO}_2$	191.11
8418	—, 3,4,5-trihydroxy-.....	See <i>Pyrogallol, 5-methyl-</i>.	.....	.....
8419	—, 2,3,4-trinitro-*	.....	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{CH}_3$...	227.13
8420	—, 2,4,5-trinitro-*	<i>γ</i> -trinitrotoluene.....	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{CH}_3$...	227.13
8421	—, 2,4,6-trinitro-*	<i>sym</i> -trinitrotoluene; <i>o</i> -trinitrotoluene; "T.N.T."	$(\text{NO}_2)_3\text{C}_6\text{H}_2\text{CH}_3$...	227.13
8421H	Tolueneboronic acid, <i>o</i>	— and <i>m</i> -. See <i>Boric acid, <i>o</i></i>	and <i>m</i> -tolyl-.	.....
8421K	<i>o</i>-Tolueneboronic acid	See <i>Boric acid, benzyl-</i>.	.....	.....
8422	Toluenediamine.	See <i>Tolylenediamine</i>.	.....	.....
8423	<i>o</i>, <i>o</i>-Toluenediamine,	<i>N,N</i>-dibenzylidene- . See	<i>Hydrobenzamide</i>.	.....
8424	<i>o</i>, 2,-Toluenedicarboxylic acid.	See <i>Homophthalic acid</i>.	.....	.....

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8386	col. liq., 1.49966 ^{19.9}	0.869 ²⁰	.....	162.5 (158-9)	i.	s.	s. eth.
8387	col. liq., 1.49303 ^{22.8}	0.862	<-20	162	i.	s.	s. eth.
8388	col. liq., 1.4704	1.0041 ¹³	<-80	114	i.	v. s.	v. s. eth.
8389	col. liq., 1.4691	0.9972 ¹³	-110.8	116	i.	v. s.	v. s. eth.
8390	col. liq., 1.470	1.001 ¹⁵	.....	117	i.	v. s.	v. s. eth.
8390M							
8391							
8392							
8393							
8394	liq., 1.61066 ^{15.9}	1.697	.....	211	i.	∞	∞ eth.
8395	liq.,	1.698	.....	204	i.	∞	∞ eth.
8396	leaf, .....	.....	35	211.5	i.	v. s.	v. s. eth.
8397							
8398							
8399							
8400							
8402	yel. liq., 1.54739 ^{20.4}	1.163 ²⁰ ₄	(α)-10.6; (β)-4.1	222.3	0.0652 ³⁰	∞	∞ eth.; s. bz., chl., pet. eth.
8403	cr. or liq., 1.5475	1.164 ¹⁵ ; 1.157 ²⁰ ₄	15.5	231	0.0498 ⁸⁰	∞	∞ eth.; s. bz.
8404	col. rhomb. need., 1.5346 ^{62.5}	1.286 ²⁰ ; 1.139 ^{5.5} _{5.5}	51.3	238	0.0442 ³⁰	s.	v. s. eth.; s. bz.
8405	need, .....	.....	72-2.5	.....	.....	v. s.	v. s. eth., chl.
8406	need, .....	.....	53	.....	i.	sl. s.	s. eth.
8407	col. need. f. lgr.	.....	48	.....	v. sl. s. (i.)	.....	v. s. bz., h. me. al.
8408							
8408M							
8409							
8410							
8411	liq., 1.50139 ^{15.75}	.....	.....	181-2	i.	s.	.....
8412	liq., 1.49640 ^{17.0}	0.863 ¹⁶	.....	176-7	i.	s.	∞ eth.
8413	liq., 1.49655 ^{18.8}	0.8682 ¹⁵	.....	183-4	i.	s.	s. eth.
8414							
8415	oil, 1.53414 ²⁵	1.0655 ²⁵	exp.	108 ²⁵	i.	∞	∞ eth.
8416	col. oil,	1.38	-22	214	i.	s.	s. eth., bz.
8417	col. liq., 1.41707 ¹⁴	1.196 ¹⁴	-29.05	102.4	i.	∞	∞ eth.
8417M	col. liq., 1.47582 ¹⁵	1.43571	<-20	201.5	i.	s.	s. eth.
8418							
8419	tricl. leaf. f. al.	1.620	112	302 d. exp.	i.	sl. s. c.	v. s. eth.
8420	yel. rhomb. pl. f. acet.	1.620	104	291 d.	i.	sl. s. c.	v. s. eth.
8421	col. monocl. (rhomb.) f.al.	1.654	80.7(81-2)	240 exp.	0.02 ¹⁵	1.99 ³² 18.6 ⁷⁴	3.33 ^{20.3} eth.
8421H							
8421K							
8422							
8423							
8424							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8425	α ,2-Toluenediol.	See <i>Saligenin</i> .		
8426	α ,3-Toluenediol.	See <i>Benzyl alcohol, m-hydroxy-</i> .		
8427	α ,4-Toluenediol.	See <i>Benzyl alcohol, p-hydroxy-</i> .		
8428	<i>o</i> -Toluenesulfonamide	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{SO}_2\text{NH}_2$...	171.21
8429	<i>p</i> -Toluenesulfonamide	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{SO}_2\text{NH}_2$...	171.21
8430	—, <i>N,N</i> -dichloro-.	See <i>Dichloramine (T)</i> .		
8431	<i>o</i> -Toluenesulfonic acid	2-methylbenzenesulfonic acid	$\text{CH}_3\text{C}_6\text{H}_4\text{SO}_3\text{H}$...	172.19
8432	—, 5-amino- ($\text{SO}_3\text{H}=1$)	<i>p</i> -toluidine-3-sulfonic acid ($\text{NH}_2=1$)	$\text{NH}_2\text{C}_6\text{H}_3(\text{CH}_3)-$ (SO_3H)	187.21
8433	<i>m</i> -Toluenesulfonic acid	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{SO}_3\text{H}$...	172.19
8434	<i>p</i> -Toluenesulfonic acid	4-methylbenzenesulfonic acid	$\text{CH}_3\text{C}_6\text{H}_4\text{SO}_3\text{H}$...	172.19
8435	—, 3-amino- ($\text{SO}_3\text{H}=1$)	<i>o</i> -toluidine-5-sulfonic acid ($\text{NH}_2=1$)	$\text{NH}_2\text{C}_6\text{H}_3(\text{CH}_3)-$ (SO_3H)	187.21
8436	<i>p</i> -Toluenesulfonyl chloride	<i>p</i> -toluenesulfone chloride.....	$\text{CH}_3\text{C}_6\text{H}_4\text{SO}_2\text{Cl}$...	190.64
8437	<i>o</i> , <i>m</i> or <i>p</i> -Toluenethiol	See <i>Cresol, thio-</i> .		
8438	α -Toluenethiol.....	benzyl mercaptan; thio- benzyl alcohol; benzyl hydrosulfide	$\text{C}_6\text{H}_5\text{CH}_2\text{SH}$	124.19
8439	Toluhydroquinone....	2-methyl-1,4-benzenediol*; 2-methylhydroquinone; homohydroquinone; 2,5- dihydroxytoluene; hydro- toluquinone	$\text{CH}_3\text{C}_6\text{H}_3(\text{OH})_2$...	124.13
8440	<i>o</i> -Toluic acid.....	<i>o</i> -methylbenzoic acid.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOH}$...	136.14
8441	—, ethyl ester.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOC}_2\text{H}_5$	164.20
8442	—, methyl ester.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOCH}_3$	150.17
8443	—, <i>p</i> -phenylphenacyl ester	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOCH}_2\text{-}$ $\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	330.37
8444	—, 4,6-dihydroxy-.	See <i>o</i> -Orsellinic acid.		
8445	—, α -hydroxy-.....	<i>o</i> -(hydroxymethyl) benzoic acid	$\text{HOCH}_2\text{C}_6\text{H}_4\text{-}$ COOH	152.14
8446	—, —, lactone.	See <i>Phthalide</i> .		
8447	—, 3-hydroxy-.	See 3,2-Cresotic acid.		
8448	—, 4-hydroxy-.	See 4,2-Cresotic acid.		
8449	—, 5-hydroxy-.	See 3,6-Cresotic acid.		
8450	—, 6-hydroxy-.	See 2,6-Cresotic acid.		
8451	<i>m</i> -Toluic acid.....	<i>m</i> -methylbenzoic acid.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOH}$...	136.14
8452	—, ethyl ester.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOC}_2\text{H}_5$	164.20
8453	—, <i>p</i> -phenylphenacyl ester	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOCH}_2\text{-}$ $\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	330.37
8454	—, 2-hydroxy-.	See 2,3-Cresotic acid.		
8455	—, 4-hydroxy-.	See 4,3-Cresotic acid.		
8456	—, 5-hydroxy-.	See 3,5-Cresotic acid.		
8457	—, 6-hydroxy-.	See 2,5-Cresotic acid.		
8458	<i>p</i> -Toluic acid.....	<i>p</i> -methylbenzoic acid.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOH}$...	136.14
8459	—, ethyl ester.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOC}_2\text{H}_5$	164.20
8460	—, methyl ester.....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOCH}_3$	150.17
8461	—, <i>p</i> -phenylphenacyl ester	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{COOCH}_2\text{-}$ $\text{COC}_6\text{H}_4\text{C}_6\text{H}_5$	330.37
8462	—, 2-hydroxy-.	See 2,4-Cresotic acid.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8425							
8426							
8427							
8428	octahdr.		153-6		0.1 ⁹	3.6 ⁵	sl. s. eth.
8429	monocl.		137.5		1.94 ⁹	7.42 ⁵	sl. s. eth.
8430							
8431	deliq. cr.		67.5	128.8 ²⁵	v. s.	s.	i. eth.
8432	cr. + H ₂ O.		d.		0.45	i.	
8433	need.				v. s.	s.	i. eth.
8434	monocl. leaf.		106-7	140 ²⁰	v. s.	s.	s. eth.
8435	or pr.						
8435	need.				0.974	i.	
8436	col. tricl. or rhomb.		69	146 ¹⁵	i.	s.	s. eth.; v. s. bz.
8437							
8438	liq.	1.058 ²⁰		194-5	i.	v. s.	v. s. eth.; c. CS ₂
8439	col. rhomb. leaf. f. bz.		124-25	163 ¹¹ subl.	v. s.	v. s.	v. s. eth.; sl. s. bz.
8440	col. need., 1.512 ^{114.6}	1.062 ^{$\frac{115}{4}$}	103.7 (104-5)	259.2	0.118c., 2.17 ¹⁰⁰	v. s.	s. chl.
8441	col. liq., 1.50699 ^{21.6}	1.033; 1.038 ^{$\frac{15}{4}$}	<-10	221.3	i.	∞	∞ eth.
8442	liq.	1.073 ¹⁵	<-50	213	i.	∞	∞ eth.
8443			94.5				
8444							
8445	need.		120 (128) d.		0.4 ²⁰	v. s.	v. s. eth.
8446							
8447							
8448							
8449							
8450							
8451	col. pr. f. w., 1.509	1.054 ¹¹²	108.75 (109-12)	263	0.085 ¹⁵ , 1.7 ¹⁰⁰	v. s.	v. s. eth.
8452	col. liq., 1.50502 ^{21.6}	1.028		226.4	i.	∞	∞ eth.
8453			136.5				
8454							
8455							
8456							
8457							
8458	col. need. f. w.		179.6	275	0.034c., 1.26 ¹⁰⁰	v. s.	v. s. eth.
8459	col. liq., 1.50888 ^{18.2}	1.026		228 (235.5)	i.	∞	∞ eth.
8460	cr. f. pet. eth.		33	217	i.	v. s.	v. s. eth.
8461			165				
8462							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8463	<i>p</i> -Toluic acid, 3-hydroxy-	xy-. See 3,4-Cresotic acid.		
8464	α -Toluic acid.....	phenylacetic acid.....	$C_6H_5CH_2COOH...$	136.14
8465	—, ethyl ester.....	ethyl phenylacetate.....	$C_6H_5CH_2COOC_2H_5$	164.20
8466	—, isobutyl ester.....	eglantine.....	$C_6H_5CH_2COOC_4H_9$	192.25
8467	—, methyl ester.....	methyl phenylacetate.....	$C_6H_5CH_2COOCH_3$	150.17
8468	—, piperazinium salt.....	See <i>Oxindole</i> .	$C_4H_{10}N_2 \cdot 2C_6H_5O_2..$	358.43
8469	—, <i>o</i> -amino-, lactam.			
8470	—, <i>p</i> -amino-.....	<i>p</i> -aminophenylacetic acid....	$NH_2C_6H_4CH_2-$ $COOH$	151.16
8471	—, α -amino-(<i>dl</i>)....	<i>dl</i> - α -amino- α -phenylacetic acid	$C_6H_5CH(CH_2NH_2)-$ $COOH$	151.16
8472	—, 2,4-dinitro-.....	2,4-dinitrophenylacetic acid; 2,4-dinitrobenzeneethanoic acid	$(NO_2)_2C_6H_3CH_2-$ $COOH$	226.14
8473	—, <i>o</i> -hydroxy-.....	<i>o</i> -hydroxyphenylacetic acid..	$HOC_6H_4CH_2-$ $COOH$	152.14
8474	—, <i>m</i> -hydroxy-.....		$HOC_6H_4CH_2-$ $COOH$	152.14
8475	—, <i>p</i> -hydroxy-.....		$HOC_6H_4CH_2-$ $COOH$	152.14
8476	—, α -hydroxy-.	See <i>Mandelic acid</i> .		
8477	—, <i>o</i> -methyl-.....	<i>o</i> -tolylacetic acid.....	$CH_3C_6H_4CH_2-$ $COOH$	150.17
8478	—, <i>m</i> -methyl-.....	<i>m</i> -tolylacetic acid.....	$CH_3C_6H_4CH_2-$ $COOH$	150.17
8479	—, <i>p</i> -methyl-.....	<i>p</i> -tolylacetic acid.....	$CH_3C_6H_4CH_2-$ $COOH$	150.17
8480	—, α -methyl-.	See <i>Hydratropic acid</i> .		
8481	—, α -methylene-.	See <i>Atropic acid</i> .		
8482	—, <i>p</i> -nitro-.....		$NO_2C_6H_4CH_2-$ $COOH$	181.14
8483	<i>o</i> -Toluic anhydride....		$(CH_3C_6H_4CO)_2O..$	254.27
8484	Toluidine, <i>N</i> -naphthyl-	See <i>Naphthylamine, N-tolyl-</i> .		
8485	<i>o</i> -Toluidine.....	<i>o</i> -methylaniline.....	$CH_3C_6H_4NH_2....$	107.15
8486	—, <i>N</i> -acetyl-.	See <i>o-Acetotoluide</i> .		
8487	—, <i>N</i> -benzoyl-.	See <i>o-Benzotoluide</i> .		
8488	—, <i>N,N</i> -diethyl-....	1-diethylamino-2-methylbenzene	$CH_3C_6H_4N(C_2H_5)_2$	163.26
8489	—, <i>N,N</i> -dimethyl-...		$CH_3C_6H_4N(CH_3)_2$	135.20
8490	—, <i>N</i> -methyl-.....		$CH_3C_6H_4NHCH_3..$	121.18
8491	—, 3-nitro-($NH_2=1$)	2-methyl-3-nitroaniline.....	$NO_2(CH_3)C_6H_3-$ NH_2	152.15
8492	—, 4-nitro-.....	2-methyl-4-nitroaniline.....	$NO_2(CH_3)C_6H_3-$ NH_2	152.15
8493	—, 5-nitro-.....	2-methyl-5-nitroaniline.....	$NO_2(CH_3)C_6H_3-$ NH_2	152.15
8494	—, 6-nitro-.....	2-methyl-6-nitroaniline.....	$NO_2(CH_3)C_6H_3-$ NH_2	152.15
8495	—, 4- <i>o</i> -tolylazo- ($NH_2=1$)	4'-amino-2,3'-dimethylazobenzene	$CH_3C_6H_4N:NC_6H_3(CH_3)NH_2$	225.29
8496	—, 4- <i>p</i> -tolylazo-....	4-amino-3,4'-dimethylazobenzene	$CH_3C_6H_4N:NC_6H_3(CH_3)NH_2$	225.29
8497	<i>m</i> -Toluidine.....	<i>m</i> -methylaniline.....	$CH_3C_6H_4NH_2....$	107.15
8497M	—, hydrochloride.....		$CH_3C_6H_4NH_3Cl..$	143.62

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8463							
8464	col. leaf.....	1.228 ²⁰ / ₄ ; liq. 1.0778 ⁸³	76.7	265.5	1.66 ²⁰	186	v. s. eth.; 151 chl.
8465	col. liq., 1.49921 ^{18.5}	1.031		226 (120-1 ²⁰)	i.	∞	∞ eth.
8466		0.990		254; 128-31 ²⁰	i.	s.	s. eth.
8467	col. liq.....	1.044 ¹⁶	d. 360	220	i.	∞	∞ eth.
8468	wh. need.....		146.5-7.5		s. h.	s. h.	i. eth.
8469							
8470	leaf.....		199-200 d.		i. c., s. h.	s.	
8471	pr. f. w.+al.		237-8 d.	subl. 256	i.	sl. s.	sl. s. most org. solv.
8472	col. need. f. w.		179 d. (188-9)	d.	sl. s.	s.	s. eth.
8473	need f. eth....		137 (145-7)	240-3 d.	s.		v. s. eth.; sl. s. c. chl.
8474	need. f. bz.+ lgr.		129	190 ¹¹	v. s.	v. s.	v. s. eth.
8475	pr. or need. f. w.		148	subl.	v. s. h.	v. s.	v. s. eth.
8476							
8477	col. need. f. w.		88-9		v. s. h.		
8478	need.....		61		v. s. h.		
8479	col. need. f. w.		91	266	sl. s. c., v. s. h.	v. s.	v. s. eth.; s. bz.
8480							
8481							
8482	col. need. f. w.		152-3	d.	sl. s.	sl. s.	sl. s. eth.
8483	col. f. eth....		39	325	d.	d.	v. s. eth.
8484							
8485	col. liq., 1.57276	1.004 ²⁰ / ₄	α, -24.4; β, -16.3	199.84	1.50 ²⁵	∞	∞ eth.
8486							
8487							
8488	pr. f. w.....		72-3	206	v. sl. s.	s.	s. eth.
8489	1.5153.....	0.9286 ²⁰ / ₄	-60.0	184.6	v. sl. s.	∞	= eth.
8490	liq., 1.5649....	0.973 ¹⁵		207	i.	∞	∞ eth.
8491	yel. rhomb. leaf.	1.378 ¹⁵	91.5	305 d.	1.3 h.	v. s.	v. s. eth., bz.
8492	yel. monocl. f. w.	1.366 ¹⁵	129(127.5)		v. sl. s. h.	v. s.	s. bz., glac. ac. a.
8493	yel. monocl. f. al.	1.365 ¹⁵	105 (107)		v. sl. s.	s.	s. eth.
8494	or. pr. f. al....		96		sl. s.	v. s.	v. s. eth.; s. bz., chl.
8495	yel. monocl. pl.		100		v. sl. s.	s.	s. eth., chl.
8496	yel. pl. f. al....		127-8		i.	sl. s.	sl. s. lgr.
8497	liq., 1.57106 ^{22.4}	0.989 ²⁰ / ₄	-31.5	203.3	sl. s.	∞	= eth.
8497M	leaf.....		228	249.8	96.3 ¹²	61.91 ⁹ 94%	

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8498	<i>m</i> -Toluidine, <i>N</i> -acetyl	See <i>m</i> -Acetotoluide.		
8499	—, <i>N</i> -benzoyl-	See <i>m</i> -Benzotoluide.		
8500	—, <i>N,N</i> -dimethyl-	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2$	135.20
8501	—, <i>N</i> -methyl-	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHCH}_3$	121.13
8502	—, 2-nitro- ($\text{NH}_2=1$)	3-methyl-2-nitroaniline.	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{-NH}_2$	152.15
8503	—, 4-nitro-	3-methyl-4-nitroaniline.	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{-NH}_2$	152.15
8504	—, 5-nitro-	3-methyl-5-nitroaniline.	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{-NH}_2$	152.15
8505	—, 6-nitro-	3-methyl-6-nitroaniline.	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{-NH}_2$	152.15
8506	—, 4- <i>m</i> -tolylazo- ($\text{NH}_2=1$)	4-amino-2,3'-dimethylazo-benzene	$\text{CH}_3\text{C}_6\text{H}_4\text{N:NC}_6\text{H}_3\text{-NH}_2$	225.29
8506M	—, α -trifluoro-	<i>m</i> -trifluoromethylaniline; <i>m</i> -aminobenzotrifluoride	$\text{CF}_3\text{C}_6\text{H}_4\text{NH}_2$	161.13
8507	<i>p</i> -Toluidine.	<i>p</i> -methylaniline.	$\text{CH}_3\text{C}_6\text{H}_4\text{NH}_2$	107.15
8507M	—, hydrochloride. ....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NH}_3\text{Cl}$	143.62
8508	—, <i>N</i> -acetyl-	See <i>p</i> -Acetotoluide.		
8509	—, <i>N</i> -benzoyl-	See <i>p</i> -Benzotoluide.		
8510	—, 2-bromo-	2-bromo-4-methylaniline.	$\text{Br}(\text{CH}_3)\text{C}_6\text{H}_3\text{NH}_2$	186.06
8511	—, 2-bromo-5-nitro-	2-bromo-4-methyl-5-nitroaniline	$\text{CH}_2(\text{NO}_2)\text{BrC}_6\text{H}_2\text{-NH}_2$	231.06
8512	—, <i>N,N</i> -diethyl- . . .	1-diethylamino-4-methylbenzene	$\text{CH}_3\text{C}_6\text{H}_4\text{N}(\text{C}_2\text{H}_5)_2$	163.26
8513	—, <i>N,N</i> -dimethyl- .....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2$	135.20
8514	—, <i>N</i> -methyl- .....	.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NHCH}_3$	121.13
8515	—, 2-nitro- ($\text{NH}_2=1$)	4-methyl-2-nitroaniline; <i>m</i> -nitro- <i>p</i> -toluidine	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{-NH}_2$	152.15
8516	—, 3-nitro-	4-methyl-3-nitroaniline.	$\text{NO}_2(\text{CH}_3)\text{C}_6\text{H}_3\text{-NH}_2$	152.15
8517	Toluidinesulfonic acid	See <i>Toluenesulfonic acid</i> , <i>ami</i>	<i>no</i> -	
8518	<i>o</i> -Tolunitrile.	2-methylbenzenecarbonitrile*; <i>o</i> -methylbenzonitrile	$\text{CH}_3\text{C}_6\text{H}_4\text{CN}$	117.14
8519	<i>m</i> -Tolunitrile.	<i>m</i> -methylbenzonitrile.	$\text{CH}_3\text{C}_6\text{H}_4\text{CN}$	117.14
8520	<i>p</i> -Tolunitrile.	4-methylbenzenecarbonitrile*; <i>p</i> -methylbenzonitrile	$\text{CH}_3\text{C}_6\text{H}_4\text{CN}$	117.14
8521	—, 2-amino-	homooanthranilonitrile.	$\text{CH}_3\text{C}_6\text{H}_3(\text{NH}_2)\text{CN}$	132.16
8522	α -Tolunitrile.	benzyl cyanide; phenylacetoneitrile	$\text{C}_6\text{H}_5\text{CH}_2\text{CN}$	117.14
8523	—, α -keto-	See <i>Benzoyl cyanide</i> .		
8524	—, <i>o</i> -nitro-	<i>o</i> -nitrobenzyl cyanide.	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_2\text{CN}$	162.14
8525	—, <i>p</i> -nitro- .....	.....	$\text{NO}_2\text{C}_6\text{H}_4\text{CH}_2\text{CN}$	162.14
8525M	—, α -oxo-	See <i>Benzoyl cyanide</i> .		
8526	<i>p</i> -Toluquinaldine.	See <i>Quinoline</i> , 2,6-dimethyl-*		
8527	Toluquinone.	2-methylquinone; <i>p</i> -toluquinone	$\text{CH}_3\text{C}_6\text{H}_5\text{O}_2$	122.12
8528	α -Toluyyl chloride.	phenylacetyl chloride.	$\text{C}_6\text{H}_5\text{CH}_2\text{COCl}$	154.59
8529	Toluylene.	See <i>Stilbene</i> .		
8530	Toluylenediamine.	See <i>Tolylenediamine</i> .		
8531	Tolyl-. For tolyl derivative	see the parent compounds (e.g. <i>Toluene</i> , <i>bromo</i> -	for tolylhydrazine see <i>Hy</i> -	
8532	Tolyl bromide.	See <i>Toluene</i> , <i>o</i> , <i>m</i> , or <i>p</i> -chloro-;	see also <i>Xylene</i> , α -chloro-	

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8498							
8499							
8500	1.5492.....	0.941	.....	212.5	v. sl. s.	∞	∞ eth.
8501	liq.....			206	i.	∞	= eth.
8502	yel. need.....		53		sl. s.	v. s.	s. a.
8503	yel. need. f. w.		138		s. h.	s.	s. eth., a.; sl. s. CS ₂
8504	or. need.....		98.4		v. sl. s.	v. s.	v. s. eth.; s. bz.
8505	yel. leaf. f. w.		109		s. h.	v. s.	v. s. eth.; s. bz., chl.
8506	ylsh. br. need. f. al.		80		sl. s.	s.	.....
8506M	col. liq., 1.4847 ^{12.5}	1.30467 ^{12.5}		187.5	sl. s.	s.	s. eth.
8507	leaf. f. w., 1.55324 ^{29.1}	1.046 ²⁰ / ₄ ; 0.973 ⁵⁰ / ₅₀	45 (42-3)	200.3	0.74 ²¹	156 ³⁰	s. eth.
8507M	monocl. need.		243	257.5 subl.	22.9 ¹¹	25 ¹⁷ 89%	i. eth., bz., CS ₂
8508							
8509							
8510	leaf.....	1.51 ²⁰	26 (12-3)	240	i.	s.	s. eth.
8511	yel. need. f. al.		121				.....
8512	col. liq.....	0.9242 ¹⁵ / ₄	229		v. sl. s.	∞	= eth.
8513	liq., 1.53664...	0.9287 ²⁰ / ₄		210-11	v. sl. s.	∞	∞ eth.
8514	liq.....			206-8	i.	∞	= eth.
8515	red monocl. pr. f. al.	1.312 ¹⁷	117 (114)		v. sl. s. h.	v. s.	s. conc. H ₂ SO ₄
8516	yel. monocl. f. w.		77.5 (81.5)		s.	v. s. h.	s. eth.; sl. s. CS ₂
8517							
8518	col. liq., 1.52720 ^{23.1}	0.9941 ²⁵ / ₄	-13 to -14	204	i.	∞	∞ eth.
8519	col. liq.....	0.986 ²⁵ / ₄	-23	214	0.085 c., 1.67 h.	∞	∞ eth.
8520	wh.-yel. need. f. al.	0.9805 ³⁰ / ₃₀	29.5	217	i.	v. s.	v. s. eth.
8521	need. f. al.		136		i.	v. s.	v. s. eth.
8522	col. liq., 1.52105 ²⁵	1.015 ¹⁸	-23.8	234; 107 ¹²	i.	∞	∞ eth.
8523							
8524	need. f. w.		82.5-4.0		s. h.	s.	s. eth.
8525	leaf. or pr. f. al.		117		i.	s.	s. eth.
8525M							
8526							
8527	yel. leaf. or need.		69 (65-7)	subl.	s. h.	v. s.	v. s. eth.
8528	col. fum. liq...	1.168 ²⁰ / _■		170 ²⁵⁰ , 94-5 ¹³	d.	d.	v. s. eth.
8529							
8530							
8531	<i>drazine, tolyl-).</i>						
8532							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8533	Tolylene.	See also <i>Xylylene</i> .		
8534	3-o-Tolylene-diamine (NH ₂ =1,2)	2,3-toluenediamine; 2,3-diaminotoluene; 2,3-tolylene-diamine	CH ₃ C ₆ H ₃ (NH ₂) ₂ ...	122.17
8535	4-o-Tolylene-diamine (NH ₂ =1,2)	3,4-toluenediamine; 3,4-diaminotoluene; 3,4-tolylene-diamine	CH ₃ C ₆ H ₃ (NH ₂) ₂ ...	122.17
8536	2-m-Tolylene-diamine (NH ₂ =1,3)	2,6-toluenediamine; 2,6-diaminotoluene; 2,6-tolylene-diamine	CH ₃ C ₆ H ₃ (NH ₂) ₂ ...	122.17
8537	4-m-Tolylene-diamine (NH ₂ =1,3)	2,4-toluenediamine; 2,4-diaminotoluene; 2,4-tolylene-diamine	CH ₃ C ₆ H ₃ (NH ₂) ₂ ...	122.17
8538	5-m-Tolylene-diamine (NH ₂ =1,3)	3,5-toluenediamine; 3,5-diaminotoluene; 3,5-tolylene-diamine	CH ₃ C ₆ H ₃ (NH ₂) ₂ ...	122.17
8539	p-Tolylene-diamine (NH ₂ =1,4)	2,5-toluenediamine; 2,5-diaminotoluene; 2,5-tolylene-diamine	CH ₃ C ₆ H ₃ (NH ₂) ₂ ...	122.17
8540	Tolylene glycol.	See <i>Hydrobenzoin</i> .		
8541	Tolyl mercaptan.	See <i>Cresol</i> , <i>thio</i> .		
8542	Tolyl mustard oil.	See <i>Isothiocyanic acid</i> , <i>tolyl ester</i> .		
8543	o-Tolyl phosphate ...	tri-o-cresyl phosphate.....	(CH ₃ C ₆ H ₄) ₃ PO ₄ ...	368.36
8544	p-Tolyl phosphate ...	tri-p-cresyl phosphate.....	(CH ₃ C ₆ H ₄) ₃ PO ₄ ...	368.36
8544M	Torulin.	See <i>Vitamin B₁</i> .		
8545	Toxicarol		C ₂₃ H ₂₂ O ₇	410.41
8546	Tragacanthin.	See <i>Bassorin</i> .		
8547	Tri-. For tribromo, triethyl,	etc. derivatives see the parent	compounds (e.g., <i>Acetic</i>	
8548	Triacetamide		(CH ₃ CO) ₃ N.....	143.14
8548	Triacetin.	See <i>Glycerol</i> , <i>triacetate</i> .		
8549	Triacetoneamine	2,2,6,6-tetramethyl-4-piperidone	C ₉ H ₁₇ NO·H ₂ O....	173.25
8550	Triacontane*	n-triacontane.....	CH ₃ (CH ₂) ₂₈ CH ₃ ...	422.80
8550M	1-Triacontanol*		n-C ₃₀ H ₆₁ OH.....	438.80
8551	Triazene, 1,3-bis(p-nitrophenyl)-.	See <i>Diazoaminobenzene</i> , 4,4'-dinitro- [*] .		
8552	—, 1,3-di-1-naphthyl-1-*	See 1,1'-Diazoaminonaphthalene [*] .		
8553	—, 1,3-di-2-naphthyl-1-*	See 2,2'-Diazoaminonaphthalene [*] .		
8554	—, 1,3-diphenyl-*	See <i>Diazoaminobenzene</i> [*] .		
8555	—, 1-phenyl-3-p-tolyl-	4-methyldiazoaminobenzene..	C ₆ H ₅ N ₂ NHC ₆ H ₄ -CH ₃	211.26
8556	sym-Triazine, hexahydro-1,3,5-triphenyl-	anhydroformaldehydeaniline; methyleneaniline, trimethylenetrianiiline	(C ₆ H ₅ N-CH ₂) ₃ ...	315.40
8557	—, 2,4,6-triamino-	See <i>Melamine</i> .		
8558	—, trichloro-	See <i>Cyanuric chloride</i> .		
8559	sym-Triazine-2, 4-diol,	6-amino- . See <i>Ammeline</i> .		
8560	sym-Triazinetriol.	See <i>Cyanuric acid</i> .		
8561	sym-Triazin-2-ol, 4,6-diamino-	See <i>Ammeline</i> .		
8562	Triazobenzene.	See <i>Benzene</i> , <i>triazole</i> .		
8563	1,2,4-Triazole	sym-triazole (one form); pyrr[ab] diazole.....	NHN:CHN:CH...	69.07
8564	—, 4,5-dihydro-1,4-diphenyl-3,5-phenylimin	o-. See <i>Nitron</i> .		
8565	Tribenzaldiamine.	See <i>Hydrobenzamide</i> .		
8566	Tribenzoin.	See <i>Glycerol</i> , <i>tribenzoate</i> .		
8567	Tribenzylamine		(C ₆ H ₅ CH ₂) ₃ N.....	287.39
8568	Tribromohydrin.	See <i>Propane</i> , 1,2,3-tribromo- [*] .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8533							
8534	cr. ....	.....	61	255	s.	s.	■. eth.
8535	col. leaf. f. lgr. ....	.....	88.5	265	s.	.....	.....
8536	pr. f. w. ....	.....	105	.....	s.	s.	.....
8537	col. rhomb.; need. f. w.; pr. f. al. ....	.....	99	280	s.	v. s.	v. s. eth.
8538	liq. ....	.....	.....	285	.....	■.	s. eth.
8539	leaf. f. bz. ....	.....	64	274	v. s.	v. s.	v. s. eth.
8540							
8541							
8542							
8543	liq. ....	.....	.....	410 sl. d.; 263-5 ²⁰	i.	v. s.	v. s. eth., bz.
8544	need. f. w. ....	.....	77-8	.....	i.	v. s.	v. s. eth., bz.
8544M							
8545	bright yel.-grn. hex. pl. or rods, 1.580, 1.618, 1.768	.....	219	.....	.....	sl. s.	s. h. chl.
8546	acid, tribromo-; Benzene, triethyl-)	.....	79	.....	.....	.....	s. eth.
8547	need. f. eth. ....	.....	.....	.....	.....	.....	.....
8548							
8549	tetr. need. f. w. ....	.....	anh. 40; 1H ₂ O 58	.....	s.	s.	s. eth.
8550	cr.	liq. 0.7797	66.1 (69-70) 86.3-86.5	235 ¹	i.	sl. s.	s. eth., bz.
8550M							
8551							
8552							
8553							
8554							
8555	ylsh. leaf. ....	.....	90-1	d.	i.	.....	.....
8556	wh. silky need. ....	.....	140-1(143)	185	v. sl. s.	sl. s.	s. eth., bz., chl., tol.
8557							
8558							
8559							
8560							
8561							
8562							
8563	need., 1.48544 ^{25.3}	.....	121	260	s.	s.	sl. s. eth.
8564							
8565							
8566							
8567	monocl. f. al.	0.991 ⁹⁵ / ₄	92	380-90	v. sl. s.	s. h.	s. eth.
8568							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8569	Tributylamine*	tri- <i>n</i> -butylamine	$(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_3\text{N}$	185.35
8570	Tricarballic acid	1,2,3-propanetricarboxylic acid*	$\text{HOOCCH}_2\text{CH}(\text{COOH})\text{CH}_2\text{COOH}$	176.12
8571	—, α, β -dihydroxy-	1,2-dihydroxy-1,2,3-propanetricarboxylic acid*; hydroxycitric acid	$\text{COOHCH}_2\text{CH}(\text{COOH})\text{CHOHCOOH}$	208.12
8572	—, α -hydroxy-	See <i>Isocitric acid</i> .		
8573	—, β -hydroxy-	See <i>Citric acid</i> .		
8574	—, α, α, β -trimethyl-	See <i>Camphoric acid</i> .		
8575	Tricarbonamide	See <i>Fulminuric acid</i> .		
8576	Tricosane*	<i>n</i> -tricosane	$\text{CH}_3(\text{CH}_2)_{21}\text{CH}_3$. . .	324.62
8577	12-Tricosanone*	dihendecyl ketone; diundecyl ketone; laurone	$[\text{CH}_3(\text{CH}_2)_{10}]_2\text{CO}$. .	338.60
8578	Tricresyl phosphate	See <i>Tolyl phosphate</i> .		
8579	Tricyanic acid	See <i>Cyanuric acid</i> .		
8580	Tricyanogen chloride	See <i>Cyanuric chloride</i> .		
8581	Tridecanal* , oxime	<i>n</i> -tridecylaldoxime	$\text{CH}_3(\text{CH}_2)_{11}\text{CH}_2\text{NOH}$	213.36
8582	Tridecane*		$\text{CH}_3(\text{CH}_2)_{11}\text{CH}_3$. . .	184.36
8583	—, 1-amino-	See <i>Tridecylamine*</i> .		
8584	Tridecanoic acid*	<i>n</i> -tridecoic acid; <i>n</i> -tridecyl acid	$\text{CH}_3(\text{CH}_2)_{11}\text{COOH}$	214.34
8585	—, 13-(2-cyclopentenyl)-	See <i>Chaulmoogric acid</i> .		
8586	1-Tridecanol*	<i>prim-n</i> -tridecyl alcohol	$\text{CH}_3(\text{CH}_2)_{11}\text{CH}_2\text{OH}$	200.36
8587	2-Tridecanone*	hendecyl methyl ketone	$\text{CH}_3\text{CO}(\text{CH}_2)_{10}\text{CH}_3$	198.34
8588	7-Tridecanone*	dihexyl ketone; enanthone; oenanthone	$[\text{CH}_3(\text{CH}_2)_5]_2\text{CO}$. . .	198.34
8589	<i>n</i>-Tridecoic acid	See <i>Tridecanoic acid*</i> .		
8590	<i>n</i>-Tridecyl alcohol	See 1- <i>Tridecanol*</i> .		
8591	<i>n</i>-Tridecylaldoxime	See <i>Tridecanal</i> , oxime*.		
8592	Tridecylamine* (<i>n</i>)	1-aminotridecane; <i>prim-n</i> -tridecylamine	$\text{CH}_3(\text{CH}_2)_{12}\text{NH}_2$. . .	199.37
8593	Tridecylene		$\text{C}_{13}\text{H}_{26}$	182.34
8594	<i>n</i>-Tridecyllic acid	See <i>Tridecanoic acid*</i> .		
8595	Triethanolamine	triethanolamine	$\text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$. . .	149.19
8596	Triethylamine*		$(\text{C}_2\text{H}_5)_3\text{N}$	101.19
8597	—, hydrochloride	triethylammonium chloride*	$(\text{C}_2\text{H}_5)_3\text{N}\cdot\text{HCl}$	137.65
8598	—, β, β -diethoxy-	diethylaminoacetal	$(\text{C}_2\text{H}_5)_2\text{NCH}_2\text{CH}(\text{OC}_2\text{H}_5)_2$	189.29
8599	—, β, β' -dihydroxy-	See <i>Ethanol, 2,2'-ethyliminodi-</i> .		
8600	—, β -hydroxy-	See <i>Ethanol, 2-diethylamino*</i> .		
8601	—, 2,2',2''-trihydroxy	See <i>Triethanolamine</i>		
8602	Triethyl arsenate	See <i>Ethyl arsenate</i> .		
8603	Triethyl arsenite	See <i>Ethyl arsenite</i> .		
8604	Triethyl borate	See <i>Ethyl borate</i> .		
8606	Triethylene glycol	2,2'-ethylenedioxydiethanol; glycol bis(hydroxyethyl) ether	$(\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH})_2$	150.17
8607	Triethylolamine	See <i>Triethanolamine</i> .		
8608	Triethyl phosphate	See <i>Ethyl phosphate</i> .		
8609	Triethyl phosphite	See <i>Ethyl phosphite</i> .		
8610	Trifuraldiamine	See <i>Hydrofuramide</i> .		

* Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C.	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8569	deliq. col. liq.	0.7782 ²⁰	.....	214	sl. s.	v. s.	v. s. eth.
8570	col. rhomb. pr. f. w.	.....	162-3	d.	40.5	v. s.	0.86 ¹⁵ eth.
8571	need.	1.39 ³⁵	160	.....	v. s.	sl. s.	v. s. eth.
8572							
8573							
8574							
8575							
8576	glit. leaf. f. al.	0.7799 ⁴⁸	47.7	234 ¹⁵	i.	sl. s.	s. eth.
8577	sc. or pl., 1.4283 ^{79.5}	0.8086 ⁶⁹ / ₄	69	.....	i.	v. sl. s.	s. eth.
8578							
8579							
8580							
8581	need. f. dil. al.	.....	80.5	.....	i.	sl. s.	v. s. eth., chl.; sl. s. bz., pet. eth.
8582	col. liq., 1.4419 ^{16.8}	0.757	-6.2	234	i.	v. s.	v. s. eth.
8583							
8584	pl. ....	.....	51 (39.5-40.5)	236 ¹⁰⁰	i.	v. s.	v. s. eth.
8585							
8586	col. cr.	0.8223 ³¹ / ₄	30.63	155-6 ¹⁵	i.	s.	s. eth.
8587	cr.	0.8229 ²⁸	28	263	i.	v. s.	v. s. eth.
8588	leaf. f. al.	0.825 ³⁰	33	255 ⁷⁶⁶ (264)	.....	v. s.	v. s. eth., s. chl., lgr.
8589							
8590							
8591							
8592	col. cr. ....	.....	27	275.7; 108.0 ²	sl. s.	s.	s. eth.
8593	col. liq.	0.7977 ²⁰ / ₄	.....	232.7	i.	v. s.	v. s. eth.
8594							
8595	vis. col. liq., 1.4852	1.1242 ²⁰ / ₄	21.2	277-9 ¹⁵⁰	∞	∞	sl. s. eth.
8596	col. liq., 1.40032	0.7229 ²⁵ / ₄	-114.8	89.5	1.5 ²⁰ 1.97 ⁶⁵	∞	∞ eth.
8597	cr. f. al.	1.0688 ²¹ / ₄	254	subl.	150 ²³	s.	i. eth.
8598	liq.	0.863 ¹⁶	.....	194-5	s.	s.	s. eth.
8599							
8600							
8601							
8602							
8603							
8604							
8606	col. liq.	1.1254	-5	280-90	∞	∞	sl. s. eth.
8607							
8608							
8609							
8610							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8611	Trifurfurylamine.	$\alpha, \alpha', \alpha''$ -tri-2-furyltrimethylamine	$(C_4H_3OCH_2)_3N$	257.28
8612	Trigonelline.	nicotinic acid <i>N</i> -methylbetaine	$C_7H_7NO_2$	137.13
8613	Triisoamylamine. . . . .	.....	$[(CH_3)_2CHCH_2CH_2]_3N$	227.43
8614	Triisoamyl borate.	See <i>Isoamyl borate</i>.	.....	.....
8615	Triisobutylamine. . . . .	.....	$[(CH_3)_2CHCH_2]_3N$	185.35
8616	Triisobutyl arsenite.	See <i>Isobutyl arsenite</i>.	.....	.....
8617	Triisobutyl borate.	See <i>Isobutyl borate</i>.	.....	.....
8618	Triketone, diphenyl-.	See <i>Propanetrione, diphenyl-</i>.*	.....	.....
8619	Trilaurin.	See <i>Glycerol, trilaurate</i>.	.....	.....
8620	Trimellitic acid.	1,2,4-benzenetricarboxylic acid*	$C_6H_3(COOH)_3$	210.14
8621	Trimesic acid.	1,3,5-benzenetricarboxylic acid*	$C_6H_3(COOH)_3$	210.14
8622	—, hydroxy-	phenol-2,4,6-tricarboxylic acid	$HOC_6H_2(COOH)_3$	226.14
8623	Trimesitic acid.	2,4,6-pyridinetricarboxylic acid	$C_5H_2N(COOH)_3$	211.13
8624	Trimethylamine*. . . . .	.....	$(CH_3)_3N$	59.11
8625	—, hydrochloride.	trimethylammonium chloride*	$(CH_3)_3N \cdot HCl$	95.58
8626	—, $\alpha, \alpha', \alpha''$ -tri-2-furyl-.	See <i>Trifurfurylamine</i>.	.....	.....
8627	Trimethyl borate.	See <i>Methyl borate</i>.	.....	.....
8628	Trimethylene.	See <i>Cyclopropane</i>.*	.....	.....
8629	Trimethylene bromide.	See <i>Propane, 1,3-dibromo</i>.*	.....	.....
8630	Trimethylene bromohydrin.	See 1-Propanol, 3-bromo-*	.....	.....
8631	Trimethylene chloride.	See <i>Propane, 1,3-dichloro</i>.*	.....	.....
8632	Trimethylene chlorohydrin.	See 1-Propanol, 3-chloro-*	.....	.....
8633	Trimethylene cyanide.	See <i>Glutaronitrile</i>.	.....	.....
8634	Trimethylenediamine.	See 1,3-Propanediamine*.	.....	.....
8635	Trimethylene dibromide.	See <i>Propane, 1,3-dibromo</i>.*	.....	.....
8636	Trimethylene dichloride.	See <i>Propane, 1,3-dichloro</i>.*	.....	.....
8637	Trimethylene dicyanide.	See <i>Glutaronitrile</i>.	.....	.....
8638	Trimethylene glycol.	See 1,3-Propanediol*.	.....	.....
8639	—, diphenyl ether.	See <i>Propane, 1,3-diphenozyl</i>.*	.....	.....
8640	—, methylene ether.	See <i>m-Dioxane</i>.	.....	.....
8641	—, α -methyl-.	See 1,3-Butanediol*.	.....	.....
8642	—, $\alpha, \alpha', \alpha''$ -trimethyl-.	See 2,4-Pentanediol, 2-methyl-*	.....	.....
8643	Trimethylene methylenedioxide.	See <i>m-Dioxane</i>.	.....	.....
8644	Trimethylenetriaminin	See <i>sym-Triazine, hexahydro</i> -	1,3,5-triphenyl-.	.....
8645	Trimethylene trisulfide.	See <i>Formaldehyde, thio-(trimer)</i>.	.....	.....
8646	Trimethylenimine.	tetrahydroazete; azetidine.	$CH_2CH_2CH_2NH$	57.09
8647	Trimethyl phosphate.	See <i>Methyl phosphate</i>.	.....	.....
8648	Trinitrin.	See <i>Nitroglycerin</i>.	.....	.....
8649	Trinitro-. See the parent compound	compounds (e.g., for trinitrotoluene see <i>Toluene, trinitro-</i>).	.....	.....
8649	Triolein.	See <i>Glycerol, trioleate</i>.	.....	.....
8650	Trional.	2,2-bis(ethylsulfonyl)butane*	$CH_3C(SO_2C_2H_5)_2CH_2CH_3$	242.35
8651	sym-Trioxane.	1,3,5-trioxane; α -trioxymethylene	$OCH_2OCH_2OCH_2$	90.08
8652	—, 2,4,6-trimethyl-.	See <i>Paraldehyde</i>.	.....	.....
8653	sym-Trioxanetriimine.	See <i>Cyameliide</i>.	.....	.....
8654	Trioxymethylene.	See <i>Polyoxymethylene</i>.	.....	.....
8655	α -Trioxymethylene.	See <i>s-Trioxane</i>.	.....	.....
8656	Tripalmitin.	See <i>Glycerol, tripalmitate</i>.	.....	.....
8657	Triphenyl.	See <i>Terphenyl</i>.	.....	.....
	Triphenyl-. For triphenyl	derivatives see the parent compounds (e.g., for triphenyl-	.....	.....

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8611	col. liq.....	.....	.....	133-8 ¹	i.	.....	s. eth.
8612	hyg. pr. f. al...	.....	218 d.	.....	v. s.	s.	sl. s. eth., chl.; i. bz.
8613	col. liq.....	0.7859 ²⁰	.....	237 (242-5)	i.	v. s.	= eth.
8614	col. liq.,	0.766 ^{$\frac{25}{25}$}	-21.8	191.5 l	i.	v. s.	∞ eth.
8615	1.42519 ^{17.3}						
8616							
8617							
8618							
8619							
8620	col. need. f. w.	.....	216 d.	.....	s. h.	v. s.	s. eth.
8621	col. pr. f. w....	.....	350 (375-80)	subl. <300	2.69 ²²	v. s.	s. eth.
8622	need. f. w....	.....	d. 180	.....	0.5 ¹⁰	v. s. h.	sl. s. eth.; i. chl.
8623	pl. f. dil. H ₂ SO ₄	.....	227 d.	subl. d.	s. h.	.....	sl. s. eth.
8624	col. gas.....	0.662 ⁻⁵	-124	3.5	v. s.	v. s.	s. eth.
8625	col. deliq. cr. f. al.	.....	275 d.	.....	v. s.	s.	i. eth.
8626							
8627							
8628							
8629							
8630							
8631							
8632							
8633							
8634							
8635							
8636							
8637							
8638							
8639							
8640							
8641							
8642							
8643							
8644							
8645							
8646	col. liq.; odor NH ₃	0.843	.....	63	∞	.....	.....
8647							
8648							
8649							
8650	col. tab. f. al. or eth.	1.251 ^{$\frac{25}{4}$}	74-6	d.	0.3	5.7	4.71 ¹⁵ eth.
8651	need.....	.....	64	subl. 46	s.	s.	s. eth.
8652							
8653							
8654							
8655							
8656							
8657	methane see Me	thane, triphe nyl-).					

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8658	Triphenylamine*		$(C_6H_5)_3N$	245.31
8659	Triphenylene	benzo[<i>l</i>] phenanthrene; isochrysene	$C_{18}H_{12}$	228.28
8660	Tripropylamine*(n)		$(CH_3CH_2CH_2)_3N$	143.27
8661	Tripropyl borate.	See <i>Propyl borate.</i>		
8662	Triquinoyl hydrate.	See <i>Cyclohexanehexone, hydrate</i> *		
8663	Trisulfide, diallyl.	See <i>Allyl trisulfide.</i>		
8664	Tritan.	See <i>Methane, triphenyl.</i>		
8665	—, α -benzyl-.	See <i>Ethane, 1,1,1,2-tetraphenyl</i> -.		
8666	—, 4,4'-dimethyl-.	See <i>Methane, phenyldi-p-tolyl.</i>		
8667	—, α -ethyl-.	See <i>Propane, 1,1,1-triphenyl.</i>		
8668	—, <i>m</i> or <i>p</i> -methyl-.	See <i>Methane, diphenyltolyl.</i>		
8669	—, α -methyl-.	See <i>Ethane, 1,1,1-triphenyl.</i>		
8670	Tritanol.	See <i>Carbinol, triphenyl.</i>		
8671	sym-Trithiane.	See <i>Formaldehyde, thio.</i>		
8672	—, 2,4,6-trimethyl- (α)	α -trithioacetaldehyde; α -trimolecular thioacetaldehyde	$SCH(CH_3)SCH-$ $(CH_3)SCHCH_3$	180.34
8673	—, 2,4,6-trimethyl- (β)	β -trithioacetaldehyde; β -trimolecular thioacetaldehyde	$SCH(CH_3)SCH-$ $(CH_3)SCHCH_3$	180.34
8674	—, triphenyl- (higher-melting)	β -trithiobenzaldehyde	$[SCH(C_6H_5)]_3$	366.54
8675	—, triphenyl- (lower-melting)	α -trithiobenzaldehyde	$(SCHC_6H_5)_3$	366.54
8676	Tritopine.	See <i>Laudanidine.</i>		
8677	Trityl.	See <i>Methyl, triphenyl.</i>		
8678	Tropacocaine	benzoylpseudotropine	$C_{15}H_{19}NO_2$	245.31
8679	—, hydrochloride		$C_{15}H_{19}NO_2 \cdot HCl$	281.78
8680	Tropaic acid.	See <i>Tropic acid.</i>		
8681	Tropic acid	α -phenylhydraerylic acid; tropaic acid	$C_6H_5CH(COOH)-CH_2OH$	166.17
8682	—, tropine ester.	See <i>Atropine.</i>		
8683	Tropine	8-methyl-3-nortropanol; <i>N</i> -methyltropoline	$C_8H_{15}NO$	141.21
8684	—, chloroplatinate		$(C_8H_{15}NO \cdot HCl)_2 \cdot PtCl_4$	692.41
8685	Tropinecarboxylic acid	See <i>L-Ecgonine.</i>		
8686	Tropoline, N-methyl-	See <i>Tropine.</i>		
8687	dl-Tryptophan	<i>dl</i> - β -(3-indyl)alanine; <i>dl</i> - α -amino-3-indolepropionic acid	$C_8H_6NCH_2CH-(NH_2)COOH$	204.22
8688	d-Tryptophan	<i>d</i> - β -(3-indyl)alanine; <i>d</i> - α -amino-3-indolepropionic acid	$C_8H_6NCH_2CH-(NH_2)COOH$	204.22
8689	l-Tryptophan	<i>l</i> - α -amino-3-indolepropionic acid; <i>l</i> - β -3-indylalanine	$C_8H_4NHCH:C-$ $CH_2CH(NH_2)-COOH$ $HOC_6H_4CH_2CH_2-NH_2$	204.22
8690	Tyramine	<i>p</i> -(β -aminoethyl)phenol; <i>p</i> -hydroxyphenethylamine	$HOC_6H_4CH_2CH_2-NH_2$	137.18
8691	Tyrosine, 3,5-diiodo-	See <i>Iodogorgoic acid.</i>		
8692	dl-Tyrosine	<i>dl</i> - β - <i>p</i> -hydroxyphenylalanine	$HOC_6H_4CH_2CH-(NH_2)COOH$	181.19

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8658	monocl. pr. f. eth., 1.353 ¹⁶	0.774 ⁰ ₀	126.5	365	i.	sl. s.	s. eth., acet.; v. s. bz.
8659	wh. cr.....	.....	198.5	.....	i.	s.	s. eth.
8660	col. liq., 1.41756 ^{19,4}	0.757 ²⁰ ₄	-93.5	156	v. sl. s.	∞	s. eth.
8661							
8662							
8663							
8664							
8665							
8666							
8667							
8668							
8669							
8670							
8671							
8672	pr.....	.....	101	247			
8673			126				
8674	need.....	.....	225			sl. s.	s. ac. a., bz.
8675	wh. amor. powd.	.....	160	d.	i.	i.	v. s. chl.; s. bz.
8676							
8677							
8678	glit. need. f. eth., 1.50801 ^{100,1}	1.043 ¹⁰⁰	49	d.	sl. s.	v. s.	v. s. eth., bz., chl., NH ₄ OH
8679	col. need. or pl. f. w.+al.	.....	271 (276-7d.)	.....	s.	sl. s. c.	i. eth.
8680							
8681	need. or pl. f. al.	.....	117-8	d.	2 ¹⁵	s.	s. eth.; i. CS ₂
8682							
8683	hyg. tab. f. eth., 1.48113 ^{99,3}	1.039 ⁷⁶ ₄	63	233	v. s.	v. s.	v. s. eth.; s. chl., bz.
8684	or-red monocl.	.....	198-200	.....	s.	i.	
8685							
8686							
8687	col. hex. pl....	.....	283-5	.....	sl. s. c., s. h.	sl. s.	
8688			281-2	.....		
8689	col. hex. leaf...	.....	293-5 (289 d.)	.....	1.14 ²⁵ , 2.79 ⁷⁵	sl. s.	i. eth.
8690	need. or leaf. f. bz.	.....	161	180	1.05 c.	10	s. bz.; sl. s. h. xylene
8691							
8692	sh. need.....	.....	316	.....	0.041 ²⁰	v. sl. s.	i. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8693	<i>d</i> -Tyrosine.....	<i>d</i> - β - <i>p</i> -hydroxyphenylalanine..	$\text{HOC}_6\text{H}_4\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$	181.19
8694	<i>l</i> -Tyrosine.....	<i>l</i> - α -amino- <i>p</i> -hydroxyhydrocinnamic acid; <i>l</i> - β -(<i>p</i> -hydroxyphenyl)alanine	$\text{HOC}_6\text{H}_4\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$	181.19
8695	Ulexine.	See <i>Cytisine</i> .		
8696	Umbellic acid.....	2,4-dihydroxycinnamic acid..	$(\text{HO})_2\text{C}_6\text{H}_3\text{CH}:\text{CHCOOH}$	180.15
8697	Umbelliferone.....	7-hydroxycoumarin.....	$\text{C}_9\text{H}_6\text{O}_3$	162.14
8698	Undecan-.	See <i>Hendecan-</i> .		
8699	Undecene*.	See <i>Hendecene</i> *.		
8700	Undecenoic acid*.	See <i>Hendecenoic acid</i> *.		
8701	<i>pri-n</i> -Undecyl alcohol.	See 1- <i>Hendecanol</i> *.		
8701	<i>n</i> -Undecylaldehyde.	See <i>Hendecanal</i> *.		
8702	<i>n</i> -Undecylamine.	See <i>Hendecylamine</i> *.		
8703	<i>n</i> -Undecyl cyanide.	See <i>Lauronitrile</i> .		
8704	β -Undecylene.	See 2- <i>Hendecene</i> *.		
8705	θ -Undecylenic acid.	See 9- <i>Hendecenoic acid</i> *.		
8706	<i>n</i> -Undecylic acid.	See <i>Hendecanoic acid</i> *.		
8706M	Undecyne.	See <i>Hendecyne</i> .		
8707	Uracil.....	2,4(1,3)-pyrimidinedione....	$\text{NHCONHCO}-\text{CH}:\text{CH}$	112.09
8708	—, 5-methyl-.	See <i>Thymine</i> .		
8708M	Uradal.	See <i>Adalin</i> .		
8709	Uramil.....	5-aminobarbituric acid; dialuramide; murexan	$\text{NHCONHCO}-\text{CH}(\text{NH}_2)\text{CO}$	143.10
8710	<i>p</i> -Urazine.....	tetrahydro- <i>sym</i> -tetrazine-dione; diurea	$\text{NHNHCONH}-\text{NHCO}$	116.08
8711	Urea.....	carbamide.....	NH_2CONH_2	60.06
8712	—, chloride.	See <i>Carbamyl chloride</i> .		
8712M	—, nitrate.....		$\text{CO}(\text{NH}_2)_2\cdot\text{HNO}_3$..	123.07
8713	—, acetonyl-.....	1-ureido-2-propanone.....	$\text{CH}_3\text{COCH}_2\text{NH}-\text{CONH}_2$	116.12
8714	—, acetyl.....		$\text{CH}_3\text{CONHCONH}_2$	102.09
8715	—, <i>N</i> -acetyl- <i>N'</i> -methyl-.....		$\text{CH}_3\text{CONHCO}-\text{NHCH}_3$	116.12
8716	—, acetyl-thio-.....	<i>N</i> -(thiocarbamyl)acetamide..	$\text{CH}_3\text{CONHCSNH}_2$	118.15
8717	—, allyl-.....	2-propenylurea*.....	$\text{C}_3\text{H}_5\text{NHCONH}_2$..	100.12
8718	—, <i>N</i> -allyl- <i>N'</i> -phenyl-.....		$\text{C}_6\text{H}_5\text{NHCONH}-\text{C}_6\text{H}_5$	176.21
8719	—, allyl-thio-.....	thiosinamine; 2-propenyl-thiourea; allylsulfocarbamide	$\text{CH}_2:\text{CHCH}_2-\text{NHCSNH}_2$	116.18
8720	—, amino-.	See <i>Semicarbazide</i> .		
8721	—, benzoyl-thio-....	benzoylthiocarbamide.....	$\text{C}_6\text{H}_5\text{CONHCS}-\text{NH}_2$	180.22
8722	—, benzyl-*	benzylcarbamide.....	$\text{C}_6\text{H}_5\text{CH}_2\text{NH}-\text{CONH}_2$	150.18
8723	—, benzyl-thio-....	benzylthiocarbamide.....	$\text{C}_6\text{H}_5\text{CH}_2\text{NHCS}-\text{NH}_2$	166.24

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8693	.....	.....	310-4	.....	.....	.....	.....
8694	sm. silky need. f. w., 1.550, 1.600, 1.680	1.456 ²⁰ ₄	295 d.	.....	0.048 ²⁵ , 0.238 ⁷⁵	0.01 ¹⁷ 95% i. abs.	i. eth., acet.; s. alk.
8695	.....	.....	.....	.....	.....	.....	.....
8696	yel. powd.....	.....	240 d.	.....	sl. s.	s.	i. eth., bz., lgr.
8697	need.....	.....	225-7	subl.	1 ¹⁰⁰	s.	sl. s. eth.; s. H ₂ SO ₄
8698	.....	.....	.....	.....	.....	.....	.....
8699	.....	.....	.....	.....	.....	.....	.....
8700	.....	.....	.....	.....	.....	.....	.....
8701	.....	.....	.....	.....	.....	.....	.....
8702	.....	.....	.....	.....	.....	.....	.....
8703	.....	.....	.....	.....	.....	.....	.....
8704	.....	.....	.....	.....	.....	.....	.....
8705	.....	.....	.....	.....	.....	.....	.....
8706 ^r	.....	.....	.....	.....	.....	.....	.....
8706M	.....	.....	.....	.....	.....	.....	.....
8707	need. f. w.....	.....	338	.....	v. sl. s. c., v. s. h.	i.	s. eth., NH ₄ OH
8708	.....	.....	.....	.....	.....	.....	.....
8708M	.....	.....	.....	.....	.....	.....	.....
8709	need.....	.....	.....	.....	sl. s. h.	.....	s. NH ₄ OH, c. H ₂ SO ₄ , NH ₃
8710	monocl. pr. f. w.	.....	270	.....	sl. s.	sl. s.	sl. s. h. ac. a.
8711	col. tetr., 1.484, 1.602	1.335	132.7	d.	78 ⁵ , 119.3 ²⁵	15.8 ²⁰	sl. s. eth.; s. conc. HCl; i. chl.
8712	.....	.....	.....	.....	.....	.....	.....
8712M	monocl. pr.....	.....	152 d.	.....	s. h.	.....	sl. s. HNO ₃ ; d. HCl, H ₂ SO ₄
8713	pr.....	0.8018 ⁴	-41	82	s.	s.	s. eth.
8714	need. f. w.....	.....	218-9	d.	1.2 ²⁰	1 ²⁰	sl. s. eth.
8715	col. monocl. f. w.	.....	180	d.	s.	s.	sl. s. eth.
8716	pr. f. w.....	.....	165-6	.....	sl. s.	s.	sl. s. eth.
8717	need. f. al.....	.....	85	.....	v. s.	v. s.	sl. s. eth., chl.; i. pet. eth., tol., CS ₂
8718	need. f. bz.....	.....	115.5	.....	v. sl. s.	s.	s. bz.
8719	col. monocl. or rhomb., γ1.63454 ⁷⁸ liq.	1.219 ²⁰ ₂₀	78.4	.....	3	s.	sl. s. eth.; i. bz.
8720	.....	.....	.....	.....	.....	.....	.....
8721	pr. f. al.....	.....	171	.....	sl. s.	s.	i. eth.
8722	col. need. f. al.	.....	147-8	.....	1.7 ⁴⁵	s.	0.36 ^{22.5} eth.; 3.1 ²³ acet.
8723	pr. f. w.....	.....	162-4	.....	i. c.	1.31 c.	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8723F	Urea, (α -bromo- α -ethylbutyryl)-. See <i>Adalin</i> .			
8723M	—, butyl-*	<i>n</i> -butylcarbamide	$C_4H_9NHCONH_2$	116.16
8723P	—, sec-butyl	sec-butylcarbamide	$C_4H_9NHCONH_2$	116.16
8723S	—, tert-butyl	tert-butylcarbamide	$(CH_3)_3CNHCONH_2$	116.16
8724	—, carbamyl-	See <i>Biuret</i> .		
8725	—, <i>N,N'</i> -diacetyl	<i>sym</i> -diacetylurea	$CH_3CONHCONHCOCH_3$	144.13
8726	—, <i>N,N</i> -diethyl-*	<i>uns</i> -diethylurea; <i>N,N</i> -diethylcarbamide	$(C_2H_5)_2NCONH_2$	116.16
8727	—, <i>N,N'</i> -diethyl-*	<i>sym</i> -diethylurea; <i>N,N'</i> -diethylcarbamide	$CO(NHC_2H_5)_2$	116.16
8728	—, <i>N,N'</i> -diethylthio-	<i>sym</i> -diethylthiourea; <i>N,N'</i> -diethylthiocarbamide	$(C_2H_5NH)_2CS$	132.22
8729	—, <i>N,N</i> -dimethyl-*	<i>uns</i> -dimethylurea	$(CH_3)_2NCONH_2$	88.11
8730	—, <i>N,N'</i> -dimethyl-*	<i>sym</i> -dimethylurea	$CH_3NHCONHCH_3$	88.11
8731	—, <i>N,N</i> -diphenyl	<i>uns</i> -diphenylurea	$(C_6H_5)_2NCONH_2$	212.24
8732	—, <i>N,N'</i> -diphenyl	See <i>Carbanilide</i> .		
8733	—, <i>sym</i> -diphenyl	See <i>Carbanilide</i> .		
8734	—, <i>N,N</i> -diphenylthio-		$(C_6H_5)_2NCSNH_2$	228.30
8735	—, ditolylthio-	See <i>Carbanilide</i> , dimethylthio-		
8736	—, <i>sym</i> -di- <i>o</i> -tolylthio-	See <i>Carbanilide</i> , thio- <i>o,o'</i> -dimethyl-		
8737	—, <i>p</i> -ethoxyphenyl-	See <i>Urea</i> , <i>p</i> -phenetyl-		
8738	—, ethyl-*		$NH_2CONHC_2H_5$	88.11
8739	—, ethylene-	2-ketotetrahydroglyoxaline; dihydro-2(3)-imidazolone	$CH_2NHCONHCH_2$	86.09
8740	—, ethylidene-	4-methyluretidone	$NHCONHCHCH_3$	86.09
8741	—, <i>N</i> -ethyl- <i>N'</i> -phenyl		$C_2H_5NHCONH-C_6H_5$	164.20
8742	—, furfuralmalonylthio-	See <i>Barbituric acid</i> , 5-(2-furfurylidene)-2-thio-		
8743	—, glycolyl-	See <i>Hydantoin</i> .		
8744	—, glycolylthio-	See <i>Hydantoin</i> , 2-thio-		
8745	—, glyoxalyl-	See <i>Allanturic acid</i> .		
8746	—, guanyl-	dicyan(o)diamidine; 1-carbamylguanidine	$NH_2C(:NH)NHCONH_2$	102.10
8747	—, hydroxy-	carbamide oxide	$NH_2CONHOH$	76.06
8748	—, isoamyl-	(γ -methylbutyl)urea*	$C_6H_{11}NHCONH_2$	130.19
8749	—, isobutyl-	(β -methylpropyl)urea*	$NH_2CONHCH_2CH(CH_3)_2$	116.16
8750	—, α -lactyl-	See <i>Hydantoin</i> , 5-methyl-		
8751	—, malonyl-	See <i>Barbituric acid</i> .		
8752	—, mesoxalyl-	See <i>Alloxan</i> .		
8753	—, methyl-*		$NH_2CONHCH_3$	74.08
8754	—, methylthio-		$CH_3NHCSNH_2$	90.14
8755	—, nitro-*		$NH_2CONHNO_2$	105.06
8755M	—, oxalate		$2CO(NH_2)_2 \cdot H_2C_2O_4$	210.15
8756	—, oxalyl-	See <i>Parabanic acid</i> .		
8757	—, oximidomesoxalyl-	See <i>Violuric acid</i> .		
8758	—, <i>p</i> -phenetyl-	<i>p</i> -ethoxyphenylurea; dulcin	$C_2H_5OC_6H_4NHCONH_2$	180.20
8759	—, phenyl-*		$C_6H_5NHCONH_2$	136.15
8760	—, phenylene-	See 2(3)-Benzimidazolone.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8723F							
8723M	wh. need. f. bz.		96		s.		
8723P	wh. need.		166			s.	
8723S	wh. need.		172 d.		s.	s.	
8724							
8725	need. f. al.		152	subl.; d. 179-80	v. sl. s.	sl. s.	
8726	col. deliq.		74 (70)		v. s.	v. s.	1.86 c. eth.
8727	col. deliq. need.	1.042	112	263	v. s.	v. s.	v. s. eth.
	f. al., 1.4616 ^{48.6}		(106-8)				
8728	col. cr.		77	d.	m.	s.	v. s. eth.
8729	col. monocl.	1.255	182		v. s.	v. sl. s.	v. sl. s. eth.
	pr. f. me. al.						
8730	col. rhomb. pr.	1.142	106(102.5)	270	v. s.	s.	i. eth.
8731	col. rhomb. need.	1.276	189	d.	v. sl. s.	s.	s. eth., chl.
8732							
8733							
8734	cr.		189		i.	s.	
8735							
8736							
8737							
8738	col. monocl. pr.	1.213 ¹⁸	92	d.	v. s.	v. s.	i. eth.
	f. al. + eth.						
8739	col. need.		131		v. s. h.	v. s. h.	sl. s. eth.; s. chl.
8740	col. need.		154	160 d.	v. sl. s.	sl. s.	v. sl. s. eth.
8741	need. f. al.		99			s.	
8742							
8743							
8744							
8745							
8746	col. pr. f. al.		105	d. 160	s. h.	sl. s. c.	i. eth., chl., bz., CS ₂ ; s. pyr.
8747	col. need. f. al.		128-30 (139-40)	d.	v. s.	s.	
8748	col. cr.		89-91		sl. s.		
8749	need. f. acet.		141				v. sl. s. eth.; sl. s. acet., bz.
8750							
8751							
8752							
8753	col. rhomb. pr.	1.204	101	d.	v. s.	v. s.	0.073 eth.
	f. w. or al.						
8754	pr.		118		s.	s.	sl. s. eth.
8755	wh. cr. f. al.		155-6	exp.	sl. s.	v. s.	v. s. eth.
	or eth.						
8755M	monocl. pr.		d.		4.4 ¹⁶ c.	1.6	i. eth.
8756							
8757							
8758	col. leaf. or need. f. dil. a.		173-4	d.	0.125 c., 2 h.	4, 90%	sl. s. eth.
8759	monocl., α 1.602, γ 1.627	1.302	147	238	sl. s. c., v. s. h.	v. s.	v. s. eth.
8760							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8761	Urea, phenyl-thio- . . .		$C_6H_5NHCSNH_2$. . .	152.21
8762	—, 2-propenyl-*	See Urea, allyl-.		
8763	—, propyl-*		$C_3H_7NHCONH_2$. . .	102.14
8764	—, tartronyl-.	See Dialuric acid.		
8765	—, tetraethyl-*		$(C_2H_5)_2NCON-(C_2H_5)_2$	172.27
8766	—, tetramethyl-*		$(CH_3)_2NCON-(CH_3)_2$	116.16
8767	—, tetraphenyl- . . .	<i>N,N'</i> -diphenylcarbanilide . . .	$(C_6H_5)_2NCON-(C_6H_5)_2$	364.43
8768	—, thio- . . .	thiocarbamide . . .	NH_2CSNH_2 . . .	76.12
8769	—, thio- <i>m</i> -tolyl- . . .		$CH_3C_6H_4NHCSNH_2$	167.25
8770	—, <i>o</i> -tolyl- . . .		$CH_3C_6H_4NHCONH_2$	151.19
8771	—, <i>m</i> -tolyl- . . .		$CH_3C_6H_4NHCONH_2$	151.19
8772	—, <i>p</i> -tolyl- . . .		$CH_3C_6H_4NHCONH_2$	151.19
8773	—, trimethyl-*		$CH_3NHCON-(CH_3)_2$	102.14
8774	Ureaacetic acid.	See Hydantoic acid.		
8775	Urethan.	See Carbamic acid, ethyl ester.		
8776	—, methyl-.	See Carbamic acid, methyl ester		
8777	—, phenyl-.	See Carbanilic acid, ethyl ester.		
8777M	—, <i>n</i> -propylphenyl-.	See Carbanilic acid, propyl ester.		
8778	—, thio-.	See Carbamic acid, thiol-, ethyl ester; Carbamic acid,		
8779	Uretidone, 4-methyl-.	See Urea, ethylidene-.		
8780	Uric acid . . .	2,6,8(1,3,9)-purinetrione; 2,6,8-trioxypurine	$C_5H_4N_4O_3$. . .	168.11
8781	—, 1-methyl- . . .		$C_6H_6N_4O_3$. . .	182.14
8782	—, 3-methyl- . . .		$C_6H_6N_4O_3$. . .	182.14
8783	—, 7-methyl- . . .		$C_6H_6N_4O_3$. . .	182.14
8784	"Urotropin".	See Hexamethylenetetramine.		
8785	<i>dl</i> -Usnic acid . . .	<i>dl</i> -usnicic acid . . .	$C_{18}H_{16}O_7$. . .	344.31
8786	<i>d</i> -Usnic acid . . .	<i>d</i> -usnicic acid . . .	$C_{18}H_{16}O_7$. . .	344.31
8787	Uvic acid, Uvinic acid.	See Pyrotritaric acid.		
8788	Uvitic acid . . .	5-methylisophthalic acid . . .	$CH_3C_6H_3(COOH)_2$	180.15
8789	Uvitonic acid . . .	6-methylutidinic acid; 2-picoline-4,6-dicarboxylic acid	$CH_3C_6H_2N(COOH)_2$	181.14
8790	Valeraldehyde . . .	pentanal*; <i>n</i> -valeric aldehyde; <i>n</i> -amyl aldehyde	$CH_3(CH_2)_3CHO$. . .	86.13
8791	—, oxime . . .	pentanal oxime* . . .	$CH_3(CH_2)_3CH:NOH$	101.15
8792	—, γ -oxo-.	See Levulin aldehyde.		
8793	Valeramide . . .	pentanamide* . . .	$CH_3(CH_2)_3CONH_2$	101.15
8793H	—, <i>N,N</i> -dimethyl- . . .		$CH_3(CH_2)_3CON-(CH_3)_2$	129.20
8793R	Valeranilide . . .	<i>n</i> -valeranilide . . .	$CH_3(CH_2)_3CON-CHC_6H_5$	177.24
8794	Valeric acid (active).	See Butyric acid, α -methyl-.		
8795	Valeric acid (<i>n</i>) . . .	pentanoic acid* . . .	$CH_3(CH_2)_3COOH$	102.13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8761	col. need. f. w. or trim. f. al.	1.3	154	.....	0.26 ¹⁸	5.66 ²⁵	.....
8762							
8763	col. cr.....	.....	107	.....	s.	.....	.....
8764							
8765	liq.....	.....	.....	210-5	i.	.....	s. a.; i. alk.
8766	liq.....	0.972 ¹⁵	.....	177	.....	v. s.	v. s. eth.
8767	col. rhomb....	1.222	183	.....	i.	s.	.....
8768	rhomb. pr. f. al.	1.405 ²⁰ / ₄	182 (174-6)	d.	9.18 ¹³	s.	v. sl. s. eth.
8769	pr. f. al.....	.....	110-1	.....	s. h.	v. s.	v. s. eth.
8770	leaf. f. al.....	.....	190-1	.....	0.25 ⁴⁵	s.	s. eth.
8771	leaf. f. w.....	.....	142-3	.....	s.	v. s.	sl. s. eth.
8772	need. f. w...	.....	187	.....	0.31 ⁴⁵	s.	0.062 ^{22.5} eth.
8773	monocl.....	1.19	75.5	232.5	v. s.	v. s.	s. eth.
8774							
8775							
8776	ethyl ester.						
8777							
8777M							
8778	thiono-, ethyl ester.						
8779							
8780	sc.....	1.893	d.	.....	0.00645 ³⁷ , 0.06 h.	i.	i. eth.; s. glyc. h. conc. H ₂ SO ₄
8781	col. need.....	.....	400 d.	.....	0.05 ¹⁰⁰	v. sl. s.	.....
8782	col. pr. f. w....	.....	>360 d.	.....	0.38 ¹⁰⁰	v. sl. s.	s. alk.
8783	col. leaf. f. w.	.....	370 d.	.....	1.25 ¹⁰⁰	.....	s. alk.
8784							
8785	yel. monocl. pr.	.....	193	.....	i.	v. sl. s.	0.3 ²⁰ eth.
8786	yel. pr. f. al., 1.463, 1.653, 1.780	.....	203	d.	i.	v. sl. s.	sl. s. eth.
8787							
8788	col. need. f. w.	.....	290	subl.	sl. s. h.	v. s.	v. s. eth.
8789	col. cr. powd..	.....	274 d.	.....	v. sl. s.	.....	s. a., aniline; v. sl. s. h. bz.
8790	liq., 1.3952....	0.8185 ¹¹	-91.5	103.4	sl. s.	v. s.	v. s. eth.
8791	cr.....	.....	52	.....	s.	s.	.....
8792							
8793	monocl. pl....	1.023	114-6 (105.8)	.....	s.	s.	s. eth.
8793H	col. liq.....	1.4419 ²⁵	-51	141 ¹⁰⁰	∞	∞	= eth.
8793R	col. monocl. pr.	.....	63	.....	.....	s.	s. eth.
8794							
8795	col. liq., 1.4086	0.942 ²⁰ / ₄ ; 0.9435 ¹⁵ / ₄	-59; -34.5	187	3.7 ¹⁶	=	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8796	Valeric acid, amyl ester.	amyl valerate; pentyl pentanoate*	$C_4H_9COOC_5H_{11}$	172.26
8797	—, butyl ester.	butyl valerate; butyl pentanoate*	$CH_3(CH_2)_3COOC_4H_9$	158.24
8798	—, ethyl ester.	ethyl valerate; ethyl pentanoate	$CH_3(CH_2)_3COOC_2H_5$	130.18
8799	—, 2-furylmethyl ester.	furfuryl valerate.	$CH_3(CH_2)_3COO-CH_2C_4H_3O$	182.21
8800	—, isobutyl ester.	isobutyl valerate; β -methylpropyl pentanoate*	$CH_3(CH_2)_3COO-CH_2CH(CH_3)_2$	158.24
8801	—, methyl ester.	methyl pentanoate*; methyl valerate	$CH_3(CH_2)_3COOCH_3$	116.16
8802	—, <i>p</i> -phenylphenacyl ester		$CH_3(CH_2)_3COO-CH_2COC_6H_5$	296.35
8803	—, piperazinium salt.		$C_4H_{10}N_2 \cdot 2C_4H_9COOH$	290.40
8804	—, propyl ester.	<i>n</i> -propyl <i>n</i> -valerate.	$CH_3(CH_2)_3COOC_3H_7$	144.21
8806	—, α -amino-	2-aminopentanoic acid*	$CH_3CH_2CH_2CH(NH_2)COOH$	117.15
8807	—, γ -amino-	4-aminopentanoic acid*	$CH_3CH(NH_2)CH_2CH_2COOH$	117.15
8808	—, δ -amino-	5-aminopentanoic acid*	$NH_2(CH_2)_4COOH$	117.15
8809	—, α -amino- δ -guanido-	do-. See <i>Arginine</i> .		
8810	—, α -amino- β -methyl-	yl-. See <i>Isoleucine</i> .		
8811	—, α -bromo-	2-bromopentanoic acid*	$CH_3(CH_2)_2CHBrCOOH$	181.04
8812	—, —, ethyl ester.	ethyl 2-bromopentanoate*	$CH_3CH_2CH_2CHBrCOOC_2H_5$	209.09
8813	—, α , δ -diamino-	See <i>Ornithine</i> .		
8814	—, α -ethyl-	2-ethylpentanoic acid*; 3-hexanecarboxylic acid; ethylpropylacetic acid	$CH_3CH_2CH_2CH(C_2H_5)COOH$	130.18
8815	—, β -ethyl-	3-ethylpentanoic acid*; β , β -diethylpropionic acid	$(C_2H_5)_2CHCH_2COOH$	130.18
8816	—, α -hydroxy-	2-hydroxypentanoic acid*; valerolactic acid	$CH_3CH_2CH_2CH(OH)COOH$	118.13
8817	—, γ -hydroxy-, lactone	4-hydroxypentanoic acid lactone; γ -valerolactone	$CH_3CH_2CH_2CH_2COO$	100.11
8818	—, γ -keto-	See <i>Levulinic acid</i> .		
8819	—, α -methyl-	2-methylpentanoic acid*; methylpropylacetic acid	$CH_3(CH_2)_2CH(CH_3)COOH$	116.16
8820	—, β -methyl-	3-methylpentanoic acid*; <i>sec</i> -butylacetic acid	$C_2H_5CH(CH_3)CH_2COOH$	116.16
8820M	—, γ -oxo-	See <i>Levulinic acid</i> .		
8821	—, α , β , γ , δ -tetrahydroxy-	roxy-. See <i>Arabonic acid</i> .		
8822	Valeric anhydride.	pentanoic anhydride*	$[CH_3(CH_2)_3CO]_2O$	186.25
8823	Valerolactic acid.	See <i>Valeric acid</i> , α -hydroxy-		
8824	γ -Valerolactone.	See <i>Valeric acid</i> , γ -hydroxy-, lactone.		
8825	Valerone.	See <i>4-Heptanone</i> , 2,6-dimethyl-		
8826	Valeronitrile.	pentanenitrile*; <i>n</i> -butyl cyanide	$CH_3(CH_2)_3CN$	83.13
8827	Valerophenone.	butyl phenyl ketone.	$CH_3(CH_2)_3COC_6H_5$	162.22
8828	—, γ -oxo- (or γ -keto-)	1-phenyl-1,4-pentanedione; phenacylacetone; β -acetylpropionophenone; α -acetylacetophenone	$C_6H_5COCH_2CH_2COCH_3$	176.21
8829	Valeryl chloride.	pentanoyl chloride*	$CH_3(CH_2)_3COCl$	120.58
8830	Valerylene.	See <i>2-Pentyne</i> *.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8796	col. liq., 1.4145	0.881 ⁰	-78.8	203.7	sl. s.	∞	∞ eth.
8797	liq.....	0.8700 ¹⁵ ₄	-92.8	185.6	v. sl. s.	∞	∞ eth.
8798	col. liq., 1.40094 ²⁰	0.8739 ²⁰ ₄	-91.2	146	0.237 ²⁵	∞	∞ eth.
8799	col. liq.....	1.0284 ²⁰ ₄	.....	228-9764; 82-31	i.	s.	s. eth.
8800	col. liq.....	0.854	.....	167	i.	∞	∞ eth.
8801	col. liq.....	0.910 ⁰	-91.0	127.3	v. sl. s.	∞	∞ eth.
8802	.....	.....	63.5	.....	.....	.....	.....
8803	wh. cr.....	.....	112.5-13	.....	s.	s.	i. eth.; s. h. dioxane
8804	col. liq.....	0.889 ⁰	.....	167.5	i.	s.	∞ eth.; s. chl.
8806	leaf. f. w.....	.....	291.5 d.	subl.	10.7 ⁵	sl. s.	i. eth.
8807	cr.....	.....	193	d.	v. s.	sl. s.	i. eth., bz., lgr.
8808	leaf.....	.....	157	d.	v. s.	sl. s.	i. eth.
8809	.....	.....	.....	.....	.....	.....	.....
8810	.....	.....	.....	67 ¹⁰	sl. s.	v. s.	s. eth.
8811	.....	.....	.....	(126-30 ²⁷)	.....	.....	.....
8812	liq.....	1.226 ¹⁸ ₄	.....	192(74-6 ¹¹)	i.	∞	∞ eth.
8813	.....	.....	.....	.....	.....	.....	.....
8814	col. oil.....	.....	.....	209.2	i.	s.	s. eth.
8815	oil.....	.....	.....	212	.....	.....	.....
8816	hyg. pl.....	.....	34	subl.	v. s.	v. s.	v. s. eth.
8817	liq.....	1.072	-31	206-7	s.	s.	.....
8818	.....	.....	.....	.....	.....	.....	.....
8819	col. liq.....	0.928 ²⁰ ₄	.....	193.5	0.57 ¹⁷	∞	s. eth.
8820	liq.....	0.930 ¹⁵	.....	195-6	.....	s.	s. eth.
8820M	.....	.....	.....	.....	.....	.....	.....
8821	.....	.....	.....	.....	.....	.....	.....
8822	col. liq.....	0.929 ²⁰ ₄	-56.1	215	d. h.	s. d.	v. s. eth.
8823	.....	.....	.....	.....	.....	.....	.....
8824	.....	.....	.....	.....	.....	.....	.....
8825	.....	.....	.....	.....	.....	.....	.....
8826	col. liq., 1.3909	0.8014 ²⁰ ₄	-96.0	141	i.	s.	s. eth.
8827	liq.....	.....	.....	239.5	i.	v. s.	v. s. eth.
8828	yel. oil.....	>1	.....	162 ¹² d.	sl. s. c.	.....	i. alk.
8829	col. liq., 1.41555	1.016 ¹⁵	-110.0	128	d.	d.	∞ eth.
8830	.....	.....	.....	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8831	<i>dl</i>-Valine	<i>dl</i> - α -aminoisovaleric acid; <i>dl</i> -2-amino-3-methylbutanoic acid*	$(\text{CH}_3)_2\text{CHCH}(\text{NH}_2)\text{COOH}$	117.15
8832	<i>d</i>-Valine	α -aminoisovaleric acid	$(\text{CH}_3)_2\text{CHCH}(\text{NH}_2)\text{COOH}$	117.15
8833	<i>l</i>-Valine	<i>l</i> - α -aminoisovaleric acid; <i>l</i> -2-amino-3-methylbutanoic acid*	$(\text{CH}_3)_2\text{CHCH}(\text{NH}_2)\text{COOH}$	117.15
8834	Valylene		Mixt. (?)	
8835	Vanillaldehyde	See <i>Vanillin</i> .		
8836	Vanillic acid	4-hydroxy-3-methoxybenzoic acid	$\text{CH}_3\text{O}(\text{HO})\text{C}_6\text{H}_3\text{COOH}$	168.14
8837	—, ethyl ester		$\text{HO}(\text{CH}_3\text{O})\text{C}_6\text{H}_3\text{COOC}_2\text{H}_5$	196.20
8838	Vanillin	vanillaldehyde; 4-hydroxy-3-methoxybenzaldehyde; protocatechualdehyde 3-methyl ether	$\text{CH}_3\text{O}(\text{OH})\text{C}_6\text{H}_3\text{CHO}$	152.14
8839	—, acetate	4-acetoxy-3-methoxybenzaldehyde; acetylvanillin	$\text{CH}_3\text{O}(\text{CH}_3\text{COO})\text{C}_6\text{H}_3\text{CHO}$	194.18
8840	—, ethyl ether	See <i>Benzaldehyde</i> , 4-ethoxy-3-methoxy-.		
8841	—, acetyl-	See <i>Vanillin</i> , acetate.		
8842	—, 5-bromo-	5-bromo-4-hydroxy-3-methoxybenzaldehyde	$\text{CH}_3\text{O}(\text{OH})\text{BrC}_6\text{H}_2\text{CHO}$	231.05
8843	—, 5-chloro-	5-chloro-4-hydroxy-3-methoxybenzaldehyde	$\text{CH}_3\text{O}(\text{OH})\text{ClC}_6\text{H}_2\text{CHO}$	186.59
8443H	—, 2,5-diiodo-		$\text{CH}_3\text{O}(\text{OH})\text{C}_6\text{H}_2\text{I}_2\text{CHO}$	403.97
8843M	—, 2-iodo-		$\text{CH}_3\text{O}(\text{OH})\text{C}_6\text{H}_2\text{ICHO}$	278.06
8843N	—, 5-iodo-		$\text{CH}_3\text{O}(\text{OH})\text{C}_6\text{H}_2\text{ICHO}$	278.06
8844	Vanillyl alcohol	4-hydroxy-3-methoxybenzyl alcohol; vanillic alcohol	$\text{CH}_3\text{O}(\text{HO})\text{C}_6\text{H}_3\text{CH}_2\text{OH}$	154.16
8845	Vasicine		$\text{C}_{11}\text{H}_{12}\text{N}_2\text{O}$	188.22
8846	Veratraldehyde	3,4-dimethoxybenzaldehyde; protocatechualdehyde dimethyl ether; 3,4-dimethoxybenzenecarbonyl*	$(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{CHO}$	166.17
8847	Veratric acid	3,4-dimethoxybenzoic acid; protocatechuic acid dimethyl ether	$(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{COOH}$	182.17
8848	Veratrine (crystalline)	cevadine	$\text{C}_{32}\text{H}_{49}\text{NO}_9$	591.72
8850	Veratrole	1,2-dimethoxybenzene*; pyrocatechol dimethyl ether	$\text{C}_6\text{H}_4(\text{OCH}_3)_2$	138.16
8851	—, 4-allyl-	eugenol methyl ether; methyleugenol	$\text{CH}_2=\text{CHCH}_2\text{C}_6\text{H}_3(\text{OCH}_3)_2$	178.22
8852	—, 4-propenyl-	isoeugenol methyl ether	$\text{CH}_3\text{CH}=\text{CHC}_6\text{H}_3(\text{OCH}_3)_2$	178.22
8853	Veronal	See <i>Barbital</i> .		
8854	<i>l</i>-Vicine		$\text{C}_{10}\text{H}_{16}\text{O}_7\text{N}_4$	304.26
8856	Vinaconic acid	1,1-cyclopropanedicarboxylic acid*; ethylenemalononic acid	$\text{CH}_2\text{CH}_2\text{C}(\text{COOH})_2$	130.10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8831	monocl. leaf. f. al.	.....	298(292)d.	subl.	7.44 ²⁵ 13.31 ⁷⁵	0.571 ²⁵ 75% ; 0.014 ⁹⁰ abs.	i. eth., acet.
8832	hex. leaf. f. al.; pr. f. w.	.....	315 d.	subl. d.	9.1 ^{16.5}	v. sl. s.	i. eth.
8833	leaf. f. al. ....	.....	293 d.	.....	5.3 ²⁰	.....	.....
8834	col. liq.	.....	.....	50	i.	v. s.	∞ eth.
8835	.....	.....	.....	.....	.....	.....	.....
8836	col. need. f. w.	.....	207	subl.	0.12 ¹⁴ 2.5 ¹⁰⁰	v. s.	v. s. eth.
8837	col. need. ....	.....	44	293	i.	v. s.	v. s. eth.; s. alk.
8838	col. monocl. need. f. w. or lgr.	.....	81-2	285 (in CO ₂); 140-5 ⁶	1 c.; 5 h.	v. s.	v. s. eth.; s. chl., glyc.
8839	col. need. ....	.....	77	.....	v. sl. s.	v. s.	v. s. eth.
8840	.....	.....	.....	.....	.....	.....	.....
8841	.....	.....	.....	.....	.....	.....	.....
8842	col. leaf. ....	.....	164	.....	i.	s. h.	sl. s. c. eth., c. bz.
8843	col. pl. ....	.....	164-5	.....	i.	s. h.	.....
8843H	nearly col. rods	.....	200	.....	i.	s.	sl. s. eth.
8843M	nearly col. need.	.....	155-156	.....	i.	s.	sl. s. eth.
8843N	pa. yel. need. .	.....	180	.....	i.	sl. s.	sl. s. eth.
8844	col. need. f. w. or bz.	.....	115	d.	v. s. h.	v. s.	v. s. eth.
8845	need. ....	.....	198 d.	.....	sl. s.	s.	sl. s. eth., bz.; s. chl.; i. pet. eth.
8846	col. need. f. eth.	.....	42-3 (44-5)	283	i., sl. s. h.	v. s.	v. s. eth.
8847	cr. f. w. ....	.....	anh. 181	subl.	0.05 ¹⁴ 0.6 ¹⁰⁰	v. s.	v. s. eth.
8848	col. cr. f. al., [α] _D ²⁵ +12.5 ¹⁷ in al.	.....	205 d.	.....	0.11 c.	s.	s. chl.
8850	col. cr. f. pet. eth., 1.52870 ^{21.2} D	1.0842 ²⁵ 25	22.5 (19-20)	206-7	sl. s.	s.	s. eth.
8851	col. liq., 1.5383 ¹⁷	1.055 ¹⁵	.....	243-9	i.	∞	= eth.
8852	col. liq., 1.5720 ^{11.5}	1.0551 ²²	.....	262-4	i.	s.	s. eth.
8853	.....	.....	.....	.....	.....	.....	.....
8854	need. ....	.....	242	.....	s.	i.	s. me. al.
8856	tricl. need. f. eth.	.....	175	210 ³⁰	v. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8857	Vinetine.	See <i>Oxyacanthine</i> .		
8858	Vinyl alcohol	ethenol; vinol.....	$\text{CH}_2\text{:CHOH}$	44.05
8859	Vinylamine	ethenylamine*.....	$\text{CH}_2\text{:CHNH}_2$	43.07
8860	Vinyl bromide	bromoethene*; bromoethylene	$\text{CH}_2\text{:CHBr}$	106.96
8861	Vinyl chloride	chloroethylene; chloroethene*	$\text{CH}_2\text{:CHCl}$	62.50
8862	Vinyl cyanide	See <i>Acrylonitrile</i> .		
8863	Vinyl ether	ethenyloxyethene*; divinyl ether	$(\text{CH}_2\text{:CH})_2\text{O}$	70.09
8863M	Vinyl fluoride	fluoroethylene.....	$\text{CH}_2\text{:CHF}$	46.04
8864	Vinyl iodide	iodoethylene; iodoethene*....	$\text{CH}_2\text{:CHI}$	153.96
8865	Vinyl sulfide	ethenylthioethene*; divinyl sulfide	$(\text{CH}_2\text{:CH})_2\text{S}$	86.15
8866	Vinyl tribromide	See <i>Ethane, 1,1,2-tribromo*</i> .		
8867	Vinyl trichloride	See <i>Ethane, 1,1,2-trichloro*</i> .		
8868	Violuric acid	alloxan 5-oxime; 5-isonitrosobarbituric acid; oximidomesoxalylurea	CONHCO- NHCOC:NOH	157.09
8868D	Vitamin A	axerophthol.....	$\text{C}_{20}\text{H}_{29}\text{OH}$	286.44
8868H	Vitamin B₁	thiamine hydrochloride; thiamin chloride; aneurin; antineuritic vitamin; oryzanin; torulin	$\text{C}_{12}\text{H}_{18}\text{ON}_4\text{SCl}_2$...	337.27
8868M	Vitamin B₂	See <i>D-Riboflavin</i> .		
8868S	Vitamin B₆	adermin; pyridoxin; 5-hydroxy-6-methyl-3,4-pyridinedicarbinol	$\text{C}_8\text{H}_{11}\text{NO}_3$	169.18
8868U	—, hydrochloride.....		$\text{C}_8\text{H}_{11}\text{NO}_3\cdot\text{HCl}$...	205.64
8869	Vitamin C	See <i>L-Ascorbic acid</i> .		
8869C	Vitamin D₂	See <i>Calciferol</i> .		
8869G	Vitamin E	See α - <i>Tocopherol</i> .		
8869J	Vitamin F	See <i>Linoleic acid</i> .		
8869M	Vitamin G	See <i>D-Riboflavin</i> .		
8869S	Vitamin K	See <i>Phthiocol</i> .		
8870	Wintergreen oil	See <i>Salicylic acid, methyl ester</i> .		
8871	Wood alcohol	See <i>Methanol*</i> .		
8872	Wood sugar	See <i>L-Xylose</i> .		
8873	Xanthaline		$\text{C}_{37}\text{H}_{36}\text{N}_2\text{O}_9$	652.68
8874	Xanthene	dibenzo-1,4-pyran; diphenylmethane oxide; <i>o,o'</i> -methylene-diphenyl ether	$\text{C}_6\text{H}_4\text{OC}_6\text{H}_4\text{CH}_2$...	182.21
8875	9-Xanthene-o-benzoic acid, 9-hydroxy- , lactone.	See <i>Gallin</i> .	See <i>Fluoran</i> .	
8876	—, 3,4,5,6-tetrahydroxy-	See <i>Xanthone</i> .		
8877	9-Xanthenone	ethyl ethoxymethanethionothiolate*; ethyl xanthogenate	$\text{C}_2\text{H}_5\text{OCSSC}_2\text{H}_5$...	150.25
8878	Xanthic acid, ethyl ester			
8879	Xanthine	2,6(1,3)purinedione; 2,6-dioxypurine	$\text{C}_6\text{H}_4\text{N}_4\text{O}_2$	152.11
8880	—, 1,3-dimethyl-	See <i>Theophylline</i> .		
8881	—, 3,7-dimethyl-	See <i>Theobromine</i> .		
8882	—, 1,3,7-trimethyl-	See <i>Caffeine</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8857							
8858	unstable.....						
8859	liq.....	0.832 $\frac{20}{4}$		56	∞	s.	= eth.
8860	liq., 1.4462....	1.5167 ¹⁴	-137.8	15.8	i.	∞	∞ eth.
8861	gas.....	liq. 0.9195 $\frac{15}{4}$	-159.7	-13.9	sl. s.	s.	v. s. eth.
8862							
8863	col. liq.....	0.774 $\frac{20}{20}$		39 (28.3)	i.	∞	∞ eth.
8863M	col. gas.....			-51	i.	400 ²⁰ cm ³	550 ²⁰ cm ³ eth.
8864	liq.....	2.08 ⁰		56	i.	∞	= eth.; s. chl., bz., tol., CS ₂
8865	oil.....	0.912		101	sl. s.	=	= eth.
8866							
8867							
8868	rhomb.....		-H ₂ O, 100; 224 d.		s. h.	s.	
8868D	micr. need.; pa. yel. visc. liq.; 1.627 ⁴⁰	0.948 $\frac{25}{4}$	8	120-30 ^{0.001}	i.	s.	v. s. eth;
8868H	wh. cr.....		245-8 d.		100 ²⁵	0.3; 1 95%	i. eth., bz;
8868M							
8868S	clusters of wh. need. or wh. platelets		160 d.	subl. in vacuo	v. s.	s.	sl. s. eth., chl.; s. acet.
8868U	wh. platelets..		206-8 d.		22.2	1.1	sl. s. acet.
8869C							
8869G							
8869J							
8869M							
8869P							
8869S							
8870							
8871							
8872							
8873	cr. powd.....		208		i.	v. sl. s. h.	
8874	leaf. f. al.....		100.5	315	v. sl. s.	sl. s.	s. eth., bz., chl., CS ₂ , H ₂ - SO ₄
8875							
8876							
8877							
8878	cr., garlic odor	1.085 $\frac{19}{4}$		200 (91-3 ¹⁸)			
8879	yel.-wh. powd.; sm. pl. become anh. at 125		>150 d.	subl. d.	0.26 ¹⁷	0.033 ¹⁷	v. s. alk.
8880							
8881							
8882							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8883	Xanthogenamide.	See <i>Carbamic acid, thiono-, ethyl ester.</i>		
8884	Xanthogenic acid	thiolthionocarbonic acid <i>O</i> -ethyl ester; ethylxanthogenic acid	C_2H_5OCSSH	122.20
8885	—, ethyl- .	See <i>Xanthogenic acid.</i>		
8886	Xanthone	9-xanthenone; diphenylene ketone oxide	$CO:(C_6H_4)_2:O$...	196.19
8887	—, 1,7-dihydroxy- .	See <i>Euxanthone.</i>		
8888	—, 1,7-dihydroxy-3-methoxy- .	See <i>Gentisin.</i>		
8889	Xenylamine	<i>p</i> -biphenylamine; 4-amino-biphenyl; <i>p</i> -phenylaniline	$C_6H_5C_6H_4NH_2$...	169.22
8890	Xenyl isothiocyanate,	Xenyl mustard oil. See <i>Is</i>	isothiocyanic acid, xenyl ester.	
8891	Xylene, musk.	See <i>Benzene, 1-tert-butyl-3,5-di</i>	methyl-2,4,6-trinitro-	
8892	<i>o</i>-Xylene	1,2-dimethylbenzene*.....	$C_6H_4(CH_3)_2$	106.16
8893	—, α-bromo-	<i>o</i> -xylyl bromide; ω -bromo- <i>o</i> -xylene	$CH_3C_6H_4CH_2Br$...	185.07
8894	—, 4-bromo-	<i>as</i> -bromo- <i>o</i> -xylene.....	$BrC_6H_3(CH_3)_2$	185.07
8895	—, α-chloro-	<i>o</i> -xylyl chloride; ω -chloro- <i>o</i> -xylene; <i>o</i> -tolyl chloride (incorrect)	$CH_3C_6H_4CH_2Cl$...	140.61
8896	—, α, α'-dibromo- ...	<i>o</i> -xylylene bromide; <i>o</i> -xylylene dibromide; ω, ω' -dibromo- <i>o</i> -xylene	$C_6H_4(CH_2Br)_2$...	263.98
8897	—, α, α'-dichloro-	<i>o</i> -xylylene (di)chloride; ω, ω' -dichloro- <i>o</i> -xylene	$C_6H_4(CH_2Cl)_2$	175.06
8898	—, dihydro- .	See <i>Cantharene.</i>		
8899	—, 3,5-dihydroxy- .	See <i>Resorcinol, 4,5-dimethyl-</i> .		
8900	—, 3,6-dihydroxy- .	See <i>Hydroquinone, 2,3-dimethyl-</i>		
8901	—, 3,4-dinitro-	1,2-dimethyl-3,4-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196.16
8902	—, 3,5-dinitro-	1,2-dimethyl-3,5-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196.16
8903	—, 3,6-dinitro-	2,3-dimethyl-1,4-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196.16
8904	—, 4,5-dinitro-	1,2-dimethyl-4,5-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196.16
8905	—, 4-ethyl-	4-ethyl-1,2-dimethylbenzene*	$(CH_3)_2C_6H_3C_2H_5$...	134.21
8906	—, 3-nitro-.....	.....	$NO_2C_6H_3(CH_3)_2$...	151.16
8907	—, 4-nitro-.....	.....	$NO_2C_6H_3(CH_3)_2$...	151.16
8908	<i>m</i>-Xylene	1,3-dimethylbenzene*.....	$C_6H_4(CH_3)_2$	106.16
8909	—, α-bromo-	<i>m</i> -xylyl bromide; ω -bromo- <i>m</i> -xylene	$CH_3C_6H_4CH_2Br$...	185.07
8910	—, 4-bromo-	<i>as</i> -bromo- <i>m</i> -xylene.....	$BrC_6H_3(CH_3)_2$	185.07
8911	—, α-chloro-	<i>m</i> -xylyl chloride; ω -chloro- <i>m</i> -xylene; <i>m</i> -tolyl chloride (incorrect)	$CH_3C_6H_4CH_2Cl$...	140.61
8912	—, 4,6-dibromo-	4,6-dibromo-1,3-dimethylbenzene	$C_6H_2Br_2(CH_3)_2$...	263.98
8913	—, α, α-dichloro-	<i>m</i> -xylene (di)chloride; ω, ω' -dichloro- <i>m</i> -xylene	$C_6H_4(CH_2Cl)_2$	175.06
8914	—, 2,4-dihydroxy- .	See <i>Resorcinol, 2,4-dimethyl-</i> .		
8915	—, 2,5-dihydroxy- .	See <i>Hydroquinone, 2,6-dimethyl-</i>		
8916	—, 4,6-dihydroxy- .	See <i>Resorcinol, 4,6-dimethyl-</i>		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8883							
8884	liq.....	>1	-53	24 d.	v. sl. s. (i.)	.....	.....
8885							
8886	wh. need. f. al.	.....	174	351	sl. s. h.	0.55 c., 6.71 h.	sl. s. eth., bz., lgr.
8887							
8888							
8889	col. leaf. f. dil. al.	1.160 ²⁰ / ₂₀	53	302	sl. s. c.	44.18 ^{19.5}	v. s. eth.; s. chl.; 58 ^{19.5} me. al.
8890							
8891							
8892	col. liq., 1.50777 ^{15.5}	0.8745 ²⁰ / ₄	-29(-27.1)	144	i.	v. s.	v. s. eth.
8893	pr.....	1.381 ²³ / ₄	21	217.7	i.	s.	v. s. eth.
8894	liq.....	.....	-2	214	i.	v. s.	v. s. eth.
8895	liq.....	.....	.....	199	i.	∞	∞ eth.
8896	rhomb. cr. f. chl.	1.988	95	d.	i.	v. s.	20 eth.
8897	monocl. f. pet. eth.	1.393 ⁰ / ₄	55	241	i.	v. s.	v. s. eth., chl.
8898							
8899							
8900							
8901	need. f. al.....	.....	82	exp. 413	.....	sl. s.	v. s. eth.; s. chl., CS ₂ , bz.
8902	yel. need. f. al.	.....	75-6	.....	.....	s.	v. s. bz., chl.; s. acet.
8903	col. cr. f. al. . .	.....	89-90(56)	.....	v. sl. s.	s.	s. eth., chl., bz., acet.
8904	need. f. al.....	.....	115-6	.....	v. sl. s. h.	v. sl. s.	s. eth., chl., CS ₂ , acet., bz.; sl. s. pet. eth.
8905	liq.....	0.869 ²⁰ / ₄	<-20	189(183-4)	i.	v. s.	s. eth.
8906	liq. or need. f. al.	1.147 ¹⁵	7-9	245(250.8)	i.	s.	.....
8907	yel. pr. f. al. . . .	1.139 ⁸	30	258	i.	∞	s. eth.
8908	col. liq., 1.49962 ^{14.85}	0.8684 ¹⁵ ; 0.8641 ²⁰ / ₄	-53.6 (-47.4)	138.8	i.	v. s.	v. s. eth.
8909	liq.....	1.371 ²³	.....	215.8 sl.d.	i.	v. s.	v. s. eth.
8910	liq.....	.....	.....	203	i.	v. s.	v. s. eth.
8911	liq.....	1.064 ²⁰	.....	196	i.	∞	∞ eth.
8912	cr.....	.....	69-72	255-6	i.	sl. s. c., s. h.	v. s. eth.
8913	col. cr.....	1.302 ²⁰ / ₄	34.2	255	i.	v. s.	v. s. eth.
8914							
8915							
8916							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8917	<i>m</i>-Xylene, 2,5-dinitro-	1,3-dimethyl-2,5-dinitrobenzene*	$(\text{NO}_2)_2\text{C}_6\text{H}_2(\text{CH}_3)_2$	196.16
8918	—, 4-ethyl-.....	1-ethyl-2,4-dimethylbenzene*	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{C}_2\text{H}_5$	134.21
8919	—, 5-ethyl-.....	1-ethyl-3,5-dimethylbenzene*	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{C}_2\text{H}_5$	134.21
8920	—, hexahydro-	See <i>Cyclohexane</i> , 1,3-dimethyl-		
8921	—, 2-nitro-.....		$\text{NO}_2\text{C}_6\text{H}_3(\text{CH}_3)_2$	151.16
8922	—, 4-nitro-.....		$\text{NO}_2\text{C}_6\text{H}_3(\text{CH}_3)_2$	151.16
8923	—, 5-nitro-.....		$\text{NO}_2\text{C}_6\text{H}_3(\text{CH}_3)_2$	151.16
8924	—, 2,4,6-trinitro-.....		$(\text{NO}_2)_3\text{C}_6\text{H}(\text{CH}_3)_2$	241.16
8925	<i>p</i>-Xylene	1,4-dimethylbenzene*	$\text{C}_6\text{H}_4(\text{CH}_3)_2$	106.16
8926	—, α -bromo-.....	<i>p</i> -xylyl bromide; ω -bromo- <i>p</i> -xylene	$\text{CH}_3\text{C}_6\text{H}_4\text{CH}_2\text{Br}$	185.07
8927	—, 2-bromo-.....	<i>eso</i> -bromo- <i>p</i> -xylene	$\text{BrC}_6\text{H}_3(\text{CH}_3)_2$	185.07
8928	—, α -chloro-.....	<i>p</i> -xylyl chloride; ω -chloro- <i>p</i> -xylene; <i>p</i> -tolyl chloride (incorrect)	$\text{CH}_3\text{C}_6\text{H}_4\text{CH}_2\text{Cl}$	140.61
8929	—, α, α' -dibromo-...	<i>p</i> -xylylene bromide; <i>p</i> -xylylene dibromide	$\text{C}_6\text{H}_4(\text{CH}_2\text{Br})_2$	263.98
8930	—, α, α' -dichloro-...	<i>p</i> -xylylene (di)chloride; ω, ω' -dichloro- <i>p</i> -xylene	$\text{C}_6\text{H}_4(\text{CH}_2\text{Cl})_2$	175.06
8931	—, 2,5-dihydroxy-	See <i>Hydroquinone</i> , 2,5-dimethyl-		
8932	—, 2,6-dihydroxy-	See <i>Resorcinol</i> , 2,5-dimethyl-		
8933	—, 2,3-dinitro-.....	1,4-dimethyl-2,3-dinitrobenzene	$(\text{NO}_2)_2\text{C}_6\text{H}_2(\text{CH}_3)_2$	196.16
8934	—, 2,5-dinitro-.....	1,4-dimethyl-2,5-dinitrobenzene	$(\text{NO}_2)_2\text{C}_6\text{H}_2(\text{CH}_3)_2$	196.16
8935	—, 2,6-dinitro-.....	2,5-dimethyl-1,3-dinitrobenzene	$(\text{NO}_2)_2\text{C}_6\text{H}_2(\text{CH}_3)_2$	196.16
8936	—, 2-ethyl-.....	2-ethyl-1,4-dimethylbenzene*	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{C}_2\text{H}_5$	134.21
8937	—, hexahydro-.....	See <i>Cyclohexane</i> , 1,4-dimethyl-		
8938	—, 2-nitro-.....		$\text{NO}_2\text{C}_6\text{H}_3(\text{CH}_3)_2$	151.16
8939	—, 2,3,5-trinitro-.....		$(\text{NO}_2)_3\text{C}_6\text{H}(\text{CH}_3)_2$	241.16
8940	α, α' -Xylenediol.	See <i>Xylylene glycol</i> .		
8941	<i>o</i>-Xylene-4-sulfonic acid	3,4-xylenesulfonic acid	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{SO}_3\text{H}$	186.22
8942	2,3-Xylenol	2,3-dimethylphenol; <i>vic-o</i> -xylenol	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{OH}$	122.16
8943	2,4-Xylenol	2,4-dimethylphenol; <i>as-m</i> -xylenol	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{OH}$	122.16
8944	2,5-Xylenol	2,5-dimethylphenol; <i>p</i> -xylenol	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{OH}$	122.16
8945	2,6-Xylenol	2,6-dimethylphenol; <i>vic-m</i> -xylenol	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{OH}$	122.16
8946	3,4-Xylenol	3,4-dimethylphenol; <i>as-o</i> -xylenol	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{OH}$	122.16
8946M	—, 2,5,6-tribromo-		$(\text{CH}_3)_2\text{C}_6\text{Br}_3\text{OH}$	358.88
8947	3,5-Xylenol	3,5-dimethylphenol; <i>sym-m</i> -xylenol	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{OH}$	122.16
8947M	—, 2,4,6-tribromo-		$(\text{CH}_3)_2\text{C}_6\text{Br}_3\text{OH}$	358.88
8948	<i>vic-o</i>-Xylic acid.	See <i>Hemellitic acid</i> .		
8949	<i>sym-m</i>-Xylic acid.	See <i>Mesitylenic acid</i> .		
8950	<i>p</i>-Xylic acid.	See <i>Isoxylic acid</i> .		
8951	2,3-Xylic acid.	See <i>Hemellitic acid</i> .		
8952	2,4-Xylic acid	2,4-dimethylbenzoic acid; <i>as-m</i> -xylic acid	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{COOH}$	150.17

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8917	ylsh. cr. f. al.	.....	101	.....	.....	s.	s. eth., CS ₂ , chl., bz.
8918	col. liq.....	0.8686 ²⁰ / ₄	<-20	185-6	i.	v. s.	s. eth.
8919	col. liq.....	0.861 ²⁰	<20	185	i.	s.	s. eth.
8920							
8921	liq.....	1.112 ¹⁵	13	225	i.	.....	.....
8922	liq.....	1.135 ¹⁵	2	244	i.	s.	s. eth.
8923	col. need. f. al.	.....	71	273.7	i.	v. s.	v. s. eth.
8924	rhomb. need. f. al.+bz.	1.604 ¹⁹	181.5	.....	i.	0.039 c.	sl. s. eth.
8925	col. monocl. or liq.,	0.8611 ²⁰ / ₄	13.2	138.5	i.	v. s.	v. s. eth.
8926	1.4942 ^{23.4} need. f. al....	1.3237 ²⁰ / ₄	38(34-5.5)	220.7	i.	v. s.	v. s. eth., chl.
8927	liq.....	.....	9	200	i.	v. s.	v. s. eth.
8928	oil.....	.....	.....	202	i.	∞	= eth.
8929	monocl. f. bz.	2.012 ⁹	143.5	245	i.	v. s.	2.65 ²⁰ eth.; s. h. chl.
8930	monocl. pl. or leaf.	1.417 ⁹	100.5	240-50	i.	s.	v. s. eth.
8931							
8932							
8933	monocl. pr. f. al.	.....	93	.....	i.	s. h.	s. eth., chl., bz., acet.
8934	yel. need. f. al.	.....	147	.....	i.	s. h.	s. h. eth., bz., acet.
8935	need. f. al....	.....	123-4	.....	i.	sl. s.	s. eth.
8936	liq.....	0.875 ²²	<-20	185	i.	sl. s.	s. eth.
8937							
8938	ylsh. liq.....	1.132 ¹⁵	.....	239.9	i.	s.	s. eth.
8939	col. monocl. need. f. al.	1.59 ¹⁹	140	exp. 410	v. sl. s.	s. h.	sl. s. eth.
8940							
8941	pl. f. dil. H ₂ SO ₄	.....	d.	.....	s.	.....	.....
8942	lng. need. f. w.	.....	75	218	s.	s.	.....
8943	col. need.....	1.036 ²⁰ / ₄	26	211.5	v. sl. s.	∞	∞ eth.
8944	col. monocl. f. al.+eth.	1.169 ¹⁵ / ₄	74.5	211.5	s.	s.	v. s. eth.
8945	col. leaf.....	.....	49	212	s. h.	s.	.....
8946	need. f. w....	1.023 ¹⁷ / ₁₅	65	225	s.	s.	∞ eth.
8946M	col. silky need.	.....	173-74	.....	i.	s.	s. eth.
8947	need. f. w....	.....	68(64)	219.5	sl. s.	s.	s. NaOH
8947M	col. need.....	.....	166	.....	i.	v. s.	s. eth.
8948							
8949							
8950							
8951							
8952	col. monocl....	.....	126	268	v. sl. s. h.	v. s. h.	s. eth., bz., chl., acet., tol.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. Wt.
8953	2,5-Xylic acid.	See <i>Isoxylic acid</i> .		
8954	2,6-Xylic acid.	2,6-dimethylbenzoic acid; <i>vic-m</i> -xylic acid	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{COOH}$	150.17
8955	3,4-Xylic acid.	3,4-dimethylbenzoic acid; <i>as-o</i> -xylic acid; paraxylic acid	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{COOH}$	150.17
8956	3,5-Xylic acid.	See <i>Mesitylenic acid</i> .		
8957	2,3-Xylidine.	2,3-dimethylaniline; <i>vic-o</i> -xylidine	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NH}_2$...	121.18
8958	2,4-Xylidine.	2,4-dimethylaniline; <i>as-m</i> -xylidine	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NH}_2$...	121.18
8959	2,5-Xylidine.	2,5-dimethylaniline; <i>p</i> -xylidine	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NH}_2$...	121.18
8960	2,6-Xylidine.	2,6-dimethylaniline; <i>vic-m</i> -xylidine	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NH}_2$...	121.18
8961	3,4-Xylidine.	3,4-dimethylaniline; <i>as-o</i> -xylidine	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NH}_2$...	121.18
8962	3,5-Xylidine.	3,5-dimethylaniline; <i>sym-m</i> -xylidine	$(\text{CH}_3)_2\text{C}_6\text{H}_3\text{NH}_2$...	121.18
8963	<i>p</i>-Xylohydroquinone.	See <i>Hydroquinone</i> , 2,5-dimethyl-		
8964	<i>o</i>-Xyloquinone.	2,3-dimethylquinone	$(\text{CH}_3)_2\text{C}_6\text{H}_2\text{O}_2$...	136.14
8965	<i>m</i>-Xyloquinone.	2,6-dimethylquinone	$(\text{CH}_3)_2\text{C}_6\text{H}_2\text{O}_2$...	136.14
8965M	—, 3,5-dibromo-		$(\text{CH}_3)_2\text{C}_6\text{Br}_2\text{O}_2$...	293.96
8966	<i>p</i>-Xyloquinone.	See <i>Phlorone</i> .		
8967	<i>m</i>-Xylorcinol.	See <i>Resorcinol</i> , 4,6-dimethyl-		
8968	<i>p</i>-Xylorcinol.	See <i>Resorcinol</i> , 2,5-dimethyl-		
8968M	<i>D</i>-Xylose, phenylosazone.	<i>D</i> -xylosazone; <i>D</i> -lyxosazone	$\text{C}_{17}\text{H}_{20}\text{N}_4\text{O}_8$	328.36
8969	<i>D</i>-Xylose.	wood sugar	$\text{C}_6\text{H}_{12}\text{O}_6$	150.13
8970	Xylol bromide.	See <i>Xylene α-bromo-</i> .		
8971	Xylol chloride.	See <i>Xylene, α-chloro-</i> .		
8972	Xylylene alcohol.	See <i>Xylylene glycol</i> .		
8973	Xylylene bromide.	See <i>Xylene, α, α'-dibromo-</i> .		
8974	Xylylene chloride.	See <i>Xylene, α, α'-dichloro-</i> .		
8975	Xylylene cyanide.	See <i>Benzenediacetonitrile</i> .		
8976	<i>o</i>-Xylylene glycol.	α, α' - <i>o</i> -xylenediol; 1,2-benzenedicarbinol; <i>o</i> -xylylene alcohol; phthalyl alcohol	$\text{C}_6\text{H}_4(\text{CH}_2\text{OH})_2$...	138.16
8977	<i>m</i>-Xylylene glycol.	α, α' - <i>m</i> -xylenediol; 1,3-benzenedicarbinol; <i>m</i> -xylylene alcohol	$\text{C}_6\text{H}_4(\text{CH}_2\text{OH})_2$...	138.16
8978	<i>p</i>-Xylylene glycol.	α, α' - <i>p</i> -xylenediol; 1,4-benzenedicarbinol; <i>p</i> -xylylene alcohol	$\text{C}_6\text{H}_4(\text{CH}_2\text{OH})_2$...	138.16
8979	Yara-yara.	See <i>Ether, methyl 2-naphthyl</i> .		
8980	Yellow cross liquid.	See <i>Sulfide, β, β'-dichloroethyl</i> .		
8981	Yohimbine.	corynine	$\text{C}_{21}\text{H}_{26}\text{N}_2\text{O}_8$	354.44
8982	—, hydrochloride(<i>d</i>).	corynine hydrochloride; aphrodine hydrochloride	$\text{C}_{21}\text{H}_{26}\text{N}_2\text{O}_8 \cdot \text{HCl}$...	390.90
8983	—, nitrate.		$\text{C}_{21}\text{H}_{26}\text{N}_2\text{O}_8 \cdot \text{HNO}_3$	417.45
8985	Yperite.	See <i>Sulfide, β, β'-dichloroethyl</i> .		
8986	Zinc, diethyl-*	zinc ethyl; zinc diethyl; zinc ethide	$\text{Zn}(\text{C}_2\text{H}_5)_2$	123.50
8987	—, dimethyl-*	zinc methyl; zinc methide	$\text{Zn}(\text{CH}_3)_2$	95.45
8987M	Zinc ethide.	See <i>Zinc, diethyl-*</i> .		
8988	Zinc methide.	See <i>Zinc, dimethyl-*</i> .		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8953							
8954	col. need. f. lgr.	...	116	274.5	sl. s.	s.	v. s. eth.
8955	col. pr. f. al...	...	165-6	subl.	sl. s. h.	s.	s. eth., bz.
8956							
8957	liq., 1.570....	0.991 ¹⁵	<-15	223.8	v. sl. s.	v. s.	v. s. eth.
8958	liq., 1.559....	0.974 ²⁰ / ₄ ; 0.9761 ¹⁸ / ₄	...	216	v. sl. s.	s.	s. eth., bz.
8959	oil.....	0.980 ¹⁵	15.5	217	v. sl. s.	0.980	s. eth.
8960	col. liq., 1.561	0.979	...	216.9	i.	s.	s. eth.
8961	monocl. tab. f. lgr.	1.076	49	226	sl. s.	.....	v. s. lgr.
8962	liq., 1.558	0.972 ²⁰ / ₄ ; 0.9935 ⁹	...	221	sl. s.	.....	.....
8963							
8964	yel. need.....	...	55	subl.	sl. s.	s.	s. eth.
8965	yel. need.....	...	73	subl.	.....	.....	.....
8965M	yel. pl.....	...	174	.....	i.	s.	s. eth.
8966							
8967							
8968							
8968M	bright yel. rhomb. need.; 1.725, 1.760, 1.805; [α] _D -40.9 (al.)	0.85 (in al.)	160; d. 167	.....	sl. s.	s.	s. eth., acet.
8969	wh. rhomb. need.; 1.517, 1.544, 1.546	1.525 ²⁰ / ₄ ; 1.535 ⁰	153(144)	.....	117 ²⁰	6.2 ²⁰ 80%	v. sl. s. eth.
8970							
8971							
8972							
8973							
8974							
8975							
8976	pl. f. eth.....	...	62.0-4.8	.....	s.	s.	17.9 eth.
8977	col. cr. f. bz....	1.161 ¹⁸	46-7	.....	v. s.	.....	s. eth.
8978	need.....	...	115-6	.....	v. s.	v. s.	v. s. eth.
8979							
8980							
8981	col. need. f. w. +al.	...	248(231)	...	v. sl. s.	v. s.	s. eth., chl., bz.
8982	col. cr.....	...	295-300 d.	.....	s.	.....	.....
8983	col. pr.....	...	276	.....	.....	.....	.....
8985							
8986	col. liq. ign. in air	1.182 ¹⁸	-28	118	d.	d.	s. eth.
8987	col. liq. ign....	1.386 ¹⁰	-40	46	d.	d.	= eth.
8987M							
8988							

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
64Z	Acetanilide, <i>m</i>-ethoxy-	See <i>m</i> -Acetophenetide.		
71Z	—, <i>m</i> -methoxy-	See <i>m</i> -Acetanilide.		
83M	—, α -trichloro-.....	trichloroacetic anilide.....	$\text{CCl}_3\text{CONHC}_6\text{H}_5$...	238.51
83T	<i>m</i>-Acetanilide	<i>N</i> -acetyl- <i>m</i> -anisidine; <i>m</i> -methoxyacetanilide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-OCH}_3$	165.19
87M	Acetic acid , acetonyl ester	See <i>Acetol</i> , acetate.		
107W	—, vinyl ester.....	vinyl acetate; ethenyl ethanoate*	$\text{CH}_3\text{COOCH:CH}_2$	86.09
164F	—, naphthyl-	See <i>Naphthaleneacetic acid</i> .		
164T	—, nitrilotri-	trimethylamine- α , α' , α'' -tricarboxylic acid; triglycolamic acid; triglycolamic acid	$\text{N}(\text{CH}_2\text{COOH})_3$...	191.14
207C	Acetol , acetate.....	acetonyl acetate; acetoxyacetone; acetylmethyl acetate	$\text{CH}_3\text{COOCH}_2\text{-COCH}_3$	116.11
222M	Acetone , acetoxy-	See <i>Acetol</i> , acetate.		
233M	—, hexamethyl-	See 3-Pentanone, 2,2,4,4-tetramethyl-.		
236W	<i>m</i>-Acetophenetide	<i>N</i> -acetyl- <i>m</i> -phenetidine; <i>m</i> -ethoxyacetanilide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{-OCH}_3$	179.21
285M	Acetophenone , 3,4-di-	methoxy- . See <i>Acetoveratrone</i> .		
285Q	—, <i>m</i>-dimethylamino-	.....	$\text{CH}_3\text{COC}_6\text{H}_4\text{N-(CH}_3)_2$	163.21
285R	—, <i>p</i>-dimethylamino-	.....	$\text{CH}_3\text{COC}_6\text{H}_4\text{N-(CH}_3)_2$	163.21
286W	—, <i>o</i>-hydroxy-	<i>o</i> -acetylphenol.....	$\text{CH}_3\text{COC}_6\text{H}_4\text{OH}$...	136.14
286X	—, <i>m</i>-hydroxy-	<i>m</i> -acetylphenol.....	$\text{CH}_3\text{COC}_6\text{H}_4\text{OH}$...	136.14
288F	—, 4-hydroxy-3-methoxy-	See <i>Acetovanillone</i> .		
293X	—, <i>o</i>-methoxy-	<i>o</i> -acetylanisole; <i>o</i> -anisyl methyl ketone	$\text{CH}_3\text{COC}_6\text{H}_4\text{OCH}_3$	150.17
293Y	—, <i>m</i>-methoxy-	<i>m</i> -acetylanisole; <i>m</i> -anisyl methyl ketone	$\text{CH}_3\text{COC}_6\text{H}_4\text{OCH}_3$	150.17
294X	—, <i>o</i>-methyl-	methyl <i>o</i> -tolyl ketone.....	$\text{CH}_3\text{COC}_6\text{H}_4\text{CH}_3$...	134.17
312M	Acetovanillone	4-hydroxy-3-methoxyacetophenone; apocynin	$\text{CH}_3\text{COC}_6\text{H}_3(\text{OH})(\text{OCH}_3)$	165.16
312T	Acetoveratrone	3,4-dimethoxyacetophenone..	$\text{CH}_3\text{COC}_6\text{H}_3(\text{OCH}_3)_2$	180.20
372M	Acridine , 6-chloro-9-(4-diethylamino-1-methylbutylamino)-2-	See <i>Methacrylonitrile</i> .		
406E	Acrylonitrile , α -methyl-	See <i>Methacrylonitrile</i> .		
419S	Alanine , β -(3,4-dihydroxyphenyl)-(l)....	<i>l</i> -2-amino-3-(3,4-dihydroxyphenyl)propanoic acid; <i>l</i> -dopa	$(\text{HO})_2\text{C}_6\text{H}_3\text{CH}_2\text{CH-(NH}_2\text{)COOH}$	197.19
425F	—, β , β' -methylene	dithiodi- . See <i>Djenkolic acid</i> .		
441M	Aleuritic acid	9,10,16-trihydroxyhexadecanoic acid*; δ , ϵ , ω -trihydroxypalmitic acid	$\text{C}_{16}\text{H}_{32}\text{O}_6$	304.42
522M	Amphetamine	<i>dl</i> - α -methylphenethylamine; <i>dl</i> -2-phenylisopropylamine; Benzedrine	$\text{C}_6\text{H}_5\text{CH}_2\text{CH-(CH}_3\text{)NH}_2$	135.20
555M	Amyl phosphate (<i>n</i>)...	tri- <i>n</i> -amyl phosphate.....	$(\text{C}_5\text{H}_{11})_3\text{PO}_4$	308.39
562F	Androstane , 3(α)-hydroxy-17-keto-	See <i>Androsterone</i> .		
562L	3-Androstene , 17-hydroxy-	See <i>Testosterone</i> .		
562Q	Androsterone	3(α)-hydroxy-17-ketoandrostane	$\text{C}_{19}\text{H}_{26}\text{O}_2$	290.43

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
64Z 71Z 83M 83T	sc. nd. or lf.		95-7 80-1			v. s.	
87M 107W	col. liq., 1.3953	0.9317	-100.2	72.3 ⁷⁶⁵	2.5	∞	
164F 164T	sm. pr.		258-9 d. (246 d.)		0.13 ⁵ ; 3.3 ¹⁰⁰		
207C	col. liq., 1.415	1.075		174-5; 65 ¹¹		s.	s. eth.
222M 238M 263W	lf. f. w.		96				
285M 285Q	col. cr.		42-3	148 ¹³			v. s. eth.
285R	col. cr.		110.5	108-10 ¹²	v. s. h.		v.s.eth.; v.s.h. pet. eth.
286W	col. liq., 1.558 ^{21.3}	1.1307 ^{20.8}		106-7 ¹⁷	sl. s.	s.	s. eth., ac. a.
286X	yel. powd.		99		v. s. h.	v. s.	v. s. eth., chl., ac. a., bz.; i. lgr.
288F 293X	yel. liq.			245			
293Y	col. liq. 1.543 ^{13.35}	1.0943 ¹⁹		239			
294X	col. liq. 1.535 ^{12.7}	1.0201 ¹³ / ₄		92-3 ¹⁷			
312M	pr. f. h. w.		115	295-300; 233-5 ¹⁵⁻²⁰	s. h.	s.	s. eth., bz., chl.; sl. s. lgr.
312T	pr. f. dil. al.		51	205-7 ¹⁰⁻¹⁵	s. h.	s.	s. eth., bz., chl.
372M 406E 419S	methoxy- . See <i>Quinacrin</i> e. nd. or pr. f. w.		280		0.5	i.	i. eth., s. alk., a.
425F 441M	lf. or nd.		101(102)				
552M	liq.			203 (205); 63-4 ⁷			
555M	col. liq.	0.9497 ²⁵ / ₄		158-63 ⁶	i.	s.	s. eth., tol., CS ₂
562F 562L 562Q	lf. or nd.; [α] + 94.6° (in al.)		185-5.5 (184-5)		v. sl. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
716V	Anisole, acetyl-	See <i>Acetophenone, methoxy-</i> .		
718M	—, p-anisoyl-	See <i>Benzophenone, p,p'-dimethoxy-</i> .		
726M	—, thio-	See <i>Sulfide, methyl phenyl-</i> .		
870M	Apocynin.	See <i>Acetovanillone</i> .		
933M	Atabrine, Atebrin.	See <i>Quinacrine, dihydrochloride</i> .		
935M	Atophan.	See <i>Cinchonic acid, 2-phenyl-</i> .		
950C	Auxenetriolic acid.	See <i>Auxin a</i> .		
950E	Auxenolonic acid.	See <i>Auxin b</i> .		
950H	Auxin a	auxenetriolic acid; 3-5-di-sec-butyl- α,β,δ -trihydroxy-1-cyclopentenevaleric acid	$C_{18}H_{32}O_6$	328.44
950J	Auxin b	auxenolonic acid 3,5-di-sec-butyl- δ -hydroxy- β -oxo-2-cyclopentenevaleric acid	$C_{18}H_{30}O_4$	310.42
952M	5-Azepotetrazole, 6,7,	8,9-tetrahydro- . See <i>Metrazol</i> .		
1032M	Benz[j]aceanthrene.	See <i>Cholanthrene</i> .		
1062M	Benzaldehyde, 4-hydroxy-3,5-dimethoxy-	See <i>Syringaldehyde</i> .		
1112M	Benzedrine.	See <i>Amphetamine</i> .		
1255M	Benzene, methylthio-	*See <i>Sulfide, methyl phenyl</i> .		
1384M	Benzenesulfonic acid, 3,4-dichloro-, dihydrate	.....	$Cl_2C_6H_3SO_3H \cdot 2H_2O$	263.10
1540B	Benzoic acid, 3,5-dinitro-, amyl ester	.....	$(NO_2)_2C_6H_3COOC_5H_{11}$	282.25
1540D	—, —, benzyl ester.....	.....	$(NO_2)_2C_6H_3COOCH_2C_6H_5$	302.24
1540F	—, —, butyl ester.....	.....	$(NO_2)_2C_6H_3COOC_4H_9$	268.22
1540H	—, —, ethyl ester.....	.....	$(NO_2)_2C_6H_3COOC_2H_5$	240.17
1540Q	—, —, isopropyl ester...	.....	$(NO_2)_2C_6H_3COOC_3H_7$	254.20
1540T	—, —, methyl ester.....	.....	$(NO_2)_2C_6H_3COOCH_3$	226.14
1540W	—, —, phenyl ester.....	.....	$(NO_2)_2C_6H_3COOC_6H_5$	288.21
1540Y	—, —, propyl ester(n)...	.....	$(NO_2)_2C_6H_3COOC_3H_7$	254.20
1561M	—, 4-hydroxy-3,5-dimethoxy-	See <i>Syringic acid</i> .		
1602J	—, m-sulfo-, dichloride	e. See <i>Benzoyl chloride, m-chlorosulfonyl-</i> .		
1669M	Benzophenone, p,p'-dimethoxy	<i>p</i> -anisoylanisole.....	$(CH_3OC_6H_4)_2CO$...	242.26
1686M	Benzopyran, dihydro-	See <i>Chroman</i> .		
1687M	Benzo[a]pyrene, 1,2-Benzopyrene	3,4-Benzpyrene.....	$C_{20}H_{12}$	252.30
1719M	2-Benzoxazolol	2-hydroxybenzoxazole; 2(3)-benzoxazolone (tautomer); oxycarbanil	$C_6H_4OC(OH):N$...	135.12
1725M	Benzoyl chloride, m-chlorosulfonyl-Benzpyrene.	<i>m</i> -sulfobenzoyl dichloride....	$ClSO_2C_6H_4COCl$...	239.08
1737M	3,3'-Bicoumarinyl.	See <i>Benzopyrene</i> .		
1813M	Bicyclohexyl	See <i>Dicoumarin</i> .		
1818M		Dicyclohexyl; dodecahydro-biphenyl	$C_6H_{11}C_6H_{11}$	166.30
1841M	Biotin	hexahydro-2-oxo-1-thieno-[3,4]imidazole-4-valeric acid; vitamin H; coenzyme R	$C_{10}H_{16}N_2O_6S$	244.30

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
716V							
718M							
726M							
870M							
933M							
935M							
950C							
950E							
950H	hex. cr. [α] — 3.19° (alc.)	.....	196	.....	sl. s.	s.	sl. s. eth., i. pet. eth.
950J	cr. [α] — 2.8°	.....	183	.....	.....	.....	.....
952M							
1032M							
1062M							
1112M							
1255M							
1384M	needl. ....	.....	69-70 (71-2)	.....	v. s.	v. m.	v. s. eth.; i. c. chl.; sl. s. h. chl.
1540B	.....	.....	46	.....	.....	s. h.	.....
1540D	.....	.....	112	.....	.....	.....	.....
1540F	monocl. nd., 1.488, 1.621	.....	63	.....	.....	s. h.	.....
1540H	monocl. nd., 1.560, 1.576	.....	93	.....	.....	s. h.	.....
1540Q	monocl. nd., (β) 1.609	.....	122	.....	.....	s. h.	.....
1540T	monocl. pl., 1.382, 1.780	.....	108	.....	.....	s. h.	.....
1540W	col. rods, 1.505, 1.690, >1.740	.....	145.8	.....	i.	s. h.	v. s. eth.
1540Y	monocl. pl., 1.486, 1.603	.....	73	.....	.....	s. h.	.....
1561M							
1602J							
1669M	wh. nd. ....	.....	144	.....	.....	v. s. h.	v. s. chl., bz.
1686M							
1687M	lt. yel. nd. ....	.....	(176-7)	310-12 ¹⁰	i.	.....	.....
1719M	nd. ....	.....	141-2(137)	>360	sl. s.	s.	s.
1725M	.....	.....	20.4	153-4 ⁷	.....	.....	.....
1737M							
1813M							
1818M	col. liq. 1.4766	0.8644 ²⁰	3.65	234	<0.01	∞ (abs. al. above 23.4)	∞
1841M	lng. nd.	1.41	230-2	.....	.....	.....	.....

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
1877M	Biphenyl, dodecahyd	o- . See <i>Bicyclohexyl</i> .		
1983M	Bromoprene.	See 1,3-Butadiene, 2-bromo-*		
1991M	1,3-Butadiene, 2-bromo-*	bromoprene.....	$\text{CH}_2\text{CBrCH:CH}_2$	133.00
2008M	Butane, 1-butoxy-3-methyl-*	See <i>Ether, butyl isoamyl</i> .		
2036F	—, 1-(2-methylprop	oxy)-*. See <i>Ether, butyl iso</i>	<i>butyl</i> .	
2036J	—, 3-methyl-1-prop	oxy-*. See <i>Ether, isoamyl pr</i>	<i>opyl</i> .	
2039M	—, 1-propoxy-*	See <i>Ether, butyl propyl</i> .		
2177F	2,3-Butylene glycol.	See 2,3-Butanediol in the Mai	n Table.	
2186Q	tert-Butyl ketone.	See 3-Pentanone, 2,2,4,4-tetra	methyl-*	
2193M	Butyl phosphate (n)	tri-n-butyl phosphate.....	$(\text{C}_4\text{H}_9)_3\text{PO}_4$	266.32
2239F	Butyric acid, α-amino-	γ-(aminoöxy)- . See <i>Can</i>	<i>aline</i> .	
2239M	—, α -amino- γ -(guan	idoöxy)-. See <i>Canavanine</i> .		
2239Q	—, α -amino- α -hydr	oxy-. See <i>Threonine</i> .		
2328F	Canaline.....	α -amino- γ -(aminoöxy)- butyric acid	$\text{H}_2\text{NOCH}_2\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$	134.14
2328M	Canavanine.....	α -amino- γ -(guanidoöxy)- butyric acid	$\text{CH}_4\text{N}_3\text{OCH}_2\text{CH}_2\text{CH}(\text{CH}(\text{NH}_2)\text{COOH})$	176.18
2329M	Cannabidiol.....		$\text{C}_{21}\text{H}_{30}\text{O}_2$	314.45
2329Q	Cannabinol.....	3-amyl-1-hydroxy-6,6,9-trimethyl-5-dibenzopyrone	$\text{C}_{21}\text{H}_{26}\text{O}_2$	310.42
2446J	Carbazone, diphenyl	thio- . See <i>Dithizone</i> .		
2595M	Cardiazol.	See <i>Metrazol</i> .		
2652M	Cetyl mercaptan.	See 1-Hexadecanethiol*		
2690M	Cholanthrene.....	benz[j]aceanthrene.....	$\text{C}_{20}\text{H}_{14}$	254.31
2690T	Cholanthrene, 3-methyl-	20-methylcholanthrene.....	$\text{C}_{21}\text{H}_{16}$	268.34
2698M	Chroman.....	3,4-dihydro-1,2-benzopyran; 2,3-dihydro-1,4-benzopyran	$\text{C}_9\text{H}_{10}\text{O}$	134.17
2698T	—, 6-hydroxy-2,5 (o	r 7), 8-trimethyl-2-(4,	8, 12-trimethyl	
2731R	Cinchoninic acid	cincophen; atophan; quino- phan	$\text{C}_6\text{H}_5\text{C}_9\text{H}_9\text{NCOOH}$	249.26
2731W	2-phenyl-	See <i>Cinchoninic acid, 2-phenyl</i> .		
2799M	Cincophen.	α -amino- δ -ureidovaleric acid; <i>N</i> δ -carbamylnorlithine; δ -ureidonorvaline	$\text{H}_2\text{NCONH}(\text{CH}_2)_3\text{CH}(\text{NH}_2)\text{COOH}$	175.19
2799M	Citrulline.....	See <i>Biotin</i> .		
2810M	Coenzyme R.	See <i>Syngin</i> .		
2827M	Coniferin, methoxy-			
2837J	Coronene.....		$\text{C}_{24}\text{H}_{12}$	300.34
2837M	Corticosterone.....	11,21-dihydroxyprogesterone.	$\text{C}_{21}\text{H}_{30}\text{O}_4$	346.45
2975J	1,3-Cyclobutanedicarb	oxylic acid, bis-(α-hydro	xyphenyl)-, dila	ctone.
3035M	2-Cyclohexen-1-one, 3,	5,5-trimethyl-* . See <i>Iso</i>	<i>phorone</i> .	
3047M	Cyclopentane, methyl-		$\text{C}_5\text{H}_9\text{CH}_3$	84.16
3060M	2-Cyclopentenevaleric	acid, 3,5-di-sec-butyl-δ-	-hydroxy-β-oxo-	-
3060P	1-Cyclopentenevaleric	acid, 3,5-di-sec-butyl α,	β, δ-trihydroxy-	-
3094F	DDT.	See <i>Ethane, 1-trichloro-2,2-bis</i>	<i>(p-chlorophenyl)-</i> .	
3104M	1-Decanethiol*.....	<i>n</i> -decyl mercaptan.....	$\text{CH}_3(\text{CH}_2)_9\text{SH}$	174.34
3117M	cis-5-Decene*.....	<i>cis</i> -1,2-dibutylethylene.....	$[\text{CH}_3(\text{CH}_2)_3\text{CH}]_2$	140.26
3117N	trans-5-Decene*.....	<i>trans</i> -1,2-dibutylethylene.....	$[\text{CH}_3(\text{CH}_2)_3\text{CH}]_2$	140.26
3117T	1-Decene-1,10-dicarbo	xylic acid. See <i>Traumatic</i>	<i>acid</i> .	
3130M	<i>n</i>-Decyl mercaptan.	See 1-Decanethiol*.		
3141J	Desoxycorticosterone..	deoxycorticosterone; 21-hydroxyprogesterone	$\text{C}_{21}\text{H}_{30}\text{O}_3$	330.45

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1877M 1983M 1991M	liq., 1.4988....	1.397	.....	42-3 ¹⁶⁵	i.	s.	s. eth.
2008M							
2036F 2036J 2039M 2177F 2186Q 2193M	col. liq.....	0.9727 ²⁵ ₄	.....	289; 160-2 ¹⁵	i.	s.	s. eth., tol., CS ₂
2239F 2239M 2239Q 2328F	nd. f. al.; [α] _D ²¹ - 8.31°	.....	214 d.	.....	.....	.....	.....
2328M	cr. f. al.; [α] + 7.9°	.....	184	.....	.....	.....	.....
2329M	rods f. pet. eth	.....	66-7	187-90 ²	i.	s.	s. eth., bz., chl.
2329Q	pl. or lf.; [α] - 148° (alc.)	.....	76-7	185 ^{0.05}	i.	s.	s. alk.
2446J 2595M 2652M 2690M 2690T	pa. yel. lf..... pa. yel. nd.....	.....	173(170-1) 176.5-7.5	.....	i. i.	.....	.....
2698M	liq. 1.544.....	1.064	.....	214-57 ¹⁹ ; 95 ¹²	s. h.	.....	∞ org. solv.
2698T 2731R	tridecyl. See sm. wh. nd.....	<i>Tocopherol.</i>	209(212-3)	.....	i. c., s. h.	0.8	s. eth.; 0.25 chl.; sl. s. bz.
2731W 2799M	pr.; [α] + 3.7°	.....	222	.....	s.	i.	.....
2810M 2827M 2837J 2837M	yel. nd..... pl. or nd.; [α] _D ²⁵ + 222° (in al.)	.....	437-40 181-2 (177-9)	.....	.....	.....	s. h. bz.
2475J 3035M 3047M	See <i>Dicoumarin</i> . col. liq., 1.4098 ²⁰	0.7488	-142.4	71.8	i.	∞	∞ eth., bz.
3060M 3060P 3094F	See <i>Auzin b.</i> See <i>Auzin a.</i>	.....	.....	.....	.....	.....	.....
3104M 3117M 3117N 3117T 3130M 3141J	col. liq., 1.4558 col. liq., 1.4252 col. liq., 1.4235 [α] _D ²² 178° (in al.)	0.7445 0.7401	-112 -73	132-4 ⁴⁰ 169.5 ⁷³⁹ 170.2 ⁷³⁹	i. i. i.	s. ∞ ∞	s. eth. ∞ eth. ∞ eth.
			141-2	.....	sl. s.	s.	s. acet.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
3192M 3208L	5-Dibenzopyrone, 3-a Dicoumarin (Ciamician, Silber)	myl-1-hydroxy-6,6,9-tri- 3,4-bis(o-hydroxyphenyl)- 1,2-cyclobutane dicarboxylic dilactone	imethyl- . See C $C_{18}H_{12}O_4$	<i>annabin</i> 292.28
3208M	Dicoumarin (Fittig, Dyson)	3,3'-bicumarinyl.....	$C_{18}H_{10}O_4$	290.26
3208N	Dicoumarin (Ström).....	2,4-bis(o-hydroxyphenyl)- 1,3-cyclobutanedicarboxylic dilactone	$C_{18}H_{12}O_4$	292.28
3210M 3376M	Dicyclohexyl. Dithizone	See <i>Bicyclohexyl</i> . phenylazothionformic phenylhydrazide; formazyl mercaptan; diphenylthio- carbazone	$C_6H_5N:NCSNH-NH$ HC_6H_5 or C_6H_5 - $N:NC(SH):NN$ - HC_6H_5	256.32
3382M	Djenkolic acid	3,3'-methylenedithiobis- (2-aminopropanoic acid); β,β' -methylenedi- thiodialanine	$CH_2(SCH_2CHNH_2$ $COOH)_2$	254.32
3389M 3393M 3398F 3400C	Dodecanamide* . 1-Dodecanethiol* . 2-Dodecenedioic acid* . Dodecylamine , hydro- chloride	See <i>Lauramide</i> . <i>n</i> -dodecyl mercaptan..... See <i>Traumatic acid</i> . dodecylammonium chloride	$CH_3(CH_2)_{11}SH$ $CH_2(CH_2)_{11}NH_3Cl$	202.39 221.81
3401M 3402W 3445D	<i>n</i>-Dodecyl mercaptan. Dopa. Enanthonitrile	See 1-Dodecanethiol*. See <i>Alanine</i> , β -(3,4-dihydroxy heptanenitrile*; <i>n</i> -hexyl cyanide	$CH_3(CH_2)_5CN$	111.18
3478M	Estradiol	$\Delta^{1,3,5(10)}$ -estratriene-3,17- diol; dihydroxyestrin; dihydrotheelin; dihydromenformone	$C_{18}H_{24}O_2$	272.37
3479F 3479J 3479M 3479Q	$\Delta^{1,3,5(10)}$ - Estratriene- Estrin, dihydroxy- . —, trihydroxy- . Estriol	3,17-diol . See <i>Estradiol</i> . See <i>Estradiol</i> . See <i>Estriol</i> . oestriol; theelol; tri- hydroxyestrin	$C_{18}H_{24}O_3$	288.37
3479T	Estrone	oestrone; theelin; menformone	$C_{18}H_{22}O_2$	270.36
3502F	Ethane, 1-chloro- 1-nitro-*	.....	$CH_3CH(Cl)NO_2$...	109.52
3509M	—, dichlorodi- phenyltrichloro- .	See <i>Ethane</i> , 1,1,1-trichloro-2,2- bis-(<i>p</i> -chlorophenyl)-	$CCl_3CH(C_6H_4Cl)_2$..	354.50
3555J	—, 1,1,1-trichloro- 2,2-bis(<i>p</i>-chloro- phenyl)-	dichlorodiphenyltrichloro- ethane; DDT	$C_{18}H_{11}Cl_5$	354.50
3578M	Ethaneorthosilicic acid, triethyl ester	triethoxyethylsilicane.....	$C_2H_5Si(OC_2H_5)_3$...	192.30
3578Q	—, trimethyl ester	ethyltrimethoxysilicane....	$C_2H_5Si(OCH_3)_3$...	150.22
3680J 3680Q	Ether, butyl isoamyl .. —, butyl isobutyl ...	1-butoxy-3-methylbutane*... 1-(2-methylpropoxy)- butane*	$C_4H_9OC_5H_{11}$ $CH_3(CH_2)_3OCH_2$ - $CH(CH_3)_2$	144.25 130.22
3682M	—, butyl propyl	1-propoxybutane*.....	$CH_3(CH_2)_2O$ - $(CH_2)_3CH_3$	116.20

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3192M 3208L	ol. lf. f. glac. ac.a.	.....	262	.....	.....	.....	.....
3208M	nd. f. glac. ac. a.	.....	>330	.....	.....	i.	i. eth., bz.; v. sl. s. chl.
3208N	nd. or lf. f. glac. ac. a.	.....	>275	.....	.....	.....	.....
3210M 3376M	bl. blk. cr. ....	.....	.....	.....	i.	sl. s.	sl. s. eth.; s. chl., alk.
3382M	nd.; [α] _D ²⁶ — 44.5°	.....	300–50d.	.....	.....	.....	.....
3389M 3393M 3398F 3400C	col. liq., 1.4589 col. cr. ....	.....	..... d. > 150	143 ¹⁵	i. 0.4 ²⁵ ; 33.3 ³⁰ 77 ⁶⁰ 103 ¹⁰⁰	s. 20.0 ²⁰ 66 ⁴⁰ 157 ⁶⁰ (95%)	s. eth. i. eth.; i. ⁰⁻⁴⁰ , 6.2 ⁵⁰ , 46.5 ⁷⁰ bz.
3401M 3402W 3445D	1.41037 ³⁰	0.80176 ³⁰ ₄	-65	186.1; 74.7 ¹⁶	v. sl. s.	∞ abs., 95%	∞ eth., bz., CCl ₄ , chl., acet., ac. a., me. al. meCN
3478M	(α)[α] + 81° (alc.); (β)[α] _D ¹⁸ + 56.7° (alc.)	.....	(α)170–8 (β)222	.....	.....	.....	(α) s. pet. eth.
3479F 3479J 3479M 3479Q	[α] + 30°	.....	281	.....	.....	sl. s.	s. pyr.; sl. s. me. al., pet. eth.
3479T	[α] — 167° ..	.....	.....	.....	0.002	v. sl. s.	s. pet. eth.; sl. s. acet.; v. sl. s. bz.
3502F	liq., 1.423	1.258 ²⁰ ₂₀	.....	124–57 ⁵⁸	0.4 ²⁰	s.	s. eth., glycols, esters, min. oil
3509M	.....	.....	.....	.....	.....	.....	.....
3555J	nd. f. al. ....	.....	107	d.	i.	s.	s. eth., bz.
3578M	.....	0.9281	.....	158–60	.....	.....	.....
3578Q	.....	0.9747°	.....	125–6	.....	s.	.....
3680J	liq. ....	.....	.....	157 ⁷⁵⁶	i.	s.	∞ eth.
3680Q	liq.	0.763	.....	131.5–32	i.	s.	∞ eth.
3682M	liq.	0.7773	.....	117	i.	s.	∞ eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
3690M	Ether, 2-chloroethyl p	benyl. See <i>Phenetole</i> , β -chloro-		
3709M	—, difurfuryl.	See <i>Furfuryl ether</i> .		
3751J	—, isoamyl propyl.	3-methyl-1-propoxybutane*	$C_3H_7OC_4H_9$	130.22
3753J	—, isobutyl propyl.	2-methyl-1-propoxypropane*	$(CH_3)_2CHCH_2O-$ $(CH_2)_2CH_3$	116.20
3755F	—, isopropyl propyl.	2-propoxypropane*.....	$(CH_3)_2CHOCH_2-$ CH_2CH_3	102.17
3815M	Ethylene, 1-butyl-2-et	hyl-. See 3- <i>Octene</i> *.		
3821M	—, 1,2-dibutyl-.	See 5- <i>Decene</i> .		
3833M	—, 1,2-dipropyl-.	See 4- <i>Octene</i> *.		
3881M	Ethylenediamine, N,N-diethyl-		$H_2NCH_2CH_2N-$ $(C_2H_5)_2$	116.20
4015M	Formazyl mercaptan.	See <i>Dithizone</i> .		
4046F	Formic acid, phenylaz	othiono- , phenylhydrazide.	See <i>Dithizone</i> .	
4070M	Fumaryl chloride.	<i>trans</i> -butenediyl chloride*	$(CICOCH)_2$	152.97
4140M	Furfuryl alcohol, tetra	hydro- , stearate. See <i>Stearic acid</i> , tetrahydrofurfuryl ester.	$(C_4H_3O-CH_2)_2O$...	178.18
4143J	Furfuryl ether.	difurfuryl ether; di- α -furfuryl ether		
4157M	Gallaldehyde, 3,5-dim	ethyl ether. See <i>Syringaldehyde</i> .		
4160M	Gallic acid, 3,5-dimethyl e	ther. See <i>Syringic acid</i> .		
4204F	Glucurone.	glucuronic acid lactone.....	$C_6H_8O_4COO$	176.12
4204K	β -D-Glucuronic acid ..		$C_6H_8O_6COOH$	194.14
4400M	Guanidine, 1-sulfanil	yl-. See <i>Sulfaguanidine</i> .		
4475M	Heptanenitrile*.	See <i>Enanthonitrile</i> .		
4522M	Heteroauxin.	See 3- <i>Indoleacetic acid</i> .		
4532M	1-Hexadecanethiol*.	cetyl mercaptan; <i>n</i> -hexadecyl mercaptan	$CH_3(CH_2)_{16}SH$	258.49
4538M	<i>n</i>-Hexadecyl mercapta	n. See 1- <i>Hexadecanethiol</i> *.		
4569M	Hexane, 1-hexylthio-*	See <i>Hexyl sulfide</i> .		
4623A	<i>cis</i> -2- Hexene *.....		$CH_3CH:CHCH_2-$ CH_2CH_3	84.16
4623B	<i>trans</i> -2- Hexene *.....		$CH_3CH:CHCH_2-$ CH_2CH_3	84.16
4628A	<i>cis</i> -3- Hexene *.....		$CH_3CH_2CH:CH-$ CH_2CH_3	84.16
4628B	<i>trans</i> -3- Hexene *.....		$CH_3CH_2CH:CH-$ CH_2CH_3	84.16
4643M	<i>n</i>-Hexyl cyanide.	See <i>Enanthonitrile</i> .		
4649F	Hexyl sulfide.	di- <i>n</i> -hexyl sulfide; 1-hexylthiohexane*	$[CH_3(CH_2)_5]_2S$	202.39
4658J	<i>L</i>-Histidine, bis-3,4-		$C_6H_9N_3O_2-$ $(Cl_2C_6H_3SO_3H)_2$	609.29
4675J	Hydantoin, 5,5-di-		$C_{15}H_{12}N_2O_2$	252.26
4882M	Indole, 1,3-dimethyl-	<i>N</i> -methylskatole.....	$C_8H_4N(CH_3)CH:C-$ (CH_3)	145.20
4884M	3-Indoleacetic acid.	heteroauxin; indole- β -acetic acid	$C_8H_6NCH_2COOH$..	175.18
4950M	Isobutenol.	See 2- <i>Propen</i> -1-ol, 2-methyl*.		
4950T	Isobutyryl chloride.	See <i>Propene</i> , 3-chloro-2-methyl-		
4996F	Isobutyric acid, α-hydroxy-, ethyl ester		$(CH_3)_2COHCOO-$ C_2H_5	132.16
5026M	Isocrotyl chloride.	See <i>Propene</i> , 1-chloro-2-methyl-		
5053M	Isohemipinic acid.	4,5-dimethoxyisophthalic acid	$(CH_3O)_2C_6H_2-$ $(COOH)_2$	226.18

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3690M							
3709M							
2751J	liq.			130	i.	s.	= eth.
3753J	liq.			105-6	i.	s.	∞ eth.
3755F	liq.			82-3	i.	s.	∞ eth.
3815M							
3821M							
3833M							
3881M	liq.	0.827 ^{18.5} _{18.5}		145; 75 ²⁰	sl. s.	s.	s. eth., tol.
4015M							
4046F							
4070M	1.500 ¹⁸	1.410		160			
4140M							
4143J	col. liq., 1.5088	1.1405; _{1.137²⁶₀}		101 ² ; 88-9 ¹	i.		
4157M							
4160M							
4204F	monocl. pl; [α] + 19.21° (in w.)		175-8		s.	i.	
4204K	need.; [α] ²⁴ + 11.73→36.26° (5.6% i. w.)		156		s.	s.	i. eth.
4400M							
4475M							
4522M							
4532M	col. liq., 1.4623		18	167-70 ³	i.	sl. s.	s. eth.
4538M							
4569M							
4623A	col. liq., 1.3954	0.6845	-146	68.2 ⁷⁴⁹	i.	∞	= eth.
4623B	col. liq., 1.3935	0.6780	-133	67.5 ⁷⁵⁰	i.	∞	∞ eth.
4628A	col. liq., 1.3934	0.6796	-135	66.8 ⁷⁴¹	i.	∞	∞ eth.
4628B	col. liq., 1.3938	0.6779	-113	67.5 ⁷⁴¹	i.	∞	∞ eth.
4643M							
4649F	1.459	0.841		230; 113.5 ⁴			
4658J	rhomb. need...		280-1 d.		sl. s. c.; s. h.	i.	0.051 ⁸ 10% w. sol reagent
4675J	cr.		286		i.	s.	s. acet., ac. a.; sl. s. chl., bz.
4882M	liq.			225-32; 135-8 ¹⁸			
4884M	lf. f. bz.; pl. f. chl.; [α] - 3.8° (alc.)		165		v. sl. s.	v. s.	v. s. eth.
4950M							
4950T							
4996F				150	∞	∞	∞
5026M							
5053M	nd. f. w.		245-6		sl. s. h.	s.	s. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
5078M 5078T	3-Isophenoxazinone, Isophorone	10-oxide. See <i>Resazurin</i> . 3,5,5-trimethyl-2-cyclohexen-1-one*	$C_9H_{14}O$	138.20
5086M 5099M 5180T 5264W 5286M	Isophthalic acid, 4,5-dimethoxy- . See <i>Isohemipinic acid</i> . Isopropylamine, dl-2-phenyl- . See <i>Amphetamine</i> . Ketone, anisyl methyl- . See <i>Acetophenone, methoxy-</i> . —, methyl <i>o</i> -tolyl. See <i>Acetone, o-methyl-</i> . Lactic acid, isopropyl ester —, phenyl ether.	isopropyl 2-hydroxypropanoate* See <i>Propionic acid, α-phenoxy-</i> .	$CH_3CHOHCOO-CH(CH_3)_2$	132.16
5287M 5300F	Lactonitrile, acetate	α -cyanoethyl acetate; α -acetoxypropionitrile	$CH_3CH(OOCCH_3)-CN$	113.11
5308F	Lauramide	dodecanamide*	$CH_3(CH_2)_{10}CO-NH_2$	199.33
5308M 5308T	—, <i>N</i> -phenyl- Lauranilide	See <i>Lauranilide</i> . <i>N</i> -phenyldodecanamide; <i>N</i> -phenyllauramide	$CH_3(CH_2)_{10}CON-HC_6H_5$	275.42
5314H	Lauric acid, methyl ester .	methyl laurate.....	$C_{11}H_{23}COOCH_3$...	214.34
5504M 5504R 5504U 5532M 5580W	α-Menaphthyl chlorid Menformone . —, dihydro- Mepacrine . Methacrylic anhydride	e. See <i>Naphthalene, 1-(chloromethyl)-</i> . See <i>Estrone</i> . See <i>Estradiol</i> . See <i>Quinacrine, dihydrochloride</i> .	$[CH_2:C(CH_3)CO]_2$ O $CH_2:C(CH_3)CN$...	154.16 67.09
5580X	Methacrylonitrile	α -methylacrylonitrile; 2-methylpropenenitrile*	$CH_2=C(CH_3)CN$...	67.09
5580Y 5580Z 5707M	Methallyl alcohol . Methallyl chloride . Methaneorthosiliconic acid, ethyl ester	See <i>2-Propen-1-ol, 2-methyl-</i> . See <i>Propene, 3-chloro-2-methyl</i>	$CH_3Si(OC_2H_5)_3$...	178.27
5761M	Methyl orthosilicate ..	methyl silicate; tetramethoxysilicane	$(CH_3)_4SiO_4$	152.20
5771M	Metrazol	6,7,8,9-tetrahydro-5-azepotetrazole; pentamethylenetetrazole; Cardiazol	$C_6H_{10}N_4$	138.17
5771T	Metycaine	2-methyl-1-piperidinepropanol benzoatehydrochloride	$C_{16}H_{24}ClNO_2$	297.82
5779M 5819M	Monophenyl orthophosphate . See <i>Phenylphosphoric acid</i> . Myristic acid, methyl ester	methyl myristate.....	$C_{13}H_{27}COOCH_3$...	242.39
5844M	Naphthalene, 1-(chloromethyl)-	α -menaphthyl chloride.....	$C_{10}H_7CH_2Cl$	176.64
5897M	1-Naphthaleneacetic acid	α -naphthylacetic acid.....	$C_{10}H_7CH_2COOH$...	186.20
5972M	1-Naphthol, 4-p-nitrophenylazo-	<i>p</i> -nitrobenzeneazo- α -naphthol	$O_2NC_6H_4N:NC_{10}H_7OH$	293.27
6038R	1,4-Naphthoquinone, 2-methyl-	vitamin K (one form).....	$C_{11}H_8O_2$	172.17

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5078M							
5078T	.....	0.9229 ²⁰ / ₂₀	.....	252	.....	.....	.....
5086M							
5099M							
5180T							
5264W							
5286M	col. liq. ....	.....	.....	166-8	s.	s.	s. eth., bz.
5287M							
5300F	liq.	1.032 ¹⁴	.....	172-3; 60-2 ¹⁰	4.0	s.	v. s. alk., eth., glac. ac. a.
5308F	col. cr. ....	.....	frz. 102.4	.....	i.	9.0 ³⁰ (95%)	v. sl. s. eth., bz., CCl ₄ , chl.; sl. s. acet.; s. me. al.
5308M							
5308T	col. cr. ....	.....	frz. 77.2	.....	i.	17.6 ³⁰ (95%)	s. eth., bz., CCl ₄ , chl., acet., me. al.
5314H	col. oil. ....	.....	frz. 5.15	.....	i.	∞ abs. 95%	∞ eth., bz., CCl ₄ , chl., et. acetate, acet., ac. a., me. al.
5504M							
5504R							
5504U							
5532M							
5580W	col. liq., 1.4525 ²³	1.0243	.....	98 ²⁵ ; 84 ¹¹	d.	∞	∞
5580X	col. liq., 1.4002	0.805	-40	90	.....	∞	∞
5580Y							
5580Z							
5707M	.....	0.938	.....	150-1	.....	s.	.....
5761M	.....	1.028 ²²	.....	121-2 ⁷⁵⁹ ; 25-27 ¹²	.....	s.	.....
5771M	sm. cr. ....	.....	59(57-8)	.....	v. s.	.....	v. s. org. solv.
5771T	sm. cr. ....	.....	171-3	.....	v. s.	s.	i. eth.; s. chl.
5779M							
5819M	col. oil. ....	.....	frz. 18.37	.....	i.	∞ abs., 95%	∞ eth., bz., CCl ₄ , chl., et. acetate, acet., ac. a., me. al.
5844M	pr. ....	.....	32(34)	291-2; 134 ³	.....	.....	.....
5897M	need. ....	.....	134(131)	d.	0.042 ^{20.5} ; s. hot	s.	s. eth., bz., glac. ac. a.
5972M	br.-red nd. ....	.....	277-9d.	.....	v. sl. s.	.....	s. boiling PhNO ₂
6038R	yel. nd. ....	.....	106(104)	.....	sl. s.	s.	s. eth., bz., ac. a.; sl. s. pet. eth.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
6038U 6127M 6139M 6151M 6214M	1,4-Naphthoquinone, 2-methyl-3-phytyl-. See <i>Niacin.</i> Niperyt. "Nitrogen mustard gas." 1-Nornicotine.	See <i>Nicotinic acid</i> , in the Main Table. See <i>Pentaerythritol</i> , tetranitrate. See <i>Triethylamine</i> , 2,2', 1,3-(2-pyrrolidyl)pyridine	<i>Vitamin K₁</i> . Table. <i>2'-trichloro-</i> $C_9H_{12}N_2$	148.20
6215M 6215S 6225M 6234M	Norvaline. —, δ -ureido- 1-Octadecanethiol* Octadecylamine, hydrochloride	See <i>Valeric acid</i> , α -amino-, in the Main Table. See <i>Citrulline</i> . <i>n</i> -octadecyl mercaptan. octadecylammonium chloride	$CH_3(CH_2)_{17}SH$ $C_{18}H_{37}NH_3Cl$	286.54 305.97
6235T 6277J	n-Octadecyl mercaptan. cis-3-Octene*.	n. See <i>1-Octadecanethiol*</i> . 1-butyl-2-ethylethylene	$CH_3CH_2CH:CH-(CH_2)_3CH_3$	112.21
6277K	trans-3-Octene*.	<i>trans</i> -1-butyl-2-ethylethylene	$CH_3CH_2CH:CH-(CH_2)_3CH_3$	112.21
6277Q 6277R	cis-4-Octene*. trans-4-Octene*.	<i>cis</i> -1,2-dipropylethylene <i>trans</i> -1,2-dipropylethylene.	$[CH_3(CH_2)_2CH:]_2$ $[CH_3(CH_2)_2CH:]_2$	112.21 112.21
6302M 6321M 6394M 6401F 6401M	Oestr-. Ornithine, Nδ-carbamyl-. Oxycarbanil. Palmitamide, N-phenyl-. Palmitanilide.	See <i>Citrulline</i> . See <i>2-Benzoxazolol</i> . See <i>Palmitanilide</i> . <i>N</i> -phenylhexadecanamide; <i>N</i> -phenylpalmitamide	$CH_2(CH_2)_{14}CON-HC_6H_5$	331.52
6403M	Palmitic acid, butyl ester	butyl hexadecanoate*	$C_{18}H_{31}COOC_4H_9$	312.52
6409Q 6457V	—, θ , ι , ω - trihydroxy-. Pentadecanoic acid*	See <i>Aleuritic acid</i> . <i>n</i> -pentadecylic acid.	$CH_3(CH_2)_{13}COOH$	242.39
6468J 6560M	Pentaerythritol, tetra-nitrate 3-Pentanone, 2,2,4,4-tetramethyl-*	pentrit(e); pentrit(e); PETN; niperyt Hexamethylacetone; <i>tert</i> -butyl ketone; pivalone	$C(CH_2NO_3)_4$ $(CH_3)_3CCOC-(CH_3)_3$	316.15 142.23
6592T 6615J	Pentrit(e), Pentrit(e), Phenanthrene, 9-bromo-	PETN. See <i>Pentaerythritol</i> , tetranitrate. $C_{14}H_9Br$	$C_{14}H_9Br$	257.13
6626T 6648M 6660C	—, quinhydrone. Phenethylamine, di-α- Phenetole, β-chloro-	-methyl-. See <i>Amphetamine</i> . 2-chloroethyl phenyl ether	$C_{28}H_{18}O_4$ $C_6H_5OCH_2CH_2Cl$	418.42 156.61
6670A 6795M 6836M	Phenol, acetyl-. —, <i>p</i> - propionyl-. o-Phenylenediamine, 4-chloro-	See <i>Acetophenone</i> , <i>hydroxy-</i> . See <i>Propiophenone</i> , <i>p-hydroxy-</i> .	$ClC_6H_3(NH_2)_2$	142.59
6858M	Phenyl phosphate	triphenyl orthophosphate	$(C_6H_5)_3PO_4$	326.28
6858Q	Phenylphosphoric acid.	monophenyl orthophosphate; dihydrogen phenyl phosphate	$C_6H_5OPO(OH)_2$	174.10

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6038U 6127M 6139M 6151M 6214M	col. liq. 1.538 ¹⁸ [α]—88.8 ²²	1.074	.....	266–7; 131 ¹¹	s.	.....	.....
6215M 6215S 6225M 6234M	solid, 1.4648... col. cr. ....	.....	20–30 d. > 180	169–71 ¹	i. i. ^{9–55} ; 7.8 ⁶⁰ ; 12.7 ¹⁰⁰	sl. s. 2.3 ³⁰ ; 11.3 ³⁰ ; 80 ⁷⁰ (95%)	s. eth. i. eth., bz.
6235T 6277J	col. liq., 1.4125	0.7189	–126	122.3 ⁷⁴¹	i.	∞	∞ eth.
6277K	col. liq., 1.4124	0.7163	–108	122.4 ⁷⁴¹	i.	∞	∞ eth.
6277Q 6277R 6302M 6321M 6394M 6401F 6401M	col. liq., 1.4136 col. liq., 1.4116 col. cr.	0.7205 0.7147	–118 –94 frz. 90.2	121.7 ³⁹ 121.4 ⁷³⁹	i. i.	∞ ∞	∞ eth. ∞ eth.
6403M	col. oil. ....	.....	(α) frz. 14.88; (β) m. 18.3	.....	i.	∞ abs., 95%	∞ eth., bz., CCl ₄ , chl., et. acetate, acet., ac. a., me. al.
6409Q 6457V	1.4348 ²⁵ ; 1.4254 ⁸⁰	0.8423 ⁸⁰	frz. 52.54	212.0 ¹⁶ ; 157.8 ¹	0.0012 ²⁰ ; 0.0020 ⁸⁰	3.1 ⁹ ; 15.6 ²⁰ ; 230 ⁴⁰ (95%)	s. eth., CS ₂ ; 31.8 bz.; 35.4 CCl ₄ ; 56.5 chl.; 10.9 acet.; 9.2 ac. a.; 13.0 me. al.
6468J	tetr. cr.	1.773	140–1 (138–40)	.....	sl. s.	sl. s.	v. sl. s. eth.; s. acet.
6560M	col. liq. 1.4170 ²⁵	0.81992 ²⁵ ₄	.....	149–51	.....	∞	v. s. eth., bz.
6592T 6615J	col. pr. ....	.....	63	.....	i.	v. sl. s.	s. eth., ac. a., CS ₂
6626T 6648M 6660C	blk. nd. pr. ....	.....	167–9 28	..... 220; 100–2 ¹²	..... i.	..... v. s.	..... v. s. eth., bz., lgr.
6670A 6795M 6836M	lf. ....	.....	76	.....	sl. s. c. w.	s.	s. eth.
6858M	pr. f. al. ....	.....	49.5	245 ¹¹	i.	s.	s. eth., bz., chl.
6858Q	nd. f. w., sc. f. chl.	.....	99.5	.....	s.	.....	s. eth., bz., alk.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
7035M 7047M 7052G	1-Piperidinepropanol, Pivalone Porphine	2-methyl- , hydrochloride. See <i>3-Pentanone</i> , 2,2,4,4-tetra	See <i>Metycaine</i> . <i>methyl</i> -. $C_{20}H_{14}N_4$	310.34
7052T 7056J	Δ^4-Pregnene-3, 20-dione Progesterone	e. See <i>Progesterone</i> Δ^4 -pregnene-3,20-dione; progesterone See <i>Corticosterone</i> . See <i>Desoxycorticosterone</i> .	$C_{21}H_{30}O_2$	314.45
7056M 7056Q 7090F	—, 11,21-dihydroxy- —, 21-hydroxy- Propane, 1-chloro-1-nitro*		$CH_3CH_2CH(Cl)NO_2$	123.54
7090M	—, 2-chloro-2-nitro*		$CH_3CCl(NO_2)CH_3$	123.54
7130M 7135B 7143F 7190M	—, 2-methyl-1-propoxy* —, 2-propoxy* 1,3-Propanediamine, 2 2-Propanol, 1,3-diamino*	oxy* . See <i>Ether, isobutyl propyl</i> . See <i>Ether, isopropyl propyl</i> . -hydroxy* . See <i>2-Propanol</i> , 1,3-diamino* 2-hydroxy-1,3-propanediamine*		
7223M	Propene, 1-chloro-2-methyl*	isocrotyl chloride	$(CH_3)_2C:CHCl$	90.55
7223Q	—, 3-chloro-2-methyl*	methallyl chloride; isobutenyl chloride	$CH_2:C(CH_3)CH_2Cl$	90.55
7234F	—, 2-methyl* , tetramer	tetraisobutylene	$(C_4H_8)_4$	224.42
7234J	—, —, trimer	triisobutylene	$(C_4H_8)_3$	168.31
7234Q 7248M	—, 2-nitro-1-phenyl 2-Propen-1-ol, 2-methyl*	-. See <i>Styrene</i> , β -methyl- β -nitro- methallyl alcohol; isobutenol.	$CH_2:C(CH_3)CH_2OH$	72.10
7277M	Propionic acid, allyl ester		$CH_3CH_2COOC_3H_5$	114.14
7315M	—, α-phenoxy-	lactic acid phenyl ether	$CH_3CH(OC_6H_5)COOH$	166.17
7319M 7319T	Propionitrile, α-acetoxyl- —, β-chloro-	y-. See <i>Lactonitrile</i> , acetate. 3-chloropropenenitrile*	$ClCH_2CH_2CN$	89.53
7329J	Propiophenone, p-hydroxy-	<i>p</i> -propionylphenol	$CH_3CH_2COC_6H_4OH$	150.17
7367M	Propyl phosphate (n)	tri- <i>n</i> -propyl orthophosphate	$(C_3H_7)_3PO_4$	224.24
7382M 7447M 7491G 7495G	Prostigmine bromide Pyrazine, 2-sulfanilamido- Pyridine, 3-(2-pyrrolidyl)- —, 2-vinyl-	ido-. See <i>Sulfapyrazine</i> . yl). See <i>Normicotine</i> . α -vinylpyridine	$CH_2:CHC_5H_4N$	105.13
7524M 7620G	Pyrimidine, 2-sulfanilamido- Quinacrine, dihydrochloride	amido-. See <i>Sulfadiazine</i> . 6-chloro-9-(4-diethylamino-1-methyl-butylamino)-2-methoxyacridine dihydrochloride; Atabrine; atebrian; mepacrine.	$C_{23}H_{30}ClN_3O \cdot 2HCl$	472.88
7731M 7738M	Quinophan Resazurin	See <i>Cinchoninic acid</i> , 2-phenyl- 3-isophenoxazinone 10-oxide; resazoin	$C_{12}H_7NO_4$	229.18
7824M 7882M	Salicylaldehyde, 3-methoxy- Semicarbazide, 1-phenyl-3-thio-	thoxy-. See <i>o-Vanillin</i> .	$C_6H_5NHNHCS-NH_2$	167.23

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7035M 7047M 7052G	dk. red pl., met. lust.				i.	v. sl. s.	sl. s.
7052T 7056J	sm. cr. [α] 193.5° (alc.)		(α) 128.5; (β) 121		i.	s.	s. org. solv.
7056M 7056Q 7090F	liq., 1.430	1.209 ²⁰ / ₂₀		141-3761	0.8 ²⁰	s.	s. eth., glycols, esters, min. oil
7090M	liq., 1.425	1.193 ²⁰ / ₂₀		133-4758	0.5 ²⁰	s.	s. eth., glycols, esters, min. oil
7130M 7135B 7143F 7190M			42	235			
7223M	col. liq., 1.4221	0.9186		68.1		∞	∞
7223Q	col. liq., 1.427	0.925		72.2		∞	∞
7234F	1.448	0.794		1067 (109.5-1115)			
7234J	1.431	0.759 (0.760)		179-81			
7234Q 7248M	col. liq. 1.4255	0.8515		114.5	19.4	∞	∞
7277M				124-4.5774			
7315M	nd.		115-6 (112-3)	265-6	v. sl. s. c., s. h.	s.	s. eth
7319M 7319T	col. liq.	1.144 ^{18.5}		175-6 (173-4.5)			
7329J	wh. nd. or pr.		148-8.5		sl. s. c.; s. h.	v. s.	v. s. eth.
7367M	col. liq.	1.0023 ²⁵ / ₄		252; 138 ⁴⁷ ; 133.5 ²²	i.	s.	s. eth., tol, CS ₂
7382M 7447M 7491G 7495G	sm. cr.		ca. 167 d.		s.		
7524M 7620G	liq.	0.999 ⁰		158-9 d.; 79-82 ²⁹	sl. s.		v. s. eth., chl., alk.
7620G	cr. f. w.		248-50				
7731M 7738M	pr., grnsh., lust		d.		i.	sl. s.	sl. s. glac. ac. a.; i. eth.
7824M 7882M	monocl. pr.		201 d.		sl. s.	s. h.	sl. s. eth., chl., bz.; s. conc. alk.

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
7882Q	Semicarbazide, 4-phenyl-3-thio-		$H_2NNHCSNH-C_6H_5$	167.23
7886W	Serine, β, β-dimethyl-	See <i>Valine, β-hydroxy-</i>		
7893M	Silicane, ethyltrimethoxy-	See <i>Ethaneorthosiliconic acid, trimethyl ester.</i>		
7896M	—, tetramethoxy-	See <i>Methyl orthosilicate.</i>		
7898M	—, triethoxyethyl-	See <i>Ethaneorthosiliconic acid, triethyl ester.</i>		
7898Q	—, triethoxymethyl-	See <i>Methaneorthosiliconic acid, ethyl ester.</i>		
7914J	Skatole, N-methyl-	See <i>Indole, 1,3-dimethyl-</i>		
7946M	Stearic acid, cyclohexyl ester	cyclohexyl octadecanoate*	$C_{17}H_{35}COOC_6H_{11}$	366.61
7953M	—, propyl ester	propyl octadecanoate*	$C_{17}H_{35}COOC_3H_7$	326.55
7953T	—, tetrahydrofurfuryl ester	tetrahydrofurfuryl octadecanoate	$C_{17}H_{35}COOCH_2-C_4H_7O$	368.58
7982J	trans-4,4'-Stilbenediol	See <i>Stilbestrol.</i>		
7982M	Stilbestrol	trans-4,4'-stilbenediol; stilboestrol	$(HOC_6H_4CH:)_2$	212.24
7982Q	—, α, α'-diethyl-	stilbestrol	$[HOC_6H_4C-(C_2H_5)_2]_2$	268.34
7993T	Styrene, o-chloro-	1-chloro-2-vinylbenzene	$ClC_6H_4CH:CH_2$	138.59
7993U	—, m-chloro-	1-chloro-3-vinylbenzene	$ClC_6H_4CH:CH_2$	138.59
7993V	—, p-chloro-	1-chloro-4-vinylbenzene	$ClC_6H_4CH:CH_2$	138.59
7995M	—, o-fluoro-	1-fluoro-2-vinylbenzene	$FC_6H_4CH:CH_2$	122.14
7995N	—, m-fluoro-	1-fluoro-3-vinylbenzene	$FC_6H_4CH:CH_2$	122.14
7995P	—, p-fluoro-	1-fluoro-4-vinylbenzene	$FC_6H_4CH:CH_2$	122.14
7998M	—, β-methyl-β-nitro-	2-nitro-1-phenylpropene	$C_6H_5CH:C(NO_2)-CH_3$	163.17
8001C	—, β-nitro-	(2-nitrovinyl)benzene	$C_6H_5CH:CHNO_2$	149.14
8048T	Sulfadiazine	N ¹ -2-pyrimidylsulfanilamide; 2-sulfanilamidopyrimidine	$H_2NC_6H_4SO_2-NHC_4H_3N_2$	250.27
8048V	Sulfaguanidine	1-sulfanilylguanidine N ¹ -guanylsulfanilamide	$NH_2C_6H_4SO_2NHC-(NH)NH_2$	214.24
8049E	Sulfanilamide, N¹-guanyl-	See <i>Sulfaguanidine.</i>		
8049J	—, N¹-2-pyrazinyl-	See <i>Sulfapyrazine.</i>		
8049Q	—, N¹-2-pyrimidyl-	See <i>Sulfadiazine.</i>		
8049T	—, N¹-2-thiazolyl-	See <i>Sulfathiazole.</i>		
8050J	Sulfapyrazine	2-sulfanilamidopyrazine; N ¹ -2-pyrazinylsulfanilamide	$C_{10}H_{10}N_4O_2S$	250.27
8050T	Sulfathiazole	N ¹ -2-thiazolylsulfanilamide; 2-sulfanilamidothiazole; thiazomide	$H_2NC_6H_4SO_2-NHC_3H_2NS$	255.31
8062M	Sulfide, dihexyl-	See <i>Hexyl sulfide.</i>		
8070M	—, methyl phenyl-	methylthiobenzene*; thioanisole	$C_6H_5SCH_3$	124.19
8091F	Syringaldehyde	4-hydroxy-3,5-dimethoxybenzaldehyde; gallaldehyde 3,5-dimethyl ether	$(CH_3O)_2(OH)C_6H_2CHO$	182.17
8091H	Syringic acid	4-hydroxy-3,5-dimethoxybenzoic acid; gallic acid 3,5-dimethyl ether	$(CH_3O)_2(OH)C_6H_2COOH$	198.17
8091K	Syringin	methoxyconiferin	$C_{17}H_{24}O_9$	372.36

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7882Q	lf. or pr.		140-1 (140 d.)				v. sl. s. bz.; i. eth., lrg., alk.
7886W							
7893M							
7896M							
7898M							
7898Q							
7914J							
7946M	semisolid.	0.890 ²⁵ / ₂₅	28-9	.. ....	i.	i.	s. eth.
7953M	col. cr.		frz. 28.78		i.	∞ ^{28.8} abs., 95%; 9.2 ²⁰ 95%	v. s. eth., bz., CCl ₄ , chl., et. acetate, acet., ac. a.; s. me. al.
7953T	liq.	0.917 ²⁵ / ₂₅	22		i.	s.	s. eth.
7982J							
7982M	nd. or tab.		284			sl. s.	s. acet., h. ac. a.; sl. s. eth.; v. sl. s. bz.
7982Q	pl.		171 (167-8)		i.	s.	
7993T	col. liq., 1.5648	1.100		60-1 ⁴	i.	s.	s. eth.
7993U	col. liq., 1.5619	1.090		62-3 ⁶	i.	s.	s. eth.
7993V	col. liq., 1.5658	1.090		53-4 ³	i.	s.	s. eth.
7995M	col. liq., 1.5197	1.030		32-4 ³	i.	s.	s. eth.
7995N	col. liq., 1.5173	1.025		30-1 ⁴	i.	s.	s. eth.
7995P	col. liq., 1.5158	1.024		29-30 ⁴	i.	s.	s. eth.
7998M	yel. nd.		64		i.	sl. s.	s. pet. eth., eth.; i. alk.
8001C	yel. pr.		58		i.	s.	s. eth., pet. eth., bz., CCl ₄ , CS ₂
8048T			255-6 (251-2)		.012 ³⁷		
8048V	col. cr.		189-90		sl. s.	sl. s.	i.
8049E							
8049J							
8049Q							
8049T							
8050J	clusters tiny nd.		253(251-1.5)				sl. s. h. cyclohexanol
8050T	col. cr.		200-2		0.06	0.5	s. acet., dil. HCl, alk.
8062M							
8070M	col. liq., 1.5847, 1.5832 ²⁵	1.053 ²⁵		58-60 ⁶	i.	s.	s. eth.
8091F	col. cr. f. lgr.		113	192-3 ¹⁴	sl. s.	v. s.	v. s. eth., chl., ac. a., h. bz.; v. sl. s. lgr.; i. pet. eth.
8091H	col. nd. f. w. or eth.		204.5		v. sl. s. c.	s.	v. s. eth. chl.
8091K	nd. (1H ₂ O) f. w.; [α] - 17.1°		191-2		v. sl. s. c.; s. h.	s. h.	i. eth.; s. c. HNO ₃ , H ₂ SO ₄

For explanations and abbreviations see beginning of table.

PHYSICAL CONSTANTS OF ORGANIC

No.	Name	Synonyms	Formula	Mol. Wt.
8139M	Testosterone	17-hydroxy-3-androstenone..	$C_{19}H_{28}O_2$	288.41
8146M	1-Tetradecanethiol* ..	<i>n</i> -tetradecyl mercaptan.....	$CH_3(CH_2)_{13}SH$...	230.44
8153M	<i>n</i>-Tetradecyl mercaptan.	See <i>1-Tetradecanethiol*</i> .		
8154W	Tetraethylene glycol. monostearate	3,6,9-trioxahendecane- 1,11-diol monoöcta- decanoate*	$C_{17}H_{35}COOCH_2-$ $CH_2(OC_2H_4)_3OH$	460.68
8154X	Tetraisobutylene.	See <i>Propene</i> , 2-methyl-*, tetra	mer.	
8162M	Tetrazole, pentameth	ylene- . See <i>Metrazol</i> .		
8169M	Theelin.	See <i>Estrone</i> .		
8169P	—, dihydro-	See <i>Estradiol</i> .		
8169R	Theolol.	See <i>Estriol</i> .		
8174Q	8-Thiachromineëthan	ol, 2,7-dimethyl- . See <i>T</i>	<i>hiochrome</i> .	
8178M	Thiazole, 2-sulfanilam	ido- . See <i>Sulfathiazole</i> .		
8179M	Thiazomide.	See <i>Sulfathiazole</i> .		
8179T	1-Thieno[3,4]imidazole	-4-valeric acid, hexahyd	ro-2-oxo- . See <i>B</i>	<i>iotin</i> .
8184M	Thiochrome	2,7-dimethyl-8-thia- chromineëthanol	$C_{12}H_{14}N_4OS$	262.32
8283G	<i>dl</i>-Threonine	<i>dl</i> - α -amino- β -hydroxy- butyric acid	$CH_3CHOHCH-$ $(NH_2)COOH$	119.1
8322P	β-Tocopherol	Vitamin E (one form); 6-hydroxy- 2,5,8-trimethyl- 2-(4,8,12-trimethyl- tridecyl) chroman	$C_{55}H_{105}O_2$	416.66
8322R	γ-Tocopherol	vitamin E (one form); 6- hydroxy-2,7,8-trimethyl- 2-(4,8,12-trimethyl- tridecyl) chroman	$C_{55}H_{105}O_2$	416.66
8434M	<i>p</i>-Toluenesulfonic acid, methyl ester	methyl <i>p</i> -toluenesulfonate	$CH_3C_6H_4SO_3CH_3$	186.22
8546M	Traumatic acid	2-dodecenedioic acid*; 1-decene-1,10-dicarboxylic acid	$C_{10}H_{18}(COOH)_2...$	228.28
8550T	Triamyl phosphate.	See <i>Amyl phosphate</i> .		
8569M	Tributyl phosphate.	See <i>Butyl phosphate</i> .		
8600Q	Triethylamine, 2,2'2''- trichloro-	"nitrogen mustard gas".....	$(ClCH_2CH_2)_3N$	204.54
8611M	Triglycolamidic acid.	See <i>Acetic acid, nitrilotri-</i> .		
8611P	Triglycollamic acid.	See <i>Acetic acid, nitrilotri-</i> .		
8617J	Triisobutylene.	See <i>Propene</i> , 2-methyl-*, trime	r.	
8626M	Trimethylaminetricar	boxylic acid. See <i>Acetic a</i>	<i>cid, nitrilotri-</i> .	
8650M	3,6,9-Trioxahendecane	-1,11-diol* . See <i>Tetraethy</i>	<i>lene glycol</i> .	
8659M	Triphenyl orthophosp	hate. See <i>Phenyl phosphate</i> .		
8686M	Tripropyl orthophosp	hate. See <i>Propyl phosphate</i> .		
8690T	<i>l</i>-Tyrosine, 3,5- dibromo-, dihydrate		$HOC_6H_3Br_2CH_2-$ $CH(NH_2)COOH.$ $2H_2O$	375.03
8810J	Valeric acid, α-amino-	δ-ureido- . See <i>Citrulline</i> .		
8831M	<i>dl</i>-Valine, β-hydroxy-	α -amino- β -hydroxyiso- valeric acid; β , β -dimethylserine	$(CH_3)_2COHCH-$ $(NH_2)COOH$	133.15
8843T	<i>o</i>-Vanillin	2-hydroxy-3-methoxyben- zaldehyde; 3-methoxysalicylaldehyde	$CH_3O(OH)C_6H_3-$ CHO	152.14
8869P	Vitamin H.	See <i>Biotin</i> .		
8869T	Vitamin K.	See also 1,4- <i>Naphthoquinone</i> ,	2-methyl-	
8869U	Vitamin K₁	2-methyl-3-phytyl-1,4- naphthoquinone	$C_{31}H_{46}O_2$	450.68

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8139M	sm. cr.; [α] + 109° (alc.)	.....	154-4.5	.....	i.	s.	s. org. solv.
8146M	col. liq., 1.4613	.....	.....	160-25	i.	s.	s. eth.
8153M	.....	.....	.....	.....	.....	.....	.....
8154W	solid	0.971 $\frac{25}{25}$	35-40	.....	.....	.....	.....
8154X	.....	.....	.....	.....	.....	.....	.....
8162M	.....	.....	.....	.....	.....	.....	.....
8169M	.....	.....	.....	.....	.....	.....	.....
8169P	.....	.....	.....	.....	.....	.....	.....
8169R	.....	.....	.....	.....	.....	.....	.....
8174Q	.....	.....	.....	.....	.....	.....	.....
8178M	.....	.....	.....	.....	.....	.....	.....
8179M	.....	.....	.....	.....	.....	.....	.....
8179T	.....	.....	.....	.....	.....	.....	.....
8184M	yel. pr. f. chl.	.....	277-8	.....	.....	sl. s.	s. me. al.; sl. s. eth., acet., chl. i. eth., chl.
8283G	orth. cr. ($\frac{1}{2}$ H ₂ O)	.....	229-30 d.	.....	v. s.	i.	i. eth., chl.
8322P	[α] $\frac{20}{5461}$ 2.9° (al.)	.....	.....	.....	.....	.....	.....
8322R	liq. [α] $\frac{20}{5461}$ - 2.4° (al.)	.....	.....	.....	.....	.....	.....
8434M	col. liq. or cr.	.....	28	.....	i.	s.	= eth., bz.
8546M	.....	.....	165-6	.....	.....	.....	.....
8550T	.....	.....	.....	.....	.....	.....	.....
8569M	.....	.....	.....	.....	.....	.....	.....
8600Q	col. or yel. liq.	.....	-4	143-4 ¹⁵	v. sl. s.	∞	∞ eth., bz.; s. HCl
8611M	.....	.....	.....	.....	.....	.....	.....
8611P	.....	.....	.....	.....	.....	.....	.....
8617J	.....	.....	.....	.....	.....	.....	.....
8626M	.....	.....	.....	.....	.....	.....	.....
8650M	.....	.....	.....	.....	.....	.....	.....
8659M	.....	.....	.....	.....	.....	.....	.....
8686M	.....	.....	.....	.....	.....	.....	.....
8690T	rhomb. nd. or tab. f. w.; [α] + 1.3° in dil. HCl	.....	ca. 245 d.	.....	sl. s.	sl. s.	i. eth.; s. a., alk.
8810J	.....	.....	.....	.....	.....	.....	.....
8831M	pl. f. al.	.....	218 d.	.....	s.	i.	i. eth., bz., et. acetate
8843T	yel. nd. f. w., lgr.	.....	45.5	265-6; 128 ¹⁰	i.	s.	s. eth., chl., lgr., ac. a.
8869P	.....	.....	.....	.....	.....	.....	.....
8869T	.....	.....	.....	.....	.....	.....	.....
8869U	yel. oil.	0.97 $\frac{25}{25}$	.....	140-45	i.	sl. s.	v. s. pet. eth.; s. acet., eth., bz., chl.

For explanations and abbreviations see beginning of table.

FORMULA INDEX OF ORGANIC COMPOUNDS

Numbers refer to compounds in the preceding table Physical Constants of Organic Compounds.

The arrangement of symbols in formulas is alphabetical except that C always comes first followed immediately by H if hydrogen is present. The arrangement of formulas is also alphabetical except that the number of atoms of any specific kind influences the order of compounds.

The numbers following any one formula are given in numerical order which is also their occurrence in the table of physical constants.

NOTE: the letter S preceding any compound number indicates that it is to be found in the **Supplement** to the table Physical Constants of Organic Compounds.

C		
C ₆ AgNO ₃ , 4062.	CH ₃ N ₂ S, 8768.	C ₂ HCl ₃ , 3867.
CBrCl ₃ , 5598.	CH ₃ N ₄ O ₂ , 4399.	C ₂ HClO ₃ , 323, 2665.
CB ₂ BrN, 2959.	CH ₃ O, 5719.	C ₂ HClO ₃ , 177.
CB ₂ NO ₃ , 1983.	CH ₃ O ₂ Si, 5710.	C ₂ HCl ₃ , 3539.
CB ₂ Br ₃ , 2586.	CH ₃ O ₂ Sn, 5711.	C ₂ HFO ₂ , 180M.
CClF ₃ , 5606M.	CH ₃ O ₃ S, 5712.	C ₂ H ₂ O ₂ , 181.
CCIN, 2960.	CH ₃ O ₄ S, 5769.	C ₂ HI ₃ , 3541.
CCl ₂ F ₂ , 5617.	CH ₃ O ₆ S ₂ , 5722.	C ₂ HNO ₂ , 6382.
CCl ₂ O, 6876.	CH ₃ S, 5715.	C ₂ H ₂ , 328.
CCl ₂ S, 6878.	CH ₃ As, 913.	C ₂ H ₂ Br ₂ , 3821.
CCl ₂ F, 5683.	CH ₃ AsO ₃ , 5701.	C ₂ H ₂ Br ₂ O, 320.
CCl ₃ NO ₂ , 2687.	CH ₃ N, 5729.	C ₂ H ₂ Br ₂ O ₂ , 133.
CCl ₄ , 2587.	CH ₃ NO, 4825, 5725.	C ₂ H ₂ Br ₃ , 3546, 3547.
CCl ₄ S, 5756.	CH ₃ N ₃ , 4391.	C ₂ H ₂ Cl ₂ , 3822, 3823,
CF ₄ , 2587M.	CH ₃ N ₃ O, 7880.	3823A.
CHBr ₃ , 1981.	CH ₃ N ₃ O ₄ , 8712M.	C ₂ H ₂ ClO, 18, 322.
CHClF ₂ , 5604M.	CH ₃ N ₃ S, 7884.	C ₂ H ₂ ClO ₂ , 135.
CHCl ₂ F, 5619.	CH ₃ O ₃ P, 5709.	C ₂ H ₂ ClNO, 49.
CHCl ₃ , 2679.	CH ₃ P, 6886.	C ₂ H ₂ Cl ₂ , 3548, 3549.
CHF ₃ , 3993.	CH ₃ CIN, 5730.	C ₂ H ₂ F ₂ , 3826M.
CHI ₃ , 4898.	CH ₃ CIN ₂ O, 7881.	C ₂ H ₂ F ₂ O ₂ , 138M.
CHN, 4783.	CH ₃ N ₂ , 4721.	C ₂ H ₂ I ₂ O ₂ , 139.
CHNO, 2952.	CH ₃ N ₄ , 4392.	C ₂ H ₂ N ₄ , 8161.
CHNS, 8185.	CH ₃ N ₄ O, 2558.	C ₂ H ₂ O, 5175.
CHN ₃ O ₆ , 6151.	CH ₃ Si, 7895.	C ₂ H ₂ O ₂ , 4363.
CH ₃ Br ₂ , 5743.	CIN, 2962.	C ₂ H ₂ O ₃ , 4373.
CH ₂ CINO, 2428.	Cl ₄ , 2588.	C ₂ H ₂ O ₄ ·2H ₂ O, 6343.
CH ₂ Cl ₂ , 5744.	(CN) _x , 6425.	C ₂ H ₂ Br, 8860.
CH ₂ F ₂ , 5746M.	CN ₄ O ₈ , 5675.	C ₂ H ₂ BrO, 319.
CH ₂ I ₂ , 5747.	CO, 2583.	C ₂ H ₂ BrO ₂ , 119.
CH ₂ N ₂ , 2947, 5613.	COF ₂ , 2589M.	C ₂ H ₂ Br ₃ , 3552.
CH ₂ N ₂ O ₂ , 4049.	COS, 2590.	C ₂ H ₂ Br ₄ O, 1977.
CH ₂ N ₂ O ₄ , 5634.	CO ₂ , 2563.	C ₂ H ₂ Cl, 8861.
CH ₂ N ₄ , 8163.	CS ₂ , 2565.	C ₂ H ₂ ClO, 321.
CH ₂ O, 3995.		C ₂ H ₂ ClO ₂ , 123, 4042.
(CH ₂ O) _x , 7050.	C ₂	C ₂ H ₂ ClNO, 36.
CH ₂ O ₂ , 4016.	C ₂ Br ₂ , 336H.	C ₂ H ₂ Cl ₃ , 3553, 3555.
CH ₂ S ₃ , 2579.	C ₂ Br ₆ , 3529.	C ₂ H ₂ ClO, 3633.
CH ₃ AsCl ₂ , 910.	C ₂ ClF ₃ , 3502M.	C ₂ H ₂ ClO ₂ , 2668.
CH ₃ AsO, 902.	C ₂ Cl ₂ F ₄ , 3510R, 3511.	C ₂ H ₂ F, 8863M.
CH ₃ Br, 5734.	C ₂ Cl ₂ O ₂ , 6363.	C ₂ H ₂ FO, 356.
CH ₃ Cl, 5738.	C ₂ Cl ₃ F ₃ , 3555R, 3556.	C ₂ H ₂ FO ₂ , 149M.
CH ₃ ClHg, 5544.	C ₂ Cl ₄ , 3862.	C ₂ H ₂ F ₃ , 3557M.
CH ₃ ClO ₂ S, 5713.	C ₂ Cl ₄ F ₂ , 3549K,	C ₂ H ₂ I, 8864.
CH ₃ Cl ₃ Sn, 8319.	3549P.	C ₂ H ₂ IO, 357.
CH ₃ F, 5750.	C ₂ Cl ₄ O, 325.	C ₂ H ₂ IO ₂ , 154.
CH ₃ I, 5752.	C ₂ Cl ₄ O ₂ , 3339.	C ₂ H ₂ I ₃ , 3558.
CH ₃ NO, 3999, 4003.	C ₂ Cl ₅ F, 3539M.	C ₂ H ₂ N, 250, 5754.
CH ₃ NO ₂ , 5661, 5759.	C ₂ Cl ₆ , 3530.	C ₂ H ₂ NO ₃ , 6365.
CH ₃ NO ₃ , 5758.	C ₂ F ₄ , 3862M.	C ₂ H ₂ NS, 5135, 8197.
CH ₃ NS ₂ , 2415.	C ₂ F ₆ , 3530M.	C ₂ H ₂ N ₃ , 8563.
CH ₃ N ₃ O ₃ , 8755.	C ₂ HBr, 333.	C ₂ H ₄ , 3809.
CH ₄ , 5584.	C ₂ HBr ₂ , 3866.	C ₂ H ₂ BrCl, 3495.
CH ₄ N ₂ O, 4004, 4048,	C ₂ HBr ₃ O, 1976.	C ₂ H ₂ BrNO, 33.
8711.	C ₂ HBr ₃ O ₂ , 176.	C ₂ H ₂ Br ₂ , 3505, 3871.
CH ₄ N ₂ O ₂ , 8747.	C ₂ HBr ₄ , 3538.	C ₂ H ₂ CINO, 34.
	C ₂ HCl, 336.	C ₂ H ₂ CINO ₂ , S3502F.
		C ₂ H ₂ Cl ₂ , 3507, 3874.

FORMULA INDEX OF ORGANIC COMPOUNDS (Continued)

$C_2H_4Cl_2O$, 3607, 3670.	C_2H_5BrN , 3788.	C_3H_5Cl , 478, 7221, 7222.
$C_2H_4F_2$, 3512L, 3891H.	C_2H_5ClN , 3278, 3789.	C_3H_5ClO , 3454, 7200, 7246, 7246C, 7324.
$C_2H_4I_2$, 3513, 3894.	C_2H_5IN , 3789M.	$C_3H_5ClO_2$, 126, 4059, 7301, 7303.
$C_2H_4N_2O_2$, 4370, 6371.	$C_2H_5N_2$, 3879, 4713.	$C_3H_5ClNO_3$, 7178H, 7192.
$C_2H_4N_2O_3$, 262.	$C_2H_5N_2 \cdot H_2O$, 3880.	C_3H_5Cl , 7139.
$C_2H_4N_2O_4$, 3516, 4303.	C_2H_5Si , 7892.	C_3H_5F , 487.
$C_2H_4N_2O_6$, 4302.	$C_2H_{10}Cl_2N_2$, 3881.	C_3H_5FO , 7325M.
$C_2H_4N_4$, 4394.	C_2I_2 , 336R.	C_3H_5I , 488.
$C_2H_4N_4O_2$, 985, 8710.	C_2I_4 , 3863.	C_3H_5IO , 3459, 7326.
C_2H_4O , 10, 3899, 8858.	C_2N_2 , 2958.	$C_3H_5IO_2$, 7312, 7313.
$(C_2H_4O)_4-6$, 5575.	C_2N_2S , 8191.	C_3H_5N , 3913, 7319.
C_2H_4OS , 173.	$C_2N_4O_6$, 260.	C_3H_5NO , 384M, 2953, 4683, 5027, 5300.
$C_2H_4O_2$, 86, 4031, 4343.	C_3	$C_3H_5NO_2$, 7612.
$C_2H_4O_2S$, 160.	$C_3Cl_3N_3$, 2968.	$C_3H_5NO_4$, 5430.
$C_2H_4O_3$, 4346.	$C_3H_2Br_2$, 7374M.	C_3H_5NS , 5131, 8193.
$C_2H_4O_3S$, 171.	$C_3H_2Cl_2O \cdot 2H_2O$, 7206.	$C_3H_5N_2O_3$, 6361.
$C_2H_4O_3S_2$, 3781.	$C_3H_2N_2$, 5469.	$C_3H_5N_2O_6$, 4258.
C_2H_4S , 3900M.	$C_3H_2N_2O_3$, 6419.	$C_3H_5N_3O$, 6152.
C_2H_5Br , 3804.	C_3H_2O , 7257.	$C_3H_5N_3O_2$, 512.
C_2H_5BrO , 3601.	$C_3H_2O_2$, 7258.	C_3H_5O , 3062, 7217.
C_2H_5Cl , 3806.	$C_3H_2O_3$, 5567.	C_3H_5BrCl , 7079, 7080.
C_2H_5ClHg , 5543.	C_3H_3Br , 7373.	$C_3H_5Br_2$, 7091, 7092, 7093, 7094.
C_2H_5ClO , 3605, 3691.	C_3H_3BrO , 5425.	$C_3H_5Br_2O$, 7177.
$C_2H_5ClO_2S$, 3583.	C_3H_3Cl , 7374.	$C_3H_5ClNO_2$, S7090F, S7090M.
C_2H_5F , 3903.	C_3H_3ClO , 406H.	$C_3H_5Cl_2$, 7096, 7097, 7098, 7099.
C_2H_5FO , 3617M.	$C_3H_3ClO_2$, 389, 390.	$C_3H_5Cl_2O$, 7178, 7191.
C_2H_5I , 3912.	$C_3H_3ClO_3$, 5439.	$C_3H_5F_2$, 7099M.
C_2H_5N , 3901, 8859.	$C_3H_3Cl_2O_2$, 179.	C_3H_5I , 7100.
C_2H_5NO , 14, 31.	$C_3H_3Cl_2O_3$, 5294.	$C_3H_5N_2$, 7452.
$C_2H_5NO_2$, 2398, 3537, 3918, 4269, 4344.	C_3H_3I , 7375T, 7376.	$C_3H_5N_2O$, 8739, 8740.
$C_2H_5NO_3$, 3627, 3917.	C_3H_3N , 406.	$C_3H_5N_2OS$, 8716.
C_2H_5NS , 47.	C_3H_3NO , 7616.	$C_3H_5N_2O_2$, 5420, 8714.
C_2H_5NaS , 3587.	$C_3H_3NO_2$, 129.	$C_3H_5N_2O_3$, 4674.
C_2H_6 , 3488.	$C_3H_3NO_2S$, 159.	$C_3H_5N_2O_4$, 2420.
C_2H_6AsCl , 2276.	C_3H_3NS , 8177.	$C_3H_5N_2O_7 \cdot \frac{1}{2}H_2O$, 4235.
$C_2H_6AsCl_3$, 2281.	$C_3H_3N_2O_3$, 2946, 2965, 4063.	$C_3H_5N_6$, 5494.
C_2H_6Cd , 2284.	$C_3H_3N_2S_3$, 8200.	C_3H_5O , 213, 468, 7240, 7266.
C_2H_6Hg , 5537.	C_3H_4 , 7062, 7372.	$C_3H_5OS_2$, 8884.
$C_2H_6N_2$, 50.	$C_3H_4Br_2$, 7225.	$C_3H_5O_2$, 103, 207, 4022, 4268, 7277.
$C_2H_6N_2O$, 3382, 8753.	$C_3H_4Br_2O_2$, 7306.	$C_3H_5O_3$, 161, 2572, 4223, 4315, 4349, 4681, 5283, 5290, 7202M, 8651.
$C_2H_6N_2O_2$, 3281.	C_3H_4ClN , S7319T.	$C_3H_5O_4$, 4224.
$C_2H_6N_2S$, 8754.	$C_3H_4Cl_2$, 7226, 7227.	C_3H_5S , 7241.
$C_2H_6N_2O \cdot H_2O$, 1927.	$C_3H_4Cl_2O$, 7201, 7202.	$C_3H_5S_2$, 4001.
$C_2H_6N_4O$, 8746.	$C_3H_4N_2$, 4851, 7449.	C_3H_5Br , 5100, 7343.
C_2H_6O , 3785, 5749.	$C_3H_4N_2O$, 7456.	C_3H_5BrO , 7174.
C_2H_6OS , 5768M.	$C_3H_4N_2OS$, 4678.	C_3H_5Cl , 5101, 7344.
$C_2H_6O_2$, 4290.	$C_3H_4N_2O_2$, 4675.	C_3H_5ClO , 7176, 7189.
$C_2H_6O_2S$, 3579, 5767M.	$C_3H_4N_2O_3$, 455.	$C_3H_5ClO_2$, 7148.
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C₆H₄CIO₃S, 1384.
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C₆H₅O₈S₃, 1406.
C₆H₅S, 6804.
C₆H₅S₂, 4809, 7761.
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C₆H₇BrN₂, 4699.
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C₆H₇N, 571, 6961, 6962, 6963.
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C₆H₁₁ClO, 2374.
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C₆H₁₁NS, 5125, 5132, 8194.
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C₆H₁₃I, 4570.
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C₇H₁₁NO₂·H₂O, 886.
C₇H₁₂, 2981, 3032, 4450, 4515, 4516, 4516F.
C₇H₁₂O, 2980, 3025, 3026, 3027, 4651H, 4651R, 6596H.
C₇H₁₂O₂, 385K, 2221, 3005, 4632, 4979, 5580N, 5580U.
C₇H₁₂O₃, 198, 3006, 5349.
C₇H₁₂O₄, 5422, 5453, 6982, 8034.
C₇H₁₂O₅, 4231.
C₇H₁₂O₆, 5569, 7633.
C₇H₁₂BrN₂O₂, 406R.
C₇H₁₂BrO₃, 8812.
C₇H₁₂N, S3445D.
C₇H₁₂NO, 7014.
C₇H₁₂NO₂·H₂O, 7931.
C₇H₁₄, 2115, 2978, 3002, 4495, 4496, 4497, 4619, 4620, 4621, 4622, 4624, 4625, 4626, 4627, 4630, 6565, 6566, 6567, 6568, 6573, 6574, 6575, 6576, 6577.
C₇H₁₄N₂O₄, 5426.
C₇H₁₄N₂O₄S₂, S3382M.
C₇H₁₄O, 2979, 3020, 3021, 3022, 3435, 4489, 4490, 4492, 4611, 4615, 6559.
C₇H₁₄O₂, 89, 99, 2235, 2248, 2355, 2364, 2365, 3487, 4026, 4088, 4984, 4987, 5145, 7280, 7285, 8798, 8814, 8815.
C₇H₁₄O₃, 2574, 5285.
C₇H₁₄O₆, 4202, 4203.
C₇H₁₄O₇, 4184, 5484.
C₇H₁₆Br, 4459.
C₇H₁₆Cl, 4460.
C₇H₁₆I, 4465.
C₇H₁₆N, 3041, 6592M, 7018, 7020, 7021, 7022.
C₇H₁₆NO, 3436, 4612, 7035, 8793H.
C₇H₁₆NO₂, 2418, 4513.
C₇H₁₆, 2041, 4458, 4571, 4572, 6493, 6494, 6495, 6496, 6498.
C₇H₁₆BrNO₂, 2696.
C₇H₁₆O, 2092, 3660, 3726, 4478, 4481, 4484, 4599, 4600, 4602, 4603, 4607, 4608, 6539, 6546, 6547, 6549, S3682M, S3753J.
C₇H₁₆O₂, 4475, 5640.
C₇H₁₆O₃, 6331.
C₇H₁₆O₄S₂, 7076.
C₇H₁₆O₇, 6602.
C₇H₁₆S, 4476.
C₇H₁₇N, 530M, 4503, 4641M.
C₇H₁₈O₃Si, S5707M.

C₈

C₈Br₂S₂, 1920.
C₈H₂Cl₄O₄, 6926.
C₈H₄ClNO, 4918.
C₈H₄Cl₂O₂, 5094, 6950, 8130.
C₈H₄N₂, 5093, 8129.
C₈H₄N₂O₄, 4916.
C₈H₄O₂S, 8209.
C₈H₄O₃, 6933.
C₈H₅BrO, 6915.
C₈H₅ClO₄, 6916.
C₈H₅NO, 1730.
C₈H₅NO₂, 1506, 1721, 4912, 6943.
C₈H₅NO₃, 4919.
C₈H₅NO₄, 6942.
C₈H₅NO₅, 4376.
C₈H₅NO₆, 6924, 6925, 7509H, 7509K, 7512, 8128, 8623.
C₈H₅NO₆·1½H₂O, 1790, 2554, 5092.
C₈H₆, 1220.
C₈H₆Br₂O, 283.
C₈H₆Br₂O₂, 6874M, 8965M.
C₈H₆Cl₂NO, S83M.
C₈H₆HgO₂, 5535.
C₈H₆I₂O₃, 8843H.
C₈H₆N₂, 7630, 7733.
C₈H₆N₂O, 4850.
C₈H₆N₂O₂, 4892, 8524, 8525.
C₈H₆N₂O₃, 8472, S1540T.
C₈H₆N₄O₃, 466.
C₈H₆O, 1437.
C₈H₆O₂, 5079, 6898, 6936, 8117.
C₈H₆O₃, 4377, 5080, 6899, 7040, 8118.
C₈H₆O₄, 5081, 5082, 5083, 5084, 6908, 7042, 8119, 8120.

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- C₈H₆O₅**, 5088, 5089, 5090, 6922, 6923.
C₈H₆O₆, 8126.
C₈H₈S, 8208.
C₈H₈S₂, 1919.
C₈H₈Br, 7992, 7993.
C₈H₈BrO, 274M, 275, 276.
C₈H₈BrO₃, 8842.
C₈H₈Br₂O, 8946M, 8947M.
C₈H₈Cl, 7994, 7995, S7993T, S7993U, S7993V.
C₈H₈ClO, 279M, 280, 281, 8528.
C₈H₈ClO₂, 731.
C₈H₈ClO₃, 8843.
C₈H₈F, S7995M, S7995N, S7995P.
C₈H₇IO₃, 8843M, 8843N.
C₈H₇N, 4881, 8518, 8519, 8520, 8522.
C₈H₇NO, 1719, 4891, 5029, 5479, 6383, 6946.
C₈H₇NO₂, 6384, 7999, 8000, 8001, S8001C.
C₈H₇NO₃, 296, 4910, 6376.
C₈H₇NO₄, 1577, 1580, 1583, 8482, 8789.
C₈H₇NS, 1705, 5126, 5138, 5139.
C₈H₇N₂O₂, 5374.
C₈H₇N₂O₅, 64.
C₈H₇N₂O₈, 8924, 8939.
C₈H₈, 7991.
(C₈H₈)_x, 5577.
C₈H₈BrNO, 57, 58, 59.
C₈H₈Br₂, 8896, 8912, 8929.
C₈H₈ClNO, 60, 61, 62.
C₈H₈Cl₂, 8897, 8913, 8930.
C₈H₈INO, 71.
C₈H₈N₂, 2948, 8521.
C₈H₈N₂OS, 8721.
C₈H₈N₂O₂, 6901, 7793.
C₈H₈N₂O₃, 76, 77, 78.
C₈H₈N₂O₄, 4279, 8901, 8902, 8903, 8904, 8917, 8933, 8934, 8935.
C₈H₈N₄O₄, 13M.
C₈H₈N₆O₆·H₂O, 5803.
C₈H₈O, 267, 3774, 6815, 6816, 8327, 8328, 8329, 8330.
C₈H₈O₂, 287, 701, 1065, 1461, 2137, 4019, 6668, 6874, 8440, 8451, 8458, 8464, 8964, 8965, S286W, S286X.
C₈H₈O₃, 166, 285, 705, 1570, 1571, 2895, 2896, 2897, 2898, 2899, 2900, 2901, 2902, 2903, 2904, 4103, 5162, 5475, 7041, 7737, 7836, 8445, 8473, 8474, 8475, 8838, S8843T.
C₈H₈O₄, 2986, 3132, 4157, 6325, 6917, 6918, 6919, 8836.
C₈H₈O₅, 3134, 4117.
C₈H₈Br, 1136, 8893, 8894, 8909, 8910, 8926, 8927.
C₈H₈BrO, 6658.
C₈H₈Cl, 8895, 8911, 8928.
C₈H₈ClO, 6659, 6660, S6660C.
C₈H₈N, 7461.
C₈H₈NO, 52, 268, 271, 272, 273, 8331, 8332, 8333.
C₈H₈NO₂, 66, 67, 68, 703M, 775, 1215, 1216, 1217, 1477, 2394, 4280, 8470, 8471, 8906, 8907, 8921, 8922, 8923, 8938.
C₈H₈NO₃, 6661, 6662, 6663.
C₈H₈NS, 83.
C₈H₁₀, 1210, 8892, 8908, 8925.
C₈H₁₀BrN, 597.
C₈H₁₀Cl₂HgN₄O₂, 2293.
C₈H₁₀N₂, 15, 1325.
C₈H₁₀N₂O, 54, 55, 56, 625, 4691, 8722.
C₈H₁₀N₂O₂, 622, 623, 624, 4273.
C₈H₁₀N₂O₃, 6654.
C₈H₁₀N₂S, 8723.
C₈H₁₀N₄O₂, 2286.
C₈H₁₀O, 1751, 2533, 2534, 2535, 3665, 3766, 3767, 3768, 6645, 6655, 6760, 6761, 6873, 8942, 8943, 8944, 8945, 8946, 8947.
C₈H₁₀O₂, 732, 1195, 1196, 1748, 2864, 3629M, 4806, 4807, 4808, 6756, 6757, 6758, 7756, 7757, 7758, 7759, 7762, 8850, 8976, 8977, 8978.
C₈H₁₀O₂S, 8079.
C₈H₁₀O₄, 2917, 4113, 4137, 4147P, 6742, 6743, 6744, 8844, S5580W.
C₈H₁₀O₈S, 8941, S8434M.
C₈H₁₀O₄, 3034, 6344.
C₈H₁₁BrN₂O₂·2H₂O, 2290.
C₈H₁₁ClN₂O₂·2H₂O, 2291.
C₈H₁₁I₂N₄O₂·1½H₂O, 2289.
C₈H₁₁N, 440, 621, 632, 633, 634, 635, 1761, 2815, 2816, 2817, 2836, 6646, 7483, 7484, 8490, 8501, 8514, 8957, 8958, 8959, 8960, 8961, 8962.
C₈H₁₁NO, 1760M, 3599, 6650, 6651, 6652, 6746, 6762, 6763, 6764, 8690.
C₈H₁₁NO₃, 8868S.
C₈H₁₁N₂O, 8770, 8771, 8772.
C₈H₁₁N₂S, 8769.
C₈H₁₂, 2330.
C₈H₁₂ClN, 621M.
C₈H₁₂CINO₃, 8868U.
C₈H₁₂Cl₆N₂O₄, 189.
C₈H₁₂N₂, 4715, 4716, 4741, 4742, 6838, 6842, 6847.
C₈H₁₂N₂O₃, 1012.
C₈H₁₂N₂O₆S, 2295.
C₈H₁₂O₃, 3008, 3009, 3151, 4065, 5400.
C₈H₁₂O₅, 6338.
C₈H₁₃NO₂, 888.
C₈H₁₄, 2835, 4543, 6301, 6301F, 6301J, 6301M.
C₈H₁₄BrNO₂, 889.
C₈H₁₄CINO₂, 890.
C₈H₁₄O, 3024, 4498, 4617.
C₈H₁₄O₃, 3018, 5144, 5580D, 5580K.
C₈H₁₄O₃, 2260, 4994.
C₈H₁₄O₄, 4306, 5458, 6351, 8008, 8022, 8043.
C₈H₁₄O₅, 5414.
C₈H₁₄O₆, 8094M, 8098, 8105M, 8106M.
C₈H₁₅ClO, 2392.
C₈H₁₅N, 2391, 2821, 2822, 2823, 2825, 7039, 7404.
C₈H₁₅NO, 6453, 7422, 8683.
C₈H₁₆, 2992, 2993, 3268, 4629, 6293, S6277J, S6277K, S6277Q, S6277R.
C₈H₁₆Cl₂N₂O₄, 128.
C₈H₁₆N₂O, 4277.
C₈H₁₆N₂O₄, 2417, 8026.
C₈H₁₆N₂S₄, 3358.

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- C₃H₁₆O**, 2347, 2375, 3652, 4491, 4494, 4497M, 4633, 6274, 6275.
C₃H₁₆O₂, 98, 2083, 2224, 2231, 2353, 2361, 2381, 3440, 4025, 4983, 5151, 6542, 7279, 7284, 8804.
C₃H₁₆O₃, 2387, 5011.
C₃H₁₆O₄, 3238, 6430.
C₃H₁₇Br, 6248, 6249.
C₃H₁₇Cl, 6250, 6251.
C₃H₁₇I, 6254.
C₃H₁₇N, 2830, 3039, 7030.
C₃H₁₇NO, 2376, 2377, 2819, 7403.
C₃H₁₇NO₂, 2386, 5796, 6299.
C₃H₁₇NO₃, 6298.
C₃H₁₈, 2040, 4467, 4468, 4469, 4564, 4565, 4566, 4567, 4569, 6245, 6499, 6500, 6511.
C₃H₁₈CIN, 2831.
C₃H₁₈CINO₂, 2697.
C₃H₁₈Hg, 5536.
C₃H₁₈N₂O₄, 105.
C₃H₁₈O, 2178, 2179, 3725, 3746, 4482, 4483, 4487, 4596, 4605, 4963, 6265, 6271, 6544, 6550, S3680Q, S3751J.
C₃H₁₈OS, 2196R.
C₃H₁₈O₂, 6260, 6261.
C₃H₁₈O₂S, 2196H.
C₃H₁₈O₃, 3235, 3672, 6327.
C₃H₁₈O₄S, 2194, 4972.
C₃H₁₈O₄S₂, 8650.
C₃H₁₈S, 2195, 2196, 4973.
C₃H₁₈S₂, 2172.
C₃H₁₉N, 3202, 3267, 4504, 6286.
C₃H₁₉NO₂, 3792.
C₃H₂₀As₂, 1805.
C₃H₂₀BrN, 515.
C₃H₂₀OSi, 7893.
C₃H₂₀O₃Si, S3578M.
C₃H₂₀O₄Si, 3923.
C₃H₂₀Pb, 5326.
C₃H₂₀Si, 7896.
C₃H₂₀Sn, 8304.
C₃H₂₁NO, 519.
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C₃H₅Cl₂N, 7665, 7666, 7667, 7668.
C₃H₅NO₄, 7262, 7263.
C₃H₅NO₈, 7508M, 7508P, 7508R.
C₃H₅Br₂O₂, 2777.
C₃H₅ClN, 7661, 7662, 7663.
C₃H₅N₂O₂, 5115, 7685, 7686, 7687, 7688.
C₃H₅N₂O₃S, 1021.
C₃H₅OS₂, 8180.
C₃H₅O₂, 2700, 2855, 5024, 7264.
C₃H₅O₃, 2854, 8697.
C₃H₅O₄, 3092, 3476.
C₃H₅O₅, 6947.
C₃H₅O₆, 4421, 8620, 8621.
C₃H₅O₇, 8622.
C₃H₇BrO₂, 2753, 2754.
C₃H₇ClO, 2782.
C₃H₇N, 5114, 7657.
C₃H₇NO, 252, 2591, 5012, 7703, 7704, 7706, 7708.
C₃H₇NO·3H₂O, 7701.
C₃H₇NO₂, 4914, 4915.
C₃H₇NO₃, 4893.
C₃H₇NO₄, 2768, 2770, 2773.
C₃H₈, 4866, 7378.
C₃H₈Br₂O₂, 4774.
C₃H₈N₂, 7658, 7659.
C₃H₈N₂O₆, S1540H.
C₃H₈O, 2737, 4863, 4864.
C₃H₈O₂, 938, 2740, 2776, 5018.
C₃H₈O₃, 116, 1469, 1470, 2848, 2850, 2851.
C₃H₈O₄, 933, 2285, 2758, 4351, 4666, 8696, 8788.
C₃H₈O₅, 1502.
C₃H₈BrO, 277.
C₃H₈Br₂NO₃·2H₂O, S8690T.
C₃H₈Br₃, 5559.
C₃H₈Cl, 7224.
C₃H₈I₂NO₃, 4900, 4901.
C₃H₈N, 4883, 7914.
C₃H₈NO, 2737M, 4761.
C₃H₈NO₂, 2749, 2751, 2752.
C₃H₈NO₃, 776, 1466, 1467, 4652.
C₃H₈NO₄, 779, 1576, 1579, 1582.
C₃H₈NO₅, S7998M.
C₃H₈N₃O₂S₂, S8050T.
C₃H₈N₃O₄S₂, 2411.
C₃H₈N₃O₆, 4420, 5560, 7408.
C₃H₈O₃, S312M.
C₃H₁₀, 1245, 1273, 4862.
C₃H₁₀N₂, 7453.
C₃H₁₀N₂O₃, 75.
C₃H₁₀N₂O₄, 5555.
C₃H₁₀O, 295, 728, 729, 730, 734, 2658, 2778, 3655, 4765, 7205, 7327, S294X, S2698M.
C₃H₁₀O₂, 90, 294, 1454, 1544, 1545, 1546, 2867, 4418, 4520, 4689, 4766, 5163, 5562, 8442, 8460, 8467, 8477, 8478, 8479, 8952, 8954, 8955, S293X, S293Y, S7329J.
C₃H₁₀O₃, 707, 936, 1054, 1541, 1542, 1543, 4102, 5499, 6597, 6862, 7329, 7832, 8681, 8846, S7315M.
C₃H₁₀O₄, 150M, 3957, 8847, S8091F.
C₃H₁₀O₅, 4122, S8091H.
C₃H₁₁N, 576, 3790, 7692.
C₃H₁₁NO, 32, 73, 307, 309, 311, 1056, 7273.
C₃H₁₁NO₂, 69, 70, 84, 85, 429, 432, 434, 774, 780, 781, 1433, 1548, 1549, 2430, 2927, 4772, 5558, 7406, 7407, S83T.
C₃H₁₁NO₃, 8692, 8693, 8694.
C₃H₁₁NO₄, S419S.
C₃H₁₂, 1276, 2925, 4419, 5552, 7405, 8385, 8386, 8387.
C₃H₁₂N₂, 219, S6214M.
C₃H₁₂N₂O, 8741.
C₃H₁₂N₂O₂, 8758.
C₃H₁₂O, 3664, 3739, 3740, 3741, 3755, 3773, 5551, 6772, 6773, 6799, 6800, 6801, 7184, 7185, 7194, 7409.
C₃H₁₂O₂, 3600, 4813M, 5565, 6796, 6797, 6798, 7767, 7774.
C₃H₁₂O₃, 1311, 1312, 4136, 4147E, 4147F, 5572.
C₃H₁₃N, 637, 680, 681, 682, 2932, 5550, 6440, 6441, 7410, 8489, 8500, 8513, S522M.
C₃H₁₃NO₂, 568.
C₃H₁₃NO₃, 418.
C₃H₁₃N₃· $\frac{1}{2}$ H₂O, 1822.
C₃H₁₄CINO₂, 569.
C₃H₁₄O, 6875, S5078T.
C₃H₁₄O₂, 385P, 3680, 6302.
C₃H₁₄O₃, 4084.
C₃H₁₄O₅, 5427.

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- $C_9H_{14}O_6$, 2324, 4250.
 $C_9H_{13}O_7$, 2794.
 $C_9H_{15}NO$, 7420.
 $C_9H_{15}NO_3 \cdot H_2O$, 3412.
 $C_9H_{15}NO_6$, 7932.
 C_9H_{16} , 4450M, 6204, 6238T.
 $C_9H_{16}ClNO_3$, 3413.
 $C_9H_{16}O_3$, 197.
 $C_9H_{16}O_4$, 951, 4214, 5424, 5445, 5447.
 $C_9H_{17}ClO$, 6452.
 $C_9H_{17}N$, 6451, 7664.
 $C_9H_{17}NO \cdot H_2O$, 8549.
 $C_9H_{17}NO_5$, 6415M.
 C_9H_{18} , 3000, 3004, 6195.
 $C_9H_{18}O$, 4493, 6190, 6191, 6192, S6560M.
 $C_9H_{18}O_2$, 97, 2222, 2230, 2384, 3438, 4032, 4079, 4980, 4982, 5147, 6448, 8797, 8800.
 $C_9H_{18}O_3$, 2567, 2571.
 $C_9H_{19}N$, 7017M.
 $C_9H_{19}NO$, 6445, 6446.
 C_9H_{20} , 4461, 4463, 6178, 6255.
 $C_9H_{20}N_2O$, 8765.
 $C_9H_{20}O$, 3724, 4485, 4486, 4606, 6183, 6185, 6186, 6187, 6188, 6272, S3680J.
 $C_9H_{20}O_2$, 6180.
 $C_9H_{20}O_4$, 6328.
 $C_9H_{20}O_4S_2$, 8165.
 $C_9H_{21}Br$, 1949.
 $C_9H_{21}BO_3$, 7342.
 $C_9H_{21}N$, 6198, 8660.
 $C_9H_{21}O_4P$, S7367M.
 $C_9H_{22}N_2S_2$, 2407.
- C_{10}
- $C_{10}H_4N_4O_6$, 5891, 5892, 5893.
 $C_{10}H_5NO_{10} \cdot 2H_2O$, 7507.
 $C_{10}H_5N_3O_6$, 5894, 5895, 5896, 5897.
 $C_{10}H_6Br_2O$, 5968, 5991.
 $C_{10}H_6ClNO_2$, 5845, 5846.
 $C_{10}H_6Cl_2$, 5850, 5851, 5852, 5853, 5854, 5855, 5856, 5857, 5858, 5859.
 $C_{10}H_6Cl_4O$, 5969.
 $C_{10}H_6N_2O_2$, 7543.
 $C_{10}H_6N_2O_4$, 5865, 5866, 5867.
 $C_{10}H_6N_2O_5$, 5970, 5992.
 $C_{10}H_6O_2$, 6028, 6033, 6039.
 $C_{10}H_6O_3$, 5172, 6031, 6032, 6037.
 $C_{10}H_6O_3S$, 6015.
 $C_{10}H_6O_4$, 4146, 5072, 5933.
- $C_{10}H_6O_5$, 5504, 7054, 7557.
 $C_{10}H_7Br$, 5840, 5841.
 $C_{10}H_7BrO$, 5988.
 $C_{10}H_7Cl$, 5842, 5843.
 $C_{10}H_7ClO$, 5990.
 $C_{10}H_7ClO_2S$, 5926, 5927.
 $C_{10}H_7F$, 5870K, 5870M.
 $C_{10}H_7I$, 5874, 5875.
 $C_{10}H_7NO_2$, 2731M, 5883, 5884, 5973, 5974, 5997, 7620M, 7698K, 7698P, 7698R, 7698T, 7698V.
 $C_{10}H_7NO_3$, 5279, 5971, 5972, 5994, 5995, 5996, 7416.
 $C_{10}H_8$, 5833.
 $C_{10}H_8Cl_4$, 5889.
 $C_{10}H_8NNaO_5S$, 6017.
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- C₁₁H₁₀N₂S**, 8249.
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5993.
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- C₁₁H₁₀S**, 8234.
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7673, 7674, 7675.
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- C₁₁H₁₂O**, 5199.
- C₁₁H₁₂O₂**, 2137M,
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- C₁₁H₁₂NO₂**, 4787.
- C₁₁H₁₂NO₃**, 4686.
- C₁₁H₁₂NO₃S**, 4687.
- C₁₁H₁₂N₃O₆**, 8352.
- C₁₁H₁₂N₂·½H₂O**, 5001.
- C₁₁H₁₂N₂O**, 3089.
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1241, 1252, 1263,
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- C₁₁H₁₆O**, 2086, 3662,
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3686, 3751, 6694,
6695, 6771, 6790,
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- C₁₁H₁₆O₂**, 6691, 6692,
6693, 7750, 7764.
- C₁₁H₁₆O₃**, 4147K.
- C₁₁H₁₇ClN₂O₂**, 6977.
- C₁₁H₁₇N**, 647, 675,
8488, 8512.
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 $C_{18}H_{15}O_4P$, S6858M.
 $C_{18}H_{15}P$, 6892.
 $C_{18}H_{16}N_2$, 4740.
 $C_{18}H_{16}N_2O_2$, 561.
 $C_{18}H_{16}O_2$, 7990.
 $C_{18}H_{16}O_4$, 4921.
 $C_{18}H_{16}O_7$, 8785, 8786.
 $C_{18}H_{17}Cl_4N_3O_8S_2$, S4658J.
 $C_{18}H_{18}$, 7785.
 $C_{18}H_{18}N_2O_4$, 7860.
 $C_{18}H_{18}O_3$, 2234.
 $C_{18}H_{18}O_4$, 3306, 8021.
 $C_{18}H_{19}NO_2$, 870.
 $C_{18}H_{19}NO_3$, 1026, 2941.
 $C_{18}H_{19}NO_3 \cdot 2H_2O$, 1783.
 $C_{18}H_{20}ClNO_3$, 1027.
 $C_{18}H_{20}O_2$, S7982Q.
 $C_{18}H_{21}NO_3$, 5020, 7402.
 $C_{18}H_{21}NO_3 \cdot H_2O$, 2807.
 $C_{18}H_{22}ClNO_3 \cdot 2H_2O$, 2808.
 $C_{18}H_{22}N_2O_5$, 6979.
 $C_{18}H_{22}N_4O_4$, 4199.
 $C_{18}H_{22}O_2$, S3479T.
 $C_{18}H_{23}N_3$, 947.
 $C_{18}H_{24}NO_7P \cdot 2H_2O$, 2809.
 $C_{18}H_{24}O_2$, S3478M.
 $C_{18}H_{24}O_3$, S3479Q.
 $C_{18}H_{26}N_2O_{12} \cdot 2H_2O$, 6133.
 $C_{18}H_{27}NO_3$, 3945.
 $C_{18}H_{28}O_2$, 5314M.
 $C_{18}H_{29}NO$, S5308T.
 $C_{18}H_{30}$, 1226.
 $C_{18}H_{30}Br_6O_3$, 7958.
 $C_{18}H_{30}O_2$, 3429, 3430, 5366.
 $C_{18}H_{30}O_4$, S950J.
 $C_{18}H_{32}Br_4O_2$, 7965.
 $C_{18}H_{32}O_2$, 2656, 3423, 5361, 7970.
 $C_{18}H_{32}O_4$, 7973.
 $C_{18}H_{32}O_5$, S950H.
 $C_{18}H_{32}O_{16} \cdot 5H_2O$, 7736.

$C_{18}H_{32}NO_{16}Ca$, 2296T.
 $C_{18}H_{34}$, 6236M.
 $C_{18}H_{34}Br_2O$, 3424.
 $C_{18}H_{34}O_2$, 3423, 6305.
 $C_{18}H_{34}O_3$, 7794.
 $C_{18}H_{35}ClO$, 7974.
 $C_{18}H_{35}N$, 7972.
 $C_{18}H_{35}NO$, 6304.
 $C_{18}H_{36}N_2S_4$, 3355.
 $C_{18}H_{36}N_2S_4Zn$, 2405.
 $C_{18}H_{36}O$, 6233M, 7941.
 $C_{18}H_{36}O_2$, 93, 2338, 6405, 7943.
 $C_{18}H_{36}O_3$, 4318, 7960, 7961, 7962, 7963, 7964.
 $C_{18}H_{36}O_4$, 7955, 7956.
 $C_{18}H_{37}Br$, 6224M.
 $C_{18}H_{37}I$, 6224T.
 $C_{18}H_{37}NO$, 7942.
 $C_{18}H_{38}$, 6224.
 $C_{18}H_{38}N_2O_4$, 3442.
 $C_{18}H_{38}O$, 6228.
 $C_{18}H_{38}O_4S$, 6203.
 $C_{18}H_{38}S$, S6225M.
 $C_{18}H_{39}N$, 6234H.
 $C_{18}H_{40}ClN$, S6234M.

C_{19}

$C_{19}H_{13}N$, 376.
 $C_{19}H_{13}N_3O_6$, 5700.
 $C_{19}H_{13}N_3O_7$, 2543.
 $C_{19}H_{14}O_2$, 405, 1109.
 $C_{19}H_{14}O_3$, 949.
 $C_{19}H_{15}$, 5726.
 $C_{19}H_{15}Cl$, 5608.
 $C_{19}H_{15}N_3 \cdot 2H_2O$, 2704.
 $C_{19}H_{16}$, 1854, 1855, 5697.
 $C_{19}H_{16}N_2$, 1652.
 $C_{19}H_{16}O$, 2540.
 $C_{19}H_{16}O_3$, 1109, 5339, 6334.
 $C_{19}H_{16}O_{10} \cdot 3H_2O$, 3953.
 $C_{19}H_{17}N$, 585, 586, 3321.
 $C_{19}H_{17}NO_3$, 2945.
 $C_{19}H_{17}N_3$, 4402, 4403.
 $C_{19}H_{17}N_3O$, 3958.
 $C_{19}H_{17}N_3O \cdot H_2O$, 3959.
 $C_{19}H_{18}N_2$, 5611.
 $C_{19}H_{19}NO_4$, 1989.
 $C_{19}H_{19}N_3$, 5335, 5336, 5337.
 $C_{19}H_{19}N_3O$, 6435.
 $C_{19}H_{20}O_3$, 5149, 8802.
 $C_{19}H_{21}NO_3$, 5122, 6392, 8168.
 $C_{19}H_{22}ClNO_3 \cdot H_2O$, 8169.
 $C_{19}H_{22}ClNO_3 \cdot 2H_2O$, 6393.
 $C_{19}H_{22}N_2O$, 2721, 2722, 2726, 4664.
 $C_{19}H_{22}N_2O_2$, 2938.
 $C_{19}H_{22}N_2O_2 \cdot 2H_2O$, 873.
 $C_{19}H_{22}N_2O_6 \cdot 2H_2O$, 6394.

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C₁₅H₂₃ClN₂O·H₂O, 2724.
C₁₅H₂₃ClN₂O·2H₂O, 2728.
C₁₅H₂₃NO₄, 2805.
C₁₅H₂₃NO₅·3H₂O, 5785.
C₁₅H₂₃N₃O⁴⁺· $\frac{1}{2}$ H₂O, 2729.
C₁₅H₂₃CINO₃·2H₂O, 5792.
C₁₅H₂₃N₂O, 2720, 2732, 4763, 6600.
C₁₅H₂₃N₂O₂, 2833, 7627.
C₁₅H₂₃N₂O₅·4H₂O, 2727.
C₁₅H₂₃N₂O₅·5H₂O, 2723.
C₁₅H₂₆N₂O₂, 2939.
C₁₅H₂₇NO₄, 3941.
C₁₅H₂₈CINO₄·H₂O, 3942.
C₁₅H₂₈O₂, S8139M.
C₁₅H₃₀O₂, 5312, S562Q.
C₁₅H₃₄Br₂O₂, 7967.
C₁₅H₃₄O₂, 5363.
C₁₅H₃₆O₂, 3426, 6311.
C₁₅H₃₈O, 6172.
C₁₅H₃₈O₂, 6170, 7952.
C₁₅H₃₈O₄, 4244.
C₁₅H₄₀, 6169.
C₁₅H₄₀O, 6171.

C₂₀

C₂₀H₆BrNa₂O₅, 3450.
C₂₀H₆I₄Na₂O₅, 3475.
C₂₀H₆Br₂HgNa₂O₆·3H₂O, 5533.
C₂₀H₈Br₄O₅, 3449.
C₂₀H₁₀O₅, 3474.
C₂₀H₁₀I₄O₄, 6818.
C₂₀H₁₂, S1687M.
C₂₀H₁₂O₃, 3979.
C₂₀H₁₂O₅, 3988, 4818.
C₂₀H₁₂O₇, 4159.
C₂₀H₁₄, 756, 1836, 1839, S2690M.
C₂₀H₁₄Hg, 5538.
C₂₀H₁₄N₂, 990, 992, 993.
C₂₀H₁₄N₂O, 1007, 1008.
C₂₀H₁₄N₄, S7052G.
C₂₀H₁₄O, 6103, 6104, 6105.
C₂₀H₁₄O₂, 1834, 1835, 6941.
C₂₀H₁₄O₄, 6817, 6911.
C₂₀H₁₄O₇, 4163.
C₂₀H₁₅N, 3290.
C₂₀H₁₅NO₄·H₂O, 7863.
C₂₀H₁₅N₃, 3176, 3177, 6051.
C₂₀H₁₆, 3869.
C₂₀H₁₆N₂, 4705, 4706.
C₂₀H₁₆N₄, 6156.
C₂₀H₁₆O₂, 183, 1490.
C₂₀H₁₇NO₄·6H₂O, 1784.
C₂₀H₁₈, 3559, 3560, 5638, 5639.

C₂₀H₁₈N₄S₂, 1709.
C₂₀H₁₈O₉, 497.
C₂₀H₁₉N, 3199.
C₂₀H₁₉NO₅, 7392.
C₂₀H₁₉NO₅·H₂O, 2662.
C₂₀H₂₀CINO₅, 2661.
C₂₀H₂₀CINO₅·2H₂O, 1786.
C₂₀H₂₀N₂, 6843.
C₂₀H₂₀N₂O₃, 1787.
C₂₀H₂₀O₆, 2922.
C₂₀H₂₀O₉, 4054.
C₂₀H₂₁NO₄, 2328, 4760, 6416.
C₂₀H₂₁NO₅, 1788.
C₂₀H₂₁N₃O, 7799.
C₂₀H₂₂CINO₄, 6417.
C₂₀H₂₂N₂O₂, 4165, 7007.
C₂₀H₂₂N₂O₄, 7004.
C₂₀H₂₂O₃, 2356.
C₂₀H₂₂O₈, 7052.
C₂₀H₂₂O₈·2H₂O, 7051.
C₂₀H₂₂ClN₂O₂, 4166.
C₂₀H₂₄N₂O₂, 7634, 7640.
C₂₀H₂₄N₂O₂·2 $\frac{1}{2}$ H₂O, 7636.
C₂₀H₂₄N₂O₂·3H₂O, 7641.
C₂₀H₂₅BrN₂O₂·H₂O, 7646.
C₂₀H₂₅ClN₂O₂, 7647.
C₂₀H₂₅ClN₂O₂·H₂O, 7638.
C₂₀H₂₅ClN₂O₂·2H₂O, 7648.
C₂₀H₂₅NO₄, 2806, 5302, 5304, 5305.
C₂₀H₂₆Cl₂N₂O₂, 7644.
C₂₀H₂₆N₂O₂, 4790.
C₂₀H₂₆N₂O₄, 8468.
C₂₀H₂₆N₂O₅, 708.
C₂₀H₂₆N₂O₅·4H₂O, 7637.
C₂₀H₂₆N₂O₅·7H₂O, 7643.
C₂₀H₂₇NO₁₁, 524.
C₂₀H₂₈O₃, 3427.
C₂₀H₂₈O₁₃, 523.
C₂₀H₃₀Cl₆N₂O₄Pt·4H₂O, 6974.
C₂₀H₃₀O, 8868D.
C₂₀H₃₀O₂, 1, 6981.
C₂₀H₃₂N₂O₅, 3453.
C₂₀H₃₂N₂O₅·H₂O, 4673.
C₂₀H₃₄Br₆O₂, 7959.
C₂₀H₃₄O₂, 2325, 5365.
C₂₀H₃₆Br₄O₂, 7966.
C₂₀H₃₆O₂, 5362.
C₂₀H₃₆O₄, 5369.
C₂₀H₃₈, 6957M.
C₂₀H₃₈O₂, 3425, 6309.
C₂₀H₃₈O₃, 2341.
C₂₀H₄₀O, 6958.
C₂₀H₄₀O₂, 882, 7949, S6403M.
C₂₀H₄₀O₃, 4319.

C₂₀H₄₂, 3417.
C₂₀H₄₂O, 3419.
C₂₀H₄₂O₄S, 3111.
C₂₀H₄₄Sn, 8305.

C₂₁

C₂₁H₁₄O, 6106, 6107, 6108.
C₂₁H₁₅NO, 6381.
C₂₁H₁₆, 5632, 5633, 6615, S2690T.
C₂₁H₁₆N₂, 5372.
C₂₁H₁₆O₃, 291.
C₂₁H₁₈N₂, 504, 4756.
C₂₁H₁₈S₃, 8674, 8675.
C₂₁H₂₀, 5665, 7140.
C₂₁H₂₀Cl₃NO₅, 1785.
C₂₁H₂₀N₂O₄·3 $\frac{1}{2}$ H₂O, 498.
C₂₁H₂₀O₅, 5033.
C₂₁H₂₀O₆, 2940.
C₂₁H₂₀O₁₁, 7619.
C₂₁H₂₁ClSn, 8312.
C₂₁H₂₁N, 8567.
C₂₁H₂₁NO₆, 4684, 7788.
C₂₁H₂₁N₃, 8556.
C₂₁H₂₁O₄P, 8543, 8544.
C₂₁H₂₂CINO₆, 4685.
C₂₁H₂₂N₂O₂, 7983.
C₂₁H₂₂O₅, 3138.
C₂₁H₂₃ClN₂O₂·2H₂O, 7984.
C₂₁H₂₃NO₂, 5370, 5371.
C₂₁H₂₃NO₄, 5491.
C₂₁H₂₃NO₅, 2920, 5790.
C₂₁H₂₃N₃O₃, 7985.
C₂₁H₂₄CINO₅·H₂O, 5791.
C₂₁H₂₄O₃, 3441.
C₂₁H₂₄O₄, 5440.
C₂₁H₂₄O₁₀·2H₂O, 6865.
C₂₁H₂₅NO₄, 2839, 4180, 5021.
C₂₁H₂₆N₂O₃, 8981.
C₂₁H₂₆N₂O₄, 7645.
C₂₁H₂₆O₂, S2329Q.
C₂₁H₂₇ClN₂O₃, 8982.
C₂₁H₂₇NO₄, 5307.
C₂₁H₂₇N₃O₆, 8983.
C₂₁H₃₀Cl₂N₄O₃·5H₂O, 7653.
C₂₁H₃₀O₂, S2329M, S7056J.
C₂₁H₃₀O₃, S3141J.
C₂₁H₃₀O₄, S2837M.
C₂₁H₃₄O₂, 5816.
C₂₁H₄₀N₂O₂, 5378.
C₂₁H₄₀O₄, 4243, 4245.
C₂₁H₄₂O₂, 884, S7953M.
C₂₁H₄₂O₄, 4247.
C₂₁H₄₄, 4437.
C₂₁H₄₄O₃, 7151.

C₂₂

C₂₂H₁₄, 3184, 6960.
C₂₂H₁₆N₃, 7800.

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C₂₂H₁₆O₃, 5679.
C₂₂H₁₆O₅, 6319.
C₂₂H₁₈O₃, 8443, 8453,
8461.

C₂₂H₁₈O₄, 6907.
C₂₂H₂₀N₈O₁₄, 6131.
C₂₂H₂₀O₁₃, 2596.
C₂₂H₂₃NO₇, 4379, 6114.
C₂₂H₂₃NO₈, 6395.
C₂₂H₂₄CINO₇·H₂O,
6115.

C₂₂H₂₅NO₆, 2813.
C₂₂H₂₆N₂O₂, 7002.
C₂₂H₂₆O₃, 2385.
C₂₂H₂₆O₁₂, 4522.
C₂₂H₂₇NO₂, 5371.
C₂₂H₂₇NO₄, 2841, 5022.
C₂₂H₂₇N₃O₅, 6956.
C₂₂H₂₈N₂O₄·4H₂O,
3414.

C₂₂H₃₀N₂O₂, 932.
C₂₂H₃₀N₂O₄, 4768.
C₂₂H₃₁NO₂, 934.
C₂₂H₃₃CINO₄, 935.
C₂₂H₃₂O₃, 559.
C₂₂H₃₃NO₅·H₂O, 942.
C₂₂H₃₄N₄O₈S, 6980.
C₂₂H₃₄O₂, 2801.
C₂₂H₃₇NO, S6401M.
C₂₂H₃₈O, 3687.
C₂₂H₄₀O₂, 1031.
C₂₂H₄₂O₂, 1970, 3465,
6207.

C₂₂H₄₂O₃, 7795, 7797.
C₂₂H₄₄O₂, 883, 1028,
7946.

C₂₂H₄₆, 3383.

C₂₃

C₂₃H₁₈O, 2526.
C₂₃H₁₈O₃, 2747.
C₂₃H₁₉NO₄, 4653.
C₂₃H₂₂O₆, 7802.
C₂₃H₂₂O₇, 8545.
C₂₃H₂₃NO₆, 2840.
C₂₃H₂₅NO₆, 2660.
C₂₃H₂₆ClNO₆, 2814.
C₂₃H₂₆N₂, 592M.
C₂₃H₂₆N₂O₄·4H₂O,
1985.
C₂₃H₂₇CIN₂O₄, 1986.
C₂₃H₂₇NO₅·3H₂O, 6111.
C₂₃H₂₇N₃, 5338.
C₂₃H₂₇N₃O₇·2H₂O,
1987.

C₂₃H₂₈CINO₃·3H₂O,
6113.

C₂₃H₂₈N₂O₃, 4164.
C₂₃H₂₈O₁₂, 6118.

C₂₃H₂₉NO₁₂S·10H₂O,
6112.

C₂₃H₃₂Cl₃N₃O, S7620G.

C₂₃H₃₈O, 6403.

C₂₃H₄₄O₂, 6310.

C₂₃H₄₄O₃, S7953T.

C₂₃H₄₆O, 8577.

C₂₃H₄₆O₂, 1030, 7944,
7951

C₂₃H₄₈, 8576.

C₂₄

C₂₄H₁₂, S2837J.

C₂₄H₁₈, 1320.

C₂₄H₁₈N₂, 984.

C₂₄H₂₀Ge, 4179.

C₂₄H₂₀N₂, 1416, 4735.

C₂₄H₂₀O₆, 4251.

C₂₄H₂₀O₈, 1010.

C₂₄H₂₀Pb, 5328.

C₂₄H₂₀Sn, 8307.

C₂₄H₂₁N₃O₃, 2966.

C₂₄H₄₀O, 7972M.

C₂₄H₄₀O₃, 7952M.

C₂₄H₄₀O₅·H₂O, 2694.

C₂₄H₄₁NO, 7942R.

C₂₄H₄₆O₂, S7946M.

C₂₄H₄₆O₃, 5316.

C₂₄H₄₅O₂, 1029, 5354.

C₂₄H₅₀, 8141.

C₂₄H₅₀O, 2597.

C₂₄H₅₀O₄S, 3402.

C₂₅

C₂₅H₂₀, 5676.

C₂₅H₂₀N₂O, 8767.

C₂₅H₂₁N₃, 4401.

C₂₅H₂₆O₃, 3952.

C₂₅H₃₁N₃O, 2921.

C₂₅H₃₄N₂O₄·H₂O,
7654.

C₂₅H₄₀O₂, 6306.

C₂₅H₄₂O₂, 7945.

C₂₅H₅₀O₂, 4832.

C₂₆

C₂₆H₁₈, 6619.

C₂₆H₂₀, 3865.

C₂₆H₂₀O, 1685.

C₂₆H₂₁NO₁₁, 361.

C₂₆H₂₁N₇O₁₈S₂, 4657.

C₂₆H₂₂, 3550, 3551.

C₂₆H₂₂N₄, 1426, 1427.

C₂₆H₂₂O, 1448.

C₂₆H₂₂O₂, 1684.

C₂₆H₂₆N₈O₁₈S₂, 893M.

C₂₆H₃₄O₃, 5315.

C₂₆H₃₇NO₃·2H₂O, 5171.

C₂₆H₄₃NO₆, 4283.

C₂₆H₄₅NO₇S·H₂O,
8110.

C₂₆H₅₀O₄, 4300.

C₂₆H₅₂O₂, 2642.

C₂₆H₅₂O₆, S8154W.

C₂₆H₅₄, 2641.

C₂₆H₅₄O, 2645.

C₂₇

C₂₇H₂₀, 7064.

C₂₇H₃₀N₂O₅·H₂O, 7650.

C₂₇H₃₄N₂O₆·2H₂O,
5387.

C₂₇H₃₉N₅O₅·6½H₂O,
6443

C₂₇H₄₆O, 2691, 5013.

C₂₇H₅₂O₆, 4234.

C₂₇H₅₆, 4440.

C₂₇H₅₆O, 4440M.

C₂₈

C₂₈H₁₄N₂O₄, 4865.

C₂₈H₁₈O₄, S6626T.

C₂₈H₂₀N₂, 505.

C₂₈H₂₄N₂O₇, 6315.

C₂₈H₂₈Sn, 8309, 8310.

C₂₈H₃₀O₄, 8291.

C₂₈H₃₃N₅O₁₁, 2145.

C₂₈H₃₈O₁₉, 2627,

8048M.

C₂₈H₄₄O, 2296M, 3461.

C₂₈H₄₈O₂, S8322P,

S8322R.

C₂₈H₅₄O₃, 5821.

C₂₈H₅₈O, 6219M.

C₂₈H₅₈O₄S, 8154.

C₂₉

C₂₉H₃₀N₂S₂, 2403.

C₂₉H₄₂Cl₂N₂O₄·7H₂O,
3433.

C₂₉H₅₀O₂, 8322M.

C₂₉H₅₁NO₈, 7808.

C₂₉H₆₀O, 6168M.

C₃₀

C₃₀H₂₂O₆, 6356

C₃₀H₂₈N₂S₄, 3360.

C₃₀H₂₈N₂S₄Zn, 2404.

C₃₀H₃₀O₇, 2705.

C₃₀H₄₀N₂O₅, 3432.

C₃₀H₄₄N₆O₈S, 6957.

C₃₀H₄₈O₃, 2618.

C₃₀H₅₈O₄, 4301.

C₃₀H₆₀, 5497.

C₃₀H₆₂, 8550.

C₃₀H₆₂O, 8550M.

C₃₁

C₃₁H₄₆N₂O₉, 7886.

C₃₁H₄₆O₂, S8869U.

C₃₁H₆₂O, 4439.

C₃₁H₆₂O₂, 5500.

C₃₁H₆₄, 4438.

C₃₁H₆₄O, 5811.

C₃₂

C₃₂H₂₄O₆, 5403.

C₃₂H₂₆O₆, 8025.

C₃₂H₃₂FeN₄O₄, 4415.

C₃₂H₃₆N₂O₁₂, 2845.

C₃₂H₃₆N₄O₆, 1832.

C₃₂H₃₆N₄O₈, 1833.

C₃₂H₄₃NO₉, 7437.

C₃₂H₄₃NO₁₀, 1033.

C₃₂H₄₄O₃, 6312.

C₃₂H₄₆O₃, 7953.

C₃₂H₄₈O₆, 7732.

C₃₂H₄₉NO₉, 8848.

C₃₂H₅₁NO₁₁, 7393.

C₃₂H₅₂O₂, 3415.

FORMULA INDEX OF ORGANIC COMPOUNDS (Continued)

C₃₂H₆₄O₂, 6404.
C₃₂H₆₆, 3403.
C₃₂H₆₆O, 2651, 3403M.
C₃₂H₆₆O₄S, 2653.

C₃₄

C₃₄H₃₀O₁₀, 5800.
C₃₄H₃₆N₂O₆, 7418.
C₃₄H₃₈Cl₂N₂O₆·2H₂O,
 7419.
C₃₄H₃₉I₃N₂O₆, 7038.
C₃₄H₄₀N₂O₁₀S·5H₂O,
 5789.
C₃₄H₄₄N₂O₁₂S·2H₂O,
 4835.
C₃₄H₄₇NO₉, 3137.
C₃₄H₄₇NO₁₀, 4861.
C₃₄H₄₇NO₁₁, 5169.
C₃₄H₄₈N₂O₈, 5303.
C₃₄H₄₈N₂O₁₀S, 941.
C₃₄H₄₈N₂O₁₀S·2H₂O,
 4839.
C₃₄H₄₉NO₁₁, 365.
C₃₄H₅₀BrNO₁₁· $\frac{1}{2}$ H₂O,
 366.
C₃₄H₅₀ClNO₁₁·3H₂O,
 367.
C₃₄H₅₀N₂O₁₄·5H₂O,
 368.
C₃₄H₅₀O₂, 2692, 5014.
C₃₄H₆₆O₄, 4304.
C₃₄H₇₀O, 8160M.

C₃₅

C₃₅H₂₃O₂, 1078, 4947.
C₃₅H₃₉N₅O₈, 3463.

C₃₅H₄₀O₁₂, 3967.
C₃₅H₄₁N₅O₆, 3464.
C₃₅H₆₈O₉, 4236.
C₃₅H₇₀O, 6563.
C₃₅H₇₂, 6562.

C₃₆

C₃₆H₄₄N₂O₁₀S·5H₂O,
 2810.
C₃₆H₄₉NO₁₂, 7398.
C₃₆H₅₁NO₁₁, 1829.
C₃₆H₅₄O₆, 1796.
C₃₆H₆₀O₃, 1797.
C₃₆H₆₀O₃₀·H₂O, 4895.
C₃₆H₆₂O₃₁, 359.
C₃₆H₇₀O₃, 7968.
C₃₆H₇₄O₄S, 6236.
C₃₆H₇₆N, 3292M.

C₃₇

C₃₇H₃₆N₂O₉, 8873.

C₃₈

C₃₈H₅₀, 3532.
C₃₈H₄₄N₂O₁₀S, 5123.
C₃₈H₄₆N₄O₆S·2H₂O,
 2730.
C₃₈H₄₆N₄O₆S·3H₂O,
 2725.
C₃₈H₅₃NO₁₃, 370.
C₃₈H₇₄O₄, 4307.

C₃₉

C₃₉H₇₄O₆, 4255.
C₃₉H₇₆O₅, 4237.

C₄₀

C₄₀H₅₀N₄O₈S, 7651.
C₄₀H₅₀N₄O₈S·2H₂O,
 7639, 7652.
C₄₀H₅₁AsN₄O₈·8H₂O,
 7642.
C₄₀H₅₆, 2599, 2600.
C₄₀H₇₄O₃, 3233.
C₄₀H₇₈O₆, 3234.

C₄₂

C₄₂H₅₆N₄O₈S·5H₂O,
 7986.
C₄₂H₅₀N₄O₈·9H₂O,
 7635.

C₄₄ to C₂₁₆

C₄₄H₃₂O₃, 1971.
C₄₅H₃₆O₆, 4256.
C₄₆H₅₄N₄O₁₂S·7H₂O,
 1988.
C₄₇H₃₄O₂, 6409.
C₄₈H₃₈O₁₀, 2793.
C₅₁H₉₈O₆, 4260.
C₅₅H₇₀MgN₄O₆, 2686.
C₅₅H₇₂MgN₄O₆· $\frac{1}{2}$ H₂O,
 2685.
C₅₇H₁₀₄O₆, 4259.
C₅₇H₁₁₀O₉, 4261.
C₆₈H₁₀₀N₂O₂₆S, 369.
C₈₀H₁₀₄I₆N₈O₂₀S₃·
6H₂O, 7649.
C₂₁₆H₂₈₈O₁₄₄, 7938M.

MELTING POINT INDEX OF ORGANIC COMPOUNDS

The following table lists the melting points of organic compounds in ascending order of temperature in degrees Centigrade. The compounds are identified by the numbers as given in the table Physical Constants of Organic Compounds.

The letter **S** preceding any compound number indicates that it is to be found in the **Supplement** to the table.

Melting points will be quoted as they occur in this table. The order of compounds listed with the same melting point is not significant and will be arbitrarily given in the order of the compound numbers. Owing to lack of agreement in values reported by various observers more than one value is sometimes given or the melting point is indicated by a temperature range. In such cases the position in the list is determined by the lower temperature of the stated range or by the *first* of two stated values, the second value being given in parentheses. Where the values are separated by more than 5° C the melting points are listed separately.

Melting points are given in bold face followed by the numbers of the compounds.

Abbreviations: a = anhydrous; h = hydrate.

(-213), 2583	-123.1, 2166	-100.6, 3530M
-207, 2583	-122.8, 7344	-100.2, S107W
-189.9, 7073	-122, 7358	< -100, 2083, 2347
-185.2, 7217	-121, 3586	-100, 5124
-184, 2587M, 5584	-120, 1990M, 5095	-99.3, 488, 5145
-181, 5606M	-119.4, 476, 4572	-99, 537, 2204, 4031
-172, 3488	-119.1, 4571	-98.9, 100
-169.4, 3809	-119, 3804	-98.5, 4618
-161.5, 1947	-118.5, 4957	-98.2, 2018
-160.5, 2028	-118, 6876, S6277Q	-98.1, 103
-159.7, 8861	-117.3, 3785	-98, 2982
-159, 7359	-117.2, 4923	-97.8, 5719
-156.5, 7895	-117, 5101	-97.6, 5738
-151, 5175	-116.6, 7218	-96.9, 2925, 5356
-150, 4650, 7892	-116.3, 3902α	-96.7, 3507, 5744
(-147.3), 3586	-115.9, 2072	-96.5, 319
-146, 5604M, 7062, S4623A	-115.5, 3681	-96, 3276, 8826
-145, 4950, 5613	-114.8, 8596	-95.3, 4028
-142.5, 3862M	-114.6, 3785	-95.2(-98), 2178
-142.4, S3047M	-114, 2589M	-95.2, 2235
-141, 4541	-113, S4628B	-95, 213, 6594, 8336
-139, 6572	-112.6, 2266	< -95, 2232
-138.7, 3806	-112.4, 2160	-94.5, 6498
-138.5, 5749	-112, 321, 8304, S3117M	-94.4, 5059
-138, 2590, 6564	(-112), 3917	-94.3, 4556
-137.8, 8860	-111.9, 4928	-94, 7324, S6277R
-136.4, 478	-111.5, 7162	-93.9(-92.8), 1210
-135.1, 2019	-111.3(-107), 2585	-93.66, 5734
-135, 1998, 2117, S4628A	-111.3, 3899	-93.5, 4966, 8660
-133, S4623B	-110.8, 8389	-93.3, 2225, 3046
-131.5(-129.9), 6481	-110, 7343, 8829	3058
-131.3, 2167	-108.6, 2565	-93, 4597
-131.2, 4958	-108.5(-105 to -111), 3912	-92.9, 4034
-130.7, 7164	-108, 4951, S6277K	-92.8, 8797
-130, 2110, 2198	-107, 3557M	-92.5, 107, 5729
-129, 468	-105, 534	-92, 2100, 3995
-127, 7331	-104.8, 5628, 8070	-91.9, 7319
-126.6, 3062	-104.7, 7372	-91.5, 2224, 8790
-126.4, 3002	-104.5, 2157	-91.3, 4543
-126, S6277J	-104, 2182	-91.2, 8798
(-125.6), 6498	(-104), 6876, 7319	-91, 4566, 8801
-125, 6493	-103.7, 3029	-90.8, 5106
-124.8, 7219	-103.5, 2181, 3691	-90.5, 4458
-124, 2120, 3678, 8624	-102.1, 3930	-90, 4020, 5000
-123.5, 10	-102, 3917	-89.55, 7280
-123.4, 6495	-101.6, 1276	-89.2 to -89.8, 2149
-123.3, 3902β	-101.4, 7362	-89, 2150, 2272, 5100
-123.1(-121), 5715	-101.2, 5099	-88.5 to -89.5, 5098
	-101, 6595	-88.2, 4981
		-88, 535
		-87.7, 378

MELTING POINT INDEX OF ORGANIC COMPOUNDS (Continued)

-87.5, 7287	-62, 5423	-41, 2384, 8713
-87.3, 2374	-60.5, 6452	-40.6, 2367, 6347
-87, 3117	< -60, 356, 4967	-40 to -48, 1220
-86.4, 2095	-60, 5103, 8489	< -40d, 2280
-86, 2993	-59, 910, 5563, 8795	< -40, 6859
(-86), 3867	-58.86, 4459	-40, 3131, 5300, 7664,
-85.6, 547	-58.2, 3057	8211, 8987, S5580X
-85.5, 4953, 8193	-58.1, 1148	-39.8, 8342
-85, 2992, 4559	-57.5, 2665	-39.6, 3345
-84.7, 4985, 6557	-57.4(-61), 7405	-39, 2129, 4490
-83.6, 94	-57, 655, 3339	(-39), 3216
-83.2, 5766	-56.9, 4610	-38.8, 616
-83, 492, 4560, 7333	-56.6 ^{5.2atm.} , 2563	-38.6, 6271
-82.7, 1147	-56.5, 6245	-38.5, 6266
-82, 406	-56.1, 8822	(-38), 6540, 6552
-81.8, 328	(-56.1), 2260	-37.6, 5143
-81.2, 1146	(-56), 1220	-37.5, 411
-81.03, 4590	-55.5, 7092	-37.3, 715
-81, 7266	-55(-50), 6991	-36.7, 3555, 6449
-80.7, 4983	-55, 530, 6248	-36.5, 4121
-80.6, 3787, 4039	-54 to -57, 6555	-36.4, 1995, 3556
-80.5, 3823, 4022	-54, 5436, 7199	-36, 6204
< -80, 192, 545M,	-53.7(-51), 6178	(-36), 3549
2257, 3627, 4975,	-53.6, 8908	-35.3, 3874
6129, 8388	-53.5, 4994	-35, 1183, 1773M,
(-79.9), 2149	-53, 3821, 8884	2927, 5005, 6185,
-79.7, 2195	-52.8, 5743	6491
-79.4, 2372	-52.7, 5552	-34.6, 1454, 4478,
< -79, 3737, 7163	-52.5, 6252, 6987	7099
-78.8, 8796	-52, 1195	-34.5, 2379, 8795
-78.5, 99, 6534	-51.6, 1464, 4593	-34.4, 2958, 7093
-78.25, 1122	-51.5, 90	-34.2, 6451
< -78, 2801	-51.1, 550, 5009	-34(-36), 8353
-78, 4250	-51, 16508, 5141,	-33.65, 2183
-77.8, 6553	8197, 8793H	-33, 4436M
-76.8, 91	(-51), 5143	-32.7, 126
-76.1, 6331	-50.5, 2153	-32.6(-34), 4492
< -76, 4596	< -50, 3537, 8442	< -32, 5156
-75.9, 7290	-50, 2971, 3216, 3668,	-32, 1217
-75.7, 6529	3823A	-31.8, 5764
< -75, 3600, 4253	-50, ca., 5580R	-31.5, 3398, 8497
-75, 2260	> -50, 2823	-31.47, 5847
-73.9(-72.6), 7282	-49.8, 5422	-31.4, 1233
-73.5(-68.9), 3070	-48.2, 4465	-31, 4293, 8817
-73.5, 3068, 4018	-48, 6543	-30.6, 1132
-73.4, 101	-47.8, 8354	-30.2, 6655, 8314
-73.2, 2222, 2230	(-47.4), 8908	-30 to -32, 3099
-73.1, 187, 7279	-47 to -48, 2086M	< -30, 2132, 4235h,
-73, 2015, 3867,	-47, 3021, 4978	5769, 6546
S3117N	-45.9, 6254	-30, ca., 5568
-71.4, 7285	-45.6, 2391	-30, 5667, 5890
-70.3, 7095	< -45, 2276	-29.5, 2096, 2205
-70, 3267	-45, 1152, 3435, 5754,	-29.05, 8417
> -70, 4515	7318	-29(-27.1), 8892
-69.9, 6961	-44.8(-43.1), 2382	< -29, 7975
-69.5, 4460	-44.5, 7200	-29, 3539, 4222
-69.3, 545	(-44.5), 6449	-28.95, 637K
-69, 2909, 3605	-44, 3264	-28.5, 2168
-67.5, 2158, 2353	-43.9, 2991	-28, 8986
-67.3, 4498	-43.8, 3549	-27.7, 1157M
-66.5, 5620	-43.5, 7992	-27.5, 5327
-66.1, 5752	-43.4, 4476	-27.2(-19.3), 1223
< -66, 3913	-43.26, 5847	-27(-26 to -29),
-65.9, 4974	-43(-48), 1767	8341
< -65, 2418	-43, 632, 2568	-27, 6645
-65, 1993, S3445D	-42, 6558, 7460	-26.5, 4426
-64, 633, 2687	-41.9, 1221	-26.45, 3617M
-63.5, 635, 2679	-41.5, 4484	-26, 125, 1037, 3197,
-63, 2932	-41 to -44, 250	3552

MELTING POINT INDEX OF ORGANIC COMPOUNDS (Continued)

- 25.6, 3454
- < -25, 2365, 2658, 3069
- 25, 2041, 2279, 4539
- 24.8, 1175
- 24.5, 3929
- 24.4, 8485 α
- 24.1, 4214
- 24, 5036
- 23.8, 8522
- 23.2, 6525
- 23, 1215, 4503, 7994, 8519
- 22.8, 2587
- 22.5, 130, 131
- 22.4, 1453
- 22.35, 3862
- 22, 132, 5877, 6186, 6552, 7277, 8416
- 21.8, 8615
- 21.2, 1134
- 21.2 to -20.5, 3020
- < -21, 5347, 6650
- 21, 412, 2283, 5136, 5598, 7341, 8022
- 20.9, 6274
- < -20, 1181, 1182, 1212, 1213, 1261, 1856, 2248, 2534, 2884, 4689, 5822, 6539, 6842, 7682, 8034, 8387, 8417M, 8905, 8918, 8936
- 20, 2162, 4264, 4302, 6544, 7101, 7341P
- 19.96, 2336
- 19.5, 7657
- 19, 531, 4641, 4996, 5401, 5870
- (-19), 6190
- < -18, 500, 771, 1437, 2363, 5119, 5271, 5863, 6585, 6873, 7185, 7677
- 18, 2337
- 17.9, 2344
- < -17.5, 6776
- 17.5, 179, 1174
- 17.4, 4290
- < -17, 173, 8385
- 17, 207, 2251, 4259, 5319M, 5759, 7380
- (-17), 7013
- 16.6, 3495
- 16.5, 160
- 16.3, 6265, 8485 β
- 16, 1774R, 2607, 2821, 3632
- 15.4, 7205
- 15.3, 1738
- 15.25, 180M
- 15.05, 3108
- < -15, 2247, 4173, 4303, 4419, 5550, 6063, 8957
- 14.7, 7139
- 14.5, 2575
- < -14, 5869
- 14, 600 α , 2088, 2245, 4783
- 13.8, 3602
- 13 to -14, 8518
- < -13, 8302
- 13, 1635
- 13(-9), 5870K
- 12.5, 1461
- < -12, 713, 3379
- 12, 2978, 3390, 6363, 8151
- (-12), 4290
- 11.9, 2090
- 11, 5361
- 10.7, 5313
- 10.6, 8402 α
- 10.45(-6.5), 3231
- 10.4, 601
- < -10, 3760, 8330, 8441
- 10, 3437, 4495, 5045, 5479
- 9.5 to -9.2, 3020
- (-9.5), 2350
- 9.3, 1139
- 9, 3115, 3402M, 4585, 7013
- 8.6, 7836
- 8.2, 6190
- 8 to -7, 7993(2)
- 8, 1577, 6191, 7459
- 7.9, 2220
- 7.6, 3329
- 7.5, 2737
- 7, 7822
- 6.9, 1171
- 6.6, 5532
- 6.5, 5821
- 6.2, 571, 8582
- 6, 1223H, 2274, 2392, 2960, 3107, 4853
- 5.9, 5131, 6192
- 5, 634, 6183, 8000, 8606
- 5¹¹, 1991
- 4.5, 2284
- 4.1, 8402 β
- 4, 1766, 2242, 4424, 6760, 7053, S8600Q
- 3.5, 600 β
- 3, 1887
- 2.5, 2830
- 2, 2081M, 4866, 8894
- (-1.68), 5313
- 1.5 to -2.0, 2350
- 1, 1724, 2388, 5825
- 0.82, 637P
- < 0, 117, 2361, 5332, 6694
- 0, 501, 600 α + β , 1723, 3546, 4151, 6716 β
- 0.1, 3547
- 0.2-0.7, 5840
- 0.35, 138M
- 0.5, 2572
- 0.5(1-2), 2605
- 0.6, 4065
- 1, 2735, 7876
- 1.3, 7832
- 1.5, 2734
- (1.6), 7822
- 1.8(5.6), 1170
- 2, 2836, 6912, 8922
- 2.1, 1138
- 2.1(5-6), 6661
- 2.4, 6652
- 2.5, 621, 701, 3113
- 2.55, 4003
- 2.9, 6152
- 3, 1735, 7044
- 3.6, 1223K
- 3.65, S1818M
- 4, 5319, 6540
- 4-5, 1773, 7674
- 4.1, 6716 γ
- 4.5, 4432
- 5, 3935, 8185
- 5-6, 135, 5747
- 5-7, 1925
- 5.15, S5314H, frz.
- 5.2(3-4), 712
- 5.48-49(5.51), 1113
- 5.5, 2864, 3732, 6988, 8144, 8154M
- 5.6(4-5), 6705
- 5.7, 1256
- 6, 3965, 5768M
- 6-7, 1981
- 6.2, 5840
- 6.5, 2744, 2988
- 7, 706, 3003, 6716 α , 7993(1)
- 7-8, 2787
- 7-9, 8906
- 7.5, 8355
- 8, 3771, 8868D
- 8.2, 775
- 8.46, 4016
- 8.5, 2657, 3879, 5312
- 9, 2282, 3832, 5264, 6994, 7258, 8927
- 9.2, 1762
- 9.4(10), 723
- 9.5(6-7), 4563
- 9.97(10), 3871
- 10, 1983, 3880, 6457, 8313
- 10-4, 7681
- 10.3, 3948
- 10.5, 3598, 5130, 5416
- 10.5(11.93), 5817
- 11, 2270, 4429, 7815
- 11(8-9), 1048
- 11-2, 720, 2878, 6415
- 11.4, 4514
- 11.7(9-13), 3297
- 12, 4430, 4475, 6448
- (12), 2744
- (12-3), 8510
- 12-5, 667
- 12.3, 385
- 12.4, 1179
- 12.6(10.5), 6429
- 13, 774, 1284, 5440, 5675, 8921
- 13-4, 8061
- 13.2, 3555R, 6152, 8925

MELTING POINT INDEX OF ORGANIC COMPOUNDS (Continued)

- 13.5**, 7999
13.6, 7613
14, 6305, 7679
14(2.5), 3113
14-5, 4433, 5025
(14-5), 280
14.5, 1390
14.6, 6193
14.88, S6403M(α) frz.
15, 206, 661, 2877,
 4363, 4538X, 5176,
 6151, 7370M
15(12.1), 4431
15-6, 7320
15.5, 8403, 8959
(15.5), 5860, 8313
16, 1040, 2059, 2381,
 5580, 6772, 6950,
 7138
16.5, 4436, 4632
16.6, 86
17, 599, 1299, 2092,
 3125, 3443, 4147S,
 7794, 8047, 8094M,
 8098
17-8, 1049, 3238M
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 250-2, 1467, 7619
 250-60d, 6781
 251, 930, 5545
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 252, 745, 795, 5998
 253, 6468
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 262, 811, 5952, S3208L
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 268, 807, 3309, 7983
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 274, 4705, 7057,
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 275, 1935, 2713, 5372
 >275, 7626, S3208N
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 275d, 4282, 8625
 275-80d, 7792M
 276, 8983
 276-80, 5933
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 278, 1489, 3958
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283(280d) , 7848	298d , 1479, 5801, 8831	> 330 , 814, S3208M
283-4 , 2671	300 , 1835, 3009, 4166	330 , <i>ca.</i> , 983
283-4d , 432, 5066	> 300 , 1592, 6357	331 , 1413
283-5 , 8687	300-50d , S3382M	332d , 5341
284 , 1482, S7982M	301d , 6212, 6213	333d , 4391R
285 , 5676, 5782, 8124	301-2d , 6136 β	337 , 8172
285-6d , 4654	301-3 , 6628	338 , 8707
286 , 794, 2732, 2773, 5502, S4675J	302 , 796, 829	338-40 , 7698P
287 , 4064	303 , 805	340 , 982
287-8 , 4655	305 , 448, 1432	345d , 1005
288 , 5090	306 , 1224	350 , 8621
288d , 8050	307-8 , 5161	(> 350), 1419
289d , 445	308-10d , 949	350d , 1229
290 , 442, 806, 810, 2670, 8788	310 , 1914a, 2618	354 , 377
(290), 5341	310d , 768, 7617	358d , 2756
290-1 , 7698R	310(306) , 5089	360 , 3968
(291), 1431	310-4 , 8693	> 360 , 764, 2965, 3978
291.5d , 8806	310-20d , 813	360d , 4404
292 , 809	312-4 , 5084	> 360d , 8782
292d , 5065	312-8d , 3988	364 , 6960
(292d), 8831	(314-6), 1413	365 , 407
293 , 1259	315d , 8832	369 , 791
293d , 1792, 8833	316 , 8692	370d , 8783
(293-5), 4064	317 , 5075	(375-80), 8621
293-5(289d) , 8689	318-20d , 429	384-5 , 826
295 , 426, 2862, 5342	319 , 808	392d , 4874
295d , 433, 8694	(320), 1005	400d , 8781
295-300d , 3972, 8982	> 320 , 812, 3133	419d , 6371
296 , 935	323 , 3291	437-40 , S2837J
	327d , 6211, 7418	450d , 1377
	327-8 , 1419	470-500d , 4865

BOILING POINT INDEX OF ORGANIC COMPOUNDS

The following table lists the boiling points of organic compounds in ascending order of temperature in degrees Centigrade. The compounds are identified by the numbers as given in the table Physical Constants of Organic Compounds.

The letter **S** preceding any compound number indicates that it is to be found in the **Supplement** to the table.

Boiling points will be quoted as they occur in this table. Only boiling points at or near atmospheric pressure will be listed. The order of compounds listed with the same boiling point is not significant and will be arbitrarily given in the order of the compound numbers. Owing to lack of agreement in values reported by various observers more than one value is sometimes given or the boiling point is indicated by a temperature range. In such cases the position in the list is determined by the lower temperature of the stated range or by the *first* of two stated values, the second value being given in parentheses. Where the values are separated by more than 5° C the boiling points are listed separately.

Boiling points are given in bold face followed by the numbers of the compounds.

-190(-192), 2583	-0.6 to -0.3, 1998	32 ⁷⁶⁸ , 4075
-161.5, 5584	-0.6(-0.2), 7099M	32-43, S7995M
-128, 2587M	(-0.2), 7099M	(32-7), 6564
-103.9, 3809	1, 2118	32.5 ⁷⁷⁷ , 3754
-88.5, 328	2, 913	34, 5095, 5099
-88.3, 3488	2(-3 to +1), 2976	34.6, 3902
-83.6, 328	2.5, 2118	34.7(34.5-5.5), 3586
-83, 2589M	3.5, 8624	35, 7240
-82.2, 3993	3.56, 5734	35-6, 7221
-80, 5606M	3.8, 3511	35-6 ⁷⁵³ , 2973
-78.6, 5750	5, 3064	35.4(34.8)(36.5), 5101
-78.5, 2563	5 ⁷⁵⁷ , 2143	35.5, 3742
-78.4, 3862M	5.8 ⁷⁵² , 5715	36, 911, 912
-78.2, 3530M	7, 2585	36.2(34-5.5), 6481
< -70, 3826M	7.4, 3276	36.4, 6572
-56.8, 7895	7.6, 5715	37, 3822
-56, 5175	7.9(11-2), 3729	37.5-8, 5766
-51.6, 5746M	8.3, 6876	38, 3804
-51, 8863M	8.6, 2198	38.4, 2120
-50.2(-47.5), 2590	8.9, 5619	38.9, 3764
-47, 7217	9.5, 7101	39, 8863
-46.8, 3557M	10-11, 3891H	40, 6564, 6594
-42.17, 7073	10.3, 1995	40.1, 5744
(-41), 5175	10.7, 3899	40.5-1.5, 1990M
-40.8, 5604M	12.2, 3806	41.2, 2113
-38, 3502M	13, 2971	42, 6891
-37.7, 3903	13.8, 2960	42-3 ¹⁶⁵ , S1991M
-34.4, 3062	15.8, 8860	42.5, 3045, 5752
-32 to -30, 336	16, 4964	43(42-4), 6462
-32, 7062	16.6, 3787	44, 5628, 7325M
-28, 5617	17, 3918	44.6, 478
-24.7, 3512L	19, 1990	45, 5111, 6461
-23.7, 5738	20.5, 356	45-6(44), 3058
-23.65, 5749	21, 10, 3063	45.8, 3555R
-23.3, 7372	23 ⁷³⁸ , 7222	46, 3653, 8987
-23, 5613	24d, 8884	46.3, 2565
-21, 3995	24.1, 5683	46.4(45.8), 2158
-20.5, 2958	25, 6883, 6884	47.2(45-7), 7344
-20.1, 7892	25(21), 2117	47.7, 3556
-20, 1947	25.8-6.2, 6463	48.4, 3823A, 7219
-14, 6886	26, 4783	48.7, 7333
-13.9, 8861	26-7 ⁷⁶¹ , 7897	48.8, 7266
-12, 5759	27.2(28.9), 2201	49-50, 5725
-10.2, 4950	28(27-31), 2028	49-51, 6464
-10.1, 5104	28.09, 558	49.5, 3046
-10, 487	(28.3), 8863	49.7, 2018
-6.5, 5729	29-30 ⁴ , S7995P	50, 8834
-6, 7234	29.3, 2199	50.4, 4363
-5, 2110	30-1 ⁴ , S7995N	51-2, 321, 2168, 3900
-3.2, 7359	31, 2116	52.5, 378
-3, 1991	31.50, 4031	52.8, 916
-2, 333, 3510R	31.95, 2179M	53-4 ³ , S7993V

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53.2, 474	68.9, 4958	84-7, 7335
53.6-3.9, 6571	69, 4556	84.1-4.3, 6565
53.6-4.0, 6570	69.6, 1993	84.4, 7087
54, 3728	69.7, 7099	84.7, 4622
54.2-5.2, 6580(2)	70-1, 4628(2)	84.85, 1221
54.3, 4022	70-5, 1942	85, 6882
55-6, 3900M, 3901	70.3, 3681	85.1-5.6, 4626(2)
55.5, 3216	70.9, 7343	85.6-6.1, 4627(2)
56, 6595, 8859, 8864	71.3, 476	86, 2015, 6496
56-6.5, 2112	71.3(66.5-8.5), 4029	86(85.4), 4547
56.5, 213	71.4, 4042	86-7(81-2), 2984
57, 7367	71.5, 4650	86.2-6.4, 6575
57d, 2579	71.8, S3047M	86.4-6.9, 4630
57.1, 103	72.2, 3912, S7223Q	87, 3867, 5107, 7096
57.3, 3507	72.3 ⁷⁶⁵ , S107W	87.1-7.6, 4626(1)
57.7-8.5, 6580(1)	72.4, 180M	87.2-7.5, 4621
58-60 ⁶ , S8070M	73, 2119	87.5, 4721
58.1, 2019	73.3, 2162	88, 2065, 7163
58.2, 5763	73.5, 381M, 1716, 6878	88-90, 7373
59 ⁷⁴¹ , 3752	74.1, 3553	88.5, 6502, 7603
59.4, 2688	75, 7044, 7226	88.7, 3917
59.5, 3691	75(77-9), 2191	88.7-9.1, 2115
59.6, 4541, 5100, 5754	75-6, 406H	89, 101, 204, 5620
60, 5027, 6503, 7164	75.7, 2204	89-91 ⁷⁴⁹ , 7081
60-1 ⁴ , S7993T	76, 6576	89.4, 6494
60.1, 3823	76, ca., 336H	89.4(91.8), 4572
60.2, 7218	76-7, 2587	89.5, 5106, 8596
61, 7257	76-8, 4954	90, 4571, 7241, 7609,
61(61.5-3.5), 4974	76.7, 319	S5580X
61-2, 2428	76.9, 6567	90-1, 2572
61.26(58-61.5), 2679	77.15, 94	90.5, 18
61.5-2.0, 6569	77.2-7.5 ⁷⁴⁴ , 4080	91, 2154, 7337, 7358
61.6, 2959	77.8(76-8), 2153	91.1-1.5, 4619
62, 7377	78, 2166, 8306	91.1-1.6, 4627(1)
62-3 ⁶ , S7993U	78-9, 406	91.3, 2161
62-4, 7340	78.5, 534	91.4(90-3), 3678
62.5-3.0 ⁷³⁷ , 7909	78.5(78.37), 3785	91.5, 3549K, 4957
62.8, 545M	78.9, 6493	92, 2155, 3930, 5000
63, 2157, 2193, 7229,	79, 3913	92.3 ¹⁷ , S294X
8646	79.6, 2095	92.5, 5141
63-5, 3224	79.9, 7287	92.6, 4985
64, 6363, 6504	80, 7324, 7375	92.8, 3549P
64(61.4), 3737	80(78-80), 3727	93, 173, 2100, 7616
64-6, 4095	80-100d., 336R	93.1-3.3, 4625
64.1, 4618	80.093-094, 1113	93.3, 6498
64.5, 3515	80.5, 387	93.9-4.3, 6568
64.65, 5719	80.5(83-4), 2982	94, 408, 4039, 4085,
65, 475, 5733, 5758,	80.6, 7976	7227
7374	80.8, 6495	94.3, 485
65.5, 4093	80.9, 2041	94.4-4.6, 4624
65.7-6.2, 6579(2)	80.9-1.3, 6566	94.5-5.5, 7183M
66, 8070	81-2, 7438	94.8-4.9, 6577
66.2-6.7, 2114	81-3, 7605	94.9(95-100), 4495
66.8 ⁷⁴¹ , S4628A	81.3, 4034	95, 1944, 4926, 5537
67, 4971	81.4, 2988	(95-6), 7899
67.2-7.5, 6578	82, 250, 4542, 5770,	95-7, 1943
67.5, 4628(1)	8713	95.1, 6573
67.5 ⁷⁴¹ , S4628B	82-3, 7336, S3755F	95.8-6.1, 4497
67.5 ⁷⁵⁰ , S4623B	82.3, 5098	96-7, 468, 2135, 6489
67.5(68.5-9.0), 5103	82.5, 3301	96-100, 858
67.6, 3651	82.6, 6574	96.3 ⁶⁴ (98d), 2668
67.6-8.2, 6579(1)	82.8, 2151	(96.5-7), 910M
67.9-8.1, 4623	83, 3029, 4017	96.8, 7097
68, 2167, 2192, 3783,	83-4, 3271	97, 4021
7162	83.5, 4546	97-8 ⁷⁴¹ , 2157M
68(67-9), 4953	83.5-3.7, 3874	97-9, 2013
68-9, 3679	84, 3999, 4620, 4651,	97.1(96-7), 7319
68-1, S7223M	8211	97.19(97.8), 7331
68.2 ⁷⁴⁹ , S4623A	(84-6), 7226	

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98 ²⁵ , S5580W	108, 323, 3794, 3821, 3927	119 ⁷⁴⁰ , 7098
98d, 3689	108-9, 2153H	119 ⁷⁵⁶ , 2992
98.1-8.4, 4496	108-10 ¹² , S285R	119(115-8), 6557
98.2, 4028, 5743	108-10(105-6), 322	119-20, 3660
98.52, 4458	108.2(107 ⁷⁴⁰), 537	119-21, 2073
98.9, 4929	108.25, 4566	119.28, 6538
99, 4942	108.39(106-8), 4951	119.4, 4100
(99), 2111	109.2, 2575	119.5, 6590, 7259
99.10, 7282	110, 1916, 4565, 4891, 5327	120, 3652, 3803, 7131F, 7201
99.3, 6511	110 ⁷⁵⁴ , 3821	120d., 4996
99.5, 7363	110(108-10), 3505	120-1, 2006, 2088
99.5-100, 2150	110.1, 8372	120.4, 4966, 5112
99.8, 386, 4515	110.7, 3345	120.5 ⁷⁵⁵ , 2993
<100d., 191M	110.8, 8336	120.65, 4928
100, 26, 5580R, 5634	111-2, 3160	120.7, 2911
100d, 27, 1371, 2183, 4922	111.3, 7286	120.8, 4984
100.3, 3002	111.5 ⁷³⁸ , 7179	121, 2179, 2992
100.5, 7366	111.7, 4981	121-2 ⁷⁵⁹ , S5761M
100.7, 4016	112, 2687, 3726, 4516, 6587	121-3, 6988
101, 5661, 8865	112-3, 92	121.20, 3862
101 ² , S4143J	113, 2134, 5160, 8232	121.3(119-21), 2225
101-2, 6333	113.5, 3555	121.4 ⁷³⁹ , S6277R
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102.3, 2232	114.5, 6560, S7248M	122.8-3.0, 6552
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105 ⁷⁵⁵ , 3296	116.8, 8177	125.8, 2568
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208.2, 8034	216, 2214, 3925, 8958	223.8, 8957
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209.2, 8814	216.9, 8960	224.5, 2336
209.6, 2364	217, 2534, 2535, 4631,	224.6, 6881
210, 4898, 6266, 6733	4997, 6344, 6718,	225, 667, 712, 2610,
210 ⁷⁹⁹ , 1955	6756, 8460, 8520,	2932, 3751, 5159,
210d, 3541	8959	5400, 5454, 8235,
210-1, 3112, 8513	217-8 ⁷³⁶ , 576	8921, 8946
210-5, 4436M, 8765	217.7, 7580, 8022,	225d, 661, 4864
210.3, 3682	8893	225-7, 647M
210.4, 3777	217.9, 5833	225-32, S4882M
210.5-1.0, 8218	218, 1302, 1303, 2435,	225.4(228-9), 4430
210.6, 3776	3238, 4065, 7327,	225.5, 5797
210.7d, 4003	8942	225.6, 34
210.9, 1256	(218), 712	226, 2819, 4099, 4304,
211, 2280, 3113, 3114,	218 ⁷⁵¹ , 6838	4433, 6193, 7733,
4147P, 4306, 4598,	218-9, 1172, 1723	8465, 8961
8394	218-20, 3142	226-7, 1158
211 ⁷⁴⁴ , 6734	218-22, 7023	226.4, 8452
211 ⁷⁴⁹ , 5457	218.5, 1459, 5136	(226.6), 6799
211d, 3151	219, 1298, 6761, 7184	227, 4632
211-4, 3657	219d, 7177, 7993(1)	(227), 4432
211-5, 5455	219(223.3), 2533	227-8 ⁷³⁸ , 279M
211-6d, 195	219-20, 6735	227-8 ⁷⁴⁴ , 4103
211.5, 8396, 8943, 8944	219-21, 6645	227-8(224), 7014

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227.5, 4722, 6449	237.9, 2605	246-7, 6757, 7622
228, 6800, 8459	238, 1705, 2430, 3801,	246-7d, 1390
228d, 7924	5767M, 6707, 8404,	246-8, 2917
228(226), 4431	8759	246-8 ⁷⁴⁷ , 3624
228-9 ⁷⁶⁴ , 8799	238-9, 6729	246-50 ⁷⁵¹ , 6713
228.3, 5424	(238-41), 629	247, 281, 701, 6758,
228.7, 2570	239, 5138, S293Y	8209, 8672
229, 593, 4173, 6349	239-40, 49	(247), 7670
229 ⁷⁵⁵ , 6548	239-41 ⁷⁶¹ , 412	247-9 ⁷⁵⁸ , 6712
229d, 2137	239-44, 4226	247.3, 6129
229(224-9)d, 2788	239.4, 6519	247.3-8.3 ⁷⁵¹ , 7683
229.2, 3685, 6650,	239.5, 7023H, 8827	248, 3933, 6651, 8117
7193M	239.9, 8938	248-9, 8851
229.3 ⁷⁵⁸ , 6773	240, 293, 714, 1061,	248-50, 1748, 6695
229.5, 3686	2223, 2359, 4296,	248-52, 5119
229.8, 601	4716, 5427, 7843,	248.4, 2930
230, 1263, 1450, 1740,	8421, 8510	249, 1449, 4767
2059, 4583, 5154,	240d, 994, 7819	249-54d, 2310
8295, S4649F	240(240-5), 7528	249.8, 8497M
230(227-8; 225), 2616	240-2, 5452	250, 1284, 2304L, 4581,
230-2, 5142M, 7558	240-3, 5877	4931, 7679
230-40, 4225	240-3d, 8473	>250, 264, 4012
230-50, 5038	240-4d, 4738	250d, 734, 4124, 5548
230.2, 2102	240-5d, 2621	(250-2), 5842
231, 602, 3107, 7908,	240-50, 8930	(250-3), 4231
8403	240-50d, 6658	250-6d, 5441
231-4, 6708	240.5 ⁷⁵⁰ , 6714	250.3, 1453
231.2, 1464, 3235	240.9, 598, 599	(250.8), 7608, 8906
232, 133, 280, 1715,	241, 1311, 2607, 7539,	251, 594, 611, 713,
8198, 8292	8897	1206, 2737, 5870,
232.3, 2270, 2379	241(235), 1311	7692
232.5, 8773	241-2, 1217	251d, 4522
232.6 ⁷⁵⁸ , 6801	241-3d, 2367	251-2 ⁷⁵⁰ , 3617
232.7, 8593	241.6, 4436	251.5 ⁷⁵⁴ , 1140
233, 2609, 3005, 5550,	242, 1162, 4955, 5415	252, 609, 1745, 2975,
8683	242-3, 1216, 5119	4667, 7463, S5078T,
233-4, 6737, 6742	242-5, 5449	S7367M
233-5, 3073	242-5 ⁷⁶⁴ d., 4174	252 ⁷⁵⁴ , 1139
233.5, 8288	242.5, 5010	252d, 271
234, 6688, 8522, 8582,	242.9, 6889	252(256-8), 6836
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234(231.5), 7832	5126, 6777, 7422,	252-5 ⁷⁴⁸ , 6983
234-5, 1179, 7410	7630	252.5, 7682, 8144,
234-7, 6711	243-5, 7761	8154M
234.5, 7815	243.4, 6346	253, 5414, 6807
234.6, 36	243.7, 2344	253-5d, 466
235, 2103, 2923, 5436,	244, 2305, 4863, 8922	253.5 ⁷⁶⁷ , 6736
7409, S7190M	244-7d, 2313	254, 1280, 1283, 4881,
235 ⁷⁶² , 647H	244.3, 6776	6448, 8466
235 ⁷⁶⁷ , 4147S	244.5, 6808	254-5, 1849, 2657
235d, 928, 8020	244.5(245-50), 3231	254-6 ⁷⁴⁶ , 3211
235-6, 1161	245, 572, 610, 3236,	254.2, 6652
235-6 ⁷⁴⁶ , 2086	4720, 5878, 7608,	254.5, 647
235-7, 1639	8906, 8929, S293X	254.7(253 ⁷¹²), 73
235-40, 5437	(245), 714	255, 2304d, 2349, 3395,
235.3, 563	245, ca., 3136	4927, 5039, 5297,
(235.5), 8459	245 ¹¹ , S6858M	5558, 5799, 6771,
235.6(237.4), 7185	245d, 176	7681, 8534, 8913
236, 1769	245d, ca., 171	255 ⁷⁴³ , 7662
236-7, 1760M, 2903	245-6, 629	255 ⁷⁶⁶ , 8588
(236-7), 2344	245-7d, 1725	255d, 3451
236-8, 6715	245-50, 1948	255-6, 8912
236.5, 1173M, 6706,	245.2, 3629M	255.5, 275, 1312, 6254
7403	245.5, 5173	256, 707, 781, 1143,
237, 1458, 2658, 4214,	245.7, 1160	3600, 4851, 5378
4715, 5139	246, 1180, 1281, 1282,	256d, 8028
237(242-5), 8613	3748, 5348, 7420,	256.5, 1142
237.5, 2381, 3003	8151	257, 6805
237.7, 7657		

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257 ⁷⁵⁴ , 1138	267, 56, 1887, 6128, 6790, 6845, 7709, 8046	280-90, 8606
257.5, 2778, 2782, 8507M	267d, 938, 1456	281, 6950(1), 7514
258, 294, 724, 3443, 5199, 8907	267-70, 2894	281-2, 5841
(258), 3760, 6842	267.5, 5045	281.1, 5840
258 ⁷³⁸ , 1923	268, 3215, 6661, 8952	282, 3733, 5850, 6910, 8095
258d, 5869	268(270-5), 5163	(282), 1860
258(262.7), 6743	268-70, 2335, 6842	282-3, 5046
258-63, 5332	269, 706, 5313, 7675	282-6, 8009
258.8, 732	(269), 1577	283, 312, 6663, 8846
259, 1544, 4250, 4475, 6853, 7835, 8130	270, 596, 691, 1924, 2322, 3132, 6619, 7488, 8730	283.8, 8167
259d, 7647	<270, 3238M	284, 1809, 6662
259-60, 685, 8238	270d, 2323, 2651, 7825, 8303	284-5, 1859
(259-61), 7672	(270d), 668, 669	284.11, 668
259.1, 3400	270-1, 6993	284.5, 6933, 7228
259.2, 8440	270.4, 7489	284.8, 1191
259.5, 6848	270.5, 6457	285, 623, 1192, 2388, 5085, 5238, 5858, 7694, 8538, 8838
260, 308, 613, 725, 774, 1885, 1919, 2433, 4509, 6850, 7970, 8563	271, 2744, 4014	285d, 166, 5977
260 ⁷¹⁹ , 7698	(271), 608	285-6, 5667
260d, 1013, 2249, 5074, 8250	272, 612, 1923	285-7, 7696
(260d), 670	272(268-86), 3518	285.2, 3771
260-2, 229	272.3, 4883	286, 669, 3599, 5024, 5855
260-5, 4389	273, 1593, 7453, 7834	(286), 5978
260-70, 7264M	273-4, 1858	286 ⁷⁴⁰ , 7466
261, 1141, 7670, 8044	273-4 ⁷⁵⁴ , 3439	286d, 2741
261 ⁷⁴⁴ , 7663	273-6, 1926	286-7, 1190
261-2, 227, 673, 6846	273.7, 8923	286-7 ⁷¹³ , 1925
261-2(264.7), 5635	274, 1883, 3761, 8539	286-90 ⁷³⁵ , 6138
261.9(259.6), 2745	(274), 725	286.2, 4791
262, 1457, 6694, 6847	274d, 2311, 5070	287d, 2794
262-3, 2623	274.5, 6048, 8954	287 ⁷⁴⁰ , 5852
262-4, 8852	275, 1577, 4411, 6791, 6950(2), 7490, 8458	287(282-4), 6840
262.4, 692	(275), 6661	287.4, 4222
262.8, 608	275 ⁷⁴⁷ , 5666	287.5, 4528
263, 4805, 5842, 7040, 8451, 8587, 8727	275-7, 2693	(287.5), 1924
263.2, 8149	275.5, 5565	288, 1447, 2767, 3186, 5955, 8045
264, 597, 7671, 7770	275.7, 8592	288d, 2996, 6001
(264), 8588	275.8, 8154T	288-90, 617, 1637
264-6, 787, 5843	276, 1296, 1878, 5094, 6000	288.1, 1236
264.3, 5863	(276), 7661	289, 82193M
265, 1230, 4689, 5018, 6348, 7406, 7831, 8535	276 ⁷⁴² , 7465	289-90, 6316
265 ⁷³⁶ , 7674	276-9, 7759	289-92d, 4269
265d, 118, 2776	276-80, 6739	290, 272, 749, 1079, 1234, 4064, 4228, 6936, 8226, 8287
265-6, 87315M, 8843T	276.4, 3732	290 ⁷³⁷ , 7673
265-8, 6746	276.5(281.4), 7740	290d, 1781, 4769
265-9, 3760	276.8, 6056	290(285), 6047
265-70d, 117	277, 723, 1260, 1261, 1886, 3832	(290-1), 2855
265-75, 2M	277-80, 7757	291, 952
265-81, 7767	277.5, 2	291 ⁷⁵⁵ , 5851
265.3, 5976	278, 675, 1297, 1728	(291), 1201
265.5, 5999, 8464	278.5, 6070	291d, 8420
266, 8479	279, 1580	291-2, 85844M
266-7, 7661, 7672, 86214M	279d, 6785	291-2 ⁷²⁷ , 8099
(266-8), 774	(279-80), 5667	291.2, 8153
266.2, 7914	279.8, 4766	291.2 ⁷⁴⁵ , 1860
266.8, 3747	280, 705, 1235, 1499, 4231, 4765, 8094M, 8098, 8100, 8537	291.5, 690
266.9, 7708	(280), 5955	291.6, 5829
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294.85, 5978	310-1, 2098	344, 1630, 2647
295, 273, 4435, 5031, 5817	310-5d, 2854	345, 2879, 5886
(295), 1926	310-12 ¹⁰ , S1687M	346, 371
295(298), 3982	310-20, 4260	346-8d, 1420
295-8, 1773	312, 6702	348, 2655
295-300, S312M	312-4, 3671	348-9 ⁷⁵¹ , 3560
296, 208M, 307, 6859	(313), 741	350, 5659, 5660
296d, 1313	313.4, 3378	>350, 6172, 7516
296-8, 1856, 5434	314, 1462	350d, 6640
296.1, 6909	315, 1092, 1153, 1155, 4253, 8874	351, 1696, 1698, 8886
296.5, 6020	315d, 1157	353-4d, 8176
297, 3326	315 ⁷⁴⁵ d, 1448	354, 6849
297.4, 958	315-6, 6063	354 ⁷⁰⁶ , 5638
298, 1226, 1579	315-9, 1864	354-5, 735
(298), 6064	316, 5271	354.8, 2444
298-9, 3769	316.5, 5272	355d, 1588
298.5, 1441	(316-7), 1452	355-60, 1863
299, 1895	317, 1091, 6224	359.2, 5697
299 ⁷⁷⁷ , 1202	317, ca., 6055	360, 1628 1706, 2414, 5639, 6015, 6627, 7704, 7944
300, 209M, 338, 590, 592, 688, 2740, 3197, 5941	317-9 ⁷⁴² d, 3749	>360, 755, 962, 1430, 1648, 2540, 6103, 6638, 6892, 6892M, 7458, S1719M
>300, 32, 1697, 1699, 4757, 5948, 6792, 8079	317.4, 3383	360, ca., 1836
300, ca., 923	319 ⁷⁷³ , 1200	360d, 951, 2691
300d, 1081, 1744, 3052, 7076, 8378	320, 499, 1888, 3379, 6377	>360d, 1656, 2445
>300d, 3199, 7701	>320, 2966	363, 1203, 1899, 7689
301, 1519, 6043	320, ca., 5801	365, 8658
(301 ⁷⁴⁶), 1447	320d, 748, 1882	371d, 6826
301.72, 2855	320-2, 6703	377.8, 6860
302, 3317, 8889	322, 3140	379-81, 794
302d, 2131, 8419	322.5, 2648M	380, 5497
302.8 ⁷⁷⁰ , 1201	323-4, 1452	380-90, 8567
303, 309, 4441, 8102	323-6d, 3750	383, 3551, 7943
303-5, 84	324.1, 8141	385, 5286
304, 5883	325, 5885, 8483	394, 7785
304d, 4213	325d, 211	398 ⁷⁵⁴ , 5267
304.8, 1908	325 ⁷⁵⁴ , 7928	399.5, 6069
305, 52, 741, 1879, 5874, 6021, 6049, 6062	326, 1225, 1843, 8180, 8236	400, 4170
305d, 3584, 8491	326.5, 5273	400, ca., 8019H
(305-7), 6063	328, 882	>400, 1910, 4179
306, 1650, 1762	329, 1278	400-5, 6071
>306d, 5539	330, 3218, 6169, 6698	401.7, 1411
306(302), 2573	330-1, 2556 α	404, 376
306-7, 1764	330.5, 3380, 7203	410d, 8543
306.1, 6059	331, 3468	417, 756
306.35, 669	331.73, 670	419-28d, 6941
307, 311, 7977	333d, 909	>420, 8307
307.6, 6460M	333-4 ⁷²⁵ , 1670	425, 3865
308, 6793, 7876	335.9, 4448M	430, 442
(308), 6703	336, 1398	431, 5676
308-10, 5875	337 ⁷³⁰ , 6946	446, 6025
308-10 ⁷⁵¹ , 6064	338-40, 3667, 7102	448, 2711
308.5, 4445	339-56d, 6402	452, 1839
309, 7545	340, 1399, 1660, 1890, 6697, 6908	459, 3978
	340.2, 6613	462d, 791
	341.5, 3987	471, 3290
	342, 1844	520, 6960
	342 ⁷⁴² , 2800	

PHYSICAL CONSTANTS OF INDUSTRIAL ORGANIC COMPOUNDS

The following table is intended to provide information concerning the characteristics and properties of commercially available organic compounds. The material presented has been compiled from information furnished by the manufacturers whose courtesy is gratefully acknowledged. Where the same compound has been reported by two or more manufacturers separate entries have been made.

ABBREVIATIONS

a.....	acid	g.....	grams	ppnt.....	precipitant
absorb.....	absorbent	gen.....	general	prep.....	preparatory, preparation
accel.....	accelerator	gran.....	granules, granular	press.....	pressure
acet.....	acetone	grn.....	green	pung.....	pungent
agt.....	agent	h.....	hot, high	purif.....	purification
al.....	alcohol	hyg.....	hygroscopic	pyr.....	pyridene
alk.....	alkali	l.....	insoluble	quant.....	quantities
amm.....	ammoniacal	imm.....	immiscible	redsh.....	reddish
approx.....	approximately	indust.....	industrial	rub.....	rubbing
art.....	artificial	init.....	initial	s.....	soluble
astring.....	astrigent	inter.....	intermediate	sec.....	secondary
boil.....	boiling	lab.....	laboratory	sl.....	slight, slightly
br.....	brown	lacq.....	lacquer	sld.....	solid
bz.....	benzene	liq.....	liquid	soft.....	softener, softening
c.....	cold	lt.....	light	solv.....	solvent
ca.....	about	lubr.....	lubricating	suff.....	suffocating
cellu.....	cellulose	lust.....	lustrous	syn.....	synthesis
char.....	characteristic	m.....	most	synth.....	synthetic
chem.....	chemical	mat.....	material	tech.....	technical
cl.....	clear	meth.....	methyl	tert.....	tertiary
col.....	colorless	mfg.....	manufacture	tetr.....	tetragonal
com.....	common	min.....	minimum	thick.....	thickening
comp.....	compound, compartment	misc.....	miscible	trans.....	transparent
conc.....	concentrated	moist.....	moistening	trig.....	trigonal
cr.....	crystals	monocl.....	monoclinic	typ.....	typical
d.....	decomposes	need.....	needles	v.....	very
deliq.....	deliquescent	nitro.....	nitrocellulose	veget.....	vegetable
deriv.....	derivative	n. res.....	non residual	visc.....	viscous
disp.....	dispersible	n. vol.....	non volatile	vol.....	volume
dist.....	distilled	org.....	organic	w.....	water
dk.....	dark	pa.....	pale	wh.....	white
et.....	ethyl	pen.....	penetrating	wt.....	weight
eth.....	ether	per.....	permanent	yel.....	yellow
ethylcellu.....	ethylcellulose	pet.....	petroleum	>.....	above
extr.....	extractant, extraction	pharm.....	pharmaceutical	<.....	below
f.....	finger	photo.....	photographic	s.....	soluble in all proportions
fa.....	faint	pk.....	pink		
fl.....	flakes	pl.....	plates		
fiam.....	flammable	pleas.....	pleasant		
		powd.....	powder		

Sources of Information

An.	Ansul Chemical Co.	P.P.	Phillips Petroleum Co.
At.	Atlas Powder Co.	Q.O.	Quaker Oats Company
C. & C.	Carbide & Carbon Chemicals Corp.	S.C.L.	Shawinigan Chemicals, Ltd.
C.S.	Commercial Solvents Corp.	S.C.	Shell Chemical Co.
C.P.	Corn Products Refining Co.	S.D.	Shell Development Co.
D.	Dow Chemical Co.	Sh.	Sharples Chemicals, Inc.
G.	Glyco Products Co., Inc.	S.P.	Solvay Process Company
N.	Niacet Chemicals Corp.	St.	Standard Oil Development Co.
Pa.	Pennsylvania Coal Products Co.	U.S.I.	U.S. Industrial Chemicals Co., Inc.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
1	Acet- <i>para</i> -toluide . . .	<i>p</i> -acetotoluide	$\text{CH}_3\text{CONHC}_6\text{H}_4\text{CH}_3$	149.19
2	Acetaldol	hydroxybutyraldehyde . . .	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CHO}$	88.10
3	Acetamide, C.P.	acetamide	CH_3CONH_2	59.07
4	Acetamide, Tech	acetamide	CH_3CONH_2	59.07
5	Acetic acid, Glacial, C.P.	acetic acid	CH_3COOH	60.0
6	Acetic acid, Glacial, U.S.P. XI, and Standard	glacial acetic acid	CH_3COOH	60.05
7	Acetic anhydride	acetic anhydride	$(\text{CH}_3\text{CO})_2\text{O}$	102.09
8	Acetoacetanilide	acetoacetanilide	$\text{CH}_3\text{COCH}_2\text{CONHC}_6\text{H}_5$	177.20
9	Acetoacetanilid	acetoacetanilid	$\text{CH}_3\text{COCH}_2\text{CONHC}_6\text{H}_5$	177.20
10	Acetoacet- <i>ortho</i> -chloranilid	acetoacet- <i>ortho</i> -chloranilid	$\text{CH}_3\text{COCH}_2\text{CONHC}_6\text{H}_4\text{Cl}$	211.65
11	Acetoacet- <i>ortho</i> -toluidid	acetoacet- <i>ortho</i> -toluidid	$\text{CH}_3\text{COCH}_2\text{CONHC}_6\text{H}_4\text{CH}_3$	191.22
12	α -Acetochloroglucose . . . . .	. . . . .	$\text{C}_{14}\text{H}_{19}\text{O}_9\text{Cl}$	366.75
13	Acetone	dimethyl ketone	CH_3COCH_3	58.08
14	"	" "	CH_3COCH_3	58.08
15	"	" "	CH_3COCH_3	58.08
16	"	" "	CH_3COCH_3	58.08
17	Acetonitrile	methyl cyanide	CH_3CN	41.05
18	Acetonyl acetone	acetonyl acetone	$\text{CH}_3\text{COCH}_2\text{CH}_2\text{COCH}_3$	114.14
19	<i>cis</i> -Acetylene dichloride	<i>cis</i> -dichloroethylene	$\text{CHCl}:\text{CHCl}$	96.95
20	<i>trans</i> -Acetylene dichloride	<i>trans</i> -dichloroethylene . . .	$\text{CHCl}:\text{CHCl}$	96.95
21	Adamsite, D.M.	diphenylamine chlorarsine	$\text{NH}(\text{C}_6\text{H}_5)_2\text{AsCl}$	277.57
22	<i>dl</i> -Alanine	<i>dl</i> - α -aminopropionic acid	$\text{CH}_3\text{CHNH}_2\text{COOH}$	88.09
23	Alkazene 3	<i>x</i> -triethyl benzene	$\text{C}_6\text{H}_5(\text{C}_2\text{H}_5)_3$	162.27
24	" 6	hexaethylbenzene	$\text{C}_6(\text{C}_2\text{H}_5)_6$	246.42
25	" 8	<i>x</i> -diethyl- <i>x</i> -diisopropylbenzene	$(\text{C}_2\text{H}_5)_2\text{C}_6\text{H}_3[\text{CH}(\text{CH}_3)_2]_2$	218.37
26	" 12	<i>m</i> -diisopropylbenzene	$\text{C}_6\text{H}_4[\text{CH}(\text{CH}_3)_2]_2$	162.27
27	" 13	<i>x</i> -triisopropylbenzene	$\text{C}_6\text{H}_3[\text{CH}(\text{CH}_3)_2]_3$	204.34
28	" 14	<i>x</i> -tetraisopropylbenzene . . .	$\text{C}_6\text{H}_2[\text{CH}(\text{CH}_3)_2]_4$	246.42

ORGANIC COMPOUNDS

No.	Physical form and color	Odor	Purity %	Sp. gr.
1	lt. gray cr.	faint.		
2	pa. yel. visc. liq.	aromatic, pen.	90-98.	1.10-1.11 ^{15.6}
3	wh. sld.	none.	99.5-99.9.	1.15 $\frac{20}{4}$
4	wh. sld.	mousey.	99.	1.15 $\frac{20}{4}$
5	col. liq.	sharp, sour.	99.8 min.	1.05
6	w. wh. liq.	vinegar.	99.5.	1.049 $\frac{20}{4}$
7	col. liq.	pungent.	96.0.	1.0830
8	wh. cr. sld.			
9	wh. fine cr. sld.	very mild.	97.	
10	wh. fine gran. powd.	very mild.	98.	
11	wh. fine gran. powd.	very mild.	96.	
12	sld.			
13	col. flam. liq.	agreeable.	99.	0.7915-.7935 $\frac{20}{20}$
14	w. wh. liq.	mild, n. res.	99-100.	0.791-.793 $\frac{20}{20}$
15	col. liq.	pleasant.	99 by wt.	0.791-.793 $\frac{20}{20}$
16	w. wh. liq.	mild.	99. ....	.791-.799 $\frac{20}{20}$
17	col. liq.	ethereal.	98.8 min. ....	.782-.785
18	col. liq.	pleasant.		0.9738
19	col. mobile liq.	mildly sweet.		1.281 $\frac{25}{25}$
20	col. mobile liq.	mildly sweet.		1.252 $\frac{25}{25}$
21	lt. yel.-grn. gran. sld.	lacrimatory.	90-95	1.648 $\frac{20}{20}$
22	wh. cr.	none.		
23	cl. col. liq.	mild char.		0.870 $\frac{25}{25}$
24	wh. cr.	almost none.		
25	col. liq. ....			.867 $\frac{25}{25}$
26	cl. col. liq.	mild, pleas. ....		.855 $\frac{25}{25}$
27	cl. col. liq.	almost none. ....		.854 $\frac{25}{25}$
28	wh. cr.			

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
1	Acet <i>para</i> -toluide	148-150.	298-302.	298-303.	
2	Acetaldol	<0.	83 ²⁹ .	variable.	181.4
3	Acetamide, C.P.	81.	220.	215-221.	
4	Acetamide, tech.	77-79.	219.	210-220.	
5	Acetic acid, glacial, C.P.	16.24.	118.1.		111
6	Acetic acid, glacial, U.S.P. XI, and Standard	15.6.	118.1.		111
7	Acetic anhydride	-67.7.	139.5.		150
8	Acetoacetanilide	83-85.			
9	Acetoacetanilid.	<82.5.			
10	Acetoacet- <i>ortho</i> -chloranilid.	102.5.			
11	Acetoacet- <i>ortho</i> -toluidide	104-105.			
12	α -Acetochloroglucose	70-71.			
13	Acetone	-95.1.	56.1.	56.1-57.1.	15
14	"	-94.9.	56.1.	55.0-57.0.	15
15	"	-95.0.	56.1.	<55.8 none; >56.6 none	<-4
16	"	-95.	56.1.	<55.6 none; >57.1 none	14
17	Acetonitrile	<-40.	81.6.	78-82.	
18	Acetonyl acetone	-5.4.	191.4.	185-195.	185
19	<i>cis</i> -Acetylene dichloride	<-80.		58.3-5%; 60.1-95%	39.2
20	<i>trans</i> -Acetylene dichloride	<-20.		47.9-5%; 49.0-95%	35.6
21	Adamsite, D.M.	182-183.		d. 195.	
22	<i>dl</i> -Alanine	270.8-275.8.			
23	Alkazene 3	<-70.		217.6-5%; 219.3-95%	181.4
24	" 6.	126.5-128.3.	296.		>563
25	" 8.	-50.		253.9-5%; 257.4-95%	224.6
26	" 12	-65.		205-5%; 208.6-95%	170.6
27	" 13	-15.		235.9-5%; 237.4-95%	206.6
28	" 14.	98.5-115.2.	260.		244.4

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
1	∞ al; s. eth; sl. s. w.	dye inter.	drums	Pa.
2	∞ w., al; s. eth	syn. rubber accel., dye inter., perfumes, pharm., denatur- ant	caus, drums	N.
3	v.s. eth.; s. al; 97.5 ²⁰ w.	solv., plasticizer, org. syn.	lined drums	N.
4	v.s. eth; s. al; 97.5 ²⁰ w.	solv., soldering flux, plasti- cizer, org. syn.	lined drums	N.
5	s. w., al., eth.	lab. reagent, photo. syn.	carboys, drums	N.
6	∞ w., al., eth.	mfg. cellulose acetate; solv. oils, gums, resins; ppt. albu- men, casein & rubber	drums, tanks, cans	N.
7	s. al; CHCl ₃ , eth.; d.w.	acetylating agt.	tanks, cars, drums, car- boys, jugs	C. & C.
8	sl. s. w.	printing ink dyes	drums	C. & C.
9	sl. s.w., v.s. al., eth., CHCl ₃ , alk., a., h.bz.	dye inter.	barrels	U.S.I.
10		dye inter.	barrels	U.S.I.
11		dye inter.	barrels	U.S.I.
12	d.h.w.; s. et. al., meth. al., acet., eth., CCl ₄			C.P.
13	∞ w.	solv. acetylene, process solv. rayon, art. leather, films, plastics, solv. lacq., dopes	tank cars, drums, cans	C. & C.
14	∞ w.	solv.	tank cars, drums, cans	C.S.
15	∞ w., al., benzol, gasoline, kerosene, org. liq.	solv. lacq., gums; raw mat. for org. syn., plastics; extr. fats	tank cars, drums, tins	S.C.
16	∞ w.	cellu. acetate solv., acetylene absorbent, dewaxing agt., mfg. acetic anhydride, CHCl ₃ , indigo, etc.	tank cars, drums, cans	U.S.I.
17	s.w., al; i. paraffins.	syn. Vitamin B ₁ and pyrimi- dines extr. agt.	carboys, drums	N
18	∞ w.	solv. cellu. acetate; syn. of cyclic comp.	drums	C. & C.
19	∞ acet., bz., CCl ₄ , eth., meth. al.; i.w.			D.
20	∞ acet., bz., CCl ₄ , eth., meth. al.; i.w.			D.
21	d. w.; % by. wt: 15.9 acet., 2 bz., 8.4 eth., 6.3 meth. al.	sickening gas.	drums	Pa.
22	17 ²⁵ w., 32 ⁷⁵ w., i. acet., bz., CCl ₄ , eth., meth. al.			D.
23	∞ eth., acet., bz., CCl ₄ ; g. per 100 g: 120 meth. al.; i.w.			D.
24	sl. s. meth. al., acet., eth., CCl ₄ , bz; i.w.			D.
25	∞ eth., CCl ₄ , bz., acet.; g. per 100 g: 44 meth. al.; i.w.			D.
26	= meth. al., eth., CCl ₄ , bz., acet.; i.w.			D.
27	∞ eth., CCl ₄ , bz., acet.; g. per 100 g: 43 meth. al.; i.w.			D.
28	g. per 100 g: 97 bz., 85 eth., 62 CCl ₄ , 18 acet.; i.w.			D.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
29	Alkazene 16.....	<i>x</i> -triisopropyltoluene.....	$\text{CH}_3\text{C}_6\text{H}_2[\text{CH}(\text{CH}_3)_2]_3$	218.37
30	" 20.....	<i>m</i> -chloroethylbenzene.....	$\text{ClC}_6\text{H}_4\text{C}_2\text{H}_5$	140.61
31	" 21.....	<i>p</i> -chloroethylbenzene.....	$\text{ClC}_6\text{H}_4\text{C}_2\text{H}_5$	140.61
32	" 24.....	1-2-dichloro- <i>x</i> -ethyl- benzene.....	$\text{Cl}_2\text{C}_6\text{H}_3\text{C}_2\text{H}_5$	175.06
33	" 25.....	<i>x</i> -dichloro- <i>x</i> -ethylbenzene.....	$\text{Cl}_2\text{C}_6\text{H}_3\text{C}_2\text{H}_5$	175.06
34	" 28.....	<i>x</i> -chloro- <i>x</i> -diethylbenzene.....	$\text{ClC}_6\text{H}_3(\text{C}_2\text{H}_5)_2$	168.66
35	" 32.....	ethyl pentachlorobenzene.....	$\text{Cl}_5\text{C}_6\text{C}_2\text{H}_5$	278.41
36	" 34.....	<i>x</i> -dichloro- <i>x</i> -diethyl- benzene.....	$\text{Cl}_2\text{C}_6\text{H}_2(\text{C}_2\text{H}_5)_2$	203.11
37	" 36.....	<i>x</i> -chloro- <i>x</i> -triethylbenzene.....	$\text{ClC}_6\text{H}_2(\text{C}_2\text{H}_5)_3$	196.71
38	" 40.....	<i>x</i> -bromoethylbenzene.....	$\text{BrC}_6\text{H}_4\text{C}_2\text{H}_5$	185.07
39	" 42.....	<i>x</i> -dibromoethylbenzene.....	$\text{Br}_2\text{C}_6\text{H}_3\text{C}_2\text{H}_5$	263.98
40	" 45.....	<i>x</i> -bromo- <i>x</i> -diethylbenzene.....	$\text{BrC}_6\text{H}_3(\text{C}_2\text{H}_5)_2$	213.12
41	" 47.....	<i>x</i> -bromoisopropylbenzene, <i>x</i> -bromocumene.....	$\text{BrC}_6\text{H}_4\text{CH}(\text{CH}_3)_2$	199.10
42	" 60.....	<i>x</i> -chloroisopropylbenzene, <i>x</i> -chlorocumene.....	$\text{ClC}_6\text{H}_4\text{CH}(\text{CH}_3)_2$	154.64
43	Allyl alcohol.....	allyl alcohol.....	$\text{CH}_2\text{CHCH}_2\text{OH}$	58.05
44	" chloride.....	" chloride.....	$\text{CH}_2\text{CHCH}_2\text{Cl}$	76.50
45	4-Aminobenzophenone.....	4-aminobenzophenone.....	$\text{C}_6\text{H}_5\text{COC}_6\text{H}_4\text{NH}_2$	197.23
46	Ammonium stearate, anhydrous.....	ammonium stearate, anhydrous.....	$\text{NH}_4\text{C}_{18}\text{H}_{35}\text{O}_2\text{C}_{18}\text{H}_{35}\text{O}_2$	585.98
47	Amyl acetate, tech.....	amyl acetate.....	$\text{CH}_3\text{COOC}_5\text{H}_{11}$	130.18
48	" " , high test.....	" acetate.....	$\text{CH}_3\text{COOC}_5\text{H}_{11}$	130.18
49	sec.-Amyl acetate.....	sec. amyl acetate.....	$\text{CH}_3\text{COOC}_5\text{H}_{11}$	130.18
50	Amyl alcohol.....	isoamyl alcohol.....	$\text{C}_5\text{H}_{11}\text{OH}$	88.15
51	pri- <i>n</i> -Amyl alcohol.....	(1-pentanol) (normal butyl carbitol).....	$\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{OH}$	88.15
52	sec.-Amyl alcohol.....	sec.-amyl alcohol.....	$\text{C}_5\text{H}_{11}\text{OH}$	88.15
53	tert.-Amyl alcohol, re- fined.....	2 butanol, 2-methyl.....	$\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)\text{OHCH}_3$	88.15
54	Amyl phthalate.....	diamyl phthalate.....	$\text{C}_6\text{H}_4(\text{COOC}_5\text{H}_{11})_2$	306.39
55	Amyl propionate.....	amyl propionate.....	$\text{CH}_3\text{CH}_2\text{COOC}_5\text{H}_{11}$	144.21
56	<i>N</i> -(β -phenoxyethyl)- Aniline.....	aniline, <i>N</i> -(β -phenoxy- ethyl).....	$\text{C}_6\text{H}_5\text{O}(\text{CH}_2)_2\text{NHC}_6\text{H}_5$	213.27

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
29	cl. col. liq.	almost none		.866 $\frac{25}{25}$
30	cl. col. liq.	mild. char		1.045 $\frac{25}{25}$
31	cl. col. liq.	mild, char		1.050 $\frac{25}{25}$
32	cl. col. liq.	faint char		1.210 $\frac{25}{25}$
33	col. liq.	none		1.208 $\frac{25}{25}$
34	col. liq.	char		1.017 $\frac{25}{25}$
35	wh. cr. sold			1.552 $\frac{60}{25}$
36	col. liq.	aromatic		1.158 $\frac{25}{25}$
37	col. liq.	none		1.003 $\frac{25}{25}$
38	col.-pa. straw liq.	char		1.339 $\frac{25}{25}$
39	cl. col. liq.	fa.		1.731 $\frac{25}{25}$
40	col. liq.	char		1.259 $\frac{25}{25}$
41	col. liq.	char		1.294 $\frac{25}{25}$
42	col. liq.	char		1.029 $\frac{25}{25}$
43	col. liq. (poison)	lachrymatory, irritating	98 by wt.	0.852 $\frac{20}{20}$
44	col.-straw. liq. (poisonous)	char	97 by wt.	0.937 $\frac{20}{20}$
45	lt. br. cr. sld	fa. char		
46	cream-colored wax-like sld	fa. fatty	tech.	0.889 $\frac{22}{22}$
47	w. wh. liq.	mild n. res.	90-93 by wt.	.868-.872 $\frac{20}{20}$
48	w. wh. liq.	mild. n. res.	85-88 by wt.	.860-.864
49	w. wh. liq.	mild. n. res.	85-88	0.862-0.866 $\frac{20}{20}$
50	w. wh. liq.	n. res.		.811-.815 $\frac{20}{20}$
51	w. white			0.82 $\frac{20}{20}$
52	w. wh. liq.	mild n. res.	99	.810-.816 $\frac{20}{20}$
53	w. wh.		98	0.81 $\frac{20}{20}$
54	col. liq.	sl. pleas	99-100	1.022-1.026 $\frac{20}{20}$
55	w. wh. liq.	mild n. res.	90-92	.869-.873 $\frac{20}{20}$
56	straw colored sld	amine-like		1.070 $\frac{60}{25}$

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
29	Alkazene 16.....	< -20.....		252.7-5%; 255-95%	204.8
30	" 20.....	< -70.....		182.8-5%; 183.3-95%	149
31	" 21.....	< -70.....		181.2-5%; 183.8-95%	147.2
32	" 24.....	< -70.....		224.5-5%; 225.8-95%	201.2
33	" 25.....	< -70.....		220.6-5%; 223.6-95%	204.8
34	" 28.....	< -70.....		217.8-5%; 220.6-95%	195.8
35	" 32.....	53.2-53.6...	305.....		none
36	" 34.....	-55.....		249.0-5%; 250.8-95%	249.8
37	" 36.....	< -60.....		249.9-5%; 254.7-95%	235.4
38	" 40.....	-65.....		200.5-5%; 202.8-95%	199.4
39	" 42.....	< -70.....		258.5-5%; 260.6-95%	none
40	" 45.....	< -70.....		236.8-5%; 238.8-95%	240.8
41	" 47.....	-30.....		212.4-5%; 216.2-95%	204.8
42	" 60.....	< -20.....		191.3-5%; 193.2-95%	174.2
43	Allyl alcohol.....	-129.....	97.....	<94° none; >99° none	85
44	" chloride.....	-134.5.....	45.....	<43° none >49° none	-20
45	4-Aminobenzophenone.....	119-122.2.....			
46	Ammonium stearate, anhydrous.....	74-76.....	d. before boiling, ca 110		
47	Amyl acetate, tech.....			<110-none; 130-50%; >150-none	94
48	" " high test.....	-78.5.....	142.1.....	<110-none; 140-60%; >150-none	84
49	sec-Amyl acetate.....			123-init.; 132-60%; >145-none	89
50	Amyl alcohol.....		131.....	<126 none >132 none	127
51	pri-n-Amyl alcohol.....	-78.5.....	137.9.....	134.5-138.5-95%	136
52	sec-Amyl alcohol.....			<105-none; 112-10%; 120-90%; >125-none	91
53	tert-Amyl alcohol, refined.....			99.8-103.8-95%	70
54	Amyl phthalate.....	-30 (approx.)	264 ^{99.5}	256-269 ^{99.5} mm	359.6
55	Amyl propionate.....		160.3.....	<135-none; 150-30%; 165-90%; >175-none	106
56	N-(β-phenoxyethyl)aniline.....	43.8-48.5.....	202 ¹⁰		338

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
29	g. per 100 g.: 22 meth. al.; eth., CCl ₄ , bz., acet.; i.w.			D
30	∞ meth. al., eth., bz., CCl ₄ , acet; i.w.			D
31	∞ meth. al., eth., bz., CCl ₄ , acet.; i.w.			D
32	∞ meth. al., eth., CCl ₄ , acet., bz.; i.w.			D
33	∞ acet., bz., CCl ₄ , eth., meth. al; i.w.			D
34	∞ eth., acet., bz., meth. al., CCl ₄ ; i.w.			D
35	v.s. bz.; g. per 100 g.: 23 acet., 157 CCl ₄ , 166 eth., 2 meth. al.; i.w.			D
36	∞ eth., CCl ₄ , bz., acet.; g. per 100 g.: 50 meth. al.; i.w.			D
37	∞ eth., CCl ₄ , acet., bz.; g. per 100 g.: 38 meth. al.; i.w.			D
38	∞ meth. al., eth., bz., CCl ₄ , acet.; i.w.			D
39	∞ eth., CCl ₄ , bz., acet.; g. per 100 g.: 50 meth. al.; i.w.			D
40	∞ eth., acet., bz., CCl ₄ ; g. per 100 g.: 125 meth. al.; i.w.			D
41	∞ acet., bz., CCl ₄ , eth., meth. al.; i.w.			D
42	∞ acet, bz., CCl ₄ , eth., meth. al.; i.w.			D
43	∞ w.....	flavorings, perfumes, pharm.; raw mat. for plastics	drums, tins.....	S.C.
44	<.1 w.....	syn. pharm. & anesthetics mfg. plastics & synth. resins	drums, tins.....	S.C.
45	g. per 100 g.: 44 acet., 4 bz., .1 CCl ₄ , 2 eth., .2 meth. al.; i.w.			D
46	disp. h.w.; s.h. al., hydrocar- bons, oils	emulsifying, thickening, dis- persing agt., cosmetics, waterproofing	drums, slabs.....	G.
47	1.744 ²⁵ w.....	solv. cellu. nitrate; lacq. dopes, art. leather, coated paper, polishes	tank cars, drums, cans	C.S.
48	1.8 ²⁵ w.....	solv. nitrocellulose, et. ace- tate. mfg. perfumes & flavors	tank cars, drums, cans	U.S.I.
49	0.8 ²⁵ w.....	nitro. ethylcellu. solv. lacq.	tanks, drums, cans	U.S.I.
50	∞ com. org. solv.....	chemical syn.....	tank cars, drums, cans	U.S.I.
51	sl. s. w.; s. meth. al., ethyl ether., acet., bz., gasoline, acetate	mfg. of pharm. & synth. chem.	cans, drums	Sh.
52	8.2 ²⁵ w.....	lacq. thinner, chem. prep. base	tank cars, drums, cans	U.S.I.
53	partially s. w.; s. meth. al., ethyl eth., acet., bz., gasoline, ethyl acetate	dry-cleaning; coating mat....	cans, drums	Sh.
54	0.01 ²⁵ % by vol. wt.....	plasticizer, lubricant.....	drums, cans	C.S.
55	0.3 ²⁵	resins, nitro. solv.....	tank cars, drums, cans	U.S.I.
56	v. s. eth., bz., acet., CCl ₄ , meth. al; i.w.			D.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
57	Arlacel A.....	mannide monooleate.....	$C_6H_5O_2(OH)OCO(CH_2)_7-$ $CH(C_8H_{17})CH\uparrow$	410.4†
58	" B.....	mannitan monooleate.....	$C_6H_8(OH)_3OCO(CH_2)_7-$ $CH(C_8H_{17})CH\uparrow$	429†
59	" C.....	sorbitan monooleate.....	$C_6H_8O(OH)_3OCO(CH_2)_7-$ $CH(C_8H_{17})CH\uparrow$	429†
60	Arlex.....	sorbitol.....	$C_6H_{14}O_6$	182.1
61	Atlas A-815.....	sorbide.....	$C_6H_8O_2(OH)_2$	146.1
62	" G-220.....	sorbitol tri-2-butylidene...	$C_6H_8O_6(C_4H_9)_3$	
63	" G-221.....	" tributylidone.....	$C_6H_8O_6(C_4H_9)_3$	
64	" G-750.....	sodium sorbitol borate.....		
65	" G-2400.....	sorbitan tetrapropionate.....	$C_6H_8O(C_2H_5COO)_4$	388
66	" G-2800.....	mannitol polyoxyalkylene- deriv. of oleic acid		
67	" G-9046T.....	polyoxyalkylene deriv. of mannitan monolaurate		
68	" K-100.....	triisopropylidene man- nitol	$C_6H_8O_6[C(CH_3)_2]_3$	302.36
69	" K-101.....	trimethylene mannitol.....	$C_6H_8O_6(CH_2)_3$	218.20
70	" K-103.....	triethylidene mannitol.....	$C_{12}H_{20}O_6$	260.28
71	" K-110.....	triisopropylidene sorbitol.....	$C_6H_8O_6[C(CH_3)_2]_3$	302.36
72	" K-111.....	trimethylene sorbitol.....	$C_6H_8O_6(CH_2)_3$	218.20
73	" K-113.....	triethylidene sorbitol.....	$C_{12}H_{20}O_6$	260.28
74	" NNO.....	mannitan monolaurate.....		
75	Benzene azophenol....	<i>p</i> -hydroxy azobenzene....	$C_6H_5N_2C_6H_4OH$	198.22
76	Benzene- <i>meta</i> -disul- fonic acid	benzene- <i>meta</i> -disulfonic acid	$C_6H_4(SO_3H)_2$	238.23
77	Benzoyl acetone.....	benzoyl acetone.....	$C_6H_5COCH_2COCH_3$	162.18
78	Benzyl "Cellosolve"*		$C_6H_5CH_2OC_2H_4OH$	152.19
79	BK-5.....	butyl cinnamoyl pyruvate	$C_6H_5CH:CHCOCH_2COCO-$ OC_4H_9	274.31
80	Bromoacetic acid.....	bromoacetic acid.....	$BrCH_2COOH$	138.96
81	5-Bromo- aspirin.....	acetyl-5-bromosalicylic acid	$BrC_6H_3COOHOCOCH_3$	259.06
82	2-Bromo-4- <i>tert</i> -butyl- phenol	2-bromo-4- <i>tert</i> -butyl- phenol	$BrC_6H_3(OH)C(CH_3)_3$	229.12

* Trade mark.

† Theoretical.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
57	lt. amber oily liq.; ref. index 1.475 ²⁵	sl. char., pleasant; sl. oily taste	tech.....	0.99-1.03
58	lt. amber oily liq.; ref. index 1.460 ²⁵	sl. char., pleasant; sl. oily taste	tech.....	0.99-1.03
59	lt. amber oily liq.....	faint, fatty.....	tech.....	0.99-1.03
60	w. wh. to lt. straw-colored liq.; ref. index 1.487 ²⁵	faint, sweet; bland sweet taste	83.....	1.322
61	pa. yel. liq.....	carmel, with bitter taste	83.....	
62	lt. yel., non-hygroscopic fluid, liq.	sl. pungent; bitter taste	tech.....	
63	lt. yel., non-hygroscopic fluid, liq.	sl. pungent; bitter taste		
64	w. wh. resin sol.; ref. index 1.45 ²⁵		80.....	1.47-1.54
65	lt. yel. mobile liq.; non-hygroscopic fluid	bland, ester-like; bitter taste	tech.....	1.15 ²⁰
66	amber oily liq.; ref. index 1.471 ²⁵	faint, oily odor; sl. bitter taste	tech.....	0.98-1.02
67	amber oily liq.; ref. index 1.4740..	sl. sweet odor; sharp bitter taste	tech.....	1.03-1.05
68	col. cr. need.....	none; bitter taste.....		
69	col. cr. need.....	none; bitter taste.....		
70	col. cr. need.....	sl. pung.; bitter taste.....		
71	col. cr. need.....	none, bitter taste.....		
72	col. cr. need.....	none, bitter taste.....		
73	lt. yel. liq.....	none, bitter taste.....		
74	amber oily liq.....	pleasant oily.....	tech.....	1.00-1.05
75	tan cr. powd.....	none.....		
76	cr. sld.....	sl. like SO ₂	ca. 80.....	
77	sld.....			
78	liq.....	pleas.....		1.0700 ²⁰ / ₂₀
79	yel. cr.....	cinnamon like.....	100.....	
80	wh.-pa. yel., deliq. cr. sld.....	sharp, pen.....		
81	wh. cr.....	none.....		
82	cl. pa. straw colored liq.....	mild.....		1.338 ²⁵ / ₂₅

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
57	Arlacel A.....	-5 to 0°			395
58	“ B.....	11-14°			
59	“ C.....				395
60	Arlex.....				
61	Atlas A-815.....				
62	“ G-220.....		145-165 ³ mm		
63	“ G-221.....		162-167 ⁴ mm		
64	“ G-750.....				
65	“ G-2400.....				
66	“ G-2800.....				
67	“ G-9046T.....				610
68	“ K-100.....	68-69	136-139 ⁴		
69	“ K-101.....	228-231		volatile with steam...	
70	“ K-103.....	171-172			
71	“ K-110.....	39.5-40.5...	127-130 ⁴		
72	“ K-111.....	211-214		volatile with steam...	
73	“ K-113.....		122-126 ⁴	distilled with steam...	
74	“ NNO.....	15-16			385
75	Benzene azophenol.....	152.1-153.6..			
76	Benzene- <i>meta</i> -disulfonic acid	109-115.....			
77	Benzoyl acetone.....	58			
78	Benzyl “Cellosolve” [”]	<-75.....	255.9		265
79	BK-5.....	63-64			
80	Bromoacetic acid.....	38.0-42.9...			
81	5-Bromo aspirin.....	155.5-163.8..			
82	2-Bromo-4- <i>tert</i> -butylphenol	<-20.....		109-5%; 129-95%...	240.8

” Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
57	s. most org. solv.; i.w., polyal.; sl.s. veget. & animal oils, ether and glycols	w/o emulsifier; drugs, cos- metics	drums, cans. . . .	At.
58	s. most org. solv.; sl.s. veget. & animal oils, eth., & glycols; i.w., polyal.	w/o emulsifier; drugs, cos- metics	drums, cans. . . .	At.
59	s. most org. solv.; i.w., polyal. . .	w/o emulsifier; stab. to a. and salts; cosmetics	drums, cans. . . .	At.
60	s.w., methanol; sl.s. pyridine, ethanolamines, acetic acid; i. hydrocarbons, other org. solv.	humectant; plasticizer cos- metics; leather finishing; glue	drums, cans. . . .	At.
61	s.w., lower al., ethylene, glycol, cellosolve, pyridine; i. most other solv.	humectant, solvent.	drums, cans. . . .	At.
62	s. hydrocarbons, eth., ketones; sl.s. veget. & mineral oils; i.w.	plasticizer for vinyl polymers & cellu. deriv.	drums, cans. . . .	At.
63	s. hydrocarbons, eth., ketone, al.; sl.s. veg.-mineral oils; i.w.	plasticizer for cellu. deriv. & vinyl polymers	drums, cans. . . .	At.
64	s.w.; i. most org. solv.	w. sol. resin binder, size, filler	drums, cans. . . .	At.
65	s. hydrocarbons, eth., ketones, esters; v.sl.s.w.	plasticizer for vinyl polymers, synth. rubber; various cellu. deriv.	drums, cans. . . .	At.
66	s. veg. oils, most org. solv. disp.w.	oil soluble emulsifying agt. for Vitamin oils	drums, cans. . . .	At.
67	s.w., most org. solv.; i. mineral & veget. oils	emulsifier, wetting dispersing and solubilizing agt.	drums, cans. . . .	At.
68	i.w.; sl.s. veget., animal oils; s. all organic solvents	antioxidant, color stab., source of mannitol plasticizer	.....	At.
69	s. ketones, amines, eth., al.; sl.s. w., hydrocarbons, esters, oils	plasticizer, hardener for cellu. acetate and nitrate.	.....	At.
70	s. al., eth. amines, ketones. sl.s. hydrocarbons, esters, eth.al. v.sl. s.w.	plasticizer, hardening agt., alk. resistant, resins	.....	At.
71	i.s.w.; sl.s. veget. & animal oils; s. org. solv.	plasticizer, carrier for sorbitol and acetone	.....	At.
72	s. al., amines, eth., ketones; sl.s.w., hydrocarbons, veget. and animal oils, esters, poly- hydric al.	hardener or stiffener, alk. re- sistant resins	.....	At.
73	s. al. eth., ketones, amines, esters; sl.s. hydrocarbons, veg. & animal oils; v. sl.s. w.	alkaline resistant resins, plasticizer	.....	At.
74	s. most org. solv.; dispersible w.	insecticidal spreader.	drums, cans. . . .	At.
75	v.s. eth. g. per 100 g: 6 CCl ₄ , 2 bz., 31 al.; i.w.	.....	.....	D
76	v.s.w.; sl.s. al., eth., bz.; i. CHCl ₃	electroplating.	drums.	Pa.
77	5 ²⁰ % by wt. in w.	chem. inter.	cans (research quantities)	C. & C.
78	43 ²³ % by wt. in w.	perfume fixatives, solv. inks, dyes, resins	cans.	C. & C.
79	> 2% veg. oils.	light screen.	barrels, bottles. .	U.S.I.
80	∞ w., al., eth., 26 g. per 100 g. CCl ₄	.....	.....	D
81	sl. s. eth., al.; i.w., CCl ₄ , bz. . .	.....	.....	D
82	∞ al., bz., CCl ₄ , eth, monochlor- benzene, pet. eth.; i.w.	.....	.....	D

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
83	4-Bromodiphenol.	4-bromodiphenyl.	$C_6H_5C_6H_4Br$	233.11
84	<i>p</i> -Bromophenol.	<i>p</i> -bromophenol.	BrC_6H_4OH	173.02
85	2-Bromo-4-phenyl- phenol	3-bromo-4-hydroxy- diphenyl	$C_6H_5C_6H_3(OH)Br$	249.11
86	2-Bromopropane.	isopropyl bromide.	$CH_3CHBrCH_3$	123.00
87	5-Bromosalicylic acid. .	5-bromosalicylic acid. .	$BrC_6H_3COOH(OH)$	217.03
88	<i>o</i> -Bromotoluene.	<i>o</i> -bromotoluene.	$BrC_6H_4CH_3$	171.04
89	<i>p</i> - "	<i>p</i> - "	$BrC_6H_4CH_3$	171.04
90	Butadiene.	1,3-butadiene.	$CH_2CHCH:CH_2$	54.09
91	" Pure.	1,3-butadiene.	$CH_2CHCHCH_2$	54.08
92	Butaldehyde.	<i>n</i> -butyraldehyde.	$CH_3(CH_2)_2CHO$	72.10
93	<i>n</i> -Butane, Pure.	<i>n</i> -butane.	$CH_3(CH_2)_2CH_3$	58.12
94	Butene-1, Technical. .	butene-1.	$CH_2CHCH_2CH_3$	56.10
95	" -2, Technical. .	butene-2.	$CH_3CH_2CH=CH_2$	56.10
96	<i>n</i> -Butanol.	<i>n</i> -butyl alcohol.	$CH_3CH_2CH_2CH_2OH$	74.12
97	Butanol.	" " "	$CH_3(CH_2)_2CH_2OH$	74.12
98	"	" " "	C_4H_9OH	74.12
99	<i>sec</i> -Butanol.	<i>sec</i> - " "	$CH_3CH(OH)CH_2CH_3$	74.12
100	" " (-2)	" " "	$CH_3CH(OH)CH_2CH_3$	74.12
101	" "	" " "	C_4H_9OH	74.12
102	<i>n</i> -Butyl acetate.	<i>n</i> -butyl acetate.	$CH_3COOC_4H_9$	116.16
103	" " "	" " "	$CH_3COOC_4H_9$	116.16
104	" " "	" " "	$CH_3COOC_4H_9$	116.16
105	<i>sec</i> -Butyl acetate.	<i>sec</i> -butyl acetate.	$CH_3COOCH(CH_3)(C_2H_5)$	116.16
106	" " "	" " "	$CH_3(C_2H_5)CHCOOCH_3$	116.16
107	" " "	" " "	$CH_3COOC_4H_9$	116.16
108	Butyl acetyl ricinoleate	butyl acetyl ricinoleate. .	$C_{17}H_{32}(OCOCH_3)(COOC_4H_9)$	396.60
109	<i>tert</i> -Butyl alcohol.	<i>tert</i> -butanol.	$CH_3C(CH_3)_2OH$	74.12

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
83	wh. cr.	mild aromatic. ....	.....	.....
84	wh.-pk. cr.	phenolic. ....	.....	.....
85	lt. colored cr. sld.	fa. char. ....	.....	.....
86	cl. col. mobile liq.	mildly sweet. ....	.....	1.304 $\frac{25}{25}$
87	wh. powd.	fa. aromatic. ....	.....	.....
88	pa.-straw colored liq.	char. like bromobenzene. ....	.....	1.422 $\frac{25}{25}$
89	wh. cr. sld.	char. like bromobenzene. ....	.....	1.400 $\frac{25}{25}$
90	inflam. liquified gas.	hydrocarbon.	98 by wt.	0.618 $\frac{20}{4}$
91	.....	.....	99.	0.6222 $\frac{20}{4}$
92	w. wh. liq.	char. pung.	94. ....	.803-.809 $\frac{20}{20}$
93	flammable col. liq. or gas. ....	.....	99.	0.579 $\frac{20}{4}$
94	olefin. ....	.....	95.	0.595 $\frac{15.6}{15.6}$
95	olefin. ....	.....	95.	0.608 $\frac{15.6}{15.6}$
96	col. liq. ....	.....	99.	0.810-.813 $\frac{20}{20}$
97	w. wh. liq.	n. res.	95. ....	.810-.813 $\frac{20}{20}$
98	w. wh. liq.	n. res.	98-100. ....	.810-.813 $\frac{20}{20}$
99	w. wh. liq.	char.	98 by wt.	0.8065 $\frac{20}{4}$
100	liq.	char.	99-100.	0.807-.8107 $\frac{20}{20}$
101	w. wh. liq.	mild n. res.	99. ....	.808-.812 $\frac{20}{20}$
102	col. liq.	char. ester.	88-92.	0.872-0.877
103	w. wh. liq.	pleas. fruity, n. res.	88-92. ....	.872-.880 $\frac{20}{20}$
104	w. wh. liq.	mild, n. res.	90-92.	0.874-0.878 $\frac{20}{20}$
105	col. liq.	fruity.	88-92 by wt.	0.860-.866 $\frac{20}{20}$
106	liq.	char.	85.	0.8598-.8658 $\frac{20}{20}$
107	w. wh. liq.	mild, n. res.	85-88.	0.862-.866 $\frac{20}{20}$
108	yel. oily liq.	mild.	95. ....	.94 $\frac{20}{20}$
109	w. cr. sld.	sl. camphor-like.	99 by wt.	0.7791 $\frac{26}{4}$

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
83	4-Bromodiphenol.....	88.3-90.3..	311.....		291.2
84	<i>p</i> -Bromophenol.....	64.0-66.0..	237.....		>464
85	2-Bromo-4-phenylphenol...	93.6-95.6..			
86	2-Bromopropane.....	-90.....		58.5-5%; 60.5-95%.	none.
87	5-Bromosalicylic acid.....	165.2-167.7..			
88	<i>o</i> -Bromotoluene.....	-27.....		180.4-5%; 181.3-95%	174.2
89	<i>p</i> -Bromotoluene.....	25.5.....		183.3-5%; 184.1-95%	185
90	Butadiene.....	-108.7.....	-4.4.....		
91	“ Pure.....		-4.75.....		
92	Butalylde.....	-99.....	75.7.....	71-78.....	64.4
93	<i>n</i> -Butane, Pure.....	-135.....	-0.6.....		-103
94	Butene-1, Tech.....		6.1.....		
95	“ -2, Tech.....		1.1-4.4.....		
96	<i>n</i> -Butanol.....	-90.....	117.9.....	<115->118.....	116
97	Butanol.....	-89 (approx.)	117.7.....	<115-none; >118-none	95
98	“	-89.8.....	117.7.....	<115-none; >118-none	95
99	<i>sec</i> -Butanol.....	-114.7.....	99.5.....	<95-none; >101-none	85
100	“ “ , (2).....			<94-none; 96-5%; 102-90%; >109-none	72
101	“ Butyl alcohol.....	-114.7.....	99.5.....	<94-none; >96-10% 102-90%; 109-none	75
102	<i>n</i> -Butyl acetate.....	-75.....	126.3.....	118-128.....	100
103	“ “ “	-76.8.....	126.5.....	<110-none; >145-none	82.4
104	“ “ “	-76.8.....	126.5.....	<115-none, <127-70%; >135 none	81
105	<i>sec</i> -Butyl acetate.....		112.4.....	104-none; 108-10% 110-50%; 116-90%; 125-none	64
106	<i>sec</i> -Butyl acetate.....			104-none; 111-50% 116-95%; 125-none	66
107	“ “ “	-76.8.....	126.5.....	104-none; 111-10% 114-60%; 130-none	66
108	Butyl acetyl ricinoleate....	-32 to -65..		220-235 ³⁻⁵	230
109	<i>tert</i> “ “	25.6.....	82.4.....	<78-none; >85-none 81-88-95%	60

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
83	g. per 100 g.: 50 acet., 100 bz., 50 CCl ₄ , 34 eth., 3 meth.al.; i.w.			D
84	v.s. meth. al., eth.; g. per 100 g.: 88 acet., 40 bz., 3 CCl ₄ , 1 w.			D
85	v.s.eth., acet. g. per 100 g.: 125 al., 32 bz., 8 CCl ₄ ; i.w.			D
86	∞ al., acet., CCl ₄ , bz., eth; sl. s.w.			D
87	g. per 100 g.: 85 al., 70 eth., 1 bz., .3 ⁸⁰ w.; i. CCl ₄ , 1. w ²⁵			D
88	∞ meth. al., eth., CCl ₄ , bz., acet.; i.w.			D
89	∞ meth.al., eth., CCl ₄ , bz., acet.; i.w.			D
90		mfg. synth. rubber	cylinders, tank cars	S.C.
91		copolymerizations to form synth. rubbers		P.P.
92	6.24 ²⁵ w	mfg. butyric acid, flavoring extracts, medicines, perfumes, synth. resins	tank cars, drums, cans	C.S.
93		hydrocarbon research; refrig., solv.	cylinders	P.P.
94		polymerization	cylinders	P.P.
95		resin mfg.; copolymerization	cylinders	P.P.
96	7.7 ²⁰ % by wt. in w	dehydrating agt; solv		C. & C.
97	misc. all org. solv.; 7.209 ²⁵ w	blending agent; solv. resins, waxes, gums, oils, alkaloids; detergent; syn. base mat.	tank cars, comp. tank cars, drums	C.S.
98	20 ²⁵ w	mfg. nitro. solv. gen. org. mfg. of derivatives	tank cars, drums	U.S.I.
99	24.4 ²⁰ % by wt, in w.; w. in comp. 56.0 ²⁰ % by wt.	lacq. thinners, solv., mfg. org. chem.	tank cars	S.C.
100	19 ²⁵ w	gen. solv	tank cars, drums, cans	St.
101	34 ²⁵ w	mfg. chem. deriv., lacq. thinners	tank cars, drums, cans	U.S.I.
102	sl. s. w.; ∞ com. org.	medium boil. solv. nitro. cellu.; lacq., art. leather, plastics, photo. films	cans, drums, tank cars	C. & C.
103	misc. all com. org. solv. 436 ²⁵ w	solv. nitro., lacq. etc.; perfume and flavor base	tank cars, drums	C.S.
104	1.2 ²⁵ w	nitro. solv.; textile sizing	tanks, drums, cans	U.S.I.
105	misc. castor, linseed oil, hydro- carbons	solv., lacq	tank cars, drums, cans	S.C.
106	.74 ²⁵ w	lacq., solv	tank cars, drums, cans	St.
107		nitro. solv., lacq. thinners; lacq. text. sizing	tank cars, drums, cans	U.S.I.
108	misc. most org. solv.; i.w	plasticizing agt; emulsifying, lubricating detergent agent	tank cars; comp. tank cars, steel drums, cans	C.S.
109	misc. w., org. solv	extr. solv. drugs; blend. agt., insecticides, fumigant, deha- turant. synth. resins, mfg. perfumes, disinfections	tank cars, drums, tins	S.C.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
110	<i>n</i> -Butyl amine.....	<i>n</i> -butyl amine.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$	73.14
111	<i>sec</i> -Butyl carbinol....	<i>pri</i> -active amyl alcohol (1-butanol 2-methyl)	$\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{OH}$	88.15
112	Butyl "Carbitol"*....	diethylene glycol mono- butyl ether	$\text{C}_4\text{H}_9\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH}$	162.23
113	" " acetate	diethylene glycol mono- butyl ether acetate	$\text{CH}_3\text{CO}(\text{OC}_2\text{H}_4)_2\text{OC}_4\text{H}_9$	204.26
114	4- <i>tert</i> -Butyl catechol...	4- <i>tert</i> -butyl-1,2-dihydroxy- benzene	$(\text{OH})_2\text{C}_6\text{H}_3\text{C}(\text{CH}_3)_3$	166.21
115	Butyl "Cellosolve"*..	ethylene glycol monobutyl ether	$\text{C}_4\text{H}_9\text{OCH}_2\text{CH}_2\text{OH}$	118.17
116	<i>n</i> -Butyl chloride.....	<i>n</i> -butyl chloride.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$	92.57
117	4- <i>tert</i> -Butyl-2- chlorophenol	4- <i>tert</i> -butyl-2- chlorophenol	$\text{ClC}_6\text{H}_4(\text{OH})\text{C}(\text{CH}_3)_3$	184.66
118	<i>p</i> - <i>tert</i> -Butyl- <i>o</i> -cresol..	4- <i>tert</i> -butyl-2-methyl phenol	$(\text{OH})\text{C}_6\text{H}_3\text{CH}_3\text{C}(\text{CH}_3)_3$	164.24
119	Butyl ether.....	butyl ether.....	$\text{C}_4\text{H}_9\text{OC}_4\text{H}_9$	130.23
120	" "	" "	$\text{C}_4\text{H}_9\text{OC}_4\text{H}_9$	130.23
121	" lactate.....	" lactate.....	$\text{CH}_3\text{CHOHCOOC}_4\text{H}_9$	146.18
122	Butyl oxalate.....	dibutyl oxalate.....	$(\text{COOC}_4\text{H}_9)_2$	202.25
123	" phthalate.....	" phthalate.....	$\text{C}_6\text{H}_4(\text{CO}_2\text{C}_4\text{H}_9)_2$	278.34
124	β - <i>n</i> -Butyloxyethyl salicylate	β - <i>n</i> -butyloxyethyl salicylate	$\text{OHC}_6\text{H}_4\text{COOCH}_2\text{CH}_2\text{OC}_4\text{H}_9$	238.28
125	4- <i>tert</i> -Butyl-2- phenylphenol	5- <i>tert</i> -butyl-2- hydroxydiphenyl	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{OHC}(\text{CH}_3)_3$	226.31
126	Butyl propionate.....	butyl propionate.....	$\text{CH}_3\text{CH}_2\text{COOC}_4\text{H}_9$	130.18
127	Butyl stearate.....	butyl stearate.....	$\text{C}_{17}\text{H}_{35}\text{COOC}_4\text{H}_9$	340.58
128	1,3-Butylene glycol....	1,3-butylene glycol.....	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{OH}$	90.12
129	<i>n</i> -Butyraldehyde.....	<i>n</i> -butyric aldehyde.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$	72.10
130	<i>n</i> -Butyric acid.....	<i>n</i> -butyric acid.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$	88.10
131	Butyric anhydride....	butyric anhydride.....	$(\text{CH}_3\text{CH}_2\text{CH}_2\text{CO})_2\text{O}$	158.19
132	Calcium benzene- <i>meta</i> - disulfonate	calcium benzene- <i>meta</i> - disulfonate	$\text{C}_6\text{H}_4(\text{SO}_3)_2\text{Ca}$	276.29
133	<i>n</i> -Caproic acid.....	<i>n</i> -caproic acid.....	$\text{CH}_3(\text{CH}_2)_4\text{COOH}$	116.16
134	"Carbitol"*.....	diethylene glycol mono- ethyl ether	$\text{C}_2\text{H}_5\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH}$	134.17
135	"Carbitol"* acetate...	diethylene glycol mono- ethyl ether acetate	$\text{CH}_2\text{COOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{-}$ OC_2H_5	176.21
136	Catechol.....	pyrocatechol.....	$\text{C}_6\text{H}_4(\text{OH})_2$	110.11
137	"Cellosolve"*.....	ethylene glycol monoethyl ether	$\text{C}_2\text{H}_5\text{OCH}_2\text{CH}_2\text{OH}$	90.12
138	"Cellosolve"* acetate.	ethylene glycol monoethyl ether acetate	$\text{CH}_3\text{COOCH}_2\text{CH}_2\text{OC}_2\text{H}_5$	132.16

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
110	liq.	char. ammoniacal.		0.740 $\frac{20}{20}$
111	w. white.			0.81-0.82 $\frac{20}{20}$
112	col. liq.	almost none.	96.	0.954-0.960 $\frac{20}{20}$
113	liq.	almost none.	95-100.	*0.9810 $\frac{20}{20}$
114	tan cr. sld.	phenolic.		1.049 $\frac{60}{25}$
115	w. wh. liq.	mild.	99.	0.9019 $\frac{20}{20}$
116	liq.			0.8854 $\frac{20}{20}$
117	lt. straw-colored liq.	char.		1.112 $\frac{25}{25}$
118	straw-colored liq.	char. ....		.969 $\frac{25}{25}$
119	col. liq.	ethereal.		0.7696
120	w. wh. liq.	mild, ethereal.	99.95. ....	.769-.771 $\frac{20}{20}$
121	w. wh. liq.	mild n. res.	95. ....	.974-.984 $\frac{20}{20}$
122	w. wh. liq.	mild.	99. ....	.989-.993 $\frac{20}{20}$
123	w. wh. liq.	none.	99-100.	1.047-1.051 $\frac{20}{20}$
124	col. refractive liq.	mild, pleas.		1.077 $\frac{25}{25}$
125	wh. cr. sld. or visc. liq.	fa. char.		1.022 $\frac{55}{25}$
126	w. wh. liq.	mild, n. res.	90-92. ....	.868-.872 $\frac{20}{20}$
127	lt. straw.	faint.	98.5. ....	.855-.862 $\frac{25}{20}$
128	col. liq.	odorless.		1.0059
129	col. liq.	char. pung. aldehyde.	96.	0.803-.808 $\frac{20}{20}$
130	col. liq.	strong. char.	99-100.	0.957-.961 $\frac{20}{20}$
131	col. liq.	pungent.	95-100.	0.9681 $\frac{20}{20}$
132	lt. gray powd.	none.		
133	col. liq.	char.	98-100.	0.9295 $\frac{20}{20}$
134	col. sl. hyg. liq.	mild, pleas.		1.024-1.030 $\frac{20}{20}$
135	col. liq.	pleas, ester-like.	95.	1.0114 $\frac{20}{20}$
136	wh. cr.	phenolic.	100.	1.371
137	w. wh. liq.	mild, agreeable, n. res.	99.	0.928-0.933
138	w. wh. liq.	pleas. ester-like.	95.	0.971-.976

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
110	<i>n</i> -Butyl amine.....		78.....	73-92.....	<40
111	<i>sec</i> -Butyl carbinol.....	<-70.....	128.....	125.-131-95%.....	122
112	Butyl "Carbitol"*.....	-73.9.....	230.7.....	220-none; 224-5% 232-95%	240
113	" " acetate.....	-32.2.....	264.4.....	235-250.....	240
114	4- <i>tert</i> -Butyl catechol.....	55.4-56.7.....	285.....		266
115	Butyl "Cellosolve"*.....	<-100.....	171.2.....	<163->174 none.....	165
116	<i>n</i> -Butyl chloride.....	-123.1.....	78.0.....	71-86.....	<40
117	4- <i>tert</i> -Butyl-2-chlorophenol.....	<-20.....		234-5%; 251-95%.....	224.6
118	<i>p</i> - <i>tert</i> -Butyl- <i>o</i> -cresol.....	27.....		136.8-5%; 138-95%.....	244.4
119	Butyl ether.....	-94.1.....	142.4.....	137-143.....	100
120	" ".....	-96.....	140.9.....	<137-none; >143-none	87
121	" lactate.....	-43.....		149-none; 155-195- 90%; 187-189-60%	159.8
122	" oxalate.....	-29.6.....	245.5.....	<240.5%; 248-90; >255-none	265
123	" phthalate.....		236-244 ^{50mm}	236-244 ^{50mm}	352
124	β - <i>n</i> -Butyloxyethyl salicylate.....	<-20.....		186-5%; 192.8-95%.....	314.6
125	4- <i>tert</i> -Butyl-2-phenylphenol.....	50.....		196-5%; 198.5-95%.....	320
126	Butyl propionate.....	-89.5.....	146.8.....	<120-none; <140- 50%; <150-85%	109
127	Butyl stearate.....	19.....		220-225 ²⁵	370
128	1,3-Butylene glycol.....		206.5.....		250
129	<i>n</i> -Butyraldehyde.....	-99.....	75.7.....	<70-none; <80-95%	20
130	<i>n</i> -Butyric acid.....	-6.3.....	163.7.....	<158-none; >165-none	170
131	Butyric anhydride.....	-65.7.....	199.5.....	<190-none; >200-none	190
132	Calcium benzene- <i>meta</i> -di- sulfonate.....				
133	<i>n</i> -Caproic acid.....	-5.4.....	203.1.....	195-212.....	215
134	"Carbitol"*.....	<-76.....	201.9.....	185-205.....	210
135	"Carbitol"* acetate.....	-25.....	217.7.....	208-223.....	230
136	Catechol.....		130-137 ²⁻³	130-137 ²⁻³	
137	"Cellosolve"*.....	<-70.....	135.1.....	132-137.....	130
138	"Cellosolve"* acetate.....		156.3.....	145-165.....	140

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
110	= w.	chem. inter.	drums	C. & C.
111	s. meth. al., ethyl eth., acet., bz., gasoline, ethyl acetate; sl. s.w.	org. syn.	cars, drums	Sh.
112	∞ w.	solv. nitro. & resins	cans, drums	C. & C.
113	misc. most org. liq.; 6.5 ²⁰ % by wt. in w.	formation of nitro. & synth. resin coatings	cans, drums	C. & C.
114	v.s. meth. al., eth., CCl ₄ , bz., acet.; i.w.			D
115	∞ w.	solv. lacq., nitro., resins	cans, drums	C. & C.
116	i.w.	chem. inter.	cans	C. & C.
117	∞ meth. al., eth., CCl ₄ , bz., acet.; i.w.			D
118	∞ meth. al., eth., CCl ₄ , bz., acet.; i.w.			D
119	0.05 ²⁰ % by wt. in w.	extr. agt. inert reaction medium	drums	C. & C.
120	s. most com. org. solv.; i., imm. w.	solv. gums, oils, org. a.; extr. ppnt. grignard solv.	drums, cans	C.S.
121	misc. org. solv.; 3.33 ²⁵ w.	solv. nitro., oils, dyes, nat. gums, synth. resins	tanks, comp. cars, drums	C.S.
122	1.6 ²⁵ w.	org. syn.	tank cars, drums	U.S.I.
123	0.15 ²⁵ w.	nitro. plasticizer, paper coat- ings, linoleum, shatter-proof glass, airplane dope	tank cars, drums, cans	U.S.I.
124	∞ eth., CCl ₄ , bz., al., acet.; i.w.			D
125	v.s. meth. al., eth., CCl ₄ , bz., acet.; i.w.			D
126	1.2 ²⁵ w.	cellu. nitrate solv.	tank cars, drums, cans	U.S.I.
127	misc. org. liq.; 171 ²⁵ w.	plasticizer, lubricant, polish cosmetic base	drums, cans	C.S.
128	∞ w.	mfg. plasticizer, resins, etc.	cans	C. & C.
129	7.1 ²⁰ % by wt. in w.	prep. rubber accel., synth. resins, org. syn.	cans, drums	C. & C.
130	∞ w.	drugs, deliming hides, lacq.	drums	C. & C.
131	d.w.	esterifying agt.	cans, drums	C. & C.
132	s.w.	dyestuff inter.	drums	Pa.
133	1.10 ²⁰ % by wt. in w.	formation esters	cans, drums	C. & C.
134	∞ w.	solv. nitro.; non-shatterable glass	cans, drums	C. & C.
135	∞ w.; misc. most org. solv.	resin finishes; printing ink	cans, drums	C. & C.
136	s. w., al., eth. amyl al., acet.	antioxidant, photo. developer, dye inter.	drums, barrels	Pa.
137	∞ w.	lacq., nitrocellu. solv.	cans, drums, cars	C. & C.
138	23 ²⁰ % by wt. in w.	solv. for nitro. & resins	cans, drums	C. & C.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
139	<i>o</i> -Chloracetoacetanilide	<i>o</i> -chloracetoacetanilide....	$\text{CH}_3\text{COCH}_2\text{CONHC}_6\text{H}_4\text{Cl}$	211.65
140	Chloracetyl chloride...	chloracetyl chloride.....	ClCH_2COCl	112.95
141	Chloramine-B.....	sodium <i>N</i> -chlorobenzene-sulfonamide	$\text{C}_6\text{H}_5\text{SO}_2\text{Na}:\text{NCl}\cdot 1\frac{1}{2}\text{H}_2\text{O}$	240.6
142	5-Chloroanthranilic acid	2-amino-5-chlorobenzoic acid	$\text{ClC}_6\text{H}_2\text{NH}_2\text{COOH}$	171.58
143	4-Chlorobenzophenone	4-chlorobenzophenone....	$\text{C}_6\text{H}_5\text{COC}_6\text{H}_4\text{Cl}$	216.66
144	β -Chloroethyl acetate..	β -chloroethyl acetate....	$\text{CH}_3\text{COOCH}_2\text{CH}_2\text{Cl}$	122.55
145	2-Chloroethyl-2-xenyl ether	2-(β -chloroethoxy)di-phenyl	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{OCH}_2\text{CH}_2\text{Cl}$	232.70
146	β -Chlorophenetole....	β -phenoxyethyl chloride..	$\text{C}_6\text{H}_5\text{OCH}_2\text{CH}_2\text{Cl}$	156.61
147	<i>o</i> -Chlorophenoxyacetic acid	<i>o</i> -chlorophenoxyacetic acid	$\text{ClC}_6\text{H}_4\text{OCH}_2\text{COOH}$	186.59
148	2-Chloro-4-phenyl-phenol	3-chloro-4-hydroxydi-phenyl	$\text{C}_6\text{H}_5\text{C}_6\text{H}_3\text{ClOH}$	204.65
149	α -Chloro-(phenyl xenyl ether)	α -chloro(phenyl diphenyl ether)	$\text{C}_{18}\text{H}_{13}\text{OCl}$	280.74
150	Chloropicrin.....	chloropicrin.....	CCl_2NO_2	164.38
151	α -Chloropropionic acid	α -chloropropionic acid....	$\text{CH}_3\text{CHClCOOH}$	108.53
152	1-Chloropropylene....	1-chloro-1-propene.....	CH_3CHCHCl	76.53
153	<i>ortho</i> -Chlor phenol....	<i>ortho</i> -chlorophenol.....	$\text{C}_6\text{H}_4\text{OHCl}$	128.56
154	Coumarin-3-carboxylic acid	coumarin-3-carboxylic acid	$\text{C}_8\text{H}_4(\text{CHCCOOH})(\text{OCO})$	190.15
155	Crotonaldehyde.....	crotonaldehyde.....	$\text{CH}_3\text{CH}:\text{CHCHO}$	70.09
156	Crotonaldehyde.....	crotonaldehyde.....	$\text{CH}_3\text{CHCHCHO}$	70.09
157	Crotonic acid.....	crotonic acid.....	$\text{CH}_3\text{CH}:\text{CHCOOH}$	86.09
158	Crotonyl alcohol.....	crotonyl alcohol.....	$\text{CH}_3\text{CH}:\text{CHCH}_2\text{OH}$	72.10
159	Crystalline sorbitan...	monoanhydrosorbitol....	$\text{C}_6\text{H}_8\text{O}(\text{OH})_4$	164.16
160	Cumene.....	isopropylbenzene.....	$\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)_2$	120.19
161	<i>p</i> -Cumyl phenol.....	α , α -dimethyl- <i>p</i> -benzyl-phenol	$\text{C}_6\text{H}_5\text{C}(\text{CH}_3)_2\text{C}_6\text{H}_4(\text{OH})$	212.28
162	Cyanoacetic ester.....	ethyl cyanoacetate.....	$\text{CH}_2\text{CNCOOCC}_2\text{H}_5$	113.11
163	Cyclohexane.....	hexahydrobenzene.....	$(\text{CH}_2)_6$	84.16
164	Cyclohexene.....	cyclohexene.....	$(\text{CH}_2)_4(\text{CH})_2$	82.14
165	Cyclohexyl glycolate..	cyclohexyl glycolate....	$(\text{CH}_2)_5\text{CHOOC}\cdot\text{CH}_2\text{OH}$	158.2
166	Cyclohexyl levulinate..	cyclohexyl levulinate....	$(\text{CH}_2)_5\text{CHOOCCH}_2\text{CH}_2\text{COCH}_3$..	198.25
167	Cyclohexyl stearate...	cyclohexyl stearate.....	$(\text{CH}_2)_5\text{CHOOCC}_{17}\text{H}_{35}$	366.6

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
139	wh. cr. sld.	odorless.		
140	col. liq.	sharp, pung		1.498
141	col. flat cr.	essentially odorless.	99	
142	grayish-wh. gran	fa. char.		
143	col. cr. sld.	fa. pleas.		
144	col. liq.	fruity.		1.152 $\frac{25}{25}$
145	fine wh. cr.			1.142 $\frac{60}{25}$
146	col. liq.	plea. aromatic.		1.147 $\frac{25}{25}$
147	wh. cr. sld.	almost none		
148	wh. cr.	char.		
149	pa. straw-colored visc.	none		1.162 $\frac{25}{25}$
150	liq.	pen. tear gas	99.5	1.651 $\frac{20}{4}$
151	col. liq.	char.		1.263 $\frac{25}{25}$
152	col. volatile liq.	char.		0.935 $\frac{15}{25}$
153	wh. liq.	strong phenolic.	ca 97	1.250 ¹⁸
154	lt. tan cr. powd.			
155	straw colored, flam. liq.	char. pung. irritating	90	0.866-0.876
156	w. wh.-yel. liq. inflam.	char. lacrymatory	97-99	0.852 $\frac{20}{4}$
157	straw-colored liq.			0.966
158	liq.			0.873
159	col. cr.	none; sweet with bitter aftertaste	v. high	
160	cl. col. mobile liq.	pleas. char.		.861 $\frac{25}{25}$
161	wh.-lt. tan. cr. sld.	fa. phenolic		
162	col. liq.	sweetish ester-like.		1.059 $\frac{25}{25}$
163	col. liq.	char. aromatic.		0.777 $\frac{25}{25}$
164	col. liq.	char.		0.808 $\frac{25}{25}$
165	yel. liq.	spicy.		1.030 ²⁷
166	amber liq.	spicy.		1.023 $\frac{25}{25}$
167	cream-colored soft sld.	spicy.		0.925 ²⁵

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
139	<i>o</i> -Chloracetoacetanilide . . .	107			none
140	Chloroacetyl chloride		105		none
141	Chloramine-B	d, ca 170			
142	5-Chloroanthranilic acid . . .	179.4-185.4 . . .			
143	4-Chlorobenzophenone	64.5-72.1	331		
144	β -Chloroethyl acetate	< -20		144.7-5%; 146.5-95%	150.8
145	2-Chloroethyl-2-xenyl ether . .	53.8-56.7	323		320
146	β -Chlorophenetole	24.5		152.6-5%; 155.2-95%	224.6
147	<i>o</i> -Chlorophenoxyacetic acid . .	146.0-148.5 . . .			
148	2-Chloro-4-phenylphenol . . .	78-80	323		345.2
149	<i>x</i> -Chloro-(phenylxenylother) .	-10	> 180 ¹⁰		314.6
150	Chloropierin	-64	112.21, some d	110.5-113.5, 96%	none
151	α -Chloropropionic acid	< -20		183.6-5%; 189.5-95%	215.6
152	1-Chloropropylene	< -20		30.3-5%; 32.0-95%	< 21.2
153	<i>ortho</i> -Chlor phenol	7	172-173	172-173	
154	Coumarin-3-carboxylic acid . . .	189.4-190.4 . . .			
155	Crotonaldehyde	-75	102.3	< 82-none; < 108-90%	55
156	Crotonaldehyde	-69	102.4	99-104	80.5
157	Crotonic acid	72	185		
158	Crotonyl alcohol		117		
159	Crystalline sorbitan	110-111			
160	Cumene	< -70		152-5%; 153-95%	96.8
161	<i>p</i> -Cumyl phenol	187 ¹⁰			320
162	Cyanoacetic ester	< -20		205.3-5%; 209.1-95%	219.2
163	Cyclohexane	> 0		80.3-81.1	32
164	Cyclohexene	< -20		83.1-84.2	21.2
165	Cyclohexyl glycolate				
166	Cyclohexyl levulinate				
167	Cyclohexyl stearate	28-29			

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
139		printing inks, coloring	cans, drums	C. & C.
140	d.w.	chem. inter.		C. & C.
141	25 ²⁰ w.; d. eth. al., acet.; i.bz.	germicide, oxidizing agt.	barrels, fiber containers	S.P.
142	g. per 100 g.: 10 al.; i.w., bz., CCl ₄ , eth.			D
143	g. per 100 g.: 3 meth. al.; 57 eth.; 54 CCl ₄ ; 95 bz., 94 acet.; i.w.			D
144	∞ meth. al., eth., CCl ₄ , bz., acet., g. per 100 g.: 3 w.			D
145	g. per 100 g.: 12 meth. al.; 29 CCl ₄ , 51 isopropyl eth., v.s. bz., acet., v.s.l.s. w.			D
146	∞ meth.al., isopropyl eth., CCl ₄ , bz., acet. v.s.l.s. w.			D
147	g. per 100 g.: 5 w., 9 eth., 21 al.; i.bz., CCl ₄ .			D
148	g. per 100 g.: .03 w., 100 meth. al., 100 eth., 100 acet., 50 bz., 25 CCl ₄			D
149	g. per 100 g.: meth. al.; eth., CCl ₄ , bz., acet.; i.w.			D
150	0.162 ²⁵ w.	fumigant, tear gas.	steel cylinders	An.
151	∞ w., acet., bz., CCl ₄ , eth., meth.al.			D
152	∞ acet., bz., CCl ₄ , eth., meth.al.			D
153	s. al., eth.	make catechol.	drums	Pa.
154	g. per 100 g.: 0.9 al., 0.7 bz.; i.w.			D.
155	15.3 ²⁰ % by wt. in w.	tear gases, chem. syn., warn- ing agt.	cans, drums	C. & C.
156	∞ al. eth. benzol. toluol, kero- sene, gasoline; 18.05 w.	dyestuffs, rubber accel., tear gas, purif. lubr. oils	drums	N.
157	8.3 ²⁰ % by wt. in w.	chem. inter	research quantities	C. & C.
158	15 ²⁰ % by wt. in w.	inter. syn. drugs, esters.	research quantities	C. & C.
159	s. w., pyridene, acet.a., al.; s.l.s. dioxan, acet., meth.et.ketone; i. most other org. solv.	org. syn.		At.
160	∞ eth., CCl ₄ , bz., al.; i. w.			D
161	v.s. acet.; g. per 100 g.: 123 bz., 36 CCl ₄ ; i.w.			D
162	2 g. per 100 g. w.; eth., CCl ₄ , bz. al., acet.			D
163	∞ acet., bz., CCl ₄ ; i.w.			D
164	v.s. acet.; bz., meth. al., CCl ₄ ; v.sl. s.w.			D
165	s.l.s. w.; s. al., acet., toluene, naphtha, ethyl acetate	plsticizer for proteins.		G
166	s. al., acet., ethyl acetate, toluene, naphtha; i.w.	plasticizer; solv.		G
167	s.h. al., acet., toluene, naphtha; i.w.	plasticizer.		G

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
168	<i>o</i> -Cyclohexylphenol...	<i>o</i> -cyclohexylphenol.....	(HO)C ₆ H ₄ (C ₆ H ₁₁).....	176.25
169	<i>p</i> -Cyclohexylphenol...	<i>p</i> -cyclohexylphenol.....	(HO)C ₆ H ₄ (C ₆ H ₁₁).....	176.25
170	Decylene glycol.....		CH ₃ CH(OH)C(C ₂ H ₅)- (C ₄ H ₉)CH ₂ OH	174.28
171	Diacetone alcohol (ace- tone free)	4-hydroxy-4-methyl- pentanone-2	(CH ₃) ₂ COHCH ₂ COCH ₃	116.16
172	Diacetone-(acetone free)	diacetone.....	CH ₃ COCH ₂ C(CH ₃) ₂ OH.....	116.16
173	Diacetone alcohol (ace- tone free)	4-hydroxy-4-methyl-pent- anone-2	(CH ₃) ₂ COHCH ₂ COCH ₃	116.16
174	Diacetone, tech.....	diacetone.....	CH ₃ COCH ₂ C(CH ₃) ₂ OH.....	116.16
175	" alcohol, tech	4-hydroxy-4-methyl- pentanone-2	CH ₃ COCH ₂ C(OH)(CH ₃)CH ₃ ...	116.16
176	" glucose....	diacetone glucose.....	C ₁₂ H ₂₀ O ₆	260.28
177	Diallyl ether.....	diallyl ether.....	CH ₂ CHCH ₂ OCH ₂ CHCH ₂	98.14
178	4,4'-Diaminobenzo- phenone	4,4'-diaminobenzophenone	(NH ₂ C ₆ H ₄) ₂ CO.....	212.24
179	4,4'-Diamino diphenyl ether	4,4'-diamino diphenyl ether	NH ₂ C ₆ H ₄ OC ₆ H ₄ NH ₂	200.23
180	1,3-Diamino- isopropanol	1,3-diamino-2-propanol...	NH ₂ CH ₂ CHOHCH ₂ NH ₂	90.13
181	Diamyl phthalate.....	amyl phthalate.....	C ₆ H ₄ (CO ₂ C ₆ H ₁₁) ₂	306.39
182	Di (β-ethyloxy) aniline.	<i>N</i> -phenyldiethanolamine..	C ₆ H ₅ N(CH ₂ CH ₂ OH) ₂	181.23
183	Dibenzothioxin.....	phenothioxin.....	C ₆ H ₄ SOC ₆ H ₄	200.24
184	Dibenzyl.....	dibenzyl.....	C ₆ H ₅ CH ₂ CH ₂ C ₆ H ₅	182.25
185	Dibenzyl disulfide....	dibenzyl disulfide.....	C ₆ H ₅ CH ₂ SSCH ₂ C ₆ H ₅	246.37
186	4,4'Dibromodiphenyl..	4,4' dibromodiphenyl.....	BrC ₆ H ₄ C ₆ H ₄ Br.....	312.02
187	Di(<i>n</i>)butyl amine.....	di(<i>n</i>)butyl amine.....	(CH ₂ CH ₂ CH ₂ CH ₂) ₂ NH.....	129.24
188	Di- <i>n</i> -butylamine.....	dibutylamine.....	(C ₄ H ₉) ₂ NH.....	129.23
189	Dibutyl phthalate....	dibutyl phthalate.....	C ₆ H ₄ (CO ₂ C ₄ H ₉) ₂	278.34
190	" ".....	" ".....	C ₆ H ₄ (COOC ₄ H ₉) ₂	278.34
191	" tartrate.....	" tartrate.....	(CO ₂ C ₄ H ₉) ₂ (CHOH) ₂	262.30
192	2,5-Dichloraceto- acetanilide	2,5-dichloracetoacetanilide	CH ₃ COCH ₂ CONHC ₆ H ₃ Cl ₂	246.09
193	Dichlorethyl ether....	2-2'-dichlorethyl ether....	ClCH ₂ CH ₂ OCH ₂ CH ₂ Cl.....	143.02
194	Dichlorisopropyl ether.	dichlorisopropyl ether....	CH ₃ CH(CH ₂ Cl)OCH(CH ₂ Cl)- CH ₃	171.07

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
168	grayish-wh sld.....	phenolic.....		1.018 $\frac{60}{25}$
169	grayish-wh. fine cr.....	fa. phenolic.....		
170	liq.....			0.945 $\frac{20}{20}$
171	col. liq.....	pleas.....		0.937-.942
172	w. wh. liq.....	mild.....		0.937-.943 $\frac{20}{20}$
173	w. wh.....	faint.....		.937-.946 $\frac{20}{20}$
174	w. wh. liq.....	mild.....	85-87 by wt...	.915-.920 $\frac{20}{20}$
175	w. wh. liq.....	faint.....	85-87 by wt...	.9382 $\frac{20}{4}$
176	cr. sld.....			
177	col. liq.....	pung.....	95.....	.805 $\frac{20}{4}$
178	lt. tan gran.....	none.....		
179	tan powd.....	faint.....		
180	wh.-pa. yel. hyg. cr. sld.....	amine-like.....		1.086 $\frac{60}{25}$
181	w. wh. liq.....	almost none.....	99-100.....	1.022-1.026 $\frac{20}{20}$
182	lt. tan sld.....	fa. amine-like.....		1.119 $\frac{60}{25}$
183	wh. cr.....	fa. pleas.....		1.226 $\frac{60}{25}$
184	sld.....			
185	pk. cr. sld.....	pung.....		
186	wh. cr.....	fa. aromatic.....		
187	liq.....	char., ammoniacal.....		0.7680 $\frac{20}{20}$
188	w. wh.....	ammoniacal.....		0.76 $\frac{20}{20}$
189	stable, col. liq.....	fa. v. sl. aromatic.....	98.....	1.047-1.049
190	w. wh.....	none.....	99-100.....	1.047-1.049
191	lt. straw.....	mild, pleas.....	98.....	1.087-1.093 $\frac{20}{20}$
192	wh. cr. sld.....			
193	col. liq.....	chloroform-like.....	99.....	1.219-1.224 $\frac{20}{20}$
194	col. liq.....	chloroform-like.....		1.1122

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
168	<i>o</i> -Cyclohexylphenol.....	47.3-55.5...	148 ¹⁰		273.2
169	<i>p</i> -Cyclohexylphenol.....	129.2-131.4..	166.....		
170	Decylene glycol.....		130 ³		>250
171	Diacetone alcohol.....	-42.8.....	167.9.....	<135-none; >-170- none	170
172	Diacetone-acetone free.....	-44.....	164-166.....	130-180; 150-170 85%	153
173	Diacetone alcohol.....	-44.....	166.....	130-180.....	151
174	“ tech.....	-63(approx).....		60-180.....	39
175	“ alcohol, tech.....	-44.....	166.....	<60-none; <100- none; <150-25%; >175-none	151
176	“ glucose.....	110-111.....			
177	Diallyl ether.....		95.....		20
178	4,4'-Diaminobenzophenone	239.0-244.6..			
179	4,4'-Diamino diphenyl ether.....	178-185.....			
180	1,3-Diaminoisopropanol....	39.4.....	130 ¹⁰		269.6
181	Diamyl phthalate.....		247-255 ⁵⁰	247-255 ¹⁰	357
182	Di(β -ethyloxy)aniline.....	55.....	200 ¹⁰		392
183	Dibenzothioxin.....	54.6-57.1....	180 ¹⁰		323.6
184	Dibenzyl.....	52.....			
185	Dibenzyl disulfide.....	58.9-65.4....			
186	4,4'-Dibromodiphenyl.....	166.8-167.7..			
187	Di(<i>n</i>)butyl amine.....		159.....	150-180.....	135
188	Di- <i>n</i> -butylamine.....	<-50.....	161.....	153-172.....	135
189	Dibutyl phthalate.....	-35 (approx).....	339.2.....		340
190	“ “.....	<-10.....		227-235 ³⁷	347
191	“ tartrate.....	21.....	204 ²⁶	197-204.....	270
192	2,5-Dichloroacetoacetanilide	92-96.....			none
193	Dichlorethyl ether.....	-51.9.....	178.5.....	<170-none; >180- none	185
194	Dichlorisopropyl ether.....	-79.6.....	187.3.....	180-190.....	185

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
168	v.s.acet., bz., eth.; 75 g. per 100 g.: CCl ₄ , v. sl. s. w.			D
169	v. sl. s. w.; g. per 100 g.: 70 acet.; 4 bz., 2 CCl ₄ ; v.sl.s.w.			D
170	sl. s. w.	chem. inter	research quantities	C. & C.
171	∞ w.	solv. nitro., cellu. acetate, oils, resins, waxes	cans, drums, tins	C. & C.
172	misc. w.	thinner, preservative, anti-freeze	tank cars, comp. tank cars, drums, cans	C.S.
173	∞ w.	solv. nitro., cellu. acetate, resins, gums, lacq., thinners	tank cars, drums, tins	S.C.
174	misc. w.	thinner, preservative, anti-freeze	tank cars, drums, cans	C.S.
175	misc. dist. w.	high boil, solv. hydraulic brake fluid, photo. film	tank cars, drums	S.C.
176	s. w., acet., ethanol, meth.al.			C.P.
177	0.3w.			S.D.
178	i. w., bz., CCl ₄ , eth., meth. al., acet.			D
179	15 g. per 100 g. acet.; i.w., al., CCl ₄ , eth., bz.			D
180	s. w. al., acet.; i. bz. CCl ₄ , eth.			D
181	0.05 ²⁵ w.	nitro. solv. mfg. lacq., plastics	tank cars, drums, cans	U.S.I.
182	g. per 100 g.: 5 w., 1 CCl ₄ , 23 bz., 29 eth.; v.s. acet., meth. al.			D
183	g. per 100 g.: 7 meth. al.; 165 eth., 100 CCl ₄ , 165 bz., 200 acet.; i.w.			D
184			research quantities	C. & C.
185	s. bz., CCl ₄ , v.sl.s. al.; i.w.			D
186	g. per 100 g.: 3 meth. al.; 2 eth.; 4 CCl ₄ ; 8 bz.; 3 acet.; i.w.			D
187	∞ w.	mfg. rubber accel., dystuffs.	drums.	C. & C.
188	∞ most org. solv.; i.w.	rubber vulcanization accel.; flotation reagents; dyestuffs, corrosion inhibitors	cans, drums.	Sh.
189	<0.02 ²⁰ % by wt. in w.	solv. for resins, plasticizer	cans, drums	C. & C.
190	.0418 ²⁵ w.; misc. all org. liq.	solv. dyes, oils, resins, nitro., lubricant, perfume fixative, antifoaming agt., plasticizer	tanks, drums comp. cars	C.S.
191	misc. meth., et. & butyl al., butyl, et. acetates, eth., acet., benzol., naphtha	plasticizer cellu. acetates; syn. resins, lubricant, mfg. rubber goods	drums, cans.	C.S.
192		printing ink, coloring	cans, drums	C. & C.
193	1.07 ²⁰ % by wt. in w.	h. boiling solv., wetting agt.	cans, drums	C. & C.
194	0.17 ²⁰ % by wt. in w.	solv., extr. fats, waxes, greases	drums.	C. & C.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
195	3,4-Dichloroaniline....	3,4-dichloroaniline.....	$\text{NH}_2\text{C}_6\text{H}_3\text{Cl}_2$	162.02
196	<i>ortho</i> -Dichlorobenzene..	<i>ortho</i> -dichlorobenzene.....	$\text{C}_6\text{H}_4\text{Cl}_2$	147.01
197	<i>para</i> -Dichlorobenzene..	<i>para</i> -dichlorobenzene.....	$\text{C}_6\text{H}_4\text{Cl}_2$	147.01
198	2,4-Dichlorobenzophenone	2,4-dichlorobenzophenone..	$\text{ClC}_6\text{H}_4\text{COC}_6\text{H}_4\text{Cl}$	251.11
199	4,4'-Dichlorobenzophenone	4,4'-dichlorobenzophenone	$\text{ClC}_6\text{H}_4\text{COC}_6\text{H}_4\text{Cl}$	251.11
200	1,1-Dichloroethane....	ethylidene dichloride.....	CH_3CHCl_2	98.97
201	2,4-Dichlorophenol....	2,4-dichlorophenol.....	$\text{Cl}_2\text{C}_6\text{H}_3\text{OH}$	163.01
202	<i>x</i> -Dichloro-(phenyl xenyl ether)	<i>x</i> -dichloro-(phenyl di-phenyl ether)	$\text{C}_{18}\text{H}_{12}\text{OCl}_2$	315.19
203	Dicyclohexyl.....	dicyclohexyl.....	$\text{C}_6\text{H}_{11}\text{C}_6\text{H}_{11}$	166.30
204	1,2 Di-(-2-phenylphenoxy) ethane	1,2 di-(-2-xenoxy)ethane...	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{O}(\text{CH}_2)_2\text{OC}_6\text{H}_4\text{C}_6\text{H}_5$...	366.44
205	Diethanolamine.....	di(2-hydroxyethyl)amine..	$(\text{HOCH}_2\text{CH}_2)_2\text{NH}$	105.14
206	Diethylaminoethanol..	diethylaminoethanol.....	$(\text{C}_2\text{H}_5)_2\text{NC}_2\text{H}_4\text{OH}$	117.19
207	Diethyl benzene.....	diethyl benzene.....	$\text{C}_2\text{H}_5\text{C}_6\text{H}_4\text{C}_2\text{H}_5$	134.21
208	Diethyl "Carbitol"*	.....	$(\text{C}_2\text{H}_5\text{OC}_2\text{H}_4)_2\text{O}$	162.23
209	Diethyl carbinol.....	<i>sec</i> - <i>n</i> -amyl alcohol.....	$(\text{CH}_3\text{CH}_2)_2\text{CHOH}$	88.15
210	Diethyl "Cellosolve"*	.....	$\text{C}_2\text{H}_5\text{OCH}_2\text{CH}_2\text{OC}_2\text{H}_5$	118.17
211	" phthalate.....	" phthalate.....	$\text{C}_6\text{H}_4(\text{COOC}_2\text{H}_5)_2$	222.23
212	" sulfate.....	" sulfate.....	$(\text{C}_2\text{H}_5)_2\text{SO}_4$	154.18
213	Diethylamine.....	diethylamine.....	$(\text{C}_2\text{H}_5)_2\text{NH}$	73.14
214	Diethylene glycol....	diethylene glycol.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH}$	106.12
215	Diethyl glycol.....	diethyl glycol.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH}$	106.12
216	" glycol	" " diacetate	$(\text{CH}_3\text{COOCH}_2\text{CH}_2)_2\text{O}$	190.19
217	Diethylene glycol diglycolate	diethylene glycol diglycolate	$(\text{CH}_2\text{CH}_2\text{OOCCH}_2\text{OH})_2\text{O}$	222.18
218	Diethylene glycol dilevulinate	diethylene glycol dilevulinate	$[\text{CH}_2\text{CH}_2\text{OOC}(\text{CH}_2)_2\text{COCH}_3]_2\text{O}$..	270.4
219	Diethylene triamine...	diethylene triamine.....	$\text{NH}_2\text{C}_2\text{H}_4\text{NHC}_2\text{H}_4\text{NH}_2$	103.17
220	Diglycol chlorohydrin.	diglycol chlorohydrin.....	$\text{ClCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH}$	124.57
221	" laurate.....	diglycol laurate.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OOC}-(\text{CH}_2)_{10}\text{CH}_3^\dagger$	288.42†
222	" myristate....	diglycol myristate.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OOC}-(\text{CH}_2)_{12}\text{CH}_3^\dagger$	316.47†

* Trade mark.

† Theoretical.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
195	fine lt. tan cr.	mild.		
196	cl. col. liq.	aromatic.		1.303 $\frac{20}{4}$
197	gran. wh.-trans. sld.	aromatic.	100.	1.520 26
198	wh. powd.	faint.		
199	wh. cr.	musty.		
200	col. liq.	sweet.		1.168 $\frac{25}{25}$
201	wh. cr. sld.	phenolic.		1.382 $\frac{60}{25}$
202	lt. straw-colored visc. liq.			1.233 $\frac{25}{25}$
203	col. liq.	aromatic.		.885 $\frac{25}{25}$
204	fine wh. cr.	none.		
205	col. liq.	ammoniacal.	95-100.	1.0985
206	col. hyg. liq.	amine-like.	98-100.	0.8851
207	col. cl. mobile liq.	pleas. char.		.868 $\frac{25}{25}$
208	col. liq.	almost none.	99.	0.9094
209	w. wh.			0.82 $\frac{20}{20}$
210	col. liq.	sl. ethereal.	95.	0.8424 $\frac{20}{20}$
211	w. wh. liq.	none.	99-100.	1.118-1.120 $\frac{20}{20}$
212	w. wh. liq.	fa. ethereal.	98.	1.177-1.182 $\frac{20}{20}$
213	cl. w. wh. liq.	ammoniacal.	98.	0.71 $\frac{20}{20}$
214	w. wh. liq.	almost none.		1.117-1.120 $\frac{20}{20}$
215	w. wh. liq.	almost none.		1.1170-1.1200 $\frac{20}{20}$
216	w. wh. liq.	ester-like.		1.1159 $\frac{20}{20}$
217	yel. liq.	faint.		1.30 30
218	amber liq.	pleas.		1.145 25
219	hyg. visc. liq.	char. amine-like.		0.953-0.958
220	w. wh. liq.			1.1698 $\frac{20}{20}$
221	lt. straw-colored oily, liq.	v. faint.	tech.	0.963-.968
222	lt. colored, wax-like.	v. faint.	tech.	0.938 38

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
195	3,4-Dichloroaniline.....		71.0-73.2...	144 ¹⁰	330.8
196	<i>ortho</i> -Dichlorobenzene.....	-17.2.....	173.....	173-186.....	167
197	<i>para</i> -Dichlorobenzene.....	53.04.....	173.....		158
198	2,4-Dichlorobenzophenone..	194 ¹⁰	60-62.2.....		366.8
199	4,4'-Dichlorobenzophenone..	146.6-147.8..			
200	1,1-Dichloroethane.....	< -20.....		57.2-5%; 57.4-95%.	39.2
201	2,4-Dichlorophenol.....	41-42.2.....	100 ¹⁰		237.2
202	<i>x</i> -Dichloro-(phenyl xenyl ether)	< 0.....	222 ¹⁰		399.2
203	Dicyclohexyl.....	3.....		238-5%; 239-95%...	210.2
204	1,2 Di-(-2-phenylphenoxy) ethane	101.1-102.3..			
205	Diethanolamine.....	28.....	268.0.....		280
206	Diethylaminoethanol.....		162.1.....	158-165.....	140
207	Diethyl benzene.....	-70.....		180-5%; 182-95%...	138.2
208	Diethyl "Carbitol"*.....	-47.....	187.9.....	180-190.....	180
209	Diethyl Carbinol.....	< -75.....	115.6.....	113.6-117.6; 95%...	102
210	Diethyl "Cellosolve"*.....	-74.....	121.4.....	115-140.....	95
211	Diethyl phthalate.....	-40.5.....	296.1.....		305
212	Diethyl sulfate.....	-23.1.....	210.2.....	106-111 ²⁵ , 190 of 200 cc.	250
213	Diethylamine.....	-50.....		not < 53; not > 59.5	< 0
214	Diethylene glycol.....	-6.0.....	244.8.....	< 230-none; < 270-95%	290
215	Diethyl glycol.....	-6.....	245.....	< 230-none; > 270-none	295
216	Diethylene glycol diacetate.	19.1.....	250.0.....		275
217	Diethylene glycol diglycolate				
218	Diethylene glycol dilevulinate				
219	Diethylene triamine.....		206.7.....	185-215.....	215
220	Diglycol chlorhydrin.....		196.8.....		225
221	" laurate.....	11-14.....	315-325.....	240-325, 75%; rest in vacuo	290
222	" myristate.....	36-37.....			290

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
195	g. per 100 g.: 6 CCl ₄ , 51 bz., 70 al., v.s. eth., i.w.	.....	.....	D
196	s. al., eth.; i.w.	insecticide, deodorant, solv. org. syn.	drums, cans	S.P.
197	s. al., eth; i.w.	insecticide, fungicide, deodorant	barrels, drums, cans	S.P.
198	g. per 100 g.; 10 meth. al., 48 eth., 20 CCl ₄ , 190 bz., 150 acet.; i.w.	.....	.....	D
199	g. per 100 g.: 1 meth. al.; 2 eth.; 2 CCl ₄ ; 12 bz.; 5 acet.; i.w.	.....	.....	D
200	∞ meth.al., eth., CCl ₄ , bz., acet.; v.s.s.w.	.....	.....	D
201	v.s. acet., al., eth.; g. per 100 g.: 160 CCl ₄ , 5 w.	.....	.....	D
202	g. per 100 g.: 14 meth.al., >100 eth. >100 CCl ₄ , >100 bz., >100 acet.; i.w.	.....	.....	D
203	g. per 100 g.: 7 meth.al.; ∞ eth., CCl ₄ , bz., acet.; i.w.	.....	.....	D
204	g. per 100 g.: .02 w., .4 meth.al., 2 isopropyl eth., 9 CCl ₄ , 55 bz., 19 acet.	.....	.....	D
205	∞ w.	absorb. a., gases, soft., moist. agt.	cans, drums	C. & C.
206	∞ w., al.	formation esters.	drums	C. & C.
207	∞ bz., CCl ₄ , eth., s.al., i.w.	.....	.....	D
208	∞ w.	h. boil. reaction medium.	drums	C. & C.
209	s.meth.al., ethyl eth., acet., bz., gasoline, ethyl acetate; s.l.s.w.	mfg. pharmaceuticals.	cans, drums	Sh.
210	21 ²⁰ % by wt. in w.	inert reaction medium.	drums	C. & C.
211	.09 ²⁵ % by vol. w.; misc. most org. liq.	plasticizer fixative, denaturant	drums, cans	C.S.
212	0.7 ²⁰ % by wt. in w.	ethylating agt.	glass jug, cans, drums	C. & C.
213	s.w., meth. al., ethyl eth., acet., bz., gasoline, ethyl acetate	rubber chem., soaps.	cans, drums	Sh.
214	misc. w., eth. al., acet.; imm. bz., CCl ₄	antifreeze plasticizer, soft. agt.	cans, drums, tank cars	C. & C.
215	∞ w.	chem. syn.; soft. agt.	tank cars, drums, cans	U.S.I.
216	∞ w.	h. boil. lacq. solv.	cans	C. & C.
217	∞ w.; s. polar solv.; i.non-polar solv.	compatible with nitro., cellu. acetate, hygroscopic	.....	G
218	∞ w.; s. al., acet., ethyl acetate, toluene; i.naphtha	compatible with nitro. cellu. acetate, some vinyl resins	cans, drums	G
219	■ w. & hydrocarbons	form soaps for derivatives.	cans, drums	C. & C.
220	∞ w.	chem. syn., plasticizer inter.	research quant.	C. & C.
221	disp. c.w.; s.al., hydrocarbons, oils	emulsifying, disp. agt. cosmetics, dry cleaning, dye solv.; furs and leather	drums, cans	G.
222	disp. h.w.; s.h.al., hydrocarbons, oils	emulsifying, thick., disp. agt.	drums, slabs	G.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
223	Diglycol oleate.....	diglycol oleate.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OOC}-$ $(\text{CH}_2)_7\text{CH}(\text{C}_8\text{H}_{17})\text{CH}\dagger$	370.56†
224	“ palmitate....	“ palmitate.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OOC}-$ $(\text{CH}_2)_{14}\text{CH}_3\dagger$	344.52†
225	“ stearate.....	“ stearate.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OOC}-$ $(\text{CH}_2)_{16}\text{CH}_3\dagger$	372.58†
226	2,4'-Dihydroxybenzo- phenone	2,4'-dihydroxybenzo- phenone	$\text{OHC}_6\text{H}_4\text{COC}_6\text{H}_4\text{OH}.....$	214.21
227	4,4'-Dihydroxybenzo- phenone	4,4'-dihydroxybenzo- phenone	$\text{OHC}_6\text{H}_4\text{COC}_6\text{H}_4\text{OH}.....$	214.21
228	Diisobutyl ketone....	diisobutyl ketone.....	$(\text{CH}_3)_2\text{CHCH}_2\text{COCH}_2\text{CH}(\text{CH}_3)_2.....$	142.24
229	Diisopropanolamine...	diisopropanolamine.....	$(\text{CH}_3\text{CHOHCH}_2)_2\text{NH}.....$	133.19
230	Dimethallyl ether....	dimethallyl ether.....	$\text{CH}_2\text{C}(\text{CH}_3)\text{CH}_2\text{OCH}_2-$ $\text{C}(\text{CH}_3)\text{CH}_2$	126.19
231	Dimethoxytetraglycol.	dimethyl ether of tetra- ethylene glycol	$(\text{CH}_3\text{OC}_2\text{H}_4\text{OC}_2\text{H}_4)_2\text{O}.....$	222.28
232	Dimethylamine.....	dimethylamine.....	$(\text{CH}_3)_2\text{NH}.....$	45.08
233	Dimethyl dioxane....	dimethyl dioxane.....	$\text{OCH}(\text{CH}_3)\text{CH}_2\text{OCH}_2\text{CH}(\text{CH}_3).....$	116.16
234	“ ethyl carbinol	(tert amyl alcohol) (2-methyl-2-butanol)	$\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)\text{OHCH}_3.....$	88.15
235	1,3-Dimethyl-1,3-di- phenyl cyclobutane	1,3-dimethyl-1,3-diphenyl cyclobutane	$\text{C}_6\text{H}_5\text{CCH}_3(\text{CH}_2)_2\text{CCH}_3\text{C}_6\text{H}_5.....$	236.34
236	Dimethyl furane.....	dimethyl furane.....	$\text{OC}(\text{CH}_3):\text{CHCH}:\text{C}(\text{CH}_3).....$	96.12
237	“ phthalate....	dimethyl phthalate.....	$\text{C}_6\text{H}_4(\text{CO}_2\text{CH}_3)_2.....$	194.18
238	“ “....	dimethyl phthalate....	$\text{C}_6\text{H}_4(\text{COOCH}_3)_2.....$	194.18
239	Diocetyl amine.....	diocetylamine.....	$[\text{CH}_3(\text{CH}_2)_9\text{CH}(\text{C}_2\text{H}_5)\text{CH}_2]_2\text{NH}.....$	241.45
240	Diocetylaminioethanol..	diocetylaminioethanol.....	$[\text{CH}_3(\text{CH}_2)_9\text{CH}(\text{C}_2\text{H}_5)\text{CH}_2]_2\text{N}(\text{CH}_2)_2\text{OH}.....$	285.50
241	Dioxane.....	1,4-diethylene dioxide....	$\text{O}:(\text{CH}_2\text{CH}_2)_2\text{O}.....$	88.10
242	Dioxolane.....	dioxolane.....	$\text{OCH}_2\text{CH}_2\text{OCH}_2.....$	74.08
243	1,1-Diphenylethane....	1,1-diphenyl ethane.....	$\text{C}_6\text{H}_5\text{CHCH}_2\text{C}_6\text{H}_5.....$	182.25
244	Diphenyl phosphate...	diphenyl phosphate.....	$\text{C}_6\text{H}_5\text{OHPO}_3\text{C}_6\text{H}_5\cdot 2\text{H}_2\text{O}.....$	286.22
245	N,N'-Diphenyl piper- azine	N,N'-diphenyl piperazine..	$\text{C}_6\text{H}_5\text{N}(\text{CH}_2)_4\text{NC}_6\text{H}_5.....$	238.32
246	Dipropyl ketone- (butyrene)	dipropyl ketone(butyrene)	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COCH}_2\text{CH}_2\text{CH}_3.....$	114.18
247	Dipropylene glycol....	dipropylene glycol.....	$(\text{CH}_2\text{CHOHCH}_2)_2\text{O}.....$	134.17
248	Epichlorohydrin.....	epichlorohydrin.....	$\text{CH}_2\text{ClCHOCH}_2.....$	92.53
249	Ethanol.....	ethyl alcohol.....	$\text{CH}_3\text{CH}_2\text{OH}.....$	46.07
250	“.....	“ “.....	$\text{CH}_3\text{CH}_2\text{OH}.....$	46.07
251	β-(p-tert-Butyl- phenoxy) Ethanol	2-(4-tert-butylphenoxy) ethanol	$\text{C}_6\text{H}_4\text{C}(\text{CH}_3)_3\text{OCH}_2\text{CH}_2\text{OH}.....$	194.27

† Theoretical.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
223	lt. red oily liq.	fatty	tech.	0.930
224	lt. colored, wax-like	v. faint.	tech.	0.924 ⁴⁶
225	wh. wax-like sld.	faint, fatty	tech.	0.960
226	straw colored cr.	faint.		
227	lt. tan gran	none.		
228	col. liq.	agreeable, ketone-like	95	0.8089 ²⁰ ₂₀
229	col. liq.	amine-like		1.0089 ²⁰ ₂₀
230	col. liq.	pungent.	95.	0.816 ²⁰ ₄₀
231	w. wh. liquid.	almost none.		1.0132 ²⁰ ₂₀
232	gas.	strong amm.	98.	.6865 ⁻⁶
233	w. wh. liq.			0.9268 ²⁰ ₂₀
234	w. wh.			0.81 ²⁰ ₂₀
235	wh. cr.	none.		.982 ⁵⁰ ₂₅
236	w. wh. liq.			0.8900 ²⁰ ₂₀
237	col. liq.	faint.	98.	1.192-1.194 ²⁰ ₂₀
238	lt. straw	v. faint.	99-100.	1.192-1.194 ²⁰ ₂₀
239	col. liq.	sl. ammoniacal.		0.8062
240	visc. liq.	amine-like		
241	col. liq.	mild, n. res.	99 by wt.	1.030-1.038 ²⁰ ₂₀
242	col. liq.	pleasant ethereal.		1.065
243	pa. straw colored liq.	aromatic.		.987 ²⁵ ₂₅
244	wh.-pk. cr. powd.	mild, phenolic		1.242 ⁶⁰ ₂₅
245	wh.-pk. cr.			
246	col. liq.	agreeable.	95-100.	0.8162 ²⁰ ₂₀
247	col. liq.	none.		1.034-1.039
248	col. liq.	fa., musty	95.	1.181 ²⁰ ₄
249	w. wh. liq.	char.	99.	0.8090-0.8128 ²⁰ ₂₀
250	w. wh. liq.	char.	99.9.	<.7944 ⁶⁰ ₆₀
251	cl. col. pa. straw, visc. liq.	none.		1.014 ²⁵ ₂₅

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
223	Diglycol oleate	<0		240-330, 85%; none	290
224	“ palmitate	46.5			290
225	“ stearate	53-54			290
226	2,4-Dihydroxybenzo-phenone	139-143.6			
227	4,4'-Dihydroxybenzo-phenone	206.-218.8			
228	Diisobutyl ketone	41.5	168.1	165-170	140
229	Diisopropanolamine		116 ^s		
230	Dimethallyl ether		134		23
231	Dimethoxytetraglycol	-21.4	275.8	255-285	285
232	Dimethylamine	-96	7.2-7.3764		20.8 (27% soln.)
223	Dimethyl dioxane		117.5		75
234	Dimethyl ethyl carbinol	-11.9	101.8	not <99.5 not >103.0	70
235	1,3-Dimethyl-1,3-diphenyl cyclobutane	49		306.9-5% 308.7-95%	289.4
236	Dimethyl furane		94		45
237	“ phthalate	5.5	281.8	280-285 95% within 2.0	300
238	“ “	0.8 (approx.)	282	<280-none >290-none	295
239	Diocetylamine		281.1		270
240	Diocetyl aminoethanol				
241	Dioxane	10	101.1	95-none; 103-none	65
242	Dioxolane		74-75		35
243	1,1-Diphenylethane	-20		272.1-5%; 274.6-95%	264.2
244	Diphenyl phosphate	50-51			
245	N,N'-Diphenyl piperazine	165.7-167.7			
246	Dipropyl ketone (butyrone)	-32.1	143.7	138-145	105
247	Dipropylene glycol		231.8	215-240	280
248	Epichlorohydrin	-57	116		90
249	Ethanol	-114.4	78.3	<77-none; >80-none	70
250	“	-114.4	78.4		65
251	β-(p-tert-butylphenoxy)-Ethanol	13		146.5-5%; 155.5-95%	248

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
223	disp. c.w.; s.al., hydrocarbons, oils	emulsifying, disp. agt.; sprays, polishes	drums, cans...	G.
224	disp. h.w.; s.h.al., hydrocarbons, oils	emulsifying, thick., disp. agt.	drums, slabs...	G.
225	disp. h.w.; s.al., hydrocarbons, oils	emulsifying, thick., disp. agt.; ceramic insulation; cosmet- ics, pharm., lubricant	drums, slabs...	G.
226	g. per 100 g.: 44 eth., 44 meth. al.; 52 acet.; i.w., bz., CCl ₄			D.
227	g. per 100 g.: 2 meth. al., 4 eth., .6 acet.; i.w., bz., CCl ₄			D.
228	misc. most org. liq.; <0.06 ²⁰ % by wt. in w.	syn; solv. rubber nitro., synth. resins	drums...	C. & C.
229	∞ w.	prep. of soap	drums	C. & C.
230	<0.2 w.			S.D.
231	∞ w., hydrocarbons	plasticizer neutral reaction medium mutual solv.	drums...	C. & C.
232	s.w., al., eth., org. liq.	dehairing agt.; acid gas absorb. solv.; gasoline stabilizer	drums, bottles..	C.S.
233	4.33 ²⁰ % by wt. in w.	solv. rayon, cellu. ester.	research quant.	C. & C.
234	s.w.	chem. syn.	cases, drums	Sh.
235	g. per 100 g.: 8 meth. al.; 147 eth.; 104 CCl ₄ , 190 bz., 125 acet.; i.w.			D.
236	i.w.		research quant.	C. & C.
237	0.43 ²⁰ % by wt. in w.	plasticizer nitro., cellu. ace- tate, lacq., plastics	cans, drums	C. & C.
238	misc. most com. org. solv.; 536 w.	plasticizer rubber mix., cellu. acetate; solv. gelatinizing agt.	drums, cans...	C.S.
239	<0.02 ²⁰ % by wt. in w.	chem. inter.	research quant.	C. & C.
240	i.w.	chem. inter.	research quant.	C. & C.
241	∞ w., com. org. solv.	solv.	cans...	C. & C.
242	∞ w.	solv. cellu. esters	research quant.	C. & C.
243	∞ acet., bz., CCl ₄ , eth., meth. al.; i.w.			D.
244	v.s.al., s.w.; g. per 100 g.: 100 eth., 100 acet., 10 bz., 4 CCl ₄			D.
245	g. per 100 g.: 2 meth. al., 2 eth., 3 CCl ₄ , 7 bz., 4 acet.; i.w.			D.
246	0.43 ²⁰ % by wt. in w.	h. boil. lacq. solv.	research quant.	C. & C.
247	∞ w.	h. boil. solv. plasticizer	cans, drums	C. & C.
248	6 w.			S.D.
249	∞ w.; misc. com. solv.	industrial chem.	cans, drums, tank cars	C. & C.
250	∞ w.; misc. com. solv.	solv. lacq., resins, flavors, oils, chem. syn.	tank cars, drums cans	U.S.I.
251	∞ meth. al., isopropyl eth., bz., acet.; s. CCl ₄ ; i.w.			D.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
252	(4- <i>tert</i> -butyl-2-chloro-phenyl) (2-chloroethyl) Ether	β -(4- <i>tert</i> -butyl-2-chloro-phenoxy)ethyl chloride	$\text{ClC}_6\text{H}_3\text{C}(\text{CH}_3)_3\text{OCH}_2\text{CH}_2\text{Cl}$	247.16
253	Ethyl acetate.....	ethyl acetate.....	$\text{CH}_3\text{COOC}_2\text{H}_5$	88.10
254	" ".....	" ".....	$\text{CH}_3\text{COOC}_2\text{H}_5$	88.10
255	" ".....	" ".....	$\text{CH}_3\text{COOC}_2\text{H}_5$	88.10
256	" acetoacetate....	" acetoacetate.....	$\text{CH}_3\text{COCH}_2\text{COOC}_2\text{H}_5$	130.14
257	" ".....	" ".....	$\text{CH}_3\text{COCH}_2\text{COOC}_2\text{H}_5$	130.14
258	" alcohol.....	" alcohol.....	$\text{C}_2\text{H}_5\text{OH}$	46.07
259	" benzene.....	" benzene.....	$\text{C}_6\text{H}_5\text{CH}_2\text{CH}_3$	106.16
260	" borate.....	" borate.....	$(\text{C}_2\text{H}_5\text{O})_3\text{B}$	146.00
261	2-Ethylbutyraldehyde..	diethyl acetaldehyde....	$(\text{C}_2\text{H}_5)_2\text{CHCHO}$	100.16
262	2-Ethylbutyric acid...	" acetic acid.....	$(\text{C}_2\text{H}_5)_2\text{CHCOOH}$	116.16
263	Ethyl benzoylacetate...	" benzoylacetate.....	$(\text{C}_6\text{H}_5\text{COCH}_2\text{COOC}_2\text{H}_5)$	192.20
264	" chloroformate....	" chlorocarbonate.....	$\text{ClCOOC}_2\text{H}_5$	108.53
265	" carbonate.....	" carbonate.....	$(\text{C}_2\text{H}_5)_2\text{CO}_3$	118.13
266	<i>x</i> -Ethyl diphenyl ether	<i>x</i> -ethyl diphenyl ether...	$\text{C}_6\text{H}_5\text{OC}_6\text{H}_4\text{C}_2\text{H}_5$	198.25
267	Ethyl ether.....	ethyl ether.....	$\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$	74.12
268	" " , A.C.S.....	" " (sulphuric ether)	$(\text{C}_2\text{H}_5)_2\text{O}$	74.12
269	" formate.....	ethyl formate.....	HCOOC_2H_5	74.08
270	" ".....	" ".....	HCOOC_2H_5	74.08
271	" lactate.....	" lactate.....	$\text{CH}_3\text{CHOHCOCOC}_2\text{H}_5$	118.13
272	" ".....	" ".....	$\text{CH}_3\text{CHOHCOCOC}_2\text{H}_5$	118.13
273	" oxalate.....	" oxalate.....	$(\text{COOC}_2\text{H}_5)_2$	146.14
274	<i>p</i> -Ethyl phenol.....	<i>p</i> -ethyl phenol.....	$\text{OHC}_6\text{H}_4\text{C}_2\text{H}_5$	122.16
275	Ethyl phenyl ethanol-amine	ethyl phenyl ethanolamine	$\text{C}_6\text{H}_5\text{N}(\text{C}_2\text{H}_5)\text{CH}_2\text{CH}_2\text{OH}$	165.23
276	" phthalate.....	diethyl phthalate.....	$\text{C}_6\text{H}_4(\text{CO}_2\text{C}_2\text{H}_5)_2$	222.23
277	2-Ethylbutyl alcohol...	2-ethylbutyl alcohol.....	$(\text{C}_2\text{H}_5)_2\text{CHCH}_2\text{OH}$	102.17
278	2-Ethylhexanol.....	octyl alcohol.....	$\text{C}_4\text{H}_9\text{CH}(\text{C}_2\text{H}_5)\text{CH}_2\text{OH}$	130.23

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
252	col.-pa. straw liq.....	fa. aromatic.....		1.149 ²⁵ / ₂₆
253	w. wh. liq.....	pleasant.....	95-98.....	0.894-0.900 ²⁰ / ₂₀
254	w. wh. liq.....	n. res. pleas. fruity.....	85-88 by wt.....	.883-.888 ²⁰ / ₂₀
255	w.wh. liq.....	mild, n. res.....	99-100.....	.899-.902 ²⁰ / ₂₀
256	col. liq.....		97.5-100.....	1.023-1.028 ²⁰ / ₂₀
257	almost w. wh.....	mild.....	96.....	1.027-1.030 ²⁰ / ₂₀
258	liq.....	mild, n. res.....	99.9.....	0.7944 ^{16.56} / _{15.56}
259	col. liq.....	aromatic.....		0.870
260	col. liq.....		98-100.....	0.864
261	col. liq.....		90-100.....	0.8170-0.823
262	w. wh. liq.....	faint.....	95-100.....	0.9170-.9220
263	lt. yel. liq.....	char.....	95.5.....	1.111-1.117 ²⁰ / ₂₀
264	w. wh. liq.....	irritating, tear producing	96.....	1.135-1.139 ²⁰ / ₂₀
265	w. wh. liq.....	mild n. res.....	98-100.....	.973-.977 ²⁰ / ₂₀
266	lt. grn.-yel. liq.....	pleas. aromatic.....		1.032 ²⁵ / ₂₅
267	w. wh. flam. liq.....	ethereal.....	99-100.....	0.715-.718 ²⁰ / ₂₀
268	w. wh. liq.....	char., n. res.....	99.7.....	>.7100 ²⁰ / ₂₀
269	w. wh. liq.....	pleas. aromatic.....	95-100 by wt.....	.900-.930 ²⁰ / ₂₀
270	w. wh. liq.....	pleas. char.....	94-96.....	0.900-0.930 ²⁰ / ₂₀
271	w. wh. liq.....	mild, n. res.....	96-100.....	1.020-1.036 ²⁰ / ₂₀
272	w. wh. liq.....	mild, n. res.....	96.....	1.020-1.036 ²⁰ / ₂₀
273	w. wh. liq.....	mild, n. res.....	99.....	1.075-1.079 ²⁰ / ₂₀
274	dk. strawcolored cr. sld.....	phenolic odor.....		.984 ⁶⁰ / ₂₅
275	col. liq.....	amine-like.....		1.04 ²⁰ / ₂₀
276	w. wh. liq.....	none.....	99-100.....	1.117-1.121 ²⁰ / ₂₀
277	col. liq.....	mild.....	99.....	0.830-0.835 ²⁰ / ₂₀
278	col. liq.....	mild.....	99.....	0.832-0.837 ²⁰ / ₂₀

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
252	(4- <i>tert</i> -Butyl-2-chlorophenyl) (2-chloroethyl) Ether	-20		176.0-5%; 179.8-95%	339.8
253	Ethyl acetate	-83.5	77.1	<73-none; >80-none	40
254	" "	-83.6	77.1	<70-none; <72-10% >80-none	23
255	" "	-83.6	77.1	<75-none; >80-none	42
256	" acetoacetate	-43.3	180.7	<96-5%; >110-none	185
257	" "		180		171
258	" alcohol	-112	78.3		ca 57
259	" benzene	-92.8	135.7		85
260	" borate	-86.6	120.0	112-121	65
261	2-Ethylbutyraldehyde	-89.0	116.8	80-135	70
262	2-Ethylbutric acid	-9.4	194.0	185-200	210
263	Ethyl benzoylacetate		146 ¹⁰	<114 ¹⁰ -none; >148 ¹⁰ -none	285
264	" chloroformate	-80.6	95		82
265	" carbonate	-43.0	126.8	<120-none; <128-90%; >130-none	89
266	<i>x</i> -Ethyl diphenyl ether	<-20		159.5-5%; 166.5-95%	294.8
267	Ethyl ether	-116.3	34.5		-40
268	" " , A.C.S.	-116.3	34.5		<10
269	" formate	-80.5	54.3	<51-none; >55-none	-2.2
270	" "	-80	54	<51-none; >55-none	9
271	" lactate	-25	154	<102-none; >173-none	145
272	" "		153.9	<102-none; >173-none	129
273	" oxalate	-40.6	185.4	<180-none; >190-none	168
274	<i>p</i> -Ethyl phenol	37		216.6-5%; 219.3-95%	219.2
275	Ethyl phenyl ethanolamine		268 ⁷⁴⁰	260-276 ⁷⁴⁰	
276	" phthalate	-5	200-207 ⁵⁰	200-207 ⁵⁰	325
277	2-Ethylbutyl alcohol		148.9	<140-none; >160-none; <145-5%; <155-95%	135
278	2-Ethylhexanol			<180-none; >190-none	185

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
252	∞ meth.al., eth., CCl ₄ , bz., acet.; i.w.			D.
253	8.72 ²⁰ % by wt. in w.; s.al., eth., CHCl ₃	solv.syn. other compounds . . .	cans, drums, cars	C. & C.
254	misc.et.al., butyl al., acet., CHCl ₃ , CCl ₄ , 7.6 w.	solv. nitro. lacq., prep. medi- cines, perfumes, flavors. denaturant	tans, drums, cans	C.S.
255	3.5 ²⁵ w	nitrocellu. solv., syn. base for org. chem., pharm., flavor- ing, denaturant	tank cars, drums, cans	U.S.I.
256	11.6 ²⁰ % by wt. in w. ∞ al., eth., et. acet.	inter. dye and drugs	cans, drums . . .	C. & C.
257	4.8 ²⁵ w	mfg. dyes, pharm	drums, cans, bottles	U.S.I.
258	misc.w., most org. liq	solv. lacq., varnishes, flavors, raw mat. in chem. syn.	bottles, cans, drums, tankcars	C.S.
259	i.w		research quant.	C. & C.
260	d.w	chem. syn., indust. solv	research quant.	C. & C.
261	0.31 ²⁰ % by wt. in w	prep. of pharm., rubber accel., synth. resins	cans, drums . . .	C. & C.
262	0.22 ²⁰ % by wt. in w	inter. drugs, dyes	cans, drums . . .	C. & C.
263	misc. com. org. solv	dye inter	drums, cans . . .	U.S.I.
264	d.w	flotation agt; diethyl carbon- ate inter.	glass	U.S.I.
265	1.4 ²⁵ w	neutral lacq. solv	tans, drums, cans	U.S.I.
266	= meth. al., eth., CCl ₄ , bz., acet.; i.w			D.
267	6.89 ²⁰ % by wt. in w	solv. denaturant extr	drums, tank cars	C. & C.
268	0.9 ²⁵ w	lab. agt., solv., synth. base dry-cleaner, denaturant	drums	U.S.I.
269	9.15 ²⁰ w	fumigant, larvicide, synth. flavor prep., medicine	drums, cans . . .	C.S.
270	misc. com. org. solv	Vitamin B ₁ syn	tank cars, drums, cans	U.S.I.
271	∞ w	solv	drums, cans . . .	C.S.
272	∞ ²⁶ w	cellu. nitrate solv., cellu. ace- tate solv., resins solv	drums, cans . . .	U.S.I.
273	1.5 ²⁵ w	dye inter. pharm. base, nitro. solv.	tank cars, drums, cans	U.S.I.
274	∞ meth. al., eth., CCl ₄ , bz., acet.; v.s.l.s.w.			D.
275	0.5 ²⁰ % by wt. in w	azo dyes	cans, drums . . .	C. & C.
276	0.7 ²⁵ w	nitrocellu. plasticizer, cellu. acetate plasticizer, perfume fixative, insecticide, synth. resins	tank cars, cans drums	U.S.I.
277	0.43 ²⁰ % by wt. in w. misc. most org. solv.	lacq., synth. resin, varnishes .	cans, drums . . .	C. & C.
278	0.10 ²⁰ % by wt. in w. misc. most org. solv.	defoaming agt., solv. synth. gums, waxes, resins, disp., wetting agt.	cans, drums . . .	C. & C.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
279	2-Ethylhexoic acid....	2-ethylhexoic acid.....	$\text{CH}_3(\text{CH}_2)_3\text{CH}(\text{C}_2\text{H}_5)\text{COOH}...$	144.21
280	Ethylidene diacetate...	ethylidene diacetate.....	$\text{CH}_3\text{CH}(\text{OCOCH}_3)_2.....$	146.08
281	2-Ethyl-3-propylacrolein	2-ethyl-3-propylacrolein...	$\text{CH}_3\text{C}_2\text{H}_4\text{CH}_2\text{C}(\text{C}_2\text{H}_5)\text{CHO}...$	126.19
282	Ethyl silicate.....	ethyl silicate.....	$(\text{C}_2\text{H}_5)_4\text{Si}:\text{O}_4.....$	208.30
283	" sodium oxal- acetate	sodium ethyl oxalacetate..	$\text{C}_2\text{H}_5\text{OOC}(\text{ONa})\text{CHCOOC}_2\text{H}_5..$	210.17
284	Ethylene.....	ethylene.....	$\text{C}_2\text{H}_4.....$	28.05
285	" chlorhydrin, anhydrous	" chlorhydrin anhydrous	$\text{HOCH}_2\text{CH}_2\text{Cl}.....$	80.52
286	" diamine, anhydrous	" diamine, anhydrous	$\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2.....$	60.10
287	" dichloride ...	" dichloride.....	$\text{ClCH}_2\text{CH}_2\text{Cl}.....$	98.97
288	" glycol.....	" glycol.....	$\text{HOCH}_2\text{CH}_2\text{OH}.....$	62.07
289	" "	" "	$\text{HOCH}_2\text{CH}_2\text{OH}.....$	62.07
290	" " silicate	" " silicate....	$(\text{HOCH}_2\text{CH}_2\text{O})_4\text{Si}.....$	272.30
291	" oxide.....	" oxide.....	$(\text{CH}_3)_2\text{O}.....$	44.05
292	"Flexol" plasticizer 3GH	di-2-ethylbutyrate triethylene glycol	$\text{C}_5\text{H}_{11}\text{COOC}_2\text{H}_4(\text{OC}_2\text{H}_4)_2$ $\text{OOC}\text{C}_5\text{H}_{11}$	346.46
293	"Flexol" plasticizer 3GO	di-2-ethyl hexoate triethylene glycol	$\text{C}_7\text{H}_{15}\text{COOC}_2\text{H}_4(\text{OC}_2\text{H}_4)_2$ $\text{OOC}\text{C}_7\text{H}_{15}$	402.56
294	Furfural.....	2-furancarbalal 2-furfuraldehyde	$\text{C}_4\text{H}_3\text{O}-\text{CHO}.....$	96.08
295	Furfuryl alcohol.....	2-furancarbinol.....	$\text{C}_4\text{H}_3\text{O}-\text{CH}_2\text{OH}.....$	98.10
296	Fusel oil.....	isoamyl alcohol.....	$\text{C}_5\text{H}_{11}\text{OH}.....$	88.15
297	Glaurin.....	diethylene glycol monolaurate	$\text{C}_{11}\text{H}_{23}\text{COOC}_2\text{H}_4\text{OC}_2\text{H}_4\text{OH}.....$	288.42
298	α -d-Glucose penta- acetate	α -d-glucose pentaacetate..	$\text{C}_{16}\text{H}_{22}\text{O}_{11}.....$	390.34
299	β -d-Glucose penta- acetate	β -d-glucose pentaacetate..	$\text{C}_{16}\text{H}_{22}\text{O}_{11}.....$	390.34
300	Glucose pentabutyrate.	glucose pentabutyrate....	$\text{C}_{26}\text{H}_{42}\text{O}_{11}.....$	530.60
301	Glucose pentapalmitate	glucose pentapalmitate...	$\text{C}_{86}\text{H}_{162}\text{O}_{11}.....$	1372.17
302	Glucose penta- propionate	glucose pentapropionate..	$\text{C}_{21}\text{H}_{32}\text{O}_{11}.....$	460.47
303	Glycerin dichloro- hydrin	glycerin dichlorohydrin...	$\text{CH}_2\text{ClCHClCH}_2\text{OH}.....$	128.99
304	Glycerin- α -monochloro- hydrin	glycerin- α -monochloro- hydrin	$\text{CH}_2\text{OHCH}(\text{OH})\text{CH}_2\text{Cl}.....$	110.54
305	Glycerol dichlorhydrin	1,3-dichloro-2-propanol...	$\text{CH}_2\text{ClCHOHCH}_2\text{Cl}.....$	128.99
306	Glyceryl laurate.....	glyceryl laurate.....	$\text{CH}_2\text{OHCHOHCH}_2\text{OOC}-$ $(\text{CH}_2)_{10}\text{CH}_3$	274.39
307	" monoricin- oleate	" monoricinoleate..	$\text{CH}_2\text{OHCHOHCH}_2\text{OOC}(\text{CH}_2)_7$ $\text{CHCHCH}_2\text{CHOH}(\text{CH}_2)_5\text{CH}_3$	372.52
308	" monostearate	" monostearate....	$\text{CH}_2\text{OHCHOHCH}_2\text{OOC}\text{C}_{17}\text{H}_{35}...$	358.55

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
279	liq.....	mild.....	95-100.....	0.904-.909 ²⁰ / ₂₀
280	w. wh. liq.....	heavy, pleas. char.....	90.0+.....	.....
281	yel. liq.....	powerful.....	90-100.....	0.847-.853
282	col. liq.....	faint.....	.....	0.933-938
283	lt. yel. fine gran. powd.....	none.....	92.....	.....
284	col. gas.....	faint.....	99.....	1.260 ^{0°750mm} g/l
285	w. wh. liq.....	faint ethereal.....	98.....	1.202-1.208 ²⁰ / ₂₀
286	col. liq.....	ammoniacal.....	66 by wt.....	0.987 ²⁰ / ₂₀
287	col. liq.....	chloroform-like.....	99.....	1.255-1.257 ²⁰ / ₂₀
288	w. wh. liq.....	mild, n. res.....	.....	1.1150-1.1158 ²⁰ / ₂₀
289	w. wh. liq.....	mild, n. res.....	.....	1.1151-1.1156 ²⁰ / ₂₀
290	col liq.....	.....	.....	.....
291	col. gas; col. liq.-low temp.....	pleas., agreeable.....	.....	0.8707 ²⁰ / ₂₀
292	liq.....	mild.....	98.5-100.....	0.9947 ²⁰ / ₂₀
293	liq.....	mild.....	98.5-100.....	0.9655-.9705
294	yel-amber liq.....	almond.....	99+.....	1.161 ²⁰ / ₂₀
295	yel.-dk. amber liq.....	mild.....	>95.....	1.130 ²⁵ / ₂₅
296	w. wh. liq.....	n. res.....	.....	.811-.815 ²⁰ / ₂₀
297	lt. yel. oily liq.....	pleas.....	.....	.0960 ²⁵ / ₂₅
298	sld.....	.....	.....	.....
299	sld.....	.....	.....	.....
300	visc. oil.....	.....	.....	.....
301	waxy sld.....	.....	.....	.....
302	visc. oil.....	.....	.....	.....
303	col. liq.....	fa.chloroform-like.....	95.....	1.362 ²⁰ / ₄
304	col. liq.....	none.....	95.....	1.320 ²⁰ / ₄
305	dk. amber-colored liq.....	char. chlorohydrin-like.....	.....	1.351 ²⁵ / ₂₅
306	cream-colored semi-sld.....	v. faint.....	.....	0.98 ²⁵ / ₂₅
307	amber colored, oily liq.....	fa.....	tech.....	1.02
308	cream-colored wax-like sld.....	fa. fatty.....	tech.....	0.97 ²⁰ / ₂₀

See two following pages for additional data on above compounds.

† Theoretical.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
279	2-Ethylhexoic acid	-118.4	226.9	220-230	260
280	Ethylidene diacetate		166		
281	2-Ethyl-3-propylacrolein		175	85-185	155
282	Ethyl silicate		168.1	160-170	125
283	" sodium oxalacetate				
284	Ethylene	-169.4	-103.9		
285	" chlorhydrin, anhy- drous	-62.6	128.7	<122-none; <132- 97%	140
286	" diamine, anhy- drous	10.8	117.2	<115-none; >122- none	110
287	" dichloride	-35.5	83.5	<82.5-none; >84- none	70
288	" glycol	-12	197.2	<190-none; <202- 95%	240
289	" "	-12	197	<190-none >210- none	260
290	" " silicate				
291	" oxide	-111	10.7		<20
292	"Flexol" plasticizer, 3GH		358		385
293	" " 3GO		215 ⁵		405
294	Furfural	-37	161.7	157-167 99%	132.8
295	Furfuryl alcohol	-20	171 ⁷⁵⁰	167-177 95%	167
296	Fusel oil			<110-none; >135- none	123
297	Glaurin	17-18	>280		
298	α -D-Glucose pentaacetate	112-113			
299	β -D-Glucose pentaacetate	131-132			
300	Glucose pentabutyrate		228 ^{1.5}		
301	" pentapalmitate	ca 70			
302	" pentapropionate		205 ²		
303	Glycerin dichlorohydrin		182		200
304	" - α -monochloro- hydrin		213		280
305	Glycerol dichlorohydrin	<-20		78-5%; 104-95%	195.8
306	Glyceryl laurate	24-25			
307	" monoricinoleate	<-16			
308	" monostearate	56-57			

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
279	1.23 ²⁰ % by wt. in w.	org. syn.	cans, drums.	C. & C.
280	5.0% w.	inter. anhydride mfg., acety- lating agt., solv.	steel drums.	S.C.L.
281	0.079 ²⁰ % by wt. in w.	warning agt., insecticides.	cans, drums.	C. & C.
282	d.w.	perservative, w.-proofing agt..	cans, drums.	C. & C.
283	d.w.	mfg. dyes.	barrels.	U.S.I.
284	.....	fuel gas for welding, ripening agt., gen. anaesthesia, synth. base mat.	cylinders.	U.S.I.
285	∞ w.	chem. syn.	jugs, carboys, drums	C. & C.
286	∞ w.	neutralizing agt., corrosion inhibitor	cans, drums.	C. & C.
287	0.86 ²⁰ % by wt. in w.	solv. for oils, fats, waxes. extr. spotting agt.	cans, drums tank cars	C. & C.
288	∞ w.	prep of esters, liq. coolant.	cans, drums.	C. & C.
289	∞ w.	anti-freeze syn. resins.	tank cars, cans.	U.S.I.
290	∞ w. ....	.....	research quant.	C. & C.
291	∞ w., com. org. solv.	fumigant, org. syn.	cylinders.	C. & C.
292	0.04 ²⁰ % by wt. in w.	plasticizer, soft. agt.	cans, drums.	C. & C.
293	.....	plasticizer.	cans, drums.	C. & C.
294	∞ al., eth., 8.3 ²⁰ w.	solv., resins, org. syn.	cans, drums, tanks	Q.O.
295	∞ al., eth.; s. w.	solv., resins, wetting agt.	cars, tanks, drums	Q.O.
296	misc. com. org. solv.	lacq.	tank cars, drums, cans	U.S.I.
297	s.al., hydrocarbons; i.w.	emulsifying, lubricant, plasticizer, solvent	drums, cans.	G.
298	s. eth., acet., bz.; i.w., pet. eth., CHCl ₃	.....	.....	C.P.
299	s. eth., bz., acet., CCl ₄ , CHCl ₃ ; i.w., pet. eth	.....	.....	C.P.
300	s. ethanol, meth. al., CHCl ₃. ....	.....	.....	C.P.
301	i.w. ....	.....	.....	C.P.
302	s. CHCl ₃ , eth., al., meth. al., i.w	.....	.....	C.P.
303	13w. ....	.....	.....	S.D.
304	∞ w. ....	.....	.....	S.D.
305	∞ acet., bz., CCl ₄ , eth., meth. al., 12 w	.....	.....	D.
306	disp. w.; s. al., veg. oils; i. hydrocarbons	emulsifying, disp. agt.	drums, cans.	G.
307	disp.w.; s. al., veg. oils, hydro- carbon	emulsifying agt.	drums, cans.	G.
308	disp.h.w.; s.h.al., hydrocarbon, oils	emulsifying, thick. disp. agt.	drums, slabs.	G.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
309	Glyceryl myristate....	glyceryl myristate.....	$\text{CH}_2\text{OHCH}(\text{OH})\text{CH}_2\text{OOC}(\text{CH}_2)_{12}\text{CH}_3$	302.45
310	" palmitate....	" palmitate.....	$\text{CH}_2\text{OHCH}(\text{OH})\text{CH}_2\text{OOC}(\text{CH}_2)_{14}\text{CH}_3$	330.5
311	Glycol diacetate.....	glycol diacetate.....	$(\text{CH}_3\text{COO})_2\text{C}_2\text{H}_4$	146.14
312	Heptadecanol.....	heptadecanol.....	$\text{C}_{17}\text{H}_{35}\text{OH}$	256.46
313	Hexachlorocyclohexa-2, 5-diene-1-one	hexachlorophenol.....	$\text{Cl}_2\text{C}_6\text{Cl}_4\text{:O}$	300.80
314	<i>n</i> -Hexaldehyde.....	<i>n</i> -hexaldehyde.....	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$	100.16
315	Hexamethyl mannitol..	hexamethyl ether of man- nitol	$\text{C}_6\text{H}_5\text{O}_6(\text{CH}_3)_6$	266.33
316	Hexamethyl sorbitol..	hexamethyl ether of sor- bitol	$\text{C}_6\text{H}_5\text{O}_6(\text{CH}_3)_6$	266.33
317	<i>n</i> -Hexanol.....	<i>n</i> -hexanol.....	$\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{OH}$	102.17
318	Hydroxyacetic acid....	glycolic acid.....	OHCH_2COOH	76.05
319	<i>p</i> -Hydroxybenzaldehyde	<i>p</i> -hydroxybenzaldehyde...	$\text{OHC}_6\text{H}_4\text{CHO}$	122.12
320	<i>p</i> -Hydroxybenzoic acid	<i>p</i> -hydroxybenzoic acid....	$\text{OHC}_6\text{H}_4\text{COOH}$	138.12
321	<i>p</i> -Hydroxybenzoic acid, ethyl ester	ethyl- <i>p</i> -hydroxybenzoate..	$\text{OHC}_6\text{H}_4\text{COOC}_2\text{H}_5$	166.17
322	<i>p</i> -Hydroxybenzoic acid, methyl ester	methyl- <i>p</i> -hydroxybenzoate	$\text{OHC}_6\text{H}_4\text{COOCH}_3$	152.14
323	4-Hydroxybenzo- phenone	4-hydroxybenzophenone...	$\text{C}_6\text{H}_5\text{COC}_6\text{H}_4\text{OH}$	198.21
324	Hydroxyethyl ethylene diamine	hydroxyethyl ethylene diamine	$\text{H}_2\text{NCH}_2\text{CH}_2\text{NHCH}_2\text{CH}_2\text{OH}$	104.15
325	β -Hydroxyphenetole...	β -phenoxy ethanol.....	$\text{C}_6\text{H}_5\text{OCH}_2\text{CH}_2\text{OH}$	138.16
326	4-Hydroxypropio- phenone	4-hydroxypropiophenone...	$\text{CH}_3\text{CH}_2\text{COC}_6\text{H}_4\text{OH}$	150.17
327	Indalone.....	α,α -dimethyl- α' -carbo- butoxy-dihydro- γ -pyrone	$\text{OC}(\text{CH}_3)_2\text{CH}_2\text{C:OCH:}$ CCOOC_4H_9	226.27
328	α -Iodo asprin (acetyl- α - iodosalicylic acid)	acetyl- α -iodosalicylic acid	$\text{IC}_6\text{H}_3\text{COOHOCOCH}_3$	306.07
329	α -Iodosalicylic acid....	α -iodosalicylic acid.....	$\text{IC}_6\text{H}_3\text{COOHOH}$	264.03
330	Isobutane, Pure.....	isobutane.....	$(\text{CH}_3)_2\text{CHCH}_3$	58.12
331	Isobutyl carbinol.....	(isoamyl alcohol) (3-methyl-1-butanol)	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{OH}$	88.15
332	Isocrotyl chloride....	isocrotyl chloride.....	$\text{CH}_3\text{C}(\text{CH}_3)\text{CHCl}$	90.56
333	Isopentane, Pure.....	isopentane.....	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$	72.14
334	Isophorone.....	isophorone.....	$\text{COCH:}\text{C}(\text{CH}_3)\text{CH}_2\text{C}(\text{CH}_3)_2\text{CH}_2$	138.20
335	Isopropanol.....	isopropyl alcohol.....	$(\text{CH}_3)_2\text{CHOH}$	60.09
336	".....	".....	$\text{C}_3\text{H}_7\text{OH}$	60.09
337	Isopropyl acetate....	" acetate.....	$\text{CH}_3\text{COOCH}(\text{CH}_3)_2$	102.13

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
309	lt. colored, wax-like sld.	v. faint.	tech.	0.954 ⁴⁴
310	cream-colored, wax-likd sld.	fa. fatty	tech.	0.916 ⁸⁷
311	w. wh. liq.	none	98-100.	1.104-1.109
312	liq.	mild		0.8475 ²⁰ ₂₀
313	wh.-grayish yel cr. powd.	pung. char.		
314	col. liq.	sharp aldehyde	90-100.	0.820-0.826
315	col.-pa. yel. liq.	sl. ethereal		1.02
316	col.-pa. yel. liq.	sl. ethereal		1.02
317	col. liq.	mild		0.819-0.823 ²⁰ ₂₀
318	wh. yel. cr.	char.		
319	wh.-pk. powd.	fa. pleas.		
320	wh.-buff cr. sld.			
321	wh. cr.	none		
322	wh. cr.	none		
323	yel.-tan gran.	fa.		
324	col. hyg.	mild amm.	99-100.	1.0280-1.0330
325	col.-pa. straw-colored liq.	faint		1.106 ²⁵ ₂₅
326	tan. gran.	faint		
327	amber liq.	mild	100.	1.08 ²⁰ ₂₀
328	wh. cr.			
329	wh. powd.			
330	flammable col. gas.		99.	0.559 ²⁰ ₄
331	w. white.			0.81-0.82 ²⁰ ₂₀
332	col. liq.	char.	97.	0.919 ²⁰ ₄
333	col. liq. or gas.	sweet, non-corrosive	99.	0.619 ²⁰ ₄
334	liq.			0.9229
335	col. liq.	pleas. char.	99.	0.7863-0.7893 ²⁰ ₂₀
336	w. wh. liq.	n. res.	98 by wt.	.786-.790 ²⁰ ₂₀
337	w. wh. liq.	mild, n. res.	95.	0.866-0.871

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
309	Glyceryl myristate.....	47-48.....			
310	" palmitate.....	54-55.....			
311	Glycol diacetate.....	41.5.....	190.5.....	183-195.....	220
312	Heptadecanol.....		308.5.....		310
313	Hexachlorocyclohexa-2,5-diene-1-one	104.9-105.9..			
314	<i>n</i> -Hexaldehyde.....	-59.2.....	128.6.....	90-150.....	90
315	Hexamethyl mannitol.....	7.....	134-6 ¹⁰		
316	" sorbitol.....	0.....	134-6 ¹⁰		
317	<i>n</i> -Hexanol.....	-44.6.....	157.2.....	<153->160 none...	165
318	Hydroxyacetic acid.....	76.2-77.9.....			
319	<i>p</i> -Hydroxybenzaldehyde...	116.4-117.0..			
320	<i>p</i> -Hydroxybenzoic acid.....	213.8-215.0..			
321	<i>p</i> -Hydroxybenzoic acid, ethyl ester	114.5-115.0..			
322	<i>p</i> -Hydroxybenzoic acid, methyl ester	126-127.....			
323	4-Hydroxybenzophenone...	125.6-131.0..			
324	Hydroxyethyl ethylene diamine		243.7.....	232-250.....	275
325	β -Hydroxyphenetole.....	12.5.....		131.5-5%; 133.8-95%	244.4
326	4-Hydroxypropiofenone..	137.0-148.8..			
327	Indalone.....		113.....		315
328	α -Iodo aspirin(acetyl- α -iodosalicylic acid)	161-168.....			
329	α -Iodosalicylic acid.....	189.4-197.2..			
330	Isobutane, Pure.....	-144.....	-12.1.....		-117
331	Isobutyl carbinol.....	-117.2.....	130.5.....	123-132.....	132
332	Isocrotyl chloride.....		68.....		35
333	Isopentane, Pure.....	-159.....	28.....		-68
334	Isophorone.....	-8.1.....	215.2.....	205-220.....	205
335	Isopropanol.....	-89.5.....	82.4.....	81.6-83.1.....	70
336	" 	-89.5.....	82.3.....	<80.5-none; >82.5-none	71
337	Isopropyl acetate.....	-69.3.....	88.4.....	84.5-90.0.....	60

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
309	disp. h.w.; s.h.al., hydrocarbon, oils	emulsifying, thick.agt.....	drums, slabs....	G.
310	disp.h.w.; s.h.al., hydrocarbon, oils	emulsifying, thick.disp.agt....	drums, slabs....	G.
311	16.44 ²⁰ % by wt. in w.....	solv. inks, lacq., perfume fix.	cans, drums....	C. & C.
312	<0.01 ²⁰ % by wt. in w.....	perfume fix., plasticizer inter.	cans, drums....	C. & C.
313	s. al., ethylene dichloride, CHCl ₃ , monochlorobz.pet.- eth.; i.w.	.....	.....	D.
314	0.54 ²⁰ % by wt. in w.....	org. syn.....	cans, drums....	C. & C.
315	∞ w., org solv.....	solubilizer blending agt.....	.....	At.
316	∞ w., org solv.....	solubilizer blending agt.....	.....	At.
317	0.58 ²⁰ % by wt. in w.....	synthesize hypnotics, anti- septics and pharm.	cans, drums....	C. & C.
318	s.w., eth.; i.CCl ₄ ; g. per 100 g.: 90 al., 59 acet.	.....	.....	D.
319	g. per 100 g.: 90 meth.al., 70 acet., 18 eth., 4 bz., 1 w.; v. s. al.	.....	.....	D.
320	g. per 100 g.: 50 meth., 30 acet., 23 eth., 5 w.; i.bz., CCl ₄	.....	.....	D.
321	g. per 100 g.: 72 acet., 83 meth., 45 eth., 1 CCl ₄ , 1 bz., .1 w.	.....	.....	D.
322	g. per 100 g.: <1 bz., 50 acet., 25 eth., 59 meth.al., .2 w.	.....	.....	D.
323	g. per 100 g.: 25 acet., 8 eth., 1 meth.al., i. w., bz., CCl ₄	.....	.....	D.
324	∞ w.....	org. syn.....	cans, drums....	C. & C.
325	∞ meth.al., isopropyl eth., CCl ₄ , bz., acet.; g. per 100 g.: 2 w.	.....	.....	D.
326	g. per 100 g.: meth.al., 8 acet., 4 eth.; i. w., CCl ₄ , bz.	.....	.....	D.
327	misc.com.org. solv.....	light screen, insect repellent, solv.	drums, cans....	U.S.I.
328	sl.s. eth.; al.; i. w., CCl ₄ , bz.	.....	.....	D.
329	g. per 100 g.: 72 eth., 6 al.; i. w., CCl ₄ , bz.	.....	.....	D.
330	.....	reagent; refrigerant.....	cylinders.....	P.P.
331	s.meth.al., ethyl eth., acet., bz., gasoline, ethyl acetate; sl. s.w.	photo. chem. syn. pharm.....	cans, drums....	Sh.
332	<0.1w.....	.....	.....	S.D.
333	imm. w.....	blending agt; research.....	cans, drums....	P.P.
334	1.2% by wt. in w.....	solv. "vinylite"* resins, lacq.	drums.....	C. & C.
335	∞ w.....	solv. gums, alkaloids, oils; germicide	cans, drums....	C. & C.
336	∞ ²⁵ w.....	solv. cosmetics, gums, alka- loids, oils, derivative base	tank cars, drums, cans	U.S.I.
337	2.91 ²⁰ % by wt. in w.....	solv.....	cans, drums....	C. & C.

* Trade mark.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
338	Isopropyl acetate	isopropyl acetate	$\text{CH}_3\text{COOCH}(\text{CH}_3)_2$	102.13
339	“ “	“ “	$(\text{CH}_3)_2\text{CHCOOCH}_3$	102.13
340	“ “	“ “	$\text{CH}_3\text{COOCH}(\text{CH}_3)_2$	102.13
341	“ alcohol	isopropanol	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$	60.09
342	“ benzene	isopropyl benzene	$\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)_2$	120.19
343	“ ether	“ ether	$(\text{CH}_3)_2\text{CHOCH}(\text{CH}_3)_2$	102.17
344	“ “	“ “	$(\text{CH}_3)_2\text{CHOCH}(\text{CH}_3)_2$	102.17
345	Malonic acid	malonic acid	$\text{CH}_2(\text{COOH})_2$	104.06
346	Mannitol	<i>d</i> -mannitol	$\text{C}_6\text{H}_8(\text{OH})_6$	182.17
347	“ hexaacetate . .	mannitol hexaacetate	$\text{C}_6\text{H}_8\text{O}_6(\text{CH}_3\text{CO})_6$	434.39
348	“ monoborate . .	“ monoborate	$\text{C}_6\text{H}_{10}\text{O}_8\text{B}$	226.00
349	Melaniline octadecanoate	melaniline octadecanoate	$(\text{C}_6\text{H}_5\text{NH})_2\text{CNHC}_{17}\text{H}_{35}\text{COOH}$	495.7
350	Mesityl oxide	mesityl oxide	$(\text{CH}_3)_2\text{C}:\text{CHCOCH}_3$	98.14
351	“ “	4-methyl-3-pentenone-2	$\text{CH}_3\text{COCHC}(\text{CH}_3)_2$	98.14
352	“ “	mesityl oxide	$(\text{CH}_3)_2\text{CCHCOCH}_3$	98.14
353	Methallyl alcohol	isobutenol	$\text{CH}_2\text{C}(\text{CH}_3)\text{CH}_2\text{OH}$	72.10
354	“ chloride	isobutenyl chloride	$\text{CH}_2\text{C}(\text{CH}_3)\text{CH}_2\text{Cl}$	90.56
355	Methane, Pure	methane	CH_4	16.04
356	Methanol	methyl alcohol	CH_3OH	32.04
357	“	“ “	CH_3OH	32.04
358	“	“ “	CH_3OH	32.04
359	Methyl acetate	“ acetate	$\text{CH}_3\text{COOCH}_3$	74.08
360	“ “ , C.P	“ “	$\text{CH}_3\text{COOCH}_3$	74.08
361	“ “ , tech	“ “	$\text{CH}_3\text{COOCH}_3$	74.08
362	“ acetoacetate . . .	“ acetoacetate	$\text{CH}_3\text{COCH}_2\text{COOCH}_3$	116.11
363	“ acetone	“ acetone	$\text{CH}_3\text{COCH}_2\text{CH}_3$	74.08
364	“ amyl acetate . .	“ isobutyl carbinol acetate	$\text{CH}_3\text{COOCH}(\text{CH}_3)\text{-}$ $\text{CH}_2\text{CH}(\text{CH}_3)_2$	144.21

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
338	col. liq.	none.	95 by wt.	0.866-0.871 $\frac{20}{20}$
339	liq.	char.	85-88.	0.8608-0.8648 $\frac{20}{20}$
340	w. wh. liq.	mild, n. res.	85-88. ....	.860-.870 $\frac{20}{20}$
341	w. wh. liq.	pleas. sl. bitter taste.	99.	0.785-0.787 $\frac{20}{20}$
342	col. liq.	aromatic. ....	.....	0.862
343	col. liq.	ethereal.	99.	0.722-0.726 $\frac{20}{20}$
344	w. wh. liq.	pung. ethereal.	ca. 99.	0.7238 $\frac{20}{4}$
345	wh. cr. ....	.....	.....	.....
346	col. cr. powd.	none; fa. sweet taste.	100.	1.5115-20
347	wh. cr.	none; bitter taste. ....	.....	.....
348	col. cr. powd.	none, sharp taste. ....	.....	.....
349	amber balsam.	fa. fatty. ....	.....	.....
350	col. liq.	mild.	86.	0.852-0.853
351	straw yel. liq.	peppermint.	95 by wt.	0.8546 $\frac{20}{4}$
352	straw colored liq.	mild, ethereal. ....	.....	0.853-0.863 $\frac{20}{20}$
353	col. liq., poisonous.	char.	98.	0.852-0.856 $\frac{20}{20}$
354	col.-straw liq.	char.	95.	0.926-0.929 $\frac{20}{20}$
355	col. gas.	char. pleas.	99.	0.5540 $\frac{76m}{20}$
356	col. liq. ....	.....	99.85.	0.7929 $\frac{20}{20}$
357	w. wh. liq.	no foreign odor.	99.8-100. ....	.792-.793 $\frac{20}{20}$
358	w. wh. liq.	no foreign odor.	99.8 by wt. ....	.7962 $\frac{15}{4}$
359	col. liq.	ester.	99.	0.930-0.940
360	w. wh. mobile liq.	fragrant ester.	97. ....	.930-.940 $\frac{20}{20}$
361	w. wh. mobile liq.	fragrant ester.	82-85. ....	.904-.914 $\frac{20}{20}$
362	col. liq. ....	.....	95-100.	1.074-1.079 $\frac{20}{20}$
363	w. wh. liq.	n. res. ....	.....	.83-.88 $\frac{20}{20}$
364	w. wh. liq.	mild, agreeable.	95.	0.855-0.860 $\frac{20}{20}$

See two following pages for additional data on above compounds

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
338	Isopropyl acetate.....	-73.4.....	88.6.....	<84.5-none; >90-none	54
339	“ “.....	-73.4.....		<81.5-none; 91.5-95%; >95-none	36
340	“ “.....	-73.4.....	89.0.....	<81-none; 91-90% >95-none	59
341	“ alcohol.....	-89.5.....	82.3.....	<81-none; >83-none	56
342	“ benzene.....		152.5.....		130
343	“ ether.....	-86.5.....	68.4.....	<63-none; >69-none	15
344	“ “.....	-86.8.....	68.4 ⁷⁶⁰	<66-none; >70-none	16
345	Malonic acid.....	131.2-136.8.....			
346	Mannitol.....	167.....			
347	“ hexaacetate.....	121-124.....			
348	“ monoborate.....	78-80.....			
349	Melaniline octadecanoate.....				
350	Mesityl oxide.....	-46.4.....	128.0.....	123-132.....	90
351	“ “.....	-59.....	129.5.....	<120-none; >135-none	83
352	“ “.....	-59.....	128.7.....	110-40%; 126-131-60%	78
353	Methallyl alcohol.....		115.....	<109-none; >116-none	92
354	“ chloride.....		72.2.....	<69-none; >77-none	14
355	Methane, Pure.....	182.6.....	161.4.....		
356	Methanol.....	-95.8.....	64.5.....	64.5-65.0.....	60
357	Methanol.....	-97.8.....	64.5.....	<64-none; >66-none	60
358	“.....	-97.8.....	64.5.....	<64-none; >65-95%; 66-none	52 (approx.)
359	Methyl acetate.....	-98.9.....	57.1.....	55-none; 58-none.....	25
360	“ “, C.P.....	-98.1.....	57.1.....	55-58.....	-16
361	“ acetate, tech.....	-98.1.....	57.1.....	52-58.....	-16
362	“ acetoacetate.....	-31.9.....	171.7.....	<91-10%; 90-95-85%	170
363	“ acetone.....				
364	“ amyl acetate.....	-55.8.....	146.3.....	<140-none; >150-none	110

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
338		solv.	tank cars, drums	S.C.
339	3.2 ²⁵ w.	lacq. solv.	tank cars, drums, tank wagons, cans	St.
340	4.0 ²⁵ w.	nitrocellu. solv.	tank cars, drums, cans	U.S.I.
341	∞ ²⁵ w.	solv., thinner lacq.; germicide, preservative, dehydrating agt., mfg. pectin; antifreeze; rub. al.	tank cars, drums	S.C.
342	i.w.	chem. syn.	research quant.	C. & C.
343	1 22 ²⁰ % by wt. in w.	dewaxing agt., solv.	cans, drums, tank cars	C. & C.
344	.72 ²⁰ w.	solv. oils, waxes, ethylcellu.; extr., delusterizing agt. for art. silk	tank cars, drums	S.C.
345	v.s.w.; s. acet., g. per 100 g.: 42 al., 8 eth.; i.bz., CCl ₄			D.
346	s.w.	fermentation industries, re- sins, pharm., form. deriva- tives	cans, barrels...	At.
347	s.al., amines, chlorinated solv., eth., ketones; sl. s. other org. solv.; i.w.	lacq. hardener, plasticizer...		At.
348	s.w.; sl.s. ketones, polyhydric al., i. other org. solv.	electrolytic condensers; syn. of mannitol		At.
349	s.h.al., acet., ethyl acetate, naphtha, c. toluene; i.w.			G.
350	2.78 ²⁰ % by wt. in w.	inter. org. syn.	cans, drums...	C. & C.
351	3.1 ²⁰ by wt. in w; w. in comp. 3.1 ²⁰ by wt.	solv. thinners, lacq. nitro., gums, resins	tank cars, drums	S.C.
352	3.4% by vol. in w.	industrial solv., chem. syn., rust remover	drums...	C.S.
353	15 w.	mfg. synth. chem., plastics...	drums, tins...	S.C.
354	<0.1	fumigant; synthesis...	drums, tins...	S.C.
355	imm. w.	research	cylinders	P.P.
356	∞ w., eth.al., org. comp.	org. syn., antifreeze	cans, drums, tanks	C. & C.
357	∞ w., org. solv.	solv. antifreeze, synth. per- fume, resins, flavors, pharm., refrig.	tank cars, drums	C.S.
358	∞ ²⁵ w.	solv. embalming fluid, org. deriv. base	tank cars, drums, cans	U.S.I.
359	24.2 ²⁰ % by wt. in w.	solv. cellu. nitrate, acetate, form. lacq., varnishes, plastics, perfumes	cans, drums, tanks	C. & C.
360	31.9 ²⁰ w., al., eth., com. hydro- carbon solv.	lacq. solv., thinner; org. syn., extr. fats, oils	drums...	N.
361	31.9 ²⁰ w. al., eth., com. hydro- carbon solv.	lacq. solv., thinner; org. syn. extr. fats	drums...	N.
362	44.5 ²⁰ % by wt. in w.	org. syn.	cans, drums...	C. & C.
363	misc. com. org. solv.	solvent	tank cars, drums cans	U.S.I.
364	0.13 ²⁰ % by wt. in w.	h.boil. solv.	cans, drums, cars	C. & C.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
365	Methyl amyl alcohol..	4-methyl pentanol-2.....	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{OH})\text{CH}_3$	102.17
366	" " carbinol	methyl amyl carbinol.....	$\text{CH}_3(\text{CH}_2)_4\text{CHOHCH}_3$	116.20
367	" <i>n</i> -amyl ketone	" <i>n</i> -amyl ketone....	$\text{CH}_3\text{CO}(\text{CH}_2)_4\text{CH}_3$	114.18
368	<i>N</i> -Methylaniline.....	<i>N</i> -methylaniline.....	$\text{C}_6\text{H}_5\text{NHCH}_3$	107.15
369	Methyl "Carbitol"*...	diethylene glycol mono- methyl ether.....	$\text{CH}_3\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH}$	120.15
370	" " acetate	.....	$\text{CH}_3\text{COOC}_2\text{H}_4\text{OC}_2\text{H}_4\text{OCH}_3$	162.18
371	" " Cellosolve"*.	ethylene glycol monomethyl ether.....	$\text{CH}_3\text{OCH}_2\text{CH}_2\text{OH}$	76.09
372	" " Cellosolve"*	ethylene glycol mono- methyl ether acetate	$\text{CH}_3\text{COOCH}_2\text{CH}_2\text{OCH}_3$	118.13
373	" chloride.....	methyl chloride.....	CH_3Cl	50.49
374	" chloroform....	1,1,1-trichloroethane.....	CH_3CCl_3	133.42
375	" dioxolane.....	methyl dioxolane.....	$\text{OCH}_2\text{CH}_2\text{OCH}(\text{CH}_3)$	88.10
376	" ethyl ketone...	" ethyl ketone.....	$\text{CH}_3\text{COCH}_2\text{CH}_3$	72.10
377	" " " " ..	" " " " ..	$\text{CH}_3\text{COC}_2\text{H}_5$	72.10
378	" formate.....	" formate.....	HCOOCH_3	60.05
379	α -Methyl- <i>d</i> -glucoside..	α -methyl- <i>d</i> -glucoside.....	$\text{C}_7\text{H}_{14}\text{O}_6$	194.18
380	Methyl-3-hydroxy- butyrate	methyl-3-hydroxybutyrate	$\text{CH}_3\text{CHOHCH}_2\text{COOCH}_3$	118.13
381	4-Methyl-2-hydroxy quinoline	4-methyl-2-hydroxy quinoline.....	$\text{C}_8\text{H}_4\text{N}:\text{C}(\text{OH})\text{CH}:\text{C}(\text{CH}_3)$	160.19
382	Methyl isobutyl ketone	hexone.....	$(\text{CH}_3)_2\text{CHCH}_2\text{COCH}_3$	100.16
383	" " "	4-methylpentanone-2.....	$(\text{CH}_3)_2\text{CHCH}_2\text{COCH}_3$	100.16
384	" lactate.....	methyl lactate.....	$\text{C}_3\text{H}_5\text{O}_3\text{CH}_3$	104.10
385	" phthalate.....	dimethyl phthalate.....	$\text{C}_6\text{H}_4(\text{CO}_2\text{CH}_3)_2$	194.18
386	1-Methyl-1-phenyl- ethylene	α -methyl sterene.....	$\text{C}_6\text{H}_5\text{CCH}_2\text{CH}_3$	118.17
387	α -Methyl tetraacetyl- <i>d</i> -glucoside	α -methyl tetraacetyl- <i>d</i> -glucoside.....	$\text{C}_{15}\text{H}_{22}\text{O}_{10}$	362.33
388	Methyl tetramethyl glucoside	methyl tetramethyl glucoside.....	$\text{C}_{11}\text{H}_{22}\text{O}_6$	250.29
389	Monoacetone glucose..	monoacetone glucose.....	$\text{C}_9\text{H}_{16}\text{O}_6$	220.22
390	Monochlorobenzene...	monochlorobenzene.....	$\text{C}_6\text{H}_5\text{Cl}$	112.56
391	Monoethanolamine.....	2-hydroxyethyl amine....	$\text{HOCH}_2\text{CH}_2\text{NH}_2$	61.08
392	Monoethylamine.....	ethylamine.....	$\text{C}_2\text{H}_5\text{NH}_2$	45.08
393	Monoisopropanolamine	monoisopropanolamine....	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{NH}_2$	75.11

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
365	w. wh. liq.	mild.	99.	0.806-.811 $\frac{20}{20}$
366	col. liq.	mild.		0.816-.821
367	w. wh. liq.	agreeable.	95-100.	0.816-0.821 $\frac{20}{20}$
368	straw colored liq.	char. amine-like. ....		.985 $\frac{25}{25}$
369	col. liq.	mild, n.res.		1.030-1.040 $\frac{20}{20}$
370	col. liq.	mild.	99.	1.0396
371	w. wh. liq.	mild, n. res.	-89.5.	0.961-0.966 $\frac{20}{20}$
372	col. liq.	pleas. ester.	95-100.	1.003-1.008
373	col. gas under press.-w. wh. liq.	ethereal, fa. sweet.	99.87.	0.909 $\frac{26.7}{20}$
374	cl. col. liq.	mild, chloroform-like.		1.332 $\frac{25}{25}$
375	col. liq.			0.982
376	col. liq.	typical ketone, less pung. than acet.	99.	0.8047 $\frac{20}{20}$
377	liq.	char.	98.	0.8037-0.8067 $\frac{20}{20}$
378	w. wh. col. liq.	pleas. ethereal.	95-100 by wt. ....	.95-.98 $\frac{20}{20}$
379	sld.			
380	col. liq.			1.0559
381	sld.			
382	w. wh. liq.	none.	95.	0.799-0.804 $\frac{20}{20}$
383	w. wh. liq.		99 by wt.	0.8004 $\frac{20}{4}$
384	w. wh. liq.	mild, n. res.	95 by wt.	1.087-1.097
385	w. wh. liq.	none.	99-100.	1.192-1.194 $\frac{20}{20}$
386	col. liq.	styrene-like. ....		.908 $\frac{25}{25}$
387	sld.			
388	visc. oil.			
389	sld.			
390	cl. col. liq.	aromatic.	tech.	1.107 $\frac{20}{4}$
391	w. wh. liq.	distinct amm.	97-100.	1.017-1.027 $\frac{20}{20}$
392	w. wh.		100.	0.79-0.80 $\frac{20}{20}$
393	liq.	sl. amm.		0.981

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
365	Methyl amyl alcohol.....		131.8.....	<125-none; >135-none	130
366	“ “ carbinol.....		160.4.....	147-154.....	160
367	“ n-amyl ketone.....	-26.9.....	150.6.....	<147-none; <149-5%; <152-95%	120
368	N-Methylaniline.....	-20.....		194.9-5%; 195.7-95%	185
369	Methyl “Carbitol*.....		193.2.....	<185-none; >195-none	200
370	“ “ acetate..		209.1.....	203-212.....	180
371	“ “ Cellosolve”*. . .	-89.5.....	125.0.....	<122-none; >126-none	115
372	“ “ acetate.....	-65.1.....	144.5.....	<132-none; >152-none	140
373	“ chloride.....	-97.7.....	-24.22.....	-23.7-24.7.....	632
374	“ chloroform.....			74-5%; 74.8-95%...	none
375	“ dioxolane.....		81-82.....		
376	“ ethyl ketone.....	-86.4.....	79.6.....	<79-none; >80.5-none	34
377	“ “ “.....	-86.4.....		78-5%; 82-85%; 84-none	24
378	“ formate.....	-99.8.....	31.8.....	<31.5-none; >35.0-none	-25.6
379	α-Methyl-d-glucoside. . .	165-166.....			
380	Methyl-3-hydroxybutyrate		174.9.....		180
381	4-Methyl-2-hydroxy quinoline	222.....			
382	Methyl isobutyl ketone. . .	-77.2.....	116.0.....	<111-none; >117-none	75
383	“ “ “.....	-83.5.....	115.9.....	<114-none; >117-none	81
384	“ lactate.....	-66.....	144.8.....	<115-none; 141-145-60% >155-none	142
385	“ phthalate.....		282.....	<186-none >194-none	310
386	1-Methyl-1-phenylethylene	<-20.....		164.9-5% 166.2-95%	129.2
387	α-Methyl tetraacetyl-d-glucoside	100-101.....			
388	Methyl tetramethyl glucoside	145-150 ⁵			
389	Monoacetone glucose.....	157-158.....			
390	Monochlorobenzene.....	-45.....	130.6.....	130.6-131.8.....	87.8.....
391	Monoethanolamine.....	9.9.....	170.5.....	165-173, 90%.....	200
392	Monoethylamine.....	-80.6.....			<0
393	Monoisopropanolamine.....		45 ⁵		

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
365	1.55 ²⁰ % by wt. in w.....	lacq.form., prep.esters.....	cans, drums...	C. & C.
366	0.35 ²⁰ % by wt. in w.....	plasticizer, xanthates, drugs, pharm., wetting agt.	drums.....	C. & C.
367	0.43 ²⁰ % by wt. in w.....	solv.rubber, nitrocellu., syn. resins	cans, drums...	C. & C.
368	.01 w., meth.al., eth., CCl ₄ , bz., acet			D.
369	∞ w.; misc.most org. solv....	solv.dyes, org.syn.....	cans, drums...	C. & C.
370	∞ w.....	lacq.solv.....	research quant..	C. & C.
371	∞ w.....	rapid drying, varnishes, enamels; dyeing leather	cans, drums...	C. & C.
372	∞ w.; misc. com.org.solv.....	solv. cellu.acetate.....	cans, drums...	C. & C.
373	303 ³⁻²⁰ w.....	refrigerant.....	steel cylinders...	An.
374	acet., al., bz., CCl ₄ , eth.; i.w....			D.
375	59.0 ²⁰ % by wt. in w.....	solv.cellu.esters.....	research quant..	C. & C.
376	misc. nitro.lacq.solv.; imm.w....	solv., dewaxing lubr. oil, plastics; art.leather, airplane dopes; synth.rubber	tank cars.....	S.C.
377	23.4 ²⁵ w.....	lacq., dewaxing, solv., art leather airplane dopes; print- ing; solv. synth.rubber	tank cars, tank wagons, drums, cans	St.
378	28.95w.....	fumigants, larvacide.....	drums, cans...	C.S.
379	s.meth.al., ethanol, w.; i.eth. acet.			C.P.
380	∞ w.....	chem.inter.....	research quant..	C. & C.
381		chem.syn.....	research quant..	C. & C.
382	1.98 ²⁰ w., misc. most org.solv...	lacq.solv.extr.....	cans, drums...	C. & C.
383		solv.cellu.acetate, natural & synth. resins, gums, waxes		S.C.
384	v.s. w., most org.liq.....	solv.cellu.acetate.....	cans.....	C.S.
385	misc.com.org.solv.; imm.gas...	plasticizer.....	tank cars, drums, cans	U.S.I.
386	∞ acet., bz., CCl ₄ , eth., meth.al.; i.w.			D.
387	s.CHCl ₃ , acet., eth., CCl ₄ , et. acet.			C.P.
388	5 w.; s.CHCl ₃ ; sl.s. eth., pet. eth.			C.P.
389	s.w., ethanol, meth. al.....			C.P.
390	s. al., eth.; i.w.....	mfg. sulfur dyes, poison gases, phenol, aniline	tank cars.....	S.P.
391	∞ w.....	extr. CO ₂	cans, drums...	C. & C.
392	s.w.; meth. al., ethyl eth., acet., bz., gasoline, ethyl acetate	mfg. dyestuff inter.....	cans, drums...	Sh.
393	∞ w.....	prep. soaps with fatty acids..	research quant..	C. & C.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
394	Monomethylamine.....	monomethylamine.....	CH_3NH_2	31.06
395	Mono- <i>n</i> -Butylamine....	1-amino butane.....	$\text{C}_4\text{H}_9\text{NH}_2$	73.14
396	Morpholine.....	morpholine.....	$\text{O}:(\text{CH}_2\text{CH}_2)_2:\text{NH}$	87.12
397	“ ethanol.....	“ ethanol.....	$\text{CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{NCH}_2\text{CH}_2\text{OH}$	131.17
398	“ ethanol.....	“ “.....	$\text{CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{NC}_2\text{H}_4\text{OC}_2\text{H}_5$	159.23
399	ethyl ether 1-Naphthyl acetic acid	ethyl ether α -naphthalene acetic acid	$\text{C}_{12}\text{H}_{10}\text{O}_2$	186.20
400	Neohexane, Pure.....	2, 2 dimethyl butane.....	$(\text{CH}_3)_3\text{CCH}_2\text{CH}_3$	86.17
401	<i>meta</i> -Nitro acet- <i>para</i> - toluide	<i>meta</i> -nitro acet- <i>para</i> - toluide	$\text{CH}_3\text{CONHC}_6\text{H}_3\text{NO}_2\text{CH}_3$	194.19
402	<i>meta</i> -Nitro <i>para</i> - toluidine	3-nitro-4-amino toluene....	$\text{C}_6\text{H}_5\text{CH}_3\text{NH}_2\text{NO}_2$	152.15
403	Nonaethylene glycol hexaricinoleate	nonaethylene glycol hexa- ricinoleate	$\text{C}_{126}\text{H}_{230}\text{O}_{22}$	2096.7
404	Nonaethylene glycol monostearate.....	nonaethylene glycol monostearate	$\text{HOCH}_2\text{CH}_2(\text{OCH}_2\text{CH}_2)_8\text{OC}_{17}\text{H}_{35}\text{CO}$	680.5
405	Octaldehyde.....	2-ethylhexanal.....	$\text{C}_4\text{H}_9\text{CH}(\text{C}_2\text{H}_5)\text{CHO}$	128.21
406	Octyl acetate.....	octyl acetate.....	$\text{CH}_3\text{COOCH}_2\text{CH}(\text{C}_2\text{H}_5)\text{C}_4\text{H}_9$	172.26
407	“ amine.....	“ amine.....	$\text{CH}_3(\text{CH}_2)_3\text{CH}(\text{C}_2\text{H}_5)\text{CH}_2\text{NH}_2$..	129.24
408	Paraldehyde, U.S.P.XI Grade	paraldehyde.....	$(\text{CH}_3\text{CHO})_3$	132.16
409	“ tech.....	“	$(\text{CH}_3\text{CHO})_3$	132.16
410	Pentachloroethane....	pentachloroethane.....	$\text{CHCl}_2\text{CCl}_3$	202.31
411	Pentachlorophenol....	pentachlorophenol.....	$\text{Cl}_5\text{C}_6\text{OH}$	266.35
412	Pentaerythritol.....	pentaerythritol.....	$\text{C}(\text{CH}_2\text{OH})_4$	136.15
413	Pentaerythritol tetra- acetate	pentaerythritol tetra- acetate	$\text{C}(\text{CH}_2\text{OOCH}_3)_4$	304.29
414	<i>n</i> -Pentane, Pure.....	<i>n</i> -pentane.....	$\text{CH}_3(\text{CH}_2)_3\text{CH}_3$	72.09
415	Pentaphen.....	<i>p</i> -tert-amyl phenol.....	$\text{C}_3\text{H}_{11}\text{C}_6\text{H}_4\text{OH}$	164.24
416	Perchlorobenzene.....	hexachlorobenzene.....	C_6Cl_6	284.80
417	Petrohol 91%.....	propanol-2.....	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$	60.09
418	Petrohol 99%.....	propanol-2.....	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$	60.09
419	Phenetole.....	phenetole.....	$\text{C}_6\text{H}_5\text{OC}_2\text{H}_5$	122.16
420	Phenoxyacetic acid....	phenoxyacetic acid.....	$\text{C}_6\text{H}_5\text{OCH}_2\text{COOH}$	152.14
421	β -Phenoxy phenetole..	1,2,diphenoxy ethane.....	$\text{C}_6\text{H}_5\text{OCH}_2\text{CH}_2\text{OC}_6\text{H}_5$	214.25

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
394	flam. gas.....	strongly amm.....	98.....	$.699\frac{-10.8}{15}$
395	w. wh.....	amm.....		$0.74-0.76\frac{20}{20}$
396	col. liq.....	sharp, amm.....	98-100.....	0.999-1.004
397	liq.....			1.0724
398	liq.....			0.9648
399	w. cr.....	none.....		
400	flammable paraffin.....		99.....	$0.649\frac{20}{4}$
401	yel. cr.....			
402	orange-red monoc. cr.....	typical nitro-comp.....	ca 98.....	1.312
403	amber liq.....	fa. fatty.....		$0.960\frac{25}{25}$
404	cream-colored soft sld.....	fa. fatty.....		$1.005\frac{30}{30}$
405	col. liq.....	mild char.....		0.8196
406	col. liq.....	ester.....	99.....	$0.870-0.875\frac{20}{20}$
407	liq.....	sl. amm.....		0.792
408	w. wh. liq.....	pleas.....	99.....	$.904\frac{20}{20}$
409	w. wh. liq.....	pleas.....	98.....	$.993\frac{20}{20}$
410	col. liq.....	mild pleas.....		$1.670\frac{25}{25}$
411	wh. cr.....	phenolic.....		
412	wh. cr. powd.....	none.....		$1.35\frac{25}{4}$
413	wh. cr. powd.....	none.....	99.....	
414	flammable col. liq. or gas.....	sweet, non-corrosive.....	99.....	$0.626\frac{20}{4}$
415	yel. liq.....			$0.92-0.93\frac{25}{25}$
416	wh.-pa. yel need.....			
417	liq.....	char.....	90.9.....	$.818-.8192\frac{20}{20}$
418	liq.....	char.....	99.....	$0.786-.7937\frac{20}{20}$
419	col. refractive liq.....	pleas. char.....		$.964\frac{25}{25}$
420	lt. tan cr.....	none.....		
421	wh. cr.....	pleas.....		

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
394	Monomethylamine.....	-92.5.....	-6.0 to -5.5 ⁷⁶⁸	.....	32.5
395	Mono- <i>n</i> -Butylamine.....	-50.5.....	77.8.....	not <73.0; not >86.0	<40
396	Morpholine.....	-3.1.....	128.9.....	120-132.....	100
397	Morpholine ethanol.....	.....	225.5.....	.....	210
398	Morpholine ethanol ethyl ether.....	.....	206.2.....	.....	.....
399	1-Naphthyl acetic acid.....	132.4-135.3..	.....	.....	.....
400	Neohexane, Pure.....	-98.....	49.5.....	.....	-54
401	<i>meta</i> -Nitro acet- <i>para</i> -toluide.....	82-84.....	.....	.....	.....
402	<i>meta</i> -Nitro- <i>para</i> -toluidine..	114-115.....	.....	.....	.....
403	Nonaethylene glycol hexaricinoleate.....	.....	.....	.....	.....
404	Nonaethylene glycol mono-stearate.....	25-30.....	.....	.....	.....
405	Octaldehyde.....	.....	164.1.....	150-165.....	125
406	Octyl acetate.....	.....	198.6.....	<192-none; >202-none	190
407	" amine.....	.....	167-168.....	.....	.....
408	Paraldehyde, U.S.P. XI. Grade.....	11 min.....	124.5.....	120-125.....	111.2
409	Paraldehyde, tech.....	10 (approx.)..	124.5.....	100-127.....	111.2
410	Pentachloroethane.....	<-20.....	.....	159-5%; 161.4-95%	none
411	Pentachlorophenol.....	187.1-189.1..	.....	.....	.....
412	Pentaerythritol.....	257.....	276 ³⁰.....	.....	.....
413	Pentaerythritol tetra acetate.....	80-81.....	225 ³⁰.....	.....	.....
414	<i>n</i> -Pentane, Pure.....	130.....	36.0.....	.....	-59
415	Pentaphen.....	not <91.....	.....	.....	232
416	Perochlorobenzene.....	229.9-230.6..	.....	.....	.....
417	Petrohol 91%.....	-85.8.....	.....	79.5-80.7.....	63
418	" 99%.....	-85.8.....	.....	80.5-82.5.....	59
419	Phenetole.....	<-20.....	.....	73-5%; 74.8-95%...	145.4
420	Phenoxyacetic acid.....	99.9-101.5..	.....	.....	.....
421	β Phenoxy phenetol.....	95.9-98.0....	.....	.....	.....

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
394	v.s.w., al; s. eth.	tanning, dyestuffs.	drums, bottles.	C.S.
395	s.w., bz., acet., methyl al., gaso- line, ethyl acetate, ethyl eth.	raw mat. mfg pharm., dye- stuffs, rubber chem., emulsi- fying agt., desizing agt.	cans, drums.	Sh.
396	∞ w.	corrosion inhibitor, solv. dyes, resins, waxes, shellacs	cans, drums.	C. & C.
397	∞ w.	syn. drugs, rubber accel.	research quant.	C. & C.
398	∞ w.	syn. drugs, rubber accel.	research quant.	C. & C.
399	g. per 100 g.: 83 meth. al., 22 eth., 1 CCl ₄ , 7 bz., 71 acet., .04 w.			D.
400	imm. w.	research.	cans, drums.	P.P.
401	s. al., meth. al., eth.; sl.s.w.	dye inter.	drums.	Pa.
402	s.al., con. H ₂ SO ₄ ; v.sl.s. h.w.	hansa yellows, toluidine toners.	barrels.	Pa.
403	disp. w., s. org. solv.; i.al.	lubricant, water-oil emulsifier, hydraulic fluids	drums.	G.
404	disp. w., s.al., acet., ethyl ace- tate, toluene, h.naphtha	soapless emulsifier, thickener.	drums.	G.
405	0.07 ²⁰ w.	blend. perfumes.	drums.	C. & C.
406	∞ w.	solv. nitro. & resins.	cans, drums.	C. & C.
407		chem. syn.	drums.	C. & C.
408	11.7 ²⁰ w, ∞ com. solv.	soporific.	drums, tank cars	N.
409	11.7 ²⁰ w.	mfg. resins, plastics; tanning leather; sacq. solv., plasti- cizer	drums, tank cars	N.
410	∞ meth. al., eth., CCl ₄ , bz., acet.; i.w.			D.
411	g. per 100 g.: 53 acet., 11 bz., 4 CCl ₄ , 148 eth., 57 meth. al., .002 w.			D.
412	5.56 ²⁵ w.; v.sl.s.al.; i.eth.	prep. alkyd resins; org. syn.	cartons, drums barrels	N.
413	v.s.al.; s. eth.; v.sl.s.w.	plasticizer cellu. acetate, ni- trate lacq., plastics	cartons, drums.	N.
414	imm. w.	lab. reagent.	cans, drums.	P.P.
415	s. 10% KOH, oil, al., eth., bz., chloroform, acet.; i.w.	germicide, fumigant, pharm.	cans, bottles, barrels	Sh.
416	v.s.eth.; s. CCl ₄ ; sl.s.bz.; i.w., al.			D.
417	∞ ²⁵ w.	solv., antiseptics, cosmetics.	tank cars, drums, tank wagons, cans	St.
418	∞ ²⁵ w.	solv. antiseptics, cosmetics.	tank cars, drums, tank wagons, cans	St.
419	∞ bz., acet., CCl ₄ , eth., meth. al.; i.w			D.
420	v.s.al.; g. per 100 g.: 29 eth., 3 bz., 1 w.; i.CCl ₄			D.
421	g. per 100 g.: 23 acet., 27 bz., 7 CCl ₄ , 9 eth., 2 meth. al.; i.w.			D.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
422	Phenyl "Ceilosolve"*		$C_6H_5OC_2H_4OH$	138.16
423	" diethanolamine	phenyl diethanolamine...	$C_6H_5N(CH_2CH_2OH)_2$	181.23
424	<i>o</i> -Phenyl diphenyl ether	" xenyl ether.....	$C_6H_5OC_6H_4C_6H_5$	246.29
425	Phenyl ethane.....	ethyl benzene.....	$C_6H_5C_2H_5$	106.16
426	" ethanolamine..	phenyl ethanolamine.....	$C_6H_5NHCH_2CH_2OH$	137.18
427	" methyl pyrazolone	" methyl pyrazolone	$C_6H_5N.N:N:C(CH_3)CH_2CO$	174.20
428	Phenyl morpholine....	" morpholine.....	$C_6H_5NCH_2CH_2OCH_2CH_2$	163.21
429	Phorone.....	phorone.....	$(CH_3)_2C:CHCOCH:C(CH_3)_2$	138.2
430	Phosphen 1.....	diphenyl mono-(<i>p</i> -tert butyl phenyl) phosphate	$(CH_3)_3CC_6H_4OP(OC_6H_5)_2O$	382.39
431	" 2.....	di-(<i>p</i> -tert-butylphenyl) monophenyl phosphate	$C_{26}H_{31}O_4P$	438.49
432	" 3.....	diphenyl mono(<i>o</i> -chloro- phenyl) phosphate	$C_{18}H_{14}O_4ClP$	360.73
433	" 4.....	di(<i>o</i> -chlorophenyl)mono- phenyl phosphate	$C_{18}H_{13}O_4Cl_2P$	395.18
434	" 5.....	diphenyl mono(<i>o</i> -xenyl) phosphate	$C_{24}H_{19}O_4P$	402.37
435	" 6.....	di(<i>o</i> -xenyl)monophenyl phosphate	$C_{30}H_{23}PO_4$	478.47
436	" 7.....	tri-(<i>p</i> -tert-butylphenyl) phosphate	$C_{30}H_{33}O_4P$	494.60
437	" 8.....	tri- <i>o</i> -chlorophenyl phosphate	$C_{18}H_{12}O_4Cl_3P$	429.63
438	" 9.....	tri- <i>o</i> -xenyl phosphate.....	$C_{36}H_{27}O_4P$	554.56
439	Piperazine.....	piperazine.....	$NHCH_2CH_2NHCH_2CH_2$	86.14
440	Propane, Pure.....	propane.....	$CH_3CH_2CH_3$	44.09
441	Propionic anhydride...	propionic anhydride.....	$(CH_3CH_2CO)_2O$	130.14
442	Propiophenone.....	ethyl phenyl ketone.....	$C_6H_5COC_2H_5$	134.17
443	Propyl <i>p</i> -hydroxy- benzoate	propyl <i>p</i> -hydroxy- benzoate	$C_{10}H_{12}O_3$	180.20
444	Propylene chlorhydrin anhydrous	chlorisopropyl alcohol...	$CH_2CHOHCH_2Cl$	94.54
445	Propylene diamine, anhydrous	propylene diamine.....	$CH_3CH(NH_2)CH_2NH_2$	74.13
446	Propylene dibromide..	" bromide.....	$CH_3CHBrCH_2Br$	201.91
447	Propylene dichloride...	" dichloride.....	$CH_3CHClCH_2Cl$	112.99
448	Propylene glycol.....	1,2-dihydroxypropane....	$CH_3CHOHCH_2OH$	76.09
449	Propylene glycol di- ricinoleate	propylene glycol diricin- oleate	$CH_3CHCH_2(C_{17}H_{32}OHCOO)_2$	639.14
450	" " di- stearate	propylene glycol distearate	$CH_3CHCH_2(C_{17}H_{35}COO)_2$	609.14
451	" " mono- stearate	propylene glycol mono- stearate	$CH_3CHOHCH_2OOC C_{17}H_{35}$	342.54

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
422	w. wh. liq.	fa. aromatic.		1.106-1.111
423	liq.			
424	lt. yel. cr.	none.		1.109 $\frac{30}{25}$
425	cl. col. mobile liq.	pleas. ....		.866 $\frac{25}{25}$
426	liq.			1.094-1.099
427	wh. sld.	none.		
428	liq.			
429	yel. liq.	geranium-like.		0.8791
430	cl.-col.pa. straw mobile perm. liq.	none.		1.16 $\frac{25}{25}$
431	cl., col. visc. per. liq.	none.		1.11 $\frac{25}{25}$
432	cl. col. pa. straw mobile perm. liq.			1.3 $\frac{25}{25}$
433	cl. col.-pa. straw mobile perm. liq.			1.34 $\frac{25}{25}$
434	cl. col. mobile liq.	none.		1.20 $\frac{60}{4}$
435	cl. col. visc. liq.			1.20 $\frac{60}{4}$
436	wh. cr. sld.	none.		
437	wh. sld. or cl. col. sld.		1.38 $\frac{60}{4}$	
438	wh. gran. sld.	none.		
439	liq.	amine-like.		
440	col. flammable gas.	char. pleas. sweet.	99.9.	0.503 $\frac{20}{4}$
441	col. liq.	pungent.	95-100.	1.0119
442	pa. lemon colored liq.	sweet pleas.	ca. 95.	1.015
443	wh. cr.	none.		
444	w. wh. liq.	mild, n. res.	46-54.	1.1270 $\frac{20}{20}$
445	col. liq.	amm.		0.8732
446	cl. col. heavy liq.	sweet.		1.943 $\frac{25}{25}$
447	w. wh. liq.	chloroform-like.		1.157-1.163 $\frac{20}{20}$
448	w. wh. liq.	almost none.	99.	1.037-1.039 $\frac{20}{20}$
449	amber oil.	fa. fatty.		0.942 $\frac{25}{25}$
450	cr. colored sld.	fa. fatty.		0.965 $\frac{25}{25}$
451	cr. colored soft sld.	fa. fatty.		0.93 $\frac{25}{25}$

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
422	Phenyl "Cellosolve"*	14.0	244.7	240-248	250
423	" diethanolamine	58			
424	α -Phenyl diphenyl ether	27.6	205 ¹⁰		359.6
425	Phenyl ethane	< -70		135-5%; 137-95%	68
426	" ethanolamine	15.4	285.2	280-290	305
427	" methyl pyrazolone	128	289 ²⁶⁵		
428	" morpholine	57	268 ⁷⁸⁰		
429	Phorone	28.0	197.9		185
430	Phosphen 1	<0	245-260 ⁵		>437
431	" 2	<0	260-275 ⁵		482
432	" 3	<0	240-255 ⁵		>419
433	" 4	<0	255-270 ⁵		>437
434	" 5	<0	250-285 ⁵		437
435	" 6		285-330		482
436	" 7	102-105	300 ⁶		527
437	" 8	35		255-265 ⁵	545
438	" 9	113-115			
439	Piperazine	104			
440	Propane, Pure	-190	-42.2		-140
441	Propionic anhydride	-43	169.0	160-175	165
442	Propiophenone	16.4-17.5	215-218, 80%	215-218, 80%	
443	Propyl <i>p</i> -hydroxybenzoate	96			
444	Propylene chlorhydrin		127.4		125
445	Propylene diamine, anhydrous		119.7		160
446	Propylene dibromide			139.6-5%; 142.6-95%	none
447	Propylene dichloride	< -80	95.9	<93-none; >99-none	70
448	Propylene glycol	< -60	188.2	<180-none; <195-90%; >210-none	225
449	Propylene glycol diricinoleate				
450	Propylene glycol distearate	34-35			
451	Propylene glycol mono-stearate	37-39			

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
422	2.67 ²⁰ % by wt. in wt.	fixative for perfumes; org. syn.	cans, drums	C. & C.
423	3.34 ²⁰ % by wt. in w.	inter.	cans, drums	C. & C.
424	g. per 100 g.: 100 eth., 100 CCl ₄ , 100 bz., 100 acet.; i.w.	....	....	D.
425	∞ eth., CCl ₄ , bz., al.; i.w. ....	....	....	D.
426	4.58 ²⁰ % by wt. in w.	syn. dyes, inter.	cans, drums	C. & C.
427	1.0 ²⁰ % by wt. in w.	inter.org.syn.; pharm.	drums, barrels	C. & C.
428	1.0 ²⁰ % by wt. in w.	syn.drugs, rubber accel.	research quant.	C. & C.
429	0.11 ⁵⁰ % by wt. in w.	inter.	cans, drums	C. & C.
430	∞ bz., CCl ₄ ; v.s.al.; s.V.M.P. naphtha; i.w.	....	....	D.
431	∞ CCl ₄ , bz., v.s.al.; s. V.M.P. naphtha; i.w.	....	....	D.
432	CCl ₄ , bz.; v.s.al., sls.V.M.P. naphtha; i.w.	....	....	D.
433	CCl ₄ , bz., v.s.al; sls.V.M.P. naphtha; i.w.	....	....	D.
434	CCl ₄ , bz.; v.s.al; sls.V.M.P. naphtha; i.w.	....	....	D.
435	∞ bz., CCl ₄ ; v.s.al.; s. V.M.P. naphtha; i.w.	....	....	D.
436	∞ bz., CCl ₄ , g. per 100 g.: 2 al; i.w.	....	....	D.
437	∞ bz., CCl ₄ ; v.s.al; sls.V.M.P. naphtha; i.w.	....	....	D.
438	g. per 100 g.: 8 bz., 1 CCl ₄ ; sls. V.M.P. naphtha; i.w.,al.	....	....	D.
439	15 ²⁰ % by wt. in w.	syn. drugs.	research quant.	C. & C.
440	imm. w.	refrig., reagent; org. syn.	cylinders.	P.P.
441	d.w.	esterifying agt. ....	....	C. & C.
442	s. eth., bz.; i.w. ....	....	tins, bottles	Pa.
443	g. per 100 g.: 105 acet., 100 meth.al., 50 eth., 3 bz., .5 CCl ₄ ; i.w.	....	....	D.
444	∞ w.	chem.syn.	jugs, carboys	C. & C.
445	∞ w.	chem.syn.	drums	C. & C.
446	acet., bz., CCl ₄ ; vs.eth.; s.al; g. per 100 g. 0.2 ²⁵ w.	....	....	D.
447	0.3 ²⁰ % by wt. in w.	cleaning comp., org. syn.	cans, drums	C. & C.
448	∞ w.	sol., anti-freeze.	cans, drums, tank cars	C. & C.
449	s. al., naphtha; i.w.	hydraulic fluids, lubricants, plasticizer	....	G.
450	s. naphtha, h.al.; i.w. ....	....	....	G.
451	s. acet., ethyl acetate, h.al., toluene, naphtha; i.w.	suppositories; emulsifier with soap	....	G.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
452	Propylene oxide.....	propylene oxide.....	$\text{CH}_3\text{CHCH}_2\text{O}$	58.08
453	" , Technical....	propylene.....	CH_2CHCH_3	42.08
454	Pyrosal.....	antipyrène acetyl salicylate	$\text{C}_{20}\text{H}_{20}\text{O}_5\text{N}_2$	368.38
455	Resorcin.....	meta-dihydroxy benzene	$\text{C}_6\text{H}_4(\text{OH})_2$	110.11
456	Salicyl salicylic acid...	salicyl salicylic acid.....	$\text{C}_{14}\text{H}_{10}\text{O}_6$	258.22
457	SOA*	sucrose octa acetate.....	$\text{C}_{12}\text{H}_{14}\text{O}_3(\text{OOCCH}_3)_8$	678.59
458	Sodium benzene- <i>meta</i> -disulfonate	sodium benzene <i>meta</i> -disulfonate	$\text{C}_6\text{H}_4(\text{SO}_3\text{Na})_2$	282.21
459	" diphenyl-4-sulfonate	diphenyl-4-sulfonic acid...	$\text{C}_{12}\text{H}_9\text{O}_3\text{SNa}$	256.25
460	Sorbitol hexaacetate...	sorbitol hexaacetate.....	$\text{C}_6\text{H}_5\text{O}_6(\text{CH}_2\text{CO})_6$	434.39
461	Span 20.....	sorbitan monolaurate.....	$\text{C}_{18}\text{H}_{35}\text{O}(\text{OH})_3(\text{OCOC}_{11}\text{H}_{23})^\dagger$	346.3†
462	" 40.....	" monopalmitate....	$\text{C}_{18}\text{H}_{35}\text{O}(\text{OH})_3\text{OCO}(\text{CH}_2)_{14}(\text{CH}_3)^\dagger$	402.3†
463	" 60.....	" monostearate.....	$\text{C}_{18}\text{H}_{35}\text{O}(\text{OH})_3\text{OCO}(\text{CH}_2)_{16}\text{CH}_3^\dagger$	430.4†
464	" 80.....	" monooleate.....	$\text{C}_{18}\text{H}_{35}\text{O}(\text{OH})_3\text{OCO}(\text{CH}_2)_7\text{CH}(\text{C}_8\text{H}_{17})\text{CH}^\dagger$	428.4†
465	" 85.....	" trioleate.....	$\text{C}_{18}\text{H}_{35}\text{O}(\text{OH})_3[\text{OCOC}_{17}\text{H}_{33}]_3^\dagger$	957.0†
466	1,2,4,5-Tetrachlorobenzene	1,2,4,5-tetrachlorobenzene	$\text{C}_6\text{H}_2\text{Cl}_4$	215.90
467	Tetrachloro hydroquinone	tetrachloro hydroquinone.	$\text{C}_6\text{H}_2\text{O}_2\text{Cl}_4$	247.90
468	2,3,4,6 Tetrachlorophenol	2,3,4,6 tetrachlorophenol.	$\text{C}_6\text{H}_2\text{OCl}_4$	231.90
469	Tetrachloroquinone.....	chloranil.....	$\text{Cl}_4\text{C}_6\text{O}_2$	245.89
470	Tetradecanol.....	tetradecanol.....	$\text{C}_{14}\text{H}_{29}\text{OH}$	214.38
471	Tetraethanolammonium hydroxide.....	tetraethanolammonium hydroxide	$(\text{HOCH}_2\text{CH}_2)_4\text{NOH}$	211.26
472	Tetraethylene glycol...	tetraethylene glycol.....	$\text{HO}(\text{CH}_2\text{CH}_2\text{O})_3\text{CH}_2\text{CH}_2\text{OH}$	194.23
473	Tetraethylene pentamine	tetraethylene pentamine..	$\text{NH}_2(\text{CH}_2\text{CH}_2\text{NH})_3\text{CH}_2\text{CH}_2\text{NH}_2$	189.31
474	Tetraglycol dichloride.	tetraglycol dichloride.....	$(\text{ClCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2)_2\text{O}$	231.12
475	Tetrahydrofurfuryl alcohol	tetrahydro-2-furancarbinol	$\text{C}_4\text{H}_7\text{O}.\text{CH}_2\text{OH}$	102.13
476	Tetrahydrofurfuryl glycolate	tetrahydrofurfuryl glycolate	$(\text{CH}_2)_3\text{CHOCH}_2\text{OOC}.\text{CH}_2\text{OH}$...	160.16
477	Tetrahydrofurfuryl levulinate	tetrahydrofurfuryl levulinate	$(\text{CH}_2)_3\text{OCHCH}_2\text{OOC}$ $(\text{CH}_2)_2\text{COCH}_3$	200.1
478	Tetrahydrofurfuryl oleate	tetrahydrofurfuryl oleate..	$(\text{CH}_2)_3\text{OCHCH}_2\text{OCCC}_{17}\text{H}_{33}$	366.6
479	Thiodiphenylamine....	phenothiazine.....	$\text{C}_6\text{H}_4\text{SNHC}_6\text{H}_4$	199.26

* Trade mark.

† Theoretical.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
452	w. wh. liq.			0.831-0.836 ²⁰ / ₂₀
453	olefin.		95.	0.520 ²⁰ / ₄
454	wh. powd.			
455	sl. yel. sld.	fa., peculiar.	>98.	1.285 ¹⁵
456	wh. powd.	none.		
457	wh. cr. powd.	intensely bitter taste.	99 min.	1.28 (fused)
458	lt. pk. sld.	none.		
459	fine wh. cr.	aromatic.		
460	wh. cr.	none, bitter after-taste.		1.34 ²⁵
461	amber colored viscous oily liq.	fatty.	tech.	1.00-1.06
462	yel. wax.	faint, fatty.	tech.	1.00-1.05
463	yel. brittle wax.	faint, fatty.	tech.	0.98-1.03
464	amber-colored, viscous oily liq.	fatty.	tech.	1.00-1.05
465	amber, oily liq.	fatty.	tech.	0.92-0.98
466	lt. tan cr.	like <i>p</i> -dichlorobenzene.		
467	lt. tan powd.	pung.		
468	tan fl.	strong char.		1.63 ⁶⁰ / ₄
469	golden br. cr. sld.	mild char.		
470	col. liq.	mild.		0.8355
471	.....		
472	col. hyg. liq.			1.1248
473	visc. hyg. liq.	char. amine-like.		0.990-1.000
474	liq.			1.186
475	col.-straw liq.	mild.	95 min.	1.052 ²⁵ / ₂₅
476	amber liq.	faint.		1.172 ²⁵ / ₂₅
477	amber liq.	faint.		1.10 ³⁰
478	yel. liq.	faint.		0.927 ³⁰
479	pa. yel. lust. pl.	fa. char.		

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
452	Propylene oxide.....		34.1.....	<30-none; >40-5%	-35
453	“ , Tech.....	-185.2.....	-47.6.....		
454	Pyrosal.....	61.4-63.8.....			
455	Resorcin.....	109-110.....	146-152 ⁵	146-152 ⁵	
456	Salicyl salicylic acid.....	145.7-149.2.....			
457	SOA*.....	79-86.....	260 ^{0.1}	d. 285.....	
458	Sodium benzene- <i>meta</i> -disulfonate				
459	Sodium diphenyl-4-sulfonate				
460	Sorbitol hexaacetate.....	98-100.....	220-240 ¹²		
461	Span 20.....	14-16.....			400
462	“ 40.....				415
463	“ 60.....				450
464	“ 80.....	10-12.....			410
465	“ 85.....	-10.....			
466	1,2,4,5-Tetrachlorobenzene.....	136.0-139.0.....			none
467	Tetrachloro hydroquinone.....	235.0-236.1.....			
468	2,3,4,6-Tetrachlorophenol.....	55-62.....			none
469	Tetrachloroquinone.....	285-287.....			
470	Tetradecanol.....		263.2.....		285
471	Tetraethanolammonium hydroxide				
472	Tetraethylene glycol.....	-6.2.....	327.3.....		345
473	“ pentamine.....		333.....	280-360.....	325
474	Tetraglycol dichloride.....		114 ²		>250
475	Tetrahydrofurfuryl alcohol.....	<-80.....	177-87 ⁴³	170-180, 99%.....	167-176
476	Tetrahydrofurfuryl glycolate				
477	“ “ levulinate				
478	“ “ oleate.....				
479	Thiodiphenylamine.....	184.3-185.2.....			

* Trade mark.

ORGANIC COMPOUNDS Continued

No.	Solubility grams per 100 ml	Uses	Shipping container	Source of information
452	41.0 ²⁰ % by wt. in w.....	fumigant, chem. syn.....	cans, drums....	C. & C.
453	imm. w.....	research.....	cylinders.....	P.P.
454	g. per 100 g.: 126 al., 113 bz., 13 eth., 4 ⁸⁰ w., 1 ²⁵ w.; i.CCl ₄	.....	.....	D.
455	s.w., al., eth., acet., amyl al.; sl. s. bz. glycerine	dyes, pharm.....	fiber containers, drums	Pa.
456	g. per 100 g.: 66 acet., 45 al., 28 eth, 1 bz.; v.sl. s. CCl ₄ ; i.w.	.....	.....	D.
457	g. per 100 g.: .09 w., 9.0 al.; s.eth.	anhydrous adhesive, water- proofing paper, insulating, lacq., plastics, rubbing al., denaturing	cartons, drums..	N.
458	s.w.....	grinding aid for cement.....	fibre drums....	Pa.
459	g. per 100 g.: 1.5 w., .02 acet., .002 bz., .03 CCl ₄ , .03 eth., .06 meth. al.	.....	.....	D.
460	.27 ²⁵ w., 3.0 ¹⁰⁰ w.....	hardening agt., plasticizer org. syn.	.....	At.
461	disp.w.; s. oil & org. solv.....	emulsifier, wetting & drying agt; edible	drums, cans....	At.
462	disp.h. w.; s. warm oils, most org. solv.	emulsifier, thickening agt....	drums, fiber containers	At.
463	disp. h.w.; s. warm oils, most org. solv.	emulsifier, thickening agt....	drums, fiber containers	At.
464	disp.w.; s. oils, most org. solv..	w/o emulsifier, edible.....	drums, cans....	At.
465	s.oils, org. solv., sl.w. disp.....	w/o emulsifier, dispersing agt..	drums, cans....	At.
466	g. per 100 g.: 0.8 al., 6 CCl ₄ , 58 monochlorobenzene; i.w.	.....	.....	D.
467	g. per 100 g.: 45 acet., 0.2 bz., .04 CCl ₄ , 20 eth., 20 meth. al.; i.w.	.....	.....	D.
468	v.s. acet., al., bz., eth., meth.al; v.sl.s.w.; g. per 100 g.: 31 CCl ₄	.....	.....	D.
469	s. epichlorohydrin; sl.s. CCl ₄ ; i.w., al., bz., eth.	.....	.....	D.
470	0.02 ²⁰ % by wt. in w.....	plasticizer inter., perfume fixatives	cans, drums....	C. & C.
471	∞ w.....	textile auxiliary.....	research quant.	C. & C.
472	∞ w.....	solv. nitro., gen., plasticizer..	cans, drums....	C. & C.
473	= w., most org. solv.....	saponifying fatty acids.....	cans, drums....	C. & C.
474	sl.s.w.....	chem.syn.....	research quant..	C. & C.
475	∞ w., al., eth.....	solv., org.syn., wetting agt., mfg. plasticizer	cans, drums....	Q.O.
476	s.w., al., acet., toluene; i.naphtha	compatible nitro., ethyl cellu., cellu.acetate, vinylite resin	.....	G.
477	∞ w.; s.al., toluene, naphtha..	compatible nitro., ethyl cellu., cellu.acetate, vinylite	.....	G.
478	s.al., toluene, naphtha, acet., ethyl acetate, i.w.	plasticizer.....	.....	G.
479	g. per 100 g.: 27 acet., 3 bz., .6 CCl ₄ , 7 eth., 2 meth al.; i.w.	.....	.....	D.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
480	2,4,6-Tribromophenol...	2,4,6-tribromophenol....	$C_6H_3OBr_3$	330.83
481	Tributyl citrate.....	tributyl citrate.....	$(CH_2COOC_4H_9)_2C(OH)COOC_4H_9$	360.44
482	Tributyl phosphate....	tributyl phosphate.....	$(C_4H_9)_3PO_4$	266.32
483	Trichlorethylene.....	1,2,2-trichlorethylene....	$ClCH:CCl_2$	131.40
484	2,4,5-Trichlorophenol..	2,4,5-trichlorophenol....	$C_6H_3OCl_3$	197.46
485	1,1,2,-Trichloropropane	1,1,2,-trichloropropane....	$CH_3CHClCHCl_2$	147.44
486	1,2,3,-Trichloropropane	1,2,3,-trichloropropane....	$CH_2ClCHClCH_2Cl$	147.44
487	1,2,3-Trichloropropane	1,2,3-trichloropropane....	$CH_2ClCHClCH_2Cl$	147.44
488	Triethylamine.....	triethylamine.....	$(C_2H_5)_3N$	101.19
489	Triethanolamine.....	tri(2-hydroxyethyl)amine..	$(HOCH_2CH_2)_3N$	149.19
490	Triethyl phosphate....	triethyl phosphate.....	$(C_2H_5)_3PO_4$	182.16
491	Triethylene glycol....	triethylene glycol.....	$HOC_2H_4OC_2H_4OC_2H_4OH$	150.17
492	“ tetramine.....	“ tetramine.....	$NH_2C_2H_4NHC_2H_4NHC_2H_4NH_2$	146.24
493	Triglycol dichloride...	triglycol dichloride.....	$Cl(CH_2CH_2O)_2CH_2CH_2Cl$	187.07
494	Triisopropanolamine...	triisopropanolamine.....	$[CH_2CH(OH)CH_2]_3N$	191.27
495	Trimethylamine.....	trimethylamine.....	$(CH_3)_3N$	59.11
496	Trimethyl phosphate...	trimethyl phosphate.....	$(CH_3)_3PO_4$	140.08
497	Tri- <i>n</i> -Butylamine.....	tributylamine.....	$(C_4H_9)_3N$	185.34
498	Triphenyl carbinol....	triphenyl methanol.....	$C_{19}H_{15}O$	260.32
499	Tween 20.....	polyoxyalkylene deriv. of sorbitan monolaurate	.....	122.6†
500	“ 40.....	polyoxyalkylene deriv. of sorbitan monopalmitate	.....	1282†
501	“ 60.....	polyoxyalkylene deriv. of sorbitan monostearate	.....	1310†
502	“ 61.....	polyoxyalkylene deriv. of sorbitan monostearate	.....	606†
503	“ 80.....	polyoxyalkylene deriv. of sorbitan monooleate	.....
504	“ 81.....	polyoxyalkylene deriv. of sorbitan monooleate	.....
505	“ 85.....	polyoxyalkylene deriv. of sorbitan trioleate	.....
506	Undecanol-2.....	undecanol-2.....	$C_{11}H_{23}OH$	172.30
507	Urethan.....	ethyl carbamate.....	$NH_2COOC_2H_5$	89.09
508	Vinyl acetate.....	vinyl acetate.....	$CH_2CHOCOCH_3$	86.05
509	“ “.....	“ “.....	$CH_3COOCHCH_2$	86.09
510	“ chloride.....	“ chloride.....	$CH_2:CHCl$	62.50
511	“ chloride.....	chloroethylene.....	CH_2CHCl	62.50

† Theoretical.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
480	lt. pk. cr.	fa. char. sweet astringent taste		
481	lt. straw stable, n. vol. liq.	none	99	1.043-1.049 $\frac{20}{20}$
482	w. wh. liq.	none	99.95	.973-.983 $\frac{20}{20}$
483	w. wh. liq.	pleas.	99	1.47-1.48 $\frac{15}{15}$
484	tan fl.	strong phenolic.		
485	cl. col. liq.	sweetish char.		1.343 $\frac{25}{25}$
486	col. liq.	chloroform-like.	95	1.398 $\frac{20}{4}$
487	cl. col. liq.	sweet char.		1.388 $\frac{25}{25}$
488	w. wh.			0.73 $\frac{20}{20}$
489	visc. hyg. liq.	sl. amm.	80	1.1240-1.1300 $\frac{20}{20}$
490	col. liq.	apple-like.	97 by wt.	1.068-1.072 $\frac{20}{20}$
491	col. liq.	almost none.		1.122-1.127 $\frac{20}{20}$
492	visc. liq.	char. amine-like.		0.980-0.985
493	col. liq.			1.195-1.120
494	wh. cr. sld.	sl. amm.		1.0200
495	col. gas.	pung. amm.	98	.662 $\frac{5}{5}$
496	w. wh. liq.	mild	98 by wt.	1.205-1.220 $\frac{20}{20}$
497	l. yel.			0.78 $\frac{20}{20}$
498	lt. straw colored cr.	fa.		
499	amber, oily liq.	faint, fatty.	tech.	1.08-1.13
500	amber, oily liq.	faint, fatty.	tech.	1.05-1.10
501	amber, oily liq.	faint, fatty.	tech.	1.05-1.10
502	yel. waxy solid.	faint, fatty.	tech.	0.98-1.03
503	amber, oily solid.	faint, fatty.	tech.	1.05-1.10
504	amber oily liq.	faint, fatty.	tech.	1.00-1.05
505	amber oily liq.	faint, fatty.	tech.	1.03-1.05
506	col. liq.	mild.		0.8363
507	wh. cr.	slight.	98	1.06 $\frac{48.2}{4}$
508	w. wh. liq.	char. sharp; irritating to the eyes	99.0+	0.9317 $\frac{20}{4}$
509	unstable to w. wh. liq.; stable to ft. blue liq.	pleas.	99.5	0.9335-.9345 $\frac{20}{20}$
510	w. wh. cl.			0.9121 $\frac{20}{20}$
511	col. liq. under press.	ethyl chloride-like.		0.908

See two following pages for additional data on above compounds.

PHYSICAL CONSTANTS OF INDUSTRIAL

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
480	2,4,6 Tribromophenol.....	91.5-92.6...	sublimes.....		none
481	Tributyl citrate.....	-20.....	233.5 ²² .5.....	234-236.....	365 ²⁵
482	“ phosphate.....	<-80.....	177-178 ²⁷	175-184.....	294.8
483	Trichlorethylene.....		86.7.....	86-87.5, 95%.....	none
484	2,4,5-Trichlorophenol.....	60.....	252.....		none
485	1,1,2-Trichloropropane.....	<-20.....		132.0-5%; 134.3-95%.....	none
486	1,2,3-Trichloropropane.....		156.....		174
487	1,2,3-Trichloropropane.....	-15.....		155.4-5%; 156-95%.....	none
488	Triethylamine.....	-114.8.....	89.5.....	not <85; not >91.....	20
489	Triethanolamine.....	21.2.....	208 ¹⁰		365
490	Triethyl phosphate.....	-56.4.....	216.....	190-220; 210-5%.....	ca 240
491	Triethylene glycol.....	-7.2.....	287.3.....	<270-none; <290-85%; <300-95%.....	330
492	“ tetramine.....		277.5.....	260-290.....	260
493	Triglycol dichloride.....	-31.5.....	241.3.....	230-245.....	250
494	Trisopropanolamine.....	46-50.....	305.4.....		305
495	Trimethylamine.....	-124.....	3.2-3.8 ⁷⁶⁵		
496	Trimethyl phosphate.....	-47.1.....	196.....	190-205, 90%.....	none
497	Tri-n-Butylamine.....	<-70.....	214.....	not <303; not <219.....	187
498	Triphenyl carbinol.....	160-161.2.....			
499	Tween 20.....				610
500	“ 40.....				
501	“ 60.....				
502	“ 61.....				
503	“ 80.....				
504	“ 81.....				550
505	“ 85.....				610
506	Undecanol-2.....		225.4.....		235
507	Urethan.....	48-50.....	183.....		
508	Vinyl acetate.....		72.5.....	72-73.....	-8
509	“ “.....	<-60.....	71.8-73.0.....	71-73.5.....	
510	“ chloride.....	-159.7.....	-13.9.....	<10-95%.....	<20
511	“ “.....		-14.....		<-22

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
480	v.s.acet., al., eth; v.sl.s.w.; g. per 100 g.: 12 CCl ₄ , 50 bz.			D.
481	l., imm. w.	plasticizer cellu.nitrate, ace- tate, resins; antifoaming agt., lubricant, agt.		C.S.
482	.586 w	plasticizer nitro. lacq., plastics, cellu, acetates	drums, cans	C.S.
483	0.10 ²⁵ % by wt. in w.	solv.degreaser	cans, drums	C. & C.
484	v.s.al., bz., CCl ₄ , eth.; i.w.			D.
485	∞ acet., al bz., CCl ₄ , eth; i.w.			D.
486	<0.1w.			S.D.
487	∞ acet., al., bz., CCl ₄ , eth.; i.w.			D.
488	∞ w., 18; s. meth.al., ethyl eth., acet., bz., gasoline, ethyl acetate	prep.ammonium comp.; textile	cans, drums	Sh.
489	∞ w., al; sl.s.hydrocarbons	gas absorbent, form soaps, emulsifying agts.	cans, drums tank cars	C. & C.
490	∞ w.; s. most org. solv.	solv.plasticizer	cans, drums	C.S.
491	∞ w.	solv.nitrocellu.; chem.syn.	cans, drums	C. & C.
492	∞ w.	detergents, soft.agts; chem. syn.	cans, drums	C. & C.
493	1.89 ²⁰ % by wt. in w.	chlorinated solv.extr.	cans, drums	C. & C.
494	∞ w.	emulsifying agt.	cans, drums	C. & C.
495	v.s.w.	synth.chem.base; warning agt; insect attractant	drums, bottles	C.S.
496	∞ w., most org. liq.	solvent	drums, cans	C.S.
497	∞ most org. solv.; i.w.	hydraulic fluid formulation	cans, drums	Sh.
498	g. per 100 g.: 22 acet., 16 bz., 16 eth., 2 CCl ₄ , 3 meth.al.			D.
499	s.w., most org. solv.; i. mineral, veget. oils	emulsifier, wetting, disp.; solubilizing agent	drums, cans	At.
500	s.w., most org. solv.; i. mineral, veget. oils	emulsifier, dispersing, solubi- lizing agt.	drums, cans	At.
501	s.w., most org. solv; i. mineral, veget. oils	emulsifier, dispersing, solubi- lizing agt.	drums, cans	At.
502	s. org. solv.; i.w.; disp. h.w.	emulsifier, thick. agt.	drums, cans	At.
503	s.w., most org. solv.; i. mineral, veget. oils	emulsifier, wetting, disp. agt.	drums, cans	At.
504	disp.w.; s. all org. solv.	emulsifier, disp. agt. lubricant	drums, cans	At.
505	s.w., most org. solv.; i. mineral, veg. oils	emulsifier, wetting, dispersing, solubilizing agt.	drums, cans	At.
506	<0.02 ²⁰ % by wt. in w.	plasticizer inter., perfume fixatives	drums	C. & C.
507	180 ²⁵ w., 125 ²⁵ eth.	pharm.	drums, cans	U.S.I.
508	2.5 w.	inter. resin, drug mfg.	drums, tank cars	S.C.L.
509	∞ al., eth.; i.w.	mfg. vinyl acetate resins	drums, tank cars	N.
510	0.09 ²⁰ % by wt. in w.	mfg. plastics.	cylinders	C. & C.
511	v.s. CCl ₄ , eth.; s.al; sl.s.w.			D.

CONSTANTS OF VEGETABLE AND ANIMAL

No.	Common name	Scientific name	Class†
1	Almond.....	<i>Prunus amygdalus</i>	I
2	Beef marrow.....	<i>Adeps bovis</i>	IX
3	Beef tallow.....	<i>Adeps bovis</i>	IX
4	Beechnut.....	<i>Fagus sylvatica</i> F. <i>Americana</i>	V
5	Beeswax.....	<i>Apis mellifera</i>	XII
6	Black mustard.....	<i>Sinapis nigra</i>	II
7	Bone fat.....	<i>Sevum ossis</i>	IX
8	Butter fat.....	<i>Vaccae lactis adeps</i>	IX
9	Candlenut.....	<i>Aleurites moluccana</i>	VI
10	Candlenut.....	<i>Aleurites triloba</i>	VI
11	Carnauba wax.....	<i>Corypha cerifera</i>	XI
12	Castor.....	<i>Ricinus communis</i>	III
13	Chaulmoogra.....	<i>Taraktogenos Kurzii</i>	V
14	Chaulmoogra.....	U. S. P. 10th Revision.....	V
15	Chinese insect wax.....	<i>Coccus cerifera</i>	XII
16	Chinese vegetable tallow.....	<i>Stilbingia sebifera</i>	VIII
17	Coconut.....	<i>Cocos butyracea</i> , <i>C. nucifera</i>	VIII
18	Cocoa butter (Cacao).....	<i>Theobroma cacao</i>	VIII
19	Cod liver.....	<i>Gadus morrhua</i>	VII
20	Corn (maize).....	<i>Zea mais</i>	V
21	Cotton seed.....	<i>Species Gossypium</i>	V
22	Cotton seed stearin.....	<i>Gossypium</i>	VIII
23	Croton.....	<i>Croton tiglium</i>	V
24	Goose fat.....	<i>Anser cinereus</i>	IX
25	Grape seed.....	<i>Vites vinefera</i>	III
26	Hazelnut.....	<i>Corylus avellana</i>	I
27	Hemp seed.....	<i>Cannabis sativa</i>	VI
28	Horse fat.....	<i>Equus caballus</i>	IX
29	Human fat.....	.....	IX
30	Japan wax.....	<i>Rhus succedaneum</i>	VIII
31	Lard oil.....	<i>Oleum adipis</i>	IV
32	Lard oil (fatty tissue).....	<i>Adeps</i>	IX
33	Laurel (bayberry).....	<i>Laurus nobilis</i>	VIII
34	Linseed.....	<i>Linum usitatissimum</i>	VI
35	Menhaden.....	<i>Alosa menhaden</i> (<i>Brevortia tyrannus</i>).....	VII
36	Mutton tallow.....	<i>Adeps ovis</i>	IX
37	Myrtle wax.....	<i>Myrica cerifera</i> (<i>M. Carolinensis</i>).....	VIII
38	Neat's foot.....	<i>Oleum pedis bovis</i>	IV
39	Nutmeg butter (mace).....	<i>Myristica officinalis</i>	VIII
40	Olive.....	<i>Olea Europaea sativa</i>	I
41	Palm.....	<i>Elaeis guineensis</i>	VIII
42	Palm kernel.....	<i>Elaeis guineensis</i> (W. Africa).....	VIII
43	Palm kernel.....	<i>Elaeis guineensis</i> (S. America).....	VIII
44	Peach kernel.....	<i>Amygdalus Persica</i>	I
45	Peanut.....	<i>Arachis hypogaea</i>	I
46	Poppy seed.....	<i>Papaver somniferum</i>	VI
47	Porpoise (body oil).....	<i>Delphinus phocaena</i>	VII
48	Pumpkin seed.....	<i>Cucurbita pepo</i>	V
49	Rabbit fat.....	<i>Lepus cuniculus</i>	IX
50	Rape seed.....	<i>Brassica campestris</i>	II
51	Safflower.....	<i>Carthamus tinctorius</i>	VI
52	Seal.....	<i>Species Phoca</i>	VII
53	Sesame.....	<i>Sesamum indicum</i>	V

OILS, FATS AND WAXES

No.	Specific gravity at $\frac{15^{\circ}}{15^{\circ}}$ C.	Solidifying point $^{\circ}$ C.	Saponi- fication value	Iodine value	Hehner's number
1	0.914-0.921	-15 to -20	183.3-207.6	93-103.4	96.0
2	0.9311-0.938	31 to 29	196-199.6	39-55.4	.....
3	0.895	31 to 38	196-200	35.4-42.3	96-96.5
4	0.922	-17	191-196	97-111	95-96
5	0.961-0.968	60.5 to 62	88-96	8.8-10.7	.....
6	0.915-0.919	-17	173-175	99-110	96
7	0.914-0.916	15 to 17	190-196	50-55	94-95
8	0.907-0.912 $\frac{40^{\circ}}{15^{\circ}}$	19 to 24.5	210-230	26-28	87.6-89.6
9	0.925	< -18	189-195	163-164	95-96
10	0.927	< -18	202-204	139-143.8	.....
11	0.995-0.999	80 to 87	79-84	13.5	.....
12	0.960-0.967	-12 turbid; -17 to -18 solid	175-183	84	.....
13	0.943-0.954	20 to 25	196-213	97.6-110.4	.....
14	ca 0.950 $\frac{26^{\circ}}{26^{\circ}}$	< 25	196-213	98-104	.....
15	0.809-0.811	80 to 81	80.4-91.7	1.4	.....
16	0.918-0.922	24 to 34	179-206	23-40.5	95.3
17	0.926	14 to 22	253.4-262	6.2-10	82.3-90.5
18	0.964-0.974	21.5 to 27.3	192.8-195	32.8-41.7	94-95
19	0.922-0.931	-3	171-189	137-166	95.3
20	0.921-0.928	-10 to -20	187-193	111-128	93-95
21	0.917-0.918 $\frac{25^{\circ}}{25^{\circ}}$	+12 to -13	194-196	103-111.3	95.7
22	0.9188-0.923	16 to 22	195	89-103	95.9
23	0.942-0.944	-8 to -18	193-215	108-109	89.0
24	0.923-0.930	22 to 24	191-193	58-67	94.5-95.3
25	0.917-0.933	-10 to -17	171-191	94.3-135	92
26	0.917	-17 to -18	191-197	87	95.5
27	0.928-0.934	-15 to -28	190-195	145-161.7	.....
28	0.919-0.933	20 to 45	195-200	75-86	95-98
29	0.9179	15	193.3-199	64	.....
30	0.970-0.980	40.5 to 46	206.6-237.5	4.9-12.8	90-91
31	0.913-0.915	+4 to -2	193-198	62.5-79	97
32	0.934-0.938	27.1 to 29.9	195-203	47-66.5	93-95
33	0.880 $\frac{100^{\circ}}{100^{\circ}}$	24 to 25	198-199	68-80	.....
34	0.930-0.938	-19 to -27	188-195	175-202	94.5-95.5
35	0.923-0.933	-5	189-192.9	148-185	.....
36	0.937-0.953	36 to 41	195-196	48-61	95.5
37	0.995	39 to 43	205.5-211.7	3.9-9.5	92-94
38	0.913-0.918	-2 to +10	193-199	57.5-75	94.8-95.8
39	0.945-0.996	40 to 44	154-178	59.3-65	.....
40	0.915-0.920	+2 turbid; -6 solid	185-196	79-88	95
41	0.924	.....	200-205	49.2-58.9	94.5-97
42	0.866-0.873 $\frac{100^{\circ}}{100^{\circ}}$	20 to 24	243-255	10.5-17.5	91-91.5
43	.....	27.4	220.2-231.4	25.5-31.6	.....
44	0.918-0.925	-20	191-193	92-99.7	94-96
45	0.917-0.926	3	186-194	88-98	95
46	0.924-0.926	-16 to -18	193-195	128-141	95.4
47	0.926	-16	203.4	126.9	68.4
48	0.923-0.925	-15	188-193	121-130	96
49	0.934-0.936	22 to 24	199-203	70-99.8	99.5
50	0.913-0.917	-10	168-179	94-105	94.5-96.3
51	0.925-0.928	-13 to -18	188-203	122-141	95
52	0.915-0.926	3	187.5-196.2	130-152	93-96
53	0.919 $\frac{25^{\circ}}{25^{\circ}}$	-4 to -16	188-193	103-117	95

CONSTANTS OF VEGETABLE AND ANIMAL

No.	Common name	Mau- mene' num- ber	Acid value	Acetyl value	Refractive index at 25° C.
1	Almond.....	51-53	0.5-3.5	9.6	1.4593-1.4646*
2	Beef marrow.....		1.6		1.4628
3	Beef tallow.....		0.25	2.7-8.6	
4	Beechnut.....				1.4698
5	Beeswax.....		16.8-20.6	15.2	1.4538-1.4566*
6	Black mustard.....	43	5.7-7.3		1.4718
7	Bone fat.....			11.3	
8	Butter fat.....		0.45-35.4	1.9-8.6	1.4555-1.4578*
9	Candlenut.....			9.8	1.4760-1.4790
10	Candlenut.....				1.4760-1.4790
11	Carnauba wax.....		4-8	55.2	1.4672-1.4701*
12	Castor.....	46-47	0.12-0.8	146-150.5	1.4771
13	Chaulmoogra.....		0.79-21.5		1.4777-1.4779
14	Chaulmoogra.....				
15	Chinese insect wax.....		63		
16	Chinese vegetable tallow.....		2.4		1.4470-1.4579*
17	Coconut.....	21	2.5-10.0	2.3-6.9	1.4477-1.4495*
18	Cocoa butter (Cacao).....		1.1-1.9	1.97	1.4537-1.4580*
19	Cod liver.....	102-115	5.6	1.15	1.4758-1.4783
20	Corn (maize).....	81-86	1.37-2.02	7.5-11.5	1.4733
21	Cotton seed.....	75-90	0.6-0.9	21-25	1.4743-1.4752 ¹⁶⁰
22	Cotton seed stearin.....				
23	Croton.....		27-30.9	19.8-38.6	1.4710*
24	Goose fat.....		0.59		1.4583-1.4626*
25	Grape seed.....	53	0.75	13.5-14.5	1.4713-1.4725
26	Hazelnut.....	36		3.2	1.4667
27	Hemp seed.....	97	0.45		1.4740-1.4745*
28	Horse fat.....		0-2.44		1.4618-1.4696*
29	Human fat.....				1.459-1.4613*
30	Japan wax.....		11-12	17.25-26.5	1.4560-1.4591*
31	Lard oil.....	41-45	1.56		1.4607*
32	Lard oil (fatty tissue).....		0.5-0.8	2.6	1.4609-1.4620
33	Laurel (bayberry).....		26.3		1.4783
34	Linseed.....	103-126	1-3.5		1.4797-1.4802
35	Menhaden.....	123-128	5-8		1.4787
36	Mutton tallow.....		1.7-14		1.4545-1.4585*
37	Myrtle wax.....		3-4.4		1.4511*
38	Neat's foot.....	43-49	0.1-0.6	7.7-9.3	1.4643-1.4685
39	Nutmeg butter (mace).....		17.2		1.4704*
40	Olive.....	41.5-47	0.3-1.0	10.5	1.4657-1.4667
41	Palm.....		10	15.7	1.4603-1.4639*
42	Palm kernel.....		5-22	7.6	1.4492-1.4543*
43	Palm kernel.....		0.33-0.55		
44	Peach kernel.....	42.5	1-1.5	6.5	1.4682-1.4701
45	Peanut.....	45-67	0.8	3.5	1.4620-1.4653*
46	Poppy seed.....	86-88	2.5		1.4739-1.4742
47	Porpoise (body oil).....	50-61	1.2		1.4622-1.4625
48	Pumpkin seed.....				1.4724-1.4739
49	Rabbit fat.....		6.2-7.2		1.459*
50	Rape seed.....	51-64	0.36-1.0	14.75	1.4649-1.4659*
51	Safflower.....		0.6	16.1	1.4769
52	Seal.....				1.4742-1.4762
53	Sesame.....	65.5	9.8		1.4704-1.4717
54	Soja bean (Soya, Soy).....	87-88	0.3-1.8	4.9	1.4723-1.4756

OILS, FATS AND WAXES (Continued)

No.	Reichert Meissl number	Unsaponi- fiable matter	Insoluble fatty acids			
			Melting point °C.	Solidifying point °C.	Iodine value	Acid value
1	0.5	0.75	13-14	9.5-11.8	93.5-96.5	204
2	2.2	.....	45-46	37.9-40	55.5	204.5
3	.....	.....	42.5-44	37.9-46.2	41.3	197.2
4	.....	.....	23-24	17	114	.....
5	.....	.....	67.2	.....	.....	.....
6	.....	3.3	16-17	13.4-13.7	87-93	179.2
7	0.2-1.7	0.5-1.5	42.5-44	28	55.7-57.4	200
8	17.0-34.5	0.3-0.45	38-41	33-39	28-31	210-220
9	1.2	0.5-0.9	20-21	13	185.7	.....
10	.....	.....	.....	17.8	.....	.....
11	.....	54-55	85	.....	.....	.....
12	1.4	0.6	13	3	86.6-88.3	192.1
13	.....	.....	.....	.....	.....	.....
14	.....	.....	.....	.....	.....	.....
15	.....	.....	92.2	.....	.....	.....
16	0.2-0.9	.....	39-57	45.2-47.2; 50.9-52.5	34.2	182-208.5
17	6.6-7.5	0.2	24-27	21.2-25.2	8.4-8.8	258
18	0.3-1	.....	48-53	47.2-49.2	32.6-39	190
19	0.2	0.54-2.68	21.8-38	17.5-24.3	164-171	204-207
20	4.3	1.5-2.8	17-20	14-16	113-125	198.4
21	0.95	1.1	34.5	32-35	111-115	201.6-203.9
22	.....	.....	27-30	35.1	94	.....
23	12-13.6	0.55	.....	17-19	111-112	201
24	0.2-0.98	.....	36.6-40	31-34	65.3	202.4
25	0.46	1.6	23-25	18-20	99-132	187.4
26	0.99	0.5	22-25	19-20	87.5-90.1	200.6
27	.....	1.08	17-21	15.6-16.6	141	.....
28	1.64-2.14	.....	31.3-53.4	37.7	83.9-87.1	202.6
29	0.25-0.55	.....	35.5	30.5	64	.....
30	.....	1.1-1.6	54.5-59.6	53-56.5	.....	213.7
31	.....	0.6	33-38.4	27-33	.....	.....
32	.....	.....	37-46.6	36-42.4	.....	.....
33	1.6	.....	.....	.....	81.6-82	.....
34	0.95	0.4-1.2	20-24	16-20.6	179-209.8	196-198.8
35	1.2	0.6-1.43	.....	.....	.....	.....
36	.....	.....	33.5-49	40-48.5	34.8	198
37	0.5	.....	47-48	46	.....	230.9
38	0.9-1.2	0.12-0.65	29-41	16-26.5	62-77	201.2-206.3
39	1.1-4.2	.....	42.5	40-45	31.6	.....
40	0.6-1.5	0.4-1.0	26-30	16.9-26.4	86-90	193
41	0.9-1.9	.....	50	42.5-45.5	53.3	204-207
42	5-6.8	.....	25-28.5	20-25.5	12	251-265
43	.....	.....	.....	.....	.....	.....
44	.....	.....	10-18.9	13-13.5	94.1-101.9	205-209.9
45	0.4	0.5-0.9	.....	30.5-39	95.5-103.4	201.6
46	0.6	0.43	20.5	17-19	139	199
47	46.9	16-17	.....	.....	126	207
48	4.45	.....	26.5-29.8	26-28	.....	.....
49	0.7-2.8	.....	39-50	35-41	64.4-101.1	210-218
50	0-0.79	1.48	18.5-20	11.7-13.6	100-106	.....
51	0-0.2	.....	11-17	7-12	132.5-148.2	199
52	0.2	0.3-1.0	22-23	13-17	186.5-201.8	190.4-198
53	1.1-1.2	0.95-1.32	25-35	23-32	109-112	196-201.6
54	0.5-2.8	1.27-1.54	26.2-27.5	21.2	122	.....

CONSTANTS OF VEGETABLE AND ANIMAL

No.	Common name	Scientific name	Class†
1	Soja bean (Soya, Soy) . . .	<i>Soja hispida (Dolichos hispida)</i>	V
2	Sperm	<i>Physeter macrocephalus</i>	X
3	Spermaceti	<i>Cetacea Oils</i>	XII
4	Sunflower	<i>Helianthus annus</i>	VI
5	Tung (China wood)	<i>Aleurites Fordii</i>	VI
6	Tung (China wood)	<i>Aleurites montana</i>	VI
7	Walnut	<i>Juglans regia</i>	VI
8	Whale	<i>Balaena mysticetus</i>	VII
9	White mustard seed	<i>Sinapis alba</i>	II
10	Wool fat	<i>Adeps lanae</i>	XII

† Class I, Non-drying vegetable oil of the olive oil type; Class II, non-drying vegetable oil of the rape oil type; Class III, non-drying vegetable oil of the castor oil type; Class IV, non-drying animal oil; Class V, semi-drying vegetable oil; Class VI, drying vegetable oil; Class VII, fish and marine animal oil; Class VIII, vegetable fat; Class IX, animal fat; Class X, sperm oil; Class XI, vegetable non-glyceridic wax; Class XII, animal wax.

No.	Common name	Mau-mene' number	Acid value	Acetyl value	Refractive index at 25° C.
1	Sperm	51	13.2	4.5-6.4	1.4573
2	Spermaceti		0.5-2.8	2.6	
3	Sunflower	72	11.2		1.4659-1.4721*
4	Tung (China wood)		2		1.515-1.520
5	Tung (China wood)		2		1.515-1.520
6	Walnut	96-110	2.5		1.4770
7	Whale	85-92	1.9	11-23	1.4679-1.4724
8	White mustard seed	44-49	5.4		1.4649
9	Wool fat		59.8	23	1.4784-1.4822*

* Refractive index at 40° C.

OILS, FATS AND WAXES (Continued)

No.	Specific gravity at $\frac{15^{\circ}}{15^{\circ}}$ C.	Solidifying point °C.	Saponi- fication value	Iodine value	Hehner's number
1	0.924-0.927	-10 to -16	189-193.5	122-134	93-94.5
2	0.878-0.884	15.5	120-137	80-84	.....
3	0.905-0.945	42 to 49	126-135	3.5-9.3	.....
4	0.924-0.926	-17	188-193	129-136	95
5	0.939-0.949	2 to 3	190-197	163-171	96.2
6	0.925	.....	189-195	163-164	95-96
7	0.925-0.927	-27.5	190.1-197	139-150	93.4-95.4
8	0.917-0.924	0 to -2	160-202	90-146	93-95
9	0.912-0.916	-8 to -16	171-174	94-98.4	96-97
10	0.970-0.973	.....	82-130	17-29	.....

No.	Reichert Meissl number	Unsaponi- fiable matter	Insoluble fatty acids			
			Melting point °C.	Solidifying point °C.	Iodine value	Acid value
1	.....	39-42	13.4	16.1	88-99	23.6
2	.....	51.5	.....	.....	.....	.....
3	0.5	0.31	22-24	18-19.8	124-134	201.6
4	1.10	0.4-0.8	40-43.8	31.2-37	145-159.4	188.8
5	0.35	0.4-0.8	.....	.....	.....	.....
6	0.92	0.5-1.0	15-20	14.3	150	.....
7	14	1-4	14-27	10-24	130.3-132	.....
8	.....	.....	15-16	9-10	94.7-110.4	181-185.8
9	8	39-44	41.8	40	17	.....

PHYSICAL AND CHEMICAL CONSTANTS OF

The following abbreviations are used: Class I, Resins; Class II, Oleo-acid; al, alcohol; bz, benzene; chl., chloroform; eth., ether; eth. acet., ethyl oil of turpentine; p. sol., partly soluble; sol., soluble; sl. sol., slightly soluble;

Name	Class	Specific Gravity	Melting Point °C.	Saponification No.	Iodine No.	Acid No.
Amber.....	I	1.05-1.10	250-325	85-150	62	15-35
Ammoniacum.....	III	1.2	.....	160-77	.....	100-6
Anime (East Indian).....	I	1.03	230-40	60-90	128-37	18-27
Anime (West Indian).....	I	.....	.....	150-60	.....	45-7
Benzoin.....	I	1.2	75-100	155-270	.....	90-190
Canada Balsam.....	II	.....	.....	90-6	.....	80-90
Caoutchouc.....	I	.....	.....	.....	71	81
Colophony.....	I	1.07-.09	120-50	150-200	112-7	150-80
Copaiba (Para).....	II	0.9-1.0	.....	.....	.....	30-68
Copaiba (Maracaibo)....	II	0.9-1.0	.....	.....	.....	79-91
Copaiba (Maranhã)....	II	0.9-1.0	.....	.....	.....	72-90
Copal (Benin).....	I	1.06-.08	120-66	125-150	61	100-34
Copal (Loango).....	I	.....	.....	126-34	.....	106-15
Copal (Sierra Leone)....	I	.....	.....	146-50	.....	109-14
Copal (Manilla).....	I	.....	.....	178	.....	128
Dammar.....	I	1.00-.05	95-190	20-65	.....	18-60
Dragon's Blood.....	I	1.2	120	150-60	.....	.....
Elemi.....	.....	1.02-.08	75-120	25-45	.....	18-25
Galbanum.....	III	1.11-.13	.....	75-225	.....	5-65
Guaiacum.....	I	1.2	85-90	.....	.....	70-80
Jalap.....	I	1.14-.15	150	.....	.....	12-25
Mastic.....	I	1.04-.07	105-20	82-92	64	50-71
Myrrh.....	III	1.12-.28	.....	160-200	.....	59-72
Olibanum.....	III	1.2	.....	65-120	.....	45-88
Sandarac.....	I	1.04	135-50	143	.....	140-55
Shellac.....	I	1.08-.13	.....	194-213	.....	48-64
Storax.....	I	1.12	.....	130-230	.....	35-175
Tolu.....	II	1.1	.....	154-220	.....	112-68
Turpentine (Common)...	II	.....	.....	100-75	.....	110-50
Turpentine (Larch).....	II	1.1-1.2	.....	75-125	.....	75-100

RESINS, OLEO-RESINS AND GUM-RESINS

Resins; Class III, Gum-Resins; a, acid; acet., acetone; acet. a., glacial acetic acetate; insol., insoluble; lgr., ligroin; meth. al., methyl alcohol; oil turp., w., water.

Ester No.	% Volatile at 100° C.	% Ash	Solubility
71-91	.....	0.3	p. sol. in CS ₂ , oil turp; sl. sol. in al., meth. al., amyl al., bz., eth; insol. in acet. a., acet., chl.
60-70	2-15	2-7	p. sol. w., al., eth.
47-62	.....	.....	.....
100-15	.....	0.05-.1	.....
30-175	4-10	0.2-3.0	sl. sol. w.; p. sol. al.
4-8	.....	.....	sol. in bz., chl., eth. acet., oil turp.; p. sol. in al., eth., lgr.
.....	.....	.....	sol. bz.; insol. acet.
7-22	0-0.5	0.02-.05	sol. in acet., al., meth. al., amyl al., bz., acet. a., chl., eth., eth. acet., CS ₂ , oil turp.; p. sol. in lgr.
2-18	.....	.....	sol. in bz., chl., eth., oil turp.; p. sol. al., lgr., eth. acet., CS ₂ ; insol. w.
1-8	.....	.....	sol. chl., eth., lgr.; p. sol. in al., eth. acet., oil turp.; insol. w.
2-18	.....	.....	sol. in bz., chl., eth., oil turp.; p. sol. al., lgr., eth. acet., CS ₂ ; insol. w.
.....	0.5-2.5	0.25-2.0	p. sol. acet. a., bz., chl., eth., oil turp.; insol. in acet., al., meth. al., lgr., CS ₂ .
.....	.....	.....	98.7 % sol. in eth.-al. mixture.
.....	.....	.....	92.9 % sol. in eth.-al. mixture.
.....	0.1-1.0	0.01-.1	sol. in bz., chl., CS ₂ ; p. sol. in al., eth., acet., amyl al., lgr.
.....	.....	3.6	sol. in al., eth., bz.; p. sol. in chl., eth. acet., lgr.
6-26	12-20	0.02-.1	sol., in eth., chl. bz., amyl al., CS ₂ ; sl. sol. in lgr.; p. sol. in acet. a., acet., al., meth. al., eth. acet., oil turp.
50-175	1-30	1-25	15-20 % sol. in w.; p. sol. in al.
.....	.....	1-5	p. sol. in al., bz., eth., lgr., CS ₂
120-5	.....	.....	sol. in al.; p. sol. in acet. a., eth., chl.; insol. in w., bz., oil turp., CS ₂
29	0.1-1.5	0.1-.2	p. sol. in acet. a., acet., al., meth. al. chl., oil turp.; sl. sol. in CS ₂ ; sol. in amyl al., bz., eth.; insol. w.
108-31	.....	1-8	p. sol. in w., al.
7-72	.....	.....	p. sol. in al., acet., meth. al., amyl al., chl., eth., eth. acet., oil turp.; sl. sol. in acet. a., bz.
1-33	0.05-.2	0.04-.1	sol. in acet., amyl al.; p. sol. in acet. a., al., meth. al., bz., chl., eth., lgr., CS ₂ ; sl. sol. in oil turp.
137-63	.....	0.72-1.4	p. sol. in acet. a., meth. al., amyl al., bz., chl., eth., lgr., eth. acet., oil turp., CS ₂
70-185	5-35	0-2	sol. in acet. a., al., meth. al., amyl al.; sl. sol. in acet., bz., oil turp.; insol. in eth., lgr., CS ₂
25-70	.....	.....	sol. in al., chl., eth. acet.; sl. sol. in w.; p. sol. in bz., eth., lgr., oil turp.
5-55	.....	.....	sol. in al., bz., chl., eth., eth. acet., oil turp.; p. sol. in lgr., CS ₂
0-50	.....	.....	sol. in acet. a., al., meth. al., amyl al., bz., chl., eth., eth. acet., oil turp.; p. sol. in lgr., CS ₂

PHYSICAL CONSTANTS OF MINERALS

The following table presents data for about 350 of the more common minerals.

In order to avoid duplication and save space, very few cross references are given in the body of the table. If the name sought is not found in the table, consult the **synonym index** given below.

Specific gravities are given at normal atmospheric temperatures, a more precise statement being valueless considering the large variations in natural minerals.

Hardness is given in terms of Mohs' scale. (See under Hardness.)

Indices of refraction for the sodium line, $\lambda = 5893 \text{ \AA}$, unless otherwise indicated. Li, $\lambda = 6708 \text{ \AA}$. Indices will invariably be given in the order ω , ϵ or α , β , γ . Uniaxial crystals are considered positive if $\epsilon > \omega$, negative if $\omega > \epsilon$. Biaxial crystals are considered positive if β is nearer α in value than it is γ and negative if β is nearer γ than α .

ABBREVIATIONS

amor.....	amorphous	hex.....	hexagonal	rhbdr.....	rhombohedral
bet.....	between	int.....	internal	rhomb.....	rhombic
bl.....	blue	inter.....	intermediate	silv.....	silver
blk.....	black	iridesc.....	iridescent	sl.....	slightly
blksh.....	blackish	lt.....	light	somet.....	sometimes
blsh.....	bluish	monocl.....	monoclinic	st.....	steel
br.....	brown	oft.....	often	tarn.....	tarnishes
brnsh.....	brownish	opt.....	optically	tetr.....	tetragonal
col.....	colorless	pa.....	pale	tricl.....	triclinic
cub.....	cubic	prob.....	probably	trig.....	trigonal
dk.....	dark	purp.....	purple	var.....	variety
emer.....	emerald	(R).....	radioactive	vlt.....	violet
expos.....	exposure	rar.....	rarely	wh.....	white
gold.....	golden	redsh.....	reddish	yel.....	yellow
grn.....	green	refl.....	reflection	yelsh.....	yellowish
grnsh.....	greenish				

SYNONYM INDEX

Compound sought	Listed	Compound sought	Listed
Aegirite.....	Aemite	+Fe Bronzite.....	Enstatite
Alalite.....	Diopside	Brown hematite.....	Limonite
Allanite.....	Orthite	Calcium-chromium garnet.....	Uvarovite
Alum stone.....	Alunite	Calcspar.....	Calcite
Amphibole.....	Hornblende	Caporcianite.....	Laumonite
Amphigene.....	Leucite	Carbonado.....	Diamond
Antimonite.....	Stibnite		
Aphthitalite.....	Arcanite	Carbuncle, Al-Fe garnet.....	Almandite
Arsenic nickel.....	Nicolite	Chalybite.....	Siderite
Asparagus-stone.....	Apatite	Chessylite.....	Azurite
Beauxite.....	Bauxite	Chile salt-peter.....	Soda niter
Black hematite.....	Psilomelane	China clay.....	Kaolinite
Black lead.....	Graphite	Chlorite.....	Clinochlorite
Black mica.....	Biotite	Chrome-spinel.....	Picotite
Blue iron ore.....	Vivianite	Cobalt bloom.....	Erythrite
Blue malachite.....	Azurite	Cobalt glance.....	Cobaltite
Blue stone.....	Chalcanthite	Copper pyrites.....	Chalcopyrite
Blue vitriol.....	Chalcanthite	Copper uranite.....	Torbernite (R)
Bortz.....	Diamond		
Brimstone.....	Sulfur		

SYNONYM INDEX (Continued)

Compound sought	Listed	Compound sought	Listed
Copperas.....	Melanterite	Magnetic pyrites.....	Pyrrhotite
Cromfordite.....	Phosgenite	Malaccolite.....	Diopside
Crysolite.....	Olivine	Manganblende.....	Alabandite
Cymophane.....	Chrysoberyl	Manganese-aluminum garnet.....	Spessartite
Dark red silver ore.....	Pyrrargyrite	Meerschaum.....	Sepiolite
Desmine.....	Stilbite	Menaccanite.....	Ilmenite
Dialogite.....	Rhodochrosite	Microcosmic salt.....	Stercorite
Dichroite.....	Cordierite	Mispickel.....	Arsenopyrite
Disthene.....	Cyanite	Molybdenum glance.....	Molybdenite
Dry bone.....	Smithsonite	Needle zeolite.....	Natrolite
Elacolite.....	Nephelite	Nickelin.....	Nicolite
Emerald.....	Beryl	Nigrine.....	Rutile
Epsom salt.....	Epsomite	Niobite.....	Columbite
Erubescite.....	Bornite	Noumeite.....	Garnierite
Facellite.....	Kaliophilite	Octahedrite.....	Anatase
Fahlerz.....	Tetrahedrite	Peanut ore.....	Wolframite
Fibrolite.....	Sillimanite	Pearl spar.....	Dolomite
Flint.....	Chalcedony	Pencil stone agalmatol- ite.....	Pyrophyllite
Fluorapatite.....	Apatite	Peridot.....	Olivine
Fluorspar.....	Fluorite	Pistacite.....	Epidote
Fool's gold.....	Pyrite	Plumbago.....	Graphite
Fowlerite.....	Rhodonite	Polianite.....	Pyrolusite
Glance.....	Galena	Potassium feldspar.....	Orthoclase
Glaserite.....	Arcanite	Purple copper ore.....	Bornite
Glauber salt.....	Mirabilite	Red copper ore.....	Cuprite
Grammatite.....	Tremolite	Red zinc ore.....	Zincite
Gray copper ore.....	Tetrahedrite	Rock salt.....	Halite
Gray manganese ore.....	Manganite	Ruby.....	Corundum
Green carbonate of copper.....	Malachite	Ruby silver ore.....	Proustite
Green lead ore.....	Pyromorphite	Sapphire.....	Corundum
Harmotome.....	Harmotome	Silver glance.....	Argentite
Hebronite.....	Amblygonite	Soapstone.....	Talc
Hessonite.....	Grossularite	Soda-microcline.....	Anorthoclase
Hiddenite.....	Spodumene	Sodium feldspar.....	Albite
Horn mercury.....	Calomel	Spathic iron.....	Siderite
Horn silver.....	Cerargyrite	Sphene.....	Titanite
Hyacinth.....	Zircon	Stassfurtite.....	Boracite
Hydrargillite.....	Gibbsite	Steatite.....	Talc
Hydrohematite.....	Turgite	Stream tin.....	Cassiterite
Hypersthene.....	Enstatite	Tabular spar.....	Wollastonite
Ice stone.....	Cryolite	Tincal.....	Borax
Iceland spar.....	Calcite	Tinstone.....	Cassiterite
Idocrase.....	Vesuvianite	Titanic iron ore.....	Ilmenite
Iolite.....	Cordierite	Troosite, var. cont. Mn.....	Willemite
Iron pyrites.....	Pyrite	Urao.....	Trona
Iron spinel.....	Hercynite	Vermilion, natural.....	Cinnabar
Jargon.....	Zircon	Websterite.....	Aluminite
Kunzite.....	Spodumene	Wernerite.....	Scapolite
Lapis-Lazuli.....	Lazurite	Wheel ore.....	Bournonite
Lead carbonate.....	Cerussite	White iron pyrites.....	Marcasite
Lead oxide.....	Litharge	White lead ore.....	Cerussite
Leonhardite.....	Laumontite	White mica.....	Muscovite
Lime feldspar.....	Anorthite	Wood tin.....	Cassiterite
Lime-soda feldspar.....	Oligoclase	Zincblende.....	Sphalerite
Lithiophyllite.....	Triphylite	Zinc-spinel.....	Gahnite
Lithium mica.....	Lepidolite	Zinc vitriol.....	Goslarite
Lodestone.....	Magnetite		
Magnesium mica.....	Phlogopite		

PHYSICAL CONSTANTS

No.	Name	Synonym	Formula	Sp. gr.
1	Acmite.....	aegirite.....	$\text{Na}_2\text{O} \cdot \text{Fe}_2\text{O}_3 \cdot 4\text{SiO}_2$	3.5-3.56
2	Actinolite.....	.....	$\text{Ca}(\text{Mg}, \text{Fe})_3(\text{SiO}_3)_4$	2.9-3.2
3	Agate See <i>chalcodony</i>	.....	.....	.....
4	Alabandite.....	manganblende.....	MnS	3.95-4.04
5	Albite.....	sodium feldspar.....	$\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$	2.61-2.64
6	Almandine.....	carbuncle, Al-Fe garnet.....	$\text{Al}_2\text{O}_3 \cdot 3\text{FeO} \cdot 3\text{SiO}_2$	3.688-4.33
7	Aluminite.....	websterite.....	$\text{Al}_2\text{O}_3 \cdot \text{SO}_3 \cdot 9\text{H}_2\text{O}$	1.66
8	Alunite.....	alum stone.....	$\text{K}_2\text{Al}_6(\text{OH})_{12}(\text{SO}_4)_4$	2.53-2.75
9	Alunogenite.....	alunogen.....	$\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$	1.6-1.8
10	Amblygonite.....	hebronite.....	$\text{AlPO}_4 \cdot \text{LiF}$	2.98-3.15
11	Analcite.....	analcime.....	$\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot 2\text{H}_2\text{O}$	2.22-2.29
12	Anatase.....	octahedrite.....	TiO_2	3.82-3.95
13	Andalusite.....	.....	\text{Al_2SiO_5 or $\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$	3.1-3.2
14	Andesine.....	feldspar group.....	$(\text{CaO}, \text{Na}_2\text{O})\text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2$	2.647-2.69
15	Andradite.....	common garnet, black garnet.....	$3\text{CaO} \cdot \text{Fe}_2\text{O}_3 \cdot 3\text{SiO}_2$	3.64-3.9
16	Anglesite.....	.....	\text{PbSO_4	6.12-6.39
17	Anhydrite.....	.....	\text{CaSO_4	2.899-2.985
18	Anorthite.....	lime feldspar.....	$\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$	2.703-2.763
19	Anorthoclase.....	feldspar group, soda-microcline.....	$(\text{Na}, \text{K})_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$	2.56-2.651
20	Anthophyllite.....	.....	$(\text{Mg}, \text{Fe})\text{SiO}_3$	2.857-3.2
21	Antigorite.....	.....	$3\text{MgO} \cdot 3\text{SiO}_2 \cdot 2\text{H}_2\text{O}$	2.55-2.62
22	Apatite.....	fluorapatite, asparagus-stone.....	$\text{CaF}_2 \cdot 3\text{Ca}_3\text{P}_2\text{O}_8$	3.151-3.270
23	Apophyllite.....	.....	$\text{K}_2\text{O} \cdot 8\text{CaO} \cdot 16\text{SiO}_2 \cdot 16\text{H}_2\text{O}$	2.3-2.4
24	Aragonite.....	.....	\text{CaCO_3	2.85-2.94
25	Arcanite.....	aphthitalite, glaserite.....	$(\text{K}, \text{Na})_2\text{SO}_4$	2.662
26	Argentite.....	silver glance.....	Ag_2S	7.24-7.40
27	Arsenic.....	native arsenic.....	As	5.64-5.78
28	Arsenopyrite.....	mispickel.....	$\text{FeS}_2 \cdot \text{FeAs}_2$	5.89-6.20
29	Atacamite.....	.....	$3\text{CuO} \cdot \text{CuCl}_2 \cdot 3\text{H}_2\text{O}$	3.77-3.94
30	Augelite.....	.....	$2\text{Al}_2\text{O}_3 \cdot \text{P}_2\text{O}_5 \cdot 3\text{H}_2\text{O}$	2.77
31	Augite.....	.....	$\text{CaMg}(\text{SiO}_3)_2 + (\text{Mg}, \text{Fe})\text{-(AlFe)}_3\text{SiO}_6$	3.2-3.6
32	Autunite.....	lime uranite.....	$\text{CaO} \cdot 2\text{UO}_3 \cdot \text{P}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$	3.05-3.19
33	Axinite.....	.....	$\text{HCa}_3\text{Al}_2\text{BSi}_4\text{O}_{16}$	3.22-3.314
34	Azurite.....	blue malachite, chessylite.....	$2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	3.77-3.83
35	Baddeleyite.....	.....	\text{ZrO_2	5.50-6.03
36	Barite.....	barytes.....	BaSO_4	4.3-4.6
37	Barysilite.....	.....	$\text{Pb}_2\text{Si}_2\text{O}_7$	6.53-6.707
38	Bauxite.....	beauxite.....	$\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$	2.55
39	Beccarite.....	.....	$\text{ZrO}_2 \cdot \text{SiO}_2$	6.54-6.74
40	Benitoite.....	.....	$\text{BaTiSi}_3\text{O}_9$	3.64-3.65
41	Bertrandite.....	.....	$4\text{BeO} \cdot 2\text{SiO}_2 \cdot \text{H}_2\text{O}$	2.571-2.60
42	Beryl.....	.....	$3\text{BeO} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$	2.63-2.91
43	Beryllonite.....	.....	\text{NaBePO_4	2.845
44	Biotite.....	black mica.....	$(\text{K}, \text{H})_2(\text{Mg}, \text{Fe})_2(\text{Al}, \text{Fe})_2(\text{SiO}_4)_3$	2.69-3.16

OF MINERALS

No.	Hard- ness	Crystalline form and color	Index of refract. (Na); n ; ω , ϵ ; α , β , γ	Angle of the optic axes, $2V$
1	6.0-6.5	monocl., blk., brnsh. or redsh.	1.763, 1.799, 1.813	62 13
2	5-6	monocl., grn., gray-grn. or br.	1.611, 1.627, 1.636	75
3				
4	3.5-4.0	cub., iron-blk.	(Li) 2.70	
5	6.0-6.5	tricl., gray, or rarely colored	1.525, 1.529, 1.536	70
6	7.0-7.5	cub., deep red to brnsh.-red or blk.	1.801	
7	1-2	monocl.	1.459, 1.464, 1.470	
8	3.5-4.0	hex. (trig.), col., wh., yelsh., gray or redsh.	1.572, 1.592	
9	1.5-2.0	monocl. wh., yelsh. or redsh.	1.474, 1.476, 1.483	
10	6	tricl., wh. to grnsh., blsh., yelsh., grayish or brnsh. wh.	1.579, 1.593, 1.597	50
11	5.0-5.5	cub., col. or wh., yelsh, redsh or grnsh.	1.4874	
12	5.5-6.0	tetr., br., bl., blk.	2.554, 2.493	
13	7.0-7.5	rhomb., gray, redsh., grnsh., blsh.	1.632, 1.638, 1.643	84 30
14	5-6	tricl., wh., gray, grnsh., yelsh., flesh red	1.549, 1.553, 1.556	88
15	6.5-7.0	cub., brnsh. red. br., blk., also yel. or grn.	1.857	
16	2.75-3.0	rhomb. or monocl., wh., gray, yel., bl., grn., (col.)	1.8771, 1.8823, 1.8937	75 24
17	3.0-3.5	rhomb. or monocl., col., wh., gray, bl., br. or redsh.	1.5693, 1.5752, 1.6130	43 41
18	6.0-6.5	tricl., col., wh. or grayish. (yelsh. blsh. or redsh.)	1.5755, 1.5832, 1.5885	77
19	6.0-6.5	tricl.	1.523, 1.529, 1.531	
20	5.5-6.0	rhomb., br., yelsh. or grnsh., to emer. grn.	1.633, 1.642, 1.657	83 54
21	3-4	rhomb., brnsh. grn.	1.490, 1.502, 1.511	
22	4-5	hex., br., grn., gray, yel., red or wh.	1.634, 1.632	
23	4.5-5.0	tetr., col. or wh., grn., yel. or redsh.	1.537, 1.535	
24	3.5-4.0	rhomb., col., wh., yel., redsh., blsh. or blk.	1.5299, 1.6809, 1.6854	18
25		rhbdr., wh.	1.4935, 1.4947, 1.4973	
26	2.0-2.5	cub., dk. lead gray		
27	3-4	hex., tin-wh., tarn. dk. gray to blk.		
28	5.5-6.0	rhomb., silver-wh. to grayish-wh.		
29	3.0-3.5	rhomb., bright or blksh. grn.	1.831, 1.861, 1.880	
30	4.5-5.0	monocl., col. to wh.	1.574, 1.576, 1.588	50 49
31	5-6	monocl., dk. grn. to blk.	1.712, 1.717, 1.733	60
32	2.0-2.5	rhomb., yel.	1.553, 1.575, 1.577	
33	6.5-7.0	tricl., br., bl., gray, yel.	1.678, 1.685, 1.688	72
34	3.5-4.0	monocl., bl.	1.730, 1.758, 1.838	
35	6.5	monocl., col.-yel., br., blk.	2.13, 2.19, 2.20	
36	2.5-3.5	rhomb., col., wh., yel., bl., br. or red	1.6369, 1.6381, 1.6491	37 28
37	3	trig., wh.	2.070, 2.050	
38	1-3	amor., wh., br., yel. or redsh.	1.570	
39			1.9272, 1.9277, 1.9820	
40	6.0-6.5	hex., trig., bl., col.	1.757, 1.804	
41	6-7	rhomb., col., pa. yel.	1.591, 1.605, 1.614	74 51
42	7.5-8.0	hex., grn., bl., yel., redsh.	1.581, 1.575	
43	5.5-6.0	rhomb., col. to wh., pa. yel.	1.5520, 1.5579, 1.5608	67 56
44	2.5-3.0	monocl., blk. or dk. br. or grn.	1.541, 1.574, 1.574	

PHYSICAL CONSTANTS OF

No.	Name	Synonym	Formula	Sp. gr.
1	Bismuth.....	native bismuth.....	Bi	9.70-9.83
2	Bloedite.....	blödite.....	$MgSO_4 \cdot Na_2SO_4 \cdot 4H_2O$	2.22-2.28
3	Boracite.....	stassfurtite.....	$Mg_7Cl_2B_{10}O_{30}$	2.9-3.0
4	Borax.....	tincal.....	$Na_2B_4O_7 \cdot 10H_2O$	1.69-1.72
5	Bornite.....	purple copper ore, erubescite	$FeS \cdot 2Cu_2S \cdot CuS$	4.9-5.4
6	Bournonite.....	wheel ore.....	$PbCuSbS_3$	5.7-5.9
7	Brochantite.....	.....	$CuSO_4 \cdot 3Cu(OH)_2$	3.8-3.9
8	Bromyrite.....	.....	AgBr.....	5.8-6.0
9	Brookite.....	.....	TiO_2	3.87-4.084
10	Brucite.....	.....	$MgO \cdot H_2O$	2.38-2.4
11	Bunsenite.....	.....	NiO	6.398
12	Cacoxenite.....	.....	$FePO_4 \cdot Fe(OH)_3 \cdot 4\frac{1}{2}H_2O$	3.38
13	Calamine See hemi	morphite, smithsonite		
14	Calcite.....	calcspar, iceland spar...	$CaCO_3$	2.711
15	Caledonite.....	.....	$2(Pb, Cu)O \cdot SO_3 \cdot H_2O$	6.4
16	Calomel.....	horn mercury.....	HgCl.....	6.482
17	Cancrinite.....	.....	$4Na_2O \cdot CaO \cdot 4Al_2O_3 \cdot 2CO_2 \cdot 9SiO_2 \cdot 3H_2O$	2.42-2.50
18	Carnallite.....	.....	$KCl \cdot MgCl_2 \cdot 6H_2O$	1.60
19	Carnotite.....	.....	$K_2O \cdot 2U_2O_3 \cdot V_2O_5 \cdot 3H_2O$	.....
20	Cassiterite.....	incl. tinstone, stream tin, wood tin	$SnSnO_4$	6.8-7.1
21	Celestite.....	celestine.....	$SrSO_4$	3.84-3.97
22	Cerargyrite.....	horn silver.....	AgCl.....	5.552
23	Cerussite.....	white lead ore.....	$PbCO_3$	6.46-6.57
24	Chabazite.....	.....	$CaAl_2Si_6O_{16} \cdot 8H_2O (+Na, K)$	2.06-2.16
25	Chalcanthite.....	blue vitriol, blue stone..	$CuSO_4 \cdot 5H_2O$	2.12-2.30
26	Chalcedony.....	flint, agate.....	SiO_2	2.55-2.63
27	Chalcopyrite.....	copper pyrites.....	$CuFeS_2$	4.1-4.3
28	Chiolite.....	.....	$5NaF \cdot 3AlF_3$	2.84-3.005
29	Chondrodite.....	.....	$[Mg(F, OH)]_2Mg_3[SiO_4]_2$	3.10-3.22
30	Chromite.....	.....	$FeO \cdot Cr_2O_3$	4.32-4.57
31	Chrysoberyl.....	cymophane.....	$BeO \cdot Al_2O_3$	3.50-3.84
32	Chrysocolla.....	.....	$CuSiO_3 \cdot 2H_2O$	2.40-2.42
33	Cinnabar.....	natural vermilion.....	HgS.....	8.0-8.2
34	Claudetite.....	.....	As_2O_3	3.85-4.151
35	Cleveite (R).....	A cryst. var. of uraninite		7.49
36	Clinochlorite.....	clinochlore.....	$H_3Mg_5Al_2Si_3O_{13}$	2.65-2.78
37	Cobaltite.....	cobalt glance.....	CoAsS.....	6.0-6.3
38	Colemanite.....	.....	$Ca_2B_6O_{11} \cdot 5H_2O$	2.417-2.428
39	Columbite.....	niobite.....	$(Fe, Mn)(Cb, Ta)_2O_6$	5.26-7.30
40	Connellite.....	.....	$CuSO_4 \cdot 2CuCl_2 \cdot 19Cu(OH)_2 \cdot H_2O$	3.4
41	Copiapite.....	.....	$2Fe_2O_3 \cdot 5SO_3 \cdot 18H_2O$	2.1-2.2
42	Copper.....	native copper.....	Cu.....	8.8-8.9
43	Coquimbite.....	.....	$Fe_2(SO_4)_3 \cdot 9H_2O$	2.07-2.105
44	Cordierite.....	iolite, dichroite.....	$4(Mg, Fe)O \cdot 4Al_2O_3 \cdot 10SiO_2 \cdot H_2O$	2.57-2.66
45	Corundum.....	ruby, sapphire.....	Al_2O_3	3.95-4.10

MINERALS (Continued)

No.	Hard- ness	Crystalline form and color	Index of refract. (Na); n ; ω , ϵ ; α , β , γ	Angle of the optic axes, $2V$ °
1	2.0-2.5	hex., redsh. wh.		
2	2.5	monocl., col. to grnsh., yelsh or red	1.486, 1.488, 1.489	
3	7	rhomb., wh., gray, yel. or grn.	1.662, 1.667, 1.673	83 33
4	2.0-2.5	monocl., wh., grayish, blsh. or grnsh.	1.4468, 1.4686, 1.4715	39
5	3	cub., dk. redsh. br., tarn. blue, purp. or iridesc.		
6	2.5-3.0	rhomb., st. gray to iron blk.		
7	3.5-4.0	rhomb., emer. to blksh. grn.	1.730, 1.778, 1.803	77
8	2-3	cub., yel. to grn. or gray	2.253	
9	5.5-6.0	rhomb., br., yelsh, redsh. to iron blk.	2.583, 2.586, 2.741	
10	2.5	trig., wh., gray, blue or grn.	1.559, 1.580	
11	5.5	cub., grn.	(Li) 2.18	
12	3-4	hex., yel. or brnsh.	1.582, 1.645	
13				
14	3	hex., col., wh. or yelsh.; rar. pa. gray, red, grn., bl., vit.	1.6583, 1.4864	
15	2.5-3.0	rhomb., deep grn.	1.818, 1.866, 1.909	
16	1-2	tetr., wh., yelsh, gray or br.	1.97325, 2.6559	
17	5-6	hex., wh., gray, yel., grn., bl., redsh.	1.524, 1.496	
18	1	rhomb., wh. or redsh.	1.466, 1.475, 1.494	70
19	1-2	hex., rhomb., yel.	1.750, 1.925, 1.95	
20	6-7	tetr., br. or blk., somet. red, gray, wh. or yel.	1.997, 2.093	
21	3.0-3.5	rhomb., col., wh. or yel., oft. blsh., redsh. or grnsh.	1.6220, 1.6237, 1.6309	51 12
22	1-1.5	cub. wh., gray, yelsh., grnsh., turns vit., br. or blk. in light	2.0710	
23	3.0-3.5	rhomb., col., wh. or gray	1.8037, 2.0763, 2.0780	8 34
24	4-5	hex. (rhbdr.), col., wh., redsh., yelsh. or br.	1.480, 1.482	65 ±
25	2.5	tricl., bl. or grnsh. bl.	1.5140, 1.5368, 1.5433	56 2
26	6	wh., grayish bl., br.-blk.	1.537 (1.533-1.539), 1.530	
27	3.5-4.0	tetr., brass to gold. yel. tarn. to bl., purp. tints		
28	3.5-4	tetr., wh.	1.349, 1.342	
29	6.0-6.5	monocl., wh., yel., red.-br.	1.607, 1.619, 1.639	80
30	5.5	cub., blk.-brnsh. blk.		2.16
31	8.5	rhomb., grn.-yel.	1.747, 1.748, 1.757	
32	2-4	amor., tetr. or hex., grn.-bl.-blk.	1.46-1.57	
33	2.0-2.5	hex., scarlet, redsh.-br., blk.	2.854, 3.201	
34	2.5	monocl.	1.871, 1.92, 2.01	
35	5.5	cub.		
36	2.0-2.5	monocl., grn. to yelsh. or wh.	1.585, 1.586, 1.596	
37	5-6	cub., silv. wh., redsh. or grayish		
38	4.0-4.5	monocl., col. to wh. or yelsh.	1.5863, 1.5920, 1.6139	55 20
39	6	rhomb., br. to blk.	2.26, 2.29, 2.34	
40	.....	hex., blue	1.724, 1.746	
41	2.5	monocl., yel.	1.530, 1.543, 1.595	
42	2.5-3.0	cub., red		
43	2.0-2.5	hex. (trig.), wh., yelsh., brnsh.	1.5519, 1.5575	
44	7.0-7.5	rhomb., lt.-dk. blue	1.534, 1.538, 1.540	70 23
45	9	hex. (trig. rhbdr.) col., red, yel., bl., br. or gray	1.768, 1.760	

PHYSICAL CONSTANTS OF

No.	Name	Synonym	Formula	Sp. gr.
1	Cotunnite		PbCl ₂	5.84
2	Cristobalite		SiO ₂	2.27-2.34
3	Crocoite	crocoisite	PbCrO ₄	5.9-6.1
4	Cryolite	ice stone	Na ₃ AlF ₆ or 3NaF·AlF ₃	2.95-3.00
5	Cryolithionite		3NaF·3LiF·2AlF ₃	2.777-2.778
6	Cuprite	red copper ore	Cu ₂ O	5.85-6.15
7	Cyanite	disthene	Al ₂ SiO ₅ or Al ₂ O ₃ ·SiO ₂	3.559-3.675
8	Danburite		CaO·B ₂ O ₃ ·2SiO ₂	2.93-3.02
9	Datolite		Ca(B.OH)SiO ₄	2.89-3.00
10	Derbylite		6FeO·5B ₂ O ₃ ·5TiO ₂	4.512-4.530
11	Diamond	bortz, carbonado	C	3.150-3.525
12	Diaspore		Al ₂ O ₃ ·H ₂ O	3.3-3.5
13	Diopside	malacolite, alalite	CaMg(SiO ₃) ₂	3.20-3.38
14	Dioplasite	diopase	H ₂ O·CuO·SiO ₂	3.05-3.35
15	Dolomite	pearl spar	CaCO ₃ MgCO ₃	2.80-2.99
16	Douglasite		2KCl·FeCl ₂ ·2H ₂ O	2.16
17	Dysanaleite		CaO·FeO·TiO ₂ , etc.	4.02-4.26
18	Eglestonite		Hg ₂ Cl ₂ O	8.327
19	Embolite		Ag(Br,Cl)	5.31-5.81
20	Emery	mix. of corundum, magnetite, hematite, quartz and spinel		3.75-4.31
21	Enargite		3Cu ₂ S·As ₂ S ₅	4.43-4.55
22	Erythrite	cobalt bloom	Co ₃ (AsO ₄) ₂ ·8H ₂ O	2.912-2.948
23	Eucalase		Be(AlOH)SiO ₄	3.051-3.103
24	Eudialite		6Na ₂ O·6(Ca,Fe)O·20(Si,Zr)O ₂ ·NaCl	2.8-3.1
25	Eulytite		3SiO ₂ ·2Bi ₂ O ₃	6.106
26	Enstatite	+Fe, bronzite, hypersthene	MgO·SiO ₂	3.10-3.43
27	Epidote	pistacite	4CaO·3(AlFe) ₂ O ₃ ·6SiO ₂ ·H ₂ O	3.07-3.50
28	Epsomite	epsom salt	MgSO ₄ ·7H ₂ O	1.68
29	Fayalite		Fe ₂ SiO ₄	3.91-4.34
30	Feldspars	See orthoclase, microcline, albite, labradorite, andesine, anorthoclase or anorthite		
31	Ferberite		FeWO ₄	6.801-7.109
32	Fluorite	fluorspar	CaF ₂	2.97-3.25
33	Forsterite		Mg ₂ SiO ₄	3.191-3.33
34	Franklinite		(Fe,Mn,Zn)(FeO ₂) ₂	5.07-5.22
35	Gahnite	zinc-spinel	ZnAl ₂ O ₄	4.478-4.602
36	Galenite	galenite, glance	PbS	7.3-7.6
37	Ganomalite		4CaO·6PbO·6SiO ₂ ·H ₂ O	5.57-5.7
38	Garnet	See almandine, andradite, grossularite, spessartite, uvarovite		
39	Garnierite	noumeite	H ₂ (Ni,Mg)SiO ₄ (variable)	2.27-2.87
40	Gay-Lussite		CaCO ₃ ·Na ₂ CO ₃ ·5H ₂ O	1.93-1.95
41	Gehlenite		CaO·MgO·Al ₂ O ₃ ·SiO ₂	2.9-3.07
42	Geikielite		(Mg,Fe)O·TiO ₂	3.98-4.0
43	Gibbsite	hydrargillite	Al ₂ O ₃ ·3H ₂ O	2.3-2.42
44	Glauberite		Na ₂ SO ₄ ·CaSO ₄	2.7-2.85
45	Glaucophane	glaucophanite	NaAl(SiO ₃) ₂ ·(Fe,Mg)-SiO ₃	2.991-3.15
46	Gold	native gold	Au	14.56-19.33

MINERALS (Continued)

No.	Hard- ness	Crystalline form and color	Index of refract. (Na); n ; ω , ϵ ; α , β , γ	Angle of the optic axes, $2V$
1	soft	rhomb., wh., yelsh.	2.1992, 2.2172, 2.2596	
2	6-7	pseudo-isometric?	1.486	
3	2.5-3.0	monocl., red.	(Li): 2.31, 2.37, 2.66	
4	2.5	monocl., col. to wh.; rar. redsh, brnsh. or blk.	β 1.364	
5	2.5-3.0		1.339	
6	3.5-4.0	cub., red.; rar. br.-blk.	2.705	
7	4-7	tricl., bl., gray, wh., grn. or blk.	1.712, 1.720, 1.728	82
8	7	rhomb., yel.-col.	1.632, 1.634, 1.636	88
9	5.0-5.5	monocl., col., wh., yelsh., redsh., grnsh.	1.625, 1.653, 1.669	74
10	5	rhomb., blk.	(Li): 2.45, 2.51	
11	10	cub., col. or sl. yelsh., also yel., red, grn., blue or blk.	2.4173	
12	6.5-7.0	rhomb., gray, wh., pink, yel., br.	1.702, 1.722, 1.750	84
13	5-6	monocl., lt. to dk. grn., col., gray, yel., rar. bl.	1.664, 1.671, 1.694	59
14	5	trig., emer. grn.	1.644, 1.697	
15	3.5-4.5	hex. (trig. rhbdr.), wh., yel., redsh., br., blk., rar. col.	1.6817, 1.5026	
16			1.488, 1.500	
17	5-6	cub., iron blk.	2.330	
18	2-3	cub., brnsh., yel., blk. on expos	(Li) 2.49	
19	1-1.5	grayish grn. to yelsh-grn., yel.	2.15	
20	7-9	dk. gray to blk.		
21	3	rhomb., gray to blk.		
22	1.5-2.5	monocl., red., pink or pearl gray	1.6263, 1.6614, 1.6986	
23	7.5	monocl., col., pa. grn, blue	1.652, 1.655, 1.671	
24	5-6	hex., red to br.	1.606, 1.611	
25	4.5	cub., br. to yel. or col.	2.05	
26	5-6	rhomb., grayish or yelsh., wh., grnsh. or brnsh.	1.650, 1.653, 1.658	31
27	6-7	monocl., yelsh to blksh. grn; rar. red or col.	1.729, 1.754, 1.768	
28	2.0-2.5	rhomb., col. or wh.	1.4326, 1.4554, 1.4609	51 25
29	6.5	rhomb., yel.-blk.	1.835, 1.877, 1.886	
30				
31	4.0-4.5	monocl., br. to blk.	(Li) β 2.40	
32	4	cub., col., oft. yel., bl., grn., vlt.; rar. red	1.4339	
33	6-7	rhomb., wh., grnsh, yelsh.	1.635, 1.651, 1.670	
34	5.5-6.5	cub., iron blk.	(Li) 2.360	
35	7.5-8.0	cub., grn., br., blk.	1.780	
36	2.5	cub., lead gray to blk.	3.912	
37	3	tetr., col., gray.	1.910, 1.91, 1.945	
38				
39	2-3	amor., bright grn., pa. grn. to wh.	1.59	
40	2-3	monocl., wh. to yelsh.	1.4435, 1.5156, 1.5233	33 46
41	5.5-6.0	tetr., grayish grn. to br.	1.666, 1.661	
42	6	hex. (trig.), bluish or brnsh. blk.	2.31, 1.95	
43	2.5-3.5	monocl., wh., grnsh., redsh. to yel.	1.566, 1.566, 1.587	
44	2.5-3.0	monocl., pa. yel., gray, or red	1.515, 1.532, 1.536	7
45	6.0-6.5	monocl., blue	1.621, 1.638, 1.638	43 58
46	2.5-3.0	cub., yel.		

PHYSICAL CONSTANTS OF

No.	Name	Synonym	Formula	Sp. gr.
1	Goslarite.....	zinc vitriol.....	$ZnSO_4 \cdot 7H_2O$	1.9-2.1
2	Göthite.....	.....	$Fe_2O_3 \cdot H_2O$	4.0-4.4
3	Graphite.....	plumbago, black lead...	C (traces of Fe, SiO_2 , etc.)	2.09-2.25
4	Grossularite.....	hessonite.....	$3CaO \cdot Al_2O_3 \cdot 3SiO_2$	3.4-3.6
5	Gummite (R).....	.....	$(Pb, Ca, Ba)SiU_3O_{12} \cdot 5H_2O(?)$	3.9-5.16
6	Gypsum.....	.....	$CaSO_4 \cdot 2H_2O$	2.314-2.328
7	Halite.....	rock salt.....	NaCl.....	2.135-2.170
8	Hambergite.....	.....	Be_2HBO_4	2.347-2.36
9	Hanksite.....	.....	$9Na_2SO_4 \cdot 2Na_2CO_3 \cdot KCl$	2.562
10	Harmotome.....	harmotomite.....	$(K_2, Ba)O \cdot Al_2O_3 \cdot 5SiO_2 \cdot 5H_2O$	2.345-2.50
11	Hausmannite.....	.....	Mn_3O_4	4.722-4.856
12	Häuynite.....	.....	$5(Na_2, Ca)O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2SO_3$	2.4-2.5
13	Helvite.....	.....	$3(Be, Mn, Fe)_2SiO_4 \cdot (Mn, Fe)_2S$	3.16-3.37
14	Hematite.....	.....	Fe_2O_3	4.9-5.3
15	Hemimorphite.....	calamine.....	$2ZnO \cdot SiO_2 \cdot H_2O$	3.45
16	Hercynite.....	iron spinel.....	$FeAl_2O_4$	3.91-3.95
17	Herderite.....	.....	$CaPO_4 \cdot BeFOH$	2.952-3.012
18	Heulandite.....	.....	$CaO \cdot Al_2O_3 \cdot 6SiO_2 \cdot 5H_2O$	2.16-2.249
19	Hopeite.....	.....	$3ZnO \cdot P_2O_5 \cdot 4H_2O$	3.03
20	Hornblende.....	amphibole.....	$Ca(Mg, Fe)_3(SiO_2)_4Al_2(Mg, Fe)_2(AlO_3)_2(SiO_3)_2, Fe(Mg, Fe)_2(FeO_3)_2(SiO_3)_2$	3.0-3.5
21	Hübnerite.....	.....	$MnO \cdot WO_3$	7.2-7.5
22	Hutchinsonite.....	.....	$(Ti, Ag, Cu)_2S \cdot As_2S_3 + PbS \cdot As_2S_3(?)$	4.6
23	Hydronephelite.....	.....	$HNa_2Al_3Si_3O_{12} \cdot 3H_2O$	2.263-2.48
24	Hydrotalcite.....	.....	$MgCO_3 \cdot 5Mg(OH)_2 \cdot 2Al(OH)_3 \cdot 4H_2O$	2.04-2.091
25	Ilmenite.....	menaccanite, titanite ore	$FeO \cdot TiO_2$	4.44-4.90
26	Iodyrite.....	iodargyrite.....	AgI	5.60-5.707
27	Jarosite.....	.....	$K_2Fe_6(OH)_{12}(SO_4)_4$	3.15-3.26
28	Kainite.....	.....	$MgSO_4 \cdot KCl \cdot 3H_2O$	2.067-2.188
29	Kaliophilite.....	phacellite.....	$KAlSiO_4$	2.49-2.67
30	Kaolinite.....	china clay, kaolin.....	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	2.60-2.63
31	Kieserite.....	.....	$MgSO_4 \cdot H_2O$	2.57
32	Labradorite.....	Labrador feldspar, inter. bet. albite and anorthite	$NaAlSi_3O_8, CaAl_2Si_2O_8$, ratio 1:1 to 1:3	2.70-2.72
33	Lanarkite.....	.....	$Pb_2O \cdot (SO_4)$	6.3-6.8
34	Lanthanite.....	.....	$La_2(CO_3)_3 \cdot 9H_2O$	2.6-2.74
35	Laubanite.....	.....	$Ca_2Al_2Si_5O_{15} \cdot 6H_2O$	2.23
36	Laumontite.....	leonhardtite, caporicianite	$CaO \cdot Al_2O_3 \cdot 4SiO_2 \cdot 4H_2O$	2.23-2.42
37	Laurionite.....	.....	$PbCl_2 \cdot Pb(OH)_2$	6.24
38	Lazulite.....	.....	$(Fe, Mg)O \cdot Al_2O_3 \cdot P_2O_5 \cdot H_2O$	3.057-3.122
39	Lazurite.....	lapis-lazuli.....	$3Na_2O_3 \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2Na_2S$	2.38-2.45
40	Leadhillite.....	.....	$Pb(OH)_2 \cdot PbSO_4 \cdot 2PbCO_3$	6.26-6.44

MINERALS (Continued)

No.	Hard- ness	Crystalline form and color	Index of refract. (Na); n ; ω , ϵ ; α , β , γ	Angle of the optic axes, $2V$ °
1	2.0-2.5	rhomb., wh. or yelsh.	1.457, 1.480, 1.484	
2	5.0-5.5	rhomb., yel., red or br.	2.26, 2.39, 2.40	
3	1-2	hex., blk., dk. gray.		
4	6.5-7.0	cub., yel., grn., br., red or wh.	1.735	
5	2.5-3.0	gumlike masses, redsh. yel. to brnsh.	1.61	
6	1.5-2.0	monocl., wh.; oft. yel., red, br., blk.	1.5205, 1.5226, 1.5296	58 5
7	2.5	cub., col.-yelsh.; oft. redsh.-bl., gray or blk.	1.5442	
8	7.5	rhomb., grayish wh.	1.5595, 1.5908, 1.6311	
9	3.0-3.5	hex., wh. to yel.	1.481, 1.461	
10	4.5	monocl., wh., gray, yel., red or br.	1.503, 1.505, 1.508	43
11	5.0-5.5	tetr., brnsh.-blk. to blk.	(Li): 2.46, 2.15	
12	5.5-6.0	cub., bl., grn., red, yel.	1.496	
13	6.0-6.5	cub., yel., yelsh.-br., grn. or redsh.-br.	1.739	
14	5.5-6.5	hex. (trig.), st. gray-blk.	(Li): 3.01, 2.94	
15	4.5-5.0	rhomb. wh., yel., br., blsh. or grnsh.	1.614, 1.617, 1.636	46 10
16	7.5-8.0	cub., blk.	1.800	
17	5	monocl., yel., grnsh. wh.	1.592, 1.612, 1.621	68 2
18	3.5-4.0	monocl., wh., red, gray, brown	1.498, 1.499, 1.505	
19	2.5-3.0	rhomb., grayish wh.	1.572, 1.590, 1.590	54 44
20	5-6	monocl., dk. grn. to blk.	1.629, 1.642, 1.653	84
21	4.5-5.5	monocl., brnsh. red, yel. to blk.	2.170, 2.220, 2.320	
22	1.5-2.0	rhomb., scarlet to red	3.078, 3.176, 3.188	
23	4.5-6.0	hex., wh., dk. gray	1.490, 1.502	
24	2	hex., wh.	1.512, 1.498	
25	5-6	hex. (trig.), iron-brnsh. blk.		
26	1	hex., pa. yel. or grn.	2.21, 2.22	
27	2.5-3.5	rhomb., ocher-yel., br.	1.820, 1.715	
28	2.5-3.0	monocl., wh.-gray or redsh.	1.494, 1.505, 1.516	
29	6	hex. or fine threads, col.	1.537, 1.533	
30	2.0-2.5	monocl., wh., yelsh., redsh., blsh., grnsh., brnsh.	1.561, 1.565, 1.567	
31	3.0-3.5	monocl., col.-wh. or yelsh.	1.523, 1.535, 1.586	57
32	5.0-6.0	tricl., gray, br. or grnsh.	1.559, 1.563, 1.568	
33	2.0-2.5	monocl., grnsh., wh., pa. yel. or gray	1.93, 1.99, 2.02	
34	2.5-3.0	rhomb., grayish wh., pink, yelsh.	1.520, 1.587, 1.613	
35	4.5-5.0	wh.	1.475, 1.486	
36	3-4	monocl., wh., yel., gray or red	1.513, 1.524, 1.525	
37	3.0-3.5	rhomb., col.	2.0767, 2.1161, 2.1580	
38	5-6	monocl., azure-blue	1.603, 1.632, 1.639	69
39	5.0-5.5	cub., dk.-lt. bl., vit. or grnsh. bl.	1.500	
40	2.5	monocl.	1.87, 2.00, 2.01	

PHYSICAL CONSTANTS OF

No.	Name	Synonym	Formula	Sp. gr.
1	Lepidocrocite.....		$\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$	4.09
2	Lepidolite.....	lithium mica.....	$\text{KLi}[\text{Al}(\text{OH}, \text{F})_2]_2\text{Al}(\text{SiO}_3)_3$	2.799-2.9
3	Leucite.....	amphigene.....	$\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2$	2.45-2.51
4	Lewisite.....		$5\text{CaO} \cdot 2\text{TiO}_2 \cdot 3\text{Sb}_2\text{O}_3$	4.950
5	Limonite.....	brown hematite.....	$2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$	3.6-4.0
6	Litharge.....	lead oxide, lithargite.....	PbO	9.13
7	Magnesite.....		MgCO_3	2.95-3.2
8	Magnetite.....	lodestone.....	Fe_3O_4	4.967-5.180
9	Malachite.....	green carbonate of copper	$\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	3.90-4.03
10	Manganite.....	gray manganese ore.....	$\text{Mn}_2\text{O}_3 \cdot \text{H}_2\text{O}$	4.2-4.4
11	Manganosite.....		MnO	5.18
12	Marcasite.....	white iron pyrites.....	FeS_2	4.61-4.90
13	Marialite.....		$3\text{Na}_2\text{O} \cdot 3\text{Al}_2\text{O}_3 \cdot 18\text{SiO}_2 \cdot 2\text{NaCl}$	2.50-2.692
14	Marshite.....		CuI	5.59-5.62
15	Mascagnite.....		$(\text{NH}_4)_2\text{SO}_4$	1.76-1.77
16	Matlockite.....		$\text{PbO} \cdot \text{PbCl}_2$	7.21
17	Meionite.....		$4\text{CaO} \cdot 3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$	2.70-2.815
18	Melanterite.....	copperas.....	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	1.89-1.90
19	Melilite.....		$\text{Na}_2(\text{Ca}, \text{Mg})_{11}(\text{Al}, \text{Fe})_4(\text{SiO}_4)_9$	2.9-3.4
20	Mellite.....		$\text{Al}_2\text{O}_3 \cdot \text{C}_{12}\text{O}_9 \cdot 18\text{H}_2\text{O}$	1.55-1.65
21	Mendipite.....		$2\text{PbO} \cdot \text{PbCl}_2$	7-7.1
22	Microcline.....		$\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$	2.54-2.57
23	Microlite.....		$6\text{CaO} \cdot 3\text{Ta}_2\text{O}_5 \cdot \text{CbOF}_3$	5.405-5.562
24	Miersite.....		$4\text{AgI} \cdot \text{CuI}$	5.64
25	Milarite.....		$\text{K}_2\text{O} \cdot 4\text{CaO} \cdot 2\text{Al}_2\text{O}_3 \cdot 24\text{SiO}_2 \cdot \text{H}_2\text{O}$	2.5-2.59
26	Mimetite.....		$9\text{PbO} \cdot 3\text{As}_2\text{O}_5 \cdot \text{PbCl}_2$	6.98-7.25
27	Mirabilite.....	glauber salt.....	$\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$	1.40-1.481
28	Moissanite.....	carborundum, artificial.....	SiC	3.2
29	Molybdenite.....	molybdenum glance.....	MoS_2	4.7-4.8
30	Monazite.....		$(\text{Ce}, \text{Nd}, \text{Pr}, \text{La})\text{PO}_4 (+\text{Th}_3[\text{PO}_4]_4)$	5.2(4.9-5.3)
31	Monetite.....		HCaPO_4	2.75-2.863
32	Monticellite.....		CaMgSiO_4	3.03-3.25
33	Montroydite.....		HgO	11.14
34	Muscovite.....	white mica.....	$\text{K}_2\text{O} \cdot 3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot 2\text{H}_2\text{O}$	2.76-3.00
35	Nantokite.....		CuCl	3.930
36	Natrolite.....	needle zeolite.....	$\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2 \cdot 2\text{H}_2\text{O}$	2.18-2.25
37	Nephelite.....	nepheline, elaeolite.....	$(\text{Na}, \text{K})_8\text{Al}_8\text{Si}_9\text{O}_{34}$ or NaAlSiO_4	2.55-2.65
38	Newberyite.....		$\text{HMgPO}_4 \cdot 3\text{H}_2\text{O}$	2.10
39	Niecolite.....	arsenic nickel, nickelin.....	NiAs	7.33-7.67
40	Noselite.....	nosean.....	$5\text{Na}_2\text{O} \cdot 3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot 2\text{SO}_3$	2.25-2.4
41	Oligoclase.....	lime-soda feldspar.....	$\text{NaAlSi}_3\text{O}_8 + \text{CaAl}_2\text{Si}_2\text{O}_8$	2.62-2.672
42	Olivenite.....		$4\text{CuO} \cdot \text{As}_2\text{O}_5 \cdot \text{H}_2\text{O}$	4.1-4.4
43	Olivine.....	chrysolite, peridot.....	$(\text{Mg}, \text{Fe})_2\text{SiO}_4$	3.26-3.40
44	Opal.....		$\text{SiO}_2 \cdot x\text{H}_2\text{O}$	2.1-2.3

MINERALS (Continued)

No.	Hard- ness	Crystalline form and color	Index of refract. (Na); n; ω , ϵ ; α , β , γ	Angle of the optic axes, $2V$ °
1	.....	rhomb.	1.94, 2.20, 2.51	.....
2	2.5-4.0	monocl., pink, oft. wh.-gray or vlt.	1.560, 1.598, 1.605	.....
3	5.5-6.0	cub., wh., gray	1.508, 1.509	.....
4	5.5	cub., yel.	2.20	.....
5	5.0-5.5	prob. amor., br.-yelsh.	.....	.....
6	2	tetr., yel.	2.510, 2.610, 2.710	.....
7	3.5-4.5	hex. (trig. rhbdr.), col., wh.-yelsh., br.- blk.	1.700, 1.509	.....
8	5.5-6.5	cub., iron blk.	.....	.....
9	3.5-4.0	monocl., lt-dk. grn.	1.655, 1.875, 1.909	.....
10	4-5	rhomb., iron blk. to steel gray	2.24, 2.24 (Li), 2.53	.....
11	5-6	cub., emer. grn., blk. on expos.	2.16	.....
12	6.0-6.5	rhomb., pa. yel. to steel gray	.....	.....
13	5.5-6.0	tetr.	1.539, 1.537	.....
14	2.5-3.0	cub., br.	2.346	.....
15	2.0-2.5	rhomb., lem. yel., yelsh., gray	1.5209, 1.5230, 1.5330	.....
16	2.5-3.0	tetr., yelsh. or grnsh.	2.150, 2.040	.....
17	5.5-6.0	tetr. col. to wh.	1.597, 1.560	.....
18	2	monocl., var. shades of grn. to yel.	1.4713, 1.4782, 1.4856	85 27
19	5-6	tetr., wh., yel., grnsh., redsh., br.	1.634, 1.629	.....
20	2.0-2.5	tetr., yel.	1.539, 1.511	.....
21	2.5-3.0	rhomb., wh.	2.24, 2.27, 2.31	.....
22	6.0-6.5	tricl., wh., yelsh., gray, grn. or red.	1.522, 1.526, 1.530	83
23	5.5	cub., yel., br., rar. red	1.925	.....
24	2	cub., bright yel.	2.20	.....
25	5.5-6.0	hex. col., grn., glassy	1.532, 1.529	.....
26	3.5	hex., yel., br., wh. or col.	2.135, 2.118	.....
27	1.5-2.0	monocl., wh.	1.394, 1.396, 1.398	76
28	9.5	hex., grn., bluish-blk.	2.654, 2.697	.....
29	1.0-1.5	hex., blue gray	.....	.....
30	5.0-5.5	monocl., red or yelsh. br.	1.786, 1.788, 1.837	14
31	3.5	tricl., yel., wh.	1.515, 1.518, 1.525	.....
32	5.0-5.5	rhomb., col. to gray	1.651, 1.662, 1.668	.....
33	1.5-2.0	rhomb., orange red	2.37, 2.50, 2.65	.....
34	2.5-3.0	monocl., col. or pa. yel., gray or br.; rar. rose	1.561, 1.590, 1.594	40 (?)
35	2.0-2.5	cub., col. to wh. or grayish	1.93	.....
36	5.0-5.5	rhomb. wh. also redsh., yelsh., grnsh.	1.480, 1.482, 1.493	63
37	5.5-6.0	hex. col. wh., yelsh., gray or red	1.542, 1.538	.....
38	3.0-3.5	rhomb., wh. cryst.	1.514, 1.518, 1.533	.....
39	5.0-5.5	hex., lt. copper-red	.....	.....
40	5.5	cub., grayish, blsh., brnsh.	1.495	.....
41	6-7	tricl., wh., gray, grnsh., redsh.	1.539, 1.543, 1.547	.....
42	3	rhomb., olv. grn., dk. grn. to br.	1.747, 1.788, 1.829	.....
43	6.5-7.0	rhomb., olv. grn., or grayish grn. to yelsh. br.	1.662, 1.680, 1.699	88 54
44	5.5-6.5	amor., col., wh., yel., br., red, grn.; int. refl.	1.41-1.46	.....

PHYSICAL CONSTANTS

No.	Name	Synonym	Formula	Sp. gr.
1	Orpiment.....		As_2S_3	3.4-3.5
2	Orthite.....	allanite	$Ca_2(Al, Ce, Fe)_2(Al, OH)(SiO_4)_3$	3.0-4.2
3	Orthoclase.....	potassium feldspar.....	$K_2O \cdot Al_2O_3 \cdot 6SiO_2$	2.56
4	Parisite.....		$CaO \cdot 2CeOF \cdot 3CO_2$	4.320-4.42
5	Pectolite.....		$HNaCa_2(SiO_3)_3$	2.74-2.88
6	Penfieldite.....		$PbO \cdot 2PbCl_2$	.....
7	Penninite.....		$5(Mg, Fe)O \cdot Al_2O_3 \cdot 3SiO_2 \cdot 4H_2O$	2.6-2.85
8	Percylite.....		$PbCl_2 \cdot CuO \cdot H_2O$	4.675-4.71
9	Periclase.....		MgO	3.64-3.674
10	Perovskite.....		$CaO \cdot TiO_2$	3.95-4.039
11	Petalite.....		$Li_2O \cdot Al_2O_3 \cdot 8SiO_2$	2.386-2.465
12	Pharmacosiderite.....		$3Fe_2O_3 \cdot 2As_2O_3 \cdot 13H_2O$	2.9-3.0
13	Phenacite.....		$2BeO \cdot SiO_2$	2.944-3.041
14	Phlogopite.....	magnesium mica	$(K, H)_3Mg_3Al(SiO_4)_3 \cdot (- + Na, Fe, F)$	2.737-2.869
15	Phosgenite.....	cromfordite.....	$PbCl_2 \cdot PbCO_3$	6.0-6.305
16	Picotite.....	chrome-spinel.....	$(Mg, Fe)O \cdot (Al, Cr)_2O_3$	4.08
17	Pitchblende (R) S	ee uraninite		
18	Platinum.....	native platinum	Pt	13.35-19.00
19	Pleonaste.....	iron-magnesium spinel	$(Mg, Fe)O \cdot Al_2O_3$	3.5-3.6
20	Pollucite.....		$2Cs_2O \cdot 2Al_2O_3 \cdot 9SiO_2 \cdot H_2O$	2.868-2.901
21	Powellite.....		$CaO \cdot MoO_3$	4.356-4.526
22	Prehnite.....		$2CaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot H_2O$	2.80-2.95
23	Proustite.....	ruby silver ore	$3Ag_2S \cdot As_2S_3$	5.51-5.64
24	Pseudobrookite.....		$2Fe_2O_3 \cdot 3TiO_2$	4.4-4.9
25	Psilomelane.....	black hematite	$MnO_2 \cdot BaO \cdot H_2O \cdot K_2O \cdot etc.$	3.7-4.7
26	Pyrargyrite.....	dark red silver ore	$Ag_6Sb_2S_6$	5.77-5.86
27	Pyrite.....	iron pyrites, fool's gold	FeS_2	4.95-5.17
28	Pyrochlorite.....	pyrochlore.....	$RNb_2O_6 \cdot R(Ti, Th)O_3$	4.2-4.36
29	Pyrochroite.....		$Mn(OH)_2$	3.258
30	Pyrolusite.....	polianite.....	$MnO_2(-nH_2O)$	4.73-4.86
31	Pyromorphite.....	green lead ore	$PbCl_2 \cdot 3Pb_3(PO_4)_2$	6.50-7.12
32	Pyrophyllite.....	pencil stone agalmatolite	$Al_2O_3 \cdot 4SiO_2 \cdot H_2O$	2.66-2.90
33	Pyrrhotite.....	magnetic pyrites	Fe_5S_6 to $Fe_{16}S_{17}$	4.53-4.66
34	Quartz.....		SiO_2	2.59-2.660
35	Raspite.....		$PbO \cdot WO_3$	.....
36	Realgar.....		AsS	3.56
37	Rhodochrosite.....	dialogite.....	$MnCO_3$	3.30-3.76
38	Rhodonite.....	fowlerite.....	$MnO \cdot SiO_2$	3.40-3.68
39	Rutile.....	nigrine.....	TiO_2	4.18-5.13
40	Sassolite.....		$B(OH)_3$	1.48
41	Scapolite.....	wernerite.....	$nNa_4Al_3Si_9O_{24}Cl + mCa_4Al_6Si_6O_{26}$	2.6-2.8
42	Scheelite.....		$CaWO_4$	5.88-6.14
43	Schorlomite.....		$3CaO \cdot (Fe, Ti)_2O_3 \cdot 3(Si, Ti)O_2$	3.783-3.88
44	Scolecite.....		$CaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot 3H_2O$	2.16-2.4

OF MINERALS (Continued)

No.	Hard- ness	Crystalline form and color	Index of refract. (Na); n ; ω , ϵ ; α , β , γ	Angle of the optio axes, $2V$ °
1	1.5-2.0	monocl., lem. yel.	(Li) β 2.72	
2	5.5-6.0	monocl., br. to blk.	β 1.682	
3	6	monocl., col., wh., pa. yel., flesh red to gray.	1.518, 1.524, 1.526	69 43
4	4.5	trig., rhbdr., brnsh., yel.	1.5690, 1.6700	
5	4.5-5.0	monocl., col., wh., grayish wh.	1.595, 1.606, 1.634	60
6	.....	hex., wh.	2.13, 2.21	
7	2.0-2.5	pseudo-rhbdr., grn., vit., pink, rose red; rar. yelsh. or silver wh.	1.576, 1.579	
8	2.0-2.5	cub., blue	2.05	
9	5.5-6.0	cub.	1.7364	
10	5.5	cub., yel., redsh. br., grayish blk.	β 2.38	
11	6.0-6.5	monocl., col., wh., gray; rar. redsh or grnsh.	1.504, 1.510, 1.516	83 34
12	2.5	monocl., grn., yelsh. br.	β 1.676	
13	7.5-8.0	tricl., col., yel., red, br.	1.6542, 1.6700	
14	2.5-3.0	monocl., wh.-gray., yelsh. br. to brnsh. red	1.562, 1.606, 1.606	
15	2.75-3.0	tetr., col., gray or yel.	2.114, 2.140	
16	.....	yelsh. br., grnsh. br. to blk.	2.950	
17				
18	4-6	cub., silvery metal		
19	.....	br., blk., dk. grn.		
20	6.5	cub., col.	1.521	
21	3.5	tetr., yel., grn. or blsh.	1.967, 1.978	
22	6.0-6.5	rhomb., lt. grn., wh. or gray	1.616, 1.626, 1.649	67
23	2.0-2.5	hex., scarlet to vermilion	3.0877, 2.7924	
24	6	rhomb., dk. br. to blk.	(Li): 2.38, 2.39, 2.42	
25	5-6	cryptocryst., iron blk. to gray		
26	2.5	hex. (trig.), dk. red to gray or blk.	(Li): 3.084, 2.881	
27	6.0-6.5	cub., pa. brass to gold yel.		
28	5.0-5.5	cub. br.-blk.	1.960-2.000	
29	2.5	trig., rhbdr., wh.; dk. on expos.	1.723, 1.681	
30	2.0-2.5	rhomb., blk., steel gray		
31	3.5-4.0	hex., grn., yel., gray, br. or wh.	2.042, 2.050, 2.050	
32	1-3	monocl., wh., grn., yelsh., grayish	1.552, 1.588, 1.600	
33	3.5-4.5	hex., yel., red to dk. br.		
34	7	hex. (trig.), col. or yel., rose, br., grn., bl., gray	1.544, 1.553	
35	.....	monocl., brnsh. yel.	2.27, 2.27, 2.30	
36	1.5-2.0	monocl., red, yel.	(Li): 2.46, 2.59, 2.61	
37	3.5-4.5	hex. (trig.), red, pink, gray, br.; rar. col.	1.817, 1.5973	
38	5.5-6.5	tricl., red, pink, yelsh., grnsh., brnsh., blk.	1.733, 1.740, 1.744	
39	6.0-6.5	tetr., redsh. br., red, yelsh., blsh., vit., blk.	2.6158, 2.9029	
40	1	tricl., wh. scales	1.340, 1.456, 1.459	
41	5-6	tetr., col., wh., gray, grnsh., blsh., redsh.	1.570, 1.549	
42	4.5-5.0	tetr., col., wh., yel., br., grn., redsh.	1.918, 1.934	
43	7.0-7.5	blk.	1.980	
44	5.0-5.5	monocl.	1.512, 1.519, 1.519	36

PHYSICAL CONSTANTS

No.	Name	Synonym	Formula	Sp. gr.
1	Scorodite.....		$\text{FeAsO}_4 \cdot 4\text{H}_2\text{O}$	3.1-3.3
2	Selenite, colorless tr	ansparent gypsum, which	see	
3	Sellaite.....		MgF_2	2.972-3.170
4	Senarmontite.....		Sb_2O_3	5.22-5.30
5	Sepiolite.....	meerschaum.....	$2\text{MgO} \cdot 3\text{SiO}_2 \cdot 2\text{H}_2\text{O}$	2.02
6	Serpentine.....	incl. chrysotile or asbestos and verd-antique	$3\text{MgO} \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$	2.50-2.65
7	Siderite.....	spathic iron, chalybite.....	FeCO_3	3.00-3.88
8	Sillimanite.....	fibrolite.....	$\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$	3.23-3.25
9	Silver.....	native silver.....	Ag	10.1-11.1
10	Smaltite.....		CoAs_2	6.4-6.6
11	Smithsonite.....	calamine, dry bone.....	ZnCO_3	4.30-4.45
12	Sodalite.....		$\text{Na}_4(\text{AlCl})\text{Al}_2(\text{SiO}_4)_3$	2.14-2.40
13	Soda niter.....	Chile saltpeter.....	NaNO_3	2.24-2.290
14	Spessartite.....	manganese-aluminum garnet	$3\text{MnO} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2$	4.0-4.3
15	Sphalerite.....	zincblende.....	ZnS	3.90-4.11
16	Spinel.....		$\text{MgO} \cdot \text{Al}_2\text{O}_3$	3.5-4.1
17	Spodumene.....	hiddenite, kunzite.....	$\text{Li}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2$	32.644-2.649
18	Staurolite.....		$5\text{Al}_2\text{O}_3 \cdot 2\text{FeO} \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$	3.65-3.77
19	Stercorite.....	microcosmic salt.....	$\text{HNa}(\text{NH}_4)\text{PO}_4 \cdot 4\text{H}_2\text{O}$	1.615
20	Stibiotantalite.....		$\text{Sb}_2\text{O}_3 \cdot \text{Ta}_2\text{O}_5$	6.6-7.9
21	Stibnite.....	antimonite.....	Sb_2S_3	4.52-4.62
22	Stilbite.....	desmine.....	$(\text{Na}_2, \text{Ca})\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot 6\text{H}_2\text{O}$	2.09-2.24
23	Stolzite.....		$\text{PbO} \cdot \text{WO}_3$	7.87-8.13
24	Strengite.....		$\text{FePO}_4 \cdot 2\text{H}_2\text{O}$	2.84-2.87
25	Strontianite.....		SrCO_3	3.680-3.714
26	Struvite.....		$(\text{NH}_4)_2\text{O} \cdot 2\text{MgO} \cdot \text{P}_2\text{O}_5 \cdot 12\text{H}_2\text{O}$	1.65-1.72
27	Sulfur.....	brimstone.....	S	2.05-2.09
28	Sylvite.....	sylvine.....	KCl	1.988
29	Talc.....	soapstone, steatite.....	$3\text{MgO} \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$	2.7-2.8
30	Tantalite.....		$(\text{Fe}, \text{Mn})[(\text{Cb}, \text{Ta})\text{O}_3]_2$	6.5-8.20
31	Tapiolite.....		$\text{Fe}(\text{Ta}, \text{Nb})_2\text{O}_6$	7.3-7.8
32	Terlinguaite.....		Hg_2ClO	8.723-8.728
33	Tetrahedrite.....	gray copper ore, fahlerz.....	$4\text{Cu}_2\text{S} \cdot \text{Sb}_2\text{S}_3$	4.4-5.1
34	Thaumasite.....		$3\text{CaO} \cdot \text{SiO}_2 \cdot \text{CO}_2 \cdot \text{SO}_3 \cdot 15\text{H}_2\text{O}$	1.83-1.877
35	Thenardite.....		Na_2SO_4	2.68-2.69
36	Thermonatrite.....		$\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$	1.5-1.6
37	Thomsenolite.....		$\text{NaF} \cdot \text{CaF}_2 \cdot \text{AlF}_3 \cdot \text{H}_2\text{O}$	2.93-3.0
38	Thomsonite.....		$(\text{Na}_2\text{Ca})\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 3\text{H}_2\text{O}$	2.196-2.4
39	Thorianite (R).....		$(\text{ThU})\text{O}_2 (+\text{He}, \text{Ce}, \text{La}, \text{Pb}, \text{Fe})$	9.32-9.33
40	Thorite (R).....		$\text{ThSiO}_4 (+\text{He})$	blk. 4.5-5 yel. 5.2-5.4
41	Titanite.....	sphene.....	$\text{CaO} \cdot \text{TiO}_2 \cdot \text{SiO}_2$	3.40-3.56
42	Topaz.....		$(\text{AlF})_2\text{SiO}_4$ or $[\text{Al}(\text{F}, \text{OH})_2\text{SiO}_4$	3.4-3.65
43	Torbernite (R).....	copper uranite.....	$\text{Cu}(\text{UO}_2)_2\text{P}_2\text{O}_7 \cdot 12\text{H}_2\text{O}$	3.22-3.60
44	Tourmaline.....		$(\text{H}, \text{Li}, \text{Na}, \text{K})_3\text{Al}_3[\text{B}, \text{OH}]_2\text{Si}_4\text{O}_{19} (+\text{Fe}_2\text{O}_3, \text{FeO}, \text{MgO}, \text{MnO})?$	2.9-3.2
45	Tremolite.....	grammatite.....	$\text{CaMg}_3(\text{SiO}_4)_3$	2.9-3.2
46	Tridymite.....		SiO_2	2.28-2.33

MINERALS (Continued)

No.	Hardness	Crystalline form and color	Index of refract. (Na); n ; ω , ϵ ; α , β , γ	Angle of the optic axes, $2V$
1	3.5-4.0	rhomb., grn., br.	1.765, 1.774, 1.797	.....
2				
3	5	tetr., col.	1.378, 1.390	.....
4	2.0-2.5	cub., col. to grayish	2.087	.....
5	2.0-2.5	monocl., wh., yelsh., grayish	β , 1.55	.....
6	2.5-4.0	monocl. (opt.), fibrous var., asbestos; gray to grnsh. or brnsh.	1.490-1.571	.....
7	3.5-4.5	hex., brnsh. to blk., gray, grn., wh.	1.875, 1.633	.....
8	6.0-7.5	rhomb., gray, br., yelsh., grnsh.	1.638, 1.642, 1.653	25-30
9	2.5-3.0	cub., wh.; tarn. to gray or blk.	0.18	.....
10	5.5-6.0	cub., tin wh. to lt. steel gray		.....
11	4.5-5.0	hex. (trig.), wh.-yel. or br.; rar. grn., bl.	1.818, 1.618	.....
12	5.5-6.0	cub., bl., wh., grn., redsh. or gray	1.483	.....
13	1.5-2.0	hex., col., wh., yelsh., gray, redsh., br.	1.5874, 1.3361	.....
14	.....	cub., dk. red to brnsh. red	1.811	.....
15	3.5-4.0	cub., wh., yel., br., blk.	2.368	.....
16	8	cub., col. or red, bl., grn., yel., br., blk.	1.723	.....
17	β 5.5-6.0	monocl., wh., gray, grn., pink or purp.	1.660, 1.666, 1.676	.....
18	7.0-7.5	rhomb., redsh. br., blk., yelsh. br., gray	1.736, 1.741, 1.746	88
19	2	monocl., wh.	1.439, 1.441, 1.469	.....
20	5.0-5.5	rhomb., br., redsh. yel., yel.	2.374, 2.404, 2.457	.....
21	2	rhomb., lead gray or blk.	3.194, 4.046, 4.303	.....
22	3.5-4.0	monocl., col., wh., also br., yel., redsh.	1.494, 1.498, 1.500	30
23	2.75-3.0	tetr., grn. to gray or br.	2.2685, 2.182	.....
24	3-4	rhomb., pa. red	1.730, 1.732, 1.762	.....
25	3.5-4.0	rhomb., col., wh., gray, yel., grn.	1.516, 1.664, 1.666	.....
26	2	rhomb., wh. or yelsh.	1.495, 1.496, 1.504	.....
27	1.5-2.5	rhomb., yel.	1.95047, 2.03832, 2.24052	68 58
28	2	cub., col., wh., blsh. or yelsh.-red	1.4903	.....
29	1.0-1.5	monocl., wh., grnsh. wh., lt. grn.	1.589, 1.589, 1.589	.....
30	6	rhomb., blk. to redsh. br.	2.26, 2.29, 2.34	.....
31	6	tetr., blk.	(Li): 2.270, 2.420	.....
32	2-3	monocl., yel. to olive grn.	(Li): 2.35, 2.64, 2.66	.....
33	3.0-4.5	cub., st. gray to iron blk.		.....
34	3.5	hex.	1.507, 1.468	.....
35	2-3	rhomb., wh. to brnsh.	1.464, 1.474, 1.485	.....
36	1.0-1.5	rhombic	1.420, 1.495, 1.518	.....
37	2	monocl.	1.407, 1.414, 1.415	.....
38	5.0-5.5	rhomb., wh., redsh. grn. to br.	1.497, 1.503, 1.525	53 50
39	6.5	cub., blk.		.....
40	4.5-5.0	tetr., blk. or or. yel. (orangite)		.....
41	5.0-5.5	monocl., yel., grn., br., redsh. or blk.	1.900, 1.907, 2.034	23 9
42	8	rhomb., col. or yel., lt. blue, grn. or pink Brazil	1.619, 1.620, 1.627 1.6294, 1.6308, 1.6375	65 17 49 31
43	2.0-2.5	tetr., grn.	1.592, 1.582	.....
44	7.0-7.5	hex. (rhbdr.), blk.-br.-bl.-grn., red; rar. wh. or col.	1.6366, 1.6193 (col.)	.....
45	5-6	monocl., wh., gray, grnsh., yelsh.	1.609, 1.623, 1.635	88
46	7	rhomb., col. or wh.	1.469, 1.47, 1.473	.....

PHYSICAL CONSTANTS OF

No.	Name	Synonym	Formula	Sp. gr.
1	Triphylite-lithiophyllite		Li(Fe,Mn)PO_4	3.42-3.56
2	Trögerite (R)		$(\text{UO}_2)_3\text{As}_2\text{O}_3 \cdot 12\text{H}_2\text{O}$	3.3
3	Trona	uraolite	$\text{Na}_2\text{CO}_3 \cdot \text{HNaCO}_3 \cdot 2\text{H}_2\text{O}$	2.11-2.147
4	Turgite	hydrohematite	$2\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$	4.29-5.00
5	Turquois		$\text{H}_5(\text{CuOH})_2[\text{Al}(\text{OH})_2]_6(\text{PO}_3)_4$	2.60-2.89
6	Uraninite (R)	pitchblende; incl. cleveite (+Th, A, He), nivenite (+Yt), Bröggerite (+Th)	$\text{UO}_3 \cdot \text{UO}_2, \text{PbO}$, etc.	6.5-9.7
7	Uranite lime (R)	See autunite		
8	Uvarovite	calcium-chromium garnet	$3\text{CaO} \cdot \text{Cr}_2\text{O}_3 \cdot 3\text{SiO}_2$	3.418-3.81
9	Valentinite		Sb_2O_3	5.566
10	Vanadinite		$9\text{PbO} \cdot 3\text{V}_2\text{O}_5 \cdot \text{PbCl}_2$	6.7-7.2
11	Variscite		$\text{AlPO}_4 \cdot 2\text{H}_2\text{O}$	2.47-2.54
12	Vesuvianite	idocrase	$\text{Ca}_4[\text{Al}(\text{OH},\text{F})\text{Al}_2(\text{SiO}_4)_5]$	3.35-3.45
13	Villiaumite		NaF	2.79
14	Vivianite	blue iron ore	$\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$	2.58-2.693
15	Wagnerite		$\text{Mg}_3\text{P}_2\text{O}_8 \cdot \text{MgF}_2$	2.985-3.14
16	Wavellite		$4\text{AlPO}_4 \cdot 2\text{Al}(\text{OH})_3 \cdot 9\text{H}_2\text{O}$	2.316-2.356
17	Whewellite		$\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	2.23
18	Willemite	troosite, var. cont. Mn	Zn_2SiO_4 , (+Mn)	3.89-4.19
19	Witherite		$\text{BaO} \cdot \text{CO}_2$	4.28-4.35
20	Wolframite	peanut ore	$(\text{Fe,Mn})\text{WO}_4$	7.14-7.54
21	Wollastonite	tabular spar	CaSiO_3	2.80-2.92
22	Wulfenite		PbMoO_4	6.7-7.0
23	Xenotime	xenotimite	$\text{Y}_2\text{O}_3 \cdot \text{P}_2\text{O}_5$	4.45-4.56
24	Zeunerite (R)		$\text{Cu}(\text{UO}_2)_2\text{As}_2\text{O}_8 \cdot 8\text{H}_2\text{O}$	3.28
25	Zincite	red zinc ore	ZnO	5.43-5.70
26	Zircon	hyacinth, jargon	ZrSiO_4	4.02-4.86

MINERALS (Continued)

No.	Hard- ness	Crystalline form and color	Index of refract. (Na); n ; ω , ϵ ; α , β , γ	Angle of the optic axes, $2V$
1	4.5-5.0	rhomb., grnsh. gray, bluish, pink, yel. to br.	1.688, 1.688, 1.692	.....
2	soft	monocl.	1.585, 1.630, 1.630	.....
3	2.5-3.0	monocl., gray or yelsh. wh.	1.410, 1.492, 1.542	.....
4	5.5-6.0	dk. redsh. blk. or br., red.	(Li): 2.450, 2.550, 2.550	.....
5	5	tricl., blue, grn.	1.61, 1.62, 1.65	.....
6	5.5	cub. or amor., gray, br.-blk.	.....	.....
7				
8	6.5-7.5	cub., emer. grn.	1.838	.....
9	2.5-3.0	rhomb., wh., gray	2.18, 2.35, 2.35	.....
10	3	hex., yel., br. or red	2.354, 2.299	.....
11	4	rhomb., grn.	1.551, 1.558, 1.582	.....
12	6.5	tetr., yel., grn., br., rar. bl., red., blk.	1.716, 1.718	.....
13	3.5	cub.	1.336	.....
14	1.5-2.0	monocl., col. to bl. or blsh. grn. on expos.	1.579, 1.603, 1.633	.....
15	5.0-5.5	monocl., col., yel., grayish, grnsh., redsh.	1.569, 1.570, 1.582	37 49
16	3.5-4.0	rhomb., col., gray., yel., grn., blue, blk.	1.525, 1.534, 1.552	.....
17	2.5	monocl., col.	1.491, 1.555, 1.650	.....
18	5.5	hex. (trig.-rhdbr.), wh. or grn. yel.- redsh.-br.	1.694, 1.723	.....
19	3.00-3.75	rhomb., col., grayish wh. or yelsh.	1.529, 1.676, 1.677	.....
20	5.0-5.5	monocl., dk. gray or brnsh. blk.	2.310, 2.360, 2.460	.....
21	4.5-5.0	monocl., wh.-gray, yel., red or br.	1.616, 1.629, 1.631	40
22	2.5-3.0	tetr., yel., red, grn., gray, wh.	(Li): 2.402, 2.304	.....
23	4-5	tetr., yel.-br., brnsh. red-gray	1.721, 1.816	.....
24	2.0-2.5	tetr.	1.643-1.623	.....
25	4.0-4.5	hex., red or yel.	2.008, 2.029	.....
26	7.5	tetr., col., pa. yel., gray, yelsh. grn., br., redsh.-br.	1.9239, 1.9682	.....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS*

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Aluminum				
99.2Al.....	Aluminum 2S.....	2.71	23.94×10^{-6}	660
97Al, 3Cu.....	.....	.....	24	640
95Al, 5Cu.....	Lynite, body alloy.....	.....	26	650
95Al, 4.2Cu, 0.6Mn, 0.5Si, 0.4Fe.....	Zeppelin rod.....	.....	.....	.....
95Al, 2Cu, 1.5Mg, 0.8Fe, 0.2Si, 0.01Mn.....	Lynite, piston.....	.....	.....	.....
94Al, 4Cu, 0.5Mg, 0.5Mn, coated with 99.7 + Al.....	Alclad 17 ST.....	2.96	21.96	538-46
93Al, 7-8.5Cu, >1.7 other elements.....	Lynite, 146.....	.....	.....	.....
92Al, 9.3-11Cu, >2 other elements.....	Lynite, 122.....	.....	.....	.....
90Al, 7.8Cu, 1.5Zn, 1.3Fe.....	Lynite, crank case.....	.....	.....	.....
89Al, 11Cu, 0.5Mg.....	Lynite, piston.....	.....	.....	.....
89Al, 12-14Cu, >2 other elements.....	Lynite, 109.....	.....	.....	.....
99Al, 0.4Fe, 0.4Si, 0.1Zn, 0.06Cu.....	Zeppelin braces.....	.....	.....	.....
90 Al, 10Mg.....	Magnalium.....	2.50	24	600
70Al, 30Mg.....	Magnalium.....	2.00	.....	435
98Al, 1.25Mn.....	Aluminum Alloy 3S.....	2.74	23.04	640-55
95Al, 5Si.....	Aluminum-silicon 43.....	2.58	21.96	577-630
91Al, 9Zn.....	.....	2.80	26	650
90Al, 7.8Zn, 0.7Cu, 0.5Fe, 0.4Si, 0.3Mn, 0.1Sn.....	Zeppelin angles.....	.....	.....	.....
89Al, 9Zn, 0.7Cu, 0.5Si, 0.5Mn, 0.4Fe, 0.2Sn.....	Zeppelin channels.....	.....	.....	.....
77Al, 21Zn, 1.1Cu, 0.5Fe, Pb, Sn.....	Liberty pistons.....	.....	.....	.....
70Al, 30Zn.....	.....	.....	26	610
Bismuth				
53Bi, 32Pb, 15Sn.....	Eutectic fusible alloy.....	.....	.....	96
52Bi, 40Pb, 8Cd.....	Eutectic fusible alloy.....	.....	.....	91.5
50Bi, 27.1Pb, 22.9Sn.....	Rose metal.....	.....	.....	.....
50Bi, 27Pb, 13Sn, 10Cd.....	Eutectic fusible alloy; Lipowitz alloy.....	.....	.....	70-4
50Bi, 25Pb, 12.5Sn, 12.5Cd.....	Wood's metal.....	9.70	.....	70
40Bi, 40Pb, 20Sn.....	Bismuth solder.....	.....	.....	111
54Bi, 26Sn, 20Cd.....	Eutectic fusible alloy.....	.....	.....	103
45Bi, 17Sn, 30Pb, 5-10Hg.....	Fusible tea spoons.....	.....	.....	.....
Cerium				
70-3Ce, 17-24Zn, 1.6-6Fe, 0-2.4Al, Mn.....	Ignition pin alloy.....	.....	.....	.....
61Ce, 37Fe.....	Ignition pin alloy.....	.....	.....	.....
Cobalt				
Co, Cr, W Alloy.....	Stellite No. 1 Alloy.....	8.59	14.4×10^{-6}	1250
Co, Cr, W Alloy.....	Stellite No. 6 Alloy.....	8.38	16.9×10^{-6}	1275
Co, Cr, W Alloy.....	Stellite No. 12 Alloy.....	8.40	15.8×10^{-6}	1263
Co, Cr, W Alloy.....	Stellite Star J-Metal.....	8.76	14.6×10^{-6}	1270
Co, Cr, W Alloy.....	Stellite "2400" Alloy.....	.....	.....	.....

* See also Supplementary Table following this table.

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Copper				
99.9 + Cu.....	Deoxidized copper.....	8.50	17.71×10 ⁻⁶	1082
99.90 + Cu, 0.01P.....	Deoxidized copper.....	8.91	17.71	1082
90Cu, 10Al.....	Aluminum bronze.....	7.6	16.5	1050
90Cu, 9Al, 1Fe.....	Resistac.....	.....	.....	1066
80-90Cu, 8-10Al, 6-7Fe....	Ampeco Metal.....	7.20	.....	649
88-96.1Cu, 2.3-10.5Al, Fe, Sn.....	Aluminum bronze.....	7.50-8.19	.....	1038-71
50Cu, 25Au, 25Ag.....	Cooper's pen metal.....	.....	.....	.....
47Cu, 33Au, 20Ag.....	Gold 8 carat.....	.....	.....	.....
40Cu, 31Au, 19Ag, 10Pd.....	Palladium gold.....	.....	.....	.....
77Cu, 15Pb, 8Sn.....	"B" Alloy, P.R.R.....	.....	.....	.....
95Cu, 5Mn.....	Manganese bronze.....	8.8	.....	1060
82-6Cu, 4-15Mn, 2-12Ni, Fe.....	Manganin.....	.....	.....	.....
82Cu, 15Mn, 3Ni.....	Manganin.....	8.5	.....	.....
70Cu, 25Mn, 5Ni.....	Manganin.....	.....	.....	.....
61Cu, 26Mn, 13Al.....	Magnetic alloy.....	.....	.....	.....
88.5Cu, 5Ni, 5Sn, 1.5Si....	Barberite.....	8.80	.....	1070
80Cu, 20Ni.....	Nickeline.....	8.5	.....	1185
75 Cu, 25Ni.....	Nickel coinage, U.S.A....	.....	.....	1205
75Cu, 20Ni, 5Zn.....	.....	8.58	16.40	1150
65Cu, 18Ni, 17Zn.....	Nickel silver 18% A....	8.75	18.36	1110
60Cu, 40Ni.....	Constantan.....	8.4	.....	1280
55-65Cu, 12-18Ni, 11-17-Zn, 8-12 Fe, 0.5-1Si....	Glass mold alloy, U.S.P. 1,360,773.....	.....	.....	.....
57Cu, 20Ni, 20Zn, 3Al....	Typewriter metal.....	.....	.....	.....
55Cu, 18Ni, 27Zn.....	Nickel silver 18% B....	8.69	.....	1055
45-60Cu, 40-55Ni, 0-1.4-Mn, 0.1C, Fe.....	Constantan.....	.....	.....	.....
45Cu, 33Ni, 16Sn, 5.5Zn, 1Bi.....	Sea water bronze.....	.....	.....	.....
67-81Cu, 19-30Pt, 0-4Zn.....	Cooper's gold.....	.....	.....	.....
94.8-96Cu, 3-4Si, 1-1.2Mn	.....	8.46	16.99	1000
98.55Cu, 1.40Sn.....	Phono-electric wire.....	.....	.....	.....
95.5Cu, 4.3Sn, 0.2P.....	Phosphor bronze 30....	8.91	18.90	1050
95Cu, 4Sn, 1Zn.....	Coinage bronze.....	8.96	.....	.....
92-7Cu, 1-8Sn, 0-2Zn.....	Medal bronze.....	.....	.....	.....
91.6Cu, 8.25Sn, 0.15P.....	Phosphor bronze 47.....	8.91	.....	.....
90Cu, 10Sn, trace P.....	Phosphor bronze 209....	9.00	.....	.....
90Cu, 10Sn.....	Bronze, gun metal.....	8.8	18	1000
88Cu, 10Sn, 2Zn.....	U.S. Government bronze, spec. G.....	.....	.....	.....
82Cu, 16Sn, 2Zn.....	Bronze bearings.....	.....	.....	.....
83Cu, 14Sn, 3.5Pb.....	Naval journal bearing, spec. HX.....	.....	.....	.....
83Cu, 14Sn, 3.5Zn.....	Naval journal bearing, spec. H.....	.....	.....	.....
83Cu, 14Sn, 3Zn, 0.8Pb...	U.S. Government bronze, spec. H.....	.....	.....	.....
79.7Cu, 10Sn, 9.5Sb, 0.8P	Phosphor bronze.....	8.8	.....	.....
78Cu, 22Sn.....	Bell metal.....	8.7	.....	870
67Cu, 33Sn.....	Bronze, speculum metal	8.6	18.6	745
58Cu, 28Sn, 9.5Pt, 3.5Zn, 1.5As.....	Cooper's mirror.....	.....	.....	.....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Copper				
90Cu, 10Zn.....	Commercial bronze; red brass.....	8.80	18.18×10^{-6}	1050
89Cu, 9Zn, 2Pb.....	Hardware bronze.....	8.83	18.18	1050
85Cu, 15Zn.....	Red brass.....	8.75	18.72	1030
85Cu, 13Zn, 2Sn.....	Pen metal.....			
84Cu, 16Zn.....	Medal metal.....			
70Cu, 29Ni, 1Sn.....	Admic.....		16.29	1205
70Cu, 29Zn, 1Sn.....	Admiralty.....	8.17	20.16	935
67-72Cu, 28-33Zn, Pb, Fe	Spring brass.....			
67-70Cu, 30-33Zn, Pb, Fe	Cartridge brass.....			
67Cu, 33Zn.....	Brass, ordinary yellow.....	8.40	18.5	940
64Cu, 25Zn, 8.5Pb, 2.5Sn.	Ship nail brass.....			
61.2Cu, 37.3Zn, 0.9Sn, 0.4Pb, 0.2Fe.....				
61Cu, 39Zn.....	Pin wire brass.....			905
60-1Cu, 31-7Zn, 1.4Sn, 0.7-9Pb.....	Pewter, for clock work.....			
60Cu, 40Zn.....	Muntz metal.....			840
60Cu, 25Zn, 15Ni.....	German silver.....		18.4	
60Cu, 19Zn, 10Al, 6Fe, 5Mn.....	Hytsenl bronze.....			980
58Cu, 42Zn.....	Solder, very refractory.....			850
58Cu, 17.5Zn, 11.5Ni, 11Co, 2Ag.....	Chinese silver.....			
57Cu, 28Zn, 15Sn.....	Solder, very soft, white.....			
55Cu, 45Zn.....	For brazing.....			880
55Cu, 25Zn, 20Ni.....	German silver, common formula.....			
53Cu, 43Zn, 1.3Sn, 0.3Pb.	Solder, hard yellow.....			
53Cu, 39Zn, 2.7Sn, 2.5Ni, 1.7Mn, 0.2Al.....	Manganin.....			
52Cu, 26Zn, 22Ni.....	German silver.....	8.45		
51Cu, 32Zn, 9.5Pb, 6.4Ni, 1.6Sn.....	Dienett's German silver.....			
50Cu, 50Zn.....	Solder, refractory.....			900
50-7Cu, 43-50Zn.....	Solder, hard.....			
50-62Cu, 20-32Zn, 12-30Ni.....	German silver, Birmingham.....			
50-60Cu, 20-5Zn, 20-5Ni	German silver, Austrian (Gersdorf).....			
46Cu, 34Zn, 20Ni.....	German silver, best.....			
Gold				
79Au, 21Al.....	Roberts-Austen (purple gold).....			750
92Au, 8Cu.....	Standard gold, Great Britain.....			900
90Au, 10Cu.....	Coinage.....	17.17		940
84Au, 16Cu.....	Jewelry.....			895
75Au, 24Cu.....	Jewelry.....			925
67Au, 25Cu, 8Ag.....	Pen metal.....			
67Au, 8-27Cu, 6.6-26Ag...	Gold 16 carat.....			
62Au, 13Cu, 11Ag.....	Gold 15 carat.....			
58Au, 14-28Cu, 4-28Ag...	Gold 14 carat.....			
50Au, 50Cu.....	Dark red gold.....			1000
50Au, 35Cu, 15Ag.....	Gold solder 12 carat.....			

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point C
			×10 ⁻⁶	
Gold				
42Au, 38-46Cu, 12-20Ag	Gold 10 carat.....	.....	.....	.....
86Au, 5.7-17Fe, 0-8.6Ag	Gray gold.....	.....	.....	.....
75Au, 25Fe	Blue gold.....	.....	.....	1365
75-85Au, 8-10Ni, 2-9Zn	White gold.....	.....	.....	.....
90Au, 10Pd	White gold, palladium gold.....	.....	.....	1265
60-90Au, 10-40Pd	Rhotanium.....	.....	.....	.....
80Au, 20Pd	Palau.....	.....	.....	1375
60Au, 40Pt	Platinum gold, white.....	.....	.....	1500
92Au, 4.9Ag, 3.1Cu	Gold 22 carat dental, dark.....	.....	.....	.....
91.66Au, 4.16Ag, 4.16Cu	Gold 22 carat.....	.....	.....	.....
92Au, 0-8.3Ag, 0-8.3Fe	Pale yellow gold.....	.....	.....	.....
84Au, 8.3-11Ag, 6-8.3Cu	Gold 20 carat.....	.....	.....	.....
75Au, 17Ag, 8.3Cu	Gold solder 16 carat.....	.....	.....	.....
75Au, 10-20Ag, 5-15Cu	Gold 18 carat.....	.....	.....	.....
63-75Au, 13-31Ag, 6.3-12Cu	Gold solder 18 carat.....	.....	.....	.....
70Au, 25Ag, 5Ni or Pt	Platinum substitute, electrical.....	.....	.....	.....
68Au, 25Ag, 7.5Pt	Platinum substitute, electrical.....	.....	.....	.....
63Au, 23Ag, 15Cu	Gold solder, best.....	.....	.....	.....
58Au, 30Ag, 12Cu	Gold 14 carat dental.....	.....	.....	.....
55Au, 32Ag, 14Cu	Gold solder, easy melt.....	.....	.....	.....
50 Au, 33Ag, 17Cu	Gold solder 14 carat.....	.....	.....	.....
41Au, 37Ag, 21Cu, 0.6 brass	Gold solder 10 carat.....	.....	.....	.....
40Au, 37Ag, 23Cu	Gold solder 8 carat.....	.....	.....	.....
Iridium				
95Ir, 5Pt	.....	22.38	.....	.....
Iron				
99.94Fe, 0.025S, 0.017Mn, 0.012C, 0.005P	Armco ingot iron.....	7.86	.....	1530
98.5Fe	Wrought iron.....	7.70	.....	1510
80Fe, 20Al	Ferro-aluminum.....	6.30	.....	1480
99Fe, 1C	Steel.....	7.83	12.0	1430
97Fe, 3C	Cast iron, white.....	7.60	.....	1150
94Fe, 3.5C, 2.5Si	Cast iron, gray.....	7.0	11.2	1230
Fe, 30-40Co, 5-9W, 1.5-3-Cr, 0.4-0.8C	K. S. Magnet steel.....	.....	.....	.....
Fe, 0.45Cu, 0.07Mo, 0.03C	Toncan copper; molybdenum iron.....	7.83	11.99	1525
Fe, + 10Cr, < 0.5Mn, + 0.25C	Stainless steel.....	7.75	.....	1510
90-2Fe, +8Cr, 0.4Mn, < 0.12C	Stainless steel.....	7.75	11.00	1450
90Fe, +8Cr, 0.4Mn, < 0.12C	Stainless iron.....	7.75	11.00	1450
88Fe, 16-7Cr, 0.4Mn, 0.1C max.	Stainless iron.....	.....	9.99	.....
86-8Fe, 12-4Cr, 0.3C	Carpenter stainless steel 2.....	7.75	.....	1425
86-8Fe, 12-4Cr, < 0.5Mn, < 0.1C, trace Ni	Defrust rustless iron...	7.75	.....	1480

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Iron				
86-8Fe, 12-4Cr, 0.1C.....	Carpenter stainless steel 1.....	7.78	.....	1490
85-9 Fe, 10-4 Cr, <0.5Mn, <0.13C.....	Stainless iron.....	7.78	10.19	1490
82-6Fe, 12-6Cr, <0.5Ni, <0.05Si, <0.5 Mn, <0.12C.....	Ascoloy 33.....	7.64	10.89	1495
86.7Fe, 12.5Cr, 0.35Mn, 0.35Ni, 0.12C.....	Sterling stainless steel T	7.75	9.99	1430
86.4Fe, 13.5Cr, 0.1C.....	Stainless I.....	7.75	10.91	.....
84-6Fe, 12.5-4.5Cr, 0.5- Mn max., 0.5Si max., 0.5Ni min., 0.12-0.18C.	Enduro S15.....	7.86	10.89	1475
84-6Fe, 12.5-4.5Cr, 0.5Mn max., 0.5Si max., 0.25Ni, 0.05-12C.....	Enduro S.....	7.86	10.89	1500
85.8Fe, 13.5Cr, 0.35Mn, 0.35C.....	Sterling stainless steel A	7.75	10.30	1425
85.6Fe, 14Cr, 0.35C.....	Stainless A.....	7.75	10.91	.....
85Fe, 13-4Cr, 2Ni max., 0.3-6Mn, 0.12C max....	Enduro KM1.....	7.75	9.99	1490
82-4Fe, 16-8Cr, <0.5Mn, C.....	Duraloy B.....	7.61	.....	1510
84.3Fe, 12Cr, 2.15C, 0.75- V, 0.75Co.....	Crocar.....	.....	.....	.....
82-4Fe, 16-8Cr, <0.5Mn, <0.1C, trace Ni.....	Special defirust rustless iron.....	7.75	.....	1480
81-3Fe, 16.5-8.5Cr, 0.75- Si, 0.1C max.....	Enduro A.....	7.64	11.00	1510
82.8Fe, 16.5Cr, 0.65C.....	Stainless B.....	.....	.....	.....
82.5Fe, 16.5Cr, 0.65C, 0.35Mn.....	Sterling stainless steel B	7.72	10.91	1425
82Fe, 16-8Cr, 0.5Mn, 0.5Ni, 0.35C.....	Sweetaloy 16.....	7.83	11.00	1495
79-82Fe, 16-9Cr, <0.5Mn, <0.5Ni, <0.5Si, <0.12C	Ascoloy 66.....	7.64	.....	.....
79-82Fe, 16.5-8.5Cr, 0.5- Mn max., 0.5-1.25Si max., 0.25Ni max., 0.1C max.....	Enduro A.....	7.86	10.80	1490
79-81Fe, 16.5-18Cr, 1-1.1 C, 0.75-1Si, 0.35-5Mn.	Delhi hard.....	7.75	9.99	1500
78.7Fe, 20Cr, 1Cu, 0.3C...	Carpenter stainless steel 3.....	7.70	.....	1475
71-6Fe, 17-9Cr, 7-10Ni, <0.05Mn, 0.2C.....	Defistain rustless iron..	7.83	.....	1455
71-5Fe, 17-9Cr, 8-9Ni, <0.5Mn, 0.06-25C.....	Midvale V2A.....	7.89	16.99	1450
70-5Fe, 25-30Cr, <0.5Mn, 0.25C, trace Ni.....	Defiheat rustless iron...	7.89	.....	1596
70-5Fe, 17-20Cr, 7-10Ni, <0.5Mn, <0.5Si, <0.2C	Allegheny metal.....	7.86-.95	17.30	1430-70
69-75Fe, 16.5-9.5Cr, 7-10 Ni, 0.75Si max., 0.5Mn max., 0.15C max.....	Enduro KA2.....	7.86	15.98	1400

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Iron				
74Fe, 18Cr, 8Ni, 0.18C...	Stainless N.....	.....	18.00×10^{-6}	.....
71-4Fe, 17.5-19Cr, 8-9Ni, 0.5Mn, 0.15C max.....	Rezistal KA2.....	7.86	15.98	.....
73.5Fe, 18Cr, 8Ni, 0.35Mn, 0.15C.....	Sterling nirosta steel...	7.92	16.99	1425
73Fe, 18Cr, 9Ni, 0.5Mn, C	Duraloy 18-8.....	7.86	14.99	1475
70-3Fe, 27-30Cr, 0.5Mn, C	Duraloy A.....	7.61	.....	1510
72.4Fe, 18Cr, 9.5Ni, 0.1C	Carpenter stainless steel 4.....	7.72	.....	1400
70-2Fe, 17.5-19Cr, 8-9Ni, 2-2.5Si, 0.1-2C.....	Rezistal 2C.....	7.86	15.98	.....
68-72Fe, 26-30Cr, <1Mn, <0.6Ni, <0.6Si, <0.25C	Ascology 55.....	7.61	10.19	.....
70Fe, 28Cr, 0.5Mn, 0.5Ni, 0.5C.....	Sweetaloy 19.....	7.86	11.00	1495
70Fe, 19Cr, 9Ni, 1Cu, 1Mo, 0.2C.....	Stainless U.....	.....	18.00	.....
69Fe, 18-20Cr, 8-10Ni, 0.5Mn, 0.15C.....	Sweetaloy 17.....	7.86	15.98	1450
68.1Fe, 20Cr, 7Ni, 4W, 0.35C, 0.5Mn.....	Midvale HR.....	8.03	.....	.....
60-6Fe, 22-5Cr, 10-3Ni, <1Mn, <0.5Si, <0.2C.	Ascology 44.....	7.86-95	16.20	1400-25
57-62Fe, 28-30Cr, 8-10Ni, 1.5Si, 0.5-7C, 0.4-5Mn	Misco C.....	7.89	.....	1540
60Fe, 28Cr, 10Ni, 0.5Mn, 0.35C.....	Sweetaloy 22.....	7.97	.....	1495
50-4Fe, 25-6Cr, 19-21Ni, 2-3Si, 0.2C.....	Rezistal 7.....	.....	.....	.....
85-8Fe, 11-4Mn, 1-1.3C..	Rol-Man Manganese steel.....	.....	.....	1290
86Fe, 13Mn, 1C.....	Manganese steel.....	7.81	.....	1510
96.5Fe, 3.5Ni.....	Nickel steel.....	.....	.....	1530
95.1Fe, 3Ni, 1.5Cr, 0.4C..	Nickel-chrome steel .....	.....	.....	.....
79Fe, 15Ni, 2.5Cr, 3Si, 0.6C.....	Durimet D.....	.....	.....	1450
74.2Fe, 25Ni, 0.8C.....	Ferro-nickel.....	8.1	18	1500
70.9Fe, 20Ni, 8Cr, 0.75Mn, 0.4C.....	Cyclops 17 Metal.....	8.00	.....	1425-80
70Fe, 25Ni, 5Si, 0.25C.....	Durimet A.....	7.89	.....	1500
67.8Fe, 32Ni, 0.2C.....	Ferro-nickel, valve steel	8.0	4	1480
67Fe, 22Ni, 10Cr, 0.5Mn, 0.2C.....	Sweetaloy 18.....	7.97	18.90	1450
63.8Fe, 36Ni, 0.2C.....	Invar.....	8.0	0.8	1495
57-61Fe, 24-6Ni, 10-2Cr, 4.5-5.5Si, 0.15C.....	Rezistal 255C.....	7.81	.....	.....
51-8Fe, 25-8Ni, 13-5Cr, 3-4W, 1-1.5Mn, 0.4-0.5C	Midvale ATV 3.....	8.11	.....	.....
57Fe, 25Ni, 15Cr, 0.3C.....	Pyrasteel.....	7.89	17.10	1450
47-56Fe, 33-9Ni, 10-2Cr, 1.1-1.8Mn, 0.25-35C..	Midvale ATV 1.....	8.06	.....	1450
53-6Fe, 24-6Ni, 17-8Cr, 2.5Si, 0.15-25C.....	Rezistal 4.....	7.78	16.29	.....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Iron				
53.85Fe, 46Ni, 0.15C.....	Platinite.....	8.2	7.5×10^{-6}	1470
47-52Fe, 34-6Ni, 10-2Cr, 4.5-5.5Si, 0.15C.....	Rezistal 355C.....	7.81	.....	.....
Fe, 35-7Ni, 15-7Cr, 1.4- 1.6Si, 0.6-0.8Mn, 0.5-0.7C	Standard Misco.....	7.97	13.50	1540
50Fe, 35Ni, 15Cr.....	Chromax castings.....	7.81	12.19	1480
48Fe, 35Ni, 12Cr, 5Si, 0.25 C.....	Durimet B.....	7.89	.....	1500
45Fe, 36Ni, 18Cr, 0.5Mn, 0.3C.....	Sweetaloy 20.....	7.97	.....	1495
97.6Fe, 2Si, 0.4C.....	Silicon steel.....	.....	.....	.....
73-97Fe, 1-24Si, 2-3C, 0.1P, 0.04-0.14S.....	Meehanite metal.....	.....	.....	.....
84.86Fe, 13.5Si, 1C, 0.4Mn, 0.18P, 0.05S.....	Tantiron.....	7.83	.....	1315
84.3Fe, 14.5Si, 0.85C, 0.35 Mn.....	Duriron.....	7.00	15.59	1265
94.5Fe, 5W, 0.5C.....	Tungsten steel.....	.....	.....	.....
75Fe, 18W, 6Cr, 0.3V, 0.7C	High speed steel.....	.....	.....	.....
66Fe, 17W, 10Cr, 3.5C, 2.5 Mo.....	Cristite 1.....	7.61	15.59	.....
Lead				
99.8Pb, 0.2As.....	Lead shot.....	.....	.....	.....
94Pb, 6Sb.....	Battery plates.....	.....	.....	300
92-4Pb, 6-8Sb.....	Antimonial lead.....	11.0	27.00	245-90
90Pb, 10Sb.....	Magnolia.....	.....	.....	270
85Pb, 15Sb.....	.....	10.4	19.5	250
84.33Pb, 14.38Sb, 0.61Fe, 0.68Zn.....	Car box metal.....	.....	.....	.....
82Pb, 15Sb, 3Sn.....	Type metal.....	.....	.....	.....
75Pb, 19Sb, 5Sn, 1Cu.....	White metal.....	9.5	.....	238
70Pb, 18Sb, 10Sn, 2Cu.....	Type metal.....	.....	.....	.....
92Pb, 8Cd.....	Aluminum solder, U.S.P. 1,333,666.....	.....	.....	.....
99.93Pb, 0.08Cu.....	Chemical lead.....	11.35	28.98	310 327
87Pb, 13Sn, 1Cu.....	Lead foil (Calin).....	.....	.....	.....
72Pb, 21Sn, 7Sb.....	Marine babbitt.....	.....	.....	.....
67Pb, 33Sn.....	Solder, plumber's.....	9.4	25.0	275
56-60Pb, 10-40Sn, 4.5- 30Sb.....	Type metal, common.....	.....	.....	.....
58Pb, 26Sn, 15Sb, 1Cu.....	Type metal, standard.....	.....	.....	.....
50Pb, 50Sn.....	Solder, half and half.....	.....	24	225
Mercury				
80Hg, 20Bi.....	Bismuth amalgam.....	.....	.....	90
70Hg, 30Cu.....	Dentist's amalgam.....	.....	.....	.....
Nickel				
99-99.5Ni(+Co), 1-0.25- C, 1-0.25Si, 1-0.3Mn, 1-0.55Fe, 1-0.25Cu.....	Nickel.....	8.86	.....	1450
Ni-Cr steel alloy of high Si content.....	Elcomet.....	8.03	.....	.....
80Ni, 20Cr.....	Chromel A.....	8.4	.....	.....
80Ni, 20Cr.....	Tophet A.....	8.50	13.00	1345
80Ni, 20Cr.....	Nichrome IV.....	8.50	13.21	1395

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
			$\times 10^{-6}$	
Nickel				
58Ni, 22Cr, 6-7Cu, 4Mo, 2W, 1Mn, 6-7Fe	Illium (Illium G).....	8.31	13.50	1300
60Ni, 20Cr, 10Fe, 1.75Mn, 0.5C	Firearmor.....	8.00	13.99	1330
73Ni, 17.5Co, 6.5Fe, 2.5- Ti, 0.2Mn.....	Konel.....	8.61	10.66	1450-1500
90Ni, 3Cu, 1.5Al, 10 ± Si	Hastelloy D.....	7.81	11.59	1160
60-70Ni, 25-35Cu, 1-3Fe, 0.25-2Mn, 0.02-1.5Si, 0.5-3C.....	Monel metal.....	8.80	.....	1330
60Ni, 33Cu, 6.5Fe.....	Monel metal.....	8.90	14	1360
75Ni, 12Fe, 11Cr, 2Mn...	Nichrome wire or ribbon	.....	.....	.....
61Ni, 23Fe, 16Cr.....	Chromel C.....	8.24	.....	.....
60-2Ni, 23-6Fe, 10-11Cr, 2-2.5W, 1.2-1.5Mn, 0.3- 35C.....	Midvale BTG.....	8.47	.....	1450
60Ni, 28Fe, 12Cr.....	Tophet C.....	8.19	13.70	1350
60Ni, 25Fe, 15Cr, 0.7C...	Nichrome castings.....	8.08	12.10	.....
60Ni, 24Fe, 16Cr, 0.1C...	Nichrome.....	8.17	13.70	1350
60Ni, 20Fe, 20Mo.....	Hastelloy A.....	8.80	10.71	1300
35Ni, 17Fe, 15Cr, 1.75Mn, 0.5C.....	Zorite.....	7.92	.....	1300
Ni, 2-6Mn, Fe, Cu.....	Spark plug wire.....	.....	.....	.....
Ni, Fe, Mo.....	Hastelloy C.....	8.91	.....	1350
60Ni, 20Pt, 10Pd, 10V...	Palau.....	.....	.....	.....
Magnesium				
93.8Mg, 6Al, 0.2Mn...	Dowmetal E.....	1.79	0.000027	616
90.8Mg, 6Al, 0.2Mn, 3Zn...	Dowmetal H.....	1.83	0.000027	613
92.6Mg, 6.5Al, 0.2Mn, 0.7Zn.....	Dowmetal J.....	1.80	0.000027	618
98.5Mg, 1.5Mn.....	Dowmetal M.....	1.76	0.000027	649
90.8Mg, 8.5Al, 0.2Mn, 0.5Zn.....	Dowmetal O.....	1.80	0.000027	610
88.9Mg, 10Al, 0.1Mn, 1Zn...	Dowmetal P.....	1.82	0.000027	596
90.2Mg, 9Al, 0.2Mn, 0.6Zn	Dowmetal R.....	1.81	0.000027	604
98.8Mg, 3Al, 0.2Mn, 3Zn...	Dowmetal X.....	1.80	0.000027	635
Palladium				
67Pd, 33Ag.....	Palladium alloy.....	.....	.....	1415
90Pd, 10Rh.....	Palladium alloy.....	.....	.....	.....
Platinum				
80-100Pt, 0-20Ir.....	Platinum-iridium.....	.....	7.5-8.8	.....
90Pt, 10Ir.....	Platinum-iridium.....	21.61	8.8	.....
55Pt, 28Ir, 7Rh, 3Cu, 4Fe, Pd, As.....	Platinum-iridium (natu- ral).....	.....	.....	.....
80-100Pt, 0-20Rh.....	Platinum-rhodium for thermocouples.....	.....	8.8	.....
90Pt, 10Rh.....	Platinum-rhodium.....	.....	.....	.....
50Pt, 38Ag, 12Cu.....	Cooper's pen metal.....	.....	.....	.....
Silver				
92.5Ag, 7.5Cu.....	Standard silver.....	.....	18	920
92.5Ag, 5.75Cu, 1.75Cd..	Standard cadmium silver	.....	.....	.....
92Ag, 8Cu.....	Silver-rupee.....	.....	.....	920
90Ag, 10Cu.....	Silver U.S.coins.....	10.3	.....	890

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Silver				
80Ag, 20Cu.....	Jewelry.....	.....	18 × 10 ⁻⁶	820
80Ag, 13Cu, 6.8Zn.....	Silver solder, hard.....	.....	.....	.....
70-5Ag, 20-3Cu, 5-7.5Zn.....	Silver solder, medium.....	.....	.....	.....
66Ag, 23Cu, 10Zn.....	Silver solder, French.....	.....	.....	.....
63Ag, 30Cu, 7.5Zn.....	Silver solder, common.....	.....	.....	.....
55Ag, 29Cu, 12Au, 5.5Zn.....	Gold solder, very easy melt.....	.....	.....	.....
70Ag, 25Pd, 5Co.....	Platinum substitute (Cooper's).....	.....	.....	.....
73Ag, 27Pt.....	Platinum solder.....	.....	.....	1160
70 Ag, 25Pt, 5Ni.....	Platinum substitute (Cooper's).....	.....	.....	.....
66.7Ag, 33.3Pt.....	Platinum silver.....	.....	.....	1230
40Ag, 40Sn, 14Cu, 6Zn...	Silver solder, Bu. Stands.	.....	.....	.....
Tantalum				
99.5Ta.....	Tantalum.....	16.6	6.50	2850
Tin				
78Sn, 9Al, 8Zn, 5Cd.....	Aluminum solder, Bu. Stands. SN1.....	.....	.....	.....
70-94Sn, 3.7-15Sb, 1.8-5-Cu, 0-9Pb, 0-5Zn.....	Brittania metal, German.....	.....	.....	.....
90-1Sn, 7-8Sb, 1.4Cu.....	Brittania metal, plate.....	.....	.....	.....
90Sn, 10Sb.....	Brittania.....	.....	.....	255
90Sn, 7Sb, 3Cu.....	Babbitt.....	.....	.....	.....
85-90Sn, 9-11Sb, 0-3Zn, 0.2-1Cu.....	Brittania metal, cast.....	.....	.....	.....
85-90Sn, 5-10Sb, 1-3Cu, 0-3Zn, 0-2Bi.....	Brittania metal, English Babbitt metal.....	.....	.....	.....
89Sn, 7.3Sb, 3.7Cu.....	.....	.....	.....	.....
85-8Sn, 5.6-15Sb, 1-5Bi, 0.1-3.7 Cu, 0-1.5Zn.....	Brittania metal, spoons.....	.....	.....	.....
82Sn, 12Sb, 6Cu.....	White metal.....	.....	.....	.....
80Sn, 20Sb.....	.....	.....	.....	320
75Sn, 12.5Sb, 12.5Cu.....	Antifriction.....	7.53	.....	233
72Sn, 24Sb, 3.9Cu.....	Brittania metal, plate (Ludenscheidt).....	.....	.....	.....
68Sn, 32Cd.....	.....	7.70	.....	180
85Sn, 6.8Cu, 6Bi, 1.7Sb.....	Pewter.....	.....	.....	.....
83Sn, 8.4Cu, 8.3Sb.....	Hard babbitt.....	.....	.....	.....
97Sn, 3Cu.....	Rhine metal.....	7.35	.....	300
74-89Sn, 0-20Pb, 0-7.6Sb, 0-3.5Cu, Zn.....	Pewter.....	.....	.....	.....
88Sn, 8Pb, 4Cu, 0.5Sb.....	Tin foil.....	.....	.....	.....
67Sn, 33Pb.....	Solder, tinman's.....	.....	.....	180
60Sn, 40Pb.....	Tinsel.....	.....	.....	.....
50Sn, 32Pb, 18Cd.....	Eutectic fusible alloy.....	.....	.....	145
86Sn, 9Zn, 5Al.....	Aluminum solder, Bu. Stands. SN4.....	.....	.....	.....
86Sn, 9Zn, 5Al, 0.25P.....	Aluminum solder, Bu. Stands. SN3.....	.....	.....	.....
73Sn, 21Zn, 5Pb, 1P, Sn...	Aluminum solder, Seifert.....	.....	.....	.....
69Sn, 26Zn, 2.4Al, 2.4P...	Aluminum solder, Bu. Stands. SN2.....	.....	.....	.....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Tin			$\times 10^{-6}$	
62Sn, 15Zn, 11Al, 8.3Pb, 2.5Cu, 1.2Sb.....	Aluminum solder, Sterling.....			
55Sn, 33Zn, 11Al, 1Cu....	Aluminum solder, Soluminum.....			
48Sn, 48Zn, 3Cu, 1Pb, 1Sb	Brittania metal, cast....			
41Sn, 28Zn, 3Cu, 0.6Mn, 0.1Al.....	Aluminum solder, U.S.P. 1,332,899.....			
Tungsten				
W-C.....	Blackor.....	14.0		
W, 0.5-0.75ThO ₂	Tungsten filaments.....			
WC + 13% Co.....	Carboloy.....	14.10	6	
Zinc				
96Zn, 4Al, .05Mg.....	ASTM Alloy XXIII..... SAE Alloy 903 Zamak-3.....	6.7	26.9	380.9
95Zn, 4Al, 1Cu, .05Mg.....	Zamak-5.....	6.7	27.4	380.6
93Zn, 4Al, 3Cu, .05Mg.....	ASTM Alloy XXI..... SAE Alloy 902 Zamak-2.....	6.8	27.7	379.5
95Zn, 5Al.....		6.80	28	390
90Zn, 6Al, 4Cu.....	Aluminum solder, Geophysical Lab., Carnegie Inst.....			
65Zn, 20Al, 15Cu.....	Aluminum solder, Wüst No. 2.....			
50Zn, 30Al, 20Cu.....	Aluminum solder, Wüst			
75Zn, 20Cd, 5Al.....	Aluminum solder, Bu. Stands. ZN1.....			
67Zn, 33Cu.....	Solder, readily fusible.....		20	795
60Zn, 40Cu.....	Solder, white.....		21	840
50Zn, 44Cu, 3.3Sn, 1.2Pb..	Solder, nearly white.....			
45-57Zn, 35-45Cu, 8-10Ni	Solder, brazing.....			
69Zn, 26Sn, 5Cu, 3Sb.....	Zinc babbitt.....			
63Zn, 21Sn, 12Pb, 3.2Cu..	Battery plates.....			
50Zn, 49Sn, 0.7Sb, 0.2Cu..	Aluminum solder, Roesch.....			

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Supplementary Table

Composition	Name	Sp. gr.	Thermal expansion coeff. per °C.	Melting point °C.
Aluminum				
98.8Al, 1.2Mn	Wrought Aluminum alloy 3S			
97.75Al, 1.3Mg, 0.25Cr, 0.7Si	Wrought Aluminum alloy 53S			
98.4Al, 1.0Si, 0.6Mg	Aluminum alloys 51S			
98.15Al, 1.0Si, 0.6Mg, 0.25Cr	Wrought Aluminum alloy A51S			
97.25Al, 2.5Mg, 0.25Cr	Wrought Aluminum Alloy 52S			
97.2Al, 2.5Cu, 0.3Mg	Aluminum alloys A17S			
96.2Al, 3.8Mg	Sand-casting Aluminum alloys 214			
96Al, 4.0Cu	Sand-casting Aluminum alloys 195			
95Al, 4.0Cu, 0.5Mn, 0.5Mg	Wrought Aluminum alloy 17S			
93.5Al, 4.0Cu, 0.5Mg, 2.0Ni	Wrought Aluminum alloy 18S			
93.4Al, 4.5Cu, 0.6Mn, 1.5Mg	Wrought Aluminum alloy 24S			
93.2Al, 1.3Cu, 5.0Si, 0.5Mg	Sand-casting Aluminum alloys 355			
92.7Al, 7.0Si, 0.3Mg	Sand-casting Aluminum alloys 356			
91.6Al, 1.4Cu, 5.0Si, 0.75Mn, 0.5Mg, 0.75Ni	Wrought Aluminum alloy A355			
90.0Al, 10Mg	Sand-casting Aluminum alloy 220			
89.3Al, 7.5Cu, 1.2Fe, 2.0Zn	Sand-casting Aluminum alloy 112			
87.5Al, 12.5Si, 0.8Ni	Aluminum Alloys, 47			
85.4Al, 0.8Cu, 12.0Si, 1.0Mg, 0.8Ni	Aluminum Alloys, 32S			
Chromium				
66-70Cr, 4-6C, 24-30Fe	High carbon ferrochromium			1200-1300
67-72Cr, 0.06-2.00C, 32.94-26Fe	Low carbon ferrochromium			1255-1350
Copper				
97.6Cu, 1.4Sn, 1.0Si	Tin-Silicon Bronze	8.78	17.9×10^{-6}	1041
97.0Cu, 3Si	Silicon Bronze	8.55	17.9×10^{-6}	1024
90.85Cu, 7.15Al, 2.0Si	Aluminum Silicon Bronze Rod	7.70	17.9×10^{-6}	990
67.0Cu, 31.0Zn, 2.0Al	Aluminum Brass Condenser Tubing	8.33		970
70.0Cu, 30.0Ni	Cupro Nickel Condenser Tubing	8.94	16.0×10^{-6}	1227
62.25Cu, 35.75Zn, 2.0Pb	Leaded Brass Sheet	8.50		921
60.75Cu, 35.85 Zn, 3.4Pb	Free Turning Brass Rod	8.50	20.4×10^{-6}	885
60.0Cu, 39.0Zn, 1.0Sn	Naval Brass	8.42	21.1×10^{-6}	888

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (CONTINUED)

Composition	Name	Melting point °C.
Iron		
98.755-98.355Fe, .90-1.05C, .25-.50Mn, .040P, .055S	Steel, S.A.E. No. 1095	
98.31-97.61Fe, .25-.35C, .80-1.10Cr, .40-.60Mn, .15-.25Mo, .040P, .050S	Steel, S.A.E. No. X4130	
98.16-97.46Fe, .35-.45C, .80-1.10Cr, .60-.90Mn, .040P, .050S	Steel, S.A.E. No. 5140	
98.03-97.13Fe, .12-.17C, .40-.60Cr, .70-.90Mn, .15-.25Mo, .40-.60Ni, .20-.35Si	Natl. Emergency Steel, NE8613	
98.01-97.21Fe, .35-.45C, .60-.90Mn, .80-1.10Cr, .15-.25Mo, .040P, .050S	Steel, S.A.E. No. 4140	
97.72-97.22Fe, .48-.53C, 1.60-1.90Mn, .20-.35Si	Natl. Emergency Steel, NE1350	
97.72-96.97Fe, .28-.33C, .40-.60Cr, 1.20-1.5Mn, .40-.60Si	Natl. Emergency Steel, NE9630	
97.91-97.21Fe, .45-.55C, .80-1.10Cr, .60-.90Mn, .035P, .040S, 0.15V	Steel, S.A.E. No. 6150	
97.51-96.31Fe, .35-.45C, .45-.75Cr, .60-.90Mn, 1.00-1.50Ni, .040P, .050S	Steel, S.A.E. No. 3140	
97.36-96.16Fe, .35-.45C, .60-.90Cr, .60-.90Mn, 1.00-1.50Ni, .040P, .050S	Steel, S.A.E. No. X3140	
97.21-96.36Fe, .35-.45C, .50-.80Mn, .20-.30Mo, 1.65-2.00Ni, .040P, .050S	Steel, S.A.E. No. 4640	
96.87-96.07Fe, .95-1.10C, .25-.45 Mn, .20-.35Si, 1.30-1.60Cr, 0.35Ni, 0.08Mo	Natl. Emergency Steel, NE52100C	
96.76-95.46Fe, .35-.45C, .60-.90Cr, .50-.80Mn, .20-.30Mo, 1.50-2.00Ni, .040P, .050S	Steel, S.A.E. No. X4340	
96.57-95.60Fe, .38-.45C, .95-1.0Al, 1.40-1.80Cr, .40-.70 Mn, .30-.45Mo	Nitriding Steels N135, Modified	
95.71-94.81Fe, .35-.45C, .60-.90Mn, 3.25-3.75Ni, .040P, .050S	Steel, S.A.E. No. 2340	
94.94-93.64Fe, 0.17C, 1.25-1.75Cr, .30-.60Mn, 3.25-3.75Ni, .040P, .050S	Steel, S.A.E. No. 3312	
94.76-93.86Fe, .10-.20C, .30-.60Mn, 4.75-5.25Ni, .040P, .050S	Steel, S.A.E. No. 2515	
93.85-92.18Fe, .20-.37C, 1.10-1.40Al, 1.00-1.30Cr, .40-.70Mn, .20-.30Mo, 3.25-3.75Ni	Nitriding Steels, N125N	
81.20-77.00Fe, .50-.70C, 3.00-4.00Cr, .30Mn, 15.00-18.00W	Steel, S.A.E. No. 71660	
80.5-65Fe, 4.5-5C, 15-30Mn	Spiegeleisen	1065-1225
73.91-68.49Fe, .08C, 17.00-20.00Cr, .20-.70Mn, .75Mo, 8.00-10.00Ni, .030P, .030S	Steel, S.A.E. No. 30905	
71.11-65.61Fe, 0.08C, 17.5-20Cr, 1.25Mn, 8-10Ni, 2-3Si, .03P, .03S	Enduro 18-8-B	
67.9Fe, .10C, 17Cr, 3.0Mo, 12Ni	Stainless 316	
63.55-39.5Fe, 0.2-3.5C, 35-45V	Ferrovanadium	1425-1475
56.75-52.75Fe, 0.25C, 24-26Cr, 19-21Ni	Stainless 310	
Magnesium		
98.5Mg, 1.5Mn	Wrought Magnesium Alloys No. AM3S	
95.8Mg, 3Al, 1Zn, 0.2Mn	Wrought Magnesium Alloys No. AM52S	
93.7Mg, 2.5Al, 0.3Mn, 3.5Cd	Dowmetal L	
93.1Mg, 6.5Al, 0.2Mn, 0.2Si	Dowmetal EX	
91.6Mg, 7Al, 1.2Zn, 0.2Mn	Wrought Magnesium Alloys No. AM-C57S	
91Mg, 3.5Al, 0.5Mn, 5Sn	Wrought Magnesium Alloys No. AM65S	
90.8Mg, 8.5Al, 0.5Zn, 0.2Mn	Wrought Magnesium Alloys No. AM-C58S	

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (CONTINUED)

Composition	Name	Melting point °C.
Magnesium		
90.8Mg, 6Al, 3Zn, 0.2Mn.....	Casting Magnesium Alloys No. AM265.....	
89.8Mg, 10Al, 0.2Mn.....	Casting Magnesium Alloys No. AM240.....	
89.4Mg, 10Al, 0.1Mn, 0.5Si.....	Dowmetal K.....	
89.3Mg, 10Al, 0.2Mn, 0.5Si.....	Casting Magnesium Alloys No. AM230.....	
88.8Mg, 9Al, 2Zn, 0.2Mn.....	Casting Magnesium Alloys No. AM260.....	
Manganese		
80-85Mn, 0.3-1.0C, 19.7-14Fe.....	Low carbon ferromanganese.....	
78-82Mn, 6-8C, 16-10Fe.....	Standard ferromanganese.....	1255
Molybdenum		
55-65Mo, 45-35Fe.....	Ferromolybdenum.....	1625
Silicon		
74-79Si, 26-21Fe.....	75% Ferrosilicon.....	1175
Tungsten		
78-83W, 1.0C, 21-16Fe.....	Ferrotungsten.....	1800-1900

PROPERTIES OF COMMERCIAL PLASTICS

Compiled by Lauchlin M. Currie—1943

Trade Names of Plastics

Trade Names	Type	Composition	No.	Made By
Alvar	T.P.	Polyvinyl acetal	11	S
Ameroid	T.P.	Casein	2	A
Bakelite	T.S.	Phenol Formaldehyde	7, 9	B
Bakelite	T.S.	Urea Formaldehyde	17	B
Bakelite	T.P.	Cellulose acetate	3	B
Bakelite	T.P.	Polystyrene	14	B
Beetle	T.S.	Urea Formaldehyde	17	Be
Butacite	T.P.	Polyvinyl Acetal	11	Du
Catalin	T.S.	Phenol Formaldehyde	7, 9	Ca
Catalin	T.S.	Melamine Formaldehyde	18	Ca
Celluloid	T.P.	Cellulose Nitrate	3	Ce
Crystalite	T.P.	Acrylate and Methacrylate Resin	1	Rh
Durez	T.S.	Phenol Formaldehyde	7	Dz
Durite	T.S.	Phenol Formaldehyde	7	Dr
Durite	T.S.	Phenolic Furfural	10	Dr.
Ethocel	T.P.	Ethylcellulose	6	D, H
Ethofoil	T.P.	Ethylcellulose	6	D
Fibestos	T.P.	Cellulose Acetate	3	Mo
Formica	T.S.	Phenol Formaldehyde (Lamination)	8	F
Formvar	T.P.	Polyvinyl Formal	11	S
Gelva	T.P.	Polyvinyl acetate	12	S
Haveg	T.S.	Phenol Formaldehyde (Lamination)	8	Ha
Indur	T.S.	Phenol Formaldehyde	7	R
Koroseal	T.P.	Modified Polyvinyl Chloride	13A	Gr
Loalin	T.P.	Polystyrene	14	Ca
Lucite	T.P.	Methyl Methacrylate Resin	1	Du
Lumarith	T.P.	Cellulose Acetate	3	Ce
Lustron	T.P.	Polystyrene	14	Mo
Makalot	T.S.	Phenol Formaldehyde	7	M
Marblette	T.S.	Phenol Formaldehyde	9	Ma
Melmac	T.S.	Melamine Formaldehyde	18	Be
Micarta	T.S.	Phenol Formaldehyde (Lamination)	8	W
Nitron	T.P.	Cellulose Nitrate	5	Mo
Nixonoid	T.P.	Cellulose Nitrate	5	N
Nixonite	T.P.	Cellulose Acetate	3	N
Opalon	T.S.	Phenol Formaldehyde (cast)	9	Mo
Parlon	T.P.	Rubber Derivative	16	H
Plaskon	T.S.	Urea Formaldehyde	17	P
Plaskon	T.S.	Melamine Formaldehyde	18	P
Plastacele	T.P.	Cellulose Acetate	3	Du
Plexiglas	T.P.	Acrylate and Methacrylate Resin	1	Rh
Plioform	T.P.	Rubber Derivative	15	Gy
Pliolite	T.P.	Rubber Derivative	15	Gy
Prystal	T.S.	Phenol Formaldehyde (cast)	9	Ca
Protectoid	T.P.	Cellulose Acetate	3	Ce
Pyralin	T.P.	Cellulose Nitrate	5	Du
Resinox	T.S.	Phenol Formaldehyde	7	Mo
Saflex	T.P., T.S.	Polyvinyl Butyrals	11	Mo
Saflex F	T.P.	Polyvinyl Formals	11	Mo
Saran	T.P.	Vinylidene Chloride	19	D
Styron	T.P.	Polystyrene	14	D
Tenite	T.P.	Cellulose Acetate	3	T
Tenite II	T.P.	Cellulose Acetate Butyrate	4	T
Textolite	T.S.	Phenol Formaldehyde	7, 8	Ge
Tornesit	T.P.	Rubber Derivative	16	H
Vinylite A	T.P.	Polyvinyl Acetate	12	C
Vinylite Q	T.P.	Polyvinyl Chloride	13A	C
Vinylite V	T.P.	Vinyl chloride-acetate copolymer	13	C
			13A	
Vinylite X	T.P.	Polyvinyl Butyral	11	C

PROPERTIES OF COMMERCIAL PLASTICS (Continued)

Manufacturers of Plastics

Code Designation	Manufacturer	Producers of
A	American Plastics Corp. 50 Union Square, New York City	2
B	Bakelite Corporation 30 E. 42 Street, New York City	3, 7, 9, 14, 17
Be	Beetle Products Division American Cyanamid Company 30 Rockefeller Plaza, N.Y.C.	17, 18
C	Carbide and Carbon Chemicals Corp. 30 East 42 St., New York City	11, 12, 13, 13A
Ca	Catalin Corporation No. 1 Park Ave., New York City	7, 9, 14, 18
Ce	Celanese Corporation of America 180 Madison Avenue, New York City 16	3, 5
D	Dow Chemical Company Midland, Michigan	6, 14, 19
Du	E. I. duPont de Nemours and Co. Plastics Department 10th and Market Street Wilmington, Del.	1, 3, 5, 11
Dz	Durez Plastics and Chemicals, Inc North Tonawanda, N. Y.	7
Dr	Durite Plastics 5010 Summerdale Ave. Philadelphia, Pa.	7, 10
F	Formica Insulation Company 4671 Spring Grove Avenue Cincinnati, Ohio	8
Ge	General Electric Co., Plastic Dept. No. 1 Plastics Ave., Pittsfield, Mass.	7, 8
Gr	B. F. Goodrich Company Akron, Ohio	13A
Gy	Goodyear Tire and Rubber Co., Inc. Akron, Ohio	15
Ha	Haveg Corporation East Newark, Delaware	8
H	Hercules Powder Co. 999 Market Street Wilmington, Del.	3, 6, 16
M	Makalot Corporation 262 Washington Street Boston, Mass.	7
Ma	Marblette Corporation 37-21 30th Street Long Island City, N.Y.	9
Mo	Monsanto Chemical Co. Plastics Division Springfield, Mass.	3, 5, 7, 11
N	Nixon Nitration Works Nixon, N. J.	3, 5
P	Plaskon Company, Inc. 2121 Sylvan Ave., Toledo, Ohio	17, 18
R	Reilly Tar and Chem. Corporation 500 Fifth Ave., New York City	7
Rh	Röhm and Haas Co., Inc. 222 W. Washington Square Philadelphia, Pa.	1
Sc	Shawinigan Chemicals, Ltd. P. O. Box 6072, Montreal, Canada	11, 12

PROPERTIES OF COMMERCIAL PLASTICS (Continued)

Manufacturers of Plastics (Continued)

Code Designation	Manufacturer	Producers of
S	Shawinigan Products Corp. 350 Fifth Avenue New York City	11, 12
T	Tennessee Eastman Corp. Kingsport, Tenn.	3, 4
W	Micarta Division Westinghouse Elect. and Mfg. Co. Trafford, Pa.	8

PROPERTIES OF

	GROUP NUMBER	1	2
	Resin Group and Sub-Group or Filler	ACRYLATE & METHACRYLATE	CASEIN
	Type	Thermoplastic	Thermoplastic
	Typical Trade Names	Crystalite Lucite Plexiglas	Ameroid
1	Forms Available Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	Cs, I, Lq, P, R, S, T..	R, S, T.....
2	Clarity.....	Transparent.....	Translucent.....
3	Color Possibilities.....	Unlimited.....	Unlimited.....
4	Odor.....	None.....	None.....
5	Taste.....	None.....	None.....
6	Working Properties		Usually machined.....
a	Molding Qualities.....	Good to excellent.....	Poor.....
b	Compression Molding—Temp. °F.....	280–370°F.....	200–225°F.....
c	Compression Molding— Pressure, lbs./in. ²	1000–7000.....	2000–2500.....
d	Injection Molding—Temp. °F.....	325–500°F.....	
e	Injection Molding— Pressure, lbs./in. ²	10,000–30,000.....	
7	Compression Ratio— Vol. Dry Powder/Vol. Solid.....	1.6–2.5.....	
8	Shrinkage Allowance in Molding.....	0.001–0.006.....	
9	Tendency to Cold Flow.....	Very slight.....	
10	Machining Qualities.....	Fair to excellent.....	Good.....
11	Other Forming Qualities..... B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T.M.—transfer molding	B, I, E—Special Technique	Sw—Limited.....
	Physical Properties		
12	Specific Gravity.....	1.16–1.20.....	1.34–1.35.....
13	Specific Volume—in. ³ /lbs.....	23.8–23.0.....	20.7–20.5.....
14	Refractive Index— _n D.....	1.49–1.51.....	
15	Electrical Properties (See Note 2).....		
a	D.C. Resistivity—30°C, ohm-cm.....	10 ¹⁵	
b	Dielectric Strength—Volts/Mil.....	500.....	400–700.....
c	Dielectric Constant—60–1000 Cycle.....	3–3.7.....	
	Dielectric Constant—10 ⁶ Cycle.....	2.7–3.3.....	6.1–6.8.....
d	Power Factor—60–1000 Cycle.....	0.05–0.07.....	
	Power Factor—10 ⁶ Cycle.....	0.015–0.03.....	0.052.....

COMMERCIAL PLASTICS (Continued)

	3		4	5
	CELLULOSE ACETATE		CELLULOSE ACETO-BUTYRATE	CELLULOSE NITRATE
	SHEET	MOLDED	Thermoplastic	Thermoplastic
	Thermoplastic	Thermoplastic		
	Bakelite Lumarith Plastacele Protectoid	Fibestos Hercules Nixonite Tenite	Tenite II	Celluloid Nitron Nixonoid Pyralin
1	F, R, S, T.	P, F, S, T, R.	P, S.	F, L, Lq, P, R, S, T
2	Transparent.	Transparent.	Transparent.	Transparent.
3	Unlimited.	Unlimited.	Unlimited.	Unlimited.
4	None to very slight.	None to very slight.	None to slight.	Slight camphor.
5	None to very slight.	None to very slight.	None to slight.	Slight camphor.
6	Excellent.	Fair to excellent.	Fair to excellent.	Good.
a	200-320°F.	180-390°F.	260-370°F.	135-250°F.
b	500-5000.	500-5000.	500-5000.	1500-5000.
c		300-450°F.	310-420°F.	
d		8000-32,000.	8000-32,000.	
e				
7		2.0-2.8.	2.0-2.4.	
8	0.002-0.010.	0.001-0.010.	0.001-0.010.	
9	Very slight.	Slight.	Very slight.	Very slight.
10	Good to excellent.	Fair to excellent.	Good to excellent.	Good to excellent.
11	B, Sw, Sp.	E, I, Sh, Sp, T.M. good.	E, I, Sp, Sw, T.M.	All generally excel- lent.
12	1.27-1.60.	1.27-1.60.	1.14-1.23.	1.35-1.60.
13	21.8-17.3.	21.8-17.3.	24.3-22.5.	20.5-17.3.
14	1.47-1.51.	1.46-1.50.	1.47-1.49.	1.46-1.58.
15				
a	10 ¹⁰ -10 ¹³	10 ¹⁰ -10 ¹³	10 ⁶ -10 ¹² -50%R.H.	10 ¹⁰ -10 ¹¹
b	290-1800.	290-900.	250-900.	300-1500.
c	3.5-7.5 (60).	3.0-6.4 (60).	3.4-6.4 (60).	6.7-8.8 (60).
d	3.0-5.3.	3.2-6.2.	3.2-6.2.	6.15-6.2.
e	0.02-0.07 (60).	0.01-0.06 (60).	0.01-0.06 (60).	0.06-0.15 (60).
f	0.04-0.09.	0.01-0.06.	0.01-0.55.	0.07-0.10.

PROPERTIES OF

GROUP NUMBER		1	2
Resin Group and Sub-Group or Filler		ACRYLATE & METHACRYLATE	CASEIN
16	Thermal Properties		
a	Burning Rate.....	Slow.....	Very slow.....
b	Heat Distortion.....	50-85°C.....	149°C.....
c	Softening Point.....	66-123°C.....	94°C.....
d	Specific Heat—cal./gm. °C.....	0.35-0.40.....	
e	Thermal Conductivity— cal./sec. cm. °C.....	(1-10) × 10 ⁻⁴	
f	Thermal Expansion.....	(8-9) × 10 ⁻⁵ /°C.....	(4.1-6.8) × 10 ⁻⁵ /°C.....
17	Mechanical Properties		
a	Modulus of Elasticity—10 ⁶ lbs./in. ²	4-6.....	5.1-5.7.....
b	Tensile Strength—lbs./in. ²	4000-10,000.....	7,600-10,000.....
c	Elongation—%.....	1-15.....	2.5.....
d	Compression Strength—lbs./in. ²	10,000-15,000.....	27,000-53,000.....
e	Hardness—Brinell No. 2.5 mm. ball, 25 kg. load.....	18-20.....	23.....
f	Impact Strength, Izod.....	0.2-0.4.....	1.0.....
18	Physical Chemical Properties		
a	Effect of Sunlight.....	Very slight.....	Slight fading.....
b	Ultra Violet Light.....	Transmits most.....	Slight fading.....
19	Effect of Aging—Room Temp.....	None.....	Drier—harder.....
20	Effect of Water—Hot.....	Softens.....	Softens.....
	Effect of Water—Cold.....		Softens slowly.....
21	Water Absorption—% 24 Hour Immersion—25°C.....	0.3-0.5.....	7-14.....
22	General Resistance to		
a	Acids—Weak.....	Excellent.....	Good.....
b	Acids—Strong.....	Excellent except oxidizing.....	Decomposes.....
c	Alkalies—Weak.....	Excellent.....	Softens.....
d	Alkalies—Strong.....	Excellent.....	Decomposes.....
e	Alcohols.....	Swells or dissolves.....	Good.....
f	Ketones.....	Dissolves.....	Good.....
g	Esters.....	Dissolves.....	Good.....
h	Hydrocarbons—Aromatic.....	Dissolves.....	Good.....
i	Hydrocarbons—Aliphatic.....	Good.....	Good.....
j	Oils—Mineral.....	Excellent.....	Good.....
k	Oils—Animal.....	Excellent.....	Good.....
l	Oils—Vegetable.....	Excellent.....	Good.....

COMMERCIAL PLASTICS (Continued)

	3		4	5
	CELLULOSE ACETATE		CELLULOSE ACETO-BUTYRATE	CELLULOSE NITRATE
	SHEET	MOLDED		
16				
a	1.5-2.0 (slow) . . .	1.5-2.5 (slow) . . .	1.5 (slow)	Very high
b	50-100°C.	41-102°C.	47-102°C.	43-66°C.
c	60-120°C.	60-130°C.	60-127°C.	60-90°C.
d	0.3-0.4	0.3-0.45	0.3-0.4	0.34-0.38
e	(4.5-8.7) $\times 10^{-4}$. . .	(4.0-8.7) $\times 10^{-4}$. . .	(4-8) $\times 10^{-4}$	(3.1-5.5) $\times 10^{-4}$. . .
f	(5-16) $\times 10^{-5}/^{\circ}\text{C}$. . .	(8-16) $\times 10^{-5}/^{\circ}\text{C}$. . .	(11-17) $\times 10^{-5}/^{\circ}\text{C}$. . .	(6.5-16) $\times 10^{-5}/^{\circ}\text{C}$. . .
17				
a	1.0-3.5	0.6-4.0	0.6-3.5	1.5-4
b	3000-11,000	1700-10,000	2400-7500	5000-12,000
c	7.5-55	8-80	13-82	4-60
d	4000-30,000	5000-27,000	7200-22,500	20,000-30,000
e	6-11 (10 kg.)	1.5-15 (10 kg.)	6-12	8-11 (10 kg.)
f	1.5-4.0	0.3-4.6	0.5-7.5	2.0-8.0
18				
a	Very slight	Very slight	Slight, varies	Yellows, becomes brittle
b	Slight yellowing	Slight yellowing	Slight	Yellows, becomes brittle
19	Slight shrinkage	Slight shrinkage	Slight	Hardens slightly
20	Softens and swells	Softens and swells		Softens
	Swells slightly	Swells slightly		Slight
21	2-5	1.0-4.7	0.8-2.1	0.6-2.6
22				
a	Fair	Fair	Fair	Fair to good
b	Decomposes	Decomposes	Decomposes	Attacked by oxidizing acids
c	Fair	Fair	Fair	Fair to good
d	Decomposes	Decomposes	Decomposes	Decomposes
e	Soluble	Soluble	Poor	Soluble
f	Soluble	Soluble	Soluble	Soluble
g	Soluble	Soluble	Soluble	Soluble
h	Good	Good	Good	Good
i	Good	Good	Good	Good
j	Good	Good	Good	Good
k	Good	Good	Good	Good
l	Good	Good	Good	Good

PROPERTIES OF

GROUP NUMBER		6	
Resin Group and Sub-Group or Filler		ETHYL CELLULOSE	
			Wood Flour Filled
Type		Thermoplastic	Thermosetting
Typical Trade Names		Ditzler Ethocel Ethofoil Lumarith Nixon, Hercules	Molded and Cast
1	Forms Available Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	F, I, Lq, P, R, S, T....	P, R, S, T.....
2	Clarity.....	Transparent.....	Opaque.....
3	Color Possibilities.....	Unlimited.....	Limited.....
4	Odor.....	None to noticeable aldehydic	None to
5	Taste.....	None to noticeable aldehydic	None
6	Working Properties		
a	Molding Qualities.....	Good to excellent....	Excellent.....
b	Compression Molding—Temp. °F.....	320–380°F.....	280–360°F.....
c	Compression Molding— Pressure, lbs./in. ²	1000–5000.....	2000–4500.....
d	Injection Molding—Temp. °F.....	350–460°F.....	275–375°F.....
e	Injection Molding— Pressure, lbs./in. ²	3000–30,000.....	2000–10,000.....
7	Compression Ratio— Vol. Dry Powder/Vol. Solid.....	2.2–2.7.....	1.8–5.7.....
8	Shrinkage Allowance in Molding.....	0.001–0.008.....	0.005–0.010.....
9	Tendency to Cold Flow.....	Slight.....	None.....
10	Machining Qualities.....	Good.....	Good to fair.....
11	Other Forming Qualities..... B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T.M.—transfer molding	B, E, I, Sp, Sw, T.M.....	T.M., I.....
Physical Properties			
12	Specific Gravity.....	1.05–1.25.....	1.25–1.52.....
13	Specific Volume—in. ³ /lbs.....	26.4–22.2.....	22.2–18.2.....
14	Refractive Index— _D	1.47.....	
15	Electrical Properties (See Note 2)		
a	D.C. Resistivity—30°C, ohm-cm.....	10 ¹³ –10 ¹⁵	10 ¹⁰ –10 ¹²
b	Dielectric Strength—Volts/Mil.....	400–1700.....	275–500.....
c	Dielectric Constant—60–1000 Cycle.....	2.5–4.0 (1000).....	4–15.....
	Dielectric Constant—10 ⁶ Cycle.....	2.0–3.5.....	4–8.....
d	Power Factor—60–1000 Cycle.....	0.005–0.038 (1000).....	0.04–0.30.....
	Power Factor—10 ⁶ Cycle.....	0.007–0.03.....	0.035–0.10.....

COMMERCIAL PLASTICS (Continued)

7		8	
PHENOL-FORMALDEHYDE COMPOUNDS			
MOLDED		LAMINATED	
Mineral Filled	Macerated Fabric Filler	Paper Base	Fabric Base
Thermosetting	Thermosetting	Thermosetting	

Laminated Products—Bakelite, Durez, Durite, Micarta, Catalin, Haveg, Indur, Makalot, Resinox, Textolite, Formica
Products—Bakelite, Catalin, Gemstone, Marblette, Opalon, Prystal

1	P, R, S, T.....	P, R, S, T.....	L, S, T.....	L, S, T.....
2	Opaque.....	Opaque.....	Opaque.....	Opaque.....
3	Limited.....	Limited.....	Limited.....	Limited.....
4	Slight—Some Characteristically Phenolic—Most Phenolic When Hot			
5	None.....	None.....	None.....	None.....
6				
a	Poor to excellent...	Poor to good.....		
b	270–350°F.....	270–350°F.....	275–350°F.....	275–350°F.....
c	2000–6000.....	2000–8000.....	1000–3000.....	1000–3000.....
d	275–350°F.....			
e	2000–15,000.....			
7	2.0–12.5.....	2.5–17.8.....	1.5–3.....	1.5–3.....
8	0.001–0.007.....	0.003–0.007.....		
9	None.....	None.....	None.....	None.....
10	Poor to good.....	Fair to good.....	Fair to good.....	Fair to good.....
11	T.M., I.....	T.M.....		
12	1.59–2.09.....	1.36–1.47.....	1.30–1.40.....	1.30–1.40.....
13	17.4–13.3.....	20.4–18.8.....	21.3–19.8.....	21.3–19.8.....
14				
15				
a	10 ⁹ –10 ¹⁵	10 ⁹ –10 ¹¹	10 ¹⁰ –10 ¹³	10 ¹⁰ –10 ¹²
b	225–450.....	150–450.....	400–1300.....	150–600.....
c	4.5–50.....	4.5–10.....		
d	4–20.....	4–6.....	3.6–5.5.....	4.5–7.....
	0.01–0.30.....	0.08–0.30.....		
	0.005–0.20.....	0.03–0.10.....	0.02–0.08.....	0.02–0.08.....

PROPERTIES OF

GROUP NUMBER		6	
Resin Group and Sub-Group or Filler		ETHYL CELLULOSE	Wood Flour Filled
16	Thermal Properties		
a	Burning Rate.....	2.0-6.7.....	Very low.....
b	Heat Distortion.....	45-93°C.....	115-140°C.....
c	Softening Point.....	93-135°C.....	None.....
d	Specific Heat—cal./gm. °C.....	0.25-0.46.....	0.35-0.40.....
e	Thermal Conductivity— cal./sec. cm. °C.....	$(3.8-6.3) \times 10^{-4}$	$(4-12) \times 10^{-4}$
f	Thermal Expansion.....	$(10-14) \times 10^{-5}/^{\circ}\text{C}$	$(3.0-7.5) \times 10^{-5}/^{\circ}\text{C}..$
17	Mechanical Properties		
a	Modulus of Elasticity— 10^6 lbs./in. ²	1.7-5.0.....	8-15.....
b	Tensile Strength—lbs./in. ²	2000-12,000.....	4000-11,000.....
c	Elongation—%.....	2-40.....	0.6.....
d	Compression Strength—lbs./in. ²	10,000-20,000.....	16,000-36,000.....
e	Hardness—Brinell No. 2.5 mm. ball, 25 kg. load.....		30-45.....
f	Impact Strength, Izod.....	0.6-6.5.....	0.15-0.45.....
18	Physical Chemical Properties		
a	Effect of Sunlight.....	Slight.....	
b	Ultra Violet Light.....	Slight.....	
19	Effect of Aging—Room temp.....	None to slight.....	None.....
20	Effect of Water—Hot.....	None.....	
	Effect of Water—Cold.....	None.....	
21	Water Absorption—% 24 Hour Immersion—25°C.....	0.7-2.0.....	0.2-0.75.....
22	General Resistance to		
a	Acids—Weak.....	Fair to good.....	Good.....
b	Acids—Strong.....	Poor.....	De.....
c	Alkalies—Weak.....	Good.....	
d	Alkalies—Strong.....	Good.....	Decomposed.....
e	Alcohols.....	Fair.....	Good.....
f	Ketones.....	Fair.....	Excellent.....
g	Esters.....	Poor.....	Excellent.....
h	Hydrocarbons—Aromatic.....	Poor.....	Excellent.....
i	Hydrocarbons—Aliphatic.....	Good.....	Excellent.....
j	Oils—Mineral.....	Fair to good.....	Excellent.....
k	Oils—Animal.....	Poor.....	Excellent.....
l	Oils—Vegetable.....	Poor to fair.....	Excellent.....

COMMERCIAL PLASTICS (Continued)

7		8		
PHENOL-FORMALDEHYDE COMPOUNDS				
MOLDED		LAMINATED		
Mineral Filled		Macerated Fabric Filled	Paper Base	Fabric Base
16	Nil	Approximately Nil.	Very low.	Very low.
a	115-160°C	115-160°C	>160°C	>160°C
b	None	None	None	None
c	0.25-0.35	0.30-0.35	0.3-0.4	0.3-0.4
d	(8-20) × 10 ⁻⁴	(3-7) × 10 ⁻⁴	(5-8) × 10 ⁻⁴	(5-8) × 10 ⁻⁴
e	(1.5-4.0) × 10 ⁻⁵ /°C.	(1-6) × 10 ⁻⁵ /°C.	(1.7-2.5) × 10 ⁻⁵ /°C.	(1.7-3) × 10 ⁻⁵ /°C.
f	10-45	7-12	4-30	3.5-15
17	3500-10,000	5000-8000	7000-18,000	8000-15,000
a	0.6	0.7		
b	10,000-36,000	20,000-32,000	20,000-40,000	20,000-44,000
c		32-40	24-40	30-45
d	0.11-1.50	0.4-4.8	0.3-7.6	0.8-15.0
e				
f	Light Shades May Discolor and Surface Resistance Be Reduced			
18	None	None	Mechanical and Electrical properties improved	
a	Insulation Value Reduced			
b	Insulation Value Reduced			
19	0.01-0.3	0.5-2.5	0.3-9.0	0.3-9.0
20				
21	Good	Good	Good	Good
a	composed by Oxidizing Acids—Reducing and Organic Acids No Effect			
b	Little to Marked Effect—Depending on Alkali			
c	Decomposed	Decomposed	Decomposed	Decomposed
d	Good	Good	Good	Good
e	Excellent	Excellent	Excellent	Excellent
f	Excellent	Excellent	Excellent	Excellent
g	Excellent	Excellent	Excellent	Excellent
h	Excellent	Excellent	Excellent	Excellent
i	Excellent	Excellent	Excellent	Excellent
j	Excellent	Excellent	Excellent	Excellent
k	Excellent	Excellent	Excellent	Excellent
l	Excellent	Excellent	Excellent	Excellent

PROPERTIES OF

	GROUP NUMBER	9	10
		PHENOL-FORMALDEHYDE COMPOUNDS (Contd.)	PHENOLIC FURFURAL FILLED
		CAST UNFILLED	
		Thermosetting	Thermosetting
	Type		
	Typical Trade Names	See 7 & 8	Durite
1	Forms Available Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	Cs.	Cs, I, Lq, P.
2	Clarity.	Transparent.	Opaque.
3	Color Possibilities.	Unlimited.	Limited.
4	Odor.	Most phenolic when hot	
5	Taste.	None.	
6	Working Properties.		
a	Molding Qualities.	Not moldable.	Fair to excellent.
b	Compression Molding—Temp. °F.		300–400°F.
c	Compression Molding— Pressure, lbs./in. ²		500–10,000
d	Injection Molding—Temp. °F.		250–375°F.
e	Injection Molding— Pressure, lbs./in. ²		300–30,000
7	Compression Ratio— Vol. Dry Powder/Vol. Solid		2.5–15.0
8	Shrinkage Allowance in Molding.		0.002–0.006
9	Tendency to Cold Flow.	None.	None.
10	Machining Qualities.	Fair to excellent.	Fair to good
11	Other Forming Qualities. B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T.M.—transfer molding	May be softened and bent into simple shapes	E, T.M.
	Physical Properties		
12	Specific Gravity.	1.20–1.70	1.3–2.0
13	Specific Volume—in. ³ /lbs.	23.0–16.3	21.3–13.9
14	Refractive Index— _n D.	1.5–1.7	
15	Electrical Properties (See Note 2)		
a	D.C. Resistivity—30°C. ohm-cm.	10 ⁸ –10 ¹⁴	10 ⁹ –10 ¹²
b	Dielectric Strength—Volts/Mil.	76–450	200–600
c	Dielectric Constant—60–1000 Cycle.	5–31	4–20 (1000)
	Dielectric Constant—10 ⁶ Cycle.	4.7–14.5	5–18
d	Power Factor—60–1000 Cycle.	0.01–0.50	0.04–0.15
	Power Factor—10 ⁶ Cycle.	0.01–0.13	0.035–0.10

COMMERCIAL PLASTICS (Continued)

	11	12	13
	VINYL RESINS		
	POLYVINYL ACETALS UNFILLED	POLYVINYL ACETATE	COPOLYVINYL CHLORIDE-ACETATE
	Thermoplastic	Thermoplastic	Thermoplastic
	Alvar Formvar See Note 1.	Gelva Vinylite A	Vinylite V
1	F, I, Lq, P, S.....	I, Lq, P.....	F, I, L, Lq, P, R, S, T....
2	Transparent to opaque.....	Transparent.....	Transparent to opaque.....
3	Unlimited.....	Unlimited.....	Unlimited.....
4	None.....	None.....	None.....
5	None.....	None.....	None.....
6	None.....	None.....	None.....
a	Fair to excellent.....	Poor.....	Good to excellent.....
b	210-335°C.....		240-340°C.....
c	150-3500.....		500-2000.....
d	250-340°F.....		250-340°F.....
e	15,000-30,000.....		3,000-30,000.....
7			2.00.....
8			0.001 max.....
9	Slight.....	Appreciable.....	Slight.....
10	Fair to good.....		Good to excellent.....
11			B, E, I, Sh, Sw, Sp, T.M. all good
12	1.05-1.23.....	1.19.....	1.34-1.37.....
13	26.4-22.5.....	23.2.....	20.7-20.2.....
14	1.46-1.50.....	1.467.....	1.53.....
15			
a	$5 \times 10^{10} - >10^{14}$ —50% R.H.....		10^{14} — 10^{15}
b	360-1600.....	950-1200.....	400-500, 1/8" thick.....
c	2.7-5.6 (60).....	2.8-3.7.....	3.1-3.6.....
d	3.33-3.92.....		3.0-3.4.....
	0.007-0.115.....	0.007.....	0.01-0.04 (60).....
	0.007-0.06.....		0.01-0.02.....

1. Of the acetals, polymerized vinyl butyral is plasticized and sheeted for use in safety glass lamination. Typical trade-names: Saflex, Butacite, Vinylite X.

PROPERTIES OF

	GROUP NUMBER	9	10
		PHENOL-FORMALDEHYDE COMPOUNDS (Contd.)	PHENOLIC FURFURAL FILLED
		CAST UNFILLED	
	Thermal Properties		
16	Burning Rate.....	Very low.....	Very low.....
a	Heat Distortion.....	35-90°C.....	132-146°C.....
b	Softening Point.....		Chars 204-290°C.....
c	Specific Heat—cal./gm. °C.....	0.3-0.4.....	0.3-0.4.....
d	Thermal Conductivity—cal./sec. cm. °C.....	(3-5)×10 ⁻⁴	(3.5-20)×10 ⁻⁴
e	Thermal Expansion.....	(4-15)×10 ⁻⁵ /°C.....	(2-4.5)×10 ⁻⁵ /°C.....
f	Mechanical Properties		
17	Modulus of Elasticity—10 ⁵ lbs./in. ²	1.3-15.....	7-45.....
a	Tensile Strength—lbs./in. ²	3000-12,000.....	5000-11,000.....
b	Elongation—%.....		
c	Compression Strength—lbs./in. ²	13,000-33,600.....	24,000-36,000.....
d	Hardness—Brinell No. 2.5 mm. ball, 25 kg. load	30-45.....	30-46 (50 kg.).....
e	Impact Strength, Izod.....	0.1-1.5.....	0.3-4.6.....
f	Physical Chemical Properties		
18	Effect of Sunlight.....	Color may fade.....	Light shades discolor.....
a	Ultra Violet Light.....		
b	Effect of Aging—Room temp.....	Hardens slightly.....	Hardens slightly.....
19	Effect of Water—Hot.....	Insulation value reduced	
20	Effect of Water—Cold.....		
21	Water Absorption—% 24 Hour Immersion—25°C.....	0.01-0.6.....	0.1-1.4.....
22	General Resistance to		
a	Acids—Weak.....	Good.....	Good.....
b	Acids—Strong.....	Decomposed by	oxidizing acids
c	Alkalies—Weak.....		Good.....
d	Alkalies—Strong.....	Decomposed.....	Decomposed.....
e	Alcohols.....	Good.....	Good.....
f	Ketones.....	Excellent.....	Excellent.....
g	Esters.....	Excellent.....	Excellent.....
h	Hydrocarbons—Aromatic.....	Excellent.....	Excellent.....
i	Hydrocarbons—Aliphatic.....	Excellent.....	Excellent.....
j	Oils—Mineral.....	Excellent.....	Excellent.....
k	Oils—Animal.....	Excellent.....	Excellent.....
l	Oils—Vegetable.....	Excellent.....	Excellent.....

COMMERCIAL PLASTICS (Continued)

	11	12	13
	VINYL RESINS		
	POLYVINYL ACETALS UNFILLED	POLYVINYL ACETATE	COPOLYVINYL CHLORIDE-ACETATE
16			
a	Slow.....	Slow.....	Nil.....
b	47-100°C.....	40-50°C.....	60-69°C.....
c	47-200°C.....	65-175°C.....	60-65°C.....
d	About 0.30.....	0.389.....	0.244.....
e	$(3.4-4.4) \times 10^{-4}$	3.8×10^{-4}	$(3.5-4.1) \times 10^{-4}$
f	$(7.8-22.3) \times 10^5/^{\circ}\text{C}$	$8.6 \times 10^{-5}/^{\circ}\text{C}$	$6.9 \times 10^{-5}/^{\circ}\text{C}$
17			
a	3.5-4.0.....		3.5-4.1.....
b	2000-12,000.....	1500-5000.....	8000-10,000.....
c	4-450.....		None.....
d			
e			12-25.....
f	0.44-1.2.....		0.2-1.2.....
18			
a	Slight.....	None.....	Darkens on prolonged exposure.....
b	Slight.....	Slight.....	Darkens on prolonged exposure.....
19	Slight.....	None.....	None to slight.....
20	Butyrals absorb 18%.....	Softens and whitens.....	Softens.....
21	0.6-5.0.....	2.....	None.....
22			
a	Attacked.....	Good.....	Excellent.....
b	Attacked.....	Poor.....	Excellent.....
c	Excellent.....	Good.....	Excellent.....
d	Good.....	Poor.....	Excellent.....
e	Fair to soluble.....	Soluble.....	Excellent.....
f	Swells.....	Soluble.....	Poor—dissolves.....
g	Swells.....	Soluble.....	Poor—dissolves.....
h	Swells.....	Soluble.....	Poor—swells.....
i	Depends.....	Excellent.....	Excellent.....
j	Excellent.....	Excellent.....	Excellent.....
k	Excellent.....	Excellent.....	Excellent.....
l	Excellent.....	Excellent.....	Excellent.....

PROPERTIES OF

GROUP NUMBER		13A	14
Resin Group and Sub-Group or Filler		POLYVINYL CHLORIDE (& COPOLYMER) PLASTICIZED	POLYSTYRENE
Type		Thermoplastic	Thermoplastic
Typical Trade Names		Koroseal Vinylite (Copolymer)	Bakelite Loalite Lustron Styron
1	Forms Available. Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	Cs, F, I, L, Lq, P, R, S, T	F, I, L, Lq, P, R, S, T
2	Clarity	Transparent—opaque	Transparent
3	Color Possibilities	Unlimited	Unlimited
4	Odor	Varies	None
5	Taste	Varies	None
6	Working Properties.		
a	Molding Qualities	Fair to good	Excellent
b	Compression Molding—Temp. °F	250–350°C	240–375°F
c	Compression Molding—Pressure, lbs./in. ²	500–1000	1000–10,000
d	Injection Molding—Temp. °F	250–350°F	300–500°F
e	Injection Molding—Pressure, lbs./in. ²	18,000–30,000	10,000–40,000
7	Compression Ratio—Vol. Dry Powder/Vol. Solid		2.0–2.3
8	Shrinkage Allowance in Molding	0.016–0.10	0.002–0.008
9	Tendency to Cold Flow	Slight	Very slight
10	Machining Qualities	Fair to good	Fair to good
11	Other Forming Qualities B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T.M.—transfer molding	E, I Calendering	B, E, I, T.M. Compression molding
Physical Properties			
12	Specific Gravity	1.2–1.7	1.054–1.070
13	Specific Volume—in. ³ /lbs.	23.0–16.3	26.3–25.9
14	Refractive Index— ⁿ _D	1.544	1.592–1.597
15	Electrical Properties (See Note 2)		
a	D.C. Resistivity—30°C, ohm-cm.	5×10^{12} – 10^{16} (25°C.)	10^{17} – 10^{19}
b	Dielectric Strength—Volts/Mil.	300–2000	See Note 2
c	Dielectric Constant—60–1000 Cycle	6.5–12 (60)	2.5–2.7
	Dielectric Constant—10 ⁶ Cycle	4.2	2.5–2.7
d	Power Factor—60–1000 Cycle	0.055–0.136 (60)	0.00006–0.0008
	Power Factor—10 ⁶ Cycle	0.100	0.0001–0.0008

2. In general for all plastics, dielectric strength is a function of the thickness. For polystyrene in particular: Instantaneous Dielectric Strength—0.005 in. thick = 3500v/mil; 0.015 in. thick = 2200 v/mil; 0.125 in. thick = 500–700 v/mil. Complete information concerning thicknesses tested is not available for other plastics.

COMMERCIAL PLASTICS (Continued)

	15	16	17
	RUBBER COMPOUNDS		UREA FORMALDEHYDE
	MODIFIED ISOM- ERIZED RUBBER	CHLORINATED	
	Thermoplastic	Thermoplastic	Thermosetting
	Plioform Pliolite	Tornesit Parlon	Bakelite Beetle Plascon
1	Lq, P, F	P	I, L, P
2	Transparent	Translucent	Translucent
3	Unlimited	Pastels	Unlimited pastels
4	None	Slight	None
5	None	Slight	None
6			
a	Good	Fair	Excellent
b	260-300°F	280-380°F	280-330°F
c	1200-4000	2000-6000	1500-6000
d		300-400°F	
e		3,000-10,000	
7	3.0	2.2-2.6	2.2-3.0
8	0.000		0.005-0.011
9	Slight	Slight	None
10	Fair	Good	Fair
11			
12	1.06	1.64	1.45-1.55
13	26.1	16.9	19.1-17.9
14		1.56	1.54-1.6
15			
a	$(5-7) \times 10^{16}$	2.5×10^{13}	10^6-10^{13}
b		2300	650-720
c	2.7(60)	3	6.6-9.5 (60)
d	0.006 (60)	0.003 (60)	5.5-7.7
	0.002	0.006	0.035-0.10 (60)
			0.01-0.035

PROPERTIES OF

	GROUP NUMBER	13A	14
	Resin Group and Sub-Group or Filler	POLYVINYL CHLORIDE (& COPOLYMER) PLASTICIZED	POLYSTYRENE
16	Thermal Properties		
a	Burning Rate.....	Depends on plasticizer	Slow.....
b	Heat Distortion.....	77-121°C.....	72-88°C.....
c	Softening Point.....		88-121°C.....
d	Specific Heat—cal./gm.°C.....	0.30-0.51.....	0.31-0.33.....
e	Thermal Conductivity— cal./sec. cm.°C.....	(3.9-4.0) × 10 ⁻⁴	(1.9-3.2) × 10 ⁻⁴
f	Thermal Expansion.....	(7-25) × 10 ⁻⁵ /°C.....	(6-8) × 10 ⁻⁵ /°C.....
17	Mechanical Properties		
a	Modulus of Elasticity—10 ³ lbs./in. ²		1.7-6.....
b	Tensile Strength—lbs./in. ²	850-9000.....	3000-10,000.....
c	Elongation—%.....	Up to 550.....	1.5-5.....
d	Compression Strength—lbs./in. ²		11,000-17,000.....
e	Hardness—Brinell No. 2.5 mm. ball, 25 kg. load.....		20-30.....
f	Impact Strength, Izod.....	Does not shatter.....	0.2-0.5.....
18	Physical Chemical Properties		
a	Effect of Sunlight.....	None to slight fading.....	Slight yellowing.....
b	Ultra Violet Light.....		
19	Effect of Aging—Room temp.....	None.....	None.....
20	Effect of Water—Hot.....	Slight.....	None to 60°C.....
	Effect of Water—Cold.....	None.....	None.....
21	Water Absorption—% 24 Hour Immersion—25°C.....	0.1-0.6.....	0.00-0.06.....
22	General Resistance to		
a	Acids—Weak.....	Excellent.....	Excellent.....
b	Acids—Strong.....	Good to excellent.....	Good.....
c	Alkalies—Weak.....	Excellent.....	Excellent.....
d	Alkalies—Strong.....	Good to excellent.....	Excellent.....
e	Alcohols.....	Varies.....	Excellent.....
f	Ketones.....	Soluble.....	Swells.....
g	Ester.....	Soluble.....	Soluble.....
h	Hydrocarbons—Aromatic.....	Poor—swells.....	Soluble.....
i	Hydrocarbons—Aliphatic.....	Varies.....	Fair to good.....
j	Oils—Mineral.....	Varies.....	Poor to excellent.....
k	Oils—Animal.....	Varies.....	Poor to excellent.....
l	Oils—Vegetable.....	Varies.....	Poor to excellent.....

COMMERCIAL PLASTICS (Continued)

	15	16	17
	RUBBER COMPOUNDS		
	MODIFIED ISOMERIZED RUBBER	CHLORINATED	UREA FORMALDEHYDE
16			
a	Slow	Nil	Very low
b	75-105°C	60°C	127-138°C
c	75-105°C	80-110°C	None
d		0.37-0.43	0.4
e	$(2.6-2.9) \times 10^{-4}$	3.0×10^{-4}	7.1×10^{-4}
f	$(7-8) \times 10^{-5}/^{\circ}\text{C}$	$(12-13) \times 10^{-5}/^{\circ}\text{C}$	$(2.5-3.0) \times 10^{-5}/^{\circ}\text{C}$
17			
a	4.7	1-6	12-16
b	4300	2700-5000	5500-13,000
c	0.013	0.5-2.2	<1
d	8500-11,000		24,000-35,000
e	85-90 (Shore)	70-80 (Shore)	48-54 (10 mm. 500 kg.)
f	2.6-6.2	0.14-2.8	0.14-0.36
18			
a	Slight craze	Darkens	None
b			
19	None	Slight embrittlement	Hardens slightly
20	Softens	Varies	
		None	
21	0.02	0.1-0.3	0.75-3.0
22			
a	Good	Excellent	Good
b	Good for HCl, H ₂ SO ₄	Excellent	Decomposes
c	Good	Excellent	Depends on alkali
d	Good	Excellent	Decomposes
e	Good	Excellent	Good to excellent
f	Good	Poor	Good to excellent
g	Good	Poor	Good to excellent
h	Poor	Poor	Excellent
i	Poor	Good	Excellent
j	Poor	Good	Excellent
k	Poor	Poor	Excellent
l	Poor	Poor	Excellent

PROPERTIES OF

GROUP NUMBER		18	19
Resin Group and Sub-Group or Filler		MELAMINE FORMALDEHYDE FILLED	VINYLDENE CHLORIDE
Type		Thermosetting	Thermoplastic
Typical Trade Names		Catalin Melmac Plaskon	Saran Velon
1	Forms Available. Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	I, L, P, Lq.	F, P, R, S, T.
2	Clarity.	Opaque to translucent	Opaque to translucent
3	Color Possibilities.	Dark to unlimited.	Dark to unlimited.
4	Odor.	None.	Slight.
5	Taste.	None.	Slight.
6	Working Properties.		
a	Molding Qualities.	Excellent.	Good—special technique
b	Compression Molding—Temp. °F.	280–340°F.	220–350°F.
c	Compression Molding— Pressure, lbs./in. ²	1000–6000.	500–5000.
d	Injection Molding—Temp. °F.	290–330°F. (T.M.)	300–400°F.
e	Injection Molding— Pressure, lbs./in. ²	5000–18,000 (T.M.)	10,000–30,000.
7	Compression Ratio— Vol. Dry Powder/Vol. Solid	2–12.	2.
8	Shrinkage Allowance in Molding.	0.004–0.012.	0.004–0.12.
9	Tendency to Cold Flow.	None.	Slight.
10	Machining Qualities.	Fair.	Good.
11	Other Forming Qualities. B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—sawing, T.M.—transfer molding	T.M.	E, I, Sh, T.M. special technique
	Physical Properties		
12	Specific Gravity.	1.49–1.86.	1.68–1.75.
13	Specific Volume—in. ³ /lbs.	18.6–14.9.	16.5–15.8.
14	Refractive Index— _n D.	1.6.	1.60–1.63.
15	Electrical Properties (See Note 2)		
a	D.C. Resistivity—30°C. ohm-cm.	2.4×10^{11}	10^{14} – 10^{16}
b	Dielectric Strength—Volts/Mil.	390.	350–500.
c	Dielectric Constant—60–1000 Cycle.	6.4–11.6.	2.5–5.0.
	Dielectric Constant— 10^6 Cycle.	6.7.	2.5–5.0.
d	Power Factor—60–1000 Cycle.	0.07–0.17 (60)	0.03–0.15.
	Power Factor— 10^6 Cycle.	0.041.	0.03–0.15.

COMMERCIAL PLASTICS (Continued)

GROUP NUMBER		18	19
Resin Group and Sub-Group or Filler		MELAMINE FORMALDEHYDE FILLED	VINYLDENE CHLORIDE
16	Thermal Properties		
a	Burning Rate.....	Very low.....	Self extinguishing
b	Heat Distortion.....	130-141°C.....	66-82°C.....
c	Softening Point.....	None.....	116-138°C.....
d	Specific Heat—cal./gm.°C.....		0.32.....
e	Thermal Conductivity—cal./sec. cm.°C.....		2.2×10^{-4}
f	Thermal Expansion.....	$(1.8-4.5) \times 10^{-5}/^{\circ}\text{C}.$	$15.8 \times 10^{-5}/^{\circ}\text{C}.$
17	Mechanical Properties		
a	Modulus of Elasticity— 10^6 lbs./in. ²	12-16.....	0.2-2.0.....
b	Tensile Strength—lbs./in. ²	5500-7000.....	4000-7000.....
c	Elongation—%.....	<0.5.....	10-40.....
d	Compression Strength—lbs./in. ²	30,000.....	7500-8500.....
e	Hardness—Brinell No. 2.5 mm. ball, 25 kg. load.....		
f	Impact Strength, Izod.....	0.27-0.90.....	2-8.....
18	Physical Chemical Properties		
a	Effect of Sunlight.....	None.....	Darkens slightly.....
b	Ultra Violet Light.....		Darkens slightly.....
19	Effect of Aging—Room Temp.....	Hardens slightly.....	Slight.....
20	Effect of Water—Hot.....	None.....	Slight under 74°C.....
	Effect of Water—Cold.....	None.....	None.....
21	Water Absorption—%.....	0.07-0.6.....	<0.1.....
	24 Hour Immersion—25°C.....		
22	General Resistance to		
a	Acids—Weak.....	Excellent.....	Excellent.....
b	Acids—Strong.....	Good to decompose.....	Good to excellent.....
c	Alkalies—Weak.....	Good to excellent.....	Excellent.....
d	Alkalies—Strong.....	Good to excellent.....	Good except NH ₃
e	Alcohols.....	Excellent.....	Excellent.....
f	Ketones.....	Excellent.....	Good.....
g	Esters.....	Excellent.....	Good.....
h	Hydrocarbons—Aromatic.....	Excellent.....	Good.....
i	Hydrocarbons—Aliphatic.....	Excellent.....	Excellent.....
j	Oils—Mineral.....	Excellent.....	Excellent.....
k	Oils—Animal.....	Excellent.....	Excellent.....
l	Oils—Vegetable.....	Excellent.....	Excellent.....

PLASTICS COMPARATOR

PLASTICS COMPARATOR

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The figure 1 indicates relative excellence, higher figures indicate relative lower order of excellence. The all important matter of cost is purposely omitted.

PLASTIC MATERIAL	Toughness (Impact Strength)	Flexural Strength	Tensile Strength	Color Stability	Cold Flow	Water Resistance	Acid Resistance	Caustic Resistance	Solvent Resistance	Dimensional Change on Aging	Heat Resistance	Flammability	Heat Insulation	Specific Gravity	Hardness	Loss Factor	Resistivity	Dielectric Strength	Moldability Around Inserts
Phenolic: General Purpose	10	3	3	7	1	6	3	4	1	4	2	3	2	8	5	10	7	4	2
Phenolic: Low-Loss	11	3	7	7	1	3	4	4	1	2	3	1	7	12	3	4	3	3	2
Phenolic: Heat-Resistant	9	4	8	7	1	3	4	4	1	1	1	1	7	13	2	..	8	8	2
Phenolic: Acid and Alkali-Resistant	10	5	8	7	1	4	2	3	1	5	3	2	2	5	4	..	..	7	3
Phenolic: Shock-Resistant	2	1	5	7	1	7	4	5	1	6	3	4	3	10	5	..	9	8	1
Phenolic: Transparent	7	1	3	7	1	4	3	3	1	5	3	2	2	6	4	7	5	6	3
Urea	8	1	1	1	2	9	4	4	1	7	7	5	5	11	1	9	4	2	4
Polystyrene	7	2	7	4	4	1	1	1	3	3	6	6	1	1	6	1	1	1	6
Cellulose-Acetate	4	6	9	3	8	11	4	6	3	9	5	4	4	7	9	8	6	5	5
Aceto-Butyrate	1	5	10	3	6	8	4	4	3	8	4	6	6	4	8	3	2	1	5
Ethyl-Cellulose	3	2	6	6	7	10	4	2	3	8	4	6	4	2	8	2	2	2	5
Methyl-Methacrylate	6	1	4	2	5	5	2	2	3	8	9	6	2	3	7	5	..	1	5
Vinyl (No Filler)	5	1	2	4	3	1	1	1	2	3	8	4	2	3	7	6	2	1	5

PHYSICAL PROPERTIES OF NATURAL AND SYNTHETIC RUBBER STOCKS

Compiled by I. B. Prettyman

This table was compiled, for the most part, from the literature. Every effort has been made to give values for stocks of comparable formulation and vulcanization for any one property. It was manifestly impossible to do so between properties. Furthermore, the polymers themselves varied in the proportions of base materials and in the methods of preparation, often in an undisclosed manner. Finally, it is to be realized that changes are constantly being made, both in the polymers and in the stock formulations, and that often variations may be effected for the purpose of enhancing one or more of the specific properties, as desired.

PROPERTIES OF RUBBER STOCKS

Type of polymer	Natural rubber (Hevea)	Butadiene-styrene copolymer	Butadiene-acrylonitrile copolymer	Poly-chloroprene (neoprene)	Iso-butylene-diolefin copolymer (butyl)	Alkylene polysulfide
RAW POLYMER						
Specific gravity, 25°C.....	0.92	0.94	1.00	1.25	0.91	1.35
Heat capacity, 25°C (Int. joules $\times \text{gm}^{-1} \times ^\circ\text{C}^{-1}$).....	1.88	1.97	1.97			
VULCANIZED PURE GUM TYPE COMPOUND						
D.-C. resistivity, 25°C (ohm $\times \text{cm}$).....	10^{17}	10^{15}	10^{10}	10^{11}	10^{17}	10^{18}
Dielectric constant, 1 kc/sec., 25°C.....	2.7	2.9	13	9	2.4	6
Power factor, 1 kc/sec., 25°C (%).....	0.23	0.32	5.5	3	0.30	
Permeability to gas (cc at NTP/cm ² /cm thickness/sec/cm Hg)						
Hydrogen.....	47×10^{-10}	11×10^{-10}	20×10^{-10}	12×10^{-10}	1×10^{-10}	4×10^{-10}
Air.....	11×10^{-10}					
VULCANIZED CARBON BLACK TYPE						
COMPOUND						
Tensile strength based on original section, 25°C (kg $\times \text{cm}^{-2}$).....	315	230	280	245	210	110
Elongation at break, 25°C (%).....	600	580	580	580	640	600
Stress at 300 % elongation based on original section, 25°C (kg $\times \text{cm}^{-2}$).....	120	120	135	125	55	70

PROPERTIES OF RUBBER STOCKS (Continued)

PHYSICAL PROPERTIES OF NATURAL AND SYNTHETIC RUBBER STOCKS (Continued)

Type of polymer	Natural rubber (Hevea)	Butadiene-styrene copolymer	Butadiene-acrylonitrile copolymer	Poly-chloroprene (neoprene)	Iso-butylene-diolefin copolymer (butyl)	Alkylene-poly-sulfide
Static shear modulus (shear strain in 0.01 to 0.05 range) (megadynes \times cm ⁻²)						
30°C.....	18	25	15	14	18	.....
100°C.....	13	10	10	11	9	.....
Dynamic shear modulus at 60 cycles/sec (shear strain in 0.05 to 0.15 range)(megadynes \times cm ⁻²)						
30°C.....	24	54	27	27	35	.....
100°C.....	14	17	13	18	13	.....
Hysteresis index (frequency \times internal friction) measured in shear at 60 cycles/sec (shear strain in 0.05 to 0.15 range)(megagm \times cm ⁻¹ \times sec ⁻²)						
30°C.....	3.0	8.8	5.1	5.0	4.6	.....
100°C.....	1.1	3.0	1.5	2.0	2.0	.....
Ball rebound (1.9 cm steel ball dropped 100 cm on sample 1.9 cm thick) (%)						
-20°C.....	12	13	13	8	15	.....
20°C.....	45	37	33	35	9	.....
100°C.....	71	47	63	67	50	.....
Compression set (A.S.T.M. method B, 30% constant deflection 22 hr. at 70°C) (%)						
Stress relaxation (time for 0.076 cm thick sample to relax to 60% of 10 sec. stress value, 50% elong., 100°C) (hr.)	35	42	27	49	38	80
Tear resistance (Crescent test) (kg \times cm ⁻¹)	3.7	14	16	1.5	5	.....
Weather exposure cracking (elongated) (rating)	125	55	50	75	75	50
	4	5	3	0	0	0

PHYSICAL PROPERTIES OF NATURAL AND SYNTHETIC RUBBER STOCKS (Continued)

Type of polymer	Natural rubber (Hevea)	Butadiene-styrene copolymer	Butadiene-acrylonitrile copolymer	Polychloroprene (neoprene)	Iso-butylene-diolefin copolymer (butyl)	Alkylene polysulfide
Swelling in solvents, volume in 7 days (%)						
Gasoline 25°C.....	150	100	15	20	300	1
Benzene 25°C.....	190	210	160	150	150	90
Mineral oil 70°C.....	130	70	1	10	200	0
Water 70°C.....	3	2	3	3	.....	12
Cold stiffening index (temp. to reach bending modulus of 700 kg X cm ⁻² , 20 min. exposure) (°C).....	-47*	-40	-30	-37*	-40	-40*
Cold brittle point (Bell Lab. impact type test) (°C).....	-54	-60	-38	-40	-40	-37
Volume compressibility (pressure of 300 kg X cm ⁻²) (bar ⁻¹).....						
Thermal diffusivity (25°C to 100°C) (cm ² X sec ⁻¹).....	37 X 10 ⁻⁶	36 X 10 ⁻⁶	33 X 10 ⁻⁶	31 X 10 ⁻⁶	.....	.....
Thermal conductivity (25°C to 100°C) (cal X sec ⁻¹ X cm ⁻¹ X °C ⁻¹).....	.0010	.0012	.0012	.0012	.....	.....
	.00039	.00046	.00049	.00046	.....	.....

* Modulus of 700 kg X cm⁻² may be reached at higher temperatures upon extended exposure.

PROPERTIES OF WOODS

PHYSICAL PROPERTIES OF COMMON WOODS

Values of density marked * are for air dry samples.

Common name	Botanical name	Density, oven-dry		Modulus of rupture, air dry kg/mm ²	Modulus of elasticity, air dry kg/mm ²
		g/cm ³	lbs./ft. ³		
Appledwood or wild apple	<i>Pyrus malus</i>	0.745	46.51	8.96	894.
Ash, black	<i>Fraxinus nigra</i>	0.526	32.84	8.97	1126.
Ash, blue	<i>Fraxinus quadrangulata</i>	0.603	37.65	9.82	984.
Ash, green	<i>Fraxinus pennsylvanica lanceolata</i>				
Ash, white	<i>Fraxinus americana</i>	0.610	38.08	10.04	1170.
Aspen	<i>Populus tremuloides</i>	0.638	39.83	11.01	1249.
Aspen, large tooth	<i>Populus grandidentata</i>	0.401	25.03	6.04	838.
Balsa (Tropical America)	<i>Ochroma</i>	0.412	25.72	6.38	996.
Basewood	<i>Tilia glabra</i> or <i>Tilia americana</i>	*0.12-0.20	7.49-12.49		
Beech	<i>Fagus grandifolia</i> or <i>Fagus americana</i>	0.398	24.85	6.13	1029.
Beech, blue		0.655	40.89	10.25	1180.
Birch, gray	<i>Carpinus caroliniana</i>	0.717	44.76	8.48	752.
Birch, paper	<i>Betula populifolia</i>	0.552	34.46	6.88	797.
Birch, sweet	<i>Betula papyrifera</i>	0.600	37.46	8.79	1119.
Birch, yellow	<i>Betula lenta</i>	0.714	44.58	11.81	1520.
Buckeye, yellow	<i>Betula lutea</i>	0.668	41.70	11.88	1482.
Butternut	<i>Asculus octandra</i>	0.383	23.91	5.36	829.
Cedar, eastern red	<i>Juglans cinerea</i>	0.404	25.22	5.72	830.
Cedar, northern white	<i>Juniperus virginiana</i>	0.492	30.72	6.07	612.
Cedar, southern white	<i>Thuja occidentalis</i>	0.315	19.67	4.56	568.
Cedar, (Tropical American)	<i>Chamaecyparis thyoides</i>	0.352	21.98	4.77	655.
Cedar, western red	<i>Cedrela odorata</i>	*0.37-0.70	23.10-43.70		
Cherry, black	<i>Thuja plicata</i>	0.344	21.48	5.38	819.
Cherry, wild red	<i>Prunus serotina</i>	0.534	33.34	8.81	1046.
Chestnut	<i>Prunus pennsylvanica</i>	0.425	26.53	6.10	892.
Corkwood	<i>Castanea dentata</i>	0.454	28.34	6.16	870.
Cottonwood, eastern	<i>Leitneria floridana</i>	0.207	12.92		
	<i>Populus deltoides</i>	0.433	27.03	6.14	972.

PHYSICAL PROPERTIES OF COMMON WOODS

Values of density marked * are for air dry samples.

Common name	Botanical name	Density, oven-dry		Modulus of rupture, air dry kg/mm ²	Modulus of elasticity, air dry kg/mm ²
		g/cm ³	lbs./ft. ³		
Cypress, southern	<i>Taxodium distichum</i>	0.482	30.09	7.44	1010.
Dogwood (flowering)	<i>Cornus florida</i>	0.796	49.69	10.72	1085.
Douglas fir (coast type)	<i>Pseudotsuga taxifolia</i>	0.512	31.96	8.44	1357.
Douglas fir (mountain type)	<i>Pseudotsuga taxifolia</i>	0.446	27.84	6.72	981.
Ebony, Andaman marble-wood (India)	<i>Diospyros kurzii</i>	*0.978	61.06	7.80	1270.
Ebony, Ebène marbre (Mauritius, E. Africa)	<i>Diospyros melanida</i>	*0.768	47.95	5.55	1007.
Elm, American	<i>Ulmus americana</i>	0.554	34.59	8.44	948.
Elm, rock	<i>Ulmus racemosa</i> or <i>Ulmus thomasi</i>	0.658	41.08	10.55	1086.
Elm, slippery	<i>Ulmus fulva</i> or <i>pubescens</i>	0.568	35.46	9.29	1050.
Eucalyptus, Karri (W. Australia)	<i>Eucalyptus diversicolor</i>	*0.829	51.75	12.16	1885.
Eucalyptus, Mahogany (New South Wales)	<i>Eucalyptus hemilampra</i>	*1.058	66.05	11.50	1608.
Eucalyptus, West Australian mahogany	<i>Eucalyptus marginata</i>	*0.787	49.13	10.54	1462.
Fir, balsam	<i>Abies balsamea</i>	0.414	25.85	5.42	879.
Fir, Douglas (See Douglas Fir)					
Fir, silver	<i>Abies amabilis</i>	0.415	25.91	6.69	1076.
Greenheart (British Guiana)	<i>Nectandra rodioei</i>	*1.06-1.23	66.18-76.79		
Gum, black	<i>Nyssa sylvatica</i>	0.552	34.46	6.82	839.
Gum, blue	<i>Eucalyptus globulus</i>	0.796	49.69	11.75	1683.
Gum, red	<i>Liquidambar styraciflua</i>	0.530	33.09	8.40	1045.
Gum, tupelo	<i>Nyssa aquatica</i>	0.524	32.71	6.85	889.
Hemlock, eastern	<i>Tsuga canadensis</i>	0.431	26.91	6.06	846.
Hemlock, mountain	<i>Tsuga martensiana</i>	0.480	29.97	6.95	797.
Hemlock, western	<i>Tsuga heterophylla</i>	0.432	26.97	6.51	1015.
Hickory, bigleaf shagbark	<i>Hicoria laciniata</i>		50.53	12.91	1335.

PROPERTIES OF WOODS (Continued)

PHYSICAL PROPERTIES OF COMMON WOODS

Values of density marked * are for air dry samples.

Common name	Botanical name	Density, oven-dry		Modulus of rupture, air dry kg/mm ²	Modulus of elasticity, air dry kg/mm ²
		g/cm ³	lbs./ft. ³		
Hickory, mockernut	<i>Hicoria alba</i>		51.21	13.56	1570.
Hickory, pignut	<i>Hicoria glabra</i>		51.21	14.25	1603.
Hickory, shagbark	<i>Hicoria ovata</i>		52.17	14.39	1525.
Hornbeam	<i>Ostrya virginiana</i>	0.762	47.57	10.22	1199.
Ironwood, black	<i>Rhamnidium ferreum</i>	1.077	67.24	13.10	2100.
Jacaranda, Brazilian rosewood	<i>Dalbergia nigra</i>	*0.85	53.07		
Larch, western	<i>Larix occidentalis</i>	0.587	36.65	8.24	1188.
Locust, black or yellow	<i>Robinia pseudacacia</i>	0.708	44.20	13.63	1448.
Locust, honey	<i>Gleditsia triacanthos</i>	0.666	41.58	10.59	1165.
Magnolia, cucumber	<i>Magnolia acuminata</i>	0.516	32.21	8.91	1276.
Mahogany (W. Africa)	<i>Khaya ivorensis</i>	*0.668	41.70	< 12.38	1079.
Mahogany (E. India)	<i>Swietenia macrophylla</i>	*0.54	33.71	6.73	817.
Mahogany (E. India)	<i>Swietenia mahoganii</i>	*0.54	33.71	7.10	890.
Maple, black	<i>Acer nigrum</i>	0.620	38.71	9.37	1141.
Maple, red	<i>Acer rubrum</i>	0.546	34.09	9.35	1155.
Maple, silver	<i>Acer saccharinum</i>	0.506	31.59	6.34	805.
Maple, sugar	<i>Acer saccharum</i>	0.676	42.20	10.97	1290.
Oak, black	<i>Quercus velutina</i>	0.669	41.77	9.66	1153.
Oak, bur	<i>Quercus macrocarpa</i>	0.671	41.89	7.21	723.
Oak, canyon live	<i>Quercus chrysolepis</i>	0.838	52.32	9.26	1149.
Oak, chestnut	<i>Quercus montana</i>	0.674	42.08	9.45	1114.
Oak, laurel	<i>Quercus laurifolia</i>	0.703	43.89	8.98	1182.
Oak, live	<i>Quercus virginiana</i>	0.977	60.99	12.95	1381.
Oak, pin	<i>Quercus palustris</i>	0.677	42.27		
Oak, post	<i>Quercus stellata</i> or <i>Quercus minor</i>	0.738	46.07	9.30	1063.
Oak, red	<i>Quercus borealis</i>	0.657	41.02	10.02	1274.
Oak, scarlet	<i>Quercus coccinea</i>	0.709	44.26		
Oak, swamp chestnut	<i>Quercus prinus</i>	0.756	47.20	9.73	1247.

PHYSICAL PROPERTIES OF COMMON WOODS

Values of density marked * are for air dry samples.

Common name	Botanical name	Density, oven-dry		Modulus of rupture, air dry kg/mm ²	Modulus of elasticity, air dry kg/mm ²
		g/cm ³	lbs./ft. ³		
Oak, swamp white	<i>Quercus bicolor</i> or <i>Quercus plananoides</i>	0.792	49.44	12.36	1446.
Oak, white	<i>Quercus alba</i>	0.710	44.33	10.68	1251.
Persimmon	<i>Diospyros virginiana</i>	0.776	48.45	12.72	1443.
Pine, eastern white	<i>Pinus strobus</i>	0.373	23.29	6.26	898.
Pine, jack	<i>Pinus banksiana</i> or <i>Pinus divaricata</i>	0.461	28.78	5.70	868.
Pine, loblolly	<i>Pinus taeda</i>	0.593	37.02	9.09	1354.
Pine, longleaf	<i>Pinus palustris</i>	0.638	39.83	10.90	1445.
Pine, pitch	<i>Pinus rigida</i>	0.542	33.84	7.40	965.
Pine, red	<i>Pinus resinosa</i>	0.507	31.65	8.81	1264.
Pine, shortleaf	<i>Pinus echinata</i>	0.584	36.45	9.34	1345.
Poplar, balsam	<i>Populus balsamifera</i> or <i>Populus canadensis</i>	0.331	20.66	4.76	716.
Poplar, yellow	<i>Liriodendron tulipifera</i>	0.427	26.66	6.52	1058.
Redwood	<i>Sequoia sempervirens</i>	0.436	27.22	7.56	958.
Sassafras	<i>Sassafras variafolium</i>	0.473	29.53	6.43	790.
Satinwood (Ceylon)	<i>Chloroxylon swietenia</i>	*1.031	64.37	9.68	1101.
Sourwood	<i>Oxydendrum arboreum</i>	0.593	37.02	8.24	1083.
Spruce, black	<i>Picea mariana</i>	0.428	26.72	7.24	1069.
Spruce, red	<i>Picea rubra</i> or <i>Picea rubens</i>	0.413	25.78	7.15	1071.
Spruce, white	<i>Picea glauca</i>	0.431	26.91	6.38	1001.
Sycamore	<i>Platanus occidentalis</i>	0.539	33.65	7.12	1002.
Tamarack	<i>Larix laricina</i> or <i>Larix americana</i>	0.558	34.84	8.23	1154.
Teak (India)	<i>Tectona grandis</i>	*0.582	36.33	9.04	1195.
Walnut, black	<i>Juglans nigra</i>	0.562	35.09	10.42	1185.
Willow, black	<i>Salix nigra</i>	0.408	25.47	4.42	513.

PROPERTIES OF PIGMENTS

PHYSICAL PROPERTIES OF PIGMENTS

Rutherford J. Gettens

Trial Data on Painting Materials—Pigments and Inert Materials
Technical Studies, VIII, 1939

Pigment Name and Chemical Composition ¹	Specific Gravity ²	Particle Characteristics ³	Refractive Index ⁴
Aluminum hydrate, $\text{Al}(\text{OH})_3$	2.45	v. fine amorph part.	$n_D 1.50-1.56$ [M*]
Aluminum stearate, $\text{Al}(\text{C}_{18}\text{H}_{35}\text{O}_2)_3$	0.99	agg. of spher. gr.	1.49 (w. bi.) [W]
Anhydrite, CaSO_4	2.93	cryst. frag.	$\alpha 1.570, \gamma 1.614, \beta 1.575$ [LB]
Antimony oxide, Sb_2O_3	5.75	v. fine cryst.	{ senarmonite, $\alpha 2.18, \gamma$ and $\beta 2.35$ [LB, M*]
Antimony vermilion, Sb_2S_3	.....	v. fine red glob.	$n_D 2.65$ (isot.) [M*]
Asphaltum (bitumen), carbonaceous	.....	irr. amorph. part.	1.64-1.66 [M*]
Azurite, $2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	3.80	cryst. frag.	$\alpha 1.730, \gamma 1.838, \beta 1.758$ [LB]
Barytes (barite, nat.) BaSO_4	4.45	cryst. frag.	$\alpha 1.636, \gamma 1.648, \beta 1.637$ [LB]
(blanc fixe, art.), BaSO_4	4.36	v. fine cryst. agg.	1.62-1.64 [M*]
Barium yellow, BaCrO_4	4.49	v. fine cryst. gr.	1.94-1.98 (bi.) [M]
Blue verditer, $2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	.....	fibrous agg.	$\alpha 1.72, \gamma$ slightly > 1.74 [M*]
Bone black C + $\text{Ca}_3(\text{PO}_4)_2$	2.29	irr. coarse lumps	1.65-1.70 (for larger translucent gr.) [M]
Cadmium red, CdS (Se)	4.5	min. round. gr.	2.64 (bright red)-2.77 (deep red) (isot.) [M*]
Cadmium red lithophone, $\text{CdS}(\text{Se}) + \text{BaSO}_4$	4.30	min. round. gr.	2.50-2.76 (for CdS (Se) part) (isot.) [M*]
Cadmium yellow, CdS	4.35	min. round. gr.	2.35-2.48 (isot.) [M*]
Cadmium yellow lithophone, $\text{CdS} + \text{BaSO}_4$	4.25	fine comp. gr.	2.39-2.40 (for CdS part) [M*]
Cerulean blue, $\text{CoO} \cdot n\text{SnO}_2$	.....	round. gr.	1.84 (isot.) [M*]
Chalk (whiting), CaCO_3	2.70	hollow spherulites	$\epsilon 1.510, \omega 1.645$ [M*]
Charcoal black, C	.....	irr. splintery part.	(opaque)
China clay (kaolinite), $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$	2.60	fine, vermicular cryst.	$\alpha 1.558, \gamma 1.565, \beta 1.564$ (all $\pm .005$) [LB, M*]
Chrome green (med.) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3 + \text{PbCrO}_4$	4.06	fine green agg.	$c 2.4$ (cf. Prussian blue and chrome yellow) [M*]
Chrome red, $\text{PbCrO}_4 \cdot \text{Pb}(\text{OH})_2$	6.7	tabular cryst.	$\alpha 2.42, \gamma 2.7 +, \beta 2.7$ [M]
Chrome yellow (med.) PbCrO_4	5.96	fine prism. gr.	$\alpha_{\text{anom}} \mu < 2.31, \gamma_{650m\mu} 2.49$ [M]
Chromium oxide green, opaque, Cr_2O_3	5.10	fine cryst. agg.	$n_D 2.5$ [M]
Chrysocolla, $\text{CuSiO}_3 \cdot n\text{H}_2\text{O}$	2.4	crypt. agg.	$\alpha 1.575, \gamma 1.598, \beta 1.597$ [LB]

PHYSICAL PROPERTIES OF PIGMENTS (Continued)

PROPERTIES OF PIGMENTS (Continued)

Pigment Name and Chemical Composition ¹	Specific Gravity ²	Particle Characteristics ³	Refractive Index ⁴
Cobalt blue, $\text{CoO} \cdot \text{Al}_2\text{O}_3$	3.83	round. gr.	n var.; max. c 1.74 _{blue} (isot.) [M]
Cobalt green, $\text{CoO} \cdot n\text{ZnO}$	.....	spher. gr.	1.94-2.0 (w. bi.) [M*]
Cobalt violet, $\text{Co}_3(\text{PO}_4)_2$	.....	round. gr.	ϵ 1.65-1.79 (dull violet), ω 1.68-1.81 (salmon) (s. bi.) [M]
Cobalt yellow, $\text{CoK}_3(\text{NO}_2)_6 \cdot \text{H}_2\text{O}$	.....	fine dendritic cryst.	1.72-1.76 (isot.) [W]
Diatomaceous earth, SiO_2	2.31	min. fossil forms	n mostly 1.435, some 1.40 [M*]
Egyptian blue, $\text{CaO} \cdot \text{CuO} \cdot 4\text{SiO}_2$	.....	cryst. frag.	ϵ 1.605, ω 1.635 [APL]
Emerald green, $\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{Cu}(\text{AsO}_2)_2$	3.27	spherulites and disks	α Σ 1.71, γ Σ 1.78 (w. pleo.) [M*]
Gamboge, organic resin	.....	irr. amorph. part.	1.582-1.586 [W]
Graphite, C	2.36	irr. plates	(opaque) [M]
Green earth (celadonite and glauconite), Fe, Mg, Al, K, hydrosilicate	2.5-2.7	round. irr. gr.	n var. c 1.62 (porous) [M*]
Gypsum, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	2.36	fine cryst. gr.	α 1.520, γ 1.530, β 1.523 [LB]
Indian yellow, $\text{C}_{10}\text{H}_{16}\text{O}_{11}\text{Mg} \cdot 5\text{H}_2\text{O}$	.....	prisms, plates	1.67 (w. bi.) [M*]
Iron oxide red (haematite), Fe_2O_3	5.2	min. cryst.	ϵ 2.78, ω 3.01 [M]
Lamp black, C	1.77	min. round. part.	(opaque)
Lithopone (regular), ZnS (28-30%), BaSO_4 (72-70%)	4.30	fine comp. gr.	2.3 (ZnS)-1.64 (BaSO_4) [M]
Malachite, $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	4.0	cryst. frag.	α 1.655, γ 1.909, β 1.875 [LB]
Manganese blue, $\text{BaMnO}_4 + \text{BaSO}_4$	.....	gr. and stubby prisms	c 1.65 [W]
Manganese violet, $(\text{NH}_4)_2\text{Mn}_2(\text{P}_2\text{O}_7)_2$	.....	fine cryst. gr.	α 1.67, γ 1.75, β 1.72, (for violet) [M]
Massicot (litharge), PbO	9.40	min. flakes	α 2.51, γ 2.71, β 2.61 [M]
Mayan blue, Fe, Mg, Ca, Al, silicate (?)	.....	porous irr. agg.	β Σ 1.54 (irr.; bi. and pleo.) [M*]
Mica (muscovite), $\text{H}_2\text{KAl}_3(\text{SiO}_4)_3$	2.89	platy frag.	α 1.563, γ 1.604, β 1.599 [LB]
Molybdate orange, $\text{Pb}(\text{Mo}, \text{S}, \text{Cr}, \text{P})\text{O}_4$	.....	min. round. gr.	β 2.55 (s. bi.) [M*]
Naples yellow, $\text{Pb}_3(\text{SbO}_4)_2$	.....	round. gr.	2.01-2.28 (isot.) [M*]
Ochre, yellow (goethite), $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$, clay, etc.	2.9-4.0	irr. spherulites	n Σ 2.0 (isot. part); ($\alpha\beta$) Σ 2.05-2.31, γ Σ 2.08-2.40 (bi. part) [M*]
Orpiment, As_2S_3	3.4	min. flakes	α 2.4 \pm , γ 3.02, β 2.81 [LB]
Prussian blue, $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$	1.83	colloidal agg.	1.56 _{room μ} [M*]
Pumice (volcanic glass), Na, K, Al, silicate	.....	vesicular vitr. frag.	c 1.50 (isot.) [M*]

PROPERTIES OF PIGMENTS (Continued)

PHYSICAL PROPERTIES OF PIGMENTS (Continued)

Pigment Name and Chemical Composition ¹	Specific Gravity ²	Particle Characteristics ³	Refractive Index ⁴
Realgar, As ₂ S ₃	3.56	cryst. frag.	α_L 2.46, γ_L 2.61, β_L 2.59 [LB]
Red lead, Pb ₃ O ₄ (c 95 %)	8.73	crypt. agg.	2.42 α_i (w. bi.; pleoc.) [M]
Sepia, organic	.....	angular frag.	(opaque) [M*]
Sienna, burnt, Fe ₂ O ₃ , clay, etc.	3.56	uneven, round, part.	c 1.85 (var.) (isot.) [M]
Sienna, raw (goethite), Fe ₂ O ₃ .H ₂ O, clay, etc.	3.14	uneven sperulites	1.87-2.17 (mostly 2.06) (isot.) [M*]
Silica (quartz), SiO ₂	2.66	cryst. frag.	ϵ 1.553, ω 1.544 [LB]
(chalcedony), SiO ₂	2.6	crypt. agg.	ϵ , ω 1.54 [LB, M*]
Smalt, K, Co(Al), silicate (glass)	.....	splintery vitr. frag.	1.49-1.52 [M*]
Strontium yellow, SrCrO ₄	.....	small needles	α , β (or ω) 1.92, γ (or ϵ) 2.01 (|| ext.) [M*]
Talc, 3MgO.4SiO ₂ .H ₂ O	2.77	platy frag.	α 1.539, γ 1.589, β 1.589 [LB]
Titanium barium white, TiO ₂ (25 %) + BaSO ₄ (75 %)	4.30	min. round, gr.	$n_{\gamma c}$ 1.7-2.5 [M*]
Titanium calcium white, TiO ₂ (25 %) + CaSO ₄ (75 %)	3.10	prism. or ragged gr.	mostly 1.8-2.0 (irr.) (bi.) [M*]
Titanium dioxide (anatase), TiO ₂	3.9	min. round, gr.	ϵ and ω 2.5 (w. bi.) [M*]
(rutile), TiO ₂	4.2	round, or prism. gr.	ϵ 2.9, ω 2.6 [M*]
Ultramarine blue (art.), Na ₈₋₁₀ Al ₆ Si ₆ O ₂₄ S ₂₋₄	2.34	uniform small round, gr.	n 1.51 green, 1.63 red (isot.) [M]
(nat., lazurite), 3Na ₂ O.3Al ₂ O ₃ .6SiO ₂ .2Na ₂ S	2.4	angular, broken frag.	1.50 \pm (isot.) [LB]
Ultramarine violet	.....	round, gr. (blue, rose, and violet)	c 1.56 (isot.) [M*]
Umber, burnt, Fe ₂ O ₃ + MnO ₂ , clay, etc.	3.64	uneven, round, gr.	mostly 2.2-2.3 [M*]
Umber, raw, Fe ₂ O ₃ + MnO ₂ + H ₂ O, clay, etc.	3.20	uneven, round, gr.	mostly 1.87-2.17 [M*]
Van Dyke brown, bituminous earth	1.66	irr. amorph. part.	1.62-1.69 [M*]
Verdigris (copper basic acetate) Cu(C ₂ H ₃ O ₂) ₂ .2Cu(OH) ₂	.....	cryst. frag.	α 1.53, γ 1.56 [M]
Vermilion (art.), HgS	8.09	hexagonal gr. and pr.	ϵ_L 3.14, ω_L 2.81 [M]
(nat., cinnabar), HgS	8.1	cryst. frag.	ϵ_L 3.146, ω_L 2.819 [LB]
Viridian (chromium oxide, transparent), Cr ₂ O ₃ .2H ₂ O	3.32	spherul. gr.	α , β 1.82, γ 2.12 [M*]
White lead (basic carbonate), 2PbCO ₃ .Pb(OH) ₂	6.70	v. fine cryst.	ϵ 1.94, ω 2.09 [M]
Zinc white (ordinary), ZnO	5.65	v. fine cryst. gr.	ϵ 2.02, ω 2.00 [M]
(acicular), ZnO	.....	spicules, fouriets	ϵ 2.02, ω 2.00 [M]
Zinc yellow, ZnCrO ₄	3.46	min. spher. gr.	1.84-1.9 (irr.; bi.) [M*]

PHYSICAL PROPERTIES OF PIGMENTS (Continued)

¹ Abbreviations: art. = artificial; med. = medium; nat. = natural. The chemical formulas are those commonly accepted in chemical and mineralogical literature, but they may not compare exactly with structural formulas based on X-ray diffraction data or even on critical chemical analysis.

² The figures for specific gravity of the artificial pigments are mainly from H. A. Gardner, and those on the mineral pigments are chiefly from E. S. Larsen and H. Berman.

³ Symmetry terms (monoclinic, orthorhombic, etc.) are omitted because pigments are so finely divided that it is rare when observations on crystal symmetry can be made. The term, "spherulitic," as used here means aggregates that tend toward radial structure and spherical shape. "Amorphous" describes materials that are microscopically formless but may be truly crystalline on the basis of X-ray diffraction data. Abbreviations: agg. = aggregate(s); amorph. = amorphous; comp. = composite; crypt. = cryptocrystalline; cryst = crystal(s); frag. = fragment(s); glob. = globule(s); gr. = grain(s); irr. = irregular; min. = minute; part = particle(s); prism. = prismatic; round. = rounded; spher. = spheroidal; spherul. = spherulitic; var. = variable; v = very; vitr. = vitreous.

⁴ Unless otherwise indicated, all refractive index measurements are by sodium light. Σ is the symbol used by H. E. Merwin to indicate greater or less indefiniteness or irregularity in the case of aggregates, especially in respect to refractive index. Abbreviations: bi = birefringent; c = circa; ext. = extinction; isot. = isotropic; || = parallel; pleo. = pleochroic; s. = strongly; w. = weakly. The letters in brackets refer to the authorities for the refractive index data; M = H. E. Merwin; M* = H. E. Merwin, data by private communication, hitherto unpublished; W = C. D. West, data by private communication, hitherto unpublished; LB = E. S. Larsen and H. Berman; APL = A. P. Laurie and co-authors.

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ

Common Name	Chemical Name	Formula
Acetic ether.....	Ethyl acetate.....	$\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$
Acid of sugar.....	Oxalic acid.....	$(\text{CO}_2\text{H})_2$
Aldehyde.....	Acetaldehyde.....	CH_3CHO
Alum.....	Generally refers to potassium aluminum sulfate	$\text{K}_2\text{Al}_2(\text{SO}_4)_4 \cdot 24\text{H}_2\text{O}$
Alum flour.....		
Alum meal.....		
Alumina.....		
Alumino-ferrie.....	Aluminum oxide.....	Al_2O_3
	A mixture of aluminum and sodium sulfates	.....
Alundum.....	Fused alumina.....	Al_2O_3
Aniline.....	Phenyl amine.....	$\text{C}_6\text{H}_5\text{NH}_2$
Aniline salt.....	Aniline hydrochloride.....	$\text{C}_6\text{H}_5\text{NH}_2 \cdot \text{HCl}$
Antichlor.....	Sodium thiosulfate.....	$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$
Antifebrin.....	Acetanilide.....	$\text{C}_6\text{H}_5\text{NHCOCH}_3$
Antimony bloom.....	Antimony trioxide.....	Sb_2O_3
Antimony black.....	Antimony trisulfide.....	Sb_2S_3
Antimony glance.....		
Antimony red.....		
Antimony vermilion.....		
Antimony white.....	Antimonous oxysulfide....	$\text{Sb}_2\text{S}_3 + \text{Sb}_2\text{O}_3$
Antimony yellow.....	Antimonous oxide.....	Sb_2O_3
Aqua fortis.....	Basic lead antimonate.....	$\text{PbO} \cdot \text{Sb}_2\text{O}_5$
Aqua regia.....	Nitric acid.....	HNO_3
	Nitric acid and hydrochloric acid	$\text{HNO}_3 + 3\text{HCl}$
Argol.....	Crude potassium acid tartrate	$\text{KHC}_4\text{H}_4\text{O}_6$
Arsenic glass.....	Arsenous oxide.....	As_2O_3
Aspirin.....	Acetyl-salicylic acid.....	$\text{C}_6\text{H}_4(\text{CO}_2\text{H})(\text{OCOCH}_3)$
Azurite.....	Basic copper carbonate....	$2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$
Bakelite.....	Resin from phenol + formaldehyde	.....
Baking soda.....	Sodium bicarbonate.....	NaHCO_3
Barium white.....	Barium sulfate.....	BaSO_4
Baryta.....	Barium oxide.....	BaO
Barytes.....	Barium sulfate (natural)...	BaSO_4
Bauxite.....	Hydrated alumina.....	$\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$
Beet sugar.....	Sucrose.....	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$
Bentonite.....	Impure aluminum silicate.	.....
Benzine.....	Gasoline, petrol.....	.....
Benzol.....	Benzene.....	C_6H_6
Bichrome.....	Potassium dichromate.....	$\text{K}_2\text{Cr}_2\text{O}_7$
Bitter salt.....	Magnesium sulfate.....	$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$
Black ash.....	Impure sodium carbonate..	.....
Blanc-fixe.....	Barium sulfate (artificial)...	BaSO_4
Bleaching powder.....	Calcium chloro-hypochlorite	CaOCl_2
Blende.....	Natural zinc sulfide.....	ZnS
Blue copperas.....	Copper sulfate.....	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
Blue stone.....		
Blue vitriol.....		
Blue salts.....		
Blue verditer.....	Nickel sulfate.....	$\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$
Bone ash.....	Basic copper carbonate....	$2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$
Bone black.....	Impure calcium phosphate	.....
Boracic acid.....	Crude animal charcoal.....	C
Borax.....	Boric acid.....	H_3BO_3
Bremen blue.....	Sodium tetraborate.....	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$
Brimstone.....	Basic copper carbonate....	$x\text{CuCO}_3 \cdot y\text{Cu}(\text{OH})_2$
	Sulfur.....	S

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Burnt alum.....	Anhydrous potassium alu- minum sulfate	$K_2Al_2(SO_4)_4$
Burnt lime.....	Calcium oxide.....	CaO
Burnt ochre.....	Ferric oxide.....	Fe_2O_3
Burnt ore.....		
"Butter of".....	Refers to the chloride.....	.....
Cadmium yellow.....	Cadmium sulfide.....	CdS
Calamine.....	Zinc silicate.....	$2ZnO \cdot SiO_2 \cdot H_2O$
Calcite.....	Mineral calcium carbonate	$CaCO_3$
Caliche.....	Impure sodium nitrate....	$NaNO_3$
Calomel.....	Mercurous chloride.....	$HgCl$
Camphor, artificial.....	Pinene hydrochloride.....	$C_{10}H_{17}Cl$
Cane sugar.....	Sucrose.....	$C_{12}H_{22}O_{11}$
Carbolic acid.....	Phenol.....	C_6H_5OH
Carbonic acid.....	Carbon dioxide.....	CO_2
Carbonic anhydride.....		
Carnallite.....	Magnesium potassium chlo- ride	$MgCl_2 \cdot KCl \cdot 6H_2O$
"Caustic".....	Refers to the hydroxide of a metal	.....
Ceruse.....	Basic lead carbonate.....	$2PbCO_3 \cdot Pb(OH)_2$
Chalk.....	Calcium carbonate.....	$CaCO_3$
Chili niter.....	Sodium nitrate.....	$NaNO_3$
Chili saltpeter.....		
China clay.....	Aluminum silicate.....	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$
Chinese red.....	Basic lead chromate.....	$PbCrO_4 \cdot PbO$
Chinese white.....	Zinc oxide.....	ZnO
Chloramine T.....	Sodium p-toluene-sulfochloro- ramide	$(CH_3C_6H_4SO_2NCl-Na) \cdot 3H_2O$
Chloride of lime.....	Calcium chloro-hypochlo- rite	$CaOCl_2$
Chloride of soda.....	Sodium hypochlorite solu- tion	$NaOCl$
Chrome alum.....	Potassium chromium sul- fate	$K_2Cr_2(SO_4)_4 \cdot 24H_2O$
Chrome green.....	Chromium oxide.....	Cr_2O_3
Chrome red.....	Basic lead chromate.....	$PbCrO_4 \cdot PbO$
Chrome yellow.....	Lead chromate.....	$PbCrO_4$
Chromic acid.....	Chromium trioxide.....	CrO_3
Cinnabar.....	Mercuric sulfide.....	HgS
Cobalt black.....	Cobalt oxide.....	CoO
Cobalt green.....	Cobalt zincate.....	$CoZnO_2$
Common salt.....	Sodium chloride.....	$NaCl$
Copperas.....	Ferrous sulfate.....	$FeSO_4 \cdot 7H_2O$
Corn sugar.....	Glucose.....	$C_6H_{12}O_6 \cdot H_2O$
Corrosive sublimate.....	Mercuric chloride.....	$HgCl_2$
Corundum.....	Aluminum oxide.....	Al_2O_3
Cream of tartar.....	Potassium hydrogen tar- trate	$KHC_4H_4O_6$
Cresylic acid.....	Mixture of <i>o</i> , <i>m</i> , and <i>p</i> - cresol	$CH_3C_6H_4OH$
Cupferron.....	Nitrosophenylhydrox- ylamine	$C_6H_5N(NO)OH$
Dekaline.....	Decahydronaphthalene....	$C_{10}H_{18}$
Derby red.....	Basic lead chromate.....	$PbO \cdot PbCrO_4$
Derinatol.....	Basic bismuth gallate.....	$Bi(OH)_2 \cdot C_7H_5O_6$
Dextrose.....	Glucose.....	$C_6H_{12}O_6 \cdot H_2O$
Dutch liquid.....	Ethylene chloride.....	$(CH_2Cl)_2$

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Eau-de-Javelle.....	Potassium hypochlorite solution	KOCl
Eau-de-Labarraque.....	Sodium hypochlorite solution	NaOCl
Emerald green.....	Copper aceto-arsenite.....	$Cu(C_2H_3O_2)_2 \cdot 3CuAs_2O_4$
Emery powder.....	Impure aluminum oxide...	Al_2O_3
Epsom salts.....	Magnesium sulfate.....	$MgSO_4 \cdot 7H_2O$
Essence of bitter almonds	Benzaldehyde.....	C_6H_5CHO
Essence of mirbane.....	Nitrobenzene.....	$C_6H_5NO_2$
Everitt's salt.....	Potassium ferrous ferrocyanide	$K_2Fe_2(CN)_6$
Feldspar.....	Potassium aluminum silicate	$K_2Si_3O_7 \cdot Al_2Si_4O_{10}$
Ferro prussiate.....	Potassium ferrocyanide....	$K_4Fe(CN)_6$
Fixed white.....	Barium sulfate.....	$BaSO_4$
Flowers of sulfur.....	Sulfur.....	S
"Flowers of" a metal is a	synonym for the oxide	
Fluorspar.....	Calcium fluoride.....	CaF_2
Formalin.....	Forty per cent solution of formaldehyde in water	HCHO
Formin.....	Hexamethylene tetramine	$(CH_2)_6N_4$
Freezing salt.....	Crude sodium chloride....	NaCl
French chalk.....	Hydrated silicate of magnesium	$Mg_3Si_4O_{11} \cdot H_2O$
French verdigris.....	Basic copper acetate.....	$Cu_2(C_2H_3O_2)_2(OH)_2$
Fruit sugar.....	Fructose.....	$C_6H_{12}O_6$
Fuller's earth.....	Hydrated magnesium and aluminum silicates	
Fulminate of mercury....	Mercuric fulminate.....	$Hg(ONC)_2$
Fusel oil.....	Mixed amyl alcohols.....	$C_5H_{11}OH$
Gasoline.....	Benzine, petrol.....	
Galena.....	Natural lead sulfide.....	PbS
Glauber's salt.....	Sodium sulfate.....	$Na_2SO_4 \cdot 10H_2O$
Glucose.....	Dextrose.....	$C_6H_{12}O_6 \cdot H_2O$
Glycerin.....	Glycerol.....	$C_3H_5(OH)_3$
Grain alcohol.....	Ethyl alcohol.....	C_2H_5OH
Grape sugar.....	Glucose.....	$C_6H_{12}O_6 \cdot H_2O$
Green verditer.....	Basic copper carbonate....	$CuCO_3 \cdot Cu(OH)_2$
Green vitriol.....	Ferrous sulfate.....	$FeSO_4 \cdot 7H_2O$
Gypsum.....	Calcium sulfate.....	$CaSO_4 \cdot 2H_2O$
Hartshorn salt.....	Ammonium carbonate carbamate	$NH_4HCO_3 \cdot NH_4CO_3 \cdot NH_2$
Heavy spar.....	Barium sulfate.....	$BaSO_4$
Hexamine.....	Hexamethylene tetramine	$(CH_2)_6N_4$
Horn silver.....	Silver chloride.....	AgCl
Hydrosulfite.....	Sodium hyposulfite.....	$Na_2S_2O_4$
Hypo.....	Sodium thiosulfate.....	$Na_2S_2O_3 \cdot 5H_2O$
Iron black.....	Precipitated antimony....	Sb
Indian red.....	Ferric oxide.....	Fe_2O_3
Iron mordant.....	Ferric sulfate.....	$Fe_2(SO_4)_3$
Kainit.....	Double salt of potassium magnesium sulfate and magnesium chloride	$K_2Mg(SO_4)_2 \cdot MgCl_2 \cdot 6H_2O$
Kaolin.....	Aluminum silicate.....	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$
Kieselguhr.....	Siliceous earth.....	SiO_2
Kieserite.....	Mineral magnesium sulfate	$MgSO_4$
King's yellow.....	Arsenous sulfide.....	As_2S_3
Lampblack.....	Impure carbon.....	C

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Lanolin.....	Mixt. of cholesterol and esters.....	
Laughing gas.....	Nitrous oxide.....	N_2O
Lemon chrome.....	Barium chromate.....	$BaCrO_4$
Levulose.....	Fructose.....	$C_6H_{12}O_6$
Lime.....	Calcium oxide.....	CaO
Litharge.....	Lead monoxide.....	PbO
Lithopone.....	Zinc sulfide + barium sulfate	$ZnS + BaSO_4$
Liver of sulfur.....	Mixed potassium sulfides.....	
Lunar caustic.....	Silver nitrate.....	$AgNO_3$
Lysol.....	Cresol soap solution.....	
Magnesia.....	Magnesium oxide.....	MgO
Magnesite.....	Magnesium carbonate.....	$MgCO_3$
Malachite.....	Basic copper carbonate.....	$CuCO_3 \cdot Cu(OH)_2$
Manganese black.....	Manganese dioxide.....	MnO_2
Marble.....	Calcium carbonate.....	$CaCO_3$
Marsh gas.....	Methane.....	CH_4
Massicot.....	Lead monoxide.....	PbO
Methanol.....	Methyl alcohol.....	CH_3OH
Metol.....	p-Methylaminophenol sulfate.....	$(CH_3NHC_6H_4OH)_2 \cdot H_2SO_4$
Microcosmic salt.....	Sodium ammonium hydrogen phosphate.....	$Na(NH_4)HPO_4 \cdot 4H_2O$
Milk of barium.....	Barium hydroxide.....	$Ba(OH)_2$
Milk of lime.....	Calcium hydroxide.....	$Ca(OH)_2$
Milk of magnesium.....	Magnesium hydroxide.....	$Mg(OH)_2$
Milk of sulfur.....	Precipitated sulfur.....	S
Milk sugar.....	Lactose.....	$C_{12}H_{22}O_{11} \cdot H_2O$
Minium.....	Lead tetroxide.....	Pb_3O_4
Mohr's salt.....	Ferrous ammonium sulfate.....	$Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$
Molybdenite.....	Molybdenum disulfide.....	MoS_2
"Muriate of" a metal.....	Chloride of the metal.....	
Muriatic acid.....	Hydrochloric acid.....	HCl
Naphtha (Petroleum).....	A petroleum distillate.....	
Naphtha (Solvent).....	A coal tar distillate.....	
Natron.....	Sodium carbonate.....	$Na_2CO_3 \cdot 10H_2O$
Niter.....	Potassium nitrate.....	KNO_3
Nitro-lime.....	Calcium cyanamide.....	$CaNCN$
Nitrous ether.....	Ethyl nitrite.....	C_2H_5ONO
Nordhausen acid.....	Fuming sulfuric acid.....	$H_2SO_4 + SO_3$
Oil of bitter almond.....	Benzaldehyde.....	C_6H_5CHO
Oil of garlic.....	Allyl sulfide.....	$(C_3H_5)_2S$
Oil of mirbane.....	Nitrobenzene.....	$C_6H_5NO_2$
Oil of mustard, artificial..	Allyl isothiocyanate.....	C_3H_5NCS
Oil of pears.....	Amyl acetate.....	$CH_3CO_2C_5H_{11}$
Oil of pineapple.....	Ethyl butyrate.....	$C_3H_7CO_2C_2H_5$
Oil of vitriol.....	Concentrated sulfuric acid.....	H_2SO_4
Oil of wintergreen, artificial	Methyl salicylate.....	$o-HOC_6H_4CO_2CH_3$
Oleum.....	Fuming sulfuric acid.....	$H_2SO_4 + SO_3$
Olfiant gas.....	Ethylene.....	C_2H_4
Orpiment.....	Arsenic trisulfide.....	As_2S_3
Paris blue.....	Ferric ferrocyanide.....	$Fe_4[Fe(CN)_6]_3$
Paris green.....	Copper aceto-arsenite.....	$Cu(C_2H_3O_2)_2 \cdot 3CuAs_2O_4$
Pearl ash.....	Potassium carbonate.....	K_2CO_3
Permanent white.....	Barium sulfate.....	$BaSO_4$

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Petroleum ether.....	Benzine.....	C_6H_5OH
Phenic acid.....	Phenol.....	$COCl_2$
Phosgene.....	Carbonyl chloride.....	$Ca_3(PO_4)_2$
Phosphate rock.....	Calcium phosphate.....	$C_6H_2(NO_2)_3OH$
Picric acid.....	<i>sym</i> -Trinitrophenol.....	$CaSO_4 \cdot \frac{1}{2}H_2O$
Plaster of Paris.....	Calcium sulfate.....	C
Plumbago.....	Graphite.....	$CaCO_3$
Precipitated chalk.....	Calcium carbonate.....	$Fe_3[Fe(CN)_6]_3$
Prussian blue.....	Ferric ferrocyanide.....	HCN
Prussic acid.....	Hydrocyanic acid.....	SnO_2
Putty powder.....	Impure stannic oxide.....	FeS_2
Pyrites.....	Ferrous di-sulfide.....	CH_3CO_2H
Pyroligneous acid.....	Crude acetic acid.....	CH_3OH
Pyroligneous spirit.....	Methyl alcohol.....	MnO_2
Pyrolusite.....	Manganese dioxide.....	CaO
Quick lime.....	Calcium oxide.....	Hg
Quicksilver.....	Mercury.....	$C_6H_4(OH)_2(1, 4)$
Quinol.....	Hydroquinone.....	As_2S_2
Realgar.....	Arsenic disulfide.....	C_2H_5OH
Rectified spirit.....	Alcohol 90-5%.....	$Sb_2O_3 \cdot 2Sb_2S_3$
Red antimony.....	Antimony oxysulfide.....	Pb_3O_4
Red lead.....	Lead tetroxide.....	$Al(C_2H_3O_2)_3$
Red liquor.....	Aluminum acetate solution.....	HgO
Red precipitate.....	Oxide of mercury.....	$K_3Fe(CN)_6$
Red prussiate of potash.....	Potassium ferricyanide.....	$KNaC_4H_4O_6 \cdot 4H_2O$
Rochelle salt.....	Potassium sodium tartrate.....	$NaCl$
Rock salt.....	Sodium chloride.....	Fe_2O_3
Rouge.....	Ferric oxide.....	$o-C_6H_4 \cdot SO_2 \cdot NHCO$
Saccharin.....	Benzoic sulfimide.....	
Sal ammoniac.....	Ammonium chloride.....	NH_4Cl
Salol.....	Phenyl salicylate.....	$C_6H_4(OH)(CO_2C_6H_5)(1, 2)$
Salt.....	Sodium chloride.....	$NaCl$
Salt cake.....	Impure sodium sulfate.....	Na_2SO_4
Salt of amber.....	Succinic acid.....	$(CH_2CO_2H)_2$
Salt of lemon.....	Potassium acid oxalate.....	$KHC_2O_4 \cdot H_2O$
Salt of sorrel.....	Potassium carbonate.....	K_2CO_3
Salt of tartar.....	Potassium nitrate.....	KNO_3
Salt of wormwood.....	3, 3'-Diamino-4, 4'-dihydroxy-arsenobenzene dihydrochloride.....	$[(HO)(NH_2)C_6H_3As]_2 \cdot 2HCl$
Salt peter.....	Potassium nitrate.....	KNO_3
Salvarsan.....	3, 3'-Diamino-4, 4'-dihydroxy-arsenobenzene dihydrochloride.....	$[(HO)(NH_2)C_6H_3As]_2 \cdot 2HCl$
Satin white.....	Calcium sulfate.....	$CaSO_4 \cdot 2H_2O$
Scheele's green.....	Copper hydrogen arsenite.....	$CuHAsO_3$
Schlippe's salt.....	Sodium thioantimonate.....	$Na_3SbS_4 \cdot 9H_2O$
Silica.....	Silicon dioxide.....	SiO_2
Slaked lime.....	Calcium hydroxide.....	$Ca(OH)_2$
Soda (washing).....	Sodium carbonate.....	$Na_2CO_3 \cdot 10H_2O$
Soda crystals.....	Sodium carbonate.....	$Na_2CO_3 \cdot 10H_2O$
Soda lime.....	Mixture of calcium oxide and sodium hydroxide.....	$CaO + NaOH$
Sodium hyposulfite.....	Sodium thiosulfate.....	$Na_2S_2O_3 \cdot 5H_2O$
Soft soap.....	Potash soap.....	
Soluble glass.....	Sodium silicate.....	$Na_2SiO_3 + H_2O$
Soluble tartar.....	Potassium tartrate.....	$2K_2C_4H_4O_6 \cdot H_2O$
Spirit of hartshorn.....	Ammonia solution.....	NH_4OH
Spirit of salt.....	Hydrochloric acid.....	HCl
Spirit of wine.....	Ethyl alcohol.....	C_2H_5OH

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Stassfurtite.....	Magnesium borate and chloride double salt	$2Mg_3B_2O_{15} \cdot MgCl_2$
Sugar of lead.....	Lead acetate.....	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$
Sugar of milk.....	Lactose.....	$C_{12}H_{22}O_{11} \cdot H_2O$
Sulfuric ether.....	Diethyl ether.....	$(C_2H_5)_2O$
Superphosphate.....	Impure calcium acid phosphate	$CaH_4(PO_4)_2$
Sylvine.....	Potassium chloride.....	KCl
Sylvinite.....	Sylvine with rock salt.....	
Table salt.....	Sodium chloride.....	NaCl
Talc.....	Hydrated magnesium silicate	$Mg_3Si_4O_{11} \cdot H_2O$
Tartar.....	Crude potassium bitartrate	$KHC_4H_4O_6$
Tartar emetic.....	Potassium antimonyl tartrate	$2K(SbO)C_4H_4O_6 \cdot H_2O$
Tetralin.....	Tetrahydronaphthalene	$C_{10}H_{12}$
Tin crystals.....	Stannous chloride.....	$SnCl_2$
Tin white.....	Stannic hydroxide.....	$Sn(OH)_4$
T. N. T.....	Trinitrotoluene.....	$C_6H_2(CH_3)(NO_2)_3$ (1, 2, 4, 6)
Toluol.....	Toluene.....	$C_6H_5CH_3$
Trona.....	Natural sodium carbonate	$Na_2CO_3 \cdot NaHCO_3 \cdot 3H_2O$
Turnbull's blue.....	Ferrous ferricyanide.....	$Fe_3[Fe(CN)_6]_2$
Ultramarine yellow.....	Barium chromate.....	$BaCrO_4$
Unslaked lime.....	Calcium oxide.....	CaO
Vanillin.....	Methyl ether of protocatechualdehyde	$C_6H_3(OH)(OCH_3) \cdot CHO$ (1, 2, 4)
Venetian red.....	Ferric oxide.....	Fe_2O_3
Verdigris.....	Basic copper acetate.....	$2Cu(C_2H_3O_2)_2 + CuO(?)$
Vermilion.....	Red mercuric sulfide.....	HgS
Vitriol.....	Sulfuric acid.....	H_2SO_4
"Vitriolate of".....	"Sulfate of".....	
Washing soda.....	Sodium carbonate.....	$Na_2CO_3 \cdot 10H_2O$
Water glass.....	Sodium silicates dissolved in water	
White acid.....	Hydrofluoric acid and ammonium fluoride	$H_2F_2 + NH_4F$
White arsenic.....	Arsenous oxide.....	As_2O_3
White lead.....	Basic lead carbonate.....	$2PbCO_3 + Pb(OH)_2$
White vitriol.....	Zinc sulfate.....	$ZnSO_4 \cdot 7H_2O$
Whiting.....	Calcium carbonate.....	$CaCO_3$
Witherite.....	Barium carbonate.....	$BaCO_3$
Wood alcohol.....	Methyl alcohol.....	CH_3OH
Wood naphtha.....		
Wood spirit.....		
Xylol.....	Xylene.....	$C_6H_4(CH_3)_2$
Yellow prussiate of potash	Potassium ferrocyanide.....	$K_4Fe(CN)_6 \cdot 3H_2O$
Zinc blende.....	Mineral zinc sulfide.....	ZnS
Zinc vitriol.....	Zinc sulfate.....	$ZnSO_4 \cdot 7H_2O$
Zinc white.....	Zinc oxide.....	ZnO

Pigments named in the above list refer to the pure substance and not to mixtures often sold under the same name.

TRADE NAMES OF DYESTUFF INTERMEDIATES

Trade Name	Chemical Name
A acid.....	1, 7-Dihydroxynaphthalene-3, 6-disulfonic acid
Alizarin.....	1, 2-dihydroxyanthraquinone
Amino-G acid.....	2-Naphthylamine-6, 8-disulfonic acid
Amino-R acid.....	2-Naphthylamine-3, 6-disulfonic acid
Andresen's acid.....	1-Naphthol-3, 8-disulfonic acid
Anisidine.....	o-Aminophenol methyl ether
Anthrachrysone.....	1, 3, 5, 7-Tetrahydroxyanthraquinone
Anthraflavic acid.....	2, 6-Dihydroxyanthraquinone
Anthranilic acid.....	o-Aminobenzoic acid
Anthrarufin.....	1, 5-Dihydroxyanthraquinone
Armstrong's acid.....	Naphthalene-1, 5-disulfonic acid
Badische acid.....	2-Naphthylamine-8-sulfonic acid
Bayer's acid.....	2-Naphthol-8-sulfonic acid
Benzidine.....	p, p' -Diamino-diphenyl
Brönnér's acid.....	2-Naphthylamine-6-sulfonic acid
β acid.....	Anthraquinone-2-sulfonic acid
Chromotrope acid.....	1, 8-Dihydroxynaphthalene-3, 6-disulfonic acid
Chrysazin.....	1, 8-Dihydroxyanthraquinone
Cleve's acids.....	1-Naphthylamine-6- and -7-sulfonic acids
Cleve's acid.....	1-Naphthylamine-5-sulfonic acid
Cleve's acid.....	1-Naphthylamine-6-sulfonic acid
Cleve's acid.....	1-Naphthylamine-3-sulfonic acid
Cleve's acid.....	1-Naphthylamine-7-sulfonic acid
Cresotic acids.....	Cresol carboxylic acids
Croceine acid.....	2-Naphthol-8-sulfonic acid
Dahl's acid.....	2-Naphthylamine-5-sulfonic acid
Dahl's acid II.....	1-Naphthylamine-4, 6-disulfonic acid
Dahl's acid III.....	1-Naphthylamine-4, 7-disulfonic acid
Disulpho acid S.....	1-Naphthylamine-4, 8-disulfonic acid
DTS.....	Dehydrothio-p-toluidine sulfonic acid
δ acid.....	{ 1-Naphthol-4, 8-disulfonic acid
Ebert and Merz's acid.....	{ 1-Naphthylamine-4, 8-disulfonic acid
Ebert and Merz's acid.....	Naphthalene-2, 7-disulfonic acid
Ewer and Pick's acid.....	Naphthalene-2, 6-disulfonic acid
ε acid.....	{ Naphthalene-1, 6-disulfonic acid
F acid.....	{ 1-Naphthol-3, 8-disulfonic acid
Freund's acid.....	{ 1-Naphthylamine-3, 8-disulfonic acid
G acid.....	2-Naphthol-7-sulfonic acid
Gallic acid.....	1-Naphthylamine-3, 6-disulfonic acid
γ-acid.....	2-Naphthol-6, 8-disulfonic acid
H acid.....	3, 4, 5-Trihydroxybenzoic acid
Histazarin.....	2-Amino-8-naphthol-6-sulfonic acid
Isoanthraflavic acid.....	1-Amino-8-naphthol-3, 6-disulfonic acid
J acid.....	2, 3-Dihydroxyanthraquinone
K acid.....	2, 7-Dihydroxyanthraquinone
Kalle's acid.....	2-Amino-5-naphthol-7-sulfonic acid
Ketone base.....	1-Amino-8-naphthol-4, 6-disulfonic acid
Koch's acid.....	1-Naphthylamine-2, 7-disulfonic acid
L acid.....	Tetramethyldiaminobenzophenone
Laurent's acid.....	1-Naphthylamine-3, 6, 8-trisulfonic acid
Lepidine.....	1-Naphthol-5-sulfonic acid
Leucotrope.....	1-Naphthylamine-5-sulfonic acid
M acid.....	4-Methylquinoline
Mesidine.....	Phenyldimethylbenzylammonium chloride
Metanilic acid.....	1-Amino-5-naphthol-7-sulfonic acid
Michler's ketone.....	2, 4, 6-Trimethylaniline
Naphthazarin.....	Aniline-m-sulfonic acid
Naphthionic acid.....	Tetramethyldiaminobenzophenone
o-Naphthionic.....	5, 6-Dihydroxy-1, 4-naphthoquinone
Naphthol A. S.....	1-Naphthylamine-4-sulfonic acid
	1-Naphthylamine-2-sulfonic acid
	Anilide of -hydroxynaphthoic acid

TRADE NAMES OF DYESTUFF INTERMEDIATES (Continued)

Trade Name	Chemical Name
Naphthoresorcin.....	1, 3-Dihydroxynaphthalene
Nevile and Winther's acid..	1-Naphthol-4-sulfonic acid
Nigrotic acid.....	1, 7, 3, 6-Dihydroxysulfonaphthoic acid
Nitroso base.....	p-Nitrosodimethylaniline
NW acid.....	Nevile and Winther's acid
Peri acid.....	1-Naphthylamine-8-sulfonic acid
p-Phenetidine.....	p-Aminophenol ethyl ether
Phenyl-gamma acid.....	2-Phenylamino-8-naphthol-6-sulfonic acid
Phenyl Peri acid.....	Phenyl-1-naphthylamine-8-sulfonic acid
Phosgene.....	Carbonyl chloride
Phthalic acid.....	o-Benzenedicarboxylic acid
Picramic acid.....	2-Amino-4, 6-dinitrophenol
Picric acid.....	2, 4, 6-Trinitrophenol
Primuline base.....	p-Toluidine heated with sulfur.
Purpurin.....	1, 2, 4-Trihydroxyanthraquinone
Pyrogallol.....	1, 2, 3-Trihydroxybenzene
Quinaldine.....	2-Methylquinoline
Quinazarin.....	1, 4-Dihydroxyanthraquinone
R acid.....	2-Naphthol-3, 6-disulfonic acid
2 R acid.....	2-Amino-8-naphthol-3, 6-disulfonic acid
Red acid.....	1, 5-Dihydroxynaphthalene-3, 7-disulfonic acid
RG acid.....	1-Naphthol-3, 6-disulfonic acid
Resorcinol.....	1, 3-Dihydroxybenzene
S acid.....	1-Amino-8-naphthol-4-sulfonic acid
2 S acid.....	1-Amino-8-naphthol-2, 4-disulfonic acid
Salicylic acid.....	o-Hydroxybenzoic acid
Schäffer's acid.....	2-Naphthol-6-sulfonic acid
Schollkopf's acid.....	1-Naphthol-4, 8-disulfonic acid
	1-Naphthylamine-4, 8-disulfonic acid
	1-Naphthylamine-8-sulfonic acid
Sulfanilic acid.....	Aniline-p-sulfonic acid
Thiocarbanilide.....	Diphenylthiourea
Tobias acid.....	2-Naphthylamine-1-sulfonic acid
Tolidine.....	Di-p-aminoditoly
Toluidine.....	Amino toluene
Xylidine.....	Amino xylene
Yellow acid.....	1, 3-Dihydroxynaphthalene-5, 7-disulfonic acid

THE PRONUNCIATION OF CHEMICAL WORDS

Reprinted by permission from a report of the Nomenclature, Spelling, and Pronunciation Committee of the American Chemical Society* as published in News Edition, Industrial and Engineering Chemistry, 12, 202 (1934).

GENERALIZATIONS

(1) Accenting names of chemical substances on the final syllable is to be discouraged in all cases where the preference for such an accent is not emphatic. The names *amine*, *arsine*, *quinone*, and *sulfone* and words ending in these names (also the suffix *-phenone*) represent most of the exceptions. The general trend of the accent in the English language is recognized by authorities to be away from the end and toward the beginning of the word. However, when the last syllable of a word is a significant suffix, as *-al* for aldehydes, it is not slurred by chemists.

(2) In the interest of uniformity and in accordance with a general trend of English pronunciation in America, the ending *-ide* should be pronounced *-īd*. This appears to be uniformly the practice in inorganic chemistry. Many organic names are so pronounced also. Certain organic terms, however, are pronounced *-īd* by many, as *acetanilide*, *imide*, *phthalimide*, *lipide*, *amide*, and several words ending in *-amide*.

(3) For chemical names ending in *-ine*, usage is divided between the pronunciations *-ēn* and *-īn*, with a tendency in favor of *-ēn*. Since a distinction in spelling is made by many between names of bases ending in *-ine* and names of nonbases ending in *-in*, the pronunciation *-ēn* for the ending *-ine* is to be encouraged. (It is unfortunate that this conflicts in sound with the pronunciation of the ending *-ene*, but it is believed that this will cause confusion only with a very few words, as benzine and benzene, fluorine and fluorene. As to the pronunciation *-īn*, usage, at least in America, is very strongly against it, and it would conflict with the pronunciation of the new ending *-yne* adopted for names of acetylene hydrocarbons.) Quinine, because of strong popular usage, is an exception.

(4) The pronunciation *-ōl* for the ending of names of alcohols and phenols (except the word alcohol itself!), whether regrettable or not, seems firmly fixed and should be recognized. Emphasis on a significant ending is probably an influence in this practice. Chemical terms not belonging to the above classes, but generally pronounced *-ōl*, should be spelled with a final *e*; examples, *mole*, *pyrrole*. This is in accordance with the recommendation of the International Committee on Organic Nomenclature. For *sol* and words ending in *-sol*, the spelling *-ol* and the pronunciation *-ōl* should be encouraged.

(5) The ending *-yl* should be pronounced *-īl*. The pronunciation *-ēl* is apparently a Germanism and, although still in use

* The members of this committee are Austin M. Patterson, C. A. Jacobson, H. E. Howe, Arthur B. Lamb, E. J. Crane, *Chairman*, and the Board of Associate Editors of the *Journal of the American Chemical Society*.

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

to some extent is to be discouraged. The pronunciation *-īl*, apparently common in England, is seldom heard in the United States.

(6) The ending *-ile* (as in nitrile). Usage is divided among the pronunciations *-īl*, *-il*, and *-ēl*. The second of these is identical with the pronunciation recommended for *-yl*, and the third is apparently a Germanism. The pronunciation *-īl* should be favored.

(7) The endings *-acic*, *-alic*, *-anic*, *-aric*, *-elic*, *enic*, *-eric*, *-etic*, *-idic*, *-ilic*, *-inic*, *-isic*, *-onic*, *-opic*, *-oric*. A rather extensive study of the pronunciation of such endings shows a preference for a *short* vowel preceding *-ic* in all but a few cases. This result is in accord with age-old general English usage and is to be approved. *Acetic* (ă-sē'tik) is a very emphatic exception. Other exceptions are *cetic* (sē'tik) and *ceric* (sē'rik) and adjectives derived from the names of unsaturated hydrocarbons (because of the influence of the significant *-ene* ending).

(8) The ending *-olic*. This ending is an exception to the rule for words ending in *-ic* [compare (7)], perhaps owing to the influence of words ending in *-ol*. Inasmuch as ten cases out of twelve studied favor the long *ō*, some of them by very large majorities, it is recommended that this ending be uniformly pronounced *-ō'lik*.

(9) Adjectives ending in *-ic* should be accented on the next to the last syllable, as glycer'ic, not gly'ceric. In names of salts the accent, following the trend indicated in (1) above, usually moves one syllable (occasionally more) towards the beginning of the word, as gly'cerate, sal'icylate.

(10) The ending *-ime*. In oxime, at least, this should be pronounced *-ēm*, to accord with usage, though this is contrary to the normal English trend.

(11) The ending *-oin* should be pronounced as two syllables, *-ō-īn*, with the accent coming on the preceding syllable (as, bēn'zō-īn, fū'rō-īn). In certain words where the addition of a chemical suffix causes two vowels to come together there is a natural tendency to merge them and thus change their sound, as thebaine, linalool. While concession must be made to usage in particular cases, as cocaine, the pronunciation of such vowels separately is to be encouraged. The use of the dieresis is helpful, as linaloöl.

(12) Words ending in *-alent* should be so pronounced that the last two syllables are *-vā'lěnt*; as tri-vā'lěnt (not triv'ā-lěnt).

THE WORD LIST

The words listed below are, except for a few deletions, the ones on which the committee's study was based. After each word there is given one or more pronunciations (shown by respelling and the use of symbols as explained at the head of

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

the list). When only a single pronunciation is shown this means that usage and perhaps other influences are so strongly in favor of it that no alternative is proposed. When more than one pronunciation is shown an attempt has been made to place these in the order of preference. The provision of two, occasionally three, pronunciations indicates that usage is divided without a marked show of preference (this is true of many words throughout the English language), or that there is some conflict between usage and the other influences properly taken into consideration. The word "usage" in parentheses following a pronunciation signifies that usage supports it to a considerable extent, notwithstanding other dictates.

Again let it be said that there is no attempt to proclaim "This pronunciation is right and this one is wrong." Usage, chemical nomenclature considerations, derivation, and the rules of good English (a compromise has sometimes been necessary) suggest certain preferences and these we have tried to ascertain.

KEY TO PRONUNCIATION

The symbols used in the respelling for pronunciation have the following values: *ā*le, *senā*te, *ām*, *ā*ccount, *ā*rm; *ē*ve, *ē*vent, *ē*nd, *re*cēnt, *ma*kē; *ī*ce, *ī*ll; *ō*ld, *ō*bey, *ō*rb, *ō*dd, *cō*nnect; *ū*se, *ū*nite, *ū*rn, *ū*p, *cī*rcūs; *fō*od; *oī*l; *chā*ir; *gō*; *thī*n.

abietic	ăb'î-ět'îk	
acetal	ăs'ět-ăl	
acetaldehyde	ăs'ět-ăl'dê-hîd	
acetaldoxime	ăs'ět-ăl-dôk'sēm	
acetamide	ăs'ět-ăm'îd	ăs'ět-ăm'îd (<i>usage</i>)
		ă-sět'ă-mîd
acetanilide	ăs'ět-ăn'î-lîd	ăs'ět-ăn'î-lîd (<i>usage</i>)
acetic	ă-sē'tîk	
acetoacetate	ăs'ê-tô-ăs'ê-tāt	ă-sē'tô-ăs'ê-tāt
acetoacetic	ăs'ê-tô-ă-sē'tîk	ă-sē'tô-ă-sē'tîk
acetone	ăs'ê-tôn	
acetonitrile	ăs'ê-tô-nî'trîl	ăs'ê-tô-nî'trîl (<i>usage</i>)
acetyl	ă-sět'ô-nîl	ăs'ê-tô-nîl
acetophenone	ăs'ê-tô-fê-nôn'	ă-sē'tô-fê-nôn'
acetoxime	ăs'ět-ôk'sēm	
acetyl	ăs'ê-tîl	
acetylene	ă-sět'î-lēn	
aci-	ăs'î-	
acrolein	ă-krô'lê-în	
acyclic	ă-sî'klîk	
acyl	ăs'îl	
adiabatic	ăd'î-ă-băt'îk	
adrenaline	ăd-rên'ă-lēn	ăd-rên'ă-lîn (<i>usage</i>)
alantolic	ăl'ăn-tô'lîk	

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

alizarin	ă-lîz'ă-rîn	
alkaline	ăl'kă-lîn	ăl'kă-lîn
allotropy	ă-lôt'rô-pî	ăl'ô-trô'pî
allylamine	ăl'îl-ă-mên'	
aluminum	ă-lôô'mî-nŭm (usage)	ă-lŭ'mî-nŭm
amide	ăm'id	ăm'id (usage)
amido	ă-mē'dô	ăm'î-dô
amine	ă-mên'	
amino	ă-mē'nô	
ammine	ăm'en	
ammino	ăm'î-nô	ă-mē'nô (usage)
amyl	ăm'îl	
anhydride	ăn-hî'drîd	
aniline	ăn'î-lên	ăn'î-lîn (usage)
anistic	ă-nîs'îk	
anthranil	ăn'thră-nîl	
anthranilate	ăn-thrăn'î-lăt	
anthranilic	ăn'thră-nîl'îk	
antimonic	ăn'tî-môn'îk	ăn'tî-mô'nîk (usage)
antimonyl	ăn'tî-mô-nîl	
aqua	ăk'wă	
aqueous	ă'kwê-ŭs	
arabitol	ă-răb'î-tôl	
arabonic	ăr'ă-bôn'îk	
arachidic	ăr'ă-kîd'îk	
arecoline	ă-rē'kô-lên	ă-rē'kô-lîn (usage)
arsenic (acid)	ăr-sên'îk	ăr'sē-nîk (usage)
arsine	ăr-sên'	
arsonic	ăr-sôn'îk	
asphalt	ăs'fôlt	
assay	ăs'ă (usage)	ă-să'
asymmetric	ă'sî-mět'rîk	ăs'î-mět'rîk
atropine	ăt'rô-pên	
auricyanide	ô-rî-sî'ă-nîd	ô'rî-sî'ă-nîd (usage)
avitaminosis	ă-vî'tă-mîn-ô'sîs	
azelaic	ăz'ê-lă'îk	
azide	ăz'id	
azine	ăz'en	
azobenzene	ăz'ô-bên'zên	
barium	bă'rî-ŭm	băr'î-ŭm
behenic	bê-hên'îk	
benzamide	bên-zăm'id	bên-zăm'id (usage)
benzanilide	bên-zăn'î-lîd	bên-zăn'î-lîd (usage)
benzene	bên'zên	
benzil	bên'zîl	
benzilic	bên-zîl'îk	
benzine	bên'zên	

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

benzohydrol	bĕn'zô-hĭ'drôl	bĕn'zô-hĭ-drôl' (<i>usage</i>)
benzoin	bĕn'zô-ĭn	
benzophenone	bĕn'zô-fĕ-nôn'	
benzoyl	bĕn'zô-ĭl	bĕn'zô-ĕl (<i>usage</i>)
benzyl	bĕn'zĭl	
betaine	bĕ'tā-ĕn	
betulinamaric	bĕt'û-lĭn-ă-măr'ĭk	
biuret	bĭ'û-rĕt' (<i>usage</i>)	bĭ'û-rĕt
bivalent	bĭ-vă'lĕnt	
borneol	bô'r'nĕ-ôl	
boron	bô'rôn	bô'rôn
bromal	brô'măl	
bromide	brô'mĭd	
bromine	brô'mĕn	
buret	bû-rĕt'	
butadiene	bû'tă-di'ĕn	
butanolide	bû-tăn'ô-lĭd	bû-tăn'ô-lĭd (<i>usage</i>)
butyl	bû'tĭl	
butyronitrile	bû'tĭ-rô-nĭ'trĭl	bû'tĭ-rô-nĭ'trĭl (<i>usage</i>)
cacodyl	kăk'ô-dĭl	
cacodylate	kăk'ô-dĭl-ăt	kăk'ô-dĭl'ăt
caffeine	kăf'ĕ-ĕn	kăf'ĕ-ĭn (<i>usage</i>) kăf'ĕn (<i>popular</i>)
calorimetric	kăl'ô-rĭ-mĕt'rĭk	
camphanic	kăm-făn'ĭk	
campholenic	kăm'fô-lĕ'nĭk	kăm'fô-lĕn'ĭk
campholic	kăm-fô'ĭk	
caproate	kăp'rô-ăt	
caprylate	kăp'rĭ-lăt	
carbamate	kăr'bă-măt	kăr-băm'ăt (<i>usage</i>)
carbamide	kăr-băm'id	kăr-băm'id (<i>usage</i>)
carbanilide	kăr-băn'ĭ-lĭd	kăr-băn'ĭ-lĭd (<i>usage</i>)
carbethoxy	kăr'bĕth-ôk'sĭ	
carbinol	kăr'bĭ-nôl	
carbonyl	kăr'hô-nĭl	
cataphoresis	kăt'ă-fô-rĕ'sĭs	
catechol	kăt'ĕ-chôl	kăt'ĕ-kôl (<i>usage</i>)
cerebroside	sĕr'ĕ-brô-sĭd	sĕ-rĕ'brô-sĭd
ceric	sĕ'rĭk	sĕr'ĭk
cetic	sĕ'tĭk	
cetyl	sĕ'tĭl	sĕt'ĭl
chalcone	kăl'kôn	chăl'kôn (<i>usage</i>)
chelidonic	kĕl'ĭ-dôn'ĭk	kĕ'lĭ-dôn'ĭk (<i>usage</i>)
chloral	klô'răl	
chloride	klô'rĭd	
chlorophyllide	klô'rô-fĭl'id	
cholesterol	kô-lĕs'tĕr-ôl	
cholic	kô'lĭk	

THE PRONUNCIATION OF CHEMICAL WORDS

(Continued)

choline	kō'lēn	
choloidanic	kōl'oi-dăn'ŷk	
chromyl	krō'mŷl	
cinene	sī'nen	sīn'ēn
cinnamal	sīn'ă-măl	
cinnamate	sīn'ă-măt	sī-năm'ăt
cinnamic	sī-năm'ŷk	
citrate	sīt'răt	
clupeine	klōō'pē-ēn	
cobalticyanide	kō-bōl'tī-sī'ă-nīd	kō-bōl'tī-sī'ă-nīd (<i>usage</i>)
cocaine	kō-kăn' (<i>popular</i>)	kō'kă-ēn
codeine	kō'dē-ēn	
colchicine	kōl'chŷ-sēn (<i>usage</i>)	kōl'kŷ-sēn
colloid	kōl'oid	
comenic	kō-mēn'ŷk	
coniceine	kō-nŷs'ē-ēn	
coniine	kō'nŷ-ēn	
constitutive	kōn'stī-tū'tīv	kōn-stīt'ū-tīv
convallamarin	kōn-văl'ă-măr'ŷn	
coumaric	kōō-măr'ŷk	kū-măr'ŷk (<i>usage</i>)
coumarin	kōō'mă-rŷn	kū'mă-rŷn (<i>usage</i>)
creatine	krē'ă-tēn	krē'ă-tŷn (<i>usage</i>)
cresol	krē'sōl	
cresyl	krēs'ŷl	k. ē'sŷl
crotonic	krō-tōn'ŷk	
cyanamide	sī'ăn-ăm'id	sī'ăn-ăm'id (<i>usage</i>) sī-ăn'ă-mīd
cyanogen	sī-ăn'ō-jēn	
cyclic	sī'klŷk	
cyclohexane	sī'klō-hēk'săn	
cysteine	sŷs'tē-ēn	
decyl	dēs'ŷl	
decylene	dēs'ŷ-lēn	
desoxy	dēs'ōk'sŷ	
diacetyl	dī-ăs'ē-tŷl	
diazo	dī-ăz'ō	
dichromate	dī-krō'măt	
diethylamine	dī-ēth'ŷl-ă-mēn'	
dinaphthol	dī-năf'thōl	
dioxindole	dī'ōk-sŷn'dōl	dī-ōk'sŷn-dōl
diphenic	dī-fēn'ŷk	
diphenylethane	dī-fēn'ŷl-ēth'ăn	
dipropargyl	dī'prō-păr'jŷl	
distillate	dŷs'tī-lăt	dŷs'tī-lăt
dynamite	dŷ'nă-mīt	
elaidic	ēl'ă-ŷd'ŷk	
elemolic	ēl'ē-mō'ŷk	
enol	ē'nōl	

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

enolic	ĕ-nō'lik	
enterokinase	ĕn'tēr-ō-kī'nās	ĕn'tēr-ō-kīn'ās
enzyme	ĕn'zīm	
enzymic	ĕn-zī'mik	
ephedrine	ĕf'ĕ-drĕn	ĕ-fĕd'rĭn (<i>usage</i>)
ergosterol	ĕr-gōs'tēr-ōl	
erythrose	ĕr'ī-thrōs	ĕ-rĭth'rōs
ethoxide	ĕth-ōk'sīd	
ethyl	ĕth'ĭl	
ethylidene	ĕth-ĭl'ī-dĕn	ĕth'ĭl-ī-dĕn
ferricyanide	fĕr'ī-sī'ă-nīd	
fluorene	flōō'ō-rĕn	
fluorescein	flōō'ō-rĕs'ĕ-ĭn	flōō-ōr'ĕ-sĕn (<i>usage</i>)
fluorine	flōō'ō-rĕn	
formamide	fōrm-ăm'īd	fōrm-ăm'īd (<i>usage</i>)
fructose	frūk'tōs	
fulminic	fŭl-mĭn'ĭk	
fumaric	fŭ-măr'ĭk	
furan	fŭ'răn	
furfural	fŭr'fŭr-ăl	
furoin	fŭ'rō-ĭn	
galalith	găl'ă-lĭth	
geraniol	jĕ-ră'nĭ-ōl	
gitogenic	jĭt'ō-jĕn'ĭk	
gluconic	glōō-kōn'ĭk	
glucosamine	glōō'kōs-ă-mĕn'	
glucoside	glōō'kō-sīd	
glutamic	glōō-tăm'ĭk	
glutaric	glōō-tăr'ĭk	
glutathione	glōō'tă-thĭ'ōn	
glyceric	glĭ-sĕr'ĭk	
glycine	glĭ'sĕn	glĭ-sĕn' (<i>usage</i>)
glycolic	glĭ-kō'ĭk	glĭ-kōl'ĭk (<i>usage</i>)
glycyl	glĭ'sĭl	
glycyrrhetic	glĭs'ī-rĕt'ĭk	
glyoxal	glĭ-ōk'săl	glĭ'ōk-săl' (<i>usage</i>)
glyoxyl	glĭ-ōk'sĭl	
guaiacol	gwĭ'ă-kōl	
guanidine	gwă'nĭ-dĕn	
guanine	gwă'nĕn	
gulose	gŭ'lōs	
hafnium	hăf'nĭ-ŭm	
halide	hăl'īd	hă'īd (<i>usage</i>)
halogen	hăl'ō-jĕn	
haloid	hăl'oid	hă'loid
haloquinonoid	hăl'ō-kwĭn'ō-noid	hăl'ō-kwĭ-nō'noid
hematin	hĕm'ă-tĭn (<i>usage</i>)	hĕ'mă-tĭn
hemoglobin	hĕ'mō-glō'bĭn	hĕm'ō-glō'bĭn

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

heroine	hěr'ō-ēn	hěr'ō-lŋ (<i>usage</i>)
hydantoin	hī-dăn'tō-lŋ	
hydrazide	hī'dră-zīd	
hydrazine	hī'dră-zēn	
hydrazo	hī-drăz'ō	
hydrazoic	hī-dră-zō'ŷk	
hydriodic	hī'drī-ōd'ŷk	
hydrofluoric	hī'drō-flōō-ōr'ŷk	
hydroquinone	hī'drō-kwī-nōn'	
hydrosol	hī'drō-sōl	
hydroxylamine	hī-drōk'sīl-ă-mēn'	
hyenic	hī-ēn'ŷk	
hypoiodous	hī'pō-i-ō'dūs	
iatrochemistry	ī-ăt'rō-kēm'is-trī	
idose	ī'dōs	
illinium	ī-lŋ'ī-ŭm	
imide	īm'id	īm'id (<i>usage</i>)
imido	ī-mē'dō	īm'ī-dō
imino	ī-mē'nō	īm'ī-nō
indigotin	īn-dīg'ō-tīn	īn'dī-gō'tīn
indoxyl	īn-dōk'sīl	
inositol	īn-ō'sī-tōl	
iodine	ī'ō-dēn	
iodoso	ī'ō-dō'sō	
iodous	ī-ō'dūs	
ionone	ī'ō-nōn' (<i>usage</i>)	
irone	ī-rōn' (<i>usage</i>)	
isatide	ī'să-tīd	
isatin	ī'să-tīn	
iso	ī'sō	
isotropic	ī'sō-trōp'ŷk	ī'sō-trō'pŷk
itaconic	īt'ă-kōn'ŷk	
labile	lă'bīl	
lauronic	lō'rō-nō'ŷk	
leucine	lōō'sēn (<i>usage</i>)	lū'sēn
linaloöl	līn-ăl'ō-ōl	
linalyl	līn'ă-līl	
linoleic	līn'ō-lē'ŷk	
linolenic	līn'ō-lēn'ŷk	līn'ō-lē'nŷk (<i>usage</i>)
lipase	lī'pās	
lipide	lī'pīd	līp'id (<i>usage</i>)
lipoid	lī'poid	līp'oid (<i>usage</i>)
litharge	līth'ărj	
lutidine	lōō'tī-dēn (<i>usage</i>)	lū'tī-dēn
maleic	mă-lē'ŷk	
malic	măl'ŷk	
malonic	mă-lōn'ŷk	mă-lō'nŷk (<i>usage</i>)
malonyl	măl'ō-nīl	

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

mandelic	măn-děl'ík	
manganese	măn'gă-nēs	
manganic	măn-găn'ík	
mannonic	mă-nôn'ík	
margaric	măr-găr'ík	măr-găr'ík (<i>usage</i>)
meconic	mê-kôn'ík	
melissyl	mê-lis'íl	
mellophanic	měl'ô-făn'ík	
menthol	mên'thōl	
mercaptal	mēr-kăp'tăl	
mercaptan	mēr-kăp'tăn	
mercuric	mēr-kŭ'rík	
mercurous	mēr-kŭ'răŝ	
mesaconic	mēs'ă-kôn'ík	
mesityl	mēs'í tíl	
mesitylene	mê-sít'íl-ēn	
mesitylenic	mê-sít'í-lē'ník	mê-sít'í-lēn'ík
mesotartaric	mēs'ô-tăr-tăr'ík	mēs'ô-tăr-tăr'ík (<i>usage</i>)
mesothorium	mēs'ô-thō'rĭ-ŭm	
mesoxalic	mēs'ôk-săl'ík	měz'ôk-săl'ík (<i>usage</i>)
metarsenic	mêt'ăr-sěn'ík	
methanol	mêth'ă-nōl	
methyl	mêth'íl	
methylal	mêth'íl-ăl	mêth'íl-ăl' (<i>usage</i>)
methylamine	mêth'íl-ă-mên'	
micro	mĭ'krō	
mole	mōl	
molecule	mōl'ê-kŭl	
monacetic	môn-ăs'ê-tĭn	mō-năs'ê-tĭn
mono	môn'ô	mō'nô
monoxide	môn-ôk'sĭd	mō-nôk'sĭd
morphine	mô'r'fēn	
naphthalide	năf'thă-lĭd	năf'thă-lĭd (<i>usage</i>)
naphthenic	năf-thē'nĭk	năf-thēn'ík
naphthol	năf'thōl	
nascent	năs'ênt	nă'sênt
neurine	nōō'rēn (<i>usage</i>)	nŭ'rēn
niton	nĭ'tōn	
nitrate	nĭ-tră'tō	
nitrile	nĭ'trĭl	nĭ'trĭl (<i>usage</i>)
nitro	nĭ'trō	
nitrosamine	nĭ'trō-să-mên'	
nitrosyl	nĭ'trō-sĭl	nĭ-trō'sĭl (<i>usage</i>)
nitroxyl	nĭ-trôk'sĭl	
nonane	nō'năn	
nucleic	nŭ-klē'ík	
nucleotide	nŭ'klē-ô-tĭd	
oleic	ô-lē'ík	

THE PRONUNCIATION OF CHEMICAL WORDS

(Continued)

orcinol	ôr'sī-nōl	
ortho	ôr'thō	
osazone	ō'să-zōn	ō'să-zōn' (<i>usage</i>)
osmium	ōz'mī-ŭm	
oxalic	ōk-săl'ŭk	
oxazine	ōk'să-zēn	
oxide	ōk'sid	
oxime	ōk'sēm	
oxindole	ōk-sīn'dōl	ōk'sīn-dōl
oxozonide	ōk-sō'zō-nīd	
ozone	ō'zōn	
palladio	pă-lă'dī-ō	
pelargonic	pěl'ăr-gōn'ŭk	
pentitol	pěn'tī-tōl	
peptide	pěp'tīd	
periodic (acid)	pâr'ī-ōd'ŭk	
permutite	pâr'm ũ-tīt	
peroxide	pēr-ōk'sid	
phenate	fē'năt	fēn'ăt
phenazine	fēn'ă-zēn	
phenetidine	fēn-ēt'ī-dēn	
phenol	fē'nōl	
phenolic	fē-nō'lŭk	
phenolphthalein	fē'nōl-thăl'ē-īn	fē'nōl-thăl'ēn (<i>usage</i>)
pheophorbide	fē'ō-fôr'bīd	
phloretic	flō-rēt'ŭk	
phlorizin	flôr'ī-zīn	
phosphatide	fōs'fă-tīd	
phosphorous	fōs-fō'rŭs	fōs'fō-rŭs (<i>usage</i>)
phthalein	thăl'ē-īn	thăl'ēn (<i>usage</i>)
phthalic	thăl'ŭk	
phthalide	thăl'īd	
phthalimide	thăl-īm'īd	thăl-īm'īd (<i>usage</i>)
phytol	fī'tōl	
phytosterol	fī-tōs'tēr-ōl	
picric	pīk'rŭk	
pilocarpine	pī'lō-kăr'pēn	
pimalic	pī-măl'ŭk	
pimaric	pī-măr'ŭk	
pimelic	pī-měl'ŭk	
pinacolone	pīn-ăk'ō-lōn	
piperamide	pīp'ēr-ăm'īd	pīp'ēr-ăm'īd (<i>usage</i>)
piperidine	pī-pēr'ī-dēn	pī-pēr'ă-mīd
polymerism	pōl'ī-mēr-īz'm	pīp'ēr-ī-dēn
polymerize	pōl'ī-mēr-īz	pō-līm'ēr-īz'm
porphyrin	pôr'fī-rīn	pō-līm'ēr-īz
praseodymium	pră'zē-ō-dīm'ī-ŭm	

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

propionic	prō'pī-ō'lik	
propionamide	prō'pī-ōn-ām'id	prō'pī-ōn-ām'id (<i>usage</i>)
propionic	prō'pī-ōn'lik	
propionyl	prō'pī-ō-nīl	
propyl	prō'pīl	
propylidene	prō-pīl'ī-dēn	prō'pīl-l-dēn
protein	prō'tē-īn	
ptomaine	tō'mān (<i>popular</i>)	tō'mā-ēn
pyrazoline	pīr-āz'ō-lēn	
pyrogallol	pī'rō-gāl'ōl	
pyrrole	pīr'ōl	pīr-ōl' (<i>usage</i>)
pyrrolidine	pī-rō'lī-dēn	pī-rōl'ī-dēn
pyruvic	pī-rōō'vīk	
quadrivalent	kwōd'rī-vā'lēnt	
quinine	kwī'nīn (<i>popular</i>)	kwīn'ēn
quinone	kwīn-ōn'	
quinonoid	kwīn'ō-noid	kwī-nō'noid
racemize	rās'ē-mīz	
resorufin	rēz'ō-rōō'fīn	
rhamnitol	rām'nī-tōl	
ribonic	rī-bōn'lik	
ribose	rī'bōs	
ricin	rī'sīn	
rosaniline	rōz-ān'ī-lēn	rōz-ān'ī-līn (<i>usage</i>)
rosolic	rōz-ō'lik	rōz-ōl'lik (<i>usage</i>)
sabinene	sāb'ī-nēn	
saccharic	sā-kār'lik	
saccharide	sāk'ā-rīd	
salicylate	sāl'ī-sīl-āt	sā-līs'ī-lāt
saligenin	sā-līj'ē-nīn	
samarium	sā-mār'ī-ūm	sā-mā'rī-ūm
santalac	sān-tāl'lik	
sebacic	sē-bās'lik	
selenate	sēl'ē-nāt	
selenic	sē-lēn'lik	sē-lē'nīk (<i>usage</i>)
selenide	sēl'ē-nīd	
semicarbazide	sēm'ī-kār'bā-zīd	sēm'ī-kār'bā-zīd
serine	sēr'ēn	
skatole	skā'tōl	
solute	sōl'ūt	
stannonic	stā-nōn'lik	
stearic	stē-ār'lik	
stearin	stē'ā rīn	
stearolic	stē'-ā-rō'lik	
stibine	stīb'ēn	
strontium	strōn'shī-ūm	
strychnine	strīk'nēn	strīk'nīn (<i>usage</i>)
styrene	stī'rēn	

THE PRONUNCIATION OF CHEMICAL WORDS (Concluded)

sulfenic	sŭl-fĭn'ĭk	
sulfonal	sŭl'fō-năl	
sulfone	sŭl-fōn'	sŭl'fōn
sulfonic	sŭl-fōn'ĭk	
sulfurous	sŭl-fŭ'rŭs	
sulfuryl	sŭl'fŭ-rĭl	
tartaric	tăr-tăr'ĭk	tăr-tăr'ĭk (<i>usage</i>)
taurocholic	tô'rô-kô'lĭk	
terephthalic	těr'ěf-thăl'ĭk	
tetrolic	tê-trô'lĭk	
thebaine	thē'bā-ēn	
theine	thē'ēn	
titanic	tī-tăn'ĭk	
titanium	tī-tă'nĭ-ŭm	
titanous	tī-tăn'ŭs	
titanyl	tī'tăn-ĭl	
titer	tī'tēr	
titrate	tī'trăt	
trional	trī'ō-năl	
trivalent	trī-vă'lěnt	
univalent	ŭ'nĭ-vă'lěnt	
uranyl	ŭ'ră-nĭl	
urea	ŭ-rē'ă	
ureide	ŭ'rē-ĭd	
valeric	vă-lěr'ĭk	
valine	văl'ēn	vă'lēn
vanadate	văn'ă-dăt	
vanillin	văn'ĭ-lĭn	
veratrole	věr'ă-trōl	
vinyl	vĭ'nĭl	
vitamin	vĭ'tă-mĭn	
vitellin	vĭ-těl'ĭn	
xenon	zē'nŏn	
xylitol	zĭ'lĭ-tōl	

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FLAME AND BEAD TESTS

Flame Colorations

VIOLET

Potassium compounds. Purple red through blue glass. Easily obscured by sodium flame. Bluish green through green glass. Rubidium and Caesium compounds impart same flame as potassium compounds.

BLUES

Azure.—Copper chloride. Copper bromide gives azure blue followed by green. Other copper compounds give same coloration when moistened with hydrochloric acid.

Light Blue.—Lead, Arsenic, Selenium.

GREENS

Emerald.—Copper compounds except the halides, and when not moistened with hydrochloric acid.

Pure Green.—Compounds of thallium and tellurium.

Yellowish.—Barium compounds. Some molybdenum compounds. Borates, especially when treated with sulphuric acid or when burned with alcohol.

Bluish.—Phosphates with sulphuric acid.

Feeble.—Antimony compounds. Ammonium compounds.

Whitish.—Zinc.

REDS

Carmine.—Lithium compounds. Violet through blue glass. Invisible through green glass. Masked by barium flame.

Scarlet.—Strontium compounds. Violet through blue glass. Yellowish through green glass. Masked by barium flame.

Yellowish.—Calcium compounds. Greenish through blue glass. Green through green glass. Masked by barium flame.

YELLOW

Yellow.—All sodium compounds. Invisible with blue glass.

Borax Beads

Abbreviations employed: s., saturated; s.s., supersaturated; n.s., not saturated; h., hot; c., cold.

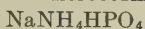
Substance	Oxidizing flame	Reducing flame
Aluminum.....	Colorless (h.c., n.s.); opaque (s.s.)	Colorless; opaque (s.)
Antimony.....	Colorless; yellow or brownish (h., s.s.)	Gray and opaque
Barium.....	Colorless (n.s.)	.....
Bismuth.....	Colorless; yellow or brownish (h., s.s.)	Gray and opaque
Cadmium.....	Colorless	Gray and opaque
Calcium.....	Colorless (n.s.)	.....
Cerium.....	Red (h.)	Colorless (h.c.)
Chromium.....	Green (c.)	Green
Cobalt.....	Blue (h.c.)	Blue (h.c.)
Copper.....	Green (h.); blue (c.)	Red (c.); opaque (s.s.); colorless (h.)

FLAME AND BEAD TESTS (Continued)

Borax Beads (Continued)

Substance	Oxidizing flame	Reducing flame
Iron	Yellow or brownish red (h., n.s.)	Green (s.s.)
Lead	Colorless; yellow or brownish (h., s.s.)	Gray and opaque
Magnesium	Colorless (n.s.)	Colorless (h.c.)
Manganese	Violet (h.c.)	Yellow or brown (h.)
Molybdenum	Colorless	Gray and opaque
Nickel	Brown; red (c.)	Colorless; opaque (s.)
Silicon	Colorless (h.c.); opaque (s.s.)	Gray and opaque
Silver	Colorless (n.s.)	Colorless; opaque (s.)
Strontium	Colorless (n.s.)	Yellow (h.); violet (c.)
Tin	Colorless (h.c.); opaque (s.s.)	Brown
Titanium	Colorless	Green
Tungsten	Colorless	
Uranium	Yellow or brownish (h., n.s.)	
Vanadium	Colorless	

Beads of Microcosmic Salt



Substance	Oxidizing flame	Reducing flame
Aluminum	Colorless; opaque (s.)	Colorless; not clear (s.s.)
Antimony	Colorless (n.s.)	Gray and opaque
Barium	Colorless; opaque (s.)	Colorless; not clear (s.s.)
Bismuth	Colorless (n.s.)	Gray and opaque
Cadmium	Colorless (n.s.)	Gray and opaque
Calcium	Colorless; opaque (s.)	Colorless; not clear (s.s.)
Cerium	Yellow or brownish red (h., s.)	Colorless
Chromium	Red (h., s.); green (c.)	Green (c.)
Cobalt	Blue (h.c.)	Blue (h.c.)
Copper	Blue (c.); green (h.)	Red and opaque (c.)
Iron	Yellow or brown (h., s.)	Colorless; yellow or brownish (h.)
Lead	Colorless (n.s.)	Gray and opaque
Magnesium	Colorless; opaque (s.)	Colorless; not clear (s.s.)
Manganese	Violet (h.c.)	Colorless
Molybdenum	Colorless; green (h.)	Green (h.)
Nickel	Yellow (c.); red (h., s.)	Yellow (c.); red (h.); gray and opaque
Silicon	(Swims undissolved)	(Swims undissolved)
Silver		Gray and opaque
Strontium	Colorless; opaque (s.)	Colorless; not clear (s.s.)
Tin	Colorless; opaque (s.)	Colorless
Titanium	Colorless (n.s.)	Violet (c.); yellow or brownish (h.)
Uranium	Green; yellow or brownish (h., s.)	Green (h.)
Vanadium	Yellow	Green
Zinc	Colorless (n.s.)	Gray and opaque

Sodium Carbonate Bead

Manganese	Green	Colorless
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PREPARATION OF REAGENTS

The following pages present directions for the preparation of various reagents. The collection has been prepared with the active collaboration of W. D. Bonner, R. K. Carleton, L. L. Carrick, Giles B. Cooke, E. J. Cragoe, Thos. De Vries, James L. Kassner, Thos. W. Mason, F. C. Mathers, M. G. Mellon, W. C. Pierce, J. H. Reedy, Arthur A. Vernon and S. R. Wood. Many others have contributed valuable suggestions.

Volumes have been stated in milliliters (ml) and liters (l). One milliliter is equivalent to 1.000027 cubic centimeters (cm³ or cc.). Masses are indicated in grams (g).

The relation to molar solution (*M*) or normal solution (*N*) is indicated in many cases.

Distilled water should be used.

LABORATORY REAGENTS FOR GENERAL USE

DILUTE ACIDS, 3 molar. Use the amount of concentrated acid indicated and dilute to one liter.

Acetic acid, 3 *N*. Use 172 ml of 17.4 *M* acid (99–100 %).

Hydrochloric acid, 3 *N*. Use 258 ml of 11.6 *M* acid (36 % HCl).

Nitric acid, 3 *N*. Use 195 ml of 15.4 *M* acid (69 % HNO₃).

Phosphoric acid, 9 *N*. Use 205 ml of 14.6 *M* acid (85 % H₃PO₄).

Sulfuric acid, 6 *N*. Use 168 ml of 17.8 *M* acid (95 % H₂SO₄).

DILUTE BASES.

Ammonium hydroxide, 3 *M*, 3 *N*. Dilute 200 ml of concentrated solution (14.8 *M*, 28 % NH₃) to 1 liter.

Barium hydroxide, 0.2 *M*, 0.4 *N*. Saturated solution, 63 g per liter of Ba(OH)₂·8H₂O. Use some excess, filter off BaCO₃ and protect from CO₂ of the air with soda lime or ascarite in a guard tube.

Calcium hydroxide, 0.02 *M*, 0.04 *N*. Saturated solution, 1.5 g per liter of Ca(OH)₂. Use some excess, filter off CaCO₃ and protect from CO₂ of the air.

Potassium hydroxide, 3 *M*, 3 *N*. Dissolve 176 g of the sticks (95 %) in water and dilute to 1 liter.

Sodium hydroxide, 3 *M*, 3 *N*. Dissolve 126 g of the sticks (95 %) in water and dilute to 1 liter.

GENERAL REAGENTS. (See also *Standard Solutions for Volumetric Analysis*, and *Decinormal Solutions of Salts and Other Reagents*.)

Aluminum chloride, 0.167 *M*, 0.5 *N*. Dissolve 22 g of AlCl₃ in 1 liter of water.

LABORATORY REAGENTS (Continued)

Aluminum nitrate, 0.167 *M*, 0.5 *N*. Dissolve 58 g of $\text{Al}(\text{NO}_3)_3 \cdot 7.5\text{H}_2\text{O}$ in 1 liter of water.

Aluminum sulfate, 0.083 *M*, 0.5 *N*. Dissolve 56 g of $\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$ in 1 liter of water.

Ammonium acetate, 3 *M*, 3 *N*. Dissolve 230 g of $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ in water and dilute to 1 liter.

Ammonium carbonate, 1.5 *M*. Dissolve 144 g of the commercial salt (mixture of $(\text{NH}_4)_2\text{CO}_3 \cdot \text{H}_2\text{O}$ and $\text{NH}_4\text{CO}_2\text{NH}_2$) in 500 ml of 3 *N* NH_4OH and dilute to 1 liter.

Ammonium chloride, 3 *M*, 3 *N*. Dissolve 160 g of NH_4Cl in water. Dilute to 1 liter.

Ammonium molybdate.

1. 0.5 *M*, 1 *N*. Mix well 72 g of pure MoO_3 (or 81 g of H_2MoO_4) with 200 ml of water, and add 60 ml of conc. ammonium hydroxide. When solution is complete, filter and pour filtrate, *very slowly* and with *rapid stirring*, into a mixture of 270 ml of conc. HNO_3 and 400 ml of water. Allow to stand over night, filter and dilute to 1 liter.

2. The reagent is prepared as two solutions which are mixed as needed, thus always providing fresh reagent of proper strength and composition. Since ammonium molybdate is an expensive reagent, and since an acid solution of this reagent as usually prepared keeps for only a few days, the method proposed will avoid loss of reagent and provide more certain results for quantitative work.

Solution 1. Dissolve 100 g of ammonium molybdate (C.P. grade) in 400 ml of water and 80 ml of 15 *M* NH_4OH . Filter if necessary, though this seldom has to be done.

Solution 2. Mix 400 ml of 16 *M* nitric acid with 600 ml of water.

For use, mix the calculated amount of solution 1 with twice its volume of solution 2, adding solution 1 to solution 2 slowly, with vigorous stirring. Thus, for amounts of phosphorus up to 20 mg, 10 ml of solution 1 to 20 ml of solution 2 is adequate. Increase amount as needed.

Ammonium nitrate, 1 *M*, 1 *N*. Dissolve 80 g of NH_4NO_3 in 1 liter of water.

Ammonium oxalate, 0.25 *M*, 0.5 *N*. Dissolve 35.5 g of $(\text{NH}_4)_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ in water. Dilute to 1 liter.

Ammonium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 33 g of $(\text{NH}_4)_2\text{SO}_4$ in 1 liter of water.

Ammonium sulfide, colorless.

1. 3 *M*. Treat 200 ml of conc. NH_4OH with H_2S until saturated, keeping the solution cold. Add 200 ml of conc. NH_4OH and dilute of 1 liter.

2. 6 *N*. Saturate 6 *N* ammonium hydroxide (40 ml conc. ammonia solution + 60 ml H_2O) with washed H_2S gas. The ammonium hydroxide bottle must be completely full and must be kept surrounded by ice while being saturated (about 48 hours for two liters). The reagent is best preserved in brown, completely filled, glass-stoppered bottles.

LABORATORY REAGENTS (Continued)

Ammonium sulfide, yellow. Treat 150 ml of conc. NH_4OH with H_2S until saturated, keeping the solution cool. Add 250 ml of conc. NH_4OH and 10 g of powdered sulfur. Shake the mixture until the sulfur is dissolved and dilute to 1 liter with water. In the solution the concentration of $(\text{NH}_4)_2\text{S}_2$, $(\text{NH}_4)_2\text{S}$ and NH_4OH are 0.625, 0.4 and 1.5 normal respectively. On standing, the concentration of $(\text{NH}_4)_2\text{S}_2$ increases and that of $(\text{NH}_4)_2\text{S}$ and NH_4OH decreases.

Antimony pentachloride, 0.1 M, 0.5 N. Dissolve 30 g of SbCl_5 in 1 liter of water.

Antimony trichloride, 0.167 M, 0.5 N. Dissolve 38 g of SbCl_3 in 1 liter of water.

Aqua regia. Mix 1 part concentrated HNO_3 with 3 parts of concentrated HCl . This formula should include one volume of water if the aqua regia is to be stored for any length of time. Without water, objectionable quantities of chlorine and other gases are evolved.

Barium chloride, 0.25 M, 0.5 N. Dissolve 61 g of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ in water. Dilute to 1 liter.

Barium hydroxide, saturated solution, 0.1 M, about 0.2 N. Dissolve 32 g of $\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$ in 1 liter of water.

Barium nitrate, 0.25 M, 0.5 N. Dissolve 65 g of $\text{Ba}(\text{NO}_3)_2$ in 1 liter of water.

Bismuth chloride, 0.167 M, 0.5 N. Dissolve 53 g of BiCl_3 in 1 liter of dilute HCl . Use 1 part HCl to 5 parts water.

Bismuth nitrate, 0.083 M, 0.25 N. Dissolve 40 g of $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$ in 1 liter of dilute HNO_3 . Use 1 part of HNO_3 to 5 parts of water.

Cadmium chloride, 0.25 M, 0.5 N. Dissolve 46 g of CdCl_2 in 1 liter of water.

Cadmium nitrate, 0.25 M, 0.5 N. Dissolve 77 g of $\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ in 1 liter of water.

Cadmium sulfate, 0.25 M, 0.5 N. Dissolve 70 g of $\text{CdSO}_4 \cdot 4\text{H}_2\text{O}$ in 1 liter of water.

Calcium chloride, 0.25 M, 0.5 N. Dissolve 55 g of $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ in water. Dilute to 1 liter.

Calcium nitrate, 0.25 M, 0.5 N. Dissolve 41 g of $\text{Ca}(\text{NO}_3)_2$ in 1 liter of water.

Chloroplatinic acid.

1. 0.0512 M, 0.102 N. Dissolve 26.53 g of $\text{H}_2\text{PtCl}_6 \cdot 6\text{H}_2\text{O}$ in water. Dilute to 100 ml. Contains 0.100 g Pt per ml.

2. Make a 10 % solution by dissolving 1 g of $\text{H}_2\text{PtCl}_6 \cdot 6\text{H}_2\text{O}$ in 9 ml of water. Shake thoroughly to insure complete mixing. Keep in a dropping bottle.

Chromic chloride, 0.167 M, 0.5 N. Dissolve 26 g of CrCl_3 in 1 liter of water.

Chromic nitrate, 0.167 M, 0.5 N. Dissolve 40 g of $\text{Cr}(\text{NO}_3)_3$ in 1 liter of water.

Chromic sulfate, 0.083 M, 0.5 N. Dissolve 60 g of $\text{Cr}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$ in 1 liter of water.

Cobaltous nitrate, 0.25 M, 0.5 N. Dissolve 73 g of $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

LABORATORY REAGENTS (Continued)

Cobaltous sulfate, 0.25 *M*, 0.5 *N*. Dissolve 70 g of $\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$ in 1 liter of water.

Cupric chloride, 0.25 *M*, 0.5 *N*. Dissolve 43 g of $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ in 1 liter of water.

Cupric nitrate, 0.25 *M*, 0.5 *N*. Dissolve 74 g of $\text{Cu}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Cupric sulfate, 0.5 *M*, 1 *N*. Dissolve 124.8 g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in water to which 5 ml of H_2SO_4 has been added. Dilute to 1 liter.

Ferric chloride, 0.5 *M*, 1.5 *N*. Dissolve 135.2 g of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ in water containing 20 ml of conc. HCl . Dilute to 1 liter.

Ferric nitrate, 0.167 *M*, 0.5 *N*. Dissolve 67 g of $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ in 1 liter of water.

Ferric sulfate, 0.25 *M*, 0.5 *N*. Dissolve 140.5 g of $\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$ in water containing 100 ml of conc. H_2SO_4 . Dilute to 1 liter.

Ferrous ammonium sulfate, 0.5 *M*, 1 *N*. Dissolve 196 g of $\text{Fe}(\text{NH}_4\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ in water containing 10 ml of conc. H_2SO_4 . Dilute to 1 liter. Prepare fresh solutions for best results.

Ferrous sulfate, 0.5 *M*, 1 *N*. Dissolve 139 g of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ in water containing 10 ml of conc. H_2SO_4 . Dilute to 1 liter. Solution does not keep well.

Lead acetate, 0.5 *M*, 1 *N*. Dissolve 190 g of $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$ in water. Dilute to 1 liter.

Lead nitrate, 0.25 *M*, 0.5 *N*. Dissolve 83 g of $\text{Pb}(\text{NO}_3)_2$ in 1 liter of water.

Lime water. See *Calcium hydroxide*.

Magnesium chloride, 0.25 *M*, 0.5 *N*. Dissolve 51 g of $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Magnesium chloride reagent. Dissolve 50 g of $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ and 100 g of NH_4Cl in 500 ml of water. Add 10 ml of conc. NH_4OH , allow to stand over night and filter if a precipitate has formed. Make acid to methyl red with dilute HCl . Dilute to 1 liter. Solution contains 0.25 *M* MgCl_2 and 2 *M* NH_4Cl . Solution may also be diluted with 133 ml of conc. NH_4OH and water to make 1 liter. Such a solution will contain 2 *M* NH_4OH .

Magnesium nitrate, 0.25 *M*, 0.5 *N*. Dissolve 64 g of $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Magnesium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 62 g of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in 1 liter of water.

Manganous chloride, 0.25 *M*, 0.5 *N*. Dissolve 50 g of $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ in 1 liter of water.

Manganous nitrate, 0.25 *M*, 0.5 *N*. Dissolve 72 g of $\text{Mn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Manganous sulfate, 0.25 *M*, 0.5 *N*. Dissolve 69 g of $\text{MnSO}_4 \cdot 7\text{H}_2\text{O}$ in 1 liter of water.

Mercuric chloride, 0.25 *M*, 0.5 *N*. Dissolve 68 g of HgCl_2 in water. Dilute to 1 liter.

LABORATORY REAGENTS (Continued)

Mercuric nitrate, 0.25 *M*, 0.5 *N*. Dissolve 81 g of $\text{Hg}(\text{NO}_3)_2$ in 1 liter of water.

Mercuric sulfate, 0.25 *M*, 0.5 *N*. Dissolve 74 g of HgSO_4 in 1 liter of water.

Mercurous nitrate. Use 1 part HgNO_3 , 20 parts water and 1 part HNO_3 .

Nickel chloride, 0.25 *M*, 0.5 *N*. Dissolve 59 g of $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Nickel nitrate, 0.25 *M*, 0.5 *N*. Dissolve 73 g of $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Nickel sulfate, 0.25 *M*, 0.5 *N*. Dissolve 66 g of $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Potassium bromide, 0.5 *M*, 0.5 *N*. Dissolve 60 g of KBr in 1 liter of water.

Potassium carbonate, 1.5 *M*, 3 *N*. Dissolve 207 g of K_2CO_3 in 1 liter of water.

Potassium chloride, 0.5 *M*, 0.5 *N*. Dissolve 37 g of KCl in 1 liter of water.

Potassium chromate, 0.25 *M*, 0.5 *N*. Dissolve 49 g of K_2CrO_4 in 1 liter of water.

Potassium cyanide, 0.5 *M*, 0.5 *N*. Dissolve 33 g of KCN in 1 liter of water.

Potassium dichromate, 0.125 *M*. Dissolve 37 g of $\text{K}_2\text{Cr}_2\text{O}_7$ in 1 liter of water.

Potassium ferriocyanide, 0.167 *M*, 0.5 *N*. Dissolve 55 g of $\text{K}_3\text{Fe}(\text{CN})_6$ in 1 liter of water.

Potassium ferrocyanide, 0.5 *M*, 2 *N*. Dissolve 211 g of $\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$ in water. Dilute to 1 liter.

Potassium iodide, 0.5 *M*, 0.5 *N*. Dissolve 83 g of KI in 1 liter of water.

Potassium nitrate, 0.5 *M*, 0.5 *N*. Dissolve 51 g of KNO_3 in 1 liter of water.

Potassium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 44 g of K_2SO_4 in 1 liter of water.

Silver nitrate, 0.5 *M*, 0.5 *N*. Dissolve 85 g of AgNO_3 in water. Dilute to 1 liter.

Sodium acetate, 3 *M*, 3 *N*. Dissolve 408 g of $\text{NaC}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$ in water. Dilute to 1 liter.

Sodium carbonate, 1.5 *M*, 3 *N*. Dissolve 159 g of Na_2CO_3 , or 430 g of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ in water. Dilute to 1 liter.

Sodium chloride, 0.5 *M*, 0.5 *N*. Dissolve 29 g of NaCl in 1 liter of water.

Sodium cobaltinitrite, 0.08 *M* (reagent for potassium). Dissolve 25 g of NaNO_2 in 75 ml of water, add 2 ml of glacial acetic acid and then 2.5 g of $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$. Allow to stand for several days, filter and dilute to 100 ml. Reagent is somewhat unstable.

Sodium hydrogen phosphate, 0.167 *M*, 0.5 *N*. Dissolve 60 g of $\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$ in 1 liter of water.

Sodium nitrate, 0.5 *M*, 0.5 *N*. Dissolve 43 g of NaNO_3 in 1 liter of water.

LABORATORY REAGENTS (Continued)

Sodium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 36 g of Na_2SO_4 in 1 liter of water.

Sodium sulfide, 0.5 *M*, 1 *N*. Dissolve 120 g of $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ in water and dilute to 1 liter. Or, saturate 500 ml of 1 *M* NaOH (21 g of 95 % NaOH sticks) with H_2S , keeping the solution cool, and dilute with 500 ml of 1 *M* NaOH .

Stannic chloride, 0.125 *M*, 0.5 *N*. Dissolve 33 g of SnCl_4 in 1 liter of water.

Stannous chloride, 0.5 *M*, 1 *N*. Dissolve 113 g of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ in 170 ml of conc. HCl , using heat if necessary. Dilute with water to 1 liter. Add a few pieces of tin foil. Prepare solution fresh at frequent intervals.

Stannous chloride (for Bettendorf test). Dissolve 113 g of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ in 75 ml of conc. HCl . Add a few pieces of tin foil.

Strontium chloride, 0.25 *M*, 0.5 *N*. Dissolve 67 g of $\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Zinc nitrate, 0.25 *M*, 0.5 *N*. Dissolve 74 g of $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in 1 liter of water.

Zinc sulfate, 0.25 *M*, 0.5 *N*. Dissolve 72 g of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ in 1 liter of water.

SPECIAL SOLUTIONS AND REAGENTS

Aluminon (qualitative test for aluminum). Aluminon is a trade name for the ammonium salt of aurin tricarboxylic acid. Dissolve 1 g of the salt in 1 liter of distilled water. Shake the solution well to insure thorough mixing.

Bang's reagent (for glucose estimation). Dissolve 100 g of K_2CO_3 , 66 g of KCl and 160 g of KHCO_3 in the order given in about 700 ml of water at 30° C. Add 4.4 g of CuSO_4 and dilute to 1 liter after the CO_2 is evolved. This solution should be shaken only in such a manner as not to allow entry of air. After 24 hours 300 ml are diluted to 1 liter with saturated KCl solution, shaken gently and used after 24 hours; 50 ml equivalent to 10 mg glucose.

Barfoed's reagent (test for glucose). See *Cupric acetate*.

Baudisch's reagent. See *Cupferron*.

Benedict's solution (qualitative reagent for glucose). With the aid of heat, dissolve 173 g of sodium citrate and 100 g of Na_2CO_3 in 800 ml of water. Filter, if necessary, and dilute to 850 ml. Dissolve 17.3 g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in 100 ml of water. Pour the latter solution, with constant stirring, into the carbonate-citrate solution, and make up to 1 liter.

Benzidine hydrochloride solution (for sulfate determination). Make a paste of 8 g of benzidine hydrochloride ($\text{C}_{12}\text{H}_8(\text{NH}_2)_2 \cdot 2\text{HCl}$) and 20 ml of water, add 20 ml of HCl (sp. gr. 1.12) and dilute to 1 liter with water. Each ml of this solution is equivalent to 0.00357 g of H_2SO_4 .

Bertrand's reagent (glucose estimation). Consists of the following solutions:

SPECIAL SOLUTIONS AND REAGENTS (Continued)

(a) Dissolve 200 g of Rochelle salts and 150 g of NaOH in sufficient water to make 1 liter of solution.

(b) Dissolve 40 g of CuSO_4 in enough water to make 1 liter of solution.

(c) Dissolve 50 g of $\text{Fe}_2(\text{SO}_4)_3$ and 200 g of H_2SO_4 (sp. gr. 1.84) in sufficient water to make 1 liter of solution.

(d) Dissolve 5 g of KMnO_4 in sufficient water to make 1 liter of solution.

Bial's reagent (for pentose). Dissolve 1 g of orcinol ($\text{CH}_3\cdot\text{C}_6\text{H}_3(\text{OH})_2$) in 500 ml of 30 % HCl to which 30 drops of a 10 % solution of FeCl_3 has been added.

Boutron-Boudet soap solution.

(a) Dissolve 100 g of pure castile soap in about 2500 ml of 56 % ethyl alcohol.

(b) Dissolve 0.59 g of $\text{Ba}(\text{NO}_3)_2$ in 1 liter of water.

Adjust the castile soap solution so that 2.4 ml of it will give a permanent lather with 40 ml of solution (b). When adjusted, 2.4 ml of soap solution is equivalent to 220 parts per million of hardness (as CaCO_3) for a 40 ml sample.

See also *Soap solution*.

Brucke's reagent (protein precipitation). See *Potassium iodide-mercuric iodide*.

Clarke's soap solution (or A.P.H.A. standard method). Estimation of hardness in water.

(a) Dissolve 100 g of pure powdered castile soap in 1 liter of 80 % ethyl alcohol and allow to stand over night.

(b) Prepare a standard solution of CaCl_2 by dissolving 0.5 g of CaCO_3 in HCl (sp. gr. 1.19), neutralize with NH_4OH and make slightly alkaline to litmus, and dilute to 500 ml. One ml is equivalent to 1 mg of CaCO_3 .

Titrate (a) against (b) and dilute (a) with 80 % ethyl alcohol until 1 ml of the resulting solution is equivalent to 1 ml of (b) after making allowance for the lather factor (the amount of standard soap solution required to produce a permanent lather in 50 ml of distilled water). One ml of the adjusted solution after subtracting the lather factor is equivalent to 1 mg of CaCO_3 .

See also *Soap solution*.

Cobalticyanide paper (Rinnmann's test for Zn). Dissolve 4 g of $\text{K}_3\text{Co}(\text{CN})_6$ and 1 g of KClO_3 in 100 ml of water. Soak filter paper in solution and dry at 100°C . Apply drop of zinc solution and burn in an evaporating dish. A green disk is obtained if zinc is present.

Cochineal. Extract 1 g of cochineal for four days with 20 ml of alcohol and 60 ml of distilled water. Filter.

Congo red. Dissolve 0.5 g of congo red in 90 ml of distilled water and 10 ml of alcohol.

Cupferron (Baudisch's reagent for iron analysis). Dissolve 6 g of the ammonium salt of nitroso-phenyl-hydroxylamine (cupferron) in 100 ml of H_2O . Reagent good for one week only and must be kept in the dark.

SPECIAL SOLUTIONS AND REAGENTS (Continued)

Cupric acetate (Barfoed's reagent for reducing monosaccharides). Dissolve 66 g of cupric acetate and 10 ml of glacial acetic acid in water and dilute to 1 liter.

Cupric oxide, ammoniacal; Schweitzer's reagent (dissolves cotton, linen and silk, but not wool).

1. Dissolve 5 g of cupric sulfate in 100 ml of boiling water, and add sodium hydroxide until precipitation is complete. Wash the precipitate well, and dissolve it in a minimum quantity of ammonium hydroxide.

2. Bubble a slow stream of air through 300 ml of strong ammonium hydroxide containing 50 g of fine copper turnings. Continue for one hour.

Cupric sulfate in glycerin-potassium hydroxide (reagent for silk). Dissolve 10 g of cupric sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, in 100 ml of water and add 5 g of glycerin. Add KOH solution slowly until a deep blue solution is obtained.

Cupron (benzoin oxime). Dissolve 5 g in 100 ml of 95 % alcohol.

Cuprous chloride, acidic (reagent for CO in gas analysis).

1. Cover the bottom of a two-liter flask with a layer of cupric oxide about one-half inch deep, suspend a bunch of copper wire so as to reach from the bottom to the top of the solution, and fill the flask with hydrochloric acid (sp. gr. 1.10). Shake occasionally. When the solution becomes nearly colorless, transfer to reagent bottles, which should also contain copper wire. The stock bottle may be refilled with dilute hydrochloric acid until either the cupric oxide or the copper wire is used up.

Copper sulfate may be substituted for copper oxide in the above procedure.

2. Dissolve 340 g of $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ in 600 ml of conc. HCl and reduce the cupric chloride by adding 190 ml of a saturated solution of stannous chloride or until the solution is colorless. The stannous chloride is prepared by treating 300 g of metallic tin in a 500 ml flask with conc. HCl until no more tin goes into solution.

3. (Winkler method). Add a mixture of 86 g of CuO and 17 g of finely divided metallic Cu, made by the reduction of CuO with hydrogen, to a solution of HCl, made by diluting 650 ml of conc. HCl with 325 ml of water. After the mixture has been added slowly and with frequent stirring, a spiral of copper wire is suspended in the bottle, reaching all the way to the bottom. Shake occasionally, and when the solution becomes colorless, it is ready for use.

Cuprous chloride, ammoniacal (reagent for CO in gas analysis).

1. The acid solution of cuprous chloride as prepared above is neutralized with ammonium hydroxide until an ammonia odor persists. An excess of metallic copper must be kept in the solution.

2. Pour 800 ml of acidic cuprous chloride, prepared by the Winkler method, into about 4 liters of water. Transfer the

SPECIAL SOLUTIONS AND REAGENTS (Continued)

precipitate to a 250 ml graduate. After several hours, siphon off the liquid above the 50 ml mark and refill with 7.5 % NH_4OH solution which may be prepared by diluting 50 ml of conc. NH_4OH with 150 ml of water. The solution is well shaken and allowed to stand for several hours. It should have a faint odor of ammonia.

Dichlorofluorescein indicator. Dissolve 1 g in 1 liter of 70 % alcohol or 1 g of the sodium salt in 1 liter of water.

Dimethylglyoxime (diacetyl dioxime), 0.01 N. Dissolve 0.6 g of dimethylglyoxime, $(\text{CH}_3\text{CNOH})_2$, in 500 ml of 95 % ethyl alcohol. This is an especially sensitive test for nickel, a very definite crimson color being produced.

Diphenylamine (reagent for rayon). Dissolve 0.2 g in 100 ml of concentrated sulfuric acid.

Diphenylamine sulfonate (for titration of iron with $\text{K}_2\text{Cr}_2\text{O}_7$). Dissolve 0.32 g of the barium salt of diphenylamine sulfonic acid in 100 ml of water, add 0.5 g of sodium sulfate and filter off the precipitate of BaSO_4 .

Diphenylcarbazide. Dissolve 0.2 g of diphenylcarbazide in 10 ml of glacial acetic acid and dilute to 100 ml with 95 % ethyl alcohol.

Esbach's reagent (estimation of protein). To a water solution of 10 g of picric acid and 20 g of citric acid, add sufficient water to make one liter of solution.

Eschka's compound. Two parts of calcined ("light") magnesia are thoroughly mixed with one part of anhydrous sodium carbonate.

Fehling's solution (reagent for reducing sugars).

(a) Copper sulfate solution. Dissolve 34.66 g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in water and dilute to 500 ml.

(b) Alkaline tartrate solution. Dissolve 173 g of potassium sodium tartrate (Rochelle salts, $\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$) and 50 g of NaOH in water and dilute when cold to 500 ml.

For use, mix equal volumes of the two solutions at the time of using.

Ferric-alum indicator. Dissolve 140 g of ferric-ammonium sulfate crystals in 400 ml of hot water. When cool, filter, and make up to a volume of 500 ml with dilute (6 N) nitric acid.

Folin's mixture (for uric acid). To 650 ml of water add 500 g of $(\text{NH}_4)_2\text{SO}_4$, 5 g of uranium acetate and 6 g of glacial acetic acid. Dilute to 1 liter.

Formaldehyde-sulfuric acid (Marquis' reagent for alkaloids). Add 10 ml of formaldehyde solution to 50 ml of sulfuric acid.

Froehde's reagent. See *Sulfomolybdic acid*.

Fuchsin (reagent for linen). Dissolve 1 g of fuchsin in 100 ml of alcohol.

Fuchsin-sulfurous acid (Schiff's reagent for aldehydes). Dissolve 0.5 g of fuchsin and 9 g of sodium bisulfite in 500 ml of water, and add 10 ml of HCl . Keep in well-stoppered bottles and protect from light.

SPECIAL SOLUTIONS AND REAGENTS (Continued)

Gunzberg's reagent (detection of HCl in gastric juice). Prepare as needed a solution containing 4 g of phloroglucinol and 2 g of vanillin in 100 ml of absolute ethyl alcohol.

Hager's reagent. See *Picric acid*.

Hanus solution (for iodine number). Dissolve 13.2 g of resublimed iodine in one liter of glacial acetic acid which will pass the dichromate test for reducible matter. Add sufficient bromine to double the halogen content, determined by titration (3 ml is about the proper amount). The iodine may be dissolved by the aid of heat, but the solution should be cold when the bromine is added.

Iodine, tincture of. To 50 ml of water add 70 g of I_2 and 50 g of KI. Dilute to 1 liter with alcohol.

Iodo-potassium iodide (Wagner's reagent for alkaloids). Dissolve 2 g of iodine and 6 g of KI in 100 ml of water.

Litmus (indicator). Extract litmus powder three times with boiling alcohol, each treatment consuming an hour. Reject the alcoholic extract. Treat residue with an equal weight of cold water and filter; then exhaust with five times its weight of boiling water, cool and filter. Combine the aqueous extracts.

Magnesia mixture (reagent for phosphates and arsenates). Dissolve 55 g of magnesium chloride and 105 g of ammonium chloride in water, barely acidify with hydrochloric acid, and dilute to 1 liter. The ammonium hydroxide may be omitted until just previous to use. The reagent, if completely mixed and stored for any period of time, becomes turbid.

Magnesium reagent. See *S and O reagent*.

Magnesium uranyl acetate. Dissolve 100 g of $UO_2 \cdot (C_2H_3O_2)_2 \cdot 2H_2O$ in 60 ml of glacial acetic acid and dilute to 500 ml. Dissolve 330 g of $Mg(C_2H_3O_2)_2 \cdot 4H_2O$ in 60 ml of glacial acetic acid and dilute to 200 ml. Heat solutions to the boiling point until clear, pour the magnesium solution into the uranyl solution, cool and dilute to 1 liter. Let stand over night and filter if necessary.

Marme's reagent. See *Potassium-cadmium iodide*.

Marquis' reagent. See *Formaldehyde-sulfuric acid*.

Mayer's reagent (white precipitate with most alkaloids in slightly acid solutions). Dissolve 1.358 g of $HgCl_2$ in 60 ml of water and pour into a solution of 5 g of KI in 10 ml of H_2O . Add sufficient water to make 100 ml.

Methyl orange indicator. Dissolve 1 g of methyl orange in 1 liter of water. Filter, if necessary.

Methyl orange, modified. Dissolve 2 g of methyl orange and 2.8 g of xylene cyanole FF in 1 liter of 50 % alcohol.

Methyl red indicator. Dissolve 1 g of methyl red in 600 ml of alcohol and dilute with 400 ml of water.

Methyl red, modified. Dissolve 0.50 g of methyl red and 1.25 g of xylene cyanole FF in 1 liter of 90 % alcohol. Or, dissolve 1.25 g of methyl red and 0.825 g of methylene blue in 1 liter of 90 % alcohol.

SPECIAL SOLUTIONS AND REAGENTS (Continued)

Millon's reagent (for albumins and phenols). Dissolve 1 part of mercury in 1 part of cold fuming nitric acid. Dilute with twice the volume of water and decant the clear solution after several hours.

Mixed indicator. Prepared by adding about 1.4 g of xylene cyanole FF to 1 g of methyl orange. The dye is seldom pure enough for these proportions to be satisfactory. Each new lot of dye should be tested by adding additional amounts of the dye until a test portion gives the proper color change. The acid color of this indicator is like that of permanganate; the neutral color is gray; and the alkaline color is green. Described by Hickman and Linstead, *J. Chem. Soc. (Lon.)*, **121**, 2502 (1922).

Molisch's reagent. See *α -Naphthol*.

α -Naphthol (Molisch's reagent for wool). Dissolve 15 g of α -naphthol in 100 ml of alcohol or chloroform.

Nessler's reagent (for ammonia). Dissolve 50 g of KI in the smallest possible quantity of cold water (50 ml). Add a saturated solution of mercuric chloride (about 22 g in 350 ml of water will be needed) until an excess is indicated by the formation of a precipitate. Then add 200 ml of 5 *N* NaOH and dilute to 1 liter. Let settle, and draw off the clear liquid.

Nickel oxide, ammoniacal (reagent for silk). Dissolve 5 g of nickel sulfate in 100 ml of water, and add sodium hydroxide solution until nickel hydroxide is completely precipitated. Wash the precipitate well and dissolve in 25 ml of concentrated ammonium hydroxide and 25 ml of water.

***p*-Nitrobenzene-azo-resorcinol** (reagent for magnesium). Dissolve 1 g of the dye in 10 ml of *N* NaOH and dilute to 1 liter.

Nitron (detection of nitrate radical). Dissolve 10 g of nitron ($C_{20}H_{16}N_4$, 4, 5-dihydro-1, 4-diphenyl-3, 5-phenylimino-1, 2, 4-triazole) in 5 ml of glacial acetic acid and 95 ml of water. The solution may be filtered with slight suction through an alundum crucible and kept in a dark bottle.

α -Nitroso- β -naphthol. Make a saturated solution in 50 % acetic acid (1 part of glacial acetic acid with 1 part of water). Does not keep well.

Nylander's solution (carbohydrates). Dissolve 20 g of bismuth subnitrate and 40 g of Rochelle salts in 1 liter of 8 % NaOH solution. Cool and filter.

Obermayer's reagent (for indoxyl in urine). Dissolve 4 g of $FeCl_3$ in one liter of HCl (sp. gr. 1.19).

Oxine. Dissolve 14 g of HC_9H_6ON in 30 ml of glacial acetic acid. Warm slightly, if necessary. Dilute to 1 liter.

Oxygen absorbent. Dissolve 300 g of ammonium chloride in one liter of water and add one liter of concentrated ammonium hydroxide solution. Shake the solution thoroughly. For use as an oxygen absorbent, a bottle half full of copper turnings is filled nearly full with the NH_4Cl-NH_4OH solution and the gas passed through.

Pasteur's salt solution. To one liter of distilled water add 2.5 g of potassium phosphate, 0.25 g of calcium phosphate, 0.25 g of magnesium sulfate and 12.00 g of ammonium tartrate.

SPECIAL SOLUTIONS AND REAGENTS (Continued)

Pavy's solution (glucose reagent). To 120 ml of Fehling's solution, add 300 ml of NH_4OH (sp. gr. 0.88) and dilute to 1 liter with water.

Phenanthroline ferrous ion indicator. Dissolve 1.485 g of phenanthroline monohydrate in 100 ml of 0.025 *M* ferrous sulfate solution.

Phenolphthalein. Dissolve 1 g of phenolphthalein in 50 ml of alcohol and add 50 ml of water.

Phenolsulfonic acid (determination of nitrogen as nitrate). Dissolve 25 g of phenol in 150 ml of conc. H_2SO_4 , add 75 ml of fuming H_2SO_4 (15% SO_3), stir well and heat for two hours at 100° C.

Phloroglucinol solution (pentosans). Make a 3% phloroglucinol solution in alcohol. Keep in a dark bottle.

Phosphomolybdic acid (Sonnenschein's reagent for alkalis).

1. Prepare ammonium phosphomolybdate and after washing with water, boil with nitric acid and expel NH_3 ; evaporate to dryness and dissolve in 2 *N* nitric acid.

2. Dissolve ammonium molybdate in HNO_3 and treat with phosphoric acid. Filter, wash the precipitate, and boil with aqua regia until the ammonium salt is decomposed. Evaporate to dryness. The residue dissolved in 10% HNO_3 constitutes Sonnenschein's reagent.

Phosphoric acid—sulfuric acid mixture. Dilute 150 ml of conc. H_2SO_4 and 100 ml of conc. H_3PO_4 (85%) with water to a volume of 1 liter.

Phosphotungstic acid (Scheibler's reagent for alkaloids).

1. Dissolve 20 g of sodium tungstate and 15 g of sodium phosphate in 100 ml of water containing a little nitric acid.

2. The reagent is a 10% solution of phosphotungstic acid in water. The phosphotungstic acid is prepared by evaporating a mixture of 10 g of sodium tungstate dissolved in 5 g of phosphoric acid (sp. gr. 1.13) and enough boiling water to effect solution. Crystals of phosphotungstic acid separate.

Picric acid (Hager's reagent for alkaloids, wool and silk). Dissolve 1 g of picric acid in 100 ml of water.

Potassium antimonate (reagent for sodium). Boil 22 g of potassium antimonate with 1 liter of water until nearly all of the salt has dissolved, cool quickly, and add 35 ml of 10% potassium hydroxide. Filter after standing over night.

Potassium-cadmium iodide (Marme's reagent for alkaloids). Add 2 g of CdI_2 to a boiling solution of 4 g of KI in 12 ml of water, and then mix with 12 ml of saturated KI solution.

Potassium hydroxide (for CO_2 absorption). Dissolve 360 g of KOH in water and dilute to 1 liter.

Potassium iodide-mercuric iodide (Brucke's reagent for proteins). Dissolve 50 g of KI in 500 ml of water, and saturate with mercuric iodide (about 120 g). Dilute to 1 liter.

SPECIAL SOLUTIONS AND REAGENTS (Continued)

Potassium pyrogallate (for oxygen absorption). For mixtures of gases containing less than 28 % oxygen, add 100 ml of KOH solution (50 g of KOH to 100 ml of water) to 5 g of pyrogallol. For mixtures containing more than 28 % oxygen the KOH solution should contain 120 g of KOH to 100 ml of water.

Pyrogallol, alkaline.

(a) Dissolve 75 g of pyrogallol in 75 ml of water.

(b) Dissolve 500 g of KOH in 250 ml of water. When cool, adjust until sp. gr. is 1.55.

For use, add 270 ml of solution (b) to 30 ml of solution (a).

Rosolic acid (indicator). Dissolve 1 g of rosolic acid in 10 ml of alcohol and add 100 ml of water.

S and O reagent (Suitsu and Okuma's test for Mg). Dissolve 0.5 g of the dye (*o-p*-dihydroxy-monazo-*p*-nitrobenzene) in 100 ml of 0.25 N NaOH.

Scheibler's reagent. See *Phosphotungstic acid*.

Schiff's reagent. See *Fuchsin-sulfurous acid*.

Schweitzer's reagent. See *Cupric oxide, ammoniacal*.

Soap solution (reagent for hardness in water). Dissolve 100 g of dry castile soap in 1 liter of 80 % alcohol (5 parts alcohol to 1 part water). Allow to stand several days and dilute with 70 % to 80 % alcohol until 6.4 ml produces a permanent lather with 20 ml of standard calcium solution. The latter solution is made by dissolving 0.2 g of CaCO_3 in a small amount of dilute HCl, evaporating to dryness and making up to 1 liter.

Sodium bismuthate (oxidation of manganese). Heat 20 parts of NaOH nearly to redness in an iron or nickel crucible and add slowly 10 parts of basic bismuth nitrate which has been previously dried. Add two parts of sodium peroxide, and pour the brownish-yellow fused mass on an iron plate to cool. When cold, break up in a mortar, extract with water, and collect on an asbestos filter.

Sodium hydroxide (for CO_2 absorption). Dissolve 330 g of NaOH in water and dilute to 1 liter.

Sodium nitroprusside (reagent for hydrogen sulfide and wool). Use a freshly prepared solution of 1 g of sodium nitroprusside in 10 ml of water.

Sodium oxalate, according to Sørensen (primary standard). Dissolve 30 g of the commercial salt in 1 liter of water, make slightly alkaline with sodium hydroxide, and let stand until perfectly clear. Filter and evaporate the filtrate to 100 ml. Cool and filter. Pulverize the residue and wash it several times with small volumes of water. The procedure is repeated until the mother liquor is free from sulfate and is neutral to phenolphthalein.

Sodium plumbite (reagent for wool). Dissolve 5 g of sodium hydroxide in 100 ml of water. Add 5 g of litharge and boil until dissolved.

SPECIAL SOLUTIONS AND REAGENTS (Continued)

Sodium polysulfide. Dissolve 480 g of $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ in 500 ml of water, add 40 g of NaOH and 18 g of sulfur. Stir thoroughly and dilute to 1 liter with water.

Sonnenschein's reagent. See *Phosphomolybdic acid*.

Starch solution.

1. Make a paste with 2 g of soluble starch and 0.01 g of HgI_2 with a small amount of water. Add the mixture slowly to 1 liter of boiling water and boil for a few minutes. Keep in a glass stoppered bottle. If other than soluble starch is used, the solution will not clear on boiling; it should be allowed to stand and the clear liquid decanted.

2. A solution of starch which keeps indefinitely is made as follows: Mix 500 ml of saturated NaCl solution (filtered), 80 ml of glacial acetic acid, 20 ml of water and 3 g of starch. Bring slowly to a boil and boil for two minutes.

3. Make a paste with 1 g of soluble starch and 5 mg of HgI_2 , using as little cold water as possible. Then pour about 200 ml of boiling water on the paste and stir immediately. This will give a clear solution if the paste is prepared correctly and the water actually boiling. Cool and add 4 g of KI . Starch solution decomposes on standing due to bacterial action, but this solution will keep a long time if stored under a layer of toluene.

Stoke's reagent. Dissolve 30 g of FeSO_4 and 20 g of tartaric acid in water and dilute to 1 liter. Just before using, add concentrated NH_4OH until the precipitate first formed is redissolved.

Sulfanilic acid (reagent for nitrites). Dissolve 0.5 g of sulfanilic acid in a mixture of 15 ml of glacial acetic acid and 135 ml of recently boiled water.

Sulfomolybdic acid (Froehde's reagent for alkaloids and glucosides). Dissolve 10 g of molybdic acid or sodium molybdate in 100 ml of conc. H_2SO_4 .

Tannic acid (reagent for albumen, alkaloids and gelatin). Dissolve 10 g of tannic acid in 10 ml of alcohol and dilute with water to 100 ml.

Titration mixture. See *Zimmermann-Reinhardt reagent*.

***o*-Tolidine solution** (residual chlorine in water analysis). Prepare 1 liter of dilute HCl (100 ml of HCl (sp. gr. 1.19) in sufficient water to make 1 liter). Dissolve 1 g of *o*-tolidine in 100 ml of the dilute HCl and dilute to 1 liter with dilute HCl solution.

Trinitrophenol solution. See *Picric acid*.

Turmeric paper. Impregnate white, unsized paper with the tincture, and dry.

Turmeric tincture (reagent for borates). Digest ground turmeric root with several quantities of water which are discarded. Dry the residue and digest it several days with six times its weight of alcohol. Filter.

Uffelman's reagent (turns yellow in presence of a lactic acid). To a 2% solution of pure phenol in water, add a water solution of FeCl_3 until the phenol solution becomes violet in color.

SPECIAL SOLUTIONS AND REAGENTS (Continued)

Wagner's reagent. See *Iodo-potassium iodide*.

Wagner's solution (used in phosphate rock analysis to prevent precipitation of iron and aluminum). Dissolve 25 g of citric acid and 1 g of salicylic acid in water and dilute to 1 liter. Use 50 ml of the reagent.

Wij's iodine monochloride solution (for iodine number). Dissolve 13 g of resublimed iodine in 1 liter of glacial acetic acid which will pass the dichromate test for reducible matter. Set aside 25 ml of this solution. Pass into the remainder of the solution dry chlorine gas (dried and washed by passing through H_2SO_4 (sp. gr. 1.84)) until the characteristic color of free iodine has been discharged. Now add the iodine solution which was reserved, until all free chlorine has been destroyed. A slight excess of iodine does little or no harm, but an excess of chlorine must be avoided. Preserve in well stoppered, amber colored bottles. Avoid use of solutions which have been prepared for more than 30 days.

Wij's special solution (for iodine number—Analyst 58, 523-7, 1933). To 200 ml of glacial acetic acid that will pass the dichromate test for reducible matter, add 12 g of dichloroamine T (paratoluene-sulfonedichloroamide), and 16.6 g of dry KI (in small quantities with continual shaking until all the KI has dissolved). Make up to 1 liter with the same quality of acetic acid used above and preserve in a dark colored bottle.

Zimmermann-Reinhardt reagent (determination of iron). Dissolve 70 g of $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$ in 500 ml of water, add 125 ml of conc. H_2SO_4 and 125 ml of 85 % H_3PO_4 , and dilute to 1 liter.

Zinc chloride solution, basic (reagent for silk). Dissolve 1000 g of zinc chloride in 850 ml of water, and add 40 g of zinc oxide. Heat until solution is complete.

Zinc uranyl acetate (reagent for sodium). Dissolve 10 g of $\text{UO}_2(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$ in 6 g of 30 % acetic acid with heat, if necessary, and dilute to 50 ml. Dissolve 30 g of $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$ in 3 g of 30 % acetic acid and dilute to 50 ml. Mix the two solutions, add 50 mg of NaCl, allow to stand over night and filter.

STANDARD SOLUTIONS FOR VOLUMETRIC ANALYSIS

Acids

Hydrochloric acid, normal. (36.465 g per liter) (a) 180.15 g of constant boiling point (760 mm) acid diluted to 1 liter gives an exactly normal solution. (b) Concentrated HCl diluted to d 1.020 is approximately normal. (c) Concentrated HCl contains about one-third of its weight of HCl and 120 g diluted with water to 1 liter will give an acid slightly greater than normal. Solutions prepared as in (b) or (c) are most accurately standardized by precipitation as AgCl.

Hydrochloric acid solutions, standard, by the method of G. A. Hulett and W. D. Bonner. *Jour. Am. Chem. Soc.* **31**, 390 (1909). Standard HCl is easily prepared by starting with HCl of about d 1.10, made up with an ordinary hydrometer, distilling off and discarding the first three-fourths of the liquid taken; the distillate which is then collected does not differ by more than one part in 10,000 from the values in the table below. This constant boiling acid is not hygroscopic or noticeably volatile and is easily weighed in a small flask. By the use of a capillary pipette, to adjust the last amount of acid, it is a very simple matter to weigh out 180.15 g to less than 10 mg and this furnishes sufficient acid to make a liter of normal solution with an accuracy that is seldom attained even with very elaborate precautions.

CONSTANT BOILING HYDROCHLORIC ACID

Bonner-Titus, J.A.C.S., **52**, 633, 1930; Bonner-Wallace, J.A.C.S., **52**, 1747

Pressure	B.P.	Density	% HCl	Pressure	B.P.	Density	% HCl	g for 1 l of N sol.
100	62.4	1.1095	22.97	600	102.209	1.0980	20.638	176.52
200	75.9	1.1058	22.202	700	106.424	1.0966	20.360	178.93
300	84.9	1.1031	21.660	760	108.584	1.0959	20.222	180.15
400	92.080	1.1010	21.235	800	110.007	1.0955	20.155	180.74
500	97.578	1.0993	20.916	1000	116.185	1.0933	19.734	
				1200	122.38	1.0917	19.42	

Slightly different figures are given for a range near atmospheric pressure by Hollingsworth and Foulk.

Bar. pressure	% HCl by weight	Wt. HCl sol. for 1 mole HCl
770	20.197	180.407
760	20.221	180.193
750	20.245	179.979
740	20.269	179.766
730	20.293	179.555

SOLUTIONS FOR VOLUMETRIC ANALYSIS (Continued)

Nitric acid, normal. (63.016 g per liter) Use a colorless acid, $d\ 1.3 \pm$, free from chlorine and nitrous acid; a yellow color due to lower oxides of nitrogen is removed by adding about 2 volumes of water, boiling, cooling and then diluting to volume. 65 ml or 93 g of acid, $d\ 1.42$ diluted to 1 liter gives an acid slightly greater than normal. Standardize by titration with standard alkali.

Oxalic acid, normal. $H_2C_2O_4$ (63.023 g of $H_2C_2O_4 \cdot 2H_2O$ or 45.008 g of $H_2C_2O_4$ per liter) Because of the uncertainty in the amount of water of crystallization, standards in dry climates cannot be prepared directly by dissolving a weighed quantity of acid. However, in a humid atmosphere finely ground oxalic acid crystals may be exposed to the air for a few hours, and brought to the proper composition. Unless this is done it is necessary to standardize the solution against alkali of known concentration using phenolphthalein as an indicator. Decinormal or less concentrated solutions are unstable and should be prepared fresh when needed; more concentrated solutions may deposit some of the acid when cooled to low temperatures but they are fairly stable at room temperature when protected from light.

Potassium acid phthalate, decinormal. ($KHC_8H_4O_4$, 10.207 g per 500 ml) This monobasic acid is recommended for the preparation of standard acid solutions, since it has a high equivalent weight, is anhydrous, stable, non-hygroscopic, and can be purchased with a purity factor of 99.95 %. Spread 10–11 g of the salt in a thin layer on a watch glass and dry at 110–120° C in an electric oven for 2–3 hours. Cool in a desiccator and weigh to the nearest milligram. Transfer the salt to a 500 ml volumetric flask, with aid of a funnel, and reweigh the watch glass with any adhering powder. Dissolve the salt in the flask, dilute to volume, and mix thoroughly. Compute the normality of the solution by the equation

$$\text{Normality} = \frac{\text{Weight of salt} \times \text{purity}}{102.07}$$

Potassium acid phthalate is suitable for the titration of carbonate-free strong bases, using phenolphthalein indicator, but is not suitable for titration of ammonium hydroxide.

Succinic acid, decinormal. $H_2C_4H_4O_4$ (5.9023 g per liter) Dry 5–6 g of pure succinic acid in an open weighing bottle at 105° for about 10 hours; cool in a desiccator. Weigh out accurately 2.9512 g, brush into a 400 ml beaker and dissolve in 150–200 ml of water; pour the solution into a 500 ml graduated flask, rinsing out the beaker several times to insure complete transference of the acid. Dilute to exactly 500 ml and mix thoroughly. This prepares an exact decinormal solution.

Sulfuric acid, normal. (49.04 g per liter) Take 30 ml of pure, concentrated H_2SO_4 , $d\ 1.84$ and pour it cautiously and slowly into about 3–4 volumes of water, cool, mix thoroughly and dilute to 1 liter. Standardize by titration with standard

SOLUTIONS FOR VOLUMETRIC ANALYSIS (Continued)

NaOH or KOH solutions with phenolphthalein as indicator. For a decinormal solution use 3 ml H_2SO_4 per liter and proceed as above. Sulfuric acid is obtained easily in a pure form; the normal acid solution is not affected by boiling (advantage over similar HNO_3 or HCl solutions); when used with lime or similar compounds, it gives precipitates and for such cases HCl is preferable.

Bases

For the titration of weak acids, bases should be made free of carbonate and used with phenolphthalein indicator. Such solutions should be stored in siphon-equipped bottles and protected from carbon dioxide by a soda-lime tube on the air inlet. The burette used for the titration should be capped by a one-hole stopper bearing a small tube of soda lime. If a base is to be used only for the titration of strong acids, it is unnecessary to remove carbonate or to protect the solution from carbon dioxide, since absorption of the latter does not change the alkaline value of the solution. Bases containing carbonate should be used with methyl orange indicator.

Potassium hydroxide, normal. (56.108 g per liter) Dissolve 64 g of potassium hydroxide, of assay value 85 % or better, in water and dilute to 1 liter. Standardize as directed for sodium hydroxide.

Sodium hydroxide, decinormal. Carbonate free. Prepare the carbonate free solution by one of the following methods:

1. Dissolve 6 g of sodium hydroxide in 200 ml of water, heat to boiling, and slowly add to the boiling solution 5 ml of 5 % barium chloride solution. Allow the precipitate to settle, add a few drops of barium chloride solution and notice whether a fresh precipitate forms. If more precipitate is formed, add another 5 ml of the reagent, and again test for completeness of precipitation of carbonate. Continue in this manner until no further precipitate forms. Allow the precipitate to settle, decant off two-thirds of the clear solution, and dilute to 1 liter with freshly boiled water. Standardize by titrating weighed 0.6–0.8 g portions of dry potassium acid phthalate, dissolved in 100 ml of water. Use phenolphthalein indicator.

2. (Recommended method) Dissolve 7 g of sodium hydroxide in 7 ml of water and filter the viscous liquid through an asbestos mat in a Gooch crucible, with aid of suction. Catch the filtrate in a small dry test tube. Do not wash the residue. Pour off two-thirds of the clear filtrate and dilute to 1 liter with freshly boiled water.

3. Place within an empty vacuum desiccator a beaker of water and a dry beaker containing 2.3 g of sodium metal, cut into thin shavings. The sodium must be clean and free of oil. Connect the desiccator to a water aspirator pump and evacuate. In the atmosphere of water vapor thus formed, the sodium metal quickly reacts to form sodium hydroxide. Continue to evacuate the desiccator until all the metal has dissolved and a

SOLUTIONS FOR VOLUMETRIC ANALYSIS (Continued)

clear solution remains in the beaker. Dilute all this solution to 1 liter with freshly boiled water.

Sodium hydroxide, normal. (40.005 g per liter) Dissolve 42 g of sodium hydroxide sticks or pellets, of assay value 95 % or better, in water and dilute to 1 liter. Standardize with normal hydrochloric acid or sulfuric acid, using methyl orange indicator.

Oxidizing and Reducing Solutions

Arsenite, alkaline, decinormal. $\text{As}^{\text{iii}} \rightarrow \text{As}^{\text{v}}$ (4.9465 g As_2O_3 per liter; equivalent to 0.0126932 g I or 0.0035457 g Cl per ml) Dissolve 4.9465 g of pure sublimed As_2O_3 in a concentrated solution of 4 g of NaOH, add 100 ml of a saturated NaHCO_3 solution and dilute to 1 liter. Do not warm the solution above 60° C when dissolving the As_2O_3 . Standardize against standard iodine solution with a starch indicator.

Ceric sulfate (oxidizing agent). Ceric sulfate is a strong oxidizing agent in acid solutions, is stable over a long period, can be used to titrate reducing agents in the presence of HCl and has only one valence change from 4 to 3. It can be used as a volumetric reagent in acid medium only since perceric compounds are formed in an alkaline medium. It cannot be used as its own indicator if the solution is colored.

1. The solution is made up for use by adding 64–66 g of ceric ammonium sulfate, $\text{Ce}(\text{SO}_4)_2 \cdot 2(\text{NH}_4)_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ or 35–40 g of ceric sulfate, $\text{Ce}(\text{SO}_4)_2$, to a solution of 500 ml of H_2O and 28 ml of concentrated H_2SO_4 . The solution should be stirred until all is dissolved and 500 ml more of distilled water added.

2. Alternative method. To 35 g of ceric oxide in a 600 ml beaker, add 46 ml of concentrated H_2SO_4 . Carefully add 50 ml of water and heat at boiling for five minutes. Cool somewhat and add, carefully, 450 ml of water. Digest until solution is complete. Filter, if necessary, dilute to 1000 ml and standardize.

The solution can be standardized against arsenious oxide dissolved in NaOH and acidified with H_2SO_4 ; against sodium oxalate or electrolytic iron by the Zimmermann-Reinhardt Method, using sodium diphenylamine sulfonate as indicator. The indicator acid is tri-ortho-phenanthroline ferrous sulfate, $(\text{C}_{12}\text{H}_8\text{N}_2 \cdot \text{H}_2\text{O})\text{FeSO}_4$. The reaction involved in the standardization with sodium oxalate is $\text{H}_2\text{C}_2\text{O}_4 + 2\text{Ce}(\text{SO}_4)_2 = 2\text{CO}_2 + \text{Ce}_2(\text{SO}_4)_3 + \text{H}_2\text{SO}_4$.

An amount of sodium oxalate is weighed out which will require 25–35 ml of 0.1 N ceric sulfate solution for titration. To this is added 10–20 ml of concentrated HCl, 5 ml of 0.005 M iodine chloride and enough water to make a volume of 100 ml. The solution should be heated to 50° C, 1 drop of indicator added, and the solution titrated with ceric sulfate until the solution becomes pale blue in color and there is no return of any pink color after one minute. The temperature should not fall below 45° C.

Ceric sulfate may be used to titrate ferrous chloride according

SOLUTIONS FOR VOLUMETRIC ANALYSIS (Continued)

to the reaction: $2\text{FeCl}_2 + 2\text{Ce}(\text{SO}_4)_2 + 2\text{HCl} = 2\text{FeCl}_3 + \text{Ce}_2(\text{SO}_4)_3 + \text{H}_2\text{SO}_4$.

Calcium may be precipitated as the oxalate, dissolved in dilute HCl and titrated with ceric sulfate. Chromium, arsenic, ferrocyanide and hydrogen peroxide may be titrated with ceric sulfate.

Iodine, decinormal. $\text{I}_2 \rightarrow 2\text{HI}$ (12.6932 g per liter) Dissolve about 13.5 g of pure sublimed iodine in a solution of 24 g of KI in 200 ml of H_2O and dilute to 1 liter. The solution is standardized by adding the iodine to a known volume of standard thiosulfate with a few drops of starch solution for the indicator.

Potassium dichromate, decinormal. $\text{Cr}^{\text{vi}} \rightarrow \text{Cr}^{\text{iii}}$ (4.904 g per liter) Grind about 5 g of potassium dichromate, of the purest grade obtainable, spread in a thin layer on a watch glass, and dry in an electric oven at 120–140° C for 2–4 hours. Cool in a desiccator and weigh to the nearest milligram. Transfer the powder to a 1 liter volumetric flask, with the aid of a funnel, and reweigh the watch glass with any adhering powder. Add water to the flask, shake until the sample is dissolved, dilute to volume and mix thoroughly. Compute the normality from the equation

$$\text{Normality} = \frac{\text{Weight potassium dichromate}}{49.04}$$

If pure dichromate is not available the solution may be standardized by iron wire or against an iron ore of known analysis. Weigh out three 0.2 g samples of clean, bright iron wire (prepared "for standardization", with purity factor of 99.8%) and transfer each to a 500 ml Erlenmeyer flask. Dissolve the wire in 10 ml of concentrated hydrochloric acid, keeping the flask covered with a small watch glass until solution is complete. Disregard a small residue of carbon which may remain in the solution as black particles. Rinse off the watch glass, heat the solution nearly to boiling and add stannous chloride solution (5 g of salt dissolved in 10 ml of concentrated hydrochloric acid, and diluted to 100 ml) a drop at a time until the solution is colorless. *Avoid an excess of over one drop of stannous chloride.* Cool completely and pour in 10 ml of saturated mercuric chloride solution. Allow to stand 2 minutes, then add a well cooled solution of 5 ml of 85% phosphoric acid in 200 ml of 3 N sulfuric acid (8:100). Add 6–8 drops of an indicator solution (containing 3 g of the sodium or barium salt of diphenylamine sulfonic acid per liter) and titrate with dichromate solution to the first appearance of a purple or violet tinge. The titration should be made slowly, since the reaction proceeds rather slowly. Run a blank. From the net volume of dichromate, compute the normality by the equation

$$\text{Normality} = \frac{\text{Weight of iron wire} \times \text{purity of iron}}{\text{Volume of dichromate} \times 0.05584}$$

Potassium permanganate, decinormal. $\text{Mn}^{\text{vii}} \rightarrow \text{Mn}^{\text{ii}}$ (3.1606 g per liter) Dissolve 3.3 g of dry KMnO_4 in 1 liter of

SOLUTIONS FOR VOLUMETRIC ANALYSIS (Continued)

distilled water and allow to stand at least 24 hours in a clean glass-stoppered bottle. The reasons for not using the freshly prepared solution are: 1st, the reducing agents in the water (dust, etc.) are thus all oxidized, and 2nd, any MnO_2 formed by this reduction is permitted to settle. The solution is then carefully siphoned through a clean glass tube into clean beakers, discarding the first 25 ml of solution and the last inch of the solution in the bottle which contains the precipitated MnO_2 ; the KMnO_4 solution should never be permitted to come in contact with rubber, filter paper or other organic matter. The solution in the beakers is now poured back into a clean bottle and standardized against sodium oxalate. Weigh out several 0.25–0.30 g samples of sodium oxalate having an assay value of 99.95 %, transfer each portion to a 600 ml beaker, and dissolve in 250 ml of dilute sulfuric acid (5:95). Stir until the oxalate has dissolved, then add rapidly* from a burette about 95 % of the amount of permanganate needed for complete oxidation of the sample (a preliminary titration is made with one sample to determine the approximate amount of permanganate needed). Allow the solution to stand until the permanganate is decolorized, then heat to 55–60° C and complete the titration at this temperature, stirring *gently* with a thermometer and allowing each drop to become decolorized before adding the next. The end point is shown by a faint pink tinge which persists for 30 seconds. Run a blank on 250 ml of dilute sulfuric acid, heated to 60° C. From the net volume of permanganate, compute the normality by the equation

$$\text{Normality} = \frac{\text{Weight sodium oxalate} \times \text{purity}}{\text{Volume permanganate} \times 0.067}$$

Sodium thiosulfate, decinormal. $2\text{Na}_2\text{S}_2\text{O}_3 \rightarrow \text{Na}_2\text{S}_4\text{O}_6$ (24.8192 g of $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ per liter) Do not dry the sodium thiosulfate in an oven as it can be obtained almost pure; weigh out 25.0 g and dilute to exactly 1 liter. After mixing thoroughly, the solution is allowed to stand two weeks. If free sulfur has separated, the clear liquid is siphoned off. The solution is standardized indirectly by titration with potassium dichromate (see above). Dissolve 5 g of KI and 4 g of NaHCO_3 in 300 ml of H_2O in a 500 ml Erlenmeyer flask at room temperature and then add HCl slowly, swirling the flask, until there is no more evolution of CO_2 and then add about 10 ml more acid; add 35 ml of 0.1 N $\text{K}_2\text{Cr}_2\text{O}_7$, mixing the solutions, rinse the sides of the flask with a few ml of water, allowing it to form a layer over the solution without mixing; stopper the flask and allow to stand about 10 minutes. Then with thorough mixing run in thiosulfate until the solution is a light yellow, add a few drops of starch solution and continue with a slow addition of thiosulfate until the bright blue color has disappeared and only the pale green color of CrCl_3 remains.

* The method given for standardization is based upon the directions of Fowler and Bright, Bur. Stand. J. Res., 15, 493 (1935).

REAGENTS FOR SEMI-MICRO QUALITATIVE ANALYSIS

Compiled by D. W. Pearce

The following reagents have been found extremely sensitive as confirmatory tests for the ions indicated. In most cases separation from other ions by micro or semi-micro technique should precede the test. For interferences, references to original literature, and detailed procedures see Feigl, "Qualitativ Analyse mit Hilfe von Tupfelreaktionen", or Engelder, Dunkelberger and Schiller, "Semi-Micro Qualitative Analysis". Also see table, *Organic Analytical Reagents*, for other reagents.

Ammonium molybdate. Dissolve 15 g of ammonium molybdate in 300 ml of water, add 100 ml of nitric acid (1:2) and saturate with ammonium nitrate. Fine yellow precipitate for H_2PO_4^- (cold) or H_2AsO_4^- (60° C) in nitric acid solution.

Aniline sulfate. Concentrated solution of aniline sulfate in concentrated sulfuric acid. Reagent gives instant blue color with ClO_3^- ; other strong oxidants as NO_3^- give the blue color much more slowly.

Benzidine acetate—cupric acetate. (a) Dilute 47.5 ml of saturated benzidine acetate solution to 100 ml. (b) Dissolve 0.286 g of cupric acetate in 100 ml solution. Solution (a) + solution (b) on spot paper gives blue color with HCN vapors.

α -Benzoinoxime. 5% alcoholic solution. Green precipitate with Cu^{++} in slightly ammoniacal solution.

Bettendorf's reagent. Saturated solution of SnCl_2 in concentrated HCl. Brown color or black precipitate upon adding As^{+3} (immediate) or As^{+5} (on standing), to excess of the reagent.

Brucine reagent. 0.02 g of brucine dissolved in 100 ml of concentrated sulfuric acid. Test solution + concentrated sulfuric acid + brucine reagent gives fleeting red color with NO_3^- , NO_2^- , or ClO_3^- .

Cacothelin. Fresh, saturated aqueous solution of cacothelin. Use a drop of reagent on test paper, warm till only slightly damp; drop of Sn^{+2} (reduced by means of Mg powder) gives violet color. Antimony does not interfere.

Cinchonin—potassium iodide reagent. One gram of cinchonin is dissolved in 100 ml of water upon the addition of a few drops of HNO_3 and warming; add 2 g of KI. Bright red-orange precipitate with Bi^{+++} , brown with Cu^{++} , yellow with Pb^{++} , white with Cd^{++} , and cream with Hg^{++} , in slightly acid solution.

Cobalticyanide paper (Rinnmann's green test). Saturate quantitative filter paper in a solution of 4 g of $\text{K}_3\text{Co}(\text{CN})_6$ and 1 g of KClO_3 in 100 ml of water. Dry. Add drop test solution and ash the paper in a crucible over flame. Green ash—presence of Zn^{++} .

***p*-Dimethylaminobenzylidenerhodanine.** Saturated solution of the crystals in acetone. (Dissolve equi-molecular

REAGENTS FOR SEMI-MICRO QUALITATIVE ANALYSIS (Continued)

amounts of rhodamine and *p*-dimethylaminobenzaldehyde in glacial acetic acid, warm on steam bath. Product may be crystallized out on addition of water.) Reagent for detection of Ag^+ (and Hg^{++}) in nitric acid solution. Red-violet precipitate.

Dimethylglyoxime. 1 g dissolved in 100 ml of alcohol. In presence of much Co^{++} first add slight excess NaCN , warm till decidedly orange, add reagent and AgNO_3 . Pink to red precipitate—presence of Ni^{++} .

Diphenylcarbazide. 1% alcoholic solution, freshly prepared. Violet or blue precipitate in neutral or slightly acid solution of $\text{Hg}(\text{NO}_3)_2$.

***p*-Nitrobenzeneazoresorcinol.** 0.001 g dissolved in 100 ml of 2 *N* NaOH . Sky blue precipitate with Mg^{++} .

Potassium thiocyanate. Saturated aqueous solution. With HCl solution of CO^{++} yields deep blue color; best observed when extracted with amyl alcohol-ether (1:6). Fe^{+++} , if present, to be reduced with crystal of $\text{Na}_2\text{S}_2\text{O}_3$.

Rhodamine B. Dissolve 0.01 g of tetraethylrhodamine in 100 ml of water. Violet color with Sb^{+5} (oxidized with KNO_2 crystal). Tin does not interfere.

Sodium nitroprusside. Freshly prepared 1% aqueous solution. Deep violet color with S^{--} (alkaline).

Sulfanilic acid— α -naphthylamine. (a) 0.4 g of sulfanilic acid in 100 ml of 10% acetic acid. (b) 0.5 g of α -naphthylamine boiled in 100 ml of water; filter. Acetic acid + solution (a) + solution (b) gives brilliant red color with NO_2^- .

Tetramethyldiaminodiphenylmethane. Acetic acid solution. Blue color as sensitive test for Pb^{++} . (Must be previously oxidized to PbO_2 in ammonia solution with H_2O_2 and the latter decomposed by warming or standing.)

Zinc uranyl acetate. Dissolve 10 g of uranyl acetate, with warming, in 6 g of 30% acetic acid; dilute to 50 ml. Treat 30 g of zinc acetate with 3 g of 30% acetic acid; dilute to 50 ml. Mix the two solutions, add a trace of NaCl , let stand 24 hours and filter out the precipitate. Yellowish-green crystalline precipitate with Na^+ .

Zirconium alizarin sulfonate reagent. (a) Dissolve 0.05 g of zirconium nitrate in 50 ml of H_2O and 10 ml of concentrated HCl . (b) Dissolve 0.05 g of alizarin red S in 50 ml of H_2O . Mix (a) and (b) to make the reagent. Gives immediate yellow color with F^- (oxalates or phosphates interfere, giving yellow color slowly).

ACID DILUTION BY VOLUME

The volume of pure acid (or water) which must be added to 50 cm³ of water (or acid) to give solutions of specific gravity shown. Temperature 20°C. Taken from curves prepared by W. W. Stiles, based on experimental determinations. The values are approximate only.

Sulfuric Acid		Sulfuric Acid		Hydrochloric acid		Nitric acid	
Sp. gr.	Acid cm ³	Sp. gr.	Acid cm ³	Sp. gr.	Acid cm ³	Sp. gr.	Acid cm ³
0.9982	0.0	1.45	38.4	0.9982	0.0	0.9982	0.0
1.01	0.2	1.46	40.2	1.000	0.4	1.00	0.2
1.02	0.5	1.47	42.3	1.005	1.4	1.01	1.1
1.03	0.9	1.48	44.5	1.010	2.7	1.02	1.9
1.04	1.3	1.49	46.6	1.015	4.1	1.03	3.
1.05	1.7	1.50	48.7	1.020	5.6	1.04	4.1
1.06	2.2			1.025	7.1	1.05	5.2
1.07	2.7			1.030	8.6	1.06	6.4
1.08	3.2			1.035	10.2	1.07	7.7
1.09	3.7			1.040	11.8	1.08	9.1
1.10	4.3			1.045	13.8	1.09	10.6
1.11	4.9			1.050	15.9	1.10	12.
1.12	5.5			1.055	18.4	1.11	13.5
1.13	6.2			1.060	21.1	1.12	15.1
1.14	6.9			1.065	24.	1.13	16.8
1.15	7.6			1.070	26.8	1.14	18.5
1.16	8.3			1.075	30.	1.15	20.3
1.17	9.0			1.080	33.7	1.16	22.3
1.18	9.7			1.085	37.9	1.17	24.4
1.19	10.5			1.090	42.2	1.18	26.7
1.20	11.3			1.095	47.0	1.19	29.3
1.21	12.1			1.100	47.8	1.20	32.1
1.22	12.9					1.21	35.1
1.23	13.7					1.22	38.3
1.24	14.5					1.23	41.8
1.25	15.3					1.24	45.6
1.26	16.1					1.25	49.4
1.27	16.9						
1.28	17.8						
1.29	18.7						
1.30	19.6						
1.31	20.6						
1.32	21.6						
1.33	22.7						
1.34	23.8						
1.35	25.0						
1.36	26.2						
1.37	27.4						
1.38	28.6						
1.39	29.8						
1.40	31.1						
1.41	32.5						
1.42	33.9						
1.43	35.4						
1.44	36.8						

ORGANIC ANALYTICAL REAGENTS

Compiled by John H. Yoe

Determination	Reagent	Reference
Aldehydes.....	Dimethyl-dihydroresorcin (Dimedon)	Ind. Eng. Chem., Anal. Ed. 3 , 365 (1931)
Aluminum.....	Alizarin S	J. Am. Chem. Soc. 50 , 748 (1928)
	Ammonium salt of aurin tricarboxylic acid ("Aluminon")	" 49 , 2395 (1927) " 55 , 2437 (1933)
	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Bull. soc. chim. Belg., 36 , 288 (1927)
	Eriochrome cyanine	Z. anal. Chem. 96 , 91 (1934)
	Hematoxylin	Ind. Eng. Chem. 16 , 233 (1924)
	8-Hydroxyquinoline	J. Am. Chem. Soc. 50 , 1900 (1928)
	Quinalizarine	J. Am. Phar. Assoc. 17 , 260 (1928)
Ammonia.....	Tannin—AgNO ₃	Snell, Vol. I, p. 659 (7)
Antimony.....	Hexamethylene-tetramine	Z. anal. Chem. 67 , 298 (1925)
	Phenylthiohydantoic acid	Compt. rend. 176 , 1221 (1923)
	Pyridine	Analyst 53 , 373 (1928)
	Pyrogallol	Z. anal. Chem. 64 , 44 (1924)
Arsenic.....	Cocaine-molybdate	Biochem. Z. 185 , 14 (1927)
	Quinine arsenomolybdate	Analyst 47 , 317 (1922)
	Strychnine-molybdate	Ann. chim. applicata 23 , 517 (1933)
Beryllium.....	Curcumin	J. Am. Chem. Soc. 50 , 393 (1928)
	8-Hydroxyquinoline	Bur. Standards J. Research 3 , 91 (1929)
	1, 2, 5, 8-Tetrahydroxyanthraquinone (Quinalizarin)	Siemens-Konzerns, Beryllium, p. 25 (1932)
Bismuth.....	Cinchonine.....	Scott, p. 77 (1)
	Dimethylglyoxime	Z. anal. Chem. 72 , 11 (1927)
	8-Hydroxyquinoline	" 72 , 177 (1927)
	Pyrogallol	" 65 , 448 (1925)
	Thiourea	" 94 , 161 (1933)
Boron.....	Curcumin	Chem. News 87 , 27 (1903)
	Mannitol	Scott, p. 90 (1)
	Methyl alcohol	J. Am. Chem. Soc. 50 , 1385 (1928)
	Turmeric	Ind. Eng. Chem., Anal. Ed. 4 , 180 (1932)
Bromine....	Fluorescein	Snell, Vol. I, p. 548 (7)
	Fuchsin	" " p. 546 (7)
	Phenol red	" " p. 549 (7)
Cadmium.....	Allylthiourea	Helvetica Chim. Acta, 12 , 718 (1929)
	Ethylenediamine	Z. anal. Chem. 77 , 340 (1929)
	Hexamethylenetetramine allioidide	C. A., 24 , 311 (1930)
	β-Naphthoquinoline	Analyst 58 , 667 (1933)
	Phenyl-trimethylammonium iodide	" 58 , 667 (1933)
Calcium....	Pyridine	Z. anal. Chem. 73 , 279 (1928)
	Alizarin	Biochem. J. 16 , 494 (1922); Yoe, Vol. I, p. 139 (2)
	1-amino-2-naphthol-4-sulfonic acid	J. Biol. Chem. 81 , 1 (1929)

ORGANIC ANALYTICAL REAGENTS (Continued)

Determination	Reagent	Reference
Calcium (Cont.)..	Ammonium oxalate Ammonium stearate Antipyrine Picrolonic acid Sodium sulforicinate	Snell, Vol. I, p. 463 (7) J. Biol. Chem. 29 , 169 (1917); Yoe, Vol. II, p. 119 (3) Snell, Vol. I, p. 462 (7) Biochem. Z. 265 , 85 (1933) " 137 , 157 (1923); Yoe, Vol. II, p. 125 (3) Snell, Vol. I, p. 366 (7) p. 588 (7)
Cerium.....	Gallic acid	Ind. Eng. Chem., Anal. Ed. 4 , 2 (1932)
Chlorate.....	Aniline hydrochloride	Chem. Weekblad. 23 , 203 (1926)
Chlorine.....	Benzidine hydrochloride Dimethyl- <i>p</i> -phenylene-diamine Oleic acid Sodium sulforicinate Thymolphthalein <i>o</i> -Tolidine	J. Soc. Chem. Ind. 42 , 427A (1923) Biochem. Z., 137 , 157 (1923); Yoe, Vol. II, p. 125 (3) Ind. Eng. Chem. 19 , 112 (1927) Yoe, Vol. I, p. 157 (2)
Chromium.....	1, 8-Dihydroxynaphthalene-3, 6-Disulfonate <i>s</i> -Diphenylcarbazine Pyrogallol dimethyl ether	Ind. Eng. Chem. 5 , 298 (1913) J. Am. Chem. Soc. 50 , 2363 (1928) C. A. 4 , 3178 (1910)
Cobalt.....	Cysteine hydrochloride Dimethylglyoxime 3, 5-Dimethylpyrazole Dinitrosoresorcinol α -Nitroso- β -naphthol Nitroso-R-salt Phenylthiohydantoic acid	J. Biol. Chem. 83 , 367 (1922) J. Am. Chem. Soc. 43 , 482 (1921) Ind. Eng. Chem., Anal. Ed. 2 , 38 (1930) J. Am. Chem. Soc. 45 , 1439 (1923) Chem. Zeit. 46 , 430 (1922) J. Am. Chem. Soc. 43 , 746 (1921) " 44 , 2219 (1922)
Columbium.....	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Hillebrand and Lundell, p. 109 (5)
Copper.....	<i>m</i> -Benzamino-semicarbazide Benzidine α -Benzionoxime (Cupron) Diacetyl-dioxime ρ -Dimethylamino-benzalrhodanine Dinitrosoresorcinol <i>s</i> -Diphenylcarbazine Diphenylthiocarbazon Hydroquinone Isatin α -Naphthol β -Naphthol Phenolphthalein Phenylthiohydantoic acid Piperidinium piperidyl-dithioformate	Snell, Vol. I, p. 166 (7) Z. anal. Chem. 67 , 31 (1925) Ber. 56 , 2083 (1923) Analyst 54 , 333 (1929) J. Am. Chem. Soc. 52 , 2222 (1930) " 47 , 1268 (1925) Chem. Weekblad. 21 , 20 (1924) J. Assoc. Official Agr. Chem. 18 , 192 (1935) Bull. soc. chim. 31 , 1176 (1922) Rec. trav. chim. 42 , 199 (1923) Bull. soc. chim. 31 , 1176 (1922) Am. J. Pharm. 105 , 62 (1933) Compt. rend. 173 , 1082 (1921) J. Am. Chem. Soc. 44 , 225 (1922) Analyst 56 , 736 (1931)

ORGANIC ANALYTICAL REAGENTS (Continued)

Determination	Reagent	Reference
Copper (Cont.)..	Potassium ethyl xanthate	Yoe, Vol. I, p. 184 (2)
	Pyridine	Z. anal. Chem. 67 , 27 (1925)
	Salicylic acid	Yoe, Vol. I, p. 183 (2)
	Sodium diethyldithiocarbamate	Analyst 54 , 650 (1929)
	<i>o</i> -Tolidine	Z. anal. Chem. 67 , 31 (1925)
Fluoride.....	Urobilin	Chem. Weekblad. 27 , 552 (1930)
	Acetylacetone	Ind. Eng. Chem., Anal. Ed. 5 , 300 (1933)
	Alizarin sodium sulfonate—Zr(NO ₃) ₄	Ind. Eng. Chem., Anal. Ed. 7 , 23 (1935)
	Quinalizarine—Zr(NO ₃) ₄	Ind. Eng. Chem., Anal. Ed. 6 , 61 (1934)
Gold.....	Benzidine	Bull. Chim. Farm. 52 , 461 (1912)
	Formaldehyde	Bull. soc. chim. 31 , 717 (1922)
	<i>m</i> -Phenylenediamine sulfate	Chem. Zeit. 36 , 934 (1912)
	Phenylhydrazine	Ann. Chim. anal. 12 , 90 (1907)
	<i>o</i> -Tolidine	Analyst 44 , 94 (1919)
Hydrogen sulfide	<i>p</i> -phenylenedimethyldiamine sulfate	Yoe, Vol. I, p. 375 (2)
Iodine.....	<i>o</i> -Tolidine	J. Am. Chem. Soc. 47 , 1000 (1925)
Iridium.....	Benzidine	Snell, Vol. I, p. 425 (7)
Iron.....	Acetylacetone	J. Am. Chem. Soc. 26 , 967 (1904)
	Alloxantin	Compt. rend. 180 , 519 (1925)
	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Ind. Eng. Chem. 3 , 629 (1911)
	Cysteine	Biochem. Z. 187 , 255 (1927)
	Dimethyl glyoxime	Z. anorg. Chemie 89 , 401 (1914)
	Dinitrosoresorcinol	J. Am. Chem. Soc. 47 , 1268 (1925)
	Diphenylamine	" 46 , 263 (1924)
	α , α' -Dipyridyl	Snell, Vol. I, p. 310 (7)
	Hexamethylenetetramine	Bull. soc. chim. Rom. 2 , 89 (1921)
	7-Iodo-8-hydroxyquinoline-5-sulfonic acid	J. Am. Chem. Soc. 59 , 872 (1937)
	Isonitrosoacetophenone	Ber. 60 , 527 (1927)
	α -Nitroso- β -naphthol	Bull. soc. chim. 35 , 641 (1924)
	<i>o</i> -Phenanthroline	Ind. Eng. Chem., Anal. Ed. 9 , 67 (1937)
	Pyramidone	Pharm. Weekblad. 63 , 1121 (1926)
	Pyrocatechol	Helv. chim. Acta 9 , 835 (1926)
	Salicylic acid	J. Chem. Soc. 93 , 93 (1908)
	Salicylsulfonic acid	Snell, Vol. I, p. 302 (7)
	Sulfosalicylic acid	Biochem. Z. 181 , 391 (1927)
	Thioglycollic acid	J. Am. Chem. Soc. 49 , 1916 (1927)
	Ammonium thiocyanate and pyridine	Z. anal. Chem. 72 , 289 (1927)
Lead.....	Aniline	Ind. Eng. Chem. 11 , 1055 (1919); Yoe, Vol. I, p. 257 (2)
	<i>s</i> -Diphenylcarbazine	Yoe, Vol. I, p. 255 (2)
	Diphenylthiocarbazone (Dithizone)	Snell, Vol. I, p. 202 (7)
	Hematein	Yoe, Vol. I, p. 257 (2)
	Tetramethyldiamidodiphenylmethane	Snell, Vol. I, p. 200 (7)

ORGANIC ANALYTICAL REAGENTS (Continued)

Determination	Reagent	Reference
Lithium.....	Ammonium stearate	J. Am. Chem. Soc. 52 , 2754(1930)
Magnesium.....	Curcumin	Ind. Eng. Chem., Anal. Ed. 4 , 426 (1932)
	Dimethylamine	Z. anorg. Chem. 26 , 347 (1901)
	Hydroquinone	Yoe. Vol. I, p. 264 (2)
	8-Hydroxyquinoline	Z. anal. Chem. 71 , 122 (1927)
	p-Nitrobenzene-azoresorcinol	J. Am. Chem. Soc. 51 , 1456 (1929)
	Oleic acid	Yoe. Vol. I, p. 270 (2)
	Titan yellow	C. A. 23 , 1838 (1929)
Manganese.....	Benzidine	Snell, Vol. I, p. 343 (7)
	o-Tolidine	" p. 341 (7)
Mercury.....	p-Dimethylamino-benzalrhodamine	J. Am. Chem. Soc. 52 , 2222 (1930)
	s-Diphenylcarbazine	Z. angew. Chem. 39 , 791 (1926)
	Potassium diphenyl-carbazone	Snell, Vol. I, p. 180 (7)
	Strychnine sulfate	" " p. 185 (7)
Molybdenum....	α-Benzoin-oxime (Cupron)	B. S. J. Research 9 , 1 (1932)
	Ethyl ether	Blair, 7th Ed., p. 210 (4)
	Phenylhydrazine	Ber. 36 , 512 (1903)
	Potassium ethyl xanthate and chloroform	J. Am. Chem. Soc. 44 , 1462 (1922)
	Tannic acid	Chem. Eng. Mining Rev. 11 , 258 (1919)
Nickel.....	α-Benzil-dioxime	Analyst 38 , 316 (1913)
	Dicyandiamidine sulfate	Chem. Zeit. 31 , 335, 911 (1907)
	Dimethylglyoxime	Chem. Weekblad. 21 , 358 (1924)
	Formaldoxime	Snell, Vol. I, p. 319 (7)
	Potassium dithiooxalate	J. Am. Chem. Soc. 54 , 1866 (1932)
Nitrate.....	Brucine	Yoe. Vol. I, p. 318 (2)
	Diphenylamine sulfonic acid	J. Am. Chem. Soc. 55 , 1448 (1933)
	Diphenylbenzidine	Yoe. Vol. I, p. 316 (2)
	Diphenyl-endo-anilohydrotriazole ("Nitron")	Fales, Inorg. Quant. Anal. p. 271 (1925)
	Phenoldisulfonic acid	Yoe. Vol. I, p. 313 (2)
	Pyrogallol	" p. 319 (2)
	Strychnine sulfate	" p. 320 (2)
	2:4-Xylenol	J. Assoc. Off. Agri. Chem. 18 , 459 (1935)
Nitrite.....	Antipyrin	Yoe. Vol. I, p. 311 (2)
	Dimethylaniline	" p. 311 (2)
	Dimethyl-α-Naphthylamine	Ind. Eng. Chem., Anal. Ed. 1 , 28 (1929)
	Diphenylamine sulfate	Yoe. Vol. I, p. 654 (2)
	α-Naphthylamine and β-Naphthylamine-6,8-Disulfonic acid	J. Pharmacol. 51 , 398 (1934)
	α-Naphthylamine hydrochloride	Yoe. Vol. I, p. 309 (2)
	m-Phenylenediamine	" p. 310 (2)
	Sulfanilic acid and α-naphthylamine	" p. 308 (2)
Osmium.....	Thiourea	Compt. rend. 167 , 235 (1918)

ORGANIC ANALYTICAL REAGENTS (Continued)

Determination	Reagent	Reference
Oxygen.....	Indigo carmine Pyrogallol	Snell, Vol. I, p. 137 (7) Dennis, Gas Analysis, p. 174 (1929)
Phosphate.....	1, 2, 4-Aminonaphtho- sulfonic acid Hydroquinone Quinine-molybdate Strychnine-molybdate	Yoe, Vol. I, p. 348 (2) " pp. 346 and 353 (2) " p. 343 (2) Yoe, Vol. II, p. 142 (3)
Phosphorus.....	Hydrazine sulfate	Yoe, Vol. I, p. 341 (2)
Potassium.....	6-Chloro-5-nitrotolu- ene-3-sulfonic acid Dipicrylamine Picric acid	Mikrochem. 14 , 368 (1934) Z. angew. Chem. 49 , 827 (1936) J. Am. Chem. Soc. 53 , 539 (1931)
Selenium.....	Codeine phosphate Hydroquinone Hydroxylamine hydrochloride Pyrrol	Arch. Pharm. 252 , 161 (1914) Am. J. Sci. 15 , 253 (1928) J. Am. Chem. Soc. 47 , 2456 (1925) Snell, Vol. I, p. 604 (7)
Silver.....	Chromotropic acid Dichlorofluorescein <i>p</i> -Dimethylamino- benzalrhodanine Methylamine	Helvetica Chim. Acta 12 , 714 (1929) J. Am. Chem. Soc. 51 , 3273 (1929) " 52 , 2222 (1930) Mikrochemie 7 , 233 (1929)
Sodium.....	Dihydroxy-tartaric acid Uranyl zinc acetate	J. Russ. Phys. Chem. Soc. 60 , 661 (1928) J. Am. Chem. Soc. 51 , 1664 (1929)
Sulfide.....	<i>p</i> -Aminodimethyl- aniline	Snell, Vol. I, p. 593 (7)
Sulfur.....	<i>p</i> -Phenylenedimethyl- diamine hydro- chloride	Yoe, Vol. I, p. 373 (2)
Tantalum.....	Ammonium salt of nitrosophenyl hy- droxylamine ("Cup- ferron")	Hillebrand and Lundell, p. 113 (5)
Tellurium.....	Hydrazine hydro- chloride Hydroquinone	J. Am. Chem. Soc. 47 , 2456 (1925) Am. J. Sci. 15 , 253 (1928)
Thorium.....	Phenylarsonic acid	J. Am. Chem. Soc. 48 , 895 (1926)
Tin.....	Ammonium salt of nitrosophenyl hy- droxylamine ("Cup- ferron") Cacotheline	Hillebrand and Lundell, p. 113 (5) Ind. Eng. Chem., Anal. Ed. 7 , 26 (1935)
Titanium.....	Ammonium salt of nitrosophenyl hy- droxylamine ("Cup- ferron") 5, 7-Dibromo-8- hydroxyquinoline Dihydroxymaleic acid Gallic acid 8-Hydroxyquinoline Tannic acid Thymol	Hillebrand and Lundell, p. 113 (5); Z. anal. Chem. 83 , 345 (1931) Z. anorg. Chem. 204 , 215 (1932) Snell, Vol. I, p. 365 (7) " p. 365 (7) Z. anal. Chem. 81 , 1 (1930) Analyst 55 , 605 (1930) Yoe, Vol. I, p. 381 (2)
Tungsten.....	Benzidine Cinchonine Hydroquinone	Ber. 38 , 783 (1905) Hillebrand and Lundell, p. 553 (5) Z. angew. Chem. 44 , 237 (1931)

ORGANIC ANALYTICAL REAGENTS (Continued)

Determination	Reagent	Reference
Tungsten (Cont.)	Phenylhydrazine hydrochloride	Bull. soc. chim. Belg. 38 , 385 (1929)
	Rhodamine B	Snell, Vol. I, p. 379 (7)
	Uric acid	Ann. chim. anal. 9 , 371 (1904)
Uranium.....	<i>o</i> -Hydroxybenzoic acid	Snell, Vol. I, p. 394 (7)
Urea.....	Sodium salicylate	Chem. Zeit. 43 , 739 (1919)
	Xanthidrol	Mikrochem. 14 , 132 (1934)
Vanadium.....	Aniline	C. A. 24 , 567 (1930)
	Diphenylamine	Yoe, Vol. I, p. 715 (2)
	Diphenylbenzidine	Ind. Eng. Chem. 20 , 764 (1928)
	Safranine	Vol. Anal., Vol. II, p. 326 (6)
	Strychnine	Yoe, Vol. I, p. 393 (2)
Zinc.....	Diphenylamine	J. Am. Chem. Soc. 49 , 2214 (1927)
	Diphenylbenzidine	" 49 , 356 (1927)
	Diphenylthiocarbazone (Dithizone)	Ind. Eng. Chem., Anal. Ed. 9 , 127 (1937)
	8-Hydroxyquinoline	Z. anal. Chem. 71 , 171 (1927)
	Pyridine	" 73 , 356 (1928)
	Resorcinol	Yoe, Vol. I, p. 396 (2)
	Urobilin	J. Ind. Hyg. 7 , 273 (1925)
Zirconium.....	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Hillebrand and Lundell, p. 109 (5)
	Phenylarsonic acid	J. Am. Chem. Soc. 48 , 895 (1926)

- (1) Scott, Standard Methods of Analysis, 1927.
- (2) Yoe, Photometric Chemical Analysis, Vol. I, Colorimetry, 1928.
- (3) Yoe, Photometric Chemical Analysis, Vol. II, Nephelometry, 1929.
- (4) Blair, Chemical Analysis of Iron.
- (5) Hillebrand and Lundell, Applied Inorganic Analysis, 1929.
- (6) Kolthoff and Furman, Volumetric Analysis, 1929.
- (7) Snell and Snell, Colorimetric Methods of Analysis, Vol. I, Inorganic, 1936.

VOLUMETRIC PRIMARY STANDARDS

Compiled by John H. Yoe

The 1937 International atomic weights were used in computing the equivalent weights.

Primary standard	Formula	Eq. wt. mol. wt.	Equivalent weight
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A. Acidimetry

s-Diphenylguanidine.....	$\text{NH}_2\text{C}[\text{NHC}_6\text{H}_5]_2$	1	211.25
Mercuric oxide.....	HgO	$\frac{1}{2}$	108.31
Potassium acid carbonate.....	KHCO_3	1	100.12
Potassium iodate.....	KIO_3	$\frac{1}{6}$	35.67
Sodium carbonate.....	Na_2CO_3	$\frac{1}{2}$	53.00
Sodium oxalate (1).....	$\text{Na}_2\text{C}_2\text{O}_4$	$\frac{1}{2}$	67.01
Sodium tetraborate (borax)...	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$	$\frac{1}{2}$	190.72

B. Alkalimetry

Benzoic acid (1).....	$\text{C}_6\text{H}_5\text{COOH}$	1	122.12
Hydrazine sulfate.....	$\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4$	$\frac{1}{2}$	65.06
Oxalic acid (cryst.) (2).....	$\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$	$\frac{1}{2}$	63.03
Potassium acid oxalate.....	KHC_2O_4	1	128.12
Potassium acid phthalate (1) ..	$\text{KHC}_8\text{H}_4\text{O}_4$	1	204.22
Potassium acid tartrate.....	$\text{KHC}_4\text{H}_4\text{O}_6$	1	188.18
Potassium tetroxalate.....	$\text{KH}_3(\text{C}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{O}$	$\frac{1}{3}$	84.73
Sodium tetraborate (borax)...	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$	$\frac{1}{2}$	190.72

C. Oxidimetry

Ferrous sulfate (3).....	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	1	278.01
Ferrous ammonium sulfate (3)	$\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$	1	392.14
Iron wire (4).....	Fe	1	55.84
Oxalic acid (cryst.) (2).....	$\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$	$\frac{1}{2}$	63.03
Potassium ferrocyanide.....	$\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$	1	422.38
Potassium iodate.....	KIO_3	$\frac{1}{2}$	107.01
Potassium iodide.....	KI	$\frac{1}{2}$	83.01
Silver.....	Ag	1	107.88
Sodium oxalate (1).....	$\text{Na}_2\text{C}_2\text{O}_4$	$\frac{1}{2}$	67.01

D. Iodimetry

Arsenious oxide (1).....	As_2O_3	$\frac{1}{2}$	49.455
Copper.....	Cu	1	63.57
Hydrazine sulfate.....	$\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4$	$\frac{1}{2}$	32.531
Iodine (resublimed) (5).....	I	1	126.92
Iodine cyanide.....	ICN	$\frac{1}{2}$	76.464
Oxalic acid (cryst.) (2).....	$\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$	$\frac{1}{2}$	63.03
Potassium bromate.....	KBrO_3	$\frac{1}{6}$	27.835
Potassium diiodate.....	$\text{KH}(\text{IO}_3)_2$	$\frac{1}{2}$	32.496
Potassium dichromate.....	$\text{K}_2\text{Cr}_2\text{O}_7$	$\frac{1}{6}$	49.035
Potassium ferricyanide.....	$\text{K}_3\text{Fe}(\text{CN})_6$	1	329.24
Potassium iodate.....	KIO_3	$\frac{1}{6}$	35.669
Sodium thiosulfate.....	$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$	1	248.19

VOLUMETRIC PRIMARY STANDARDS (Continued)

Primary standard	Formula	Eq. wt. mol. wt.	Equiva- lent weight
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E. Silver Nitrate

Potassium bromide.....	KBr	1	119.01
Potassium chloride.....	KCl	1	74.55
Sodium chloride.....	NaCl	1	58.45

F. Alkali Thiocyanates

Mercury.....	Hg	1	100.31
Mercuric oxide.....	HgO	1	108.31
Silver.....	Ag	1	107.88
Silver nitrate.....	AgNO ₃	1	169.89

G. Miscellaneous

For the determination of substances that must pass through complicated reactions, it is best to standardize against a standard sample of the substance that has been carried through all steps of the analysis. The U. S. Bureau of Standards can supply at a nominal fee a large number of standard samples of irons and steels (representing a wide range in composition), iron ores, manganese ore, zinc ore, etc.

- (1) May be obtained from the U. S. Bureau of Standards.
- (2) Difficult to obtain with exactly two molecules of water but a valuable primary standard when carefully prepared.
- (3) The pure salt is hard to obtain and to keep without slight oxidation or loss of water, hence other standards are recommended.
- (4) Possesses many disadvantages and is not recommended.
- (5) The last few drops of iodine are decolorized very slowly. Titrate till the pale yellow color persists at least two minutes. Starch retards the reaction and should be avoided.

CORRECTION FOR CAPILLARY DEPRESSION OF MERCURY IN A GLASS TUBE

Correction to be added.

Diam. of tube.	Height of meniscus in centimeters.							
	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
0.4	0.083	0.122	0.154	0.198	0.237			
0.5	.047	.065	.086	.119	.145	0.180		
0.6	.027	.041	.056	.078	.098	.121	0.143	
0.7	.018	.028	.040	.053	.067	.082	.097	.113
0.8	....	.020	.029	.038	.046	.056	.065	0.077
0.9	....	0.015	0.021	0.028	0.033	0.040	0.046	0.052
1.0	....	....	.015	.020	.025	.029	.033	.037
1.1	....	....	.010	.014	.018	.021	.024	.027
1.2	....	....	.007	.010	.013	.015	.018	.019
1.3	....	....	.004	.007	.010	.012	.013	.014

TRUE CAPACITY OF GLASS VESSELS FROM THE WEIGHT OF THE CONTAINED WATER OR MERCURY WHEN WEIGHED IN AIR WITH BRASS WEIGHTS*

A glass vessel containing G grams of water at a temperature of $t^{\circ}\text{C}$ has, at the same temperature, a capacity $V = W_t \times G$ cubic centimeters. Similarly when filled with G grams of mercury at a temperature of $t^{\circ}\text{C}$ the capacity at the same temperature is given by $V = M_t \times G$ cubic centimeters.

A glass vessel containing G grams of water at a temperature of $t^{\circ}\text{C}$ has a capacity at a temperature of 18°C given by $V = W_{18^{\circ}} \times G$ cubic centimeters. Similarly when filled with G grams of mercury at a temperature of $t^{\circ}\text{C}$ the capacity at a temperature of 18°C is given by $V = M_{18^{\circ}} \times G$ cubic centimeters. The true volume at temperature of 25°C when the weighing is made at t° is similarly obtained by use of the values under $W_{25^{\circ}}$ and $M_{25^{\circ}}$ for water and mercury respectively.

$t^{\circ}\text{C}.$	W_t	M_t	$W_{18^{\circ}}$	$M_{18^{\circ}}$	$W_{25^{\circ}}$	$M_{25^{\circ}}$
0	1.001193	0.0735501	1.001643	0.0735832	1.001818	0.0735960
1	1.001133	0.0735636	1.001559	0.0735949	1.001734	0.0736077
2	1.001092	0.0735771	1.001492	0.0736066	1.001668	0.0736194
3	1.001068	0.0735907	1.001443	0.0736183	1.001618	0.0736311
4	1.001060	0.0736037	1.001410	0.0736294	1.001586	0.0736423
5	1.001068	0.0736172	1.001394	0.0736411	1.001569	0.0736540
6	1.001092	0.0736308	1.001392	0.0736529	1.001568	0.0736657
7	1.001131	0.0736492	1.001406	0.0736695	1.001581	0.0736824
8	1.001184	0.0736628	1.001435	0.0736812	1.001610	0.0736941
9	1.001252	0.0736763	1.001477	0.0736929	1.001652	0.0737058
10	1.001333	0.0736894	1.001534	0.0737042	1.001709	0.0737171
11	1.001428	0.0736975	1.001603	0.0737104	1.001779	0.0737233
12	1.001536	0.0737111	1.001686	0.0737222	1.001862	0.0737351
13	1.001657	0.0737241	1.001782	0.0737333	1.001957	0.0737463
14	1.001790	0.0737377	1.001890	0.0737451	1.002066	0.0737581
15	1.001935	0.0737513	1.002010	0.0737569	1.002186	0.0737698
16	1.002092	0.0737644	1.002143	0.0737681	1.002318	0.0737810
17	1.002261	0.0737780	1.002286	0.0737798	1.002462	0.0737927
18	1.002441	0.0737911	1.002441	0.0737911	1.002617	0.0738039
19	1.002633	0.0738047	1.002608	0.0738028	1.002783	0.0738157
20	1.002835	0.0738183	1.002785	0.0738146	1.002960	0.0738275
21	1.003047	0.0738314	1.002972	0.0738258	1.003148	0.0738398
22	1.003271	0.0738450	1.003170	0.0738376	1.003346	0.0738505
23	1.003504	0.0738581	1.003379	0.0738489	1.003554	0.0738618
24	1.003748	0.0738717	1.003597	0.0738607	1.003773	0.0738736
25	1.004001	0.0738848	1.003825	0.0738719	1.004001	0.0738848
26	1.004264	0.0738985	1.004063	0.0738837	1.004239	0.0738966
27	1.004537	0.0739116	1.004310	0.0738950	1.004486	0.0739079
28	1.004819	0.0739253	1.004567	0.0739068	1.004743	0.0739197
29	1.005110	0.0739384	1.004833	0.0739181	1.005009	0.0739310
30	1.005410	0.0739520	1.005109	0.0739299	1.005284	0.0739428

* Assuming 25×10^{-6} as the coefficient of cubic expansion for glass.

Reduction of Weighings to Vacuo

If the apparent mass of a body is m , its density d_m , the density of the weights d_w and the density of the air d_a the true mass in vacuo is,

$$M = m + md_a \left(\frac{1}{d_m} - \frac{1}{d_w} \right)$$

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS

The weight in grams of the compound in 1 c.c. of the following deci-normal solutions is found by dividing the H equivalent in the last column by 1000.

Name	Formula	At. or mol. wt.	Hydrogen equivalent	One H equiv. in gms.
Acetic acid.....	HC ₂ H ₃ O ₂	60.03	HC ₂ H ₃ O ₂	6.003
Ammonia.....	NH ₃	17.03	NH ₃	1.703
Ammonium.....	NH ₄	18.04	NH ₄	1.804
Ammonium chloride.....	NH ₄ Cl	53.50	NH ₄ Cl	5.350
Ammonium sulfate.....	(NH ₄) ₂ SO ₄	132.14	$\frac{1}{2}$ (NH ₄) ₂ SO ₄	6.607
Ammonium sulfoeyanate.....	NH ₄ CNS	76.11	NH ₄ CNS	7.611
Barium.....	Ba	137.36	$\frac{1}{2}$ Ba	6.868
Barium carbonate.....	BaCO ₃	197.36	$\frac{1}{2}$ BaCO ₃	9.868
Barium chloride.....	BaCl ₂ . 2H ₂ O	244.31	$\frac{1}{2}$ BaCl ₂ 2H ₂ O	12.216
Barium hydroxide.....	Ba(OH) ₂	171.38	$\frac{1}{2}$ Ba(OH) ₂	8.569
Barium oxide.....	BaO	153.36	$\frac{1}{2}$ BaO	7.668
Bromine.....	Br	79.92	Br	7.992
Calcium.....	Ca	40.08	$\frac{1}{2}$ Ca	2.004
Calcium carbonate.....	CaCO ₃	100.08	$\frac{1}{2}$ CaCO ₃	5.004
Calcium chloride.....	CaCl ₂	110.99	$\frac{1}{2}$ CaCl ₂	5.550
Calcium chloride.....	CaCl ₂ . 6H ₂ O	219.09	$\frac{1}{2}$ CaCl ₂ . 6H ₂ O	10.954
Calcium hydroxide.....	Ca(OH) ₂	74.10	$\frac{1}{2}$ Ca(OH) ₂	3.705
Calcium oxide.....	CaO	56.08	$\frac{1}{2}$ CaO	2.804
Chlorine.....	Cl	35.46	Cl	3.546
Citric acid.....	C ₆ H ₈ O ₇ . H ₂ O	210.08	$\frac{1}{2}$ C ₆ H ₈ O ₇ . H ₂ O	7.003
Cobalt.....	Co	58.94	$\frac{1}{2}$ Co	2.948
Copper.....	Cu	63.57	$\frac{1}{2}$ Cu	3.179
Copper Oxide.....	CuO	79.57	$\frac{1}{2}$ CuO	3.979
Copper sulfate.....	CuSO ₄ . 5H ₂ O	249.71	$\frac{1}{2}$ CuSO ₄ . 5H ₂ O	12.485
Cyanogen.....	CN	26.01	CN	2.601
Hydrochloric acid.....	HCl	36.47	HCl	3.647
Hydrocyanic acid.....	HCN	27.02	HCN	2.702
Iodine.....	I	126.93	I	12.693
Lactic acid.....	C ₃ H ₆ O ₃	90.05	$\frac{1}{2}$ C ₃ H ₆ O ₃	9.005
Malic acid.....	C ₄ H ₆ O ₅	134.05	$\frac{1}{2}$ C ₄ H ₆ O ₅	6.702
Magnesium.....	Mg	24.32	$\frac{1}{2}$ Mg	1.216
Magnesium carbonate.....	MgCO ₃	84.32	$\frac{1}{2}$ MgCO ₃	4.216
Magnesium chloride.....	MgCl ₂	95.23	$\frac{1}{2}$ MgCl ₂	4.762
Magnesium chloride.....	MgCl ₂ . 6H ₂ O	203.33	$\frac{1}{2}$ MgCl ₂ . 6H ₂ O	10.167
Magnesium oxide.....	MgO	40.32	$\frac{1}{2}$ MgO	2.016
Manganese.....	Mn	54.93	$\frac{1}{2}$ Mn	2.747
Manganese sulfate.....	MnSO ₄	150.99	$\frac{1}{2}$ MnSO ₄	7.550
Mercuric chloride.....	HgCl ₂	271.52	$\frac{1}{2}$ HgCl ₂	13.576
Nickel.....	Ni	58.69	$\frac{1}{2}$ Ni	2.935
Nitric acid.....	HNO ₃	63.02	HNO ₃	6.302
Nitrogen.....	N	14.01	N	1.401
Nitrogen pentoxide.....	N ₂ O ₅	108.02	$\frac{1}{2}$ N ₂ O ₅	5.401
Oxalic acid.....	H ₂ C ₂ O ₄	90.02	$\frac{1}{2}$ H ₂ C ₂ O ₄	4.501
Oxalic acid.....	H ₂ C ₂ O ₄ . 2H ₂ O	126.05	$\frac{1}{2}$ H ₂ C ₂ O ₄ . 2H ₂ O	6.302
Oxalic anhydride.....	C ₂ O ₃	72.00	$\frac{1}{2}$ C ₂ O ₃	3.600
Phosphoric acid.....	H ₃ PO ₄	98.04	$\frac{1}{2}$ H ₃ PO ₄	3.268
Potassium.....	K	39.10	K	3.910
Potassium bicarbonate.....	KHCO ₃	100.11	KHCO ₃	10.011
Potassium carbonate.....	K ₂ CO ₃	138.20	$\frac{1}{2}$ K ₂ CO ₃	6.910
Potassium chloride.....	KCl	74.56	KCl	7.456
Potassium cyanide.....	KCN	65.11	KCN	6.511
Potassium hydroxide.....	KOH	56.11	KOH	5.611
Potassium oxide.....	K ₂ O	94.20	$\frac{1}{2}$ K ₂ O	4.710
Potassium permanganate for Co estimation	KMnO ₄	158.03	$\frac{1}{8}$ KMnO ₄	2.634

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS (Continued.)

Name	Formula	At. or mol. wt.	Hydrogen equivalent	One H equiv. in gms.
Potassium permanganate for Mn estimation	KMnO ₄	158.03	$\frac{1}{5}$ KMnO ₄	5.268
Potassium tartrate.....	K ₂ H ₄ C ₄ O ₆	226.23	$\frac{1}{2}$ K ₂ H ₄ C ₄ O ₆	11.312
Silver.....	Ag.....	107.88	Ag.....	10.788
Silver nitrate.....	AgNO ₃	169.89	AgNO ₃	16.989
Sodium.....	Na.....	23.00	Na.....	2.300
Sodium bicarbonate.....	NaHCO ₃	84.00	NaHCO ₃	8.400
Sodium carbonate.....	Na ₂ CO ₃	105.99	$\frac{1}{2}$ Na ₂ CO ₃	5.300
Sodium chloride.....	NaCl.....	58.45	NaCl.....	5.845
Sodium hydroxide.....	NaOH.....	40.00	NaOH.....	4.000
Sodium oxide.....	Na ₂ O.....	61.99	$\frac{1}{2}$ Na ₂ O.....	3.100
Sodium sulfide.....	Na ₂ S.....	78.05	$\frac{1}{2}$ Na ₂ S.....	3.903
Succinic acid.....	H ₂ C ₄ H ₄ O ₄	118.05	$\frac{1}{2}$ H ₂ C ₄ H ₄ O ₄	5.902
Sulfuric acid.....	H ₂ SO ₄	98.08	$\frac{1}{2}$ H ₂ SO ₄	4.904
Sulfur trioxide.....	SO ₃	80.06	$\frac{1}{2}$ SO ₃	4.003
Tartaric acid.....	C ₄ H ₆ O ₆	150.05	$\frac{1}{2}$ C ₄ H ₆ O ₆	7.502
Zinc.....	Zn.....	65.38	$\frac{1}{2}$ Zn.....	3.269
Zinc sulfate.....	ZnSO ₄ ·7H ₂ O.....	387.55	$\frac{1}{2}$ ZnSO ₄ ·7H ₂ O.....	14.377

REDUCTIONS OF WEIGHINGS IN AIR TO VACUO

When the weight M in grams of a body is determined in air, a correction is necessary for the buoyancy of the air. The following table is computed for an air density of 0.0012. The corrected weight = $M + kM/1000$ values of k being found in the table.

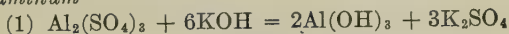
Density of body weighed	Correction factor, k.		
	Pt Ir weights	Brass weights	Quartz or Al weights
.5	+2.34	+2.26	+1.95
.6	+1.94	+1.86	+1.55
.7	+1.66	+1.57	+1.26
.75	+1.55	+1.46	+1.15
.80	+1.44	+1.36	+1.05
.85	+1.36	+1.27	+0.96
.90	+1.28	+1.19	+ .88
.95	+1.21	+1.12	+ .81
1.00	+1.14	+1.06	+ .75
1.1	+1.04	+0.95	+ .64
1.2	+0.94	+ .86	+ .55
1.3	+ .87	+ .78	+ .47
1.4	+ .80	+ .71	+ .40
1.5	+ .75	+ .66	+ .35
1.6	+ .69	+ .61	+ .30
1.7	+ .65	+ .56	+ .25
1.8	+ .62	+ .52	+ .21
1.9	+ .58	+ .49	+ .18
2.0	+ .54	+ .46	+ .15
2.5	+ .43	+ .34	+ .03
3.0	+ .34	+ .26	— .05
4.0	+ .24	+ .16	— .15
6.0	+ .14	+ .06	— .25
8.0	+ .09	+ .01	— .30
10.0	+ .06	— .02	— .33
15.0	+ .03	— .05	— .37
20.0	+ .004	— .08	— .39
22.0	— .001	— .09	— .40

DECI-NORMAL SOLUTIONS OF OXIDATION AND REDUCTION REAGENTS

Name	Formula	At. or mol. wt.	Hydrogen equivalent	One H equiv. in gms.
Antimony.....	Sb.....	121.76	$\frac{1}{3}$ Sb.....	6.089
Arsenic.....	As.....	74.93	$\frac{1}{3}$ As.....	3.747
Arsenic trisulfide.....	As ₂ S ₃	246.04	$\frac{1}{3}$ As ₂ S ₃	6.151
Arsenous oxide.....	As ₂ O ₃	197.86	$\frac{1}{3}$ As ₂ O ₃	4.947
Barium peroxide.....	BaO ₂	169.36	$\frac{1}{2}$ BaO ₂	8.468
Barium peroxide, hydrated.....	BaO ₂ ·8H ₂ O.....	313.48	$\frac{1}{2}$ BaO ₂ ·8H ₂ O.....	15.674
Calcium.....	Ca.....	40.08	$\frac{1}{2}$ Ca.....	2.004
Calcium carbonate.....	CaCO ₃	100.08	$\frac{1}{2}$ CaCO ₃	5.004
Calcium hypochlorite.....	Ca(ClO) ₂	142.99	$\frac{1}{4}$ Ca(ClO) ₂	3.574
Calcium oxide.....	CaO.....	56.08	$\frac{1}{2}$ CaO.....	2.804
Chlorine.....	Cl.....	35.46	Cl.....	3.546
Chromium trioxide.....	CrO ₃	100.01	$\frac{1}{3}$ CrO ₃	3.334
Ferrous ammonium sulfate.....	FeSO ₄ (NH ₄) ₂ SO ₄ ·6H ₂ O.....	392.13	FeSO ₄ (NH ₄) ₂ SO ₄ · 6H ₂ O.....	39.213
Hydroferrocyanic acid.....	H ₄ Fe(CN) ₆	215.92	H ₄ Fe(CN) ₆	21.592
Hydrogen peroxide.....	H ₂ O ₂	34.02	$\frac{1}{2}$ H ₂ O ₂	1.701
Hydrogen sulfide.....	H ₂ S.....	34.08	$\frac{1}{2}$ H ₂ S.....	1.704
Iodine.....	I.....	126.93	I.....	12.693
Iron.....	Fe.....	55.84	Fe.....	5.584
Iron oxide, ferrous.....	FeO.....	71.84	FeO.....	7.184
Iron oxide, ferric.....	Fe ₂ O ₃	159.68	$\frac{1}{2}$ Fe ₂ O ₃	7.984
Lead peroxide.....	PbO ₂	239.22	$\frac{1}{2}$ PbO ₂	11.961
Manganese peroxide.....	MnO ₂	86.93	$\frac{1}{2}$ MnO ₂	4.347
Nitric acid.....	HNO ₃	63.02	$\frac{1}{3}$ HNO ₃	2.101
Nitrogen trioxide.....	N ₂ O ₃	76.02	$\frac{1}{2}$ N ₂ O ₃	1.800
Nitrogen pentoxide.....	N ₂ O ₅	108.02	$\frac{1}{2}$ N ₂ O ₅	1.800
Oxalic acid.....	C ₂ H ₂ O ₄	90.02	$\frac{1}{2}$ C ₂ H ₂ O ₄	4.501
Oxalic acid.....	C ₂ H ₂ O ₄ ·2H ₂ O.....	126.05	$\frac{1}{2}$ C ₂ H ₂ O ₄ ·2H ₂ O.....	6.302
Oxygen.....	O.....	16.00	O.....	0.800
Potassium bichromate.....	K ₂ Cr ₂ O ₇	294.22	$\frac{1}{6}$ K ₂ Cr ₂ O ₇	4.904
Potassium chlorate.....	KClO ₃	122.56	$\frac{1}{6}$ KClO ₃	2.043
Potassium chromate.....	K ₂ CrO ₄	194.21	$\frac{1}{6}$ K ₂ CrO ₄	6.474
Potassium ferrocyanide.....	K ₄ Fe(CN) ₆	368.29	K ₄ Fe(CN) ₆	36.829
Potassium ferrocyanide.....	K ₄ Fe(CN) ₆ · 3H ₂ O.....	422.33	K ₄ Fe(CN) ₆ ·3H ₂ O.....	42.233
Potassium iodide.....	KI.....	166.03	KI.....	16.603
Potassium nitrate.....	KNO ₃	101.11	$\frac{1}{3}$ KNO ₃	3.370
Potassium perchlorate.....	KClO ₄	138.56	$\frac{1}{6}$ KClO ₄	1.732
Potassium permanganate.....	KMnO ₄	158.03	$\frac{1}{5}$ KMnO ₄	3.161
Sodium chlorate.....	NaClO ₃	106.45	$\frac{1}{6}$ NaClO ₃	1.774
Sodium nitrate.....	NaNO ₃	85.01	$\frac{1}{3}$ NaNO ₃	2.834
Sodium thiosulfate.....	Na ₂ S ₂ O ₃ ·5H ₂ O.....	248.19	Na ₂ S ₂ O ₃ ·5H ₂ O.....	24.819
Stannous chloride.....	SnCl ₂	189.61	$\frac{1}{2}$ SnCl ₂	9.481
Stannous oxide.....	SnO.....	134.70	$\frac{1}{2}$ SnO.....	6.735
Sulfur dioxide.....	SO ₂	64.06	$\frac{1}{2}$ SO ₂	3.203
Tin.....	Sn.....	118.70	$\frac{1}{2}$ Sn.....	5.935

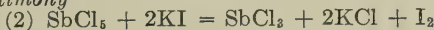
VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS

Aluminum



$$\text{KOH} = \frac{\text{Al}_2(\text{SO}_4)_3}{6} = \frac{\text{Al}_2\text{O}_3}{6} = \frac{\text{Al}}{3}$$

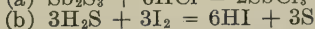
Antimony



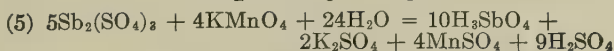
$$\text{I} = \frac{\text{Sb}}{2} = \frac{\text{Sb}_2\text{O}_5}{4}$$



$$\text{I} = \frac{\text{Sb}_2\text{O}_3}{4} = \frac{\text{Sb}}{2}$$



$$\text{I} = \frac{\text{H}_2\text{S}}{2} = \frac{\text{Sb}_2\text{S}_3}{6} = \frac{\text{Sb}}{3}$$



$$\frac{4\text{KMnO}_4}{20} = \frac{\text{Sb}_2(\text{SO}_4)_3}{4} = \frac{\text{Sb}_2\text{O}_3}{4} = \frac{\text{Sb}}{2}$$

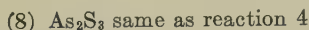
Arsenic



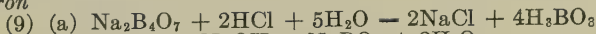
$$\text{I} = \frac{\text{As}_2\text{O}_3}{4} = \frac{\text{As}}{2}$$



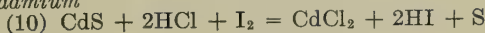
$$\text{I} = \frac{\text{AsCl}_3}{2} = \frac{\text{As}}{2}$$



Boron

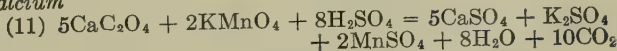


Cadmium

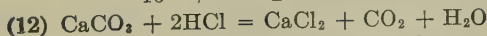


$$\text{I} = \frac{\text{CdS}}{2} = \frac{\text{Cd}}{2} = \frac{\text{S}}{2}$$

Calcium



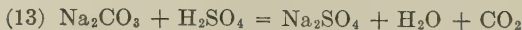
$$\frac{2\text{KMnO}_4}{10} = \frac{\text{CaC}_2\text{O}_4}{2} = \frac{\text{CaCO}_3}{2} = \frac{\text{CaO}}{2}$$



$$\text{HCl} = \frac{\text{CaCO}_3}{2} = \frac{\text{CaO}}{2}$$

VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)

Carbon



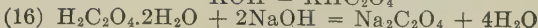
$$\frac{\text{H}_2\text{SO}_4}{2} = \frac{\text{Na}_2\text{CO}_3}{2}$$



$$\frac{\text{H}_2\text{SO}_4}{2} = \frac{\text{NaHCO}_3}{1}$$



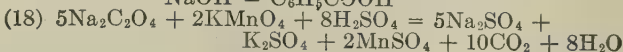
$$\text{KOH} = \text{KHC}_2\text{O}_4$$



$$\text{NaOH} = \frac{\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}}{2}$$

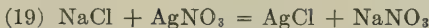


$$\text{NaOH} = \text{C}_6\text{H}_5\text{COOH}$$

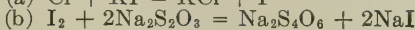
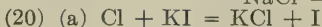


$$\frac{2\text{KMnO}_4}{10} = \frac{\text{Na}_2\text{C}_2\text{O}_4}{2}$$

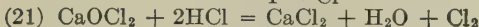
Chlorine



$$\text{NaCl} = \text{Cl}$$



$$\text{I} = \text{Cl}$$

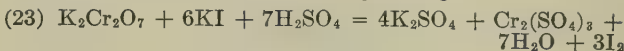


$$\text{I} = \text{Cl} = \frac{\text{CaOCl}_2}{2}$$

Chromium



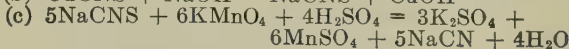
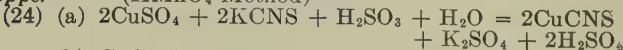
$$\text{Fe} = \frac{\text{K}_2\text{Cr}_2\text{O}_7}{6} = \frac{\text{Cr}_2\text{O}_3}{6} = \frac{\text{Cr}}{3}$$



$$\text{I} = \frac{\text{K}_2\text{Cr}_2\text{O}_7}{6} = \frac{\text{Cr}_2\text{O}_3}{6} = \frac{\text{Cr}}{3}$$

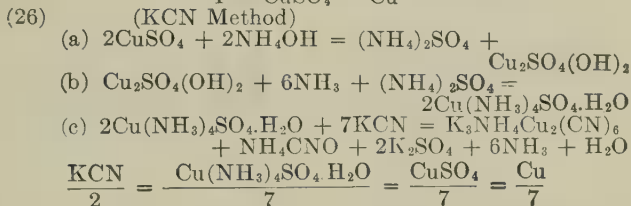
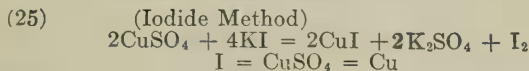
Copper

(KMnO₄ Method)

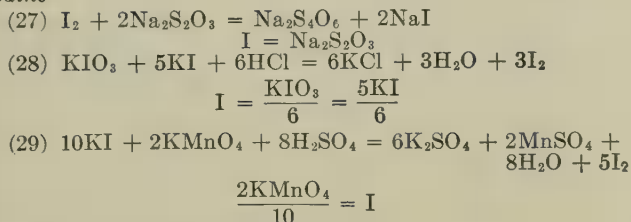


$$\frac{6\text{KMnO}_4}{30} = \frac{\text{NaCNS}}{6} = \frac{\text{CuSO}_4}{6} = \frac{\text{Cu}}{6}$$

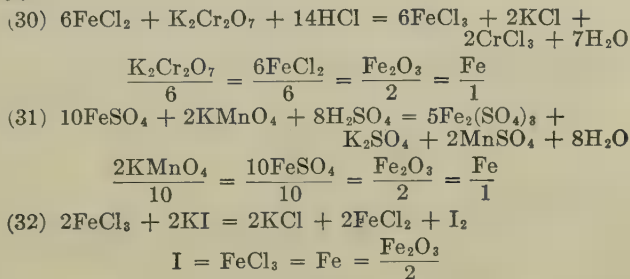
VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)



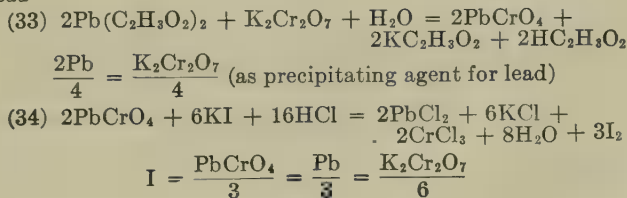
Iodine



Iron

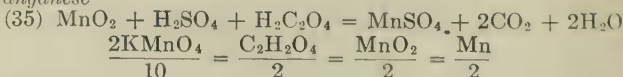


Lead

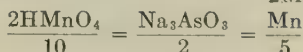
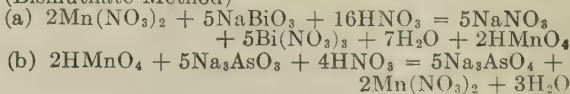


VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)

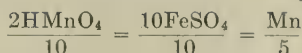
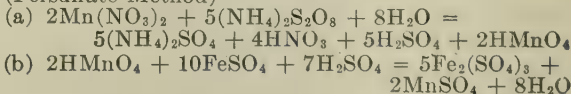
Manganese



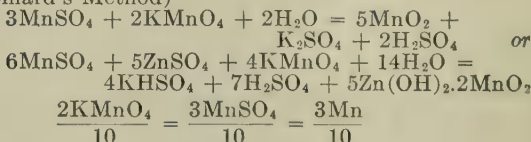
(36) (Bismuthate Method)



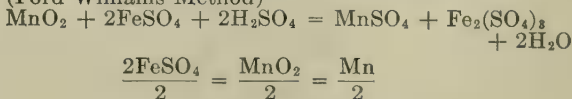
(37) (Persulfate Method)



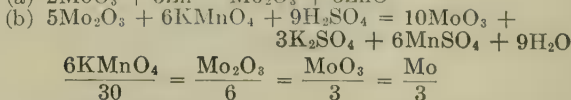
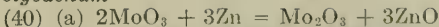
(38) (Volhard's Method)



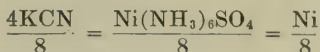
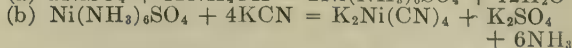
(39) (Ford Williams Method)



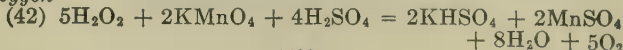
Molybdenum



Nickel (KCN Method)



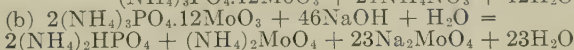
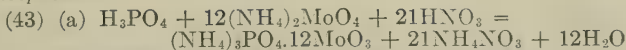
Oxygen



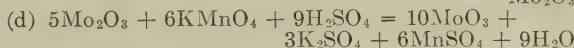
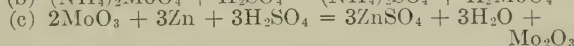
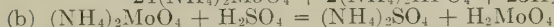
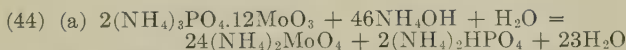
VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)

$$\frac{2\text{KMnO}_4}{10} = \frac{\text{H}_2\text{O}_2}{2}$$

Phosphorus

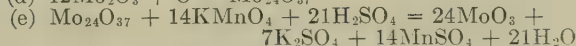
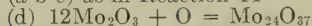
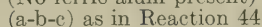
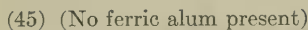


$$\frac{\text{NaOH}}{1} = \frac{2(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3}{46} = \frac{\text{P}_2\text{O}_5}{46} = \frac{\text{P}}{23}$$



$$\frac{6\text{KMnO}_4}{30} = \frac{\text{Mo}_2\text{O}_3}{6} = \frac{(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3}{36} =$$

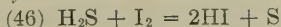
$$\frac{\text{P}}{36} = \frac{\text{P}_2\text{O}_5}{72}$$



$$\frac{14\text{KMnO}_4}{70} = \frac{\text{Mo}_{24}\text{O}_{37}}{70} = \frac{(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3}{35} =$$

$$\frac{\text{P}}{35} = \frac{\text{P}_2\text{O}_5}{70}$$

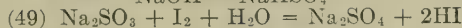
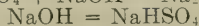
Sulfur



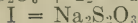
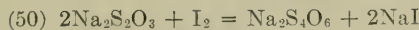
$$\text{I} = \frac{\text{H}_2\text{S}}{2} = \frac{\text{S}}{2}$$



$$\text{NaOH} = \frac{\text{Na}_2\text{SO}_4}{2}$$



$$\text{I} = \frac{\text{Na}_2\text{SO}_3}{2} = \frac{\text{SO}_2}{2} = \frac{\text{S}}{2}$$



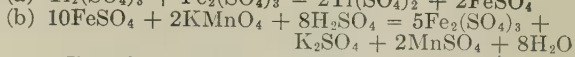
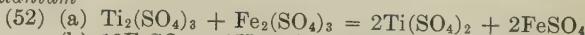
**VOLUMETRIC QUANTITATIVE REACTIONS WITH
GRAM EQUIVALENTS (Continued)**

Tin



$$\text{I} = \frac{\text{SnCl}_2}{2} = \frac{\text{Sn}}{2}$$

Titanium



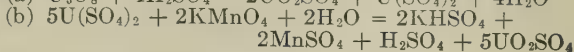
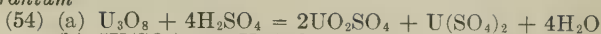
$$\frac{2\text{KMnO}_4}{10} = \frac{\text{FeSO}_4}{1} = \frac{\text{Ti}_2(\text{SO}_4)_3}{2} = \frac{\text{Ti}}{1}$$

Tungsten

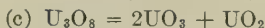


$$\frac{\text{NaOH}}{1} = \frac{\text{WO}_3}{2} = \frac{\text{W}}{2}$$

Uranium

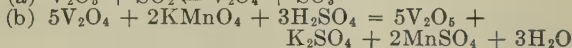
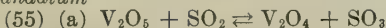


$$\frac{2\text{KMnO}_4}{10} = \frac{\text{U}(\text{SO}_4)_2}{2} = \frac{\text{UO}_2}{2} = \frac{\text{U}}{2}$$

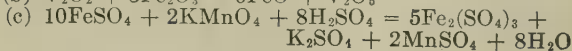
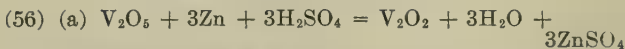


$$\frac{2\text{KMnO}_4}{10} = \frac{\text{U}_3\text{O}_8}{2} = \frac{3\text{U}}{2}$$

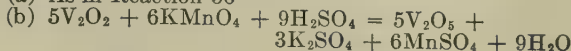
Vanadium



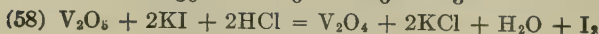
$$\frac{2\text{KMnO}_4}{10} = \frac{\text{V}_2\text{O}_4}{2} = \frac{\text{V}_2\text{O}_5}{2} = \frac{\text{V}}{1}$$



$$\frac{2\text{KMnO}_4}{10} = \frac{\text{FeSO}_4}{1} = \frac{\text{V}_2\text{O}_5}{6} = \frac{\text{V}}{3}$$



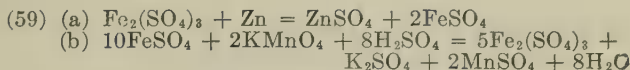
$$\frac{6\text{KMnO}_4}{30} = \frac{\text{V}_2\text{O}_5}{6} = \frac{\text{V}_2\text{O}_2}{6} = \frac{\text{V}}{3}$$



$$\text{I} = \frac{\text{V}_2\text{O}_5}{2} = \frac{\text{V}}{1}$$

VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)

Zinc



$$\frac{2\text{KMnO}_4}{10} = \frac{\text{FeSO}_4}{1} = \frac{\text{Zn}}{2}$$



$$\frac{\text{K}_4\text{Fe}(\text{CN})_6}{3} = \frac{3\text{ZnCl}_2}{6} = \frac{\text{Zn}}{2}$$

EFFICIENCY OF DRYING AGENTS

Compiled by John H. Yoe

A. Drying agents depending upon chemical action (absorption) for their efficiency:*

Substance	Weights of residual water vapor in dried air— mg per liter	Authority
P ₂ O ₅	Much less than 1 mg in 40,000 liters	Morley
Mg(ClO ₄) ₂ anh.....	Unweighable in 210 liters	Willard and Smith
Mg(ClO ₄) ₂ .3H ₂ O.....	Unweighable in 57 liters	Willard and Smith
BaO.....	.....	Booth and McIntire
CaSO ₄ .½H ₂ O.....	.....	Smith
KOH (fused).....	0.002	Baxter and Starkweather
H ₂ SO ₄	0.003	Baxter and Starkweather
MgO.....	0.008	Dover and Marden
NaOH (fused).....	0.16	Baxter and Starkweather
CaBr ₂	0.2	Baxter and Warren
CaO.....	0.2	Dover and Marden
B ₂ O ₃.....	.....	Walton and Rosenbaum
Ba(ClO ₄) ₂ anh.....	.....	Smith
CaCl ₂ (granular).....	0.14 to 0.25	McPherson
CaCl ₂ (fused).....	0.36	Baxter and Starkweather
ZnCl ₂	0.8	Baxter and Warren
ZnBr ₂	1.1	Baxter and Warren
CuSO ₄ anh.....	1.4	Dover and Marden

B. Drying agents depending upon physical action (adsorption) for their efficiency:—Alumina (low temperature fired), asbestos, charcoal, clay and porcelain (low temperature fired), glass wool, kieselguhr, silica gel, refrigeration.

* It should be noted that the efficiency of some drying agents (*e. g.* Al₂O₃, xH₂O and anhydrous CaCl₂, and probably also BaO, anhydrous Mg(ClO₄)₂, Mg(ClO₄)₂.3H₂O, anhydrous Ba(ClO₄)₂, and CaSO₄.½H₂O) depends upon both adsorption and absorption.

A METHOD OF BALANCING EQUATIONS FOR OXIDATION-REDUCTION REACTIONS

On the left-hand side of the equation write the formulae for all the compounds entering into the reaction. On the right-hand side write the formulae for all the compounds formed in the reaction.

Determine the L. C. M. (least common multiple) of the numbers representing the changes in valence per molecule of the oxidizing and reducing agents.

The quotient obtained in dividing the L. C. M. by the number representing the valence change per molecule is the number of molecules of that compound required, or formed.

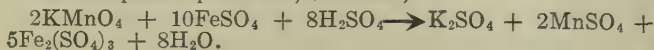
The reaction between FeSO_4 , KMnO_4 , and H_2SO_4 serves to illustrate. Following the rule as given above we write, $\text{KMnO}_4 + \text{FeSO}_4 + \text{H}_2\text{SO}_4 \longrightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$.

The valence change of manganese is five, that of iron is two per molecule of $\text{Fe}_2(\text{SO}_4)_3$. The L. C. M. of these two numbers is ten.

The quotient obtained by dividing the L. C. M. by the valence change of manganese is two. Therefore two molecules of KMnO_4 are required. The quotient obtained by dividing the L. C. M. by the valence change of iron per molecule of $\text{Fe}_2(\text{SO}_4)_3$ is five. Five molecules of $\text{Fe}_2(\text{SO}_4)_3$ are formed. Ten molecules of FeSO_4 are needed. From the two molecules of KMnO_4 used one molecule of K_2SO_4 is formed, as well as two molecules of MnSO_4 .

Eighteen sulfate radicals are used in forming the salts; ten of these radicals are supplied by the FeSO_4 used, the other eight must be supplied by the free acid. The sixteen hydrogens form eight molecules of water.

The complete equation is, therefore,



SOLUBILITY CHART

SOLUBILITY

Abbreviations: W, soluble in water; A, insoluble in water but soluble in acids; w, sparingly
I, insoluble in both water and acids; d, decomposes in water. * Certain salts occur in two

No.		Al	NH ₄	Sb	Ba	Bi	Cd	Ca
1	Acetates —(C ₂ H ₃ O ₂)	W Al(—) ₃	W NH ₄(—)	.....	W Ba(—) ₂	W Bi(—) ₃	W Cd(—) ₂	W Ca(—) ₂
2	Arsenate —(AsO ₄)	a Al(—)	W (NH ₄) ₃ (—)	A Sb(—)	w Ba ₃ (—) ₂	A Bi(—)	A Cd ₃ (—) ₂	w Ca ₃ (—) ₂
3	Arsenite —(AsO ₃)	.....	W NH ₄ AsO ₂	A Sb(—)	.....	.....	.....	w Ca ₃ (—) ₂
4	Benzoate —(C ₇ H ₅ O ₂)	.....	W NH ₄(—)	.....	W Ba(—) ₂	A Bi(—) ₃	W Cd(—) ₂	W Ca(—) ₂
5	Bromide	W AlBr ₃	W NH ₄ Br	d SbBr ₃	W BaBr ₂	d BiBr ₃	W CdBr ₂	W CaBr ₂
6	Carbonate	.....	W (NH ₄) ₂ CO ₃	.....	w BaCO ₃	.....	A CdCO ₃	w CaCO ₃
7	Chlorate —(ClO ₃)	W Al(—) ₃	W NH ₄(—)	.....	W Ba(—) ₂	W Bi(—) ₃	W Cd(—) ₂	W Ca(—) ₂
8	Chloride	W AlCl ₃	W NH ₄ Cl	W SbCl ₃	W BaCl ₂	d BiCl ₃	W CdCl ₂	W CaCl ₂
9	Chromate —(CrO ₄)	.....	W (NH ₄) ₂(—)	.....	A Ba(—)	.....	A Cd(—)	W Ca(—)
10	Citrate —(C ₆ H ₅ O ₇)	W Al(—)	W (NH ₄) ₃(—)	.....	w Ba ₃ (—) ₂	A Bi(—)	A Cd ₃ (—) ₂	w Ca ₃ (—) ₂
11	Cyanide	.....	W NH ₄ CN	.....	W Ba(CN) ₂	w Bi(CN) ₃	W Cd(CN) ₂	W Ca(CN) ₂
12	Ferricy'de —(Fe(CN) ₆)	.....	W (NH ₄) ₃(—)	.....	w Ba ₃ (—) ₂	.....	A Cd ₃ (—) ₂	W Ca ₃ (—) ₂
13	Ferroc'y'de —(Fe(CN) ₆)	w Al ₄ (—) ₃	W (NH ₄) ₄(—)	.....	W Ba ₂(—)	.....	A Cd ₂ (—)	W Ca ₂ (—)
14	Fluoride	W AlF ₃	W NH ₄ F	W SbF ₃	w BaF ₂	W BiF ₃	W CdF ₂	w CaF ₂
15	Formate —(CHO ₂)	W Al(—) ₃	W NH ₄(—)	.....	W Ba(—) ₂	W Bi(—) ₃	W Cd(—) ₂	W Ca(—) ₂
16	Hydroxide	A Al(OH) ₃	W NH ₄ OH	.....	W Ba(OH) ₂	A Bi(OH) ₃	A Cd(OH) ₂	W Ca(OH) ₂
17	Iodide	W AlI ₃	W NH ₄ I	d SbI ₃	W BaI ₂	A BiI ₃	W CdI ₂	W CaI ₂
18	Nitrate	W Al(NO ₃) ₃	W NH ₄ NO ₃	.....	W Ba(NO ₃) ₂	d Bi(NO ₃) ₃	W Cd(NO ₃) ₂	W Ca(NO ₃) ₂
19	Oxalate —(C ₂ O ₄)	A Al ₂ (—) ₃	W (NH ₄) ₂(—)	.....	w Ba(—)	A Bi ₂ (—) ₃	w Cd(—)	A Ca(—)
20	Oxide	■ Al ₂ O ₃	.....	w Sb ₂ O ₃	W BaO	A Bi ₂ O ₃	A CdO	w CaO
21	Phosphate	A AlPO ₄	W NH ₄ H ₂ PO ₄	.....	A Ba ₃ (PO ₄) ₂	A BiPO ₄	A Cd ₃ (PO ₄) ₂	w Ca ₃ (PO ₄) ₂
22	Silicate, —(SiO ₃)	I Al ₂ (—) ₃	.....	.....	W Ba(—)	.....	A Cd(—)	w Ca(—)
23	Sulfate	W Al ₂ (SO ₄) ₃	W (NH ₄) ₂ SO ₄	A Sb ₂ (SO ₄) ₃	a BaSO ₄	d Bi ₂ (SO ₄) ₃	W CdSO ₄	w CaSO ₄
24	Sulfide	■ Al ₂ S ₃	W (NH ₄) ₂ S	A Sb ₂ S ₃	d BaS	A Bi ₂ S ₃	A CdS	w CaS
25	Tartrate —(C ₄ H ₄ O ₆)	w Al ₂ (—) ₃	W (NH ₄) ₂ (—)	W Sb ₂ (—) ₃	w Ba(—)	A Bi ₂ (—) ₃	A Cd(—)	w Ca(—)
26	Thiocy'te	.....	W NH ₄ CNS	.....	W Ba(CNS) ₂	.....	.....	W Ca(CNS) ₂

CHART

soluble in water but soluble in acids; a, insoluble in water and only sparingly soluble in acids; modifications.

No.	Cr	Co	Cu	Au'	Au'''	H	Fe''	Fe'''
1	W Cr(-) ₃	W Co(-) ₂	W Cu(-) ₂	.....	.....	W C ₂ H ₄ O ₂	W Fe(-) ₂	W Fe ₂ (-) ₆
2	.....	A Co ₃ (-) ₂	A Cu ₃ (-) ₂	.....	.....	W H ₃ AsO ₄	A Fe ₃ (-) ₂	A Fe(-)
3	.....	A Co ₃ H ₆ (-) ₄	A CuH(-)	.....	.....	.....	.....	.....
4	.....	W Co(-) ₂	w Cu(-) ₂	.....	.....	W C ₇ H ₆ O ₂	W Fe(-) ₂	A Fe ₂ (-) ₆
5	W(I)* CrBr ₃	W CoBr ₂	W CuBr ₂	w AuBr	W AuBr ₃	W HBr	W FeBr ₂	W FeBr ₃
6	W CrCO ₃	A CoCO ₃	.....	.....	.....	.....	w FeCO ₃	.....
7	.....	W Co(-) ₂	W Cu(-) ₂	.....	.....	W HClO ₃	W Fe(-) ₂	W Fe(-) ₃
8	I CrCl ₃	W CoCl ₂	W CuCl ₂	w AuCl	W AuCl ₃	W HCl	W FeCl ₂	W FeCl ₃
9	.....	A Co(-)	.....	.....	.....	.....	.....	A Fe ₂ (-) ₃
10	.....	w Co ₃ (-) ₂	.....	.....	.....	W C ₆ H ₈ O ₇	.....	W Fe(-)
11	A Cr(CN) ₂	A Co(CN) ₂	A Cu(CN) ₂	w AuCN	W Au(CN) ₃	W HCN	a Fe(CN) ₂	.....
12	.....	I Co ₃ (-) ₂	I Cu ₃ (-) ₂	.....	.....	W H ₃ (-)	I Fe ₃ (-) ₂	.....
13	.....	I Co ₂ (-)	I Cu ₂(-)	.....	.....	W H ₄ (-)	I Fe ₂ (-)	a Fe ₄ (-) ₃
14	W(a)* CrF ₃	W CoF ₂	w CuF ₂	.....	.....	W HF	w FeF ₂	w FeF ₃
15	.....	W Co(-) ₂	W Cu(-) ₂	.....	.....	W CH ₂ O ₂	W Fe(-) ₂	W Fe(-) ₃
16	A Cr(OH) ₃	A Co(OH) ₂	W Cu(OH) ₂	W AuOH	A Au(OH) ₃	.....	W Fe(OH) ₂	W Fe(OH) ₃
17	W CrI ₂	W CoI ₂	I CuI	a AuI	a AuI ₃	W HI	W FeI ₂	W FeI ₃
18	W Cr(NO ₃) ₃	W Co(NO ₃) ₂	W Cu(NO ₃) ₂	.....	.....	W HNO ₃	W Fe(NO ₃) ₂	W Fe(NO ₃) ₃
19	W Cr(-)	A Co(-)	A Cu(-)	.....	.....	W C ₂ H ₂ O ₄	A Fe(-)	W Fe ₂ (-) ₄
20	I Cr ₂ O ₃	A CoO	A CuO	A Au ₂ O	A Au ₂ O ₃	W H ₂ O ₂	A FeO	A Fe ₂ O ₃
21	w Cr ₂ (PO ₄) ₂	A Co ₃ (PO ₄) ₂	A Cu ₃ (PO ₄) ₂	.....	.....	W H ₃ PO ₄	A Fe ₃ (PO ₄) ₂	w FePO ₄
22	.....	A Co ₂ SiO ₄	A Cu(-)	.....	.....	I H ₂ SiO ₃	.....	.....
23	W(I)* Cr ₂ (SO ₄) ₃	W CoSO ₄	W CuSO ₄	.....	.....	W H ₂ SO ₄	W FeSO ₄	w Fe ₂ (SO ₄) ₃
24	d Cr ₂ S ₃	A CoS	A CuS	I Au ₂ S	I Au ₂ S ₃	W H ₂ S	A FeS	d Fe ₂ S ₃
25	.....	w Co(-)	w Cu(-)	.....	.....	W C ₄ H ₆ O ₆	w Fe(-)	W Fe ₂ (-) ₃
26	.....	W Co(CNS) ₂	d CuCNS	.....	.....	W CNSH	W Fe(CNS) ₂	W Fe(CNS) ₃

SOLUBILITY

No.		Pb	Mg	Mn	Hg'	Hg''	Ni	K
1	Acetate —(C ₂ H ₃ O ₂)	W Pb(—) ₂	W Mg(—) ₂	W Mn(—) ₂	w Hg(—)	W Hg(—) ₂	W Ni(—) ₂	W K(—)
2	Arsenate —(AsO ₄)	A PbH(—)	A Mg ₃ (—)	w MnH(—)	w Hg ₃ (—)	w Hg ₃ (—) ₂	A Ni ₃ (—) ₂	W K ₃ (—)
3	Arsenite —(AsO ₃)	.....	W Mg ₃ (—) ₂	A Mn ₃ H ₆ (—) ₄	A Hg ₃ (—)	A Hg ₃ (—)	A Ni ₃ H ₆ (—) ₄	W K ₃ AsO ₃
4	Benzoate —(C ₇ H ₅ O ₂)	w Pb(—) ₂	W Mg(—) ₂	W Mn(—) ₂	w Hg ₂ (—) ₂	w Hg(—) ₂	w Ni(—) ₂	W K(—)
5	Bromide	W PbBr ₂	W MgBr ₂	W MnBr ₂	A HgBr	W HgBr ₂	W NiBr ₂	W KBr
6	Carbonate	A PbCO ₃	w MgCO ₃	w MnCO ₃	A Hg ₂ CO ₃	.....	w NiCO ₃	W K ₂ CO ₃
7	Chlorate —(ClO ₃)	W Pb(—) ₂	W Mg(—) ₂	W Mn(—) ₂	W Hg(—)	W Hg(—) ₂	W Ni(—) ₂	W K(—)
8	Chloride	W PbCl ₂	W MgCl ₂	W MnCl ₂	a HgCl	W HgCl ₂	W NiCl ₂	W KCl
9	Chromate —(CrO ₄)	A Pb(—)	W Mg(—)	.....	w Hg ₂ (—)	w Hg(—)	A Ni(—)	W K ₂ (—)
10	Citrate —(C ₆ H ₅ O ₇)	W Pb ₃ (—) ₂	W Mg ₃ (—) ₂	w MnH(—)	w Hg ₃(—)	.....	W Ni ₃ (—) ₂	W K ₃ (—)
11	Cyanide	w Pb(CN) ₂	W Mg(CN) ₂	.....	A HgCN	W Hg(CN) ₂	a Ni(CN) ₂	W KCN
12	Ferricy'de —Fe(CN) ₆	w Pb ₃ (—) ₂	W Mg ₃ (—) ₂	.....	.....	A Hg ₃ (—) ₂	I Ni ₃ (—) ₂	W K ₃ (—)
13	Ferroc'y'de —Fe(CN) ₆	a Pb ₂ (—)	W Mg ₂ (—)	A Mn ₂(—)	.....	I Hg ₂ (—)	I Ni ₂ (—)	W K ₄ (—)
14	Fluoride	w PbF ₂	w MgF ₂	A MnF ₂	d HgF	d HgF ₂	w NiF ₂	W KF
15	Formate —(CHO ₂)	W Pb(—) ₂	W Mg(—) ₂	W Mn(—) ₂	w Hg(—)	W Hg(—) ₂	W Ni(—) ₂	W K(—)
16	Hydroxide	w Pb(OH) ₂	A Mg(OH) ₂	A Mn(OH) ₂	.....	A Hg(OH) ₂	w Ni(OH) ₂	W KOH
17	Iodide	w PbI ₂	W MgI ₂	W MnI ₂	A HgI	w HgI ₂	W NiI ₂	W KI
18	Nitrate	W Pb(NO ₃) ₂	W Mg(NO ₃) ₂	W Mn(NO ₃) ₂	W HgNO ₃	W Hg(NO ₃) ₂	W Ni(NO ₃) ₂	W KNO ₃
19	Oxalate —(C ₂ O ₄)	A Pb(—)	w Mg(—)	w Mn(—)	a Hg ₂ (—)	A Hg(—)	A Ni(—)	W K ₂ (—)
20	Oxide	w PbO	A MgO	A MnO	A Hg ₂ O	w HgO	A NiO	W K ₂ O
21	Phosphate	A Pb ₃ (PO ₄) ₂	w Mg ₃ (PO ₄) ₂	w Mn ₃ (PO ₄) ₂	A Hg ₃ PO ₄	A Hg ₃ (PO ₄) ₂	A Ni ₃ (PO ₄) ₂	W K ₃ PO ₄
22	Silicate —(SiO ₃)	A Pb(—)	A Mg(—)	I Mn(—)	.....	.....	.....	W K ₂ (—)
23	Sulfate	w PbSO ₄	W MgSO ₄	W MnSO ₄	w Hg ₂ SO ₄	d HgSO ₄	W NiSO ₄	W K ₂ SO ₄
24	Sulfide	A PbS	d MgS	A MnS	I Hg ₂ S	I HgS	A NiS	W K ₂ S
25	Tartrate —(C ₄ H ₄ O ₆)	A Pb(—)	w Mg(—)	w Mn(—)	I Hg ₂(—)	.....	A Ni(—)	W K ₂ (—)
26	Thiocy'te	w Pb(CNS) ₂	W Mg(CNS) ₂	W Mn(CNS) ₂	A HgCNS	w Hg(CNS) ₂	.....	W KCNS

CHART (Continued)

No.	Ag	Na	Sn'''	Sn''	Sr	Zn	Pt
1	w Ag(-)	W Na(-)	W Sn(-) ₄	d Sn(-) ₂	W Sr(-) ₂	W Zn(-) ₂	.....
2	A Ag ₃ (-)	W Na ₃(-)	.....	.....	w SrH(-)	A Zn ₃ (-) ₂	.....
3	A Ag ₃ (-)	W Na ₂ H(-)	.....	A Sn ₃ (-) ₂	w Sr ₃ (-) ₂	.....	.....
4	w Ag(-)	W Na(-)	.....	.....	.....	W Zn(-) ₂	.....
5	■ AgBr	W NaBr	W SnBr ₄	W SnBr ₂	W SrBr ₂	W ZnBr ₂	w PtBr ₄
6	A Ag ₂ CO ₃	W Na ₂ CO ₃	.....	.....	w SrCO ₃	w ZnCO ₃	.....
7	W Ag(-)	W Na(-)	.....	W Sn(-) ₂	W Sr(-) ₂	W Zn(-) ₂	.....
8	■ AgCl	W NaCl	W SnCl ₄	W SnCl ₂	W SrCl ₂	W ZnCl ₂	W PtCl ₄
9	w Ag ₂ (-)	W Na ₂ (-)	W Sn(-) ₂	A Sn(-)	w Sr(-)	w Zn(-)	.....
10	w Ag ₃ (-)	W Na ₃(-)	.....	.....	A SrH(-)	w Zn ₃ (-) ₂	.....
11	a AgCN	W NaCN	.....	.....	W Sr(CN) ₂	A Zn(CN) ₂	I Pt(CN) ₂
12	I Ag ₃ (-)	W Na ₃(-)	.....	A Sn ₃ (-) ₂	W Sr ₃ (-) ₂	A Zn ₃ (-) ₂	.....
13	I Ag ₄ (-)	W Na ₄(-)	.....	a Sn ₂ (-)	W Sr ₂ (-)	I Zn ₂(-)	.....
14	W AgF	W NaF	W SnF ₄	W SnF ₂	w SrF ₂	w ZnF ₂	W PtF ₄
15	W Ag(-)	W Na(-)	.....	.....	W Sr(-) ₂	W Zn(-) ₂	.....
16	.....	W NaOH	w Sn(OH) ₄	A Sn(OH) ₂	W Sr(OH) ₂	A Zn(OH) ₂	A Pt(OH) ₄
17	I AgI	W NaI	d SnI ₄	W SnI ₂	W SrI ₂	W ZnI ₂	I PtI ₂
18	W AgNO ₃	W NaNO ₃	.....	d Sn(NO ₃) ₂	W Sr(NO ₃) ₂	W Zn(NO ₃) ₂	W Pt(NO ₃) ₄
19	■ Ag ₂ (-)	W Na ₂(-)	.....	A Sn(-)	w Sr(-)	A Zn(-)	.....
20	w Ag ₂ O	d Na ₂ O	A SnO ₂	A SnO	W SrO	w ZnO	A PtO
21	A Ag ₃ PO ₄	W Na ₃ PO ₄	.....	A Sn ₃ (PO ₄) ₂	A Sr ₃ (PO ₄) ₂	A Zn ₃ (PO ₄) ₂	.....
22	.....	W Na ₂(-)	.....	.....	A Sr(-)	A Zn(-)	.....
23	w Ag ₂ SO ₄	W Na ₂ SO ₄	W Sn(SO ₄) ₂	W SnSO ₄	w SrSO ₄	W ZnSO ₄	W Pt(SO ₄) ₂
24	A Ag ₂ S	W Na ₂ S	A SnS ₂	A SnS	W SrS	A ZnS	I PtS
25	w Ag ₂ (-)	W Na ₂(-)	.....	W Sn(-)	w Sr(-)	w Zn(-)	.....
26	I AgCNS	W NaCNS	.....	.....	W Sr(CNS) ₂	W Zn(CNS) ₂	.....

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER

The table shows the number of grains of the anhydrous substance indicated in the first column which can be dissolved in 100 grams of water at the temperature in degrees Centigrade given at the top. When the formula is preceded by a * the solubility is stated in grams of anhydrous substance in 100 grams of saturated solution; when preceded by ** the solubility is stated in grams of anhydrous substance in 100 c.c. of the saturated solution. The column headed with S. P. shows the solid phase hydrated form in equilibrium with the saturated solution.

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
Ag ₂ AsO ₃	1.15×10^{-3}	.....	.....	.....	.....	.....	.....	.....	.....
Ag ₂ AsO ₄	8.5×10^{-4}	.....	.....	.....	.....	.....	.....	.....	.....
AgBr	0.72	0.88	1.04	1.21	1.41	1.64	1.89	2.18	2.52	.....	2.1×10^{-2}
Ag ₂ CO ₃	8.9×10^{-6}	1.5×10^{-4}	.....	.....	5.23×10^{-4}	.....	.....	.....	.....	5×10^{-2}
AgCl	2.2×10^{-6}	.....	.....	.....	.....	.....	.....	.....	.....
Ag ₂ CrO ₄	3.2×10^{-3}	.....	.....	.....	.....	.....	.....	.....	.....
Ag ₂ CrO ₃	3.6×10^{-3}	.....	5.3×10^{-3}	.....	8×10^{-3}	.....	.....	.....
Ag ₂ CrO ₄	6.6×10^{-6}	.....	.....	.....	.....	.....	.....	.....	.....
Ag ₂ Fe(CN) ₆	3×10^{-7}	.....	.....	.....	.....	.....	.....	.....
AgI	3×10^{-3}	4×10^{-3}	.....	.....	.....	3×10^{-6}	.....	.....	.....	.....
AgIO ₃	2.20×10^{-1}	3.40×10^{-1}	.....	.....	0.95×10^{-1}	1.9×10^{-2}	.....	.....	.....	.....
AgNO ₃	1.22	170	222	300	376	455	13.63×10^{-1}	.....	669	.....	952
Ag ₂ S
*Ag ₂ SO ₄	5.7×10^{-1}	6.9×10^{-1}	7.9×10^{-1}	8.8×10^{-1}	9.7×10^{-1}	10.7×10^{-1}	11.4×10^{-1}	12.1×10^{-1}	12.8×10^{-1}	13.4×10^{-1}	13.9×10^{-1}
*AlCl ₃	41.13^{100}	.....	.....	.....	.....	.....	.....	.....	.....	.....
*Al ₂ (SO ₄) ₃	23.8	25.1	26.7	28.8	31.4	34.3	37.2	39.8	42.2	44.7	47.1
*As ₂ O ₃	37.3	38.3	39.7	41	41.6	.....	42.2	.....	42.9	.....	43.4
As ₂ S ₃	5.17×10^{-6}	at 18°	.....	.....	.....	.....	.....	.....	.....
BaCO ₃	1	1.5	2.2	.....	4.0	.....	6.2	.....	9.5	.....	15.7
BaBr ₂	98	101	104	100	114	118	123	128	135	.....	149
*Ba(BrO ₃) ₂	2.83×10^{-1}	4.39×10^{-1}	6.52×10^{-1}	9.5×10^{-1}	13.1×10^{-1}	17.2×10^{-1}	22.7×10^{-1}	29.22×10^{-1}	35.21×10^{-1}	42.6×10^{-1}	54×10^{-1}
Ba(C ₂ H ₃ O ₂) ₂	59	63	71	.....	.....	.....	.....	.....	.....	.....	.....
Ba(C ₂ H ₅ O ₂) ₂	75	79	77	74	74	.....	.....	75
BaCl ₂	31.6	33.3	35.7	38.2	40.7	43.6	46.4	49.4	52.4	.....	58.8
*Ba(ClO ₃) ₂	16.90	21.23	25.26	29.43	33.16	.....	40.05	.....	45.90	.....	51.2

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
•Ba(ClO ₄) ₂	67.3	at 8°; 2.2×10 ⁻³	74.3	2.4×10 ⁻³ at 18°; 10 ⁻³ at 18°; 2.4×10 ⁻³ at 24.2°	78.2	.....	81	.....	83.2	.....	84.9
BaCO ₃	1.6×10 ⁻³	8.2×10 ⁻³	.....	17×10 ⁻³	.....	.....	.....	.....	.....	.....	.....
•BaC ₂ O ₄	5.8×10 ⁻³	2.8×10 ⁻⁴	3.7×10 ⁻⁴	4.6×10 ⁻⁴	.....	.....	.....	.....	.....	.....	.....
BaCrO ₄	2×10 ⁻⁴	185.7	203.1	219.6	.....	.....	.....	.....	.....	.....	.....
BaI ₂	170.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ba ₂
•Ba ₂ (IO ₃) ₂	8×10 ⁻³	1.4×10 ⁻²	2.2×10 ⁻²	3.1×10 ⁻²	231.9	5.6×10 ⁻²	247.3	9.3×10 ⁻²	261.0	.....	271.7
BaMoO ₄	5.8×10 ⁻³	at 23°	.....	4.1×10 ⁻²	.....	7.4×10 ⁻²	.....	11.5×10 ⁻²	14.1×10 ⁻²	19.7×10 ⁻²
•Ba(NO ₂) ₂	40.3	.....	.....	.....	.....	.....	67.3	.....	75
Ba(NO ₃) ₂	7.0	9.2	11.6	14.2	17.1	20.3	.....	27.0	.....	34.2
Ba(OH) ₂	2.48	3.80	5.59	8.22	13.12	20.94	.....	101.40	.....	.....
BaSO ₄	1.67	2.0×10 ⁻⁴	2.4×10 ⁻⁴	2.85×10 ⁻⁴	.....	.....	.....	.....	.....	.....	.....
BeKF ₃	1.15×10 ⁻⁴	.....	2.0	.....	.....	.....	.....	.....	.....	.....	.....
BeNaF ₃	1.4	.....	.....	.....	.....	.....	.....	.....	.....
BeSO ₄	52	.....	60.67	.....	.....	.....	.....	.....
4H ₂ O	43.78	46.74	.....	.....	62	84.76	83	100
BeSO ₄	98	110
2H ₂ O
Br ₂	4.22	3.4	3.20	3.13	.....	.....	.....	.....	.....	.....	.....
Bi ₂ S ₃	1.8×10 ⁻⁵	at 18°	.....	.....	.....	.....	.....	.....	.....	.....
CaBr ₂	125	132	143	.....	.....	.....	.....	.....	.....	.....	.....
6H ₂ O	68.1	.....	73.5	.....	74.7	.....	.....
4H ₂ O	33.2	.....	32.7	.....	33.5	.....	.....
Ca(C ₂ H ₃ O ₂) ₂	37.4	36.0	34.7	33.8	.....	.....	.....	.....	.....	.....	.....
2H ₂ O
Ca(C ₂ H ₃ O ₂) ₂
H ₂ O
CaCl ₂	59.5	65.0	74.5	102	.....	.....	.....	.....	.....	31.1	29.7
6H ₂ O
2H ₂ O
CaC ₂ O ₄	6.7×10 ⁻⁴	at 13°; 6.8	×10 ⁻⁴ at 25°; 9.5×10 ⁻⁴ at 50°; 1	.....	.....	4.0×10 ⁻⁴ at 95°	136.8	141.7	147.0	152.7	159
CaF ₂	1.6×10 ⁻³	at 18°; 1.7	×10 ⁻³ at 26°	.....	.....	.....	.....	.....	.....	.....	.....
.....
•Ca(HCO ₃) ₂	16.15	.....	16.60	69	17.05	.....	17.50	.....	17.95	.....	18.40
.....	70.8	.....	74	.....	78	.....	81
•CaI ₂	64.6	66.0	67.6	0.42	0.61	0.89	1.36	.....	.....	.....	.....
•Ca(IO ₃) ₂	0.10	0.17	.....	.....	0.52	0.59	0.65	.....	0.79	.....	0.94
•Ca(IO ₃) ₂

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
*Ca(NO ₂) ₂	4H ₂ O	38.3	.....	43.4	.....	.....	.....	57	60.3	.....	71	.....
*Ca(NO ₂) ₂	2H ₂ O	.....	.....	.....	.....	66.21	.....	.....	.....	.....	.....	.....
*Ca(NO ₃) ₂	4H ₂ O	50.50	53.55	56.39	60.41	70.37	73.79	.....	.....	.....	.....	.....
*Ca(NO ₃) ₂	3H ₂ O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
*Ca(NO ₃) ₂	.....	.....	.....	.....	.....	.....	.....	.....	.....	78.2	.....	78.43
*Ca(OH) ₂	.....	1.85×10 ⁻¹	1.76×10 ⁻¹	1.65×10 ⁻¹	1.53×10 ⁻¹	1.41×10 ⁻¹	1.28×10 ⁻¹	1.16×10 ⁻¹	1.06×10 ⁻¹	9.4×10 ⁻²	8.5×10 ⁻²	7.7×10 ⁻²
CaSO ₄	.....	1.759×10 ⁻¹	1.928×10 ⁻¹	.....	2.09×10 ⁻¹	.....	2.097×10 ⁻¹	2.047×10 ⁻¹	1.974×10 ⁻¹	.....	.....	1.619×10 ⁻¹
*CdBr ₂	.....	37.92	55.58	.....	56.90	60.65	.....	61.10	.....	62.29	.....	.....
*CdCl ₂	4H ₂ O	49.39	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
*CdCl ₂	24H ₂ O	47.37	57.47	57.35	56.91	57.51	.....	57.71	.....	58.41	.....	59.52
*CdCl ₂	H ₂ O	.....	1.715°	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cd(CN) ₂	.....	79.8	83.2	86.2	89.7	93.8	97.4	.....	.....	.....	.....	127.6
CdI ₂	.....	.....	2.6×10 ⁻⁴	at 25°	.....	.....	.....	.....	.....	.....	.....	.....
Cd(OH) ₂	.....	.....	9×10 ⁻⁷	at 18°	.....	.....	.....	.....	.....	.....	.....	.....
CdS	.....	.....	.....	.....	6.36	.....	4.465	3.73	.....	.....	.....	.....
*Ce ₂ (SO ₄) ₃	9H ₂ O	17.35	.....	9.16	.....	.....	.....	3.88	.....	1.19	.....	0.46
*Ce ₂ (SO ₄) ₃	8H ₂ O	15.95	.....	8.69	.....	5.613	.....	3.145	.....	1.0	.....	0.42
*Ce ₂ (SO ₄) ₃	5H ₂ O	.....	.....	.....	.....	.....	3.31	2.3	.....	.....	0.125	0
*Ce ₂ (SO ₄) ₃	4H ₂ O	1.46	0.980	0.716	0.562	5.71	0.386	0.324	0.274	0.219	0.125	0
Cl ₂ 760mm.	.....	4.4×10 ⁻³	3.5×10 ⁻³	2.8×10 ⁻³	2.4×10 ⁻³	2.1×10 ⁻³	1.8×10 ⁻³	1.5×10 ⁻³	1.3×10 ⁻³	1.0×10 ⁻³	6×10 ⁻⁴	0
CO 760mm.	.....	0.3346	0.2318	0.1688	0.1257	0.0973	0.0761	.....	.....	.....	.....	.....
Co ₂ 760mm.	.....	29.5	31.5	33.5	35.5	.....	.....	.....	.....	.....	.....	.....
*CoCl ₂	6H ₂ O	.....	.....	.....	.....	41.0	47.0	47.5	.....	49.5	.....	51.0
*CoCl ₂	H ₂ O	58.0	61.5	65.2	70.0	75.0	79.0	.....	.....	80.0	.....	.....
*Co ₂ (NO ₃) ₂	.....	45.66	.....	50	.....	55.9	.....	.....	.....	.....	77	.....
*Co ₂ (NO ₃) ₂	3H ₂ O	.....	.....	.....	.....	.....	.....	62	64.89	68	.....	.....
CoS	.....	3.79×10 ⁻⁴	at 18°	.....	.....	.....	.....	.....	.....	.....	.....	.....
CoSO ₄	.....	25.55	30.55	36.21	42.26	48.85	55.2	60.4	65.7	70	83	83
*CrO ₃	.....	62.24	.....	.....	.....	63.50	64.55	.....	.....	.....	68.5	67.4
CrCl	.....	161.4	174.7	186.5	197.3	208.0	218.5	229.7	239.5	250.0	260.1	270.5

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
CaClO_3	2.46	3.8	6.2	9.5	13.8	19.4	26.2	34.7	45.0	58.0	79.0
CaClO_4	0.8	1.0	1.6	2.6	4.0	5.4	7.3	9.8	14.4	20.5	30.0
CaF_2	366.6 ^{180°}	.....	.....	.....	.....	.....	.....	.....	.....
CaH_2O	2.6 ^{240°}	.....	.....	.....	.....	.....	.....	.....	.....
CaIO_4	2.15 ^{150°}	.....	.....	.....	.....	.....	.....	.....	.....
CaNO_3	9.33	14.9	23.0	33.9	47.2	64.4	83.8	107.0	134.0	163.0	197.0
CaOH	79.4 ^{110°}	.....	.....	.....	.....	.....	.....	.....	.....
CaSO_4	167.1	173.1	178.7	184.1	189.9	194.9	199.9	205.0	210.3	214.9	220.3
CuCl	1.52 ^{230°}	.....	.....	.....	.....	.....	.....	.....	.....
CuCl_2	41.4	42.45	43.5	44.55	45.6	46.65	47.7	.....	49.8	.....	51.9
CuI_2	45	48.70	55.58	.....	.....	.....	.....	.....	.....	.....	.....
$\text{Cu(NO}_3)_2$	1.107	.....	.....	.....	.....	.....	.....	.....	.....
$\text{Cu(NO}_3)_2$	55.58	.....	61.51	.....	64.17	.....	67.51	.....	.....
CuS	at 18°	.....	.....	.....	.....	.....	.....	.....	.....
CuSO_4	14.3	17.4	20.7	25	28.5	33.3	40	.....	55	.....	75.4
FeBr_3	50.5	.....	53.5	55.0	56.2	56.2	59.0	.....	61.5	.....	64.0
FeCl_2	39.2	.....	42.2	43.6	45.2	47.0	.....	50.0	.....	.....
FeCl_2
FeCl_3	74.4	81.9	91.8	.....	.....	315.1	62.5	.....	525.8	51.3	51.4
$\text{Fe(NO}_3)_2$	41.53	.....	45.6	.....	.....	.....	.....	.....	.....	.....	535.7
FeS	6.16 $\times 10^{-4}$	at 18°	.....	.....	.....	.....	.....	.....	.....	.....	.....
FeSO_4	15.65	20.51	26.5	32.9	40.2	48.6	.....	.....	.....	.....	.....
FeSO_4
H_3BO_3	2.59	3.45	4.8	6.30	8.02	10.35	12.90	50.9	43.6	37.3	.....
HBr	760mm.	221.2	210.3	198	.....	.....	171.5	.....	15.70	19.11	23.30	28.7
HCl	760mm.	82.3	.....	.....	67.3	63.3	59.6	56.1	.....	.....	.....	130
H_2SeO_3	47.4	55	62.5	70.2	77.5	79.2	79.3	79.3	79.3	79.4	.....
H_2SeO_4	81	.....	85	93	94.5	96.5	100	.....	.....	.....	.....
H_2TeO_4	13.92	26.21	.....	33.36	36.38	.....	43.67	.....	51.55	.....	60.84
H_2TeO_4	25.29	.....	.....	.....	.....	.....	.....	.....	.....	.....

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
HgBr	3.9×10^{-6}	at 25° 0.5	.....	.....	.....	.....	.....	.....	.....	25
HgBr ₂	2×10^{-4}	.....	.....	.....	.....	.....	.....	.....	.....
*HgCl	1.4×10^{-4}	.....	6.1	4×10^{-4}	.....	.....	.....	.....	.....	.....	.....
*HgCl ₂	3.5	.....	53.85 at 25°	7.7	9.3	.....	14	.....	23.1	.....	38
Hg(CN) ₂	9.3×10^{-2}	53.85×10^{-10}	.....	.....	.....	.....	.....	.....	.....	.....
HgI	2×10^{-8}	at 25°	.....	.....	.....	.....	.....	.....	.....	.....
HgI ₂	5.91×10^{-3}	at 25°	.....	.....	.....	.....	.....	.....	.....	.....
I ₂	2.9×10^{-5}	4.0×10^{-2}	5.6×10^{-2}	7.8×10^{-2}	.....	.....	.....	.....	.....
KB	53.5	59.5	65.2	70.6	75.5	87.2	85.5	90.0	95.0	99.2	104.0
KBrO ₃	3.1	4.8	6.9	9.5	13.2	17.5	22.7	.....	34.0	.....	50.0
KC ₂ H ₃ O ₂	216.7	233.9	255.6	283.8	323.3	.....	.....	.....	.....	.....	.....
KC ₂ H ₃ O ₂
KCl	27.6	31.0	34.0	37.0	40.0	337.3	350	364.8	380.1	396.3	.....
KClO ₃	3.3	5	7.4	10.5	14	42.6	45.5	48.3	51.1	54.0	56.7
KClO ₄	0.75	1.05	1.80	2.6	4.4	19.3	21.5	11.8	38.5	.....	57
*KCNS	63.9	.....	68.5	.....	.....	6.5	.....	.....	14.8	18	21.8
*K ₂ CO ₃	51.3	52	52.5	53.2	53.9	54.8	55.9	57.1	58.3	59.6	60.9
K ₂ CrO ₄	58.2	60.0	61.7	63.4	65.2	66.8	68.6	70.4	72.1	73.9	75.6
K ₂ Cr ₂ O ₇	5	8.5	13.1	.....	29.2	.....	50.5	.....	73.0	.....	102.0
*KHC ₄ H ₄ O ₆	0.32	0.40	0.53	0.9	1.3	1.8	2.4	.....	4.4	.....	6.5
*KH ₂ PO ₄	18.3	21.7	24.5	28.1	31.2	.....	37.5	.....	.....	.....	.....
KHSO ₄	36.3	.....	51.4	.....	67.3	.....	.....	.....	.....	.....	.....
KI	127.5	136	144	152	160	168	176	184	192	200	208
KIO ₃	4.73	.....	8.13	11.73	12.8	.....	18.5	.....	24.8	.....	32.2
KMnO ₄	2.83	4.4	6.4	9.0	12.56	16.89	22.2	.....	.....	.....	.....
*KNO ₃	73.6	.....	74.9	.....	77	.....	.....	.....	.....	.....	.....
KNO ₃	13.3	20.9	31.6	45.8	63.9	85.5	110.0	138	169	202	246
KOH	97	103	112	126	.....	140	.....	.....	.....	.....	.....
2H ₂ O
H ₂ O
K ₂ PtCl ₆	0.74	0.96	1.12	1.41	1.76	2.17	2.64	3.19	3.79	4.45	5.18
K ₂ SO ₄	7.35	9.22	11.11	12.97	14.76	16.50	18.17	19.75	21.4	22.8	24.1

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
••K ₂ S ₂ O ₈ ...	24H ₂ O	1.62	2.60	4.49	7.19	9.89	17.00	24.75	40.0	71.0	109.0	...
K ₂ SO ₄ .Al ₂ (SO ₄) ₃ ...		3.0	4.0	5.9	8.39	11.70	...	...	...	...	...	...
Li ₂ (SO ₄) ₃ ...		3	...	...	1.9	...	1.5	...	...	...	...	0.69
LiBr	H ₂ O	...	...	...	...	...	214	224	...	245	...	266
LiBr	2H ₂ O	143	166	177	191	205	...	...	...	...	...	...
LiCl		67	72	78.5	84.5	90.5	97	103	...	115	...	127.5
Li ₂ CO ₃		1.54	1.43	1.33	1.25	1.17	1.08	1.01	...	0.85	...	0.72
LiI	3H ₂ O	151	157	165	171	179	187	202	230	435	...	481
LiI	H ₂ O	...	...	...	...	...	...	...	...	...	...	...
•LiNO ₃	3H ₂ O	34.8	37.9	...	57	...	61	63.6	...	...	...	...
•LiNO ₃	14H ₂ O	...	...	...	...	...	...	...	...	...	...	...
•LiNO ₃		...	...	...	...	...	...	...	...	...	...	...
LiOH		12.7	12.7	12.8	12.9	13	13.3	13.8	66	15.3	...	17.5
•Li ₂ SO ₄		26.1	25.9	25.5	25.1	24.7	24.5	24.2	...	23.5	...	23
MgBr ₂	6H ₂ O	91.0	94.5	96.5	99.2	101.6	104.1	107.5	...	113.7	...	120.2
MgCl ₂	6H ₂ O	52.8	53.5	54.5	...	57.5	...	61.0	...	66.0	...	73.0
•MgI ₂	8H ₂ O	54.7	...	58.3	...	63.4	...	...	...	...	...	...
•Mg(NO ₃) ₂	6H ₂ O	...	...	...	...	...	...	...	...	...	...	...
Mg(OH) ₂		9×10 ⁻⁴ at 18°	...	...	...	...	...	...	...	65	...	...
•MgSO ₄	7H ₂ O	...	23.6	26.2	29	31.3	...	...	...	...	...	...
•MgSO ₄	6H ₂ O	29	29.7	30.8	31.2	...	33.5	35.5	37.3	39.1	40.8	42.5
•MgSO ₄	H ₂ O	...	...	...	...	...	...	...	...	38.6	...	40.6
•MnBr ₂	4H ₂ O	56.0	57.6	59.5	61.1	62.8	64.5	66.3	68.0	69.2	69.5	...
•MnBr ₂	2H ₂ O	...	...	...	...	...	...	...	...	...	...	...
MnCl ₂	4H ₂ O	63.4	68.1	73.9	80.71	88.59	98.15	108.6	110.6	112.7	114.1	115.3
MnCl ₂	2H ₂ O	...	...	...	...	...	...	...	...	...	...	...
•Mn(NO ₃) ₂	6H ₂ O	50.49	54.1	58.8	67.38	...	...	...	...	...	...	...
•Mn(NO ₃) ₂	3H ₂ O	...	...	...	...	...	...	...	...	...	...	...
MnS		...	6.23×10 ⁻⁴ at 18°	...	...	...	...	...	...	...	...	...
MnSO ₄	7H ₂ O	53.23	60.01	...	...	...	...	...	...	...	...	...

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
MnSO ₄	5H ₂ O	..	59.5	62.9	67.76	68.8	72.6	..	..	..	..	..
MnSO ₄	4H ₂ O	..	..	64.5	66.44	..	58.17	55.0	52.0	48.0	42.5	34.0
MnSO ₄	H ₂ O	..	..	..	..	0.476	0.687	1.206	2.055	2.106	..	..
MoO ₃	0.138	0.264	..	..	..	..	..	..	..
Na ₂ O	0.1705	0.1211	..	..	..	..	..	..	..	..
NH ₄ Br	..	60.6	68	75.5	83.2	91.1	99.2	107.8	116.8	126	135.6	145.6
*NH ₄ CNS	..	54.5	59	63	67.5	..	..	..	..	..	..	..
*NH ₄ C ₂ O ₄	..	2.1	3	4.2	5.6	7.4	9.3	..	..	..	..	..
(NH ₄) ₂ Cd	72.3 ^{25°}	..	..	..	..	..	..	..	..
(SO ₄) ₂
NH ₄ Cl	..	29.4	33.3	37.2	41.4	45.8	50.4	55.2	60.2	65.6	71.3	77.3
**NH ₄ ClO ₄	..	11.56	..	20.85	..	30.58	..	39.05	..	48.19	..	57.01
(NH ₄) ₂ CoSO ₄	..	6.0	9.5	13.0	17.0	22.0	27.0	33.5	40.0	49.0	..	..
*NH ₄ CrO ₄	28.8	..	..	..	..	..	..	..
*NH ₄ Cr ₂ O ₇	32.05	..	..	..	..	..	..	..
(NH ₄) ₂ Cr ₂ O ₇	10.78 ^{25°}	..	..	..	..	..	..	..	..
(SO ₄) ₄
(NH ₄) ₂ Fe	..	12.5	17.2	..	..	33.0	40	..	52	..	..	..
(SO ₄) ₂
(NH ₄) ₂ Fe ₂	44.15 ^{25°}	..	..	..	..	..	..	..	..
(SO ₄) ₄
NH ₄ HCO ₃	..	11.9	15.8	21	27	..	..	..	..	..	..	..
NH ₄ H ₂ PO ₃	..	171	190 ^{14.5°}	260 ^{31°}	..	..	..	..	..	..	..	..
(NH ₄) ₂ HfO ₄	..	154.2	163.2	172.3	181.4	190.5	199.6	208.9	218.7	228.8	250.3	..
NH ₄ I
*NH ₄ LiSO ₄	35.58	..	35.87	..	36.00	..	36.18	..	..	..
NH ₄ MgPO ₄	..	0.023	..	0.052	..	0.036	0.030	0.040	0.016	0.019	..	..
NH ₄ MnPO ₄	0	..	0	..	0	0.005	0.007	..	..
NH ₄ NO ₃	..	118.3	..	192	241.8	297.0	344.0	421.0	499.0	580.0	740.0	871.0
(NH ₄) ₂ PtCl ₆	0.7	..	..	..	..	..	..	..	..	1.25
(NH ₄) ₂ SO ₄	..	70.6	73.0	75.4	78.0	81.0	..	88.0	..	95.3	..	103.3

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
(NH ₄) ₂ SO ₄	24H ₂ O	2.10	4.99	7.74	10.94	14.88	20.10	26.70	.....	.....	.....	.....
Al ₂ (SO ₄) ₃	.....	58.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(NH ₄) ₂ S ₂ O ₈	.....	41.6	.....	47.7	54.5	.....	.....	.....	.....	.....	.....	.....
•(NH ₄) ₂ SbS ₄	.....	.....	1.22 ^{150°}	.....	.....	.....	.....	.....	.....	.....	.....	.....
(NH ₄) ₂ SeO ₄	.....	.....	.....	4.3	8.4	13.2	17.8	.....	30.5	.....	.....	.....
NH ₄ VO ₃	.....	9.84×10 ⁻³	7.57×10 ⁻³	6.18×10 ⁻³	5.17×10 ⁻³	4.40×10 ⁻³	3.76×10 ⁻³	3.24×10 ⁻³	2.67×10 ⁻³	1.99×10 ⁻³	1.14×10 ⁻³	0
NO 760mm.	.....	.....	0.171	0.121	.....	.....	.....	.....	.....	.....	.....	.....
N ₂ O 760mm.	.....	44.3	.....	47.5	49.4	51.4	53.7	.....	.....	54.2	.....	54.8
•NaBr	2H ₂ O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Na ₂ B ₄ O ₇	10H ₂ O	1.3	1.6	2.7	3.9	.....	10.5	20.3	.....	.....	.....	.....
Na ₂ B ₄ O ₇	5H ₂ O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
NaBrO ₃	.....	27.5	.....	34.5	.....	50.2	.....	62.5	24.4	31.5	41	52.5
NaC ₂ H ₃ O ₂	3H ₂ O	36.3	40.8	46.5	54.5	65.5	83	139	75.7	.....	.....	90.9
NaC ₂ H ₃ O ₂	.....	119	121	123.5	126	129.5	134	139.5	146	153	161	170
Na ₂ C ₂ O ₄	.....	.....	.....	3.7	.....	.....	.....	.....	.....	.....	.....	6.33
NaCl	.....	35.7	35.8	36.0	36.3	36.6	37.0	37.3	37.8	38.4	39.0	39.8
NaClO ₃	.....	79	89	101	113	126	140	155	172	189	230	.....
Na ₂ CO ₃	10H ₂ O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Na ₂ CO ₃	H ₂ O	7	12.5	21.5	38.8	48.5	.....	46.4	.....	45.8	.....	45.5
Na ₂ CO ₃	10H ₂ O	.....	.....	.....	50.5	.....	.....	.....	.....	.....	.....	.....
•Na ₂ CrO ₄	4H ₂ O	24.07	33.41	47	47	48.97	51	53.4	55.15	55.53	.....	55.74
•Na ₂ CrO ₄	.....	.....	.....	.....	.....	.....	.....	.....	76	79	.....	.....
•Na ₂ Cr ₂ O ₇	2H ₂ O	61.98	.....	64	.....	.....	71	.....	.....	.....	.....	81
Na ₂ Cr ₂ O ₇	.....	.....	.....	.....	.....	.....	.....	.....	.....	59	.....	63
Na ₂ Fe(CN) ₆	.....	.....	.....	17.9	.....	30	.....	.....	.....	.....	.....	.....
NaHCO ₃	.....	.....	8.15	9.6	11.1	12.7	14.45	16.4	.....	.....	.....	.....
NaH ₂ PO ₄	2H ₂ O	6.9	69.9	85.2	106.5	138.2	.....	.....	.....	.....	.....	.....
NaH ₂ PO ₄	H ₂ O	57.9	.....	.....	.....	.....	158.6	179.3	190.3	207.3	225.3	246.6
NaH ₂ PO ₄	.....	.....	.....	.....	.....	.....	.....	65	.....	85	.....	.....
Na ₂ HAsO ₄	.....	7.3	15.5	26.5	37	47	.....	.....	.....	.....	.....	.....

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
Na_2HPO_4	$12\text{H}_2\text{O}$	1.67	3.6	7.7	20.8	51.8	80.2	82.9	88.1	92.4	102.9	102.2
Na_2HPO_4	$7\text{H}_2\text{O}$											302
$\text{Na}_2\text{HPO}_4 \cdot \dots$	$2\text{H}_2\text{O}$											
$\text{Na}_2\text{HPO}_4 \cdot \dots$												
NaI	$2\text{H}_2\text{O}$	158.7	168.6	178.7	190.3	205.0	227.8	256.8	294	296		
NaIO_3		2.5		9		15		21		27		34
NaNO_2		41.9	43.8	45.8	47.8	49.6	51			57		62
NaNO_3		73	80	88	96	104	114	124		148		180
NaOH	$4\text{H}_2\text{O}$	42										
$3\frac{1}{2}\text{H}_2\text{O}$												
NaOH	H_2O		51.5	109	119	129	145	174				
NaOH												
NaPO_4	$12\text{H}_2\text{O}$	1.5	4.1	11	20	31	43	55		81	313	347
NaP_2O_7	$10\text{H}_2\text{O}$	3.16	3.95	6.23	9.95	13.50	17.45	21.83		30.04		108
Na_2S	$9\text{H}_2\text{O}$		13.36	15.8	18.4	22.2	28.48	29.92		33.95	37.20	40.26
Na_2S	$5\frac{1}{2}\text{H}_2\text{O}$						26.7	28.1	31.38	32.95	36.42	
Na_2S	$6\text{H}_2\text{O}$								30.22			
Na_2S	$7\text{H}_2\text{O}$			26.9	36					28.3		
Na_2SO_3		13.9	20			28.0	28.2	28.8				
Na_2SO_3												
Na_2SO_4	$10\text{H}_2\text{O}$	5.0	9.0	19.4	40.8							
Na_2SO_4	$7\text{H}_2\text{O}$	19.5	30	44								
Na_2SO_4												
Na_2SO_4												
Na_2SO_3												
Na_2SeO_4		52.5	61.0	70.0	84.7	102.6	169.7	206.7		248.8	254.2	266.0
Na_2SeO_4	$10\text{H}_2\text{O}$	11.74			44.05							
Na_2SeO_4												
NaVO_3	$2\text{H}_2\text{O}$					30.2	44.49	68.4	36.9			42.14
NaVO_3						26.23		32.97				
Na_2WO_4	$10\text{H}_2\text{O}$	36.54										
Na_2WO_4	$2\text{H}_2\text{O}$	41.73		42	5		3.7			47.7		49.3
$\text{Nd}_2(\text{SO}_4)_3$		9.5								2.7		

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
*NiBr ₂	53		55	56.7	58	59.1	60	60.4		60.6		60.8
NiCO ₃			9.25×10 ⁻³ at 25°									
*NiCl ₂	35		37.3	39.1	40.8	42.3	43.9	45.1	46			46.7
*NiI ₂	55.4		57.5	59.7	61.7	63.5	64.7	64.8	65	65.2	65.3	
*Ni(NO ₃) ₂	44.32			49.06		55						
*Ni(NO ₃) ₂												
NiS.....			3.6 × 10 ⁻⁴ at 18°					61.99	63.95		70.16	
NiSO ₄	27.22		32		42.46							
NiSO ₄												
O ₃	3.9×10 ⁻³		2.9×10 ⁻³	2.1×10 ⁻³	7×10 ⁻⁴	4×10 ⁻⁴	50.15	54.80	59.44	63.17		76.7
PbBr ₂	0.4554			0.85	1.15	1.53	1×10 ⁻⁴	0		3.34		4.75
Pb(C ₂ H ₃ O ₂) ₂				55.04 _{25°}				2.36				
PbCO ₃				1.1×10 ⁻⁴								
PbCl ₂	0.6728			0.99	1.20	1.45	1.70	1.98		2.62		3.34
PbCrO ₄				7×10 ⁻⁶								
PbF ₂			0.06	0.064	0.068							
PbI ₂	0.0442			0.068	0.090	0.125	0.164	0.197		0.302		0.436
Pb(NO ₃) ₂	38.8		48.3	56.5	66	75	85	95		115		138.8
PbS.....				8.6×10 ⁻⁵ at 18°								
PbSO ₄	0.0028		0.0035	0.0041	0.0049	0.0056						
PbCl.....	77		84.4	91.1	97.6	103.5	109.3	115.5	121.4	127.2	133.1	138.9
RbClO ₄	2 14			5.4	8		15.98					62.8
RbClO ₄	0.5		0.6	1.0	1.5	2.3	3.5	4.85	6.72	9.2	12.7	18
RbNO ₃	19.5		33.0	53.3	81.3	116.7	155.6	200	251	309	375	452
Rb ₂ SO ₄	36.4		42.6	48.2	53.5	58.5	63.1	67.4	71.4	75.0	78.7	81.8
SO ₂ 760mm.....	22.83		16.21	11.29	7.81	5.41	4.5			∞		
SbCl ₃	601.6			931.5	1068.0	1368.0	1917.0	4531.0				
SbF ₃	384.7			444.7	563.6							
Sb ₂ S ₃			1.75×10 ⁻⁴ at 18°									
SnCl ₂	83.9		269.8 _{15°}	1.0	1.2	1.4	1.7	2.1	2.5	3.0	3.4	4.0
SnI ₂												

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
SnSO ₄		85.2	93	19	111.9	123.2	135.8	150		181.8		18
SrBr ₂		36.9	43.61	102.4								222.5
Sr(C ₂ H ₃ O ₅) ₂	4H ₂ O											
Sr(C ₂ H ₃ O ₅) ₂	$\frac{1}{2}$ H ₂ O		42.95	41.6	30.5		37.35		36.24	36.10	36.24	36.4
SrC ₂ O ₄		0.0033	0.0044	0.0040	0.0057							
SrCl ₂	6H ₂ O	43.5	47.7	52.9	58.7	65.3	72.4	81.8	85.9	90.5		
SrCl ₂	2H ₂ O											
SrCl ₂	6H ₂ O	165.3		177.8		191.5		217.5		270.4		100.8
SrI ₂	2H ₂ O											
*Sr(NO ₃) ₂	H ₂ O	34.5		39			45.6	49.3			365.2	383.1
Sr(NO ₃) ₂	4H ₂ O	40.1		70.5							56.6	58.1
Sr(NO ₃) ₂					88.6	90.1		93.8	96	98	100	
SrSO ₄		0.0113		0.0114	0.0114							
Th(SO ₄) ₂	9H ₂ O	0.74	0.98	1.38	1.995	2.998	5.22					
Th(SO ₄) ₂	8H ₂ O	1.0	1.25	1.62								
Th(SO ₄) ₂	6H ₂ O	1.50		1.90	2.45	4.04	2.54	6.64	1.09			
Th(SO ₄) ₂	4H ₂ O							1.63				
Th(SeO ₄) ₂		0.408										
TiBr		0.024	0.029	0.042								
TiBr-O ₃				0.346		0.736						
TiCl		0.21	0.25	0.33	0.42	0.52	0.63	0.8		1.2		1.8
TiClO ₃		2		3.92			12.67			36.65		57.31
TiClO ₄		6					39.62		65.32	81.49		166.6
TiI			8.04		19.72					0.070		0.120
TiI-O ₃			0.0036		0.008	0.015		0.035				
TiNO ₃				0.058								
TiNO ₃		3.91	6.22	9.55	14.3	20.9	30.4	46.2	69.5	111.0	200.0	414.0
TiOH		25.44			39.9	49.5		73.8		106	126.1	148.3
Ti ₂ S												
Ti ₂ SO ₄		2.70	3.70	4.87	6.16		9.21	10.92	12.74	14.61	16.53	18.45
Ti ₂ SeO ₄			2.13	2.8								
*UO ₂ (NO ₃) ₂	6H ₂ O	49.5	52	55.7			67					.....

SOLUBILITY OF INORGANIC COMPOUNDS (Continued)

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$\text{Yb}_2(\text{SO}_4)_3$	.....	44.2	.....	38.4	.....	21.0	.....	10.4	7.22	6.92	5.83	4.67
* ZnBr_2	$2\text{H}_2\text{O}$	79.55	.....	81.7	84.08	85.53	.....	86.08	.....	86.57	.....	87.05
* ZnBr_2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
* $\text{Zn}(\text{ClO}_3)_2$	$6\text{H}_2\text{O}$	59.19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
* $\text{Zn}(\text{ClO}_3)_2$	$4\text{H}_2\text{O}$	.....	.....	66.7	67.66	69.06	73.2	.....	.....	.....	.....	.....
* $\text{Zn}(\text{ClO}_3)_2$	$2\text{H}_2\text{O}$	81.16	82.06	82.9	.....	81.66	.....	82.37	.....	83.05	.....	83.62
* ZnI_2	.....	81.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
* ZnI_2	.....	.....	.....	54.2	.....	67.42	.....	.....	.....	.....	.....	.....
* $\text{Zn}(\text{NO}_3)_2$	$6\text{H}_2\text{O}$	48.66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
* $\text{Zn}(\text{NO}_3)_2$	$3\text{H}_2\text{O}$	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
ZnSO_4	$7\text{H}_2\text{O}$	41.9	47	54.4	.....	41.2	43.5	.....	.....	.....	45.5	44.7
ZnSO_4	$6\text{H}_2\text{O}$	.....	.....	.....	.....	.....	.....	.....	.....	46.4	.....	.....
ZnSO_4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

SOLUBILITY OF

α , the absorption coefficient, is the volume of gas when reduced to 0° and 760 mm., absorbed by one volume of water when the pressure of the gas itself, without the aqueous tension, amounts to 760 mm.

q is the weight of gas in grams dissolved in 100 grams of water when the total pressure (i.e., the sum of the partial pressure of the gas plus the aqueous tension at the given temperature) is 760 mm.

Temp.° C	Nitrogen *		Oxygen		Hydrogen		Carbon Dioxide	
	α	q	α	q	α	q	α	q
0	0.02354	0.002942	0.04889	0.006945	0.02148	0.0001922	1.713	0.3346
1	0.02297	0.002869	0.04758	0.006756	0.02126	0.0001901	1.646	0.3213
2	0.02241	0.002798	0.04633	0.006574	0.02105	0.0001881	1.584	0.3091
3	0.02187	0.002730	0.04512	0.006400	0.02084	0.0001862	1.527	0.2978
4	0.02135	0.002663	0.04397	0.006232	0.02064	0.0001843	1.473	0.2871
5	0.02086	0.002600	0.04287	0.006072	0.02044	0.0001824	1.424	0.2774
6	0.02037	0.002537	0.04180	0.005918	0.02025	0.0001806	1.377	0.2681
7	0.01990	0.002477	0.04080	0.005773	0.02007	0.0001789	1.331	0.2589
8	0.01945	0.002419	0.03983	0.005632	0.01989	0.0001772	1.282	0.2492
9	0.01902	0.002365	0.03891	0.005498	0.01972	0.0001756	1.237	0.2403
10	0.01861	0.002312	0.03802	0.005368	0.01955	0.0001740	1.194	0.2318
11	0.01823	0.002263	0.03718	0.005246	0.01940	0.0001725	1.154	0.2239
12	0.01786	0.002216	0.03637	0.005128	0.01925	0.0001710	1.117	0.2165
13	0.01750	0.002170	0.03559	0.005014	0.01911	0.0001696	1.083	0.2098
14	0.01717	0.002126	0.03486	0.004906	0.01897	0.0001682	1.050	0.2032
15	0.01685	0.002085	0.03415	0.004802	0.01883	0.0001668	1.019	0.1970
16	0.01654	0.002045	0.03348	0.004703	0.01869	0.0001654	0.985	0.1903
17	0.01625	0.002006	0.03283	0.004606	0.01856	0.0001641	0.956	0.1845
18	0.01597	0.001970	0.03220	0.004514	0.01844	0.0001628	0.928	0.1789
19	0.01570	0.001935	0.03161	0.004426	0.01831	0.0001616	0.902	0.1737
20	0.01545	0.001901	0.03102	0.004339	0.01819	0.0001603	0.878	0.1688
21	0.01522	0.001869	0.03044	0.004252	0.01805	0.0001588	0.854	0.1640
22	0.01498	0.001838	0.02988	0.004169	0.01792	0.0001575	0.829	0.1590
23	0.01475	0.001809	0.02934	0.004087	0.01779	0.0001561	0.804	0.1540
24	0.01454	0.001780	0.02881	0.004007	0.01766	0.0001548	0.781	0.1493
25	0.01434	0.001751	0.02831	0.003931	0.01754	0.0001535	0.759	0.1449
26	0.01413	0.001724	0.02783	0.003857	0.01742	0.0001522	0.738	0.1406
27	0.01394	0.001698	0.02736	0.003787	0.01731	0.0001509	0.718	0.1366
28	0.01376	0.001672	0.02691	0.003718	0.01720	0.0001496	0.699	0.1327
29	0.01358	0.001647	0.02649	0.003651	0.01709	0.0001484	0.682	0.1292
30	0.01342	0.001624	0.02608	0.003588	0.01699	0.0001474	0.665	0.1257
35	0.01256	0.001501	0.02440	0.003315	0.01666	0.0001425	0.592	0.1105
40	0.01184	0.001391	0.02306	0.003082	0.01644	0.0001384	0.530	0.0973
45	0.01130	0.001300	0.02187	0.002858	0.01624	0.0001341	0.479	0.0860
50	0.01088	0.001216	0.02090	0.002657	0.01608	0.0001287	0.436	0.0761
60	0.01023	0.001052	0.01946	0.002274	0.01600	0.0001178	0.359	0.0576
70	0.00977	0.000851	0.01833	0.001856	0.0160	0.000102	—	—
80	0.00958	0.000660	0.01761	0.001381	0.0160	0.000079	—	—
90	0.0095	0.00038	0.0172	0.00079	0.0160	0.000046	—	—
100	0.0095	0.00000	0.0170	0.00000	0.0160	0.000000	—	—

* Atmospheric Nitrogen 98.815% Vol. N₂ + 1.185% Vol. A

GASES IN WATER

l is the volume of gas in c.c. dissolved by one volume of water when the total pressure (i.e., the sum of the partial pressure of the gas plus the aqueous tension at the given temperature) is 760 mm.

	Carbon Monoxide		Hydrogen Sulfide		Sulfur Dioxide		Nitric Oxide		Air**	
	α	q	α	q	l	q	α	q	cc/100cc	%O ₂ in dissolved air
0	0.03537	0.004397	4.670	0.7066	79.789	22.83	0.07381	0.009833	29.18	34.91
1	0.03455	0.004293	4.522	0.6839	77.210	22.09	0.07184	0.009564	28.42	34.87
2	0.03375	0.004191	4.379	0.6619	74.691	21.37	0.06993	0.009305	27.69	34.82
3	0.03297	0.004092	4.241	0.6407	72.230	20.66	0.06809	0.009057	26.99	34.78
4	0.03222	0.003996	4.107	0.6201	69.828	19.98	0.06632	0.008816	26.32	34.74
5	0.03149	0.003903	3.977	0.6001	67.485	19.31	0.06461	0.008584	25.68	34.69
6	0.03078	0.003813	3.852	0.5809	65.200	18.65	0.06298	0.008361	25.06	34.65
7	0.03009	0.003725	3.732	0.5624	62.973	18.02	0.06140	0.008147	24.47	34.60
8	0.02942	0.003640	3.616	0.5446	60.805	17.40	0.05990	0.007943	23.90	34.56
9	0.02878	0.003559	3.505	0.5276	58.697	16.80	0.05846	0.007747	23.36	34.52
10	0.02816	0.003479	3.399	0.5112	56.647	16.21	0.05709	0.007560	22.84	34.47
11	0.02757	0.003405	3.300	0.4960	54.655	15.64	0.05587	0.007393	22.34	34.43
12	0.02701	0.003332	3.206	0.4814	52.723	15.09	0.05470	0.007233	21.87	34.38
13	0.02646	0.003261	3.115	0.4674	50.849	14.56	0.05357	0.007078	21.41	34.34
14	0.02593	0.003194	3.028	0.4540	49.033	14.04	0.05250	0.006930	20.97	34.30
15	0.02543	0.003130	2.945	0.4411	47.276	13.54	0.05147	0.006788	20.55	34.25
16	0.02494	0.003066	2.865	0.4287	45.578	13.05	0.05049	0.006652	20.14	34.21
17	0.02448	0.003007	2.789	0.4169	43.939	12.59	0.04956	0.006524	19.75	34.17
18	0.02402	0.002947	2.717	0.4056	42.360	12.14	0.04868	0.006400	19.38	34.12
19	0.02360	0.002891	2.647	0.3948	40.838	11.70	0.04785	0.006283	19.02	34.08
20	0.02319	0.002838	2.582	0.3846	39.374	11.28	0.04706	0.006173	18.68	34.03
21	0.02281	0.002789	2.517	0.3745	37.970	10.88	0.04625	0.006059	18.34	33.99
22	0.02244	0.002739	2.456	0.3648	36.617	10.50	0.04545	0.005947	18.01	33.95
23	0.02208	0.002691	2.396	0.3554	35.302	10.12	0.04469	0.005838	17.69	33.90
24	0.02174	0.002646	2.338	0.3463	34.026	9.76	0.04395	0.005733	17.38	33.86
25	0.02142	0.002603	2.282	0.3375	32.786	9.41	0.04323	0.005630	17.08	33.82
26	0.02110	0.002560	2.229	0.3290	31.584	9.06	0.04254	0.005530	16.79	33.77
27	0.02080	0.002519	2.177	0.3208	30.422	8.73	0.04188	0.005435	16.50	33.73
28	0.02051	0.002479	2.128	0.3130	29.314	8.42	0.04124	0.005342	16.21	33.68
29	0.02024	0.002442	2.081	0.3055	28.210	8.10	0.04063	0.005252	15.92	33.64
30	0.01998	0.002405	2.037	0.2983	27.161	7.80	0.04004	0.005165	15.64	33.60
35	0.01877	0.002231	1.831	0.2648	22.489	6.47	0.03734	0.004757		
40	0.01775	0.002075	1.660	0.2361	18.766	5.41	0.03507	0.004394		
45	0.01690	0.001933	1.516	0.2110	—	—	0.03311	0.004059		
50	0.01615	0.001797	1.392	0.1883	—	—	0.03152	0.003758		
60	0.01488	0.001522	1.190	0.1480	—	—	0.02954	0.003237		
70	0.01440	0.001276	1.022	0.1101	—	—	0.02810	0.002688		
80	0.01430	0.000980	0.917	0.0765	—	—	0.02700	0.001984		
90	0.0142	0.00057	0.84	0.041	—	—	0.0265	0.00113		
100	0.0141	0.00000	0.81	0.000	—	—	0.0263	0.00000		

** Cubic centimeters of air (free from CO₂ and NH₃) dissd. in 1000 c.c. H₂O with barometer at 760 mm. (total pressure).

SOLUBILITY OF AMMONIA IN WATER

Press. NH ₃ , mm	0°C		20°C		40°C	
	g/g	cm ³ /cm ³	g/g	cm ³ /cm ³	g/g	cm ³ /cm ³
700	.....	.....	0.497	652.9	.....	.....
800	.....	.....	0.544	714.6	0.329	429.6
900	0.997	1312	0.588	772.4	.....	.....
1000	1.094	1440	0.629	826.2	0.386	504.0
1100	1.192	1569	0.669	878.8	.....	.....
1200	1.288	1695	0.707	928.8	0.433	565.4
1300	1.388	1827	0.745	978.7	.....	.....
1400	1.488	1958	0.781	1025.9	0.472	616.3
1500	1.588	2090	0.815	1070.6	.....	.....
1600	1.688	2221	0.847	1112.6	0.508	663.3
1700	1.778	2340	0.877	1152.1	.....	.....
1800	1.847	2431	0.906	1190.1	0.543	709.0
1900	.....	.....	0.934	1226.9	.....	.....
2000	.....	.....	0.959	1259.7	0.577	753.4
2100	.....	.....	0.984	1292.6	.....	.....
2200	.....	.....	1.007	1322.8	0.611	797.8
2300	.....	.....	1.029	1351.7	.....	.....
2400	.....	.....	1.052	1381.8	0.644	840.9
2500	.....	.....	1.074	1410.8	.....	.....
2600	.....	.....	1.096	1439.6	0.676	882.7
2700	.....	.....	1.117	1467.3	.....	.....
2800	.....	.....	1.140	1497.4	0.706	921.7
2900	.....	.....	1.162	1526.4	.....	.....
3000	.....	.....	1.185	1556.6	0.732	955.8
3100	.....	.....	1.207	1585.5	.....	.....
3200	.....	.....	1.230	1615.7	0.758	989.8
3300	.....	.....	.....	.....	.....	.....
3400	.....	.....	.....	.....	0.784	1023.7

SOLUBILITIES OF VARIOUS GASES IN WATER

Henry's Law Constant K

Compiled by Hardin B. Jones, Ph.D.

Gas	$K \times 10^{-7}$ $K = P/X$ P = partial pressure mm. of Hg X = mole fraction									
References	$t = 0^\circ$	10°	20°	30°	38°	40°	50°	60°	70°	80°
Argon.....	1.65	2.18	2.58	3.02	3.41	3.49	3.76	3.92	4.12	4.25
1, 8, 14, 15, 17										
Carbon dioxide..	.0555	.0788	.108	.139	.168	.173	.217	.258		
6, 7, 9, 12										
Helium.....	10.0	10.5	10.9	11.1	11.0	10.9	10.5	10.3	9.88	
1, 3, 8, 12, 14,										
15, 18, 21										
Hydrogen.....	4.42	4.82	5.20	5.51	5.72	5.78	5.82	5.80	5.77	5.73
6, 12										
Krypton.....	0.853	1.20	1.52	1.85	2.13	2.18	2.43	2.66	2.83	2.94
2, 14, 15										
Neon.....	7.68	8.49	9.14	9.45	9.76	9.80	10.0			
(2), 8										
Nitrogen.....	4.09	4.87	5.75	6.68	7.51	7.60	8.20	8.70	9.20	
12, 16, 20, 22,										
23, 24										
Oxygen.....	1.91	2.48	2.95	3.52	4.04	4.14	4.50	4.84	5.13	5.28
6, 10, 12, 13										

SOLUBILITIES OF VARIOUS GASES IN WATER (Continued)

Gas	$K \times 10^{-7}$ $K = P/X$ P = partial pressure mm. of Hg X = mole fraction										
	References	$t = 0^\circ$	10°	20°	30°	38°	40°	50°	60°	70°	80°
Radon.....		.186	.286	.391	.529	.651	.683	.839	.976	1.07	
2, 14, 15											
Xenon.....		.392	.555	.742	.945	1.12	1.16	1.31	1.46	1.59	1.66
2, 14, 15											
Nitrous oxide...		.074	.108	.155	.210	.242	.246	.279			
6, 9, 10, 12											
Acetylene.....		.0555	.0716	.0900	.112	.131	.133				
5, 25											
Ethylene.....		.370	.552	.753	1.00	1.21	1.23				
5, 10											

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INDICATORS

R. T. Thomson's table, showing the hydrogen atoms replaced by NaOH or KOH when a compound neutral to the indicator is formed. The blank spaces indicate that the end-reaction is obscure.

(From Cohn's Indicators and Test-papers, John Wiley and Sons, publishers, by permission.)

Acid	Formula	Methyl- orange Cold	Phenolphthalein		Litmus	
			Cold	Boiling	Cold	Boiling
Sulphuric.....	H ₂ SO ₄	2	2	2	2	2
Hydrochloric....	HCl	1	1	1	1	1
Nitric.....	HNO ₃	1	1	1	1	1
Thiosulphuric...	H ₂ S ₂ O ₃	2	2	2	2	2
Carbonic.....	H ₂ CO ₃	0	1 dilute	0	..	0
Sulphurous.....	H ₂ SO ₃	1	2	..	..	..
Hydrosulphuric..	H ₂ S	0	1 dilute	0	..	0
Phosphoric.....	H ₃ PO ₄	1	2	..	..	..
Arsenic.....	H ₃ AsO ₄	1	2	..	..	..
Arsenous.....	H ₃ AsO ₃	4	..	..	0	0
Nitrous.....	HNO ₂	indicator destroyed	1	..	1	..
Silicic.....	H ₄ SiO ₄	0	..	..	0	0
Boric.....	H ₃ BO ₃	0	..	..	..	..
Chromic.....	H ₂ CrO ₄	1	2	2	..	..
Oxalic.....	H ₂ C ₂ O ₄	..	2	2	2	2
Acetic.....	HC ₂ H ₃ O ₂	..	1	..	1 nearly	..
Butyric.....	HC ₄ H ₇ O ₂	..	1	..	1 nearly	..
Succinic.....	H ₂ C ₄ H ₄ O ₄	..	2	..	2 nearly	..
Lactic.....	HC ₃ H ₅ O ₃	..	1	..	1	..
Tartaric.....	H ₂ C ₄ H ₄ O ₆	..	2	..	2	..
Citric.....	H ₃ C ₆ H ₅ O ₇	..	3	..	..	..

TABLE OF INDICATORS

Due to hydrolysis of the salt formed, the composition of a weak acid solution titrated against a strong base is basic (when equivalent amounts of acid and base are present) and of a weak base against a strong acid is acid. A truly neutral titrated solution has the same concentration of hydrogen ions [H⁺] and hydroxyl ions [OH⁻] as water. Water has a concentration of [H⁺] ion of 10⁻⁷ and of [OH⁻] ion of 10⁻⁷ at 25°C. As an index of the acid intensity the expression pH is employed and is equal to the logarithm of the reciprocal of the hydrogen ion concentration; i. e., $pH = \log \frac{1}{[H^+]}$ per liter. From this it follows that the pH of a neutral solution is the same as that of water; viz., 7; an acid solution has a pH less than 7 and a basic solution has a pH greater than 7. Those indicators in the table below with a * are the Sørensen selected indicators; those with a # are the Clark and Lubs selected indicators; those with the == are Cohen's supplement to the Clark and Lubs selection; those with the E are the Eastman indicators.

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Mauveine.....		0.1-2.9 *	
α -Naphtholbenzein.....		0-1 } E	
		8-9 } E	
Methyl Red (para).....		0-2 E	
Methyl Violet.....		0-2 E	
Iodeosin.....	Tetraiodofluorescein.....	0.1-3.1 *	
		0.3-0 } E	
		4-5 } E	
Benzoyl Auramine.....		0.1-1 E	
Quinaldine Red.....		1.2 E	
Diphenylamino-azo-benzene.....		1.2-2.1 *	
Tropeolin 00.....	Orange IV; diphenylamino azo-p-benzene sulfonic acid	1.4-2.6 *	
		1-3 E	
Metanil Yellow.....	Diphenylamino-azo-m-ben- zene sulfonic acid	1.2-2.3 *E	
Meta Cresol Purple.....		1.2-2.8 } ##	
		7.4-9.0 } ##	
Thymol Blue.....	Thymolsulfonphthalein	1.2-2.8 #	
		8.0-9.6	
Benzylaniline-azo-benzene sulfonic acid.....		1.9-3.3 *	
Ethyl Orange.....	Diethylaniline orange; sodium (or ammonium) diethylaniline-azo-benzene sulfonate	2-4 E	
Benzopurpurin 4B.....		2-4 E	
Benzylaniline-azo-benzene.....		2.3-3.3 *	
Red Cabbage Extract.....	Wild cabbage; sea cabbage; <i>Brassica oleracea</i>	2.4-4.5	Walbum
m-Chloro-diethyl aniline-azo-p-benzene sulfonic acid.....		2.6-4.0 *	
p-Dimethylamino-azo-benzene.....	Butter yellow; benzene-azo- dimethylaniline	2.9-4.0 *	
		3-4 E	
Congo Red.....	Sodium tetrazodiphenyl- naphthionate	3-5 E	Prideaux
2, 5-Dinitrohydroquinone.....		3-9	Henderson and Forbes
Bromophenol Blue.....	Tetrabromophenolsulfon- phthalein	3.0-3.6 #E	
Methyl Orange ¹	Tropeolin D; orange III; Helianthine; Lunge's Indi- cator	2.9-4.0 E	
		3.1-4.4 *	
α -Naphthylamino-azo-p-benzene sulfonic acid.....		3.5-5.7 *	
α -Naphthylamino-azo-benzene.....		3.7-5.0 *	
Brom Cresol Green.....		3.8-5.4 ##	
p-Sulfo-o-methoxybenzene-azo-di-methyl- α -naphthylamine.....		4.0-4.6 E	
Iodeosin.....	See iodeosin above.....	4-5 } E	
		0.3-0 } E	

¹ Methyl Orange may be used in the presence of carbon dioxide or hydrogen sulfide.

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Dinitrohydroquinone Acetate	4-5 } E	
Sodium Alizarinsulfonate	9-10 } E	
Dichlorofluorescein	4-5 } E	
Lacmosol	5-6 } E	Hottinger
Methyl Red	4-6 } E	
Lacmoid	4.4-5.5	
Tetrabromo-m-cresol-sulfonphthalein	4.4-6.0 #	
Azolitmin (Litmus)	4.2-6.3 E	
Cochineal	4.4-6.2	Sørensen
Chlor Phenol Red	4.5-5.5 E	
Propyl Red	4.5-8.3	Sørensen
Hematoxylin	Dried female insect, <i>Coccus cacti</i> Lin.; carminic acid	4.7-6.2	Sørensen
p-Nitrophenol	4.8-6.4 ##	
Sodium Alizarinsulfonate	4.8-6.4 E	Lubs and Clark
Brom Phenol Red	5-6 E	
Bromocresol Purple	From logwood, <i>Haematoxylon campechica</i> L.	5.0-7.0 *	
Alizarin	5-6 E	
Dinitrobenzoyleurea	4-5	
Bromothymol Blue	5-6 E	
Anisolesulfonphthalein	5.2-6.8 ##	
Curcumin	Dibromo-o-cresolsulfonphthalein	5.2-6.8 #E	
Brilliant Yellow	Roots of madder; <i>Rubia tinctorum</i> , Lin.	5.5-6.8	Sørensen
Neutral Red	Dihydroxyanthraquinone; Schaal's Indicator.	10.1-12.1	
Phenol Red	7-8 E	
Rosolic acid	6-8	Bogart and Scatchard
Cyanin	Dibromothymolsulfonphthalein	6.0-7.6 #E	
β-Naphthol-phthalein	6-8 E	
Cresol Red	Turmeric Yellow; curcumin; roots of <i>Curcuma longa</i> L.	6.8 E	
Meta Cresol Purple	6.8-8.0 *E	
Tropeolin 000	6.8-8.4 #E	
	6.9-8.0 *E	
	7-8	Prideaux
	7.2-8.6	Sørensen and Palitzsch
	7-9 E	
	7.2-8.8 #E	
	7.4-9.0	
	1.2-2.8 ##	
	7.6-8.9 *	

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Thymol Blue.....	<i>See thymol blue above.....</i>	8.0-9.6 } 1.2-2.8 } #E	
α -Naphtholbenzein..	.....	8.9 E	
Cresolphthalein.....	<i>o</i> -Cresolphthalein	8.2-9.8 #	
Phenolphthalein ² ...	Dihydroxyphthalophenone; Luck's indicator	8.3-10 *E	
Dinitrohydro- quinone Acetate	.....	9-10 E	
Alizarin Yellow R...	Sodium <i>p</i> -nitrobenzene-azo- salicylate	9-10 E	
Tetranitrophenol- sulfonphthalein	.....	9-10 E	
Thymolphthalein.....	.....	9.3-10.5 *	
Alizarin Yellow G....	<i>p</i> -nitrobenzene-azo-salicylic acid	10-11 E	
Alizarin Blue S.....	.....	10.1-12.1 *	
Poirrier's Blue.....	.....	11-13	Prideaux
Tropeolin O.....	Resorcine-azo-benzene-sul- fonic acid	11-13	Prideaux
Sodium Indigodisul- fonate.....	.....	11.1-12.7 *E	
1,3,5-Trinitrobenzene	.....	12-14 E	
	.....	14-14.3 E	

Phenolphthalein may be used in the presence of weak acids.

PREPARATION OF CLARK AND LUBS INDICATOR SOLUTIONS

To prepare a 0.04% indicator reagent, 0.1 gram of the dry indicator is mixed in a mortar with the number of cubic centimeters of 0.01 *N* sodium hydroxide as given in the table below and the mixture diluted to 250 cc with water. Such solutions give satisfactory results when five drops of indicator are added to 10 cc of the solution to be tested.

Indicator	0.01 <i>N</i> NaOH cc	Indicator	0.01 <i>N</i> NaOH cc
Brom cresol green.....	14.3	Chlor phenol red.....	23.6
Brom cresol purple.....	18.5	Cresol red.....	26.2
Brom phenol blue.....	14.9	Meta cresol purple.....	26.2
Brom phenol red.....	19.5	Phenol red.....	28.2
Brom thymol blue.....	16.0	Thymol blue.....	21.5

CONVERSION FACTORS—pH TO E. M. F.

When the half-cell:

KCl (saturated)|KCl (0.1*N*), HgCl (s)|Hg is used as a standard of reference and it is assumed, arbitrarily that in the cell:
 Pt, H₂ (1 atmosphere)|H⁺ (unknown activity)|KCl (saturated)

A

B

|KCl (0.1*N*), HgCl (s)|Hg
 C D

the potential difference at B remains constant with variations of "H (unknown activity)" and that the sum of the potential differences at B, C and D is Σ as follows: (cf. Clark: *Determination of Hydrogen Ions*, 3d Ed., 1928).

<i>t</i> °C.....	18	20	25	30
Potential difference (Σ) volts....	0.3380	0.3379	0.3376	0.3371
<i>t</i> °C.....	35	38	40	
Potential difference (Σ) volts.....	0.3365	0.3361	0.3358	

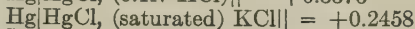
then,

$$\text{pH} = \frac{\text{E. M. F.} - \Sigma}{0.00019832 \times T} \text{ where } T \text{ is the absolute temperature.}$$

CONVERSION FACTORS—pH TO E.M.F. (Continued)

CALOMEL ELECTRODE

The voltage of the calomel electrode at 25°C. is for the half-cell:



From this the relation of the E. M. F. and pH (of a cell composed of a hydrogen electrode and one of the calomel electrodes) is given by:

$$\text{pH} = \frac{\text{E. M. F.} - \Sigma}{0.0591} \quad (\text{at } 25^\circ\text{C.})$$

QUINHYDRONE ELECTRODE

The normal electrode potential (E_h) of the quinhydrone electrode referred to the normal hydrogen electrode at $t^\circ\text{C.}$ is given by the expression:

$$E_h = 0.7177 - 0.00074t$$

McILVAINE'S STANDARD BUFFER SOLUTIONS

Stock solution A: 0.1 molar citric acid ($\text{C}_6\text{H}_8\text{O}_7$) solution.

Stock solution B: 0.2 molar disodium phosphate (Na_2HPO_4) solution.

pH	Soln. A cc	Soln. B cc	pH	Soln. A cc	Soln. B cc
2.2	19.60	0.40	5.2	9.28	10.72
2.4	18.76	1.24	5.4	8.85	11.15
2.6	17.82	2.18	5.6	8.40	11.60
2.8	16.83	3.17	5.8	7.91	12.09
3.0	15.89	4.11	6.0	7.37	12.63
3.2	15.06	4.94	6.2	6.78	13.22
3.4	14.30	5.70	6.4	6.15	13.85
3.6	13.56	6.44	6.6	5.45	14.55
3.8	12.90	7.10	6.8	4.55	15.45
4.0	12.29	7.71	7.0	3.53	16.47
4.2	11.72	8.28	7.2	2.61	17.39
4.4	11.18	8.82	7.4	1.83	18.17
4.6	10.65	9.35	7.6	1.27	18.73
4.8	10.14	9.86	7.8	0.85	19.15
5.0	9.70	10.30	8.0	0.55	19.45

pH VALUES FOR POTENTIOMETER READINGS

Harold V. Gaskill

The following table presents pH values for various potentiometer readings using the quinhydrone half-cell and saturated calomel half-cell at 25°C. The argument is potential in millivolts and the table entries are in terms of pH.

The table was constructed upon the following formula:

$$\text{pH} = \frac{0.4538 - E_q}{0.0591}$$

in which E_q is the observed potential in volts.¹

The temperature factor is 0.77 millivolts per degree, to be added above 25°C and subtracted below 25°C.

Polarity is reversed above 7.68 pH.

Milli-volts	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0	7.6785	7.6768	7.6751	7.6734	7.6717	7.6700	7.6683	7.6667	7.6650	7.6633
1	7.6616	7.6599	7.6582	7.6565	7.6548	7.6531	7.6514	7.6497	7.6480	7.6464
2	7.6447	7.6430	7.6413	7.6396	7.6379	7.6362	7.6345	7.6328	7.6311	7.6294
3	7.6277	7.6260	7.6244	7.6227	7.6210	7.6193	7.6176	7.6159	7.6142	7.6125
4	7.6108	7.6091	7.6074	7.6057	7.6040	7.6024	7.6007	7.5990	7.5973	7.5956
5	7.5939	7.5922	7.5905	7.5888	7.5871	7.5854	7.5837	7.5821	7.5804	7.5787
6	7.5770	7.5753	7.5736	7.5719	7.5702	7.5685	7.5668	7.5651	7.5634	7.5617
7	7.5601	7.5584	7.5567	7.5550	7.5533	7.5516	7.5499	7.5482	7.5465	7.5448
8	7.5431	7.5414	7.5398	7.5381	7.5364	7.5347	7.5330	7.5313	7.5296	7.5279
9	7.5262	7.5245	7.5228	7.5211	7.5194	7.5178	7.5161	7.5144	7.5127	7.5110
10	7.5093	7.5076	7.5059	7.5042	7.5025	7.5008	7.4991	7.4975	7.4958	7.4941
11	7.4924	7.4907	7.4890	7.4873	7.4856	7.4839	7.4822	7.4805	7.4788	7.4771
12	7.4755	7.4738	7.4721	7.4704	7.4687	7.4671	7.4653	7.4636	7.4619	7.4602
13	7.4585	7.4568	7.4551	7.4535	7.4518	7.4501	7.4484	7.4467	7.4450	7.4433
14	7.4416	7.4399	7.4382	7.4365	7.4348	7.4332	7.4315	7.4298	7.4281	7.4264
15	7.4247	7.4230	7.4213	7.4196	7.4179	7.4162	7.4145	7.4128	7.4112	7.4095
16	7.4078	7.4061	7.4044	7.4027	7.4010	7.3993	7.3976	7.3959	7.3942	7.3925
17	7.3909	7.3892	7.3875	7.3858	7.3841	7.3824	7.3807	7.3790	7.3773	7.3756
18	7.3739	7.3722	7.3705	7.3689	7.3672	7.3655	7.3638	7.3621	7.3604	7.3587
19	7.3570	7.3553	7.3536	7.3519	7.3502	7.3486	7.3469	7.3452	7.3435	7.3418
20	7.3401	7.3384	7.3367	7.3350	7.3333	7.3316	7.3299	7.3282	7.3266	7.3249
21	7.3232	7.3215	7.3198	7.3181	7.3164	7.3147	7.3130	7.3113	7.3096	7.3079
22	7.3062	7.3046	7.3029	7.3012	7.2995	7.2978	7.2961	7.2944	7.2927	7.2910
23	7.2893	7.2876	7.2859	7.2843	7.2826	7.2809	7.2792	7.2775	7.2758	7.2741
24	7.2724	7.2707	7.2690	7.2673	7.2656	7.2639	7.2623	7.2606	7.2589	7.2572
25	7.2565	7.2538	7.2521	7.2504	7.2487	7.2470	7.2453	7.2436	7.2420	7.2403
26	7.2386	7.2369	7.2352	7.2335	7.2318	7.2301	7.2284	7.2267	7.2250	7.2233
27	7.2216	7.2200	7.2183	7.2166	7.2149	7.2132	7.2115	7.2098	7.2081	7.2064
28	7.2047	7.2030	7.2013	7.1997	7.1980	7.1963	7.1946	7.1929	7.1912	7.1895
29	7.1878	7.1861	7.1844	7.1827	7.1810	7.1793	7.1777	7.1760	7.1743	7.1726
30	7.1709	7.1692	7.1675	7.1658	7.1641	7.1624	7.1607	7.1590	7.1573	7.1557
31	7.1540	7.1523	7.1506	7.1489	7.1472	7.1455	7.1438	7.1421	7.1404	7.1387
32	7.1370	7.1354	7.1337	7.1320	7.1303	7.1286	7.1269	7.1252	7.1235	7.1218
33	7.1201	7.1184	7.1167	7.1150	7.1134	7.1117	7.1100	7.1083	7.1066	7.1049
34	7.1032	7.1015	7.0998	7.0981	7.0964	7.0947	7.0931	7.0914	7.0897	7.0880

¹ From formula number 1, p. 405, Clark, W. M., The determination of hydrogen ions, Baltimore, 1928; and, Bayer, L. D., Soil Science, 1926, **21**, 3, 167-180.

pH VALUES FOR POTENTIOMETER READINGS (Continued)

Milli-volts	0	.1	.2	.3	.4	.5	.6	.7	.8	.9
35	7.0863	7.0846	7.0829	7.0812	7.0795	7.0778	7.0761	7.0744	7.0727	7.0711
36	7.0694	7.0677	7.0660	7.0643	7.0626	7.0609	7.0592	7.0575	7.0558	7.0541
37	7.0524	7.0508	7.0491	7.0474	7.0457	7.0440	7.0423	7.0406	7.0389	7.0372
38	7.0355	7.0338	7.0321	7.0304	7.0288	7.0271	7.0254	7.0237	7.0220	7.0203
39	7.0186	7.0169	7.0152	7.0135	7.0118	7.0101	7.0084	7.0068	7.0051	7.0034
40	7.0017	7.0000	6.9983	6.9966	6.9949	6.9932	6.9915	6.9898	6.9881	6.9865
41	6.9848	6.9831	6.9814	6.9797	6.9780	6.9763	6.9746	6.9729	6.9712	6.9695
42	6.9678	6.9661	6.9645	6.9628	6.9611	6.9594	6.9577	6.9560	6.9543	6.9526
43	6.9509	6.9492	6.9475	6.9458	6.9442	6.9425	6.9408	6.9391	6.9374	6.9357
44	6.9340	6.9323	6.9306	6.9289	6.9272	6.9255	6.9238	6.9222	6.9205	6.9188
45	6.9171	6.9154	6.9137	6.9120	6.9103	6.9086	6.9069	6.9052	6.9035	6.9019
46	6.9002	6.8985	6.8968	6.8951	6.8934	6.8917	6.8900	6.8883	6.8866	6.8849
47	6.8832	6.8815	6.8799	6.8782	6.8765	6.8748	6.8731	6.8714	6.8697	6.8680
48	6.8663	6.8646	6.8629	6.8612	6.8595	6.8579	6.8562	6.8545	6.8528	6.8511
49	6.8494	6.8477	6.8460	6.8443	6.8426	6.8409	6.8392	6.8376	6.8359	6.8342
50	6.8325	6.8308	6.8291	6.8274	6.8257	6.8240	6.8223	6.8206	6.8189	6.8172
51	6.8156	6.8139	6.8122	6.8105	6.8088	6.8071	6.8054	6.8037	6.8020	6.8003
52	6.7986	6.7969	6.7953	6.7936	6.7919	6.7902	6.7885	6.7868	6.7851	6.7834
53	6.7817	6.7800	6.7783	6.7766	6.7749	6.7733	6.7716	6.7699	6.7682	6.7665
54	6.7648	6.7631	6.7614	6.7597	6.7580	6.7563	6.7546	6.7530	6.7513	6.7496
55	6.7479	6.7462	6.7445	6.7428	6.7411	6.7394	6.7377	6.7360	6.7343	6.7326
56	6.7310	6.7293	6.7276	6.7259	6.7242	6.7225	6.7208	6.7191	6.7174	6.7157
57	6.7140	6.7123	6.7106	6.7090	6.7073	6.7056	6.7039	6.7022	6.7005	6.6988
58	6.6971	6.6954	6.6937	6.6920	6.6903	6.6887	6.6870	6.6853	6.6836	6.6819
59	6.6802	6.6785	6.6768	6.6751	6.6734	6.6717	6.6700	6.6683	6.6667	6.6650
60	6.6633	6.6616	6.6599	6.6582	6.6565	6.6548	6.6531	6.6514	6.6497	6.6480
61	6.6464	6.6447	6.6430	6.6413	6.6396	6.6379	6.6362	6.6345	6.6328	6.6311
62	6.6294	6.6277	6.6260	6.6244	6.6227	6.6210	6.6193	6.6176	6.6159	6.6142
63	6.6125	6.6108	6.6091	6.6074	6.6057	6.6040	6.6024	6.6007	6.5990	6.5973
64	6.5956	6.5939	6.5922	6.5905	6.5888	6.5871	6.5854	6.5837	6.5821	6.5804
65	6.5787	6.5770	6.5753	6.5736	6.5719	6.5702	6.5685	6.5668	6.5651	6.5634
66	6.5617	6.5601	6.5584	6.5567	6.5550	6.5533	6.5516	6.5499	6.5482	6.5465
67	6.5448	6.5431	6.5414	6.5398	6.5381	6.5364	6.5347	6.5330	6.5313	6.5296
68	6.5279	6.5262	6.5245	6.5228	6.5211	6.5194	6.5178	6.5161	6.5144	6.5127
69	6.5110	6.5093	6.5076	6.5059	6.5042	6.5025	6.5008	6.4991	6.4975	6.4958
70	6.4941	6.4924	6.4907	6.4890	6.4873	6.4856	6.4839	6.4822	6.4805	6.4788
71	6.4771	6.4755	6.4738	6.4721	6.4704	6.4687	6.4670	6.4653	6.4636	6.4619
72	6.4602	6.4585	6.4568	6.4551	6.4535	6.4518	6.4501	6.4484	6.4467	6.4450
73	6.4433	6.4416	6.4399	6.4382	6.4365	6.4348	6.4332	6.4315	6.4298	6.4281
74	6.4264	6.4247	6.4230	6.4213	6.4196	6.4179	6.4162	6.4145	6.4128	6.4112
75	6.4095	6.4078	6.4061	6.4044	6.4027	6.4010	6.3993	6.3976	6.3959	6.3942
76	6.3925	6.3909	6.3892	6.3875	6.3858	6.3841	6.3824	6.3807	6.3790	6.3773
77	6.3756	6.3739	6.3722	6.3705	6.3689	6.3672	6.3655	6.3638	6.3621	6.3604
78	6.3587	6.3570	6.3553	6.3536	6.3519	6.3502	6.3486	6.3469	6.3452	6.3435
79	6.3418	6.3401	6.3384	6.3367	6.3350	6.3333	6.3316	6.3299	6.3282	6.3266
80	6.3249	6.3232	6.3215	6.3198	6.3181	6.3164	6.3147	6.3130	6.3113	6.3096
81	6.3079	6.3062	6.3046	6.3029	6.3012	6.2995	6.2978	6.2961	6.2944	6.2927
82	6.2910	6.2893	6.2876	6.2859	6.2843	6.2826	6.2809	6.2792	6.2775	6.2758
83	6.2741	6.2724	6.2707	6.2690	6.2673	6.2656	6.2639	6.2623	6.2606	6.2589
84	6.2572	6.2555	6.2538	6.2521	6.2504	6.2487	6.2470	6.2453	6.2436	6.2420

pH VALUES FOR POTENTIOMETER READINGS (Continued)

Milli-volts	0	.1	.2	.3	.4	.5	.6	.7	.8	.9
85	6.2403	6.2386	6.2369	6.2352	6.2335	6.2318	6.2301	6.2284	6.2267	6.2250
86	6.2233	6.2216	6.2200	6.2183	6.2166	6.2149	6.2132	6.2115	6.2098	6.2081
87	6.2054	6.2047	6.2030	6.2013	6.1997	6.1980	6.1963	6.1946	6.1929	6.1912
88	6.1895	6.1878	6.1861	6.1844	6.1827	6.1810	6.1793	6.1777	6.1760	6.1743
89	6.1726	6.1709	6.1692	6.1675	6.1658	6.1641	6.1624	6.1607	6.1590	6.1573
90	6.1557	6.1540	6.1523	6.1506	6.1489	6.1472	6.1455	6.1438	6.1421	6.1404
91	6.1387	6.1370	6.1354	6.1337	6.1320	6.1303	6.1286	6.1269	6.1252	6.1235
92	6.1218	6.1201	6.1184	6.1167	6.1150	6.1134	6.1117	6.1100	6.1083	6.1066
93	6.1049	6.1032	6.1015	6.0998	6.0981	6.0964	6.0947	6.0931	6.0914	6.0897
94	6.0880	6.0863	6.0846	6.0829	6.0812	6.0795	6.0778	6.0761	6.0744	6.0727
95	6.0711	6.0694	6.0677	6.0660	6.0643	6.0626	6.0609	6.0592	6.0575	6.0558
96	6.0541	6.0524	6.0508	6.0491	6.0474	6.0457	6.0440	6.0423	6.0406	6.0389
97	6.0372	6.0355	6.0338	6.0321	6.0304	6.0288	6.0271	6.0254	6.0237	6.0220
98	6.0203	6.0186	6.0169	6.0152	6.0135	6.0118	6.0101	6.0084	6.0068	6.0051
99	6.0034	6.0017	6.0000	5.9983	5.9966	5.9949	5.9932	5.9915	5.9898	5.9881
100	5.9865	5.9848	5.9831	5.9814	5.9797	5.9780	5.9763	5.9746	5.9729	5.9712
101	5.9695	5.9678	5.9661	5.9645	5.9628	5.9611	5.9594	5.9577	5.9560	5.9543
102	5.9526	5.9509	5.9492	5.9475	5.9458	5.9442	5.9425	5.9408	5.9391	5.9374
103	5.9357	5.9340	5.9323	5.9306	5.9289	5.9272	5.9255	5.9238	5.9222	5.9205
104	5.9188	5.9171	5.9154	5.9137	5.9120	5.9103	5.9086	5.9069	5.9052	5.9035
105	5.9019	5.9002	5.8985	5.8968	5.8951	5.8934	5.8917	5.8900	5.8883	5.8866
106	5.8849	5.8832	5.8815	5.8799	5.8782	5.8765	5.8748	5.8731	5.8714	5.8697
107	5.8680	5.8663	5.8646	5.8629	5.8612	5.8595	5.8579	5.8562	5.8545	5.8528
108	5.8511	5.8494	5.8477	5.8460	5.8443	5.8426	5.8409	5.8392	5.8376	5.8359
109	5.8342	5.8325	5.8308	5.8291	5.8274	5.8257	5.8240	5.8223	5.8206	5.8189
110	5.8172	5.8156	5.8139	5.8122	5.8105	5.8088	5.8071	5.8054	5.8037	5.8020
111	5.8003	5.7986	5.7969	5.7953	5.7936	5.7919	5.7902	5.7885	5.7868	5.7851
112	5.7834	5.7817	5.7800	5.7783	5.7766	5.7749	5.7733	5.7716	5.7699	5.7682
113	5.7665	5.7648	5.7631	5.7614	5.7597	5.7580	5.7563	5.7546	5.7530	5.7513
114	5.7496	5.7479	5.7462	5.7445	5.7428	5.7411	5.7394	5.7377	5.7360	5.7343
115	5.7326	5.7310	5.7293	5.7276	5.7259	5.7242	5.7225	5.7208	5.7191	5.7174
116	5.7157	5.7140	5.7123	5.7106	5.7090	5.7073	5.7056	5.7039	5.7022	5.7005
117	5.6988	5.6971	5.6954	5.6937	5.6920	5.6903	5.6887	5.6870	5.6853	5.6836
118	5.6819	5.6802	5.6785	5.6768	5.6751	5.6734	5.6717	5.6700	5.6683	5.6667
119	5.6650	5.6633	5.6616	5.6599	5.6582	5.6565	5.6548	5.6531	5.6514	5.6497
120	5.6480	5.6464	5.6447	5.6430	5.6413	5.6396	5.6379	5.6362	5.6345	5.6328
121	5.6311	5.6294	5.6277	5.6260	5.6244	5.6227	5.6210	5.6193	5.6176	5.6159
122	5.6142	5.6125	5.6108	5.6091	5.6074	5.6057	5.6040	5.6024	5.6007	5.5990
123	5.5973	5.5956	5.5939	5.5922	5.5905	5.5888	5.5871	5.5854	5.5837	5.5821
124	5.5804	5.5787	5.5770	5.5753	5.5736	5.5719	5.5702	5.5685	5.5668	5.5651
125	5.5634	5.5617	5.5601	5.5584	5.5567	5.5550	5.5533	5.5516	5.5499	5.5482
126	5.5465	5.5448	5.5431	5.5414	5.5398	5.5381	5.5364	5.5347	5.5330	5.5313
127	5.5296	5.5279	5.5262	5.5245	5.5228	5.5211	5.5194	5.5178	5.5161	5.5144
128	5.5127	5.5110	5.5093	5.5076	5.5059	5.5042	5.5025	5.5008	5.4991	5.4975
129	5.4958	5.4941	5.4924	5.4907	5.4890	5.4873	5.4856	5.4839	5.4822	5.4805
130	5.4788	5.4771	5.4755	5.4738	5.4721	5.4704	5.4687	5.4670	5.4653	5.4636
131	5.4619	5.4602	5.4585	5.4568	5.4551	5.4535	5.4518	5.4501	5.4484	5.4467
132	5.4450	5.4433	5.4416	5.4399	5.4382	5.4365	5.4348	5.4332	5.4315	5.4298
133	5.4281	5.4264	5.4247	5.4230	5.4213	5.4196	5.4179	5.4162	5.4145	5.4128
134	5.4112	5.4095	5.4078	5.4061	5.4044	5.4027	5.4010	5.3993	5.3976	5.3959

pH VALUES FOR POTENTIOMETER READINGS (Continued)

Milli-volts	0	.1	.2	.3	.4	.5	.6	.7	.8	.9
135	5.3942	5.3925	5.3909	5.3892	5.3875	5.3858	5.3841	5.3824	5.3807	5.3790
136	5.3773	5.3756	5.3739	5.3722	5.3705	5.3689	5.3672	5.3655	5.3638	5.3621
137	5.3604	5.3587	5.3570	5.3553	5.3536	5.3519	5.3502	5.3486	5.3469	5.3452
138	5.3435	5.3418	5.3401	5.3384	5.3367	5.3350	5.3333	5.3316	5.3299	5.3282
139	5.3266	5.3249	5.3232	5.3215	5.3198	5.3181	5.3164	5.3147	5.3130	5.3113
140	5.3096	5.3079	5.3062	5.3046	5.3029	5.3012	5.2995	5.2978	5.2961	5.2944
141	5.2927	5.2910	5.2893	5.2876	5.2859	5.2843	5.2826	5.2809	5.2792	5.2775
142	5.2758	5.2741	5.2724	5.2707	5.2690	5.2673	5.2656	5.2639	5.2623	5.2606
143	5.2589	5.2572	5.2555	5.2538	5.2521	5.2504	5.2487	5.2470	5.2453	5.2436
144	5.2420	5.2403	5.2386	5.2369	5.2352	5.2335	5.2318	5.2301	5.2284	5.2267
145	5.2250	5.2233	5.2216	5.2200	5.2183	5.2166	5.2149	5.2132	5.2115	5.2098
146	5.2081	5.2064	5.2047	5.2030	5.2013	5.1997	5.1980	5.1963	5.1946	5.1929
147	5.1912	5.1895	5.1878	5.1861	5.1844	5.1827	5.1810	5.1793	5.1777	5.1760
148	5.1743	5.1726	5.1709	5.1692	5.1675	5.1658	5.1641	5.1624	5.1607	5.1590
149	5.1573	5.1557	5.1540	5.1523	5.1506	5.1489	5.1472	5.1455	5.1438	5.1421
150	5.1404	5.1387	5.1370	5.1354	5.1337	5.1320	5.1303	5.1286	5.1269	5.1252
151	5.1235	5.1218	5.1201	5.1184	5.1167	5.1150	5.1134	5.1117	5.1100	5.1083
152	5.1066	5.1049	5.1032	5.1015	5.0998	5.0981	5.0964	5.0947	5.0931	5.0914
153	5.0897	5.0880	5.0863	5.0846	5.0829	5.0812	5.0795	5.0778	5.0761	5.0744
154	5.0727	5.0711	5.0694	5.0677	5.0660	5.0643	5.0626	5.0609	5.0592	5.0575
155	5.0558	5.0541	5.0524	5.0508	5.0491	5.0474	5.0457	5.0440	5.0423	5.0406
156	5.0389	5.0372	5.0355	5.0338	5.0321	5.0304	5.0288	5.0271	5.0254	5.0237
157	5.0220	5.0203	5.0186	5.0169	5.0152	5.0135	5.0118	5.0101	5.0084	5.0068
158	5.0051	5.0034	5.0017	5.0000	4.9983	4.9966	4.9949	4.9932	4.9915	4.9898
159	4.9881	4.9865	4.9848	4.9831	4.9814	4.9797	4.9780	4.9763	4.9746	4.9729
160	4.9712	4.9695	4.9678	4.9661	4.9645	4.9628	4.9611	4.9594	4.9577	4.9560
161	4.9543	4.9526	4.9509	4.9492	4.9475	4.9458	4.9442	4.9425	4.9408	4.9391
162	4.9374	4.9357	4.9340	4.9323	4.9306	4.9289	4.9272	4.9255	4.9238	4.9222
163	4.9205	4.9188	4.9171	4.9154	4.9137	4.9120	4.9103	4.9086	4.9069	4.9052
164	4.9035	4.9019	4.9002	4.8985	4.8968	4.8951	4.8934	4.8917	4.8900	4.8883
165	4.8866	4.8849	4.8832	4.8815	4.8799	4.8782	4.8765	4.8748	4.8731	4.8714
166	4.8697	4.8680	4.8663	4.8646	4.8629	4.8612	4.8595	4.8579	4.8562	4.8545
167	4.8528	4.8511	4.8494	4.8477	4.8460	4.8443	4.8426	4.8409	4.8392	4.8376
168	4.8359	4.8342	4.8325	4.8308	4.8291	4.8274	4.8257	4.8240	4.8223	4.8206
169	4.8189	4.8172	4.8156	4.8139	4.8122	4.8105	4.8088	4.8071	4.8054	4.8037
170	4.8020	4.8003	4.7986	4.7969	4.7953	4.7936	4.7919	4.7902	4.7885	4.7868
171	4.7851	4.7834	4.7817	4.7800	4.7783	4.7766	4.7749	4.7732	4.7716	4.7699
172	4.7682	4.7665	4.7648	4.7631	4.7614	4.7597	4.7580	4.7563	4.7546	4.7530
173	4.7513	4.7496	4.7479	4.7462	4.7445	4.7428	4.7411	4.7394	4.7377	4.7360
174	4.7343	4.7326	4.7310	4.7293	4.7276	4.7259	4.7242	4.7225	4.7208	4.7191
175	4.7174	4.7157	4.7140	4.7123	4.7106	4.7090	4.7073	4.7056	4.7039	4.7022
176	4.7005	4.6988	4.6971	4.6954	4.6937	4.6920	4.6903	4.6887	4.6870	4.6853
177	4.6836	4.6819	4.6802	4.6785	4.6768	4.6751	4.6734	4.6717	4.6700	4.6683
178	4.6667	4.6650	4.6633	4.6616	4.6599	4.6582	4.6565	4.6548	4.6531	4.6514
179	4.6497	4.6480	4.6464	4.6447	4.6430	4.6413	4.6396	4.6379	4.6362	4.6345
180	4.6328	4.6311	4.6294	4.6277	4.6260	4.6244	4.6227	4.6210	4.6193	4.6176
181	4.6159	4.6142	4.6125	4.6108	4.6091	4.6074	4.6057	4.6040	4.6024	4.6007
182	4.5990	4.5973	4.5956	4.5939	4.5922	4.5905	4.5888	4.5871	4.5854	4.5837
183	4.5821	4.5804	4.5787	4.5770	4.5753	4.5736	4.5719	4.5702	4.5685	4.5668
184	4.5651	4.5634	4.5617	4.5601	4.5584	4.5567	4.5550	4.5533	4.5516	4.5499

pH VALUES FOR POTENTIOMETER READINGS (Continued)

Milli-volts	0	.1	.2	.3	.4	.5	.6	.7	.8	.9
185	4.5482	4.5465	4.5448	4.5431	4.5414	4.5398	4.5381	4.5364	4.5347	4.5330
186	4.5313	4.5296	4.5279	4.5262	4.5245	4.5228	4.5211	4.5194	4.5178	4.5161
187	4.5144	4.5127	4.5110	4.5093	4.5076	4.5059	4.5042	4.5025	4.5008	4.4991
188	4.4975	4.4958	4.4941	4.4924	4.4907	4.4890	4.4873	4.4856	4.4839	4.4822
189	4.4805	4.4788	4.4771	4.4755	4.4738	4.4721	4.4704	4.4687	4.4670	4.4653
190	4.4636	4.4619	4.4602	4.4585	4.4568	4.4551	4.4535	4.4518	4.4501	4.4484
191	4.4467	4.4450	4.4433	4.4416	4.4399	4.4382	4.4365	4.4348	4.4332	4.4315
192	4.4298	4.4281	4.4264	4.4247	4.4230	4.4213	4.4196	4.4179	4.4162	4.4145
193	4.4128	4.4112	4.4095	4.4078	4.4061	4.4044	4.4027	4.4010	4.3993	4.3976
194	4.3959	4.3942	4.3925	4.3909	4.3892	4.3875	4.3858	4.3841	4.3824	4.3807
195	4.3790	4.3773	4.3756	4.3739	4.3722	4.3705	4.3689	4.3672	4.3655	4.3638
196	4.3621	4.3604	4.3587	4.3570	4.3553	4.3536	4.3519	4.3502	4.3486	4.3469
197	4.3452	4.3435	4.3418	4.3401	4.3384	4.3367	4.3350	4.3333	4.3316	4.3299
198	4.3282	4.3266	4.3249	4.3232	4.3215	4.3198	4.3181	4.3164	4.3147	4.3130
199	4.3113	4.3096	4.3079	4.3062	4.3046	4.3029	4.3012	4.2995	4.2978	4.2961

POLARITY REVERSED

0	7.6785	7.6802	7.6819	7.6836	7.6853	7.6870	7.6887	7.6903	7.6920	7.6937
1	7.6954	7.6971	7.6988	7.7005	7.7022	7.7039	7.7056	7.7073	7.7090	7.7106
2	7.7123	7.7140	7.7157	7.7174	7.7191	7.7208	7.7225	7.7242	7.7259	7.7276
3	7.7293	7.7310	7.7326	7.7343	7.7360	7.7377	7.7394	7.7411	7.7428	7.7445
4	7.7462	7.7479	7.7496	7.7513	7.7530	7.7546	7.7563	7.7580	7.7597	7.7614
5	7.7631	7.7648	7.7665	7.7682	7.7699	7.7716	7.7733	7.7749	7.7766	7.7783
6	7.7800	7.7817	7.7834	7.7851	7.7868	7.7885	7.7902	7.7919	7.7936	7.7953
7	7.7969	7.7986	7.8003	7.8020	7.8037	7.8054	7.8071	7.8088	7.8105	7.8122
8	7.8139	7.8156	7.8172	7.8189	7.8206	7.8223	7.8240	7.8257	7.8274	7.8291
9	7.8308	7.8325	7.8342	7.8359	7.8376	7.8392	7.8409	7.8426	7.8443	7.8460
10	7.8477	7.8494	7.8511	7.8528	7.8545	7.8562	7.8579	7.8595	7.8612	7.8629
11	7.8646	7.8663	7.8680	7.8697	7.8714	7.8731	7.8748	7.8765	7.8782	7.8799
12	7.8815	7.8832	7.8849	7.8866	7.8883	7.8900	7.8917	7.8934	7.8951	7.8968
13	7.8985	7.9002	7.9019	7.9035	7.9052	7.9069	7.9086	7.9103	7.9120	7.9137
14	7.9154	7.9171	7.9188	7.9205	7.9222	7.9238	7.9255	7.9272	7.9289	7.9306
15	7.9323	7.9340	7.9357	7.9374	7.9391	7.9408	7.9425	7.9442	7.9458	7.9475
16	7.9492	7.9509	7.9526	7.9543	7.9560	7.9577	7.9594	7.9611	7.9628	7.9645
17	7.9661	7.9678	7.9695	7.9712	7.9729	7.9746	7.9763	7.9780	7.9797	7.9814
18	7.9831	7.9848	7.9865	7.9881	7.9898	7.9915	7.9932	7.9949	7.9966	7.9983
19	8.0000	8.0017	8.0034	8.0051	8.0068	8.0084	8.0101	8.0118	8.0135	8.0152
20	8.0169	8.0186	8.0203	8.0220	8.0237	8.0254	8.0271	8.0288	8.0304	8.0321
21	8.0338	8.0355	8.0372	8.0389	8.0406	8.0423	8.0440	8.0457	8.0474	8.0491
22	8.0508	8.0524	8.0541	8.0558	8.0575	8.0592	8.0609	8.0626	8.0643	8.0660
23	8.0677	8.0694	8.0711	8.0727	8.0744	8.0761	8.0778	8.0795	8.0812	8.0829
24	8.0846	8.0862	8.0880	8.0897	8.0914	8.0931	8.0947	8.0964	8.0981	8.0998
25	8.1015	8.1032	8.1049	8.1066	8.1083	8.1100	8.1117	8.1134	8.1150	8.1167
26	8.1184	8.1201	8.1218	8.1235	8.1252	8.1269	8.1286	8.1303	8.1320	8.1337
27	8.1354	8.1370	8.1387	8.1404	8.1421	8.1438	8.1455	8.1472	8.1489	8.1506
28	8.1523	8.1540	8.1557	8.1573	8.1590	8.1607	8.1624	8.1641	8.1658	8.1675
29	8.1692	8.1709	8.1726	8.1743	8.1760	8.1777	8.1793	8.1810	8.1827	8.1844

APPROXIMATE pH VALUES

The following tables give approximate pH values for a number of substances such as acids, bases, foods, biological fluids, etc. All values are rounded off to the nearest tenth and are based on measurements made at 25° C. A few buffer systems with their pH values are also given.

From Modern pH and Chlorine Control, W. A. Taylor & Co., by permission

ACIDS

Hydrochloric, N.....	0.1	Formic, 0.1N.....	2.3
Hydrochloric, 0.1N.....	1.1	Lactic, 0.1N.....	2.4
Hydrochloric, 0.01N.....	2.0	Acetic, N.....	2.4
Sulfuric, N.....	0.3	Acetic, 0.1N.....	2.9
Sulfuric, 0.1N.....	1.2	Acetic, 0.01N.....	3.4
Sulfuric, 0.01N.....	2.1	Benzoic, 0.01N.....	3.1
Orthophosphoric, 0.1N.....	1.5	Alum, 0.1N.....	3.2
Sulfurous, 0.1N.....	1.5	Carbonic (saturated).....	3.8
Oxalic, 0.1N.....	1.6	Hydrogen sulfide, 0.1N.....	4.1
Tartaric, 0.1N.....	2.2	Arsenious (saturated).....	5.0
Malic, 0.1N.....	2.2	Hydrocyanic, 0.1N.....	5.1
Citric, 0.1N.....	2.2	Boric, 0.1N.....	5.2

BASES

Sodium hydroxide, N.....	14.0	Ammonia, N.....	11.6
Sodium hydroxide, 0.1N.....	13.0	Ammonia, 0.1N.....	11.1
Sodium hydroxide, 0.01N.....	12.0	Ammonia, 0.01N.....	10.6
Potassium hydroxide, N.....	14.0	Potassium cyanide, 0.1N.....	11.0
Potassium hydroxide, 0.1N.....	13.0	Magnesia (saturated).....	10.5
Potassium hydroxide, 0.01N.....	12.0	Sodium sesquicarbonate, 0.1M.....	10.1
Sodium metasilicate, 0.1N.....	12.6	Ferrous hydroxide (saturated).....	9.5
Lime (saturated).....	12.4	Calcium carbonate (saturated).....	9.4
Trisodium phosphate, 0.1N.....	12.0	Borax, 0.1N.....	9.2
Sodium carbonate, 0.1N.....	11.6	Sodium bicarbonate, 0.1N.....	8.4

BIOLOGIC MATERIALS

Blood, plasma, human.....	7.3-7.5	Duodenal contents, human.....	4.8-8.2
Spinal fluid, human.....	7.3-7.5	Feces, human.....	4.6-8.4
Blood, whole, dog.....	6.9-7.2	Urine, human.....	4.8-8.4
Saliva, human.....	6.5-7.5	Milk, human.....	6.6-7.6
Gastric contents, human.....	1.0-3.0	Bile, human.....	6.8-7.0

FOODS

Apples.....	2.9-3.3	Milk, cows.....	6.3-6.6
Apricots.....	3.6-4.0	Olives.....	3.6-3.8
Asparagus.....	5.4-5.8	Oranges.....	3.0-4.0
Bananas.....	4.5-4.7	Oysters.....	6.1-6.6
Beans.....	5.0-6.0	Peaches.....	3.4-3.6
Beers.....	4.0-5.0	Pears.....	3.6-4.0
Beets.....	4.9-5.5	Peas.....	5.8-6.4
Blackberries.....	3.2-3.6	Pickles, dill.....	3.2-3.6
Bread, white.....	5.0-6.0	Pickles, sour.....	3.0-3.4
Butter.....	6.1-6.4	Pimento.....	4.6-5.2
Cabbage.....	5.2-5.4	Plums.....	2.8-3.0
Carrots.....	4.9-5.3	Potatoes.....	5.6-6.0
Cheese.....	4.8-6.4	Pumpkin.....	4.8-5.2
Cherries.....	3.2-4.0	Raspberries.....	3.2-3.6
Cider.....	2.9-3.3	Rhubarb.....	3.1-3.2
Corn.....	6.0-6.5	Salmon.....	6.1-6.3
Crackers.....	6.5-8.5	Sauerkraut.....	3.4-3.6
Dates.....	6.2-6.4	Shrimp.....	6.8-7.0
Eggs, fresh white.....	7.6-8.0	Soft drinks.....	2.0-4.0
Flour, wheat.....	5.5-6.5	Spinach.....	5.1-5.7
Gooseberries.....	2.8-3.0	Squash.....	5.0-5.4
Grapefruit.....	3.0-3.3	Strawberries.....	3.0-3.5
Grapes.....	3.5-4.5	Sweet potatoes.....	5.3-5.6
Hominy (lye).....	6.8-8.0	Tomatoes.....	4.0-4.4
Jams, fruit.....	3.5-4.0	Tuna.....	5.9-6.1
Jellies, fruit.....	2.8-3.4	Turnips.....	5.2-5.6
Lemons.....	2.2-2.4	Vinegar.....	2.4-3.4
Limes.....	1.8-2.0	Water, drinking.....	6.5-8.0
Maple syrup.....	6.5-7.0	Wines.....	2.8-3.8

APPROXIMATE pH VALUES (Continued)

BUFFER SYSTEMS

The following table gives some common buffer systems and the approximate pH of maximum buffer capacity. The zone of effective buffer action will vary with concentration but, for concentrations approximately 0.1 molar, the general average will be ± 1.0 pH from the value given.

Glycocoll-sodium chloride-hydrochloric acid.....	2.0
Potassium acid phthalate-hydrochloric acid.....	2.8
Primary potassium citrate.....	3.7
Acetic acid-sodium acetate.....	4.6
Potassium acid phthalate-sodium hydroxide.....	5.0
Secondary sodium citrate.....	5.0
Potassium acid phosphate-disodium phosphate.....	6.8
Potassium acid phosphate-sodium hydroxide.....	6.8
Boric acid-borax.....	8.5
Borax.....	9.2
Boric acid-sodium hydroxide.....	9.2
Sodium bicarbonate-sodium carbonate.....	10.2
Disodium phosphate-sodium hydroxide.....	11.5

POLAROGRAPHIC ANALYSIS

Courtesy E. H. Sargent and Co., 155-165 East Superior Street, Chicago, Illinois.

All values in the following tables are volts referred to the normal calomel electrode.

Table I
Cathodic Reduction Potentials of Metals (Half Wave)

Name	Val- ence	Neutral or acid	Alkali	Ammo- nia- Ammo- nium Chlo- ride	Cya- nide	Citrate or Tar- trate	Thio- cya- nate	Ammo- nium- Car- bonate	Pyri- dine
Aluminum...	3	-1.7							
Ammonium...	1	-2.09							
Antimony...	3	-0.2	-1.8		-1.13				
Barium...	2	-1.94							
Bismuth...	3	-0.1				-0.35			
Cadmium...	2	-0.68	-0.80	-0.85	-1.13	-0.80			
Calcium...	2	-2.23							
Cesium...	1	-2.1							
Chromium...	2	-1.42	-2.0	-1.74					
Chromium...	3	-0.7		-1.46					
Chromium...	6		-0.36	-0.36					
Cobalt...	2	-1.23	-1.44	-1.32	-1.23		-1.07		-1.11
Cobalt...	3	-0.4		-0.4					
Copper...	2	-0.03		-0.27		-0.14			
Copper...	1	-0.03		-0.54		-0.14			
Gallium...	3	-1.23							
Gold...	1		-1.2		-1.5				
Gold...	3		-0.55						
Hydrogen...	1	-1.60							
Indium...	3	-0.63	-1.2						
Iron...	2	-1.33	-1.56	-1.52					
Iron...	3	-0.1(?)							
Lead...	2	-0.46	-0.81		-0.73	-0.6			
Lithium...	1	-2.31	-2.31						
Manganese...	2	-1.53	-1.7	-1.69	-1.36		-1.58		
Manganese...	3		-1.3						
Manganese...	4					-1.1			
Manganese...	6		-0.2						
Nickel...	2	-1.09		-1.13	-1.43		-0.74		-0.82
Potassium...	1	-2.17	-2.17						
Radium...	2	-1.88							
Rhenium...	7	-1.2	-1.2	-1.2					
Rubidium...	1	-2.07	-2.07						
Selenium...	4			-1.6		-1.6			
Sodium...	1	-2.15	-2.15						
Strontium...	2	-2.13	-2.13						
Tellurium...	4		-0.7	-0.75		-0.9			
Thallium...	1	-0.50	-0.50	-0.50	-0.50	-0.50			
Tin...	2	-0.47	-1.1						
Titanium...	4	-0.98							
Uranium...	4							-1.45	
Uranium...	6	-0.14	-0.9					-0.83	
Vanadium...	5			-1.23					
Zinc...	2	-1.06	-1.41	-1.38					

POLAROGRAPHIC ANALYSIS (Continued)

Table II
Cathodic Reduction Potentials of Anions (Half Wave)

Bromate (alkaline).....	-1.7
Bromate (acid).....	-0.17
Iodate (alkaline).....	-1.1
Iodate (neutral).....	-1.1
Nitrate (in N/10 lanthanum chloride).....	-1.3
Nitrite (in N/10 lanthanum chloride).....	-1.3
Sulfite (acid).....	-0.2

Table III
Anodic Oxidation Potentials of Metals (Half Wave)

Metal	Valence	Normal Alkali	Normal Ammonia with Ammonium Chloride	Molar Citrate or Tartrate
Iron.....	2	.....	+0.1	.....
Manganese.....	2	.....	.....	-0.4
Tin.....	2	-0.6	.....	-0.5

Table IV
Reversible Redox Potentials of Metals

Metal	Valence	Neutral or Acid	Normal Alkali	Normal Ammonia with Ammonium Chloride	Molar Citrate or Tartrate
Copper.....	1, 2	-0.06	.....	-0.25	-0.21
Iron.....	2, 3	.....	-0.9	.....	-0.49
Titanium.....	3, 4	.....	.....	.....	-0.48

Table V
Anodic Depolarization Potentials of Anions (Half Wave)

Bromide.....	+0.09	Sulfide.....	-0.63
Chloride.....	+0.22	Sulfite.....	-0.04
Cyanide.....	-0.37	Thiocyanate.....	+0.15
Hydroxide.....	+0.05	Thiosulfate.....	-0.27
Iodide.....	-0.09		

Table VI
Reduction Potentials of Dissolved Gases (Half Wave)

Oxygen.....	-0.3 to	-0.4
Sulfur dioxide.....		-0.3
Hydrogen peroxide.....		-1.1

POLAROGRAPHIC ANALYSIS (Continued)

Table VII
Tangent Potentials of Organic Substances
(Concentrations, 10^{-4} N)

	pH	Volts		pH	Volts
Acetaldehyde	3.9	-1.61	Fumaric acid	3.9	-1.70
"	7	-1.83	Furfural	3.9	-1.23
Acetoin	2	-1.14	Glyceric aldehyde	3.9	-1.45
Acetone	2	-1.28	Hematin	3.9	-1.37
Acetophenone	2	-1.12	Hymetomelanic acid	13	-1.4
"	3.9	-1.32	Hydroxybenzaldehyde (o)	3.9	-1.26
Acetylacetone	2	-1.20	Hydroxybenzo-phenone (p)	3.9	-1.2
"	3.9	-1.24	Isovaleric aldehyde	3.9	-1.61
Acetylene dicarboxylic acid	1	-0.45	Maleic acid	1	-0.54
Acetylene dicarboxylic acid	7	-1.90	"	7	-1.90
Acotinic acid	1	-0.66	Mesaconic acid	1	-0.66
"	7	-2.1	"	7	-1.8
Albumin in ammonium ion	4	-1.60	Methemoglobin	3.9	-1.26
Aminoazobenzene (p)	7	-0.48	Methylene blue	3.9	-0.11 & -1.2
Azobenzene	3.9	-0.18	Nicotinic acid	3.9	-1.03
Benzaldehyde	3.9	-1.26	* " " "	7	-1.74
Benzil	2	-0.20	Nitraniline (o)	1	-0.193
Benzilidene acetone	3.9	-1.06	" (m)	1	-0.112
Benzoin	2	-0.95	" (p)	1	-0.183
"	3.9	-1.19	Nitrobenzene	3.9	-0.35
Benzophenone	3.9	-0.90	Nitrophenol (o)	3.9	-0.32
"	2	-1.01	" (m)	3.9	-0.33
Benzoylacetone	2	-0.95	" (p)	3.9	-0.40
Butyraldehyde	7	-1.7	Oxalic acid	1	-1.2
Cinnamic acid	1.5	-1.10	Oxyhemoglobin	3.9	-0.06
"	7	-1.8	Propionic aldehyde	3.9	-1.61
Citraconic acid	1	-0.66	Pyridine	3.9	-1.30
Crotonaldehyde	3.9	-1.34	Pyroracemic acid	1	-0.39
Cystine	1	-0.4	"	7	-1.4
"	7	-0.8	Pyruvic acid	1	-0.4
Diacetyl	2	-0.40	"	7	-1.4
Dibenzoylmethane	2	-0.82	Quinhydrone	3.9	-0.02
Dimethylaminoazobenzene	7	-0.56	Quinine	13	-1.5
Dinitrobenzene (o)	3.9	-0.15 & -0.31	Quinoline	4	-1.07
" (m)	3.9	-0.20 & -0.33	* Riboflavin	7	-0.39
" (p)	3.9	-0.18 & -0.35	Saccharin	1	-1.0
Dinitrophenol:			"	7	-1.8
2:4:1	3.9	-0.13 & -0.31	Sorbinic acid	7	-1.90
2:5:1	3.9	-0.19	Sorbose	7	-1.80
2:6:1	3.9	-0.12 & -0.23	* Thiamine	7	-1.29
Diphenyl triketone	2	-0.25	Trimethyl azonium iodide	12.5	-1.7
Formaldehyde	3.9	-1.50	Vitamin C	7	-1.80
"	7	-1.64	Tetramethyl and tetraethyl ammonium ions, half wave potential -2.8		
Fructose	7	-1.80			
Fumaric acid	1	-0.54			

* Half wave.

Table VIII
Anode Potentials in the Presence of Stated Anions
At Normal Concentration

Chloride	0.0	Sulfite	-0.25
Bromide	-0.12	Iodide	-0.30
Sulfate	+0.20	Cyanide	-0.58
Nitrate	+0.30	Sulfide	-0.90
Hydroxide	-0.16		

STANDARD OXIDATION-REDUCTION POTENTIALS

VALUES, IN VOLTS, REFERRED TO THE HYDROGEN-HYDROGEN
ION COUPLE AS ZERO, ARE FOR UNIT ACTIVITIES AND
TEMPERATURE OF 25° C.

(From Latimer and Hildebrand, Reference Book of Inorganic Chemistry,
The Macmillan Co., Publishers, by permission.)

Reaction	E ₀	Reaction	E ₀
Li=Li ⁺ +E ⁻	+2.957	H ₂ =2H ⁺ +2E ⁻	0.000
Rb=Rb ⁺ +E ⁻	+2.924	2OH ⁻ +NO ₂ ⁻ =NO ₃ ⁻ +H ₂ O+	
K=K ⁺ +E ⁻	+2.922	2E ⁻	0.0
Sr=Sr ⁺⁺ +2E ⁻	+2.92	HCN+H ₂ O=HCNO+2H ⁺ +	
Ba=Ba ⁺⁺ +2E ⁻	+2.90	2E ⁻	0.0
Ca=Ca ⁺⁺ +2E ⁻	+2.87	Sb+3H ₂ O=H ₃ SbO ₃ +3H ⁺ +3E ⁻	ca 0.0
Na=Na ⁺ +E ⁻	+2.712	W+3H ₂ O=WO ₃ +6H ⁺ +6E ⁻	ca 0.0
Mg=Mg ⁺⁺ +2E ⁻	+2.40	WO ⁺⁺⁺ +2H ₂ O=WO ₃ +4H ⁺ +	
Al=Al ⁺⁺⁺ +3E ⁻	+1.7	E ⁻	ca 0.0
Be=Be ⁺⁺ +2E ⁻	+1.69	Ti ⁺⁺⁺ +H ₂ O=TiO ⁺⁺ +2H ⁺ +E ⁻	-0.04
U=U ⁺⁺ +4E ⁻	+1.4	Hg+2OH ⁻ =HgO+H ₂ O+2E ⁻	-0.099
Mn=Mn ⁺⁺ +2E ⁻	+1.1	Ag+Br ⁻ =AgBr+E ⁻	-0.10
CN ⁻ +2OH ⁻ =CNO ⁻ +H ₂ O+		2Hg+2Br ⁻ =Hg ₂ Br ₂ +2E ⁻	-0.13
2E ⁻	+0.97	Sn ⁺⁺ =Sn ⁺⁺⁺⁺ +2E ⁻	-0.13
Fe+2OH ⁻ =Fe(OH) ₂ +2E ⁻	+0.86	H ₂ O+H ₃ SO ₃ =SO ₄ ⁻ +4H ⁺ +	
$\frac{1}{2}$ H ₂ +OH ⁻ =H ₂ O+E ⁻	+0.828	2E ⁻	-0.14
Tl+I ⁻ =TlI+E ⁻	+0.77	Cu ⁺ =Cu ⁺⁺ +E ⁻	-0.17
Hg+HS ⁻ +OH ⁻ =HgS+H ₂ O+		H ₂ S=S+2H ⁺ +2E ⁻	-0.17
2E ⁻	+0.77	Bi=Bi ⁺⁺⁺ +3E ⁻	-0.2
Zn=Zn ⁺⁺ +2E ⁻	+0.758	2Tl ₃ +5H ₂ O=Tl ₂ O ₅ +10H ⁺ +	
Zn+3OH ⁻ =HZnO ₂ +H ₂ O+		10E ⁻	ca -0.2
2E ⁻	+0.72	Pt+4Cl ⁻ =PtCl ₄ ⁻ +2E ⁻	ca -0.2
H ₂ Te=Te+2H ⁺ +2E ⁻	ca +0.7	Ag+Cl ⁻ =AgCl+E ⁻	-0.223
Fe(OH) ₂ +OH ⁻ =Fe(OH) ₃ +E ⁻	+0.65	As+3H ₂ O=H ₃ AsO ₃ +3H ⁺ +3E ⁻	-0.24
Cr=Cr ⁺⁺ +2E ⁻	+0.6	Mo+3H ₂ O=MoO ₃ +6H ⁺ +6E ⁻	-0.25
Pb+2OH ⁻ =PbO+H ₂ O+2E ⁻	+0.58	2Hg+2Cl ⁻ =Hg ₂ Cl ₂ +2E ⁻	-0.270
S ⁻ =S+2E ⁻	+0.51	PbO+2OH ⁻ =PbO ₂ +H ₂ O+2E ⁻	-0.3
H ₂ Se=Se+2H ⁺ +2E ⁻	ca +0.5	V+H ₂ O=VO ⁺⁺ +2H ⁺ +4E ⁻	-0.3
Ga=Ga ⁺⁺⁺ +3E ⁻	+0.5	Cu=Cu ⁺⁺ +2E ⁻	-0.344
Ag+2CN ⁻ =Ag(CN) ₂ ⁻ +E ⁻	+0.5	V ⁺⁺⁺ +H ₂ O=VO ⁺⁺ +2H ⁺ +E ⁻	-0.4
Fe=Fe ⁺⁺ +2E ⁻	+0.44	4OH ⁻ =O ₂ +2H ₂ O+4E ⁻	-0.40
Cr ⁺⁺ =Cr ⁺⁺⁺ +E ⁻	+0.4	PtCl ₄ ⁻ +2Cl ⁻ =PtCl ₆ ⁻ +2E ⁻	ca -0.40
H ₂ =2H ⁺ (10 ⁻⁷ M)+2E ⁻	+0.414	U ⁺⁺ +2H ₂ O=UO ₃ ⁺⁺ +4H ⁺ +2E ⁻	-0.41
Cd=Cd ⁺⁺ +2E ⁻	+0.397	S+3H ₂ O=H ₂ SO ₃ +4H ⁺ +4E ⁻	-0.47
In=In ⁺⁺⁺ +3E ⁻	+0.38	Fe(CN) ₆ ⁻ =Fe(CN) ₆ ⁻ +E ⁻	-0.49
Ti ⁺⁺ =Ti ⁺⁺⁺ +E ⁻	+0.37	H ₃ AsO ₃ +H ₂ O=H ₃ AsO ₄ +2H ⁺ +	
2Cu+2OH ⁻ =Cu ₂ O+H ₂ O+2E ⁻	+0.34	2E ⁻	-0.49
Tl=Tl ⁺ +E ⁻	+0.336	Ni(OH) ₂ +2OH ⁻ =NiO ₂ ·2H ₂ O	
Pb+SO ₄ ⁻ =PbSO ₄ +2E ⁻	+0.31	+2E ⁻	-0.40
P+4H ₂ O=H ₃ PO ₄ +5H ⁺ +5E ⁻	+0.3	2Ag+CO ₃ ⁻ =Ag ₂ CO ₃ +2E ⁻	-0.50
Co(CN) ₆ ⁻ =Co(CN) ₆ ⁻ +E ⁻	+0.3	MoO ⁺⁺⁺ +2H ₂ O=MoO ₃ +4H ⁺	
Co=Co ⁺⁺ +2E ⁻	+0.29	+E ⁻	-0.5
Ni=Ni ⁺⁺ +2E ⁻	+0.22	Cu=Cu ⁺ +E ⁻	-0.51
V ⁺⁺ =V ⁺⁺⁺ +E ⁻	+0.2	2I ⁻ =I ₂ +2E ⁻	-0.535
Cu+I ⁻ =CuI+E ⁻	+0.17	3I ⁻ =I ₃ ⁻ +2E ⁻	-0.54
Ag+I ⁻ =AgI+E ⁻	+0.15	Hg ₂ Cl ₂ +2Cl ⁻ =2HgCl ₂ +2E ⁻	-0.63
Cu ₂ O+2OH ⁻ =2CuO+H ₂ O+		MnO ₄ ⁻ =MnO ₄ ⁻ +E ⁻	-0.66
2E ⁻	+0.15	H ₂ O ₂ =O ₂ +2H ⁺ +2E ⁻	-0.68
Sn=Sn ⁺⁺ +2E ⁻	+0.13	Ag+BrO ₃ ⁻ =AgBrO ₃ +E ⁻	-0.68
Pb=Pb ⁺⁺ +2E ⁻	+0.12	C ₆ H ₄ (OH) ₂ =C ₆ H ₄ O ₂ (quinone)	
9OH ⁻ +NH ₃ =NO ₃ ⁻ +6H ₂ O+		+2H ⁺ +2E ⁻	-0.70
8E ⁻	+0.12	MnO ₂ +4OH ⁻ =MnO ₄ ⁻ +2H ₂ O	
2Hg+2I ⁻ =Hg ₂ I ₂ +2E ⁻	+0.04	+2E ⁻	-0.71
2Ag+H ₂ S=Ag ₂ S+2H ⁺ +2E ⁻	+0.036	Fe ⁺⁺ =Fe ⁺⁺⁺ +E ⁻	-0.74
Cu+H ₂ S=CuS+2H ⁺ +2E ⁻	+0.02	Se+3H ₂ O=H ₂ SeO ₃ +4H ⁺ +4E ⁻	-0.74

STANDARD OXIDATION-REDUCTION POTENTIALS (Continued)

Reaction	E _o	Reaction	E _o
H ₃ SbO ₃ +H ₂ O=H ₃ SbO ₄ +2H ⁺ +2E ⁻	-0.75	Mn ⁺⁺ +2H ₂ O=MnO ₂ +4H ⁺ +2E ⁻	-1.33
2Hg=Hg ₂ ⁺⁺ +2E ⁻	-0.798	Cl ⁻ +4H ₂ O=ClO ₄ ⁻ +8H ⁺ +8E ⁻	-1.35
Ag=Ag ⁺ +E ⁻	-0.799	2Cl ⁻ =Cl ₂ +2E ⁻	-1.359
CuI=Cu ⁺⁺ +I ⁻ +E ⁻	-0.85	2Au+3H ₂ O=Au ₂ O ₃ +6H ⁺ +6E ⁻	-1.362
Hg=Hg ⁺⁺ +2E ⁻	-0.86	I ⁻ +4H ₂ O=IO ₄ ⁻ +8H ⁺ +8E ⁻	-1.4
2H ₂ O+NH ₄ ⁺ =HNO ₂ +7H ⁺ +6E ⁻	-0.86	Br ⁻ +3H ₂ O=BrO ₃ ⁻ +6H ⁺ +6E ⁻	-1.42
3OH ⁻ =HO ₂ ⁻ +H ₂ O+2E ⁻	-0.87	Pb ⁺⁺ +2H ₂ O=PbO ₂ +4H ⁺ +2E ⁻	-1.44
CoO+2OH ⁻ =CoO ₂ +H ₂ O+2E ⁻	-0.9	Cl ⁻ +3H ₂ O=ClO ₃ ⁻ +6H ⁺ +6E ⁻	-1.45
Hg ₂ ⁺⁺ =2Hg ⁺⁺ +2E ⁻	-0.92	Cl ⁻ +H ₂ O=HClO+H ⁺ +2E ⁻	-1.50
Cl ⁻ +2OH ⁻ =ClO ⁻ +H ₂ O+2E ⁻	-0.94	Mn ⁺⁺ =Mn ⁺⁺⁺ +E ⁻	ca -1.5
NO+2H ₂ O=NO ₃ ⁻ +4H ⁺ +3E ⁻	-0.94	Au=Au ⁺ +E ⁻	ca -1.5
HNO ₂ +H ₂ O=NO ₃ ⁻ +3H ⁺ +2E ⁻	-0.95	2SO ₄ ⁻ +2H ⁺ =H ₂ S ₂ O ₈ +2E ⁻	ca -1.5
NO+H ₂ O=HNO ₂ +H ⁺ +E ⁻	-0.98	Ce ⁺⁺⁺ +2H ₂ O=CeO ₂ +4H ⁺ +E ⁻	-1.5
I ⁻ +H ₂ O=HIO+H ⁺ +2E ⁻	-0.99	Mn ⁺⁺ +4H ₂ O=MnO ₄ ⁻ +8H ⁺ +5E ⁻	-1.52
OsO ₂ Cl ₄ ⁻ +2H ₂ O=OsO ₄ +4H ⁺ +4Cl ⁻ +2E ⁻	ca -1.0	MnO ₂ +2H ₂ O=MnO ₄ ⁻ +4H ⁺ +3E ⁻	-1.63
2Br ⁻ =Br ₂ +2E ⁻	-1.065	Fe ⁺⁺⁺ +4H ₂ O=FeO ₄ ⁻ +8H ⁺ +3E ⁻	ca -1.7
I ⁻ +3H ₂ O=IO ₃ ⁻ +6H ⁺ +6E ⁻	-1.09	Bi ⁺⁺⁺ +6H ₂ O=HBiO ₃ +5H ⁺ +2E ⁻	ca -1.7
VO ⁺⁺ +2H ₂ O=HVO ₃ +3H ⁺ +E ⁻	-1.1	PbSO ₄ +2H ₂ O=PbO ₂ +4H ⁺ +SO ₄ ⁻ +2E ⁻	-1.7
Tl ⁺ =Tl ⁺⁺⁺ +2E ⁻	-1.2	2H ₂ O=H ₂ O ₂ +2H ⁺ +2E ⁻	-1.78
H ₂ SeO ₃ +H ₂ O=H ₂ SeO ₄ +2H ⁺ +2E ⁻	ca -1.2	Co ⁺⁺ =Co ⁺⁺⁺ +E ⁻	-1.8
2H ₂ O=O ₂ +4H ⁺ +4E ⁻	-1.23	Ni ⁺⁺ +4H ₂ O=NiO ₂ ·2H ₂ O+4H ⁺ +2E ⁻	-1.8
PdCl ₄ ⁻ +2Cl ⁻ =PdCl ₆ ⁻ +2E ⁻	-1.3	O ₂ +H ₂ O=O ₃ +2H ⁺ +2E ⁻	-1.9
Cr ⁺⁺⁺ +4H ₂ O=HCrO ₄ ⁻ +7H ⁺ +3E ⁻	-1.3	2F ⁻ =F ₂ +2E ⁻	-2.8
Br ⁻ +H ₂ O=HBrO+H ⁺ +2E ⁻	-1.33		

SOLUBILITY OF CANE SUGAR IN WATER

Grams of sugar in 100 grams of water, temperature in degrees Centigrade.

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
C ₁₂ H ₂₂ O ₁₁	179.2	190.5	203.9	219.5	238.1	260.4	287.3	320.5	362.1	415.7	487.2

The values below give the per cent by weight of sugar in the final solution:

Temp., °C.	Per cent sugar	Temp., °C.	Per cent sugar	Temp., °C.	Per cent sugar
0	64.18	35	69.55	70	76.22
5	64.87	40	70.42	75	77.27
10	65.58	45	71.32	80	78.36
15	66.53	50	72.25	85	79.46
20	67.09	55	73.20	90	80.61
25	67.89	60	74.18	95	81.77
30	68.80	65	75.88	100	82.97

POTENTIALS OF ELECTROCHEMICAL REACTIONS AT 25° C

Compiled by Thos. DeVries

The reactions are classified according to the main element or radical entering into the reaction. Radicals are found under the name of the parent element. The sign of the potential is the sign on the electrode, according to the "European system".

Reaction	Poten- tial, volts	Reaction	Poten- tial, volts
$\text{Ag(s)} = \text{Ag}^+ + \text{e}^-$	+0.7996	$\text{Cd-Hg} + (\text{SO}_4^{--} \text{ in } \text{CdSO}_4.8/3\text{H}_2\text{O}$	
$\text{Ag}^+ = \text{Ag}^{++} + \text{e}^-$	+1.914	$\text{sat.}) = \text{CdSO}_4.8/3\text{H}_2\text{O} + 2\text{e}^-$	-0.4346
$\text{Ag(s)} + \text{Br}^- = \text{AgBr(s)} + \text{e}^-$	+0.0713	$\text{Ce}^{+++} = \text{Ce}^{++++} + \text{e}^- (\text{H}_2\text{SO}_4 \text{ soln.})$...	+1.44
$\text{Ag(s)} + \text{BrO}_3^- = \text{AgBrO}_3(\text{s}) + \text{e}^-$	+0.680	$\text{Ce}^{+++} = \text{Ce}^{++++} + \text{e}^- (\text{HNO}_3 \text{ soln.})$...	+1.6095
$\text{Ag(s)} + \text{Cl}^- = \text{AgCl(s)} + \text{e}^-$	+0.2221	$\text{Ce}^{+++} + 2\text{H}_2\text{O} = \text{CeO}_2 + 4\text{H}^+ + \text{e}^-$...	+1.5
$\text{Ag(s)} + 2\text{CN}^- = \text{Ag(CN)}_2^- + \text{e}^-$	-0.5	$\text{Cl}^- = \frac{1}{2}\text{Cl}_2 + \text{e}^-$	+1.3583
$2\text{Ag(s)} + \text{CO}_3^{--} = \text{Ag}_2\text{CO}_3(\text{s}) + 2\text{e}^-$	+0.500	$\text{Cl}^- + \text{H}_2\text{O} = \text{HClO} + \text{H}^+ + 2\text{e}^-$	+1.50
$2\text{Ag}^+ + \text{CrO}_4^{--} = \text{Ag}_2\text{CrO}_4(\text{s}) + 2\text{e}^-$	+0.4463	$\text{Cl}^- + 3\text{H}_2\text{O} = \text{ClO}_3^- + 6\text{H}^+ + 6\text{e}^-$	+1.45
$2\text{Ag(s)} + \text{H}_2\text{S(g)} = \text{Ag}_2\text{S(s)} + 2\text{H}^+$		$\text{Cl}^- + 4\text{H}_2\text{O} = \text{ClO}_4^- + 8\text{H}^+ + 8\text{e}^-$	+1.35
$+ 2\text{e}^-$	-0.0366	$\text{Cl}^- + 2\text{OH}^- = \text{ClO}^- + \text{H}_2\text{O} + 2\text{e}^-$	+0.94
$\text{Ag(s)} + \text{I}^- = \text{AgI(s)} + \text{e}^-$	-0.1523	$\text{CN}^- + 2\text{OH}^- = \text{CNO}^- + \text{H}_2\text{O} + 2\text{e}^-$...	-0.97
$\text{Al(s)} = \text{Al}^{+++} + 3\text{e}^-$	-1.7	$\text{HCN} + \text{H}_2\text{O} = \text{HCNO} + 2\text{H}^+ + 2\text{e}^-$...	0.0
$\text{Al-Hg} + 3\text{OH}^- = \text{Al(OH)}_3(\text{s}) + 3\text{e}^-$	-1.62	$\text{Co(s)} = \text{Co}^{++} + 2\text{e}^-$	-0.29
$\text{As(s)} + 2\text{H}_2\text{O(l)} = \text{HASO}_2 + 3\text{H}^+$		$\text{Co}^{++} = \text{Co}^{+++} + \text{e}^-$	+1.817
$+ 3\text{e}^-$	+0.2375	$\text{Co(CN)}_5^{--} = \text{Co(CN)}_6^{--} + \text{e}^-$	-0.3
$\text{As(s)} + 3\text{H}_2\text{O} = \text{H}_3\text{AsO}_3 + 3\text{H}^+ + 3\text{e}^-$	+0.24	$\text{CoO(s)} + 2\text{OH}^- = \text{CoO}_2(\text{s}) + \text{H}_2\text{O}$	
$\text{H}_3\text{AsO}_3 + \text{H}_2\text{O} = \text{H}_3\text{AsO}_4 + 2\text{H}^+ + 2\text{e}^-$	+0.49	$+ 2\text{e}^-$	+0.9
$\text{Au(s)} = \text{Au}^+ + \text{e}^-$	+1.5(?)	$\text{Cr(s)} = \text{Cr}^{++} + 2\text{e}^-$	-0.557
$\text{Au(s)} = \text{Au}^{+++} + 3\text{e}^-$	+1.36	$\text{Cr}^{++} = \text{Cr}^{+++} + \text{e}^-$	-0.400
$2\text{Au(s)} + 3\text{H}_2\text{O(l)} = \text{Au}_2\text{O}_3(\text{s}) +$		$\text{Cr}^{+++} + 4\text{H}_2\text{O} = \text{HCrO}_4^- + 7\text{H}^+ + 3\text{e}^-$...	+1.3
$6\text{H}^+ + 6\text{e}^-$	+1.363	$\text{Cu(s)} = \text{Cu}^+ + \text{e}^-$	+0.51
$\text{Ba(s)} = \text{Ba}^{++} + 2\text{e}^-$	-2.90	$\text{Cu(s)} = \text{Cu}^{++} + 2\text{e}^-$	+0.3452
$\text{Ba-Hg} = \text{Ba}^{++} + 2\text{e}^-$	-1.5700	$\text{Cu(sat. amalgam)} = \text{Cu}^{++} + 2\text{e}^-$	+0.3495
$\text{Be(s)} = \text{Be}^{++} + 2\text{e}^-$	-1.69	$\text{Cu}^+ = \text{Cu}^{++} + \text{e}^-$	+0.17
$\text{Bi(s)} = \text{Bi}^{+++} + 3\text{e}^-$	+0.277	$\text{Cu(s)} + \text{Cl}^- = \text{CuCl(s)} + \text{e}^-$	+0.1287
$\text{Bi(s)} + \text{Cl}^- + \text{H}_2\text{O(l)} = \text{BiOCl(s)}$		$\text{Cu(s)} + \text{H}_2\text{S(g)} = \text{CuS(s)} + 2\text{H}^+ + 2\text{e}^-$...	-0.259
$+ 2\text{H}^+ + 3\text{e}^-$	+0.1588	$\text{Cu(s)} + \text{I}^- = \text{CuI(s)} + \text{e}^-$	-0.17
$\text{Bi(s)} + 4\text{Cl}^- = \text{BiCl}_4^- + 3\text{e}^-$	+0.1678	$2\text{Cu(s)} + 2\text{OH}^- = \text{Cu}_2\text{O(s)} + \text{H}_2\text{O(l)}$	
$\text{Bi}^{+++} + 6\text{H}_2\text{O} = \text{HBiO}_3 + 5\text{H}^+ + 2\text{e}^-$	+1.7(?)	$+ 2\text{e}^-$	-0.344
$\text{Br}^- = \frac{1}{2}\text{Br}_2(\text{l}) + \text{e}^-$	+1.0648	$\text{CuCl}_2^- = \text{Cu}^{++} + 2\text{Cl}^- + \text{e}^-$	+0.455
$\text{Br}^- + 3\text{H}_2\text{O} = \text{BrO}_3^- + 6\text{H}^+ + 6\text{e}^-$	+1.42	$\text{Cu-Hg} + (\text{SO}_4^{--} \text{ in } \text{CuSO}_4.5\text{H}_2\text{O}$	
$\text{Br}^- + \text{H}_2\text{O} = \text{HBrO} + \text{H}^+ + 2\text{e}^-$	+1.33	$\text{sat.}) = \text{CuSO}_4.5\text{H}_2\text{O(s)} + 2\text{e}^-$	+0.2684
$\frac{1}{2}\text{Br}_2(\text{l}) + 3\text{H}_2\text{O(l)} = \text{BrO}_3^- + 6\text{H}^+$		$\text{CuI(s)} = \text{Cu}^{++} + \text{I}^- + \text{e}^-$	+0.85
$+ 5\text{e}^-$	+1.491	$\text{Cu}_2\text{O(s)} + 2\text{OH}^- = 2\text{CuO(s, aged)}$	
$\text{C}_6\text{H}_4(\text{OH})_2 = \text{C}_6\text{H}_4\text{O}_2 + 2\text{H}^+ + 2\text{e}^-$	+0.6992	$+ \text{H}_2\text{O(l)} + 2\text{e}^-$	-0.154
$\text{Ca(s)} = \text{Ca}^{++} + 2\text{e}^-$	-2.763	$\text{Cu}_2\text{O(s)} + 2\text{OH}^- + \text{H}_2\text{O(l)} =$	
Calomel electrode, sat. KCl.....	+0.2446	$2\text{Cu(OH)}_2(\text{s}) + 2\text{e}^-$	-0.082
Calomel electrode, normal KCl.....	+0.2809	$2\text{F}^- = \text{F}_2 + 2\text{e}^-$	+2.88
Calomel electrode, molal KCl.....	+0.2816	$\text{Fe(s)} = \text{Fe}^{++} + 2\text{e}^-$	-0.441
Calomel electrode, decinormal KCl.....	+0.3334	$\text{Fe}^{++} = \text{Fe}^{+++} + \text{e}^-$	+0.782
$\text{Cd(s)} = \text{Cd}^{++} + 2\text{e}^-$	-0.4024	$\text{Fe}^{+++} + 4\text{H}_2\text{O} = \text{FeO}_4^{--} + 8\text{H}^+ + 3\text{e}^-$...	+1.7(?)
$\text{Cd-Hg} = \text{Cd}^{++} + 2\text{e}^-$	-0.3519	$\text{Fe(s)} + 2\text{OH}^- = \text{Fe(OH)}_2(\text{s}) + 2\text{e}^-$	-0.86
$\text{Cd-Hg} + (2\text{Br}^- \text{ in } \text{CdBr}_2.4\text{H}_2\text{O}$		$\text{Fe(CN)}_5^{--} = \text{Fe(CN)}_6^{--} + \text{e}^-$	+0.36
$\text{sat.}) = \text{CdBr}_2.4\text{H}_2\text{O} + 2\text{e}^-$	-0.4182	$\text{Fe(OH)}_2(\text{s}) + \text{OH}^- = \text{Fe(OH)}_3(\text{s}) + \text{e}^-$...	-0.65
$\text{Cd-Hg} + (2\text{Cl}^- \text{ in } \text{CdCl}_2 \text{ sat.}) =$		$\text{K}_4\text{Fe(CN)}_6 = \text{K}_3\text{Fe(CN)}_6 + \text{K}^+ + \text{e}^-$...	+0.4866
$\text{CdCl}_2(\text{s}) + 2\text{e}^-$	-0.4034	$\text{Ga(s)} = \text{Ga}^{++} + 3\text{e}^-$	-0.5
$\text{Cd-Hg} + (2\text{I}^- \text{ in } \text{CdI}_2 \text{ sat.}) =$		$\frac{1}{2}\text{H}_2(\text{g}) = \text{H}^+ + \text{e}^-$	0.0000
$\text{CdI}_2(\text{s}) + 2\text{e}^-$	-0.4588	$\text{H}_2(\text{g}) = 2\text{H}^+ (10^{-7}M) + 2\text{e}^-$	-0.4141
$\text{Cd-Hg} + 2\text{OH}^- = \text{CdO(s)} + \text{H}_2\text{O(l)}$		$\frac{1}{2}\text{H}_2(\text{g}) + \text{OH}^- = \text{H}_2\text{O(l)} + \text{e}^-$	-0.8295
$+ 2\text{e}^-$	-0.726	$2\text{H}_2\text{O} = \text{H}_2\text{O}_2 + 2\text{H}^+ + 2\text{e}^-$	+1.78
$\text{Cd-Hg} + 2\text{OH}^- = \text{Cd(OH)}_2(\text{s}) + 2\text{e}^-$	-0.761	$2\text{H}_2\text{O} = \text{O}_2(\text{g}) + 4\text{H}^+ + 4\text{e}^-$	+1.23

POTENTIALS OF ELECTROCHEMICAL REACTIONS AT 25° C (Continued)

Reaction	Poten- tial, volts	Reaction	Poten- tial, volts
$\text{H}_2\text{O}(\text{l}) = \text{O}(\text{g}) + 2\text{H}^+ + 2\text{e}^-$	+2.419	$4\text{OH}^- = \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$	+0.40
$\text{H}_2\text{O}_2 = \text{O}_2(\text{g}) + 2\text{H}^+ + 2\text{e}^-$	+0.68	$\text{OsO}_4\text{Cl}_2^- + 2\text{H}_2\text{O} = \text{OsO}_4 + 4\text{H}^+$	+1.0(?)
$2\text{Hg}(\text{l}) = \text{Hg}_2^{++} + 2\text{e}^-$	+0.7986	$+4\text{Cl}^- + 2\text{e}^-$	-0.3
$\text{Hg}^{++} = \frac{1}{2}\text{Hg}_2^{++} + \text{e}^-$	+0.9011	$\text{P}(\text{s}) + 4\text{H}_2\text{O} = \text{H}_2\text{PO}_4 + 5\text{H}^+ + 5\text{e}^-$	-0.126
$2\text{Hg}(\text{l}) + 2\text{Br}^- = \text{Hg}_2\text{Br}_2(\text{s}) + 2\text{e}^-$	+0.1385	$\text{Pb}(\text{s}) = \text{Pb}^{++} + 2\text{e}^-$	-0.2623
$2\text{Hg}(\text{l}) + 2\text{Cl}^- = \text{Hg}_2\text{Cl}_2(\text{s}) + 2\text{e}^-$	+0.2676	$\text{Pb-Hg} + 2\text{Cl}^- = \text{PbCl}_2(\text{s}) + 2\text{e}^-$	-0.3580
$\text{Hg}(\text{l}) + \text{HS}^- + \text{OH}^- = \text{HgS}(\text{s}) + \text{H}_2\text{O} + 2\text{e}^-$	-0.77	$\text{Pb-Hg} + 2\text{I}^- = \text{PbI}_2(\text{s}) + 2\text{e}^-$	-0.5786
$2\text{Hg}(\text{l}) + 2\text{I}^- = \text{Hg}_2\text{I}_2(\text{s}) + 2\text{e}^-$	-0.0416	$\text{Pb}(\text{s}) + 2\text{OH}^- = \text{PbO}(\text{s, red}) + \text{H}_2\text{O}(\text{l}) + 2\text{e}^-$	-0.575
$\text{Hg}_2\text{Cl}_2(\text{s}) + 2\text{Cl}^- = 2\text{HgCl}_2 + 2\text{e}^-$	+0.63	$\text{Pb}(\text{s}) + 2\text{OH}^- = \text{PbO}(\text{s, yellow}) + \text{H}_2\text{O}(\text{l}) + 2\text{e}^-$	-0.576
$\text{Hg}(\text{l}) + 2\text{OH}^- = \text{HgO}(\text{s, red}) + \text{H}_2\text{O}(\text{l}) + 2\text{e}^-$	+0.0969	$\text{Pb}(\text{s}) + 2\text{OH}^- = \text{PbO}(\text{s}) + \text{H}_2\text{O}(\text{l}) + 2\text{e}^-$	-0.568
$\text{Hg}(\text{l}) + 2\text{OH}^- = \text{HgO}(\text{s, yellow}) + \text{H}_2\text{O}(\text{l}) + 2\text{e}^-$	+0.0976	$\text{Pb-Hg} + 2\text{OH}^- = \text{Pb}(\text{OH})_2(\text{s}) + 2\text{e}^-$	+0.070
$2\text{Hg}(\text{l}) + \text{SO}_4^{--} = \text{Hg}_2\text{SO}_4(\text{s}) + 2\text{e}^-$	+0.6141	$\text{Pb}(\text{s}) + \text{H}_2\text{S}(\text{g}) = \text{PbS}(\text{s}) + 2\text{H}^+ + 2\text{e}^-$	-0.3447
$\text{Hg}(\text{l}), \text{HgO}(\text{s}), \text{Ba}(\text{OH})_2(\text{s}), \text{H}_2\text{O}$	+0.1462	$\text{Pb}(\text{s}) + \text{SO}_4^{--} = \text{PbSO}_4(\text{s}) + 2\text{e}^-$	-0.3505
$\text{Hg}(\text{l}), \text{HgO}(\text{s}), \text{Ca}(\text{OH})_2(\text{s}), \text{H}_2\text{O}$	+0.192	$\text{Pb-Hg} + \text{SO}_4^{--} = \text{PbSO}_4(\text{s}) + 2\text{e}^-$	+1.467
$\text{I}^- = \frac{1}{2}\text{I}_2(\text{s}) + \text{e}^-$	+0.5356	$\text{Pb}^{++} + 2\text{H}_2\text{O} = \text{PbO}_2(\text{s}) + 4\text{H}^+ + 2\text{e}^-$	+0.27
$3\text{I}^- = \text{I}_3 + 2\text{e}^-$	+0.54	$\text{PbO}(\text{s}) + 2\text{OH}^- = \text{PbO}_2(\text{s}) + \text{H}_2\text{O}(\text{l}) + 2\text{e}^-$	+1.6797
$\text{I}^- + \text{H}_2\text{O} = \text{HIO} + \text{H}^+ + 2\text{e}^-$	+0.99	$\text{PdCl}_4^{--} + 2\text{Cl}^- = \text{PdCl}_6^{--} + 2\text{e}^-$	+1.3
$\text{I}^- + 3\text{H}_2\text{O} = \text{IO}_3^- + 6\text{H}^+ + 6\text{e}^-$	+1.09	$\text{Pt}(\text{s}) + 4\text{Cl}^- = \text{PtCl}_4^{--} + 2\text{e}^-$	+0.2(?)
$\text{I}^- + 4\text{H}_2\text{O} = \text{IO}_4^- + 8\text{H}^+ + 8\text{e}^-$	+1.4	$\text{PtCl}_4^{--} + 2\text{Cl}^- = \text{PtCl}_6^{--} + 2\text{e}^-$	+0.717
$\frac{1}{2}\text{I}_2(\text{s}) + 3\text{H}_2\text{O} = \text{IO}_3^- + 6\text{H}^+ + 5\text{e}^-$	+1.195	$[\text{Pt}(\text{CN})_4]^- + 2\text{Cl}^- = [\text{Pt}(\text{CN})_4\text{Cl}_2]^- + 2\text{e}^-$	+0.879
$\text{In}(\text{s}) = \text{In}^{+++} + 3\text{e}^-$	-0.340	Quinhydrone electrode, $\text{H}^+(\text{a}=1)$	+0.6992
$\text{IrCl}_6^{--} = \text{IrCl}_6^{--} + \text{e}^-$	-0.97	$\text{Rb}(\text{s}) = \text{Rb}^+ + \text{e}^-$	-2.9259
$\text{K}(\text{s}) = \text{K}^+ + \text{e}^-$	-2.9241	$\text{S}^{--} = \text{S}(\text{rhombic}) + 2\text{e}^-$	-0.51
$\text{Li}(\text{s}) = \text{Li}^+ + \text{e}^-$	-2.9595	$\text{S}(\text{rhombic}) + 3\text{H}_2\text{O} = \text{H}_2\text{SO}_3 + 4\text{H}^+ + 4\text{e}^-$	+0.47
$\text{Mg}(\text{s}) = \text{Mg}^{++} + 2\text{e}^-$	-2.40	$\text{H}_2\text{S} = \text{S}(\text{rhombic}) + 2\text{H}^+ + 2\text{e}^-$	+0.17
$\text{Mn}(\text{s}) = \text{Mn}^{++} + 2\text{e}^-$	-1.1	$2\text{SO}_3^{--} + 2\text{H}^+ = \text{H}_2\text{S}_2\text{O}_8 + 2\text{e}^-$	+1.5(?)
$\text{Mn}^{++} = \text{Mn}^{+++} + \text{e}^-$	+1.5(?)	$\text{H}_2\text{SO}_3 + \text{H}_2\text{O} = \text{SO}_4^{--} + 4\text{H}^+ + 2\text{e}^-$	+0.14
$\text{Mn}^{++} + 2\text{H}_2\text{O} = \text{MnO}_2(\text{s}) + 4\text{H}^+ + 2\text{e}^-$	+1.236	$\text{Sb}(\text{s}) + \text{H}_2\text{O}(\text{l}) = \text{SbO}^+ + 2\text{H}^+ + 3\text{e}^-$	-0.212
$\text{Mn}^{++} + 4\text{H}_2\text{O} = \text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^-$	+1.509	$\text{Sb}(\text{s}) + 3\text{H}_2\text{O} = \text{H}_3\text{SbO}_3 + 3\text{H}^+ + 3\text{e}^-$	0.0(?)
$\text{MnO}_2(\text{s}) + 2\text{H}_2\text{O} = \text{MnO}_4^- + 4\text{H}^+ + 3\text{e}^-$	+1.691	$2\text{Sb}(\text{s}) + 3\text{H}_2\text{O}(\text{l}) = \text{Sb}_2\text{O}_3(\text{s}) + 6\text{H}^+ + 6\text{e}^-$	+0.1445
$\text{MnO}_2(\text{s}) + 4\text{OH}^- = \text{MnO}_4^- + 2\text{H}_2\text{O} + 2\text{e}^-$	+0.71	$\text{H}_3\text{SbO}_3 + \text{H}_2\text{O} = \text{H}_3\text{SbO}_4 + 2\text{H}^+ + 2\text{e}^-$	+0.75
$\text{MnO}_4^{--} = \text{MnO}_4^- + \text{e}^-$	+0.664	$\text{Se}(\text{s}) + 3\text{H}_2\text{O} = \text{H}_2\text{SeO}_3 + 4\text{H}^+ + 4\text{e}^-$	+0.74
$\text{Mo}(\text{s}) + 3\text{H}_2\text{O} = \text{MoO}_3(\text{s}) + 6\text{H}^+ + 6\text{e}^-$	+0.25	$\text{H}_2\text{Se} = \text{Se} + 2\text{H}^+ + 2\text{e}^-$	-0.5(?)
$\text{Mo}(\text{CN})_8^{--} = \text{Mo}(\text{CN})_8^{--} + \text{e}^-$	+0.7260	$\text{H}_2\text{SeO}_3 + \text{H}_2\text{O} = \text{H}_2\text{SeO}_4 + 2\text{H}^+ + 2\text{e}^-$	+1.2(?)
$\text{MoO}^{+++} + 2\text{H}_2\text{O} = \text{MoO}_3(\text{s}) + 4\text{H}^+ + \text{e}^-$	+0.5	$\text{Sn}(\text{s}) = \text{Sn}^{++} + 2\text{e}^-$	-0.136
$\text{Na}(\text{s}) = \text{Na}^+ + \text{e}^-$	-2.7146	$\text{Sn}^{++} = \text{Sn}^{+++} + 2\text{e}^- (0.1 \text{ M HCl})$	+0.070
$\text{Na-Hg} + (\text{Cl}^- \text{ in NaCl sat.}) = \text{NaCl}(\text{s}) + \text{e}^-$	-1.8378	$\text{Sn}^{++} = \text{Sn}^{+++} + 2\text{e}^- (0.53 \text{ M HCl})$	+0.144
$\text{NH}_3 + 9\text{OH}^- = \text{NO}_3^- + 6\text{H}_2\text{O} + 8\text{e}^-$	-0.12	$\text{Sn}^{++} = \text{Sn}^{+++} + 2\text{e}^- (2.0 \text{ M HCl})$	+0.133
$\text{NH}_4^+ + 2\text{H}_2\text{O} = \text{HNO}_2 + 7\text{H}^+ + 6\text{e}^-$	+0.86	$\text{Sr-Hg} = \text{Sr}^{++} + 2\text{e}^-$	-1.7932
$\text{NO} + \text{H}_2\text{O} = \text{HNO}_2 + \text{H}^+ + \text{e}^-$	+0.98	$2\text{Ta}(\text{s}) + 5\text{H}_2\text{O} = \text{Ta}_2\text{O}_5 + 10\text{H}^+ + 10\text{e}^-$	+0.2(?)
$\text{NO} + 2\text{H}_2\text{O} = \text{NO}_3^- + 4\text{H}^+ + 3\text{e}^-$	+0.94	$\text{Te}(\text{s}) = \text{Te}^{++} + 2\text{e}^-$	-0.5682
$\text{NO}_2^- + 2\text{OH}^- = \text{NO}_3^- + \text{H}_2\text{O} + 2\text{e}^-$	0.0	$\text{H}_2\text{Te} = \text{Te} + 2\text{H}^+ + 2\text{e}^-$	-0.7(?)
$\text{HNO}_2 + \text{H}_2\text{O} = \text{NO}_3^- + 3\text{H}^+ + 2\text{e}^-$	+0.95	$\text{Ti}^{++} = \text{Ti}^{+++} + \text{e}^-$	+0.37
$\text{Ni}(\text{s}) = \text{Ni}^{++} + 2\text{e}^-$	-0.227	$\text{Ti}^{+++} + \text{H}_2\text{O} = \text{TiO}^{++} + 2\text{H}^+ + \text{e}^-$	+0.04
$\text{Ni}^{++} + 4\text{H}_2\text{O} = \text{NiO}_2 \cdot 2\text{H}_2\text{O} + 4\text{H}^+ + 2\text{e}^-$	+1.8	$\text{Ti}^{+++} + 2\text{SO}_4^{--} = \text{Ti}(\text{SO}_4)_2 + \text{e}^-$	+0.04
$\text{Ni}(\text{OH})_2(\text{s}) + 2\text{OH}^- = \text{NiO}_2 \cdot 2\text{H}_2\text{O} + 2\text{e}^-$	+0.49	$\text{Ti}(\text{s}) = \text{Ti}^+ + \text{e}^-$	-0.336
$\text{O}_2(\text{g}) + \text{H}_2\text{O} = \text{O}_3(\text{g}) + 2\text{H}^+ + 2\text{e}^-$	+2.07	$\text{Ti}^+ = \text{Ti}^{+++} + 2\text{e}^-$	+1.2466
$3\text{OH}^- = \text{HO}_2^- + \text{H}_2\text{O} + 2\text{e}^-$	+0.87	$\text{Ti-Hg} = \text{Ti}^+ + \text{e}^-$	-0.3360
		$\text{Ti}(\text{s}) + \text{I}^- = \text{TiI}(\text{s}) + \text{e}^-$	-0.7715

POTENTIALS OF ELECTROCHEMICAL REACTIONS AT 25° C (Continued)

Reaction	Poten- tial, volts	Reaction	Poten- tial, volts
$\text{Tl-Hg} + \text{Cl}^- = \text{TlCl(s)} + \text{e} \dots\dots\dots$	-0.5545	$\frac{1}{2}(\text{VO})_2\text{SO}_4 + \frac{1}{2}\text{SO}_4^{--} = \text{VOSO}_4 + \text{e} \dots\dots$	+0.30
$\text{Tl-Hg} + \text{Br}^- = \text{TlBr(s)} + \text{e} \dots\dots\dots$	-0.6058	$\text{VSO}_4 + \text{H}_2\text{O(l)} = \frac{1}{2}(\text{VO})_2\text{SO}_4 + 2\text{H}^+ + \frac{1}{2}\text{SO}_4^{--} + \text{e} \dots\dots\dots$	-0.21
$\text{Tl-Hg} + \text{SO}_4^{--} = \text{Tl}_2\text{SO}_4(\text{s}) + 2\text{e} \dots\dots$	-0.4360	$\text{W(s)} + 3\text{H}_2\text{O} = \text{WO}_3(\text{s}) + 6\text{H}^+ + 6\text{e} \dots\dots$	0.0(?)
$\text{U} = \text{U}^{++++} + 4\text{e} \dots\dots\dots$	-1.4	$\text{W(CN)}_8^{--} = \text{W(CN)}_8^{--} + \text{e} \dots\dots\dots$	+0.485
$\text{U}^{+++} + 2\text{H}_2\text{O} = \text{UO}_2^{++} + 4\text{H}^+ + 2\text{e} \dots\dots$	+0.41	$\text{WO}^{+++} + 2\text{H}_2\text{O} = \text{WO}_3 + 4\text{H}^+ + \text{e} \dots\dots$	0.0(?)
$\text{U(SO}_4)_2 + 2\text{H}_2\text{O(l)} = \text{UO}_2\text{SO}_4 + 4\text{H}^+ + \text{SO}_4^{--} + 2\text{e} \dots\dots\dots$	+0.358	$\text{Zn(s)} = \text{Zn}^{++} + 2\text{e} \dots\dots\dots$	-0.7614
$\text{V}^{++} = \text{V}^{+++} + \text{e} \dots\dots\dots$	-0.2	$\text{Zn-Hg} = \text{Zn}^{++} + 2\text{e} \dots\dots\dots$	-0.7614
$\text{V}^{+++} + \text{H}_2\text{O} = \text{VO}^{++} + 2\text{H}^+ + \text{e} \dots\dots$	+0.4	$\text{Zn(s)} + 2\text{OH}^- = \text{ZnO(s)} + \text{H}_2\text{O(l)} \dots\dots$	-1.2483
$\text{V(s)} + \text{H}_2\text{O} = \text{VO}^{++} + 2\text{H}^+ + 4\text{e} \dots\dots$	+0.3	$\text{Zn(s)} + 3\text{OH}^- = \text{HZnO}_2^- + \text{H}_2\text{O} + 2\text{e} \dots\dots$	-0.72
$\text{VO}^{++} + 2\text{H}_2\text{O} = \text{HVO}_3 + 3\text{H}^+ + \text{e} \dots\dots$	+1.1	$\text{Zn-Hg} + (\text{SO}_4^{--} \text{ in } \text{ZnSO}_4 \cdot 7\text{H}_2\text{O sat.}) = \text{ZnSO}_4 \cdot 7\text{H}_2\text{O(s)} + 2\text{e} \dots\dots$	-0.7993
$\text{VOSO}_4 + 2\text{H}_2\text{O(l)} = \text{HVO}_3 + \text{H}_2\text{SO}_4 + \text{e} \dots\dots\dots$	+0.92		

DEGREE OF IONIZATION

IN NORMAL SOLUTION AT 18° UNLESS INDICATED

Acids

Nitric acid.....	0.82	† Permanganic acid.....	0.933
Hydrochloric acid.....	0.784	† Hydriodic acid.....	0.901
Sulfuric acid.....	0.510	† Hydrobromic acid.....	0.899
Hydrofluoric acid.....	0.070	† Perchloric acid.....	0.880
• Oxalic acid.....	0.500	† Chloric acid.....	0.878
▪ Tartaric acid.....	0.082	† Hydrochloric acid.....	0.876
• Acetic acid.....	0.004	† Phosphoric acid.....	0.170
• Carbonic acid.....	0.0017		
▪ Hydrogen sulfide.....	0.0007		
• Boric acid.....	0.0001		
▪ Hydrocyanic acid.....	0.0001		

* In 0.1 M. solution; primary ionization.

† In N/2 solution, at 25°.

Bases

Potassium hydroxide.....	0.77	† Strontium hydroxide.....	0.93
Sodium hydroxide.....	0.73	† Barium hydroxide.....	0.92
Barium hydroxide.....	0.69	† Calcium hydroxide.....	0.90
Lithium hydroxide.....	0.63		
Ammonium hydroxide.....	0.004		
Tetramethyl ammonium hydroxide.....	0.96		

‡ In N/64 solution, at 25°.

Salts

Approximate degree of ionization for active salts in N/10 solution:

Type R^+R^- (e.g. KCl).....	0.86
Type $R^{++}(R^-)_2$ (e.g. $BaCl_2$).....	0.72
Type $(R^+)_2R^-$ (e.g. K_2SO_4).....	0.72
Type $R^{++}R^-$ (e.g. $CuSO_4$).....	0.45

SOLUBILITY PRODUCT

The solubility product (or ion product constant) is the product of the concentrations of the ions in the saturated solution of a difficultly soluble salt. The concentrations are expressed in moles per liter of solution. The number of cations (or anions) resulting from the dissociation of one molecule of the salt, appears in the formula for calculations of the solubility product as the exponent of the concentration of the cation (or anion).

If two solutions, each containing one of the ions of a difficultly soluble salt, are mixed, no precipitation takes place unless the product of the ion concentrations in the mixture is greater than the solubility product.

In a solution containing two salts which yield a common ion the ratio of solubilities of the two salts is the ratio of the solubility products.

Substance	Solubility product at temperature noted	Substance	Solubility product at temperature noted
Aluminum hydroxide	4×10^{-13} (15°)	Calcium oxalate, $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	1.78×10^{-9} (18°)
Aluminum hydroxide	1.1×10^{-15} (18°)	Calcium oxalate, $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	2.57×10^{-9} (25°)
Aluminum hydroxide	3.7×10^{-15} (25°)	Calcium sulfate...	6.1×10^{-5} (10°)
Barium carbonate	7×10^{-9} (16°)	Calcium tartrate, $\text{CaC}_4\text{H}_4\text{O}_6 \cdot 2\text{H}_2\text{O}$	0.77×10^{-6} (18°)
Barium carbonate	8.1×10^{-9} (25°)	Cobalt sulfide...	3×10^{-26} (18°)
Barium chromate	1.6×10^{-10} (18°)	Cupric iodate...	1.4×10^{-7} (25°)
Barium chromate	2.4×10^{-10} (28°)	Cupric oxalate...	2.87×10^{-8} (25°)
Barium fluoride...	1.6×10^{-6} (9.5°)	Cupric sulfide...	8.5×10^{-46} (18°)
Barium fluoride...	1.7×10^{-6} (18°)	Cuprous bromide...	4.15×10^{-8} (18–20°)
Barium fluoride...	1.73×10^{-6} (25.8°)	Cuprous chloride...	1.02×10^{-6} (18–20°)
Barium iodate, $\text{Ba}(\text{IO}_3)_2 \cdot 2\text{H}_2\text{O}$	8.4×10^{-11} (10°)	Cuprous iodide...	5.06×10^{-12} (18–20°)
Barium iodate, $\text{Ba}(\text{IO}_3)_2 \cdot 2\text{H}_2\text{O}$	6.5×10^{-10} (25°)	Cuprous sulfide...	2×10^{-47} (16–18°)
Barium oxalate, $\text{BaC}_2\text{O}_4 \cdot 3\frac{1}{2}\text{H}_2\text{O}$	1.62×10^{-7} (18°)	Cuprous thiocyanate	1.6×10^{-11} (18°)
Barium oxalate, $\text{BaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$	1.2×10^{-7} (18°)	Ferric hydroxide...	1.1×10^{-36} (18°)
Barium sulfate...	2.18×10^{-7} (18°)	Ferrous hydroxide	1.64×10^{-14} (18°)
Barium sulfate...	0.87×10^{-10} (18°)	Ferrous oxalate...	2.1×10^{-7} (25°)
Barium sulfate...	1.08×10^{-10} (25°)	Ferrous sulfide...	3.7×10^{-19} (18°)
Barium sulfate...	1.98×10^{-10} (50°)	Lead carbonate...	3.3×10^{-14} (18°)
Cadmium oxalate, $\text{CdC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$	1.53×10^{-8} (18°)	Lead chromate...	1.77×10^{-14} (18°)
Cadmium sulfide...	3.6×10^{-29} (18°)	Lead fluoride...	2.7×10^{-8} (9°)
Calcium carbonate (calcite)	0.99×10^{-8} (15°)	Lead fluoride...	3.2×10^{-8} (18°)
Calcium carbonate (calcite)	0.87×10^{-8} (25°)	Lead fluoride...	3.7×10^{-8} (26.6°)
Calcium fluoride	3.4×10^{-11} (18°)	Lead iodate...	5.3×10^{-14} (9.2°)
Calcium fluoride	3.95×10^{-11} (26°)	Lead iodate...	1.2×10^{-13} (18°)
Calcium iodate, $\text{Ca}(\text{IO}_3)_2 \cdot 6\text{H}_2\text{O}$	22.2×10^{-8} (10°)	Lead iodate...	2.6×10^{-13} (25.8°)
Calcium iodate, $\text{Ca}(\text{IO}_3)_2 \cdot 6\text{H}_2\text{O}$	64.4×10^{-8} (18°)	Lead iodide...	7.47×10^{-9} (15°)
		Lead iodide...	1.39×10^{-8} (25°)
		Lead oxalate...	2.74×10^{-11} (18°)
		Lead sulfate...	1.06×10^{-8} (18°)
		Lead sulfide...	3.4×10^{-28} (18°)
		Lithium carbonate	1.7×10^{-3} (25°)
		Magnesium ammonium phosphate	2.5×10^{-13} (25°)

SOLUBILITY PRODUCT (Continued)

Substance	Solubility product at temperature noted	Substance	Solubility product at temperature noted
Magnesium carbonate	2.6×10^{-5} (12°)	Silver chloride...	0.21×10^{-10} (4.7°)
Magnesium fluoride	7.1×10^{-9} (18°)	Silver chloride...	0.37×10^{-10} (9.7°)
Magnesium fluoride	6.4×10^{-9} (27°)	Silver chloride...	1.56×10^{-10} (25°)
Magnesium hydroxide	1.2×10^{-11} (18°)	Silver chloride...	13.2×10^{-10} (50°)
Magnesium oxalate	8.57×10^{-6} (18°)	Silver chloride...	21.5×10^{-10} (100°)
Manganese hydroxide	4×10^{-14} (18°)	Silver chromate...	1.2×10^{-12} (14.8°)
Manganese sulfide	1.4×10^{-15} (18°)	Silver chromate...	9×10^{-12} (25°)
Mercuric sulfide	4×10^{-53} to 2×10^{-49} (18°)	Silver cyanide	2.2×10^{-12} (20°)
Mercurous bromide	1.3×10^{-21} (25°)	[Ag ⁺][Ag(CN) ⁻²]	
Mercurous chloride	2×10^{-18} (25°)	Silver dichromate	2×10^{-7} (25°)
Mercurous iodide	1.2×10^{-28} (25°)	Silver hydroxide	1.52×10^{-8} (20°)
Nickel sulfide...	1.4×10^{-24} (18°)	Silver iodate....	0.92×10^{-8} (9.4°)
Potassium acid tartrate [K ⁺][HC ₄ H ₄ O ₆ ⁻]	3.8×10^{-4} (18°)	Silver iodide....	0.32×10^{-16} (13°)
Silver bromate...	3.97×10^{-5} (20°)	Silver iodide....	1.5×10^{-16} (25°)
Silver bromate...	5.77×10^{-5} (25°)	Silver sulfide...	1.6×10^{-49} (18°)
Silver bromide...	4.1×10^{-13} (18°)	Silver thiocyanate	0.49×10^{-12} (25°)
Silver bromide...	7.7×10^{-13} (25°)	Silver thiocyanate	1.16×10^{-12} (25°)
Silver carbonate	6.15×10^{-12} (25°)	Strontium carbonate	1.6×10^{-9} (25°)
		Strontium fluoride	2.8×10^{-9} (18°)
		Strontium oxalate	5.61×10^{-8} (18°)
		Strontium sulfate	2.77×10^{-7} (2.9°)
		Strontium sulfate	3.81×10^{-7} (17.4°)
		Zinc hydroxide...	1.8×10^{-14} (18-20°)
		Zinc oxalate...	1.35×10^{-9} (18°)
		ZnC ₂ O ₄ ·2H ₂ O	
		Zinc sulfide.....	1.2×10^{-23} (18°)

TABLE FOR TRANSFORMING EXPRESSION OF RESULTS OF WATER ANALYSIS

Compiled by Dr. R. E. Brewer. (Based on Equivalents of CaCO₃)

	Parts per 1,000,000	Parts per 100,000	mg per l	g per l	Grains per U. S. gal.	Grains per Eng. gal.	English or Clark degrees	French degrees	German degrees
p.p.m.....	1	0.10	1.0	0.001	0.0583*	0.07	0.07	0.10	0.056
mg/l.....	1	0.10	1.0	0.001	0.0583	0.07	0.07	0.10	0.056
p./100,000.....	10	1.00	10.0	0.010	0.583	0.70	0.70	1.00	0.560
French degrees.....	10	1.00	10.0	0.010	0.583	0.70	0.70	1.00	0.560
g/l.....	1000	100.0	1000.0	1.000	58.300	70.00	70.00	100.00	56.000
Gr./U. S. gal.....	17.1	1.71	17.1	0.0171	1.000	1.2	1.2	1.71	0.958
Gr./Eng. gal.....	14.3	1.43	14.3	0.0143	0.829	1.00	1.00	1.43	0.80
Clark degrees.....	14.3	1.43	14.3	0.0143	0.829	1.00	1.00	1.43	0.80
German degrees.....	17.8	1.78	17.8	0.0178	1.044	1.24	1.24	1.78	1.00

*Variously reported.

DISSOCIATION CONSTANTS OF BASES

Name	Formula	Constant for first OH	Temp. °C.	Constant for second OH	Temp. °C.
Acetamide.....	C ₂ H ₅ ON...	3.1 × 10 ⁻¹⁵	25		
Acetanilide.....	C ₈ H ₉ ON...	4.1 × 10 ⁻¹⁴	40		
α-Alanine.....	C ₃ H ₇ O ₂ N...	5.1 × 10 ⁻¹²	25		
o-Aminobenzoic.....	C ₇ H ₇ O ₂ N...	1.4 × 10 ⁻¹²	25		
Ammonium Hydroxide..	NH ₄ OH...	1.8 × 10 ⁻⁵	25		
Aniline.....	C ₆ H ₇ N...	4.6 × 10 ⁻¹⁰	25		
Arsenious Oxide.....	As ₂ O ₃	1 × 10 ⁻¹⁴	25		
Beryllium Hydroxide...	Be(OH) ₂			5 × 10 ⁻¹¹	25
Brucine.....	C ₂₃ H ₂₆ O ₄ N ₂ ...	7.2 × 10 ⁻⁴	25	2.5 × 10 ⁻¹¹	25
Butylamine (sec.).....	C ₄ H ₁₁ N...	4.4 × 10 ⁻⁴	25		
Caffeine.....	C ₈ H ₁₀ O ₂ N ₄ ...	4.1 × 10 ⁻¹⁴	40		
Cinchonine.....	C ₁₉ H ₂₂ ON ₂ ...	1.6 × 10 ⁻⁷	15	3.3 × 10 ⁻¹⁰	15
Cocaine.....	C ₁₇ H ₂₁ O ₄ N...	4 × 10 ⁻⁷	25		
Diethylbenzylamine...	C ₁₁ H ₁₇ N...	3.6 × 10 ⁻⁵	25		
Diethylamine.....	C ₄ H ₁₁ N...	1.26 × 10 ⁻³	25		
Diisooamylamine.....	C ₁₀ H ₂₃ N...	9.6 × 10 ⁻⁴	25		
Diisobutylamine.....	C ₈ H ₁₉ N...	4.8 × 10 ⁻⁴	25		
Dimethylamine.....	C ₂ H ₇ N...	5.2 × 10 ⁻⁴	25		
Dimethylbenzylamine...	C ₉ H ₁₃ N...	1.05 × 10 ⁻⁵	25		
Dipropylamine.....	C ₆ H ₁₅ N...	1.02 × 10 ⁻³	25		
Ethylamine.....	C ₂ H ₇ N...	5.6 × 10 ⁻⁴	25		
Ethylenediamine.....	C ₂ H ₈ N ₂ ...	8.5 × 10 ⁻⁵	25		
Hydrazine.....	N ₂ H ₄ ·H ₂ O...	3 × 10 ⁻⁶	25		
Isoamylamine.....	C ₅ H ₁₃ N...	5 × 10 ⁻⁴	25		
Isobutylamine.....	C ₄ H ₁₁ N...	3.1 × 10 ⁻⁴	25		
Isopropylamine.....	C ₃ H ₉ N...	5.3 × 10 ⁻⁴	25		
Lead Hydroxide.....	Pb(OH) ₂			3 × 10 ⁻⁸	25
Methylamine.....	CH ₅ N...	5 × 10 ⁻⁴	25		
Methyldiethylamine...	C ₅ H ₁₃ N...	2.7 × 10 ⁻⁴	25		
α-Naphthylamine.....	C ₁₀ H ₉ N...	9.9 × 10 ⁻¹¹	25		
β-Naphthylamine.....	C ₁₀ H ₉ N...	2 × 10 ⁻¹⁰	25		
o-Phenylenediamine...	C ₆ H ₈ N ₂ ...	3.3 × 10 ⁻¹⁰	25		
Phenylhydrazine.....	C ₆ H ₈ N ₂ ...	1.6 × 10 ⁻⁹	40		
Piperidine.....	C ₅ H ₁₁ N...	1.6 × 10 ⁻³	25		
Propylamine (norm.)...	C ₃ H ₉ N...	4.7 × 10 ⁻⁴	25		
Pyridine.....	C ₅ H ₅ N...	2.3 × 10 ⁻⁹	25		
Quinine.....	C ₂₀ H ₂₄ O ₂ N ₂ ...	2.2 × 10 ⁻⁷	15	3.3 × 10 ⁻¹⁰	15
Quinoline.....	C ₉ H ₇ N...	1 × 10 ⁻⁹	25		
Semicarbazide.....	CH ₅ ON ₃ ...	2.7 × 10 ⁻¹¹	40		
Silver Hydroxide.....	AgOH.....	1.1 × 10 ⁻⁴	25		
Strychnine.....	C ₂₁ H ₂₂ O ₄ N ₂ ...	1 × 10 ⁻⁷	15	6 × 10 ⁻¹¹	15
Tetramethylenediamine	C ₄ H ₁₂ N ₂ ...	5.1 × 10 ⁻⁴	25		
Thiourea.....	CH ₄ N ₂ S...	1.1 × 10 ⁻¹⁵	25		
m-Toluidine.....	C ₇ H ₉ N...	5.5 × 10 ⁻¹⁰	25		
o-Toluidine.....	C ₇ H ₉ N...	3.3 × 10 ⁻¹⁰	25		
p-Toluidine.....	C ₇ H ₉ N...	2 × 10 ⁻⁹	25		
Triethylamine.....	C ₆ H ₁₅ N...	6.4 × 10 ⁻⁴	25		
Triisobutylamine.....	C ₁₂ H ₂₇ N...	2.6 × 10 ⁻⁴	25		
Trimethylamine.....	C ₃ H ₉ N...	7.4 × 10 ⁻⁵	25		
Trimethylenediamine...	C ₃ H ₁₀ N ₂ ...	3.5 × 10 ⁻⁴	25		
Tripropylamine.....	C ₉ H ₂₁ N...	5.5 × 10 ⁻⁴	25		
Urea.....	CH ₄ ON ₂ ...	1.5 × 10 ⁻¹⁴	25		
Zinc Hydroxide.....	Zn(OH) ₂			1.5 × 10 ⁻⁹	25

DISSOCIATION CONSTANTS OF ACIDS

Acid	Formula	Constant for the first hydrogen	Temp. °C.	Constant for the second hydrogen	Temp. °C.
Acetic	$C_2H_4O_2$	1.75×10^{-5}	25		
α -Alanine	$C_3H_7O_2N$	9×10^{-10}	25		
Arsenic	H_3AsO_4	5×10^{-3}	25	4×10^{-5} 6×10^{-10} (3H)	25 25
Arsenious	$HAsO_2$	6×10^{-10}	25		
Barbituric	$C_4H_4O_3N_2$	1.05×10^{-4}	25		
Benzoic	$C_7H_6O_2$	6.3×10^{-5}	25		
Boric	H_3BO_3	6.4×10^{-10}	25		
Bromacetic	$C_2H_3O_2Br$	1.38×10^{-3}	25		
α -Bromopropionic	$C_3H_5O_2Br$	1.08×10^{-3}	25		
β -Bromopropionic	$C_3H_5O_2Br$	9.8×10^{-5}	25		
Butyric	$C_4H_8O_2$	1.48×10^{-5}	25		
Carbonic	H_2CO_3	3.5×10^{-7}	18	4.4×10^{-11}	25
Chloracetic	$C_2H_3O_2Cl$	1.4×10^{-3}	25		
α -Chloropropionic	$C_3H_5O_2Cl$	1.47×10^{-3}	25		
β -Chloropropionic	$C_3H_5O_2Cl$	8.59×10^{-5}	25		
Citric	$C_6H_8O_7$	8.4×10^{-4}	25	1.8×10^{-5} 4×10^{-6} (3H)	
Dichloroacetic	$C_2H_2O_2Cl_2$	5×10^{-2}	25		
Formic	CH_2O_2	1.76×10^{-4}	25		
Fumaric	$C_4H_4O_4$	1×10^{-3}	25	3×10^{-5}	25
Hippuric	$C_9H_9O_3N$	2.3×10^{-4}	25		
Hydrocyanic	HCN	7.2×10^{-10}	25		
Hydroquinone	$C_6H_6O_2$	1.1×10^{-10}	18		
Hydrosulfuric	H_2S	9.1×10^{-8}	18	1.2×10^{-15}	
Hydrazoic	HN_3	1.9×10^{-5}	25		
Hypochlorous	$HOCl$	3.7×10^{-8}	17		
Iodic	HIO_3	1.9×10^{-1}	25		
Isobutyric	$C_4H_8O_2$	1.5×10^{-5}	25		
Isovaleric	$C_5H_{10}O_2$	1.7×10^{-5}	25		
Lactic	$C_3H_6O_3$	1.38×10^{-4}	25		
Maleic	$C_4H_4O_4$	1.5×10^{-2}	25	2.6×10^{-7}	25
Malic	$C_4H_6O_5$	4×10^{-4}	25	9×10^{-6}	25
Malonic	$C_3H_4O_4$	1.61×10^{-3}	25	2.1×10^{-6}	25
Mandelic	$C_8H_8O_3$	4.29×10^{-4}	25		
α -Naphthoic	$C_{11}H_8O_2$	2×10^{-4}	25		
β -Naphthoic	$C_{11}H_8O_2$	6.8×10^{-5}	25		
Nicotinic	$C_6H_5O_2N$	1.4×10^{-5}	25		
Nitrous	HNO_2	4×10^{-4}	18		
Oxalic	$H_2C_2O_4$	6.5×10^{-2}	25	6.1×10^{-5}	25
Periodic	HIO_4	2.3×10^{-2}	25		
Phenol	C_6H_6O	1.3×10^{-10}	25		
Phosphoric	H_3PO_4	1.1×10^{-2}	18	7.5×10^{-8} 4.8×10^{-13} (3H)	18 18
Phosphorous	H_3PO_3	7×10^{-3}	25	2×10^{-5}	25
Phthalic	$C_8H_6O_4$	1.26×10^{-3}	25	3.1×10^{-6}	25
Picolinic	$C_6H_5O_2N$	3×10^{-6}	25		
Picric	$C_6H_3O_7N_3$	1.6×10^{-1}	18		
Propionic	$C_3H_6O_2$	1.4×10^{-5}	25		
Pyromucic	$C_5H_4O_3$	7.1×10^{-4}	25		
Pyrophosphoric	$H_4P_2O_7$	1.4×10^{-1}	18	1.1×10^{-2} 2.9×10^{-7} (3H) 3.6×10^{-9} (4H)	18 18 18
Pyrotartaric	$C_5H_8O_4$	8.7×10^{-5}	25		
Salicylic	$C_7H_6O_3$	1.06×10^{-3}	25	1×10^{-13}	20
Selenious	H_2SeO_3	3×10^{-3}	25	5×10^{-8}	25
Succinic	$C_4H_6O_4$	6.6×10^{-5}	25	2.8×10^{-6}	25
Sulfanilic	$C_6H_7O_3NS$	6.2×10^{-4}			
Sulfuric	H_2SO_4			2×10^{-2}	18

DISSOCIATION CONSTANTS OF ACIDS (Continued)

Acid	Formula	Constant for the first hydrogen	Temp. °C.	Constant for the second hydrogen	Temp. °C.
Sulfurous.....	H ₂ SO ₃	1.7 × 10 ⁻²	25	5 × 10 ⁻⁶	25
Tartaric.....	C ₄ H ₆ O ₆	1.1 × 10 ⁻³	25	6.9 × 10 ⁻⁶	25
Telluric.....	H ₂ TeO ₄	6 × 10 ⁻⁷	25	4 × 10 ⁻¹¹	25
Tellurous.....	H ₂ TeO ₃	3 × 10 ⁻³	25	2 × 10 ⁻⁸	25
Trichloroacetic.....	C ₂ HCl ₃ O ₂	2 × 10 ⁻¹	18		
Uric.....	C ₅ H ₄ O ₃ N ₄	1.5 × 10 ⁻⁶	25		
Valeric.....	C ₅ H ₁₀ O ₂	1.6 × 10 ⁻⁶	25		

PROPERTIES OF THE AMINO ACIDS

Compiled by M. S. Dunn
with the cooperation of Frank J. Ross and M. Palmer Stoddard

Data are given in the following tables for the *dl*, *d*(+), *d*(-), *l*(+), and *l*(-) forms of the amino acids which are considered to be constituents of native proteins. All of the naturally occurring forms of the amino acids have the "*l*" configuration around the alpha carbon atom. The symbols (+) and (-) refer to the direction of rotation in water at 25°C. The values quoted are those considered to be most reliable.

Composition of the Amino Acids

The molecular weights and percentage composition of the amino acids given in the following table were calculated from the 1939 International Atomic Weights.

Amino acid	Empirical formula	Molecular weight	Percentage Composition ¹			
			Carbon	Hydrogen	Oxygen	Nitrogen
Alanine.....	C ₃ H ₇ O ₂ N	89.095	40.440	7.920	35.917	15.723
Arginine.....	C ₆ H ₁₄ O ₂ N ₄	174.205	41.365	8.102	18.369	32.164
Aspartic acid.....	C ₄ H ₇ O ₄ N	133.105	36.092	5.302	48.082	10.524
Cystine ¹	C ₆ H ₁₂ O ₄ N ₂ S ₂	240.29	29.989	5.034	26.634	11.659
Diiodotyrosine ²	C ₉ H ₉ O ₃ NI ₂	433.01	24.962	2.095	11.085	3.235
Glutamic acid.....	C ₅ H ₉ O ₄ N	147.131	40.814	6.167	43.499	9.521
Glycine.....	C ₂ H ₅ O ₂ N	75.068	31.998	6.715	42.628	18.660
Histidine.....	C ₆ H ₉ O ₂ N ₃	155.157	46.443	5.848	20.624	27.085
Hydroxyglutamic acid.....	C ₅ H ₉ O ₅ N	163.131	36.811	5.562	49.040	8.587
Hydroxyproline.....	C ₅ H ₉ O ₃ N	131.131	45.794	6.919	36.605	10.682
Isoleucine.....	C ₆ H ₁₃ O ₂ N	131.173	54.935	9.991	24.395	10.679
Leucine.....	C ₆ H ₁₃ O ₂ N	131.173	54.935	9.991	24.395	10.679
Lysine.....	C ₆ H ₁₄ O ₂ N ₂	146.189	49.292	9.654	21.889	19.164
Methionine ³	C ₅ H ₁₁ O ₂ NS	149.21	40.245	7.432	21.446	9.388
Norleucine.....	C ₆ H ₁₃ O ₂ N	131.173	54.935	9.991	24.395	10.679
Phenylalanine.....	C ₉ H ₁₁ O ₂ N	165.187	65.435	6.713	19.372	8.480
Proline.....	C ₅ H ₉ O ₂ N	115.131	52.158	7.881	27.794	12.167
Serine.....	C ₃ H ₇ O ₃ N	105.095	34.283	6.715	45.673	13.329
Threonine.....	C ₄ H ₉ O ₃ N	119.121	40.329	7.617	40.295	11.759
Thyroxine ⁴	C ₁₅ H ₁₁ O ₄ NI ₄	776.927	23.188	1.427	8.238	1.803
Tryptophane.....	C ₁₁ H ₁₂ O ₂ N ₂	204.223	64.689	5.926	15.669	13.718
Tyrosine.....	C ₉ H ₁₁ O ₃ N	181.187	59.657	6.120	26.492	7.731
Valine.....	C ₆ H ₁₁ O ₂ N	117.147	51.260	9.466	27.316	11.958

¹ 26.68 per cent sulfur. ² 58.622 per cent iodine. ³ 21.486 per cent sulfur.
⁴ 65.345 per cent iodine.

PROPERTIES OF AMINO ACIDS

IONIZATION CONSTANTS AND pH VALUES AT THE ISOELECTRIC POINTS OF THE AMINO ACIDS IN WATER AT 25°C

The majority of the recorded values are true thermodynamic constants calculated from electrometric force measurements of cells without liquid junctions. The values for the constants given in the table were derived from the classical, the zwitterionic (Bjerrum), and the acidic (Brönsted) formulations of ionization and the corresponding mass law expressions. pI values at the isoelectric points were calculated from the expression, $pI = \frac{1}{2}(pK_{A1} + pK_{B2} - pK_{A2})$. The error is approximately 0.5 per cent when this expression is used to calculate pI values for cystine, tyrosine, and diiodotyrosine.

Amino acid	Classical				Zwitterionic				Acidic				pI	Ref. no.
	pK_{A1}	pK_{A2}	pK_{B1}	pK_{B2}	pK_{A1}	pK_{A2}	pK_{B1}	pK_{B2}	pK_1	pK_2	pK_3	pK_4		
<i>dl</i> -Alanine.....	9.866	.....	11.649	.....	2.348	.....	4.131	.....	2.348	9.866	.....	.....	6.107	1
<i>l</i> (+)-Arginine.....	12.48	.....	4.96	11.99	2.01	.....	1.52	4.96	2.01	9.04	12.48	.....	10.76	2
<i>l</i> (+)-Aspartic acid.....	3.86	9.82	11.93	.....	2.10	3.86	4.18	.....	2.10	3.86	9.82	.....	2.98	3
<i>l</i> (-)-Cystine.....	8.00	10.25	11.95	12.96	1.04	2.05	3.75	6.00	1.04	2.05	8.00	10.25	5.02	4
<i>l</i> (-)-Diiodotyrosine.....	6.48	7.82	11.88	.....	2.12	6.48	6.18	.....	2.12	6.48	7.82	.....	4.29	5,6
<i>l</i> (+)-Glutamic acid.....	4.07	9.47	11.90	.....	2.10	4.07	4.53	.....	2.10	4.07	9.47	.....	3.08	7
Glycine.....	9.778	.....	11.647	.....	2.350	.....	4.219	.....	2.350	9.778	.....	.....	6.064	8
<i>l</i> (-)-Histidine.....	9.18	.....	7.90	12.23	1.77	.....	4.82	7.90	1.77	6.10	9.18	.....	7.64	3
<i>l</i> (+)-Hydroxyglutamic acid.....	4.24	9.56	11.67	.....	2.33	4.24	4.44	.....	2.33	4.24	9.56	.....	3.28	9
<i>l</i> (-)-Hydroxyproline.....	9.73	.....	12.08	.....	1.92	.....	4.27	.....	1.92	9.73	.....	.....	5.82	9
<i>dl</i> -Isoleucine.....	9.758	.....	11.679	.....	2.318	.....	4.239	.....	2.318	9.758	.....	.....	6.038	1
<i>dl</i> -Leucine.....	9.744	.....	11.669	.....	2.328	.....	4.253	.....	2.328	9.744	.....	.....	6.036	1
<i>l</i> (+)-Lysine.....	10.53	.....	5.05	11.82	2.18	.....	3.47	5.05	2.18	8.95	10.53	.....	9.47	2
<i>dl</i> -Methionine.....	9.21	.....	11.72	.....	2.28	.....	4.79	.....	2.28	8.91	.....	.....	5.74	10
<i>dl</i> -Norleucine.....	9.834	.....	11.662	.....	2.335	.....	4.163	.....	2.335	9.834	.....	.....	6.084	1
<i>dl</i> -Phenylalanine.....	9.24	.....	11.42	.....	2.58	.....	4.76	.....	2.58	9.24	.....	.....	5.91	11
<i>l</i> (-)-Proline.....	10.60	.....	12.0	.....	2.00	.....	3.40	.....	2.00	10.60	.....	.....	6.3	12
<i>dl</i> -Serine.....	9.15	.....	11.79	.....	2.21	.....	4.85	.....	2.21	9.15	.....	.....	5.68	9
<i>l</i> (-)-Tryptophane.....	9.39	.....	11.62	.....	2.38	.....	4.61	.....	2.38	9.39	.....	.....	5.88	13
<i>l</i> (-)-Tyrosine.....	9.11	10.07	11.80	.....	2.20	9.11	3.93	.....	2.20	9.11	10.07	.....	5.63	6
<i>dl</i> -Valine.....	9.719	.....	11.711	.....	2.286	.....	4.278	.....	2.286	9.719	.....	.....	6.002	1

IONIZATION CONSTANTS AND pH VALUES AT THE ISOELECTRIC POINTS OF THE AMINO ACIDS IN WATER AT 25°C (Continued)

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Ionization Constants of the Amino Acids in Aqueous Ethanol Solutions

Amino acid	pK_1	pK_2	pK_3	Volume per cent ethanol	Tempera- ture °C	Ref. No.
Alanine.....	3.55	10.02	.....	72	25	1
Arginine.....	3.34	9.40	14.1	72	25	1
Aspartic acid.....	2.85	5.20	10.51	72	25	1
Glutamic acid.....	3.16	5.63	10.75	72	25	2
Glycine.....	2.66	9.82	.....	10	19.5	2
	2.96	9.76	.....	40	19.5	2
	3.46	9.82	.....	72	25	1
	3.79	9.99	.....	90	19.5	2
Histidine.....	3.00	5.85	9.45	72	25	1
Isoleucine.....	3.69	9.81	.....	72	25	1
Lysine.....	2.75	8.95	10.53	48	25	1
	3.56	8.95	10.49	84	25	1
Proline.....	3.04	10.55	72	25	1
Valine.....	3.60	9.73	72	25	1

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Ionization Constants of the Amino Acids in Aqueous Formaldehyde Solution^a

Amino acid	Mole per cent formaldehyde				
	0.99	3.95	5.60	10.0	17.9
<i>dl</i> -Alanine.....	8.36	7.42	6.96 ^(b)	6.56	6.10
<i>l</i> (+)-Arginine.....		3.45 ^(c)	3.40 ^(d)		
<i>l</i> (+)-Aspartic acid.....			7.21 ^(d)	≅3.8 ^(e)	
				6.85 ^(f)	
<i>l</i> (+)-Glutamic acid.....			6.91 ^(d)	≅4.2 ^(e)	
				6.8 ^(f)	
Glycine.....	7.16	6.08	5.92 ^(b)	5.34	5.04
<i>l</i> (-)-Histidine.....		7.90 ^(c)	7.90 ^(d)		
<i>l</i> (-)-Hydroxyproline.....			7.19 ^(d)		
<i>l</i> (-)-Leucine.....	8.44	7.50	6.92 ^(d)	6.62	6.20
<i>dl</i> -Leucine.....	8.44	7.48		6.60	6.20
<i>l</i> (+)-Lysine.....		7.35 ^(c)	7.15 ^(d)		
<i>l</i> (+)-Norleucine.....	8.42	7.48		6.61	
<i>dl</i> -Norleucine.....	8.42	7.48	7.10 ^(b)	6.61	6.21
<i>l</i> (-)-Phenylalanine.....			6.62 ^(d)	5.9 ^(e)	
<i>dl</i> -Phenylalanine.....	8.09	7.16	6.80 ^(b)	6.35	6.13
<i>l</i> (-)-Proline.....			7.78 ^(d)		
<i>dl</i> -Serine.....	6.66	5.74	5.63 ^(b)		4.94
<i>l</i> (-)-Tryptophane.....			6.88 ^(d)		
<i>l</i> (-)-Tyrosine.....			7.50 ^(d)	6.2 ^(e)	
				>9 ^(f)	
<i>dl</i> -Valine.....	8.52	7.65	7.47 ^(b)		6.52

^(a) Dunn and Weiner (1), pK_2 at 22°.

^(b) Dunn and Loshakoff (2), pK_2 at 22°.

^(c) Levy (3) pK_2 at 30° for arginine and pK_3 at 30° for histidine and lysine.

^(d) Levy and Silberman (4), pK_2 at 30°, pK_3 at 30° for histidine and lysine.

^(e) Harris (5), pK_2 at 25° for aspartic acid, glutamic acid, phenylalanine and tyrosine.

^(f) Harris (5), pK_3 at 30° for aspartic acid, glutamic acid, and tyrosine.

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Specific Rotations of the Amino Acids Using Sodium Light (5893 Å)

Abbreviations

- c*—grams of solute per 100 ml. of solution.
d—density of the solution.
p—grams of solute per 100 grams of solution.
l—length of the tube in decimeters.
 α —observed rotation in angular degrees.
 $[\alpha]$ —specific rotation in angular degrees calculated from

$$[\alpha]_{\lambda}^t = \frac{c \times 100}{c \times l} = \frac{\alpha \times 100}{p \times d \times l}$$
 where *t* is temperature in °C and λ is wave length of the incident light in Ångstroms.
A—prepared from a protein or other naturally occurring material.
B—prepared by resolution of the inactive synthetic form.
C—prepared by resolution of the inactive racemized form.
D—prepared from the inactive synthetic form by a biological method.
E—prepared from the inactive racemized form by a biological method.
 ?—source not given.

Source	<i>c</i>	Solvent	<i>d</i>	<i>p</i>	Moles acid or base per mole amino acid	<i>l</i>	Temp. °C.	α	$[\alpha]$	Ref. No.
<i>l</i> (+)-Alanine										
A	5.790	0.97 N HCl	1.033	5.605	1.5	2	15	+1.70	+14.7	1
A	10.3	Water	1.03	1.00	0	2	22	+0.55	+2.7	2
A	1.781	3 N NaOH	.....	.....	15	2	20	.....	+3.0	3
<i>d</i> (-)-Alanine										
B	1.344	6 N HCl	1.....	.....	39.4	2	30.4	-0.392	-14.6	4
<i>l</i> (+)-Arginine										
A	1.653	6.0 N HCl	.....	.....	63	4.001	23.4	+1.777	+26.9	5
A	3.48	Water	.....	.....	0	2	20	.....	+12.5	6
A	0.87	0.50 N NaOH	.....	.....	10	2	20	.....	+11.8	6
<i>l</i> (+)-Aspartic acid										
A	2.002	6.0 N HCl	.....	.....	39	4.001	24.0	+1.972	+24.6	7
A	1.3300	Water	.....	.....	0	3	18	.....	+4.7	3
A	1.3300	3 N NaOH	.....	.....	30	3	18	.....	-1.7	3
<i>d</i> (-)-Aspartic acid										
C	4.289	0.97 N HCl	1.032	4.156	3	1	20	-1.09	-25.5	8
<i>l</i> (-)-Cystine										
A	0.9974	1.02 N HCl	1.0181	0.9797	24.6	2	24.35	-4.277	-214.40	9
A	0.400	0.20 N NaOH	.....	.....	12	2	18.5	.....	-70.0	3
<i>d</i> (+)-Cystine										
C	1.....	1 N HCl	1.....	1	24	1.....	20	1.....	+223	10
<i>l</i> (-)-Diiodotyrosine										
A	5.08	1.1 N HCl	1.05	4.84	9.4	1	20	+0.15	+2.89	11
A	4.41	13.4 N NH ₄ OH	0.9779	4.51	132	1	20	+0.10	+2.27	11
<i>l</i> (+)-Glutamic acid										
A	1.002	6.0 N HCl	.....	.....	87	4.001	22.4	+1.25	+31.2	12
A	1.471	Water	.....	.....	0	2	18	.....	+11.5	3
A	1.471	1 N NaOH	.....	.....	10	2	18	.....	+10.96	3
<i>d</i> (-)-Glutamic acid										
C	5.425	0.37 N HCl	1.0233	5.3011	1	1	20	-1.63	-30.05	8
<i>l</i> (-)-Histidine										
A	1.480	6.0 N HCl	.....	.....	63	4.001	22.7	+0.766	+13.0	7
A	1.128	Water	1.0012	1.127	0	4	25.00	-1.714	-39.01	13
A	0.775	0.50 N NaOH	.....	.....	10	2	20	.....	-10.9	6

Specific Rotations of the Amino Acids Using Sodium Light (5893 Å) (Continued)

Source	<i>c</i>	Solvent	<i>d</i>	<i>p</i>	Moles acid or base per mole amino acid	<i>l</i>	Temp. °C.	α	$[\alpha]$	Ref. No.
<i>d</i> (+)-Histidine										
?	4.000	1.0 <i>N</i> HCl	.....	.....	4	1	20	-0.407	-10.2	14
B	2.66	Water	.....	.....	0	2	23	+2.11	+39.8	14
<i>l</i> (+)-Hydroxyglutamic acid										
A	1.33	6.0 <i>N</i> HCl	.....	.....	73	2.0	20	+0.47	+17.6	15
A	4.0	Water	.....	.....	0	2.0	20	+0.10	+1.2	15
<i>l</i> (-)-Hydroxyproline (a)										
A	1.31	1.0 <i>N</i> HCl	.....	.....	10	2	20	.....	-47.3	6
A	1.001	Water	.....	.....	0	4.001	22.5	-3.009	-75.2	7
A	0.655	0.50 <i>N</i> NaOH	.....	.....	10	2	20	.....	-70.6	6
<i>d</i> (+)-Hydroxyproline (a)										
B	4.48	Water	1.03	4.35	0	1	21	+3.37	+75.2	16
(-)-Hydroxyproline (b)										
B	2.617	Water	1.014	2.581	0	1	18	-1.52	-58.1	16
(+) -Hydroxyproline (b)										
B	2.530	Water	1.013	2.998	0	1	17	+1.48	+58.5	16
<i>l</i> (+)-Isoleucine										
B	5.09	6.1 <i>N</i> HCl	1.098	4.64	15	1	20	+2.07	+40.61	17
B	3.10	Water	1.008	3.08	0	2	20	+0.70	+11.29	17
A	3.34	0.33 <i>N</i> NaOH	1.017	3.28	1.3	2	20	+0.74	+11.09	18
<i>d</i> (-)-Isoleucine										
B	4.53	6.1 <i>N</i> HCl	1.083	4.18	17	1	20	-1.85	-40.86	17
B	3.12	Water	1.006	3.10	0	2	20	-0.66	-10.55	17
<i>d</i> (-)- <i>allo</i> -Isoleucine										
D	5.14	6.0 <i>N</i> HCl	1.094	4.70	15.0	2	20	-3.80	-36.95	19
B	2.00	Water	.....	.....	0	1	20	-0.285	-14.2	20
<i>l</i> (+)- <i>allo</i> -Isoleucine										
B	3.97	6.0 <i>N</i> HCl	.....	.....	20	1	20	+1.50	+38.1	20
B	2.00	Water	.....	.....	0	1	20	+0.28	+14.0	20
<i>l</i> (-)-Leucine										
A	1.999	6.0 <i>N</i> HCl	.....	.....	38	4.001	25.9	+1.212	+15.1	5
A	2.001	Water	.....	.....	0	4.001	24.7	-0.863	-10.8	5
A	1.31	3.00 <i>N</i> NaOH	.....	.....	30	2	20	.....	+7.6	3
<i>d</i> (+)-Leucine										
?	4.0	6.0 <i>N</i> HCl	1.1	3.664	19	2	20	+1.26	-15.6	21
?	.....	Water	.....	2.08	0	2	20	+0.43	+10.34	38
<i>l</i> (+)-Lysine										
A	2.00	6.0 <i>N</i> HCl	.....	.....	43	4	22.9	+1.652	+25.9	5
A	6.496	Water	.....	.....	0	2	20	+1.90	+14.6	22
<i>d</i> (-)-Lysine										
B	2.00	0.27 <i>N</i> HCl	.....	.....	2	2	20	-0.939	-23.48	23
<i>l</i> (-)-Methionine										
B	0.80	Water	.....	.....	0	2	25	-0.13	-8.11	24
<i>d</i> (+)-Methionine										
B	0.80	0.2001 <i>N</i> HCl	.....	.....	4	2	25	-0.34	-21.18	24
B	0.80	Water	.....	.....	0	2	25	+0.13	+8.12	24
B	0.80	0.6 <i>N</i> NaHCO ₃	.....	.....	11	2	25	-0.12	-7.47	24

Specific Rotations of the Amino Acids Using Sodium Light (5893 Å) (Continued)

Source	<i>c</i>	Solvent	<i>d</i>	<i>p</i>	Moles acid or base per mole amino acid	<i>l</i>	Temp. °C.	α	$[\alpha]$	Ref. No.
<i>l</i> (+)-Norleucine										
B	4.25	6.0 <i>N</i> HCl	1.10	3.86	18	2	20	+1.81	+21.3	25
B	0.70	Water	.....	0.753	0	2	20	+0.095	+6.26	26
<i>d</i> (-)-Norleucine										
B	4.69	6.0 <i>N</i> HCl	1.10	4.26	16	2	20	-2.10	-22.4	25
B	0.96	Water	.....	0.959	0	2	20	-0.087	-4.49	26
<i>l</i> (-)-Phenylalanine										
B	1.936	Water	1.0040	1.928	0	2	20	-1.36	-35.14	27
<i>d</i> (+)-Phenylalanine										
B	3.814	5.4 <i>N</i> HCl	1.0895	3.501	23	2	20	+0.54	+7.07	28
B	2.043	Water	1.0045	2.034	0	2	20	+1.43	+35.0	27
<i>l</i> (-)-Proline										
A	0.575	0.50 <i>N</i> HCl	.....	.....	10	2	20	.....	-52.6	6
A	1.001	Water	.....	.....	0	4.001	23.4	-3.402	-85.0	7
B	2.42	0.6 <i>N</i> KOH	1.031	2.35	3	1	20	-2.25	-93.0	29
<i>d</i> (+)-Proline										
B	3.90	Water	1.01	3.865	0	1	20	+3.18	+81.5	29
<i>l</i> (-)-Serine										
B	9.344	1 <i>N</i> HCl	1.0465	8.929	1	1	25	+1.35	+14.45	30
B	10.414	Water	1.0414	9.997	0	2	20	-1.42	-6.83	30
<i>d</i> (+)-Serine										
B	9.359	1 <i>N</i> HCl	1.0465	8.943	1	1	25	-1.34	-14.32	30
B	10.412	Water	1.0414	9.998	0	2	20	+1.43	+6.87	30
<i>d</i> (-)-Threonine										
B	.....	Water	.....	1.092	0	2	26	-0.625	-28.3	31
<i>l</i> (+)-Threonine										
B	.....	Water	.....	1.331	0	2	26	+0.780	+28.4	31
(-)- <i>allo</i> -Threonine										
B	.....	Water	.....	1.634	0	2	26	-0.302	-9.1	31
(+) - <i>allo</i> -Threonine										
B	.....	Water	.....	1.643	0	2	26	+0.320	+9.6	31
<i>l</i> (?)-Thyroxine										
A	.....	0.13 <i>N</i> NaOH in 70% EtOH by weight	.....	3	3	1	.....	-0.147	-4.4	32
<i>l</i> (-)-Tryptophane										
A	1.02	0.50 <i>N</i> HCl	.....	.....	10	2	20	.....	+2.4	6
A	1.004	Water	.....	.....	0	4.001	22.7	-1.266	-31.5	7
A	2.426	0.5 <i>N</i> NaOH	1.0243	2.368	4.2	1	20	+0.15	+6.17	33
<i>d</i> (+)-Tryptophane										
C	0.5024	Water	.....	.....	0	2	25	+0.326	+32.45	34
<i>l</i> (-)-Tyrosine										
B	4.40	6.3 <i>N</i> HCl	1.116	3.94	28	2	20	-0.76	-8.64	35
A	0.906	3.0 <i>N</i> NaOH	.....	.....	60	3	18	.....	-13.2	3
<i>d</i> (+)-Tyrosine										
B	5.1484	6.3 <i>N</i> HCl	1.1175	4.6071	24	2	20	+0.89	+8.64	35

Specific Rotations of the Amino Acids Using Sodium Light (5893 Å) (Continued)

Source	<i>c</i>	Solvent	<i>d</i>	<i>p</i>	Moles acid or base per mole amino acid	<i>l</i>	Temp. °C.	α	$[\alpha]$	Ref. No.
<i>l</i> (+)-Valine										
<i>B</i>	3.4	6.0 <i>N</i> HCl	1.1	3.05	20	2	20	+1.93	+28.8	36
<i>B</i>	3.58	Water	1.007	3.56	0	2	20	+0.46	+6.42	36
<i>d</i> (-)-Valine										
<i>B</i>	3.2	6.0 <i>N</i> HCl	1.1	2.91	21	2	20	-1.86	-29.04	36
<i>E</i>	6.24	Water	1.00	6.24	0	1	20	-0.37	-6.06	37

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Solubilities of the Amino Acids in Grams per 100 Grams of Water

Amino acid	Temperature, °C.					Ref. No.
	0°	25°	50°	75°	100°	
<i>dl</i> -Alanine.....	12.11	16.72	23.09	31.89	44.04	1
<i>l</i> (+)-Alanine.....	12.73	16.65	21.79	28.51	37.30	1
<i>dl</i> -Aspartic acid.....	0.262	0.778	2.000	4.456	8.594	1
<i>l</i> (+)-Aspartic acid.....	0.209	0.500	1.199	2.875	6.893	1
<i>l</i> (-)-Cystine† × 10 ²	0.502	1.096	2.394	5.229	11.42	2
<i>dl</i> -Diiodotyrosine × 10.....	0.149	0.340	0.773	.....	.....	3
<i>l</i> (-)-Diiodotyrosine × 10.....	0.204	0.617	1.862	5.62	17.00	1
<i>dl</i> -Glutamic acid.....	0.855	2.054	4.934	11.86	28.49	1
<i>l</i> (+)-Glutamic acid.....	0.341	0.864	2.186	5.532	14.00	1
Glycine.....	14.18	24.99	39.10	54.39	67.17	1
<i>l</i> (-)-Histidine.....	.....	4.19	.....	.....	.....	4
<i>l</i> (-)-Hydroxyproline (a).....	28.86	36.11	45.18	51.67*	.....	5
<i>dl</i> -Isoleucine.....	1.826	2.229	3.034	4.607	7.802	1
<i>l</i> (+)-Isoleucine.....	3.791	4.117	4.818	6.076	8.255	2
<i>dl</i> -Leucine.....	0.797	0.991	1.406	2.276	4.206	1
<i>l</i> (-)-Leucine.....	2.270	2.426†	2.887†	3.823	5.638	1
<i>dl</i> -Methionine.....	1.818	3.381	6.070	10.52	17.60	2
<i>dl</i> -Norleucine.....	0.843	1.149	1.727	2.861	5.229	1
<i>dl</i> -Phenylalanine.....	0.997	1.411	2.187	3.708	6.886	1
<i>l</i> (-)-Phenylalanine.....	1.983	2.965	4.431	6.624	9.900	2
<i>l</i> (-)-Proline × 10 ⁻¹	12.74	16.23	20.67	23.90*	.....	3
<i>dl</i> -Serine.....	2.204	5.023	10.34	19.21	32.24	2
<i>l</i> (-)-Tryptophane.....	0.823	1.136	1.706	2.795	4.987	2
<i>dl</i> -Tyrosine × 10.....	0.147	0.351	0.836	.....	.....	3
<i>l</i> (-)-Tyrosine × 10.....	0.196	0.453	1.052	2.438	5.650	1
<i>d</i> (+)-Tyrosine × 10.....	0.196	0.453	1.052	.....	.....	3
<i>dl</i> -Valine.....	5.98	7.09	9.11	12.61	18.81	1
<i>l</i> (+)-Valine.....	8.34	8.85	9.62	10.24*	.....	6

* Value at 65°.

† Dunn and Stoddard (7) report 2.19 g. at 25° for *l*(-)-leucine rendered methionine-free by repeated recrystallization from 6 N HCl. Hlynka (8) found 2.20 g. at 25° and 2.66 g. at 50° for *l*(-)-leucine rendered methionine-free [by S. W. Fox (9)] by fractional crystallization of the formyl derivative and identical values for *d*(+)-leucine obtained by resolution of the *dl*-form.

‡ The following values were found by Loring and du Vigneaud (10): *dl*-cystine (0.0049g), *d*(+)-cystine (0.0108 g), and *meso*-cystine (0.0056 g) at 25°.

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Solubilities of the Amino Acids in Grams per 100 Grams of Water-Ethanol Mixtures

Per cent ethanol by volume	Temp. °C	Grams amino acid per 100 grams solvent	Ref. No.	Per cent ethanol by volume	Temp. °C	Grams amino acid per 100 grams solvent	Ref. No.
<i>dl</i> -Alanine				Glycine			
24.93	0.00	3.84	1	24.93	0.02	3.95	1
50.10	0.00	1.16	1	50.10	0.02	1.03	1
74.50	0.00	0.305	1	74.50	0.02	0.200	1
95.14	0.00	0.0167	1	95.09	0.01	0.0080	1
10	25	12.25	2	10	25	17.13	2
24.93	24.97	7.09	1	24.93	24.97	8.72	1
50.10	24.97	2.52	1	50.10	24.97	2.47	1
74.20	24.97	0.573	1	74.20	24.97	0.448	1
95.14	25.09	0.0329	1	95.14	25.09	0.0172	1
25.28	45.16	10.6	1	24.93	44.98	15.0	1
50.10	44.96	4.25	1	50.10	44.98	4.62	1
74.20	44.98	0.949	1	74.20	44.97	0.756	1
95.14	45.19	0.0545	1	95.14	45.19	0.0294	1
24.93	64.96	15.9	1	24.93	65.11	24.5	1
50.10	64.94	6.68	1	50.10	65.10	8.03	1
74.20	64.94	1.48	1	74.20	65.07	1.23	1
95.09	65.15	0.0851	1	95.14	65.00	0.0488	1
<i>dl</i> -Aspartic acid				<i>l</i> (+)-Isoleucine			
24.93	0.03	0.0703	1	80	20	0.46	4
50.10	0.03	0.0267	1	80	78-80	1.16	4
74.20	0.02	0.0111	1	<i>l</i> (+)- <i>allo</i> -Isoleucine			
24.55	25.06	0.266	1	80	20	0.81	4
50.25	25.06	0.0992	1	80	78-80	1.97	4
74.28	25.14	0.317	1	<i>dl</i> -Leucine			
95.14	25.07	0.0020	1	24.93	0.00	0.251	1
24.74	45.25	0.680	1	50.10	0.00	0.118	1
50.18	45.25	0.255	1	74.50	0.00	0.0693	1
74.28	45.27	0.0608	1	95.14	0.00	0.0116	1
95.14	45.21	0.0042	1	10	25	0.771	2
24.93	64.91	1.53	1	24.93	24.97	0.493	1
50.10	64.91	0.588	1	50.10	24.97	0.318	1
74.20	65.07	0.132	1	74.20	24.97	0.175	1
95.14	65.00	0.0129	1	95.14	25.09	0.0258	1
<i>l</i> (+)-Aspartic acid				24.93	45.24	0.853	1
20	25	0.204	3	50.10	45.24	0.633	1
50	25	0.0633	3	74.50	45.18	0.323	1
70	25	0.0224	3	95.14	45.18	0.0471	1
90	25	0.0034	3	24.93	65.16	1.45	1
<i>l</i> (+)-Glutamic acid				50.10	65.20	1.16	1
24.74	0.01	0.0855	1	74.20	65.15	0.584	1
50.18	0.01	0.0371	1	95.09	65.07	0.0844	1
74.28	0.03	0.0163	1	<i>l</i> (-)-Leucine			
24.56	25.05	0.292	1	20	25	1.33	2
50.25	25.08	0.131	1	60	25	0.641	2
74.35	25.07	0.0370	1	90	25	0.123	2
95.14	25.04	0.0044	1				
24.55	45.01	0.811	1				
50.18	45.27	0.378	1				
74.35	44.93	0.0885	1				
95.14	45.20	0.0127	1				

Solubilities of the Amino Acids in Grams per 100 Grams of Water-Ethanol Mixtures (Continued)

Per cent ethanol by volume	Temp. °C	Grams amino acid per 100 grams solvent	Ref. No.	Per cent ethanol by volume	Temp. °C	Grams amino acid per 100 grams solvent	Ref. No.
<i>dl</i> -Norleucine				<i>dl</i> - <i>allo</i> -Threonine			
24.93	0.00	0.275	1	95	25	0.03*	6
50.10	0.00	0.147	1	<i>l</i> (-)-Tyrosine			
74.50	0.00	0.0995	1	95	17	0.10	7
95.14	0.00	0.0192	1	<i>dl</i> -Tyrosine			
24.93	25.69	0.625	1	95.09	0.00	0.0031	8
50.10	25.69	0.453	1	25.28	24.85	0.0285	8
74.20	24.97	0.266	1	50.99	24.75	0.0226	8
95.14	25.09	0.0417	1	74.63	24.75	0.0117	8
24.93	44.97	1.12	1	95.09	25.24	0.0032	8
50.10	44.96	0.918	1	25.28	45.15	0.0630	8
74.20	44.96	0.518	1	50.99	45.16	0.0513	8
95.14	45.18	0.0759	1	74.63	44.93	0.0230	8
24.93	65.17	2.02	1	95.09	44.98	0.0035	8
50.10	65.17	1.76	1	95.09	65.06	0.0067	8
74.20	65.17	0.944	1	<i>dl</i> -Valine			
95.14	65.01	0.134	1	24.93	0.02	2.10	1
<i>l</i> (-)-Proline				50.10	0.02	0.769	1
100	19	1.5	5	74.20	0.02	0.269	1
<i>dl</i> -Serine				95.14	0.01	0.0277	1
24.93	0.00	0.1530	1	10	25	5.50	2
50.10	0.00	0.146	1	25.28	24.85	3.30	1
74.50	0.00	0.0304	1	50.99	24.85	1.53	1
95.14	0.00	0.0008	1	74.35	24.93	0.570	1
24.93	25.14	1.54	1	95.14	25.04	0.0569	1
50.10	25.14	0.461	1	24.55	44.91	5.10	1
74.50	25.10	0.0840	1	50.25	44.92	2.74	1
95.14	25.09	0.0028	1	74.35	44.92	0.999	1
24.93	45.15	3.14	1	95.14	45.21	0.0979	1
50.10	45.04	0.985	1	24.55	65.07	7.44	1
74.20	45.04	0.185	1	50.10	64.94	4.49	1
95.14	45.18	0.0058	1	74.20	64.34	1.62	1
24.93	65.26	5.99	1	95.09	65.15	0.167	1
50.10	65.25	1.88	1	<i>l</i> (+)-Valine			
74.50	65.24	0.318	1	20	25	5.11	2
95.14	65.01	0.0152	1	40	25	2.93	2
<i>dl</i> -Threonine				60	25	1.61	2
95	25	0.07*	6	80	25	0.52	2

* Grams per 100 ml. of solution.

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1. Dunn, M. S., and Ross, F. J., *J. Biol. Chem.*, **125**, 309 (1938).
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7. Stutzer, A., *Z. anal. Chem.*, **31**, 501 (1892).
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Solubilities of the Amino Acids in Grams per 100 Grams of Organic Solvent

Solvent	Grams amino acid per 100 grams solvent	Temp. °C.	Ref. No.	Solvent	Grams amino acid per 100 grams solvent	Temp. °C.	Ref. No.
<i>dl</i> -Alanine				<i>l</i> (+)- <i>allo</i> -Isoleucine			
Ethanol	0.0087	25	1	Ethanol	0.13	20	5
<i>l</i> (+)-Aspartic acid				Ethanol	0.19	78-80	5
Ethanol	0.000196	25	2	<i>l</i> (-)-Leucine			
<i>l</i> (+)-Glutamic acid				Ethanol	0.0217	25	1
Ethanol	0.000347	25	2	<i>dl</i> -Norleucine			
Ethanol	0.0056	44.93	3	Acetone	0.00132	25	4
Glycine				Butanol	0.00545	25	4
Acetone	0.000291	25	4	Ethanol	0.0173	25	1
Butanol	0.000892	25	4	Formamide	0.201	25	4
Ethanol	0.0037	25	1	Methanol	0.142	25	4
Formamide	0.558	25	4	<i>l</i> (-)-Proline			
Methanol	0.0407	25	4	Ethanol	1.5	19	6
<i>l</i> (+)-Isoleucine				<i>dl</i> -Valine			
Ethanol	0.09	20	5	Ethanol	0.0136	0.03	3
Ethanol	0.13	78-80	5	Ethanol	0.019	25	1

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1. Cohn, E. J., McMeekin, T. L., Edsall, J. T., and Weare, J. H., *J. Am. Chem. Soc.*, **56**, 2270 (1934).
2. McMeekin, T. L., Cohn, E. J., and Weare, J. H., *J. Am. Chem. Soc.*, **57**, 626 (1935).
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Densities of Crystalline Amino Acids

Amino acid	Density	Ref. No.	Amino acid	Density	Ref. No.
<i>dl</i> -Alanine.....	1.424	1	<i>dl</i> -Leucine.....	1.191	1
<i>l</i> (+)-Alanine.....	1.401	2	<i>l</i> (-)-Leucine...	1.165	1
<i>dl</i> - β -Alanine.....	1.404	1	<i>dl</i> -Methionine...	1.340	5
<i>dl</i> - α -Amino- <i>n</i> -butyric acid..	1.231	1	<i>dl</i> -Norleucine...	1.169	5
α -Aminoisobutyric acid....	1.278	1		1.174	1
<i>l</i> (+)-Arginine.....	1.1	3	<i>dl</i> -Serine.....	1.537	5
<i>l</i> (+)-Aspartic acid.....	1.66	3	<i>l</i> (-)-Tyrosine..	1.456	1
<i>dl</i> -Glutamic acid.....	1.460	4	<i>dl</i> -Valine.....	1.316	1
<i>l</i> (+)-Glutamic acid.....	1.538	4	<i>l</i> (+)-Valine....	1.230	1
Glycine*.....	1.601	3			
	1.607	1			

* The density of glycine at 50° is 1.5753 according to Houck (6) who concluded that the figure 1.1607, reported by Curtius (7) and reproduced in chemical handbooks, is a typographical error.

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2. Dalton, J. B., and Schmidt, C. L. A., *J. Biol. Chem.*, **103**, 549 (1933).
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6. Houck, R. C., *J. Am. Chem. Soc.*, **52**, 2420 (1930).
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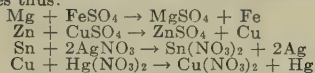
ELECTROMOTIVE FORCE SERIES OF ELEMENTS

Compiled by Giles B. Cooke
Standard Electrode Potentials at 25°C

Element	Ion	Electrode reaction	Electrode potential
Li	Li ⁺	Li = Li ⁺ + e	+2.9595
Rb	Rb ⁺	Rb = Rb ⁺ + e	2.9259
K	K ⁺	K = K ⁺ + e	2.9241
*Sr	Sr ⁺⁺	$\frac{1}{2}$ Sr = $\frac{1}{2}$ Sr ⁺⁺ + e	2.92
*Ba	Ba ⁺⁺	$\frac{1}{2}$ Ba = $\frac{1}{2}$ Ba ⁺⁺ + e	2.90
*Ca	Ca ⁺⁺	$\frac{1}{2}$ Ca = $\frac{1}{2}$ Ca ⁺⁺ + e	2.87
Na	Na ⁺	Na = Na ⁺ + e	2.7146
*Mg	Mg ⁺⁺	$\frac{1}{2}$ Mg = $\frac{1}{2}$ Mg ⁺⁺ + e	2.40
*Al	Al ⁺⁺⁺	$\frac{1}{3}$ Al = $\frac{1}{3}$ Al ⁺⁺⁺ + e	1.70
*Be	Be ⁺⁺	$\frac{1}{2}$ Be = $\frac{1}{2}$ Be ⁺⁺ + e	1.69
*U	U ⁺⁺⁺⁺	$\frac{1}{4}$ U = $\frac{1}{4}$ U ⁺⁺⁺⁺ + e	1.40
*Mn	Mn ⁺⁺	$\frac{1}{2}$ Mn = $\frac{1}{2}$ Mn ⁺⁺ + e	1.10
*Te	Te ⁻	$\frac{1}{2}$ Te = $\frac{1}{2}$ Te ⁻ + e	0.827
Zn	Zn ⁺⁺	$\frac{1}{2}$ Zn = $\frac{1}{2}$ Zn ⁺⁺ + e	0.7618
Cr	Cr ⁺⁺	$\frac{1}{2}$ Cr = $\frac{1}{2}$ Cr ⁺⁺ + e	0.557
*S	S ⁻	$\frac{1}{2}$ S = $\frac{1}{2}$ S ⁻ + e	0.51
*Ga	Ga ⁺⁺⁺	$\frac{1}{3}$ Ga = $\frac{1}{3}$ Ga ⁺⁺⁺ + e	0.50
Fe	Fe ⁺⁺	$\frac{1}{2}$ Fe = $\frac{1}{2}$ Fe ⁺⁺ + e	0.441
*Cd	Cd ⁺⁺	$\frac{1}{2}$ Cd = $\frac{1}{2}$ Cd ⁺⁺ + e	0.401
*In	In ⁺⁺⁺	$\frac{1}{3}$ In = $\frac{1}{3}$ In ⁺⁺⁺ + e	0.336
*Tl	Tl ⁺	Tl = Tl ⁺ + e	0.330
Co	Co ⁺⁺	$\frac{1}{2}$ Co = $\frac{1}{2}$ Co ⁺⁺ + e	0.278
Ni	Ni ⁺⁺	$\frac{1}{2}$ Ni = $\frac{1}{2}$ Ni ⁺⁺ + e	0.231
Sn	Sn ⁺⁺	$\frac{1}{2}$ Sn = $\frac{1}{2}$ Sn ⁺⁺ + e	0.136
Pb	Pb ⁺⁺	$\frac{1}{2}$ Pb = $\frac{1}{2}$ Pb ⁺⁺ + e	0.122
*Fe	Fe ⁺⁺⁺	$\frac{1}{3}$ Fe = $\frac{1}{3}$ Fe ⁺⁺⁺ + e	0.045
H ₂	H ⁺	H ₂ = 2H ⁺ + 2e	0.0000
*Sb	Sb ⁺⁺⁺	$\frac{1}{3}$ Sb = $\frac{1}{3}$ Sb ⁺⁺⁺ + e	-0.10
*Bi	Bi ⁺⁺⁺	$\frac{1}{3}$ Bi = $\frac{1}{3}$ Bi ⁺⁺⁺ + e	-0.226
*As	As ⁺⁺⁺	$\frac{1}{3}$ As = $\frac{1}{3}$ As ⁺⁺⁺ + e	-0.30
Cu	Cu ⁺⁺	$\frac{1}{2}$ Cu = $\frac{1}{2}$ Cu ⁺⁺ + e	-0.344
*O ₂	OH ⁻	$\frac{1}{4}$ O ₂ + $\frac{1}{2}$ H ₂ O = $\frac{1}{4}$ O ₂ + $\frac{1}{2}$ H ₂ O + e	-0.397
Po (18°C)	Po ⁺⁺⁺⁺	$\frac{1}{4}$ Po = $\frac{1}{4}$ Po ⁺⁺⁺⁺ + e	-0.40
Cu	Cu ⁺	Cu = Cu ⁺ + e	-0.470
I ₂	I ⁻	$\frac{1}{2}$ I ₂ = I ⁻ + e	-0.5345
*Te	Te ⁺⁺⁺⁺	$\frac{1}{4}$ Te = $\frac{1}{4}$ Te ⁺⁺⁺⁺ + e	-0.558
Ag	Ag ⁺	Ag = Ag ⁺ + e	-0.7978
Hg	Hg ⁺⁺	2Hg = Hg ₂ ⁺⁺ + 2e	-0.7986
*Pb	Pb ⁺⁺⁺⁺	$\frac{1}{4}$ Pb = $\frac{1}{4}$ Pb ⁺⁺⁺⁺ + e	-0.80
*Pd	Pd ⁺⁺	$\frac{1}{2}$ Pd = $\frac{1}{2}$ Pd ⁺⁺ + e	-0.820
*Pt	Pt ⁺⁺⁺⁺	$\frac{1}{4}$ Pt = $\frac{1}{4}$ Pt ⁺⁺⁺⁺ + e	-0.863
Br ₂	Br ⁻	$\frac{1}{2}$ Br ₂ = Br ⁻ + e	-1.0648
Cl ₂	Cl ⁻	$\frac{1}{2}$ Cl ₂ = Cl ⁻ + e	-1.3583
*Au	Au ⁺⁺⁺	$\frac{1}{3}$ Au = $\frac{1}{3}$ Au ⁺⁺⁺ + e	-1.360
*Au	Au ⁺	Au = Au ⁺ + e	-1.50
*F ₂	F ⁻	$\frac{1}{2}$ F ₂ = F ⁻ + e	-1.90

* These values are doubtful but they indicate the relative activity of the elements and are therefore included.

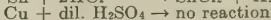
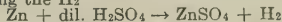
1. **Action of Metals on Salts.**—Any metal will replace any other metal below it in the series thus:



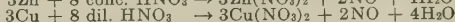
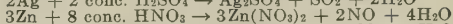
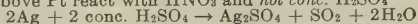
This is the fundamental principle of the Daniell Cell. The voltage of such a cell depends upon the difference between the electrode potentials of the metals employed. Thus the Zn-Cu couple gives a greater E.M.F. than the Zn-Pb couple or the Fe-Cu couple.

ELECTROMOTIVE FORCE SERIES OF ELEMENTS (Continued)

2. **Action of Metals on Acids.**—Metals *above* H_2 react with HCl and dilute H_2SO_4 , replacing the H_2

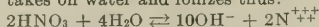


Metals *above* Pt react with HNO_3 and *hot conc.* H_2SO_4

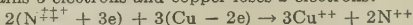


The acid first oxidizes the metal and the reaction may be explained as follows:

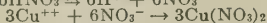
Some of the acid takes on water and ionizes thus:



Nitrogen gains 3 electrons and copper loses 2 electrons:



Some of the acid ionizes as follows:



added $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

3. **In Regard to Ease of Reduction of Oxides.**—The metallic oxides down to and including Mn can not be completely reduced to the metal state, even in a current of hydrogen. The oxides of Cd and succeeding metals are easily reduced, and far down the list, the oxides of silver, platinum, mercury, and gold are reduced (decomposed into metal and oxygen) even by heat alone.

4. **In Regard to Ease of Rusting. (Oxidation in the Air.)**—The alkali and alkaline-earth metals rust very rapidly and with considerable evolution of heat. All the metals down to copper rust with comparative ease. The metals below copper do not rust. Assuming the electrolytic theory of the process of rusting to be true, these facts are just about what might have been predicted.

5. **In Regard to the Occurrence of the Metals in the Free State in Nature.**—Natural waters are frequently dilute solutions of carbonic, nitric, humic, etc., acids. As such they contain displaceable hydrogen. Metals *above* hydrogen in the E.M.F. series scarcely, if ever, occur in the free state in nature, but are practically without exception found in the combined state, as sulfides, carbonates, etc. Metals *below* hydrogen are frequently found in the free state in nature. Thus gold is found in the form of nuggets of metallic gold. However, metals below hydrogen are also found in the combined state, as cinnabar, HgS , etc.

6. **In Regard to Action of the Metals on Water.**—The alkali and alkaline-earths metal displace hydrogen from water, even in the cold, and with evolution of much heat. Mg and succeeding metals will displace hydrogen from steam. Metals at the bottom of the list will not displace hydrogen from steam.

7. **In Regard to the Solubility and Stability of Hydroxides.**—The alkali metal oxides have great avidity for water, forming hydroxides. The alkaline-earth metal oxides react with less readiness, forming hydroxides. MgO reacts slowly and incompletely with water, forming the hydroxide. All the other metallic oxides and hydroxides are insoluble in water and have no perceptible reaction therewith. When a solution of $NaOH$ acts on solutions of salts of the metals, the alkali metal salts are not precipitated. The alkaline-earth metal salts are not precipitated unless in very concentrated solution. All the other metal solutions are acted upon, with precipitation of hydroxides, except in the case of copper which first gives copper hydroxide (blue), and which, on warming, changes to copper oxide (black). Also in the case of arsenic, no precipitate falls, sodium arsenite being formed. In the case of the last metals in the series, the oxide is precipitated, instead of the hydroxide, thus $NaOH$ acting on salts of Sb , Hg , Ag , Pd , Pt , and Au , causes a precipitation of the oxides of these metals. Bismuth, as an exception, gives a normal hydroxide.

ELECTROMOTIVE FORCE SERIES OF ELEMENTS (Continued)

8. **In Regard to Carbonates.**—The alkali metals form normal stable, soluble carbonates, not easily decomposed on heating. The alkaline-earth metals form normal carbonates, which are insoluble in water, and which decompose upon heating, leaving the oxide, carbon dioxide being evolved. When sodium carbonate solution acts on solutions of all the other metals, as a rule, a basic carbonate is precipitated, being insoluble in water, and decomposed by heat into oxide and carbon dioxide. If the solution is cold, Ag, Hg, Cd, Fe, and Mn give normal carbonates. If the solution is warm, Sb, Hg, Ag, Pd, Pt, and Au give a precipitate of the *oxide*, instead of the carbonate, thus showing the instability of the carbonates of the lowest metals in the series.

9. **In Regard to Nitrates.**—The nitrates of the alkali metals decompose when strongly heated forming the *nitrite* and oxygen. The nitrates of the heavy metals, down to and including copper, decompose when heated forming the oxide of the metal, oxygen and nitrogen dioxide. Mercury nitrate when heated yields mercury, oxygen and nitrogen dioxide.

REDUCTION VALUES FOR GLUCOSE IN BLOOD

Amounts of Glucose Corresponding to Titration Values when 0.1 c.c. Blood is Used in the Method of Hagedorn and Jensen. *Biochem. Zeit.* 135, 46; 137, 92 (1923).

Milligrams of Glucose in 0.1 c.c. of Blood

c.c. of 0.005N Na ₂ S ₂ O ₃	Hundredths of 1 c.c. of 0.005 N Sodium Thiosulfate, Na ₂ S ₂ O ₃									
	0	1	2	3	4	5	6	7	8	9
0.0	0.385	0.382	0.379	0.376	0.373	0.370	0.367	0.364	0.361	0.358
0.1	0.355	0.352	0.350	0.348	0.345	0.343	0.341	0.338	0.336	0.333
0.2	0.331	0.329	0.327	0.325	0.323	0.321	0.318	0.316	0.314	0.312
0.3	0.310	0.308	0.306	0.304	0.302	0.300	0.298	0.296	0.294	0.292
0.4	0.290	0.288	0.286	0.284	0.282	0.280	0.278	0.276	0.274	0.272
0.5	0.270	0.268	0.266	0.264	0.262	0.260	0.259	0.257	0.255	0.253
0.6	0.251	0.249	0.247	0.245	0.243	0.241	0.240	0.238	0.236	0.234
0.7	0.232	0.230	0.228	0.226	0.224	0.222	0.221	0.219	0.217	0.215
0.8	0.213	0.211	0.209	0.208	0.206	0.204	0.202	0.200	0.199	0.197
0.9	0.195	0.193	0.191	0.190	0.188	0.186	0.184	0.182	0.181	0.179
1.0	0.177	0.175	0.173	0.172	0.170	0.168	0.166	0.164	0.163	0.161
1.1	0.159	0.157	0.155	0.154	0.152	0.150	0.148	0.146	0.145	0.143
1.2	0.141	0.139	0.138	0.136	0.134	0.132	0.131	0.129	0.127	0.125
1.3	0.124	0.122	0.120	0.119	0.117	0.115	0.113	0.111	0.110	0.108
1.4	0.106	0.104	0.102	0.101	0.099	0.097	0.095	0.093	0.092	0.090
1.5	0.088	0.086	0.084	0.083	0.081	0.079	0.077	0.075	0.074	0.072
1.6	0.070	0.068	0.066	0.065	0.063	0.061	0.059	0.057	0.056	0.054
1.7	0.052	0.050	0.048	0.047	0.045	0.043	0.041	0.039	0.038	0.036
1.8	0.034	0.032	0.031	0.029	0.027	0.025	0.024	0.022	0.020	0.019
1.9	0.017	0.015	0.014	0.012	0.010	0.008	0.007	0.005	0.003	0.002

Procedure

Into a test tube (15×150 mm.) pipette 1 c.c. 0.1 normal NaOH and 5 c.c. 0.45% zinc sulfate solution; 0.1 c.c. of blood from a capillary pipette is added being washed out with the mixture in the test tube; heat for 3 minutes in a boiling water bath; filter through cotton into a test tube (30×90 mm.) and wash the filter with two 3 c.c. portions of water. Add 2 c.c. of alkaline ferricyanide solution (1.65 g potassium ferricyanide, 10.6 g anhydrous sodium carbonate in 1000 c.c. of water) and heat in a boiling water bath for 15 minutes; cool and add 3 c.c. of the iodide-sulfate solution (5 g potassium iodide, 10 g zinc sulfate, 50 g sodium chloride and sufficient water to make 200 c.c.) and 2 c.c. of 3% acetic acid solution. Titrate with 0.005 normal sodium thiosulfate using starch indicator. The method is based upon the reduction of alkaline ferricyanide by glucose and the subsequent titration of the excess unreduced ferricyanide according to the following equation: $2\text{H}_3\text{Fe}(\text{CN})_6 + 2\text{HI} = 2\text{H}_4\text{Fe}(\text{CN})_6 + \text{I}_2$

REDUCTION VALUES FOR GLUCOSE (Continued)

Amounts of Glucose Corresponding to Titration Values when 5 c.c. of 1:10 Blood Filtrate and 5 c.c. of Copper Reagent (Modified*) are Heated in a Water Bath for 15 Minutes. M. Somogyi, Jour. Biol. Chem. **70**, 599 (1926).

Milligrams of Glucose in 100 c.c. of Blood

c.c. of 0.005N Na ₂ S ₂ O ₃	Tenths of 1 c.c. of 0.005 N Sodium Thiosulfate, Na ₂ S ₂ O ₃									
	0	1	2	3	4	5	6	7	8	9
0			21	23	26	29	31	34	36	39
1	41	44	46	49	51	53	56	58	61	63
2	65	68	70	72	75	77	80	82	84	86
3	89	92	94	97	99	101	103	106	108	110
4	113	115	117	119	121	124	126	128	130	132
5	135	137	139	141	143	146	148	150	152	154
6	157	159	161	163	165	168	170	172	174	176
7	179	181	183	185	187	190	192	194	196	199
8	201	203	205	207	210	212	214	216	218	221
9	223	225	227	230	232	234	237	239	241	243
10	245	248	250	252	254	256	259	261	263	265
11	267	270	272	274	276	279	281	283	285	288
12	290	292	294	296	299	301	303	305	308	310
13	312	314	316	318	321	323	326	328	330	332
14	334	337	339	341	343	345	347	350	352	354
15	356	359	361	363	365	367	370	372	374	376
16	378	381	383	386	388	390	392	394	396	398
17	400	—	—	—	—	—	—	—	—	—

To 5 c.c. of the copper reagent in a test tube (250 × 25 mm) are added 5 c.c. of the sugar solution containing between 0.1 and 2.0 mg of glucose; mix; heat for 15 minutes in a boiling water bath; cool to 35°C; with mixing add 1 c.c. of 5N H₂SO₄ and 2 minutes later titrate with 0.005 normal Na₂S₂O₃. A blank titration using 5 c.c. of water in place of the blood is run at the same time.

Amounts of Glucose Corresponding to Titration Values when 2 c.c. of 1:15 Blood Filtrate and 2 c.c. of Copper Reagent (Modified*) are Heated in a Water Bath for 15 Minutes. M. Somogyi, Jour. Biol. Chem. **70**, 599 (1926).

Milligrams of Glucose in 100 c.c. of Blood

c.c. of 0.005N Na ₂ S ₂ O ₃	Tenths of 1 c.c. of 0.005 N Sodium Thiosulfate, Na ₂ S ₂ O ₃									
	0	1	2	3	4	5	6	7	8	9
0	—	—	42	53	63	74	83	91	100	108
1	117	125	134	142	150	159	168	176	185	193
2	202	210	219	227	236	245	253	262	270	279
3	288	296	305	313	322	330	339	347	355	364
4	373	381	390	399	407	416	424	433	441	450
5	458	—	—	—	—	—	—	—	—	—

To 2 c.c. of 0.0667 normal H₂SO₄ in a test tube add 0.2 c.c. of blood, rinsing the pipette several times with the liquid in the test tube; add exactly 0.8 c.c. of 2.5 % sodium tungstate solution; centrifugate; fasten a small tuft of absorbent cotton over the end of a 2 c.c. pipette and with this pipette remove 2 c.c. of the blood filtrate in the test tube and deliver it into a 16 × 150 mm test tube; add exactly 2 c.c. of the sugar-copper reagent; mix; heat in a boiling water bath for 15 minutes; cool to 35°C; add 1 c.c. 2 normal H₂SO₄ and titrate with 0.005 normal Na₂S₂O₃. A blank using 0.2 c.c. of water in place of the blood is run at the same time.

* Modified tartrate-carbonate copper reagent.—Copper sulfate (crystalline) 6.5 g; Rochelle salt 12 g; sodium carbonate (anhydrous) 20 g; potassium iodide 10 g; potassium iodate 0.8 g; potassium oxalate 18 g, sodium bicarbonate 25 g; water sufficient to make one liter of solution.

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

(Munson and Walker, Jour. Amer. Chem. Soc. 28, 663 (1906.)

Add exactly 25 c.c. of Fehling Solution A and 25 c.c. of Fehling Solution B (see under *Special Solutions and Reagents*) to 50 c.c. of reducing sugar solution (if a smaller volume of sugar solution is used, add sufficient water to make the final solution 100 c.c.); heat the solution at such a rate that boiling begins in four minutes and continue boiling for exactly 2 minutes, keeping the beaker covered with a watch glass; filter immediately on a Gooch crucible using suction; wash thoroughly with water at 60°C., then with 10 c.c. of alcohol and finally with 10 c.c. of ether; dry for 30 minutes in an oven at 100°C., cool in a desiccator and weigh as cuprous oxide.

(Expressed in Milligrams)

Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
10	4.0	4.5	3.8	5.9	50	21.3	22.3	30.1	37.6
11	4.5	5.0	4.5	6.7	51	21.7	22.8	30.7	38.4
12	4.9	5.4	5.1	7.5	52	22.2	23.2	31.4	39.2
13	5.3	5.8	5.8	8.3	53	22.6	23.7	32.1	40.0
14	5.7	6.3	6.4	9.1	54	23.0	24.1	32.7	40.8
15	6.2	6.7	7.1	9.9	55	23.5	24.6	33.4	41.6
16	6.6	7.2	7.8	10.6	56	23.9	25.0	34.0	42.4
17	7.0	7.6	8.4	11.4	57	24.3	25.5	34.7	43.2
18	7.5	8.1	9.1	12.2	58	24.8	25.9	35.4	44.0
19	7.9	8.5	9.7	13.0	59	25.2	26.4	36.0	44.8
20	8.3	8.9	10.4	13.8	60	25.6	26.8	36.7	45.6
21	8.7	9.4	11.0	14.6	61	26.1	27.3	37.3	46.3
22	9.2	9.8	11.7	15.4	62	26.5	27.7	38.0	47.1
23	9.6	10.3	12.3	16.2	63	27.0	28.2	38.6	47.9
24	10.0	10.7	13.0	17.0	64	27.4	28.6	39.3	48.7
25	10.5	11.2	13.7	17.8	65	27.8	29.1	40.0	49.5
26	10.9	11.6	14.3	18.6	66	28.3	29.5	40.6	50.3
27	11.3	12.0	15.0	19.4	67	28.7	30.0	41.3	51.1
28	11.8	12.5	15.6	20.2	68	29.2	30.4	41.9	51.9
29	12.2	12.9	16.3	21.0	69	29.6	30.9	42.6	52.7
30	12.6	13.4	16.9	21.8	70	30.0	31.3	43.3	53.5
31	13.1	13.8	17.6	22.6	71	30.5	31.8	43.9	54.3
32	13.5	14.3	18.3	23.3	72	30.9	32.3	44.6	55.1
33	13.9	14.7	18.9	24.1	73	31.4	32.7	45.2	55.9
34	14.3	15.2	19.6	24.9	74	31.8	33.2	45.9	56.7
35	14.8	15.6	20.2	25.7	75	32.2	33.6	46.6	57.5
36	15.2	16.1	20.9	26.5	76	32.7	34.1	47.2	58.2
37	15.6	16.5	21.5	27.3	77	33.1	34.5	47.9	59.0
38	16.1	16.9	22.2	28.1	78	33.6	35.0	48.5	59.8
39	16.5	17.4	22.8	28.9	79	34.0	35.4	49.2	60.6
40	16.9	17.8	23.5	29.7	80	34.4	35.9	49.9	61.4
41	17.4	18.3	24.2	30.5	81	34.9	36.3	50.5	62.2
42	17.8	18.7	24.8	31.3	82	35.3	36.8	51.2	63.0
43	18.2	19.2	25.5	32.1	83	35.8	37.3	51.8	63.8
44	18.7	19.6	26.1	32.9	84	36.2	37.7	52.5	64.6
45	19.1	20.1	26.8	33.7	85	36.7	38.2	53.1	65.4
46	19.6	20.5	27.4	34.4	86	37.1	38.6	53.8	66.2
47	20.0	21.0	28.1	35.2	87	37.5	39.1	54.5	67.0
48	20.4	21.4	28.7	36.0	88	38.0	39.5	55.1	67.8
49	20.9	21.9	29.4	36.8	89	38.4	40.0	55.8	68.6

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE (Continued)

Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
90	38.9	40.4	56.4	69.3	140	61.3	63.6	89.5	109.0
91	39.3	40.9	57.1	70.1	141	61.8	64.0	90.2	109.8
92	39.8	41.4	57.8	70.9	142	62.2	64.5	90.8	110.5
93	40.2	41.8	58.4	71.7	143	62.7	65.0	91.5	111.3
94	40.6	42.3	59.1	72.5	144	63.1	65.4	92.2	112.1
95	41.1	42.7	59.7	73.3	145	63.6	65.9	92.8	112.9
96	41.5	43.2	60.4	74.1	146	64.0	66.4	93.5	113.7
97	42.0	43.7	61.1	74.9	147	64.5	66.9	94.2	114.5
98	42.4	44.1	61.7	75.7	148	65.0	67.3	94.8	115.3
99	42.9	44.6	62.4	76.5	149	65.4	67.8	95.5	116.1
100	43.3	45.0	63.0	77.3	150	65.9	68.3	96.1	116.9
101	43.8	45.5	63.7	78.1	151	66.3	68.7	96.8	117.7
102	44.2	46.0	64.4	78.8	152	66.8	69.2	97.5	118.5
103	44.7	46.4	65.0	79.6	153	67.2	69.7	98.1	119.3
104	45.1	46.9	65.7	80.4	154	67.7	70.1	98.8	120.0
105	45.5	47.3	66.4	81.2	155	68.2	70.6	99.5	120.8
106	46.0	47.8	67.0	82.0	156	68.6	71.1	100.1	121.6
107	46.4	48.3	67.7	82.8	157	69.1	71.6	100.8	122.4
108	46.9	48.7	68.3	83.6	158	69.5	72.0	101.5	123.2
109	47.3	49.2	69.0	84.4	159	70.0	72.5	102.1	124.0
110	47.8	49.6	69.7	85.2	160	70.4	73.0	102.8	124.8
111	48.2	50.1	70.3	86.0	161	70.9	73.4	103.4	125.6
112	48.7	50.6	71.0	86.8	162	71.4	73.9	104.1	126.4
113	49.1	51.0	71.6	87.6	163	71.8	74.4	104.8	127.2
114	49.6	51.5	72.3	88.4	164	72.3	74.9	105.4	128.0
115	50.0	51.9	73.0	89.2	165	72.8	75.3	106.1	128.8
116	50.5	52.4	73.6	90.0	166	73.2	75.8	106.8	129.6
117	50.9	52.9	74.3	90.7	167	73.7	76.3	107.4	130.3
118	51.4	53.3	75.0	91.5	168	74.1	76.8	108.1	131.1
119	51.8	53.8	75.6	92.3	169	74.6	77.2	108.8	131.9
120	52.3	54.3	76.3	93.1	170	75.1	77.7	109.4	132.7
121	52.7	54.7	76.9	93.9	171	75.5	78.2	110.1	133.5
122	53.2	55.2	77.6	94.7	172	76.0	78.7	110.8	134.3
123	53.6	55.7	78.3	95.5	173	76.4	79.1	111.4	135.1
124	54.1	56.1	78.9	96.3	174	76.9	79.6	112.1	135.9
125	54.5	56.6	79.6	97.1	175	77.4	80.1	112.8	136.7
126	55.0	57.0	80.3	97.9	176	77.8	80.6	113.4	137.5
127	55.4	57.5	80.9	98.7	177	78.3	81.0	114.1	138.3
128	55.9	58.0	81.6	99.4	178	78.8	81.5	114.8	139.1
129	56.3	58.4	82.2	100.2	179	79.2	82.0	115.4	139.8
130	56.8	58.9	82.9	101.0	180	79.7	82.5	116.1	140.6
131	57.2	59.4	83.6	101.8	181	80.1	82.9	116.7	141.4
132	57.7	59.8	84.2	102.6	182	80.6	83.4	117.4	142.2
133	58.1	60.3	84.9	103.4	183	81.1	83.9	118.1	143.0
134	58.6	60.8	85.5	104.2	184	81.5	84.4	118.7	143.8
135	59.0	61.2	86.2	105.0	185	82.0	84.9	119.4	144.6
136	59.5	61.7	86.9	105.8	186	82.5	85.3	120.1	145.4
137	60.0	62.2	87.5	106.6	187	82.9	85.8	120.7	146.2
138	60.4	62.6	88.2	107.4	188	83.4	86.3	121.4	147.0
139	60.9	63.1	88.9	108.2	189	83.9	86.8	122.1	147.8

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE (Continued)

Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
190	84.3	87.2	122.7	148.6	240	108.0	111.5	156.1	188.1
191	84.8	87.7	123.4	149.3	241	108.4	112.0	156.7	188.9
192	85.3	88.2	124.1	150.1	242	108.9	112.5	157.4	189.7
193	85.7	88.7	124.7	150.9	243	109.4	113.0	158.1	190.5
194	86.2	89.2	125.4	151.7	244	109.9	113.5	158.7	191.3
195	86.7	89.6	126.1	152.5	245	110.4	114.0	159.4	192.1
196	87.1	90.1	126.7	153.3	246	110.8	114.5	160.1	192.9
197	87.6	90.6	127.4	154.1	247	111.3	115.0	160.7	193.6
198	88.1	91.1	128.1	154.9	248	111.8	115.4	161.4	194.4
199	88.5	91.6	128.7	155.7	249	112.3	115.9	162.1	195.2
200	89.0	92.0	129.4	156.5	250	112.8	116.4	162.7	196.0
201	89.5	92.5	130.0	157.3	251	113.2	116.9	163.4	196.8
202	89.9	93.0	130.7	158.1	252	113.7	117.4	164.1	197.6
203	90.4	93.5	131.4	158.8	253	114.2	117.9	164.7	198.4
204	90.9	94.0	132.0	159.6	254	114.7	118.4	165.4	199.2
205	91.4	94.5	132.7	160.4	255	115.2	118.9	166.1	200.0
206	91.8	94.9	133.4	161.2	256	115.7	119.4	166.8	200.8
207	92.3	95.4	134.0	162.0	257	116.1	119.9	167.4	201.6
208	92.8	95.9	134.7	162.8	258	116.6	120.4	168.1	202.3
209	93.2	96.4	135.4	163.6	259	117.1	120.9	168.8	203.1
210	93.7	96.9	136.0	164.4	260	117.6	121.4	169.4	203.9
211	94.2	97.4	136.7	165.2	261	118.1	121.9	170.1	204.7
212	94.6	97.8	137.4	166.0	262	118.6	122.4	170.8	205.5
213	95.1	98.3	138.0	166.8	263	119.0	122.9	171.4	206.3
214	95.6	98.8	138.7	167.5	264	119.5	123.4	172.1	207.1
215	96.1	99.3	139.4	168.3	265	120.0	123.9	172.8	207.9
216	96.5	99.8	140.0	169.1	266	120.5	124.4	173.5	208.7
217	97.0	100.3	140.7	169.9	267	121.0	124.9	174.1	209.5
218	97.5	100.8	141.4	170.7	268	121.5	125.4	174.8	210.3
219	98.0	101.2	142.0	171.5	269	122.0	125.9	175.5	211.0
220	98.4	101.7	142.7	172.3	270	122.5	126.4	176.1	211.8
221	98.9	102.2	143.4	173.1	271	122.9	126.9	176.8	212.6
222	99.4	102.7	144.0	173.9	272	123.4	127.4	177.5	213.4
223	99.9	103.2	144.7	174.7	273	123.9	127.9	178.1	214.2
224	100.3	103.7	145.4	175.5	274	124.4	128.4	178.8	215.0
225	100.8	104.2	146.0	176.2	275	124.9	128.9	179.5	215.8
226	101.3	104.6	146.7	177.0	276	125.4	129.4	180.2	216.6
227	101.8	105.1	147.4	177.8	277	125.9	129.9	180.8	217.4
228	102.2	105.6	148.0	178.6	278	126.4	130.4	181.5	218.2
229	102.7	106.1	148.7	179.4	279	126.9	130.9	182.2	218.9
230	103.2	106.6	149.4	180.2	280	127.3	131.4	182.8	219.7
231	103.7	107.1	150.0	181.0	281	127.8	131.9	183.5	220.5
232	104.1	107.6	150.7	181.8	282	128.3	132.4	184.2	221.3
233	104.6	108.1	151.4	182.6	283	128.8	132.9	184.8	222.1
234	105.1	108.6	152.0	183.4	284	129.3	133.4	185.5	222.9
235	105.6	109.1	152.7	184.2	285	129.8	133.9	186.2	223.7
236	106.0	109.5	153.4	184.9	286	130.3	134.4	186.9	224.5
237	106.5	110.0	154.0	185.7	287	130.8	134.9	187.5	225.3
238	107.0	110.5	154.7	186.5	288	131.3	135.4	188.2	226.1
239	107.5	111.0	155.4	187.3	289	131.8	135.9	188.9	226.9

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, IN- VERT SUGAR, LACTOSE AND MALTOSE (Continued)

Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
290	132.3	136.4	189.5	227.6	340	157.3	162.0	223.2	267.1
291	132.7	136.9	190.2	228.4	341	157.8	162.5	223.8	267.9
292	133.2	137.4	190.9	229.2	342	158.3	163.1	224.5	268.7
293	133.7	137.9	191.5	230.0	343	158.8	163.6	225.2	269.5
294	134.2	138.4	192.2	230.8	344	159.3	164.1	225.9	270.3
295	134.7	138.9	192.9	231.6	345	159.8	164.6	226.5	271.1
296	135.2	139.4	193.6	232.4	346	160.3	165.1	227.2	271.9
297	135.7	140.0	194.2	233.2	347	160.8	165.7	227.9	272.7
298	136.2	140.5	194.9	234.0	348	161.4	166.2	228.5	273.5
299	136.7	141.0	195.6	234.8	349	161.9	166.7	229.2	274.3
300	137.2	141.5	196.2	235.5	350	162.4	167.2	229.9	275.0
301	137.7	142.0	196.9	236.3	351	162.9	167.7	230.6	275.8
302	138.2	142.5	197.6	237.1	352	163.4	168.3	231.2	276.6
303	138.7	143.0	198.3	237.9	353	163.9	168.8	231.9	277.4
304	139.2	143.5	198.9	238.7	354	164.4	169.3	232.6	278.2
305	139.7	144.0	199.6	239.5	355	164.9	169.8	233.3	279.0
306	140.2	144.5	200.3	240.3	356	165.4	170.4	233.9	279.8
307	140.7	145.0	201.0	241.1	357	166.0	170.9	234.6	280.6
308	141.2	145.5	201.6	241.9	358	166.5	171.4	235.3	281.4
309	141.7	146.1	202.3	242.7	359	167.0	171.9	236.0	282.2
310	142.2	146.6	203.0	243.5	360	167.5	172.5	236.7	282.9
311	142.7	147.1	203.6	244.2	361	168.0	173.0	237.3	283.7
312	143.2	147.6	204.3	245.0	362	168.5	173.5	238.0	284.5
313	143.7	148.1	205.0	245.8	363	169.0	174.0	238.7	285.3
314	144.2	148.6	205.7	246.6	364	169.6	174.6	239.4	286.1
315	144.7	149.1	206.3	247.4	365	170.1	175.1	240.0	286.9
316	145.2	149.6	207.0	248.2	366	170.6	175.6	240.7	287.7
317	145.7	150.1	207.7	249.0	367	171.1	176.1	241.4	288.5
318	146.2	150.7	208.4	249.8	368	171.6	176.7	242.1	289.3
319	146.7	151.2	209.0	250.6	369	172.1	177.2	242.7	290.0
320	147.2	151.7	209.7	251.3	370	172.7	177.7	243.4	290.8
321	147.7	152.2	210.4	252.1	371	173.2	178.3	244.1	291.6
322	148.2	152.7	211.0	252.9	372	173.7	178.8	244.8	292.4
323	148.7	153.2	211.7	253.7	373	174.2	179.3	245.4	293.2
324	149.2	153.7	212.4	254.5	374	174.7	179.8	246.1	294.0
325	149.7	154.3	213.1	255.3	375	175.3	180.4	246.8	294.8
326	150.2	154.8	213.7	256.1	376	175.8	180.9	247.5	295.6
327	150.7	155.3	214.4	256.9	377	176.3	181.4	248.1	296.4
328	151.2	155.8	215.1	257.7	378	176.8	182.0	248.8	297.2
329	151.7	156.3	215.8	258.5	379	177.3	182.5	249.5	297.9
330	152.2	156.8	216.4	259.3	380	177.9	183.0	250.2	298.7
331	152.7	157.3	217.1	260.0	381	178.4	183.6	250.8	299.5
332	153.2	157.9	217.8	260.8	382	178.9	184.1	251.5	300.3
333	153.7	158.4	218.4	261.6	383	179.4	184.6	252.2	301.1
334	154.2	158.9	219.1	262.4	384	180.0	185.2	252.9	301.9
335	154.7	159.4	219.8	263.2	385	180.5	185.7	253.6	302.7
336	155.2	159.9	220.5	264.0	386	181.0	186.2	254.2	303.5
337	155.8	160.5	221.1	264.8	387	181.5	186.8	254.9	304.2
338	156.3	161.0	221.8	265.6	388	182.0	187.3	255.6	305.0
339	156.8	161.5	222.6	266.4	389	182.6	187.8	256.3	305.8

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, IN- VERT SUGAR, LACTOSE AND MALTOSE (Continued)

Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Cuprous Oxide Cu_2O	Dextrose $\text{C}_6\text{H}_{12}\text{O}_6$	Invert Sugar	Lactose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	Maltose $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
390	183.1	188.4	256.9	306.6	440	209.8	215.5	290.9	346.1
391	183.6	188.9	257.6	307.4	441	210.3	216.1	291.5	346.8
392	184.1	189.4	258.3	308.2	442	210.9	216.6	292.2	347.6
393	184.7	190.0	259.0	309.0	443	211.4	217.2	292.9	348.4
394	185.2	190.5	259.6	309.8	444	212.0	217.8	293.6	349.2
395	185.7	191.0	260.3	310.6	445	212.5	218.3	294.2	350.0
396	186.2	191.6	261.0	311.4	446	213.1	218.9	294.9	350.8
397	186.8	192.1	261.7	312.1	447	213.6	219.4	295.6	351.6
398	187.3	192.7	262.3	312.9	448	214.1	220.0	296.3	352.4
399	187.8	193.2	263.0	313.7	449	214.7	220.5	297.0	353.2
400	188.4	193.7	263.7	314.5	450	215.2	221.1	297.6	353.9
401	188.9	194.3	264.4	315.3	451	215.8	221.6	298.3	354.7
402	189.4	194.8	265.0	316.1	452	216.3	222.2	299.0	355.5
403	189.9	195.4	265.7	316.9	453	216.9	222.8	299.7	356.3
404	190.5	195.9	266.4	317.7	454	217.4	223.3	300.4	357.1
405	191.0	196.4	267.1	318.5	455	218.0	223.9	301.1	357.9
406	191.5	197.0	267.8	319.2	456	218.5	224.4	301.7	358.7
407	192.1	197.5	268.4	320.0	457	219.1	225.0	302.4	359.5
408	192.6	198.1	269.1	320.8	458	219.6	225.5	303.1	360.3
409	193.1	198.6	269.8	321.6	459	220.2	226.1	303.8	361.0
410	193.7	199.1	270.5	322.4	460	220.7	226.7	304.5	361.8
411	194.2	199.7	271.2	323.2	461	221.3	227.2	305.1	362.6
412	194.7	200.2	271.8	324.0	462	221.8	227.8	305.8	363.4
413	195.2	200.8	272.5	324.8	463	222.4	228.3	306.5	364.2
414	195.8	201.3	273.2	325.6	464	222.9	228.9	307.2	365.0
415	196.3	201.8	273.9	326.3	465	223.5	229.5	307.9	365.8
416	196.8	202.4	274.6	327.1	466	224.0	230.0	308.6	366.6
417	197.4	202.9	275.2	327.9	467	224.6	230.6	309.2	367.3
418	197.9	203.5	275.9	328.7	468	225.1	231.2	309.9	368.1
419	198.4	204.0	276.6	329.5	469	225.7	231.7	310.6	368.9
420	199.0	204.6	277.3	330.3	470	226.2	232.3	311.3	369.7
421	199.5	205.1	277.9	331.1	471	226.8	232.8	312.0	370.5
422	200.1	205.7	278.6	331.9	472	227.4	233.4	312.6	371.3
423	200.6	206.2	279.3	332.7	473	227.9	234.0	313.3	372.1
424	201.1	206.7	280.0	333.4	474	228.5	234.5	314.0	372.9
425	201.7	207.3	280.7	334.2	475	229.0	235.1	314.7	373.7
426	202.2	207.8	281.3	335.0	476	229.6	235.7	315.4	374.4
427	202.8	208.4	282.0	335.8	477	230.1	236.2	316.1	375.2
428	203.3	208.9	282.7	336.6	478	230.7	236.8	316.7	376.0
429	203.8	209.5	283.4	337.4	479	231.3	237.4	317.4	376.8
430	204.4	210.0	284.1	338.2	480	231.8	237.9	318.1	377.6
431	204.9	210.6	284.7	339.0	481	232.4	238.5	318.8	378.4
432	205.5	211.1	285.4	339.7	482	232.9	239.1	319.5	379.2
433	206.0	211.7	286.1	340.5	483	233.5	239.6	320.1	380.0
434	206.5	212.2	286.8	341.3	484	234.1	240.2	320.8	380.7
435	207.1	212.8	287.5	342.1	485	234.6	240.8	321.5	381.5
436	207.6	213.3	288.1	342.9	486	235.2	241.4	322.2	382.3
437	208.2	213.9	288.8	343.7	487	235.7	241.9	322.9	383.1
438	208.7	214.4	289.5	344.5	488	236.3	242.5	323.6	383.9
439	209.2	215.0	290.2	345.3	489	236.9	243.1	324.2	384.7
					490	237.4	243.6	324.5	385.5

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Computed from the International atomic weights of 1936* by Eric A. Arnold.

To facilitate the use of the table the group of substances weighed given under each element as well as the substances sought under each substance weighed are arranged in the alphabetical order of their formulae.

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Aluminum:			—10	Ammonium:			—10
Al=				N.....	NH ₄ Cl.....	3.8191	10.58196
26.97					NH ₄ NO ₃	5.7145	10.75698
Al.....	Al ₂ O ₃	1.8899	10.27643		(NH ₄) ₂ O.....	1.8590	10.26927
	AlPO ₄	4.5217	10.65530		(NH ₄) ₂ SO ₄	4.7166	10.67363
Al ₄ C ₃	Al ₂ O ₃	1.4167	10.15128	NH ₃	MgNH ₄ PO ₄		
AlCl ₃	Al ₂ O ₃	0.38225	9.58235		6H ₂ O.....	14.410	11.15867
AlF ₃	CaF ₂	1.3948	10.14451		N.....	0.82244	9.91510
Al ₂ O ₃	Al.....	0.52913	9.72357		NH ₄	1.0592	10.02497
	Al ₄ C ₃	0.70586	9.84872		NH ₄ Cl.....	3.1409	10.49706
	AlCl ₃	2.6161	10.41765		(NH ₄) ₂ CO ₃	2.8208	10.45038
	AlPO ₄	2.3926	10.37887		NH ₄ HCO ₃	4.6417	10.66668
	Al ₂ (SO ₄) ₃	3.3561	10.52583		NH ₄ NO ₃	4.6998	10.67208
	Al ₂ (SO ₄) ₃				(NH ₄) ₂ O.....	1.5289	10.18437
	18H ₂ O.....	6.5373	10.81540		NH ₄ OH.....	2.0578	10.31340
	K ₂ SO ₄ Al ₂				(NH ₄) ₂ PtCl ₆	13.036	11.11513
	(SO ₄) ₃				(NH ₄) ₂ SO ₄	3.8791	10.58873
	24H ₂ O.....	9.3071	10.96881		N ₂ O ₅	3.1709	10.50118
	(NH ₄) ₂ SO ₄				Pt.....	5.7312	10.75824
	Al ₂ (SO ₄) ₃				SO ₃	2.3502	10.37111
	24H ₂ O.....	8.8940	10.94909	NH ₄	Cl.....	1.9654	10.29346
AlPO ₄	Al.....	0.22116	9.34470		MgNH ₄ PO ₄		
	Al ₂ O ₃	0.41796	9.62113		6H ₂ O.....	13.605	11.13369
	P ₂ O ₅	0.58204	9.76495		N.....	0.77648	9.89013
	Al ₂ O ₃	0.29797	9.47417		NH ₃	0.94412	9.97503
Al ₂ (SO ₄) ₃					NH ₄ Cl.....	2.9654	10.47209
Al ₂ (SO ₄) ₃					(NH ₄) ₂ PtCl ₆	12.307	11.09016
18H ₂ O.....	Al ₂ O ₃	0.15297	9.18460		Pt.....	5.4109	10.73327
CaF ₂	AlF ₃	0.71696	9.85549	NH ₄ Br.....	Ag.....	1.1013	10.04191
K ₂ SO ₄ Al ₂					AgBr.....	1.9171	10.28265
(SO ₄) ₃					Br.....	0.81583	9.91160
24H ₂ O.....	Al ₂ O ₃	0.10745	9.03119	NH ₄ Cl.....	Ag.....	2.0165	10.30461
(NH ₄) ₂					AgCl.....	2.6793	10.42803
SO ₄ Al ₂					Cl.....	0.66278	9.82137
(SO ₄) ₃					HCl.....	0.68162	9.83354
24H ₂ O.....	Al ₂ O ₃	0.11244	9.05091		N.....	0.26184	9.41804
P ₂ O ₅	AlPO ₄	1.7181	10.23505		NH ₃	0.31838	9.50294
Ammonium:					NH ₄	0.33722	9.52791
NH ₄ =					(NH ₄) ₂ O.....	0.48676	9.68731
18.0404					NH ₄ OH.....	0.65514	9.81634
Ag.....	NH ₄ Br.....	0.90801	9.95809		(NH ₄) ₂ Pt.....		
	NH ₄ Cl.....	0.49590	9.69539		Cl ₆	4.1502	10.61807
	NH ₄ I.....	1.3437	10.12831		Pt.....	1.8247	10.26118
AgBr.....	NH ₄ Br.....	0.52161	9.71735	(NH ₄) ₂			
AgCl.....	NH ₄ Cl.....	0.37323	9.57197	CO ₃	NH ₃	0.35450	9.54962
AgI.....	NH ₄ I.....	0.61738	9.79055	NH ₄			
BaSO ₄	(NH ₄) ₂ SO ₄	0.56611	9.75290	HCO ₃	NH ₃	0.21544	9.33332
Br.....	NH ₄ Br.....	1.2257	10.08840	NH ₄ I.....	Ag.....	0.74420	9.87169
Cl.....	NH ₄	0.50880	9.70654		AgI.....	1.6198	10.20945
	NH ₄ Cl.....	1.5088	10.17863		I.....	0.87555	9.94228
HCl.....	NH ₄ Cl.....	1.4671	10.16646		NH ₃	0.21278	9.32792
I.....	NH ₄ I.....	1.1421	10.05772	NH ₄ NO ₃	(NH ₄) ₂ PtCl ₆	2.7737	10.44305
MgNH ₄					N ₂ O ₅	0.67469	9.82911
PO ₄					Pt.....	1.2194	10.08616
6H ₂ O.....	NH ₃	0.069396	8.84133				
	NH ₄	0.073503	8.86631				
	(NH ₄) ₂ O.....	0.10610	9.02571				
N.....	NH ₃	1.2159	10.08490				
	NH ₄	1.2879	10.10987				

*Revised, atomic weights 1939.

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Ammonium: (NH ₄) ₂ O.	MgNH ₄ PO ₄ . 6H ₂ O.....	9.4253	10.97429	Antimony: Sb.....	Sb ₂ S ₃	1.3950	10.14456
	N.....	0.53793	9.73073		Sb ₂ S ₅	1.6583	10.21965
	NH ₃	0.65407	9.81563		KSbOC ₄ H ₄ O ₆ . ½H ₂ O.....	2.2910	10.36003
	NH ₄ Cl.....	2.0544	10.31269		Sb.....	0.83535	9.92187
	(NH ₄) ₂ PtCl ₆ ...	8.5262	10.93076		Sb ₂ O ₄	1.0549	10.02321
	N ₂ O ₅	2.0740	10.31681		Sb ₂ O ₃	1.1098	10.04523
	Pt.....	3.7486	10.57387		Sb ₂ S ₃	1.1653	10.06643
NH ₄ OH.....	N.....	0.39967	9.60171		Sb ₂ S ₅	1.3852	10.14152
	NH ₃	0.48596	9.68660		KSbOC ₄ H ₄ O ₆ . ½H ₂ O.....	2.1718	10.33682
	NH ₄	0.51473	9.71158		Sb.....	0.79188	9.89866
	NH ₄ Cl.....	1.5264	10.18366		Sb ₂ O ₃	0.94797	9.97579
	(NH ₄) ₂ Pt. Cl ₆	6.3348	10.80174		Sb ₂ O ₅	1.0520	10.02203
	Pt.....	2.7851	10.44485		Sb ₂ S ₃	1.1046	10.04322
(NH ₄) ₂ Pt. Cl ₆	NH ₃	0.076713	8.88487		Sb ₂ S ₅	1.3132	10.11831
	NH ₄	0.081253	8.90984		Sb.....	0.75272	9.87663
	NH ₄ Cl.....	0.24095	9.38193		Sb ₂ O ₃	0.90109	9.95477
	NH ₄ NO ₃	0.36054	9.55695		Sb ₂ O ₄	0.95054	9.97797
	(NH ₄) ₂ O.....	0.11729	9.06924		Sb ₂ S ₅	1.2482	10.09629
	NH ₄ OH.....	0.15786	9.19826		KSbOC ₄ H ₄ O ₆ . O ₆ ·½H ₂ O....	1.9661	10.29360
	(NH ₄) ₂ SO ₄	0.29758	9.47360		Sb.....	0.71687	9.85544
(NH ₄) ₂ . SO ₄	BaSO ₄	1.7664	10.24710		Sb ₂ O ₃	0.85817	9.93357
	H ₂ SO ₄	0.74221	9.87053		Sb ₂ O ₄	0.90527	9.95678
	N.....	0.21202	9.32637		Sb ₂ O ₅	0.95237	9.97881
	NH ₃	0.25779	9.41127		Sb.....	0.60304	9.78035
	(NH ₄) ₂ Pt. Cl ₆	3.3605	10.52640		Sb ₂ O ₃	0.72191	9.85848
	Pt.....	1.4774	10.16951		Sb ₂ O ₄	0.76153	9.88169
	SO ₃	0.60587	9.78238	Arsenic: As = 74.91	Sb ₂ O ₅	0.80115	9.90371
N ₂ O ₅	NH ₃	0.31537	9.49882	As.....	As ₂ O ₃	1.3204	10.12070
	NH ₄ NO ₃	1.4822	10.17089		As ₂ O ₅	1.5340	10.18582
	(NH ₄) ₂ O.....	0.48216	9.68319		As ₂ S ₃	1.6420	10.21537
Pt.....	NH ₃	0.17448	9.24176		As ₂ S ₅	2.0700	10.31596
	NH ₄	0.18481	9.26673		BaSO ₄	4.6740	10.66969
	NH ₄ Cl.....	0.54804	9.73882		Mg ₂ As ₂ O ₇	2.0722	10.31644
	NH ₄ NO ₃	0.82004	9.91384		½H ₂ O.....	2.5401	10.40485
	(NH ₄) ₂ O.....	0.26677	9.42613		AsO ₃	2.8487	10.45464
	NH ₄ OH.....	0.35905	9.55515		Mg ₂ As ₂ O ₇	1.2630	10.10139
	(NH ₄) ₂ SO ₄	0.67685	9.83049		MgNH ₄ AsO ₄ . ½H ₂ O.....	1.5481	10.18980
SO ₃	NH ₃	0.42549	9.62889		BaSO ₄	2.5206	10.40150
	(NH ₄) ₂ SO ₄	1.6505	10.21762		Mg ₂ As ₂ O ₇	1.1175	10.04824
Antimony: Sb=					MgNH ₄ AsO ₄ . ½H ₂ O.....	1.3698	10.13666
121.76					As.....	0.75736	9.87930
KSbOC ₄ . H ₄ O ₆ . ½H ₂ O.....	Sb.....	0.36462	9.56184		As ₂ O ₅	1.1618	10.06512
	Sb ₂ O ₃	0.43649	9.63997		As ₂ S ₃	1.2436	10.09466
	Sb ₂ O ₄	0.46045	9.66318		As ₂ S ₅	1.5677	10.19526
	Sb ₂ S ₃	0.50863	9.70640		BaSO ₄	3.5399	10.54899
Sb.....	KSbOC ₄ H ₄ O ₆ . ½H ₂ O.....	2.7426	10.43816		Mg ₂ As ₂ O ₇	1.5694	10.19574
	Sb ₂ O ₃	1.1971	10.07813		MgNH ₄ AsO ₄ . ½H ₂ O.....	1.9238	10.28415
	Sb ₂ O ₄	1.2628	10.10134		As.....	0.65190	9.81418
	Sb ₂ O ₅	1.3235	10.12337		As ₂ O ₃	0.86076	9.93488

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Arsenic:				Barium:			
As ₂ O ₅ ...				BaO.....			
As ₂ S ₃	As ₂ S ₃	1.0704	10.02955	BaCrO ₄	1.6521	10.21804	-10
As ₂ S ₅	As ₂ S ₅	1.3494	10.13014	BaSiF ₆	1.8220	10.26055	
BaSO ₄	BaSO ₄	3.0470	10.48387	BaSO ₄	1.5220	10.18243	
Mg ₂ As ₂ O ₇	Mg ₂ As ₂ O ₇	1.3509	10.13062	CO ₂	0.28697	9.45784	
MgNH ₄ AsO ₄	MgNH ₄ AsO ₄			BaO ₂	CO ₂	1.3782	10.13933
½H ₂ O.....	½H ₂ O.....	1.6559	10.21903	BaSiF ₆	BaSiF ₆	1.3778	10.13917
As ₂ S ₃	As.....	0.60902	9.78463	Ba.....	Ba.....	0.49159	9.69160
As ₂ O ₃	As ₂ O ₃	0.80415	9.90534	BaF ₂	BaF ₂	0.62759	9.79767
As ₂ O ₅	As ₂ O ₅	0.93423	9.97045	BaO.....	BaO.....	0.54885	9.73945
As ₂ S ₅	As ₂ S ₅	1.2607	10.10059	Ba.....	Ba.....	0.58847	9.76972
Mg ₂ As ₂ O ₇	Mg ₂ As ₂ O ₇	1.2620	10.10107	BaSO ₄	BaSO ₄	0.89227	9.95050
As.....	As.....	0.48310	9.68404	BaCl ₂	BaCl ₂	1.0466	10.01980
As ₂ O ₃	As ₂ O ₃	0.63788	9.80474	BaCl ₂ ·2H ₂ O.....	BaCl ₂ ·2H ₂ O.....	0.84556	9.92714
As ₂ O ₅	As ₂ O ₅	0.74107	9.86986	Ba(NO ₃) ₂	Ba(NO ₃) ₂	1.1198	10.04913
As ₂ S ₃	As ₂ S ₃	0.79324	9.89941	BaO.....	BaO.....	0.65701	9.81757
BaSO ₄	As.....	0.21395	9.33031	BaO ₂	BaO ₂	0.72556	9.86067
AsO ₃	AsO ₃	0.35104	9.54536	BaS.....	BaS.....	0.72582	9.86083
AsO ₄	AsO ₄	0.39674	9.59850	CO ₂	BaCO ₃	4.4847	10.65173
As ₂ O ₃	As ₂ O ₃	0.28250	9.45101	BaO.....	BaO.....	3.4847	10.54216
As ₂ O ₅	As ₂ O ₅	0.32819	9.51613	Beryllium:			
Mg ₂ As ₂ O ₇	As.....	0.48257	9.68356	(glucinum)			
AsO ₃	AsO ₃	0.79179	9.89861	Be=9.02			
AsO ₄	AsO ₄	0.98487	9.95176	Be.....	BeO.....	2.7738	10.44308
As ₂ O ₃	As ₂ O ₃	0.63718	9.80426	BeCl ₂	BeO.....	0.31301	9.49556
As ₂ O ₅	As ₂ O ₅	0.74026	9.86938	BeO.....	Be.....	0.36051	9.55692
As ₂ S ₃	As ₂ S ₃	0.79237	9.89893	BeCl ₂	BeCl ₂	3.1948	10.50444
MgNH ₄ AsO ₄	As.....	0.39369	9.59515	BcSO ₄ ·4H ₂ O.....	BcSO ₄ ·4H ₂ O.....	7.0801	10.85004
AsO ₄	AsO ₄	0.64595	9.81020	BeSO ₄	BeO.....	0.14124	9.14996
½H ₂ O.....	AsO ₃	0.73004	9.86334	4H ₂ O.....	BeO.....		
As ₂ O ₃	AsO ₄	0.51982	9.71585	Bismuth:			
As ₂ O ₅	As ₂ O ₅	0.60390	9.78097	Bi=			
Barium:				209.00			
Ba=				Bi.....			
137.36				BiAsO ₄			
Ba.....	BaCO ₃	1.4369	10.15742	Bi ₂ O ₃	Bi ₂ O ₃	1.6646	10.22132
Ba.....	BaCrO ₄	1.8446	10.26589	BiOCl.....	BiOCl.....	1.1148	10.04721
Ba.....	BaSiF ₆	2.0342	10.30840	Bi ₂ Cl.....	Bi ₂ Cl.....	1.2462	10.09559
Ba.....	BaSO ₄	1.6993	10.23028	Bi ₂ S ₃	Bi.....	1.2301	10.08994
BaCl ₂	BaCO ₃	0.94765	9.97665	Bi.....	Bi.....	0.60073	9.77868
Ba.....	BaCrO ₄	1.2165	10.08512	Bi ₂ O ₃	Bi ₂ O ₃	0.66971	9.82589
Ba.....	BaSO ₄	1.1207	10.04950	Bi(NO ₃) ₃	Bi.....	0.48031	9.68152
BaCl ₂	BaSO ₄	0.95544	9.98020	5H ₂ O.....	Bi ₂ O ₃	0.53691	9.72990
2H ₂ O.....	Ba.....	0.69595	9.84258	Bi.....	Bi.....	0.89700	9.95279
BaCO ₃	BaCl ₂	1.0552	10.02335	BiOCl.....	BiAsO ₄	1.4932	10.17411
Ba.....	BaCrO ₄	1.2837	10.10847	Bi.....	Bi(NO ₃) ₃	2.0820	10.31848
Ba.....	Ba(HCO ₃) ₂	1.3143	10.11868	Bi.....	5H ₂ O.....	1.1178	10.04838
BaO.....	BaO.....	0.77702	9.89043	BiOCl.....	BiONO ₃	1.2318	10.09054
BaSO ₄	BaSO ₄	1.1827	10.07286	Bi.....	Bi ₂ S ₃	1.1034	10.04273
CO ₂	CO ₂	0.22298	9.34827	Bi.....	Bi.....	0.80244	9.90441
BaCrO ₄	Ba.....	0.54213	9.73411	Bi.....	Bi(NO ₃) ₃	1.8625	10.27010
Ba.....	BaCl ₂	0.82202	9.91488	Bi.....	5H ₂ O.....	0.89458	9.95162
Ba.....	BaCO ₃	0.77898	9.89153	BiONO ₃	BiONO ₃	1.1019	10.04216
BaO.....	BaO.....	0.60528	9.78196	Bi.....	BiO.....	0.81182	9.90946
BaF ₂	BaSiF ₆	1.5934	10.20233	Bi ₂ S ₃	BiOCl.....	0.90749	9.95784
Ba(HC.....	BaCO ₃	0.76088	9.88132	Boron:	Bi.....	0.81294	9.91006
O ₃) ₂	BaSO ₄	0.89304	9.95087	B=10.82	Bi ₂ O ₃	0.90630	9.95727
Ba(NO ₃) ₂	BaCO ₃	1.2870	10.10957	B.....	B ₂ O ₃	3.2181	10.50760

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Boron:				Cadmium:			
B.....	KBF ₄	11.637	11.06585	CdO.....	CdSO ₄	1.6235	10.21044
BO ₂	B ₂ O ₃	0.81317	9.91018	CdS.....	Cd.....	0.77809	9.89103
BO ₃	B ₂ O ₃	0.59198	9.77230		CdCl ₂	1.2689	10.10344
B ₂ O ₃	B.....	0.31074	9.49240		Cd(NO ₃) ₂	1.6365	10.21392
	BO ₂	1.2298	10.08982		CdO.....	0.88884	9.94882
	BO ₃	1.6893	10.22770		CdSO ₄	1.4430	10.15927
	B ₄ O ₇	1.1149	10.04723	CdSO ₄ ...	Cd.....	0.53921	9.73176
	H ₃ BO ₃	1.7761	10.24947		CdCl ₂	0.87938	9.94418
	KBF ₄	3.6162	10.55825		Cd(NO ₃) ₂	1.1341	10.05465
	Na ₂ B ₄ O ₇				CdO.....	0.61596	9.78956
	10H ₂ O.....	2.7386	10.43753		CdS.....	0.69300	9.84073
B ₄ O ₇	B ₂ O ₃	0.89696	9.95277	Calcium:			
H ₃ BO ₃ ...	B ₂ O ₃	0.56303	9.75053	Ca=40.08			
	KBF ₄	2.0360	10.30878	BaSO ₄ ...	CaS.....	0.30906	9.49004
KBF ₄	B.....	0.085930	8.93415		CaSO ₄	0.58324	9.76585
	B ₂ O ₃	0.27653	9.44175		CaSO ₄ ·2H ₂ O.....	0.73761	9.86783
	H ₃ BO ₃	0.49116	9.69122	Ca.....	CaCl ₂	2.7693	10.44237
	Na ₂ B ₄ O ₇				CaCO ₃	2.4973	10.39746
	10H ₂ O.....	0.75732	9.87928		CaF ₂	1.9481	10.28961
Na ₂ B ₄ O ₇ ...	B ₂ O ₃	0.36515	9.56247		CaO.....	1.3992	10.14588
10H ₂ O.	KBF ₄	1.3204	10.12072		CaSO ₄	3.3967	10.53106
Bromine:					Cl.....	1.7693	10.24780
Br=				Ca ₃ (As			
79.916				O ₄) ₂ ...	Mg ₂ As ₂ O ₇	0.77993	9.89206
Ag.....	Br.....	0.74079	9.86969	CaCl ₂ ...	Ca.....	0.36110	9.55763
	BrO ₃	1.1857	10.07398		CaCO ₃	0.90176	9.95509
	HBr.....	0.75013	9.87514		CaO.....	0.50525	9.70351
AgBr....	Br.....	0.42555	9.62895		CaSO ₄	1.2266	10.08869
	BrO ₃	0.68114	9.83324	CaCO ₃ ...	Cl.....	0.63890	9.80543
	HBr.....	0.43091	9.63439		Ca.....	0.40044	9.60254
AgCl.....	Br.....	0.55754	9.74628		CaCl ₂	1.1089	10.04491
Br.....	Ag.....	1.3499	10.13031		Ca(HCO ₃) ₂	1.6197	10.20944
	AgBr.....	2.3499	10.37105		CaO.....	0.56030	9.74842
	AgCl.....	1.7936	10.25372		CaSO ₄	1.3602	10.13360
	O.....	0.10011	9.00046		CaSO ₄ ·2H ₂ O.....	1.7202	10.23557
BrO ₃ ...	Ag.....	0.84337	9.92602		CO ₂	0.43970	9.64316
	AgBr.....	1.4681	10.16676	CaF ₂	HCl.....	0.72865	9.86252
HBr.....	Ag.....	1.3331	10.12486		Ca.....	0.51332	9.71039
	AgBr.....	2.3206	10.36561		CaSO ₄	1.7436	10.24145
O.....	Br.....	9.9895	10.99954	Ca-			
Cadmium:				(HCO ₃) ₂	CaCO ₃	0.61740	9.79056
Cd=					CaO.....	0.34592	9.53898
112.41				Ca(NO ₃) ₂	N ₂ O ₅	0.65825	9.81839
Cd.....	CdCl ₂	1.6309	10.21241	CaO.....	Ca.....	0.71469	9.85412
	Cd(NO ₃) ₂	2.1032	10.32289		CaCl ₂	1.9792	10.29649
	CdO.....	1.1423	10.05779		CaCO ₃	1.7848	10.25158
	CdS.....	1.2852	10.10897		CaF ₂	1.3923	10.14373
	CdSO ₄	1.8546	10.26824		Ca(HCO ₃) ₂	2.8908	10.46102
CdCl ₂	Cd.....	0.61318	9.78759		Ca ₃ (PO ₄) ₂	1.8438	10.26571
	CdO.....	0.70045	9.84538		CaSO ₄	2.4276	10.38518
	CdS.....	0.78806	9.89656		CaSO ₄ ·2H ₂ O.....	3.0701	10.48716
	CdSO ₄	1.1372	10.05582		Cl.....	1.2645	10.10192
Cd(NO ₃) ₂	Cd.....	0.47546	9.67711		CO ₂	0.78477	9.89474
	CdO.....	0.54313	9.73490		MgO.....	0.71897	9.85671
	CdS.....	0.61106	9.78608	Ca ₃ (PO ₄) ₂	SO ₃	1.4276	10.15461
	CdSO ₄	0.88176	9.94535		CaO.....	0.54236	9.73429
CdO.....	Cd.....	0.87540	9.94221		CaSO ₄	1.3166	10.11947
	CdCl ₂	1.4276	10.15462		Mg ₂ P ₂ O ₇	0.71760	9.85588
	Cd(NO ₃) ₂	1.8412	10.26510		(NH ₄) ₃ PO ₄		
	CdS.....	1.1251	10.05118		12MnO ₃	12.099	11.08274
					P ₂ O ₅	0.45764	9.66052

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Calcium:			—10	Carbon:			—10
CaS.....	BaSO ₄	3.2357	10.50996	CNS.....	CuCNS.....	2.0946	10.32109
CaSO ₄	BaSO ₄	1.7146	10.23415	CO ₂	BaCO ₃	4.4847	10.65173
	Ca.....	0.29440	9.46894		Ba(HCO ₃) ₂	2.9470	10.46938
	CaCl ₂	0.81529	9.91131		BaO.....	3.4847	10.54216
	CaCO ₃	0.73520	9.86640		C.....	0.27289	9.43599
	CaF ₂	0.57353	9.75855		CaCO ₃	2.2743	10.35684
	CaO.....	0.41193	9.61482		Ca(HCO ₃) ₂	1.8418	10.26525
	Ca ₃ (PO ₄) ₂	0.75951	9.88053		CaO.....	1.2743	10.10526
	SO ₃	0.58807	9.76943		CO ₂	1.3636	10.13467
CaSO ₄					CS ₂ CO ₃	7.4035	10.86944
2H ₂ O.....	BaSO ₄	1.3557	10.13217		CsHCO ₃	4.4065	10.64409
	CaCO ₃	0.58134	9.76443		FeCO ₃	2.6324	10.42034
	CaO.....	0.32572	9.51284		Fe(HCO ₃) ₂	2.0209	10.30554
	SO ₃	0.46500	9.66745		K ₂ CO ₃	3.1402	10.49696
CaWO ₄	WO ₃	0.80528	9.90595		KHCO ₃	2.2748	10.35694
Cl.....	Ca.....	0.56519	9.75220		K ₂ O.....	2.1402	10.33046
	CaCl ₂	1.5652	10.19457		Li ₂ CO ₃	1.6789	10.22503
	CaO.....	0.79082	9.89808		LiHCO ₃	1.5442	10.18869
CO ₂	CaCO ₃	2.2743	10.35684		Li ₂ O.....	0.67894	9.83183
	CaO.....	1.2743	10.10526		MgCO ₃	1.9162	10.28243
HCl.....	CaCO ₃	1.3724	10.13748		Mg(HCO ₃) ₂	1.6628	10.26283
Mg ₂ As ₂ O ₇	Ca ₃ (AsO ₄) ₂	1.2822	10.10794		MgO.....	0.91616	9.96197
MgO.....	CaO.....	1.3909	10.14329		MnCO ₃	2.6117	10.41692
Mg ₂ P ₂ O ₇	Ca ₃ (PO ₄) ₂	1.3935	10.14412		Mn(HCO ₃) ₂	2.0105	10.30331
(NH ₄) ₃ PO ₄					MnO.....	1.6117	10.20728
12MoO ₃	Ca ₃ (PO ₄) ₂	0.082654	8.91726		Na ₂ CO ₃	2.4086	10.38177
N ₂ O ₅	Ca(NO ₃) ₂	1.5192	10.18161		NaHCO ₃	1.9090	10.28081
P ₂ O ₅	Ca ₃ (PO ₄) ₂	2.1851	10.33948		Na ₂ O.....	1.4086	10.14880
SO ₂	CaO.....	0.70047	9.84539		(NH ₄) ₂ CO ₃	2.1834	10.33913
	CaSO ₄	1.7005	10.23057		NH ₄ HCO ₃	1.7964	10.25440
	CaSO ₄ ·2H ₂ O.....	2.1505	10.33255		PbCO ₃	6.0718	10.78332
WO ₃	CaWO ₄	1.2418	10.09405		Rb ₂ CO ₃	5.2481	10.72000
Carbon:					RbHCO ₃	3.3287	10.52228
C=12.01					Rb ₂ O.....	4.2481	10.62820
Ag.....	CN.....	0.24118	9.38233		SrCO ₃	3.3547	10.52565
	HCN.....	0.25052	9.39884		Sr(HCO ₃) ₂	2.3820	10.37695
	KCN.....	0.60358	9.78073	CO ₃	SrO.....	2.3547	10.37193
AgCN.....	CN.....	0.19431	9.28850		BaCO ₃	3.2890	10.51706
	HCN.....	0.20184	9.30501		CO ₂	0.73338	9.86533
	KCN.....	0.48630	9.68690		CS ₂ CO ₃	0.13507	9.13056
AgCNS.....	CNS.....	0.34996	9.54401		CsHCO ₃	0.22694	9.35591
BaCO ₃	C.....	0.060850	8.78426		CuCNS.....	0.47743	9.67891
	CO ₂	0.22298	9.34827		FeCO ₃	0.37989	9.57966
	CO ₃	0.30405	9.48294		Fe.....		
BaO.....	CO ₂	0.28697	9.45784		(HCO ₃) ₂	0.49484	9.69446
	CO ₂ , bicar- bonate.....	0.57394	9.75887	HCN.....	Ag.....	3.9917	10.60116
BaSO ₄	CNS.....	0.24881	9.39587		AgCN.....	4.9544	10.69499
C.....	BaCO ₃	16.434	11.21574	KCN.....	Ag.....	1.6568	10.21927
	CO ₂	3.6644	10.56401		AgCN.....	2.0564	10.31310
CaCO ₃	CO ₂	0.43970	9.64316		K ₂ CO ₃	0.31845	9.50304
Ca.....					KHCO ₃	0.43960	9.64306
(HCO ₃) ₂	CO ₂	0.54294	9.73475		K ₂ O.....	0.46724	9.66954
CaO.....	CO ₂	0.78477	9.89474		Li ₂ CO ₃	0.59562	9.77497
	CO ₂ , bicar- bonate.....	1.5695	10.19577		LiHCO ₃	0.64760	9.81131
CN.....	Ag.....	4.1464	10.61767		Li ₂ O.....	1.4729	10.16817
	AgCN.....	5.1464	10.71150		MgCO ₃	0.52188	9.71757
CNS.....	AgCNS.....	2.8575	10.45599		Mg.....		
	BaSO ₄	4.0191	10.60413		(HCO ₃) ₂	0.60141	9.77917
					MgO.....	1.0915	10.03803
					MnCO ₃	0.38290	9.58308

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Carbon:			-10	Cesium:			--10
Mn				Cs=			
(HCO ₃) ₂	CO ₂	0.49738	9.69669	132.91			
MnO.....	CO ₂	0.62047	9.79272	AgCl.....	CsCl.....	1.1746	10.06990
Na ₂ CO ₃	CO ₂	0.41517	9.61823	Cl.....	Cs.....	3.7485	10.57386
NaHCO ₃	CO ₂	0.52383	9.71919		CsCl.....	4.7485	10.67655
Na ₂ O.....	CO ₂	0.70991	9.85120	Cs.....	Cl.....	0.26677	9.42614
(NH ₄) ₂					CsCl.....	1.2668	10.10270
CO ₃	CO ₂	0.45800	9.66087		Cs ₂ CO ₃	1.2258	10.08840
NH ₄					Cs ₂ O.....	1.0602	10.02538
HCO ₃	CO ₂	0.55668	9.74560		Cs ₂ PtCl ₆	2.5348	10.40394
PbCO ₃	CO ₂	0.16470	9.21668		Cs ₂ SO ₄	1.3614	10.13398
Rb ₂ CO ₃	CO ₂	0.19054	9.28000	CsCl.....	AgCl.....	0.85134	9.93010
RbHCO ₃	CO ₂	0.30041	9.47772		Cl.....	0.21059	9.32345
Rb ₂ O.....	CO ₂	0.23540	9.37180		Cs.....	0.78941	9.89730
SrCO ₃	CO ₂	0.29809	9.47435		Cs ₂ O.....	0.83692	9.92268
Sr					Cs ₂ PtCl ₆	2.0010	10.30124
(HCO ₃) ₂	CO ₂	0.41981	9.62305		Cs ₂ SO ₄	1.0747	10.03128
SrO.....	CO ₂	0.42468	9.62807	Cs ₂ CO ₃	Cs.....	0.81582	9.91160
Cerium:					Cs ₂ PtCl ₆	2.0679	10.31553
Ce=					Cs ₂ SO ₄	1.1106	10.04557
140.13					Cs ₂ O.....	0.94323	9.97462
Ce.....	Ce ₂ (C ₂ O ₄) ₃				CsCl.....	1.1949	10.07732
	3H ₂ O.....	2.1350	10.32941		Cs ₂ PtCl ₆	2.3909	9.37855
	Ce(NO ₃) ₄	2.7700	10.44248		Cs ₂ SO ₄	1.2841	10.10859
	Ce(NO ₃) ₄				SO ₃	0.28408	9.45344
	(NH ₄ NO ₃) ₂				Cs.....	0.39451	9.59606
	H ₂ O.....	4.0411	10.60650		CsCl.....	0.49976	9.69876
	CeO ₂	1.2284	10.08933		Cs ₂ CO ₃	0.48358	9.68447
	Ce ₂ O ₃	1.1713	10.06866		Cs ₂ O.....	0.41826	9.62145
	Ce ₂ (SO ₄) ₃	2.0283	10.30712	Cs ₂ SO ₄	Cs.....	0.73455	9.86602
Ce ₂					CsCl.....	0.93051	9.96872
(C ₂ O ₄) ₃					Cs ₂ CO ₃	0.90038	9.95443
3H ₂ O.....	Ce.....	0.46837	9.67059		Cs ₂ O.....	0.77877	9.89141
	Ce ₂ (SO ₄) ₃	0.94998	9.97772	SO ₃	Cs ₂ O.....	3.5201	10.54656
Ce(NO ₃) ₄	Ce.....	0.36101	9.55752	Chlorine:			
	CeO ₂	0.44345	9.64684	Cl=			
	Ce ₂ O ₃	0.42284	9.62617	35.457			
Ce(NO ₃) ₄				Ag.....	Cl.....	0.32867	9.51676
(NH ₄					HCl.....	0.33802	9.52894
NO ₃) ₂				AgCl.....	Cl.....	0.24737	9.39334
H ₂ O.....	Ce.....	0.24746	9.39350		ClO ₃	0.58224	9.76510
	CeO ₂	0.30397	9.48283		ClO ₄	0.69387	9.84128
	Ce ₂ O ₃	0.28984	9.46216		HCl.....	0.25440	9.40552
CeO ₂	Ce.....	0.81409	9.91067	BaCrO ₄	Cl.....	0.27988	9.44698
	Ce(NO ₃) ₄	2.2551	10.35316		Cl.....	1.7693	10.24780
	Ce(NO ₃) ₄				Ag.....	3.0426	10.48324
	(NH ₄ NO ₃) ₂				AgCl.....	4.0426	10.60666
	H ₂ O.....	3.2898	10.51717		BaCrO ₄	3.5729	10.55302
	Ce ₂ O ₃	0.95352	9.97933		Ca.....	0.56519	9.75220
Ce ₂ O ₃	Ce.....	0.85377	9.93134		HCl.....	1.0284	10.01218
	Ce(NO ₃) ₄	2.3650	10.37383		K.....	1.1026	10.04243
	Ce(NO ₃) ₄				KCl.....	2.1026	10.32276
	(NH ₄ NO ₃) ₂				Li.....	0.19573	9.29166
	H ₂ O.....	3.4502	10.53784		Mg.....	0.34295	9.53523
	CeO ₂	1.0487	10.02067		MgCl ₂	1.3430	10.12806
	Ce ₂ (SO ₄) ₃	1.7317	10.23847		MnO ₂	1.2259	10.08844
Ce ₂ (SO ₄) ₃	Ce.....	0.49303	9.69288		Na.....	0.64859	9.81197
	Ce ₂ (C ₂ O ₄) ₃				NaCl.....	1.6486	10.21711
	3H ₂ O.....	1.0527	10.02228		NH ₄	0.50880	9.70654
	Ce ₂ O ₃	0.57748	9.76153		PbCrO ₄	4.5579	10.65877
				ClO ₃	AgCl.....	1.7175	10.23490

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm	
Chlorine:			—10	Chromium:			—10	
ClO ₃	KCl.....	0.89331	9.95100	PbCrO ₄ ..	Cr ₂ (SO ₄) ₃ .			
	NaCl.....	0.70041	9.84535		18H ₂ O.....	1.1084	10.04468	
ClO ₄	AgCl.....	1.4412	10.15872		K ₂ CrO ₄	0.60084	9.77876	
	KCl.....	0.74960	9.87483		K ₂ Cr ₂ O ₇	0.45513	9.65813	
	NaCl.....	0.58773	9.76918	Cobalt:				
HCl.....	Ag.....	2.9584	10.47106	Co=				
	AgCl.....	3.9308	10.59448	58.94				
	NH ₄ Cl.....	1.4671	10.16646	Co.....	Co(NO ₃) ₂ .			
	(NH ₄) ₂ SO ₄	1.8119	10.25813		6H ₂ O.....	4.9381	10.69356	
K.....	Cl.....	0.90692	9.95757		Co(NO ₂) ₃ .			
KCl.....	Cl.....	0.47559	9.67724		(KNO ₂) ₃	7.6735	10.88499	
	ClO ₃	1.1194	10.04900		CoO.....	1.2715	10.10430	
	ClO ₄	1.3340	10.12517		Co ₃ O ₄	1.3620	10.13416	
Li.....	Cl.....	5.1091	10.70834		CoSO ₄	2.6298	10.41992	
Mg.....	Cl.....	2.9159	10.46477		CoSO ₄ ·7H ₂ O.....	4.7695	10.67847	
MgCl ₂	Cl.....	0.74463	9.87194		(CoSO ₄) ₂ .			
MnO ₂	Cl.....	0.81576	9.91156		(K ₂ SO ₄) ₃	7.0644	10.84908	
Na.....	Cl.....	1.5418	10.18803	Co(NO ₃) ₂ .				
NaCl.....	Cl.....	0.60658	9.78289	6H ₂ O.....	Co.....	0.20251	9.30644	
	ClO ₃	1.4277	10.15465	Co(NO ₂) ₃ .				
	ClO ₄	1.7015	10.23082	(KNO ₂) ₃	Co.....	0.13032	9.11501	
NH ₄	Cl.....	1.9654	10.29346	CoO.....	CoO.....	0.16570	9.21931	
NH ₄ Cl.....	HCl.....	0.68162	9.83354	Co.....	Co.....	0.78650	9.89570	
(NH ₄) ₂					Co(NO ₂) ₃ .			
SO ₄	HCl.....	0.55191	9.74187		(KNO ₂) ₃	6.0352	10.78069	
PbCrO ₄	Cl.....	0.21940	9.34123		Co ₃ O ₄	1.0712	10.02986	
Chromium:					CoSO ₄	2.0683	10.31562	
Cr=					(CoSO ₄) ₂ .			
52.01					(K ₂ SO ₄) ₃	5.5562	10.74477	
BaCrO ₄	Cr.....	0.20527	9.31233	Co ₃ O ₄	Co.....	0.73424	9.86584	
	CrO ₃	0.39472	9.59629		CoO.....	0.93356	9.97014	
	CrO ₄	0.45787	9.66074	CoSO ₄	Co.....	0.38026	9.58008	
	Cr ₂ O ₃	0.30000	9.47712		CoO.....	0.48348	9.68438	
	Cr ₂ (SO ₄) ₃ .			CoSO ₄ .				
	18H ₂ O.....	1.4139	10.15043	7H ₂ O.....	Co.....	0.20967	9.32153	
Cr.....	BaCrO ₄	4.8716	10.68767		CoO.....	0.26658	9.42583	
	Cr ₂ O ₃	1.4614	10.16478		(CoSO ₄) ₂ .			
	PbCrO ₄	6.2146	10.79341		(K ₂ SO ₄) ₃	Co.....	0.14155	9.15092
CrO ₃	BaCrO ₄	2.5334	10.40371		CoO.....	0.17998	9.25523	
	Cr ₂ O ₃	0.76002	9.88083	Columbium:				
	K ₂ CrO ₄	1.9418	10.28821	(niobium)				
	K ₂ Cr ₂ O ₇	1.4709	10.16759	Cb=				
	PbCrO ₄	3.2319	10.50945	92.91				
CrO ₄	BaCrO ₄	2.1840	10.33926	Cb.....	Cb ₂ O ₅	1.4305	10.15550	
	PbCrO ₄	2.7861	10.44500	Cb.....	Cb.....	0.69904	9.84450	
Cr ₂ O ₃	BaCrO ₄	3.3334	10.52288	Copper:				
	Cr.....	0.68425	9.83522	Cu=63.57				
	CrO ₃	1.3157	10.11917	Cu.....	Cu ₂ C ₂ H ₃ O ₂ .			
	CrO ₄	1.5262	10.18362		(AsO ₂) ₃	3.9871	10.60065	
	PbCrO ₄	4.2523	10.62863		CuCNS.....	1.9136	10.28185	
Cr ₂ (SO ₄) ₃					CuO.....	1.2517	10.09750	
18H ₂ O.....	BaCrO ₄	0.70725	9.84957		Cu ₂ O.....	1.1258	10.05148	
	PbCrO ₄	0.90223	9.95532		Cu ₂ S.....	1.2522	10.09766	
K ₂ CrO ₄	CrO ₃	0.51498	9.71179		CuSO ₄ .			
	PbCrO ₄	1.6643	10.22124		5H ₂ O.....	3.9281	10.59419	
K ₂ Cr ₂ O ₇	CrO ₃	0.67985	9.83241	Cu ₂ C ₂ .				
	PbCrO ₄	2.1972	10.34187	H ₃ O ₂ .				
PbCrO ₄	Cr.....	0.16091	9.20659	(AsO ₂) ₃	Cu.....	0.25081	9.39935	
	CrO ₃	0.30942	9.49055		Mg ₂ As ₂ O ₇	0.91868	9.96316	
	CrO ₄	0.35892	9.55500	CuCNS.....		0.52257	9.71815	
	Cr ₂ O ₃	0.23516	9.37137					

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Copper:				Fluorine:			
CuCNS...	CuO.....	0.65410	9.81564	—10			
CuO.....	Cu.....	0.79892	9.90250	Fluorine:	H ₂ SiF ₆	0.65414	9.81567
CuCNS.....	CuCNS.....	1.5288	10.18436	K ₂ SiF ₆	KF.....	0.52754	9.72226
Cu ₂ S.....	Cu ₂ S.....	1.0004	10.00016	SiF ₄	SiF ₆	0.64499	9.80955
CuSO ₄	CuSO ₄			SiF ₆	BaSiF ₆	2.6852	10.42897
5H ₂ O.....	5H ₂ O.....	3.1383	10.49669	SiF ₆	H ₂ SiF ₆	1.3845	10.14131
Cu ₂ O.....	Cu.....	0.88822	9.94852	SiF ₆	BaSiF ₆	1.9669	10.20379
Cu ₂ S.....	Cu ₂ S.....	1.1122	10.04618	CaF ₂	CaF ₂	1.6489	10.21719
Cu.....	Cu.....	0.79862	9.90234	H ₂ SiF ₆	H ₂ SiF ₆	1.0142	10.00612
CuO.....	CuO.....	0.99962	9.99984	K ₂ SiF ₆	K ₂ SiF ₆	1.5504	10.19045
Cu ₂ O.....	Cu ₂ O.....	0.89912	9.95382	Gallium:			
CuSO ₄	CuSO ₄			Ga=			
5H ₂ O.....	5H ₂ O.....	3.1371	10.49652	69.72			
CuSO ₄	Cu.....	0.25457	9.40581	Ga.....	Ga ₂ O ₃	1.3442	10.12847
5H ₂ O.....	CuO.....	0.31865	9.50331	Ga.....	Ga ₂ S ₃	1.6898	10.22782
	Cu ₂ S.....	0.31877	9.50348	Ga.....	Ga.....	0.74392	9.87153
Mg ₂ As ₂ O ₇	Cu ₂ C ₂ H ₃ O ₂			Ga.....	Ga.....	0.59180	9.77218
	(AsO ₂) ₃	1.0885	10.03684	Germanium:			
Erbium:				Ge=			
Er=				72.60			
167.2	Er ₂ O ₃	1.1435	10.05825	Ge.....	GeO ₂	1.4408	10.15860
Er.....	Er.....	0.87448	9.94175	Ge.....	K ₂ GeF ₆	3.6473	10.56197
Er ₂ O ₃	Er.....			Ge.....	Ge.....	0.69407	9.84140
Fluorine:				Ge.....	Ge.....	0.27418	9.43803
F=19.000				Gold:			
BaF ₂	BaSiF ₆	1.5934	10.20233	Au=			
BaSiF ₆	BaF ₂	0.62759	9.79767	197.2			
	F.....	0.40799	9.61065	Au.....	AuCl ₃	1.5394	10.18735
	HF.....	0.42963	9.63310		HAuCl ₄		
	H ₂ SiF ₆	0.51563	9.71233		4H ₂ O.....	2.0898	10.32010
	SiF ₄	0.37241	9.57103		KAu(CN) ₄		
	SiF ₆	0.50841	9.70621		H ₂ O.....	1.8174	10.25944
CaF ₂	F.....	0.48668	9.68724	AuCl ₃	Au.....	0.64960	9.81265
	HF.....	0.51250	9.70970	HAuCl ₄			
	H ₂ SiF ₆	0.61508	9.78893	4H ₂ O.....	Au.....	0.47852	9.67990
	SiF ₆	0.60647	9.78281	KAu(CN) ₄			
CaSO ₄	F.....	0.27912	9.44580	H ₂ O.....	Au.....	0.55025	9.74056
	HF.....	0.29393	9.46825	Hydrogen:			
F.....	BaSiF ₆	2.4511	10.38935	H=			
	CaF ₂	2.0547	10.31276	1.0081			
	CaSO ₄	3.5826	10.55420	AgCNS.....	HCNS.....	0.35603	9.55149
	H ₂ SiF ₆	1.2638	10.10169	BaSO ₄	HCNS.....	0.25313	9.40335
	K ₂ SiF ₆	1.9320	10.28602	CuCNS.....	HCNS.....	0.48571	9.68638
HF.....	BaSiF ₆	2.3276	10.36690	H.....	H ₂ O.....	8.9357	10.96113
	CaF ₂	1.9512	10.29030	HCNS...	O.....	7.9357	10.89959
	CaSO ₄	3.4021	10.53175		AgCNS.....	2.8087	10.44351
	K ₂ SiF ₆	1.8347	10.26356		BaSO ₄	2.9505	10.59665
2HF.....	H ₂ SiF ₆	3.6004	10.55636		CuCNS.....	2.0588	10.31362
6HF.....	H ₂ SiF ₆	1.2001	10.07924	H ₂ O.....	H.....	0.11191	9.04887
H ₂ SiF ₆	BaSiF ₆	1.9394	10.28767	O.....	H.....	0.12601	9.10041
	CaF ₂	1.6258	10.21107	Indium:			
	F.....	0.79125	9.89831	In=			
	2HF.....	0.27774	9.44364	114.76			
	6HF.....	0.83323	9.92076	In.....	In ₂ O ₃	1.2091	10.08247
	K ₂ SiF ₆	1.5287	10.18433		In ₂ S ₃	1.4190	10.15200
	SiF ₄	0.72226	9.85869		In ₂ O ₃ ...	0.82704	9.91753
	SiF ₆	0.98601	9.99388		In.....	0.70470	9.84800
KF.....	K ₂ SiF ₆	1.8956	10.27774	Iodine:			
K ₂ SiF ₆	F.....	0.51759	9.71398	I=126.92			
	HF.....	0.54505	9.73644	Ag.....	HI.....	1.1858	10.07402
				AgCl....	I.....	1.1765	10.07050
					I.....	0.88547	9.94717

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Iodine:				Iron:			
AgI.....	HI.....	0.54484	9.73627	FeCl ₃	Fe ₂ O ₃	0.49220	9.69214
I.....	I.....	0.54055	9.73283	Fe ₇ (CN) ₁₈ , prussian blue...	Ag.....	2.2600	10.35412
IO ₃	IO ₃	0.74497	9.87214		CN.....	0.54507	9.73645
IO ₄	IO ₄	0.81312	9.91015		CO ₂	0.37989	9.57966
I ₂ O ₅	I ₂ O ₅	0.71090	9.85181	FeCO ₃ ...	FeO.....	0.62011	9.79247
I ₂ O ₇	I ₂ O ₇	0.77905	9.89156		Fe ₂ O ₃	0.68917	9.83832
HI.....	Ag.....	0.84329	9.92598	Fe.....			
	AgI.....	1.8354	10.26373	(HCO ₃) ₂	CO ₂	0.49484	9.69446
	Pd.....	0.41703	9.62017		Fe.....	0.31393	9.49683
	PdI ₂	1.4092	10.14896		FeO.....	0.40388	9.60625
	TIH.....	2.5898	10.41327		Fe ₂ O ₃	0.44885	9.65210
I.....	Ag.....	0.84998	9.92941	FeO.....	CO ₂	0.61261	9.78719
	AgCl.....	1.1293	10.05283		Fe.....	0.77728	9.89058
	AgI.....	1.8500	10.26717		FeCO ₃	1.6126	10.20753
	Pd.....	0.42034	9.62360		Fe(HCO ₃) ₂ ..	2.4760	10.39375
	PdI ₂	1.4203	10.15239		Fe ₂ O ₃	1.1114	10.04585
IO ₃	TIH.....	2.6104	10.41670		FePO ₄	2.0994	10.32209
	AgI.....	1.3423	10.12786		Fe.....	1.2236	10.08762
	PdI ₂	1.0306	10.01308		SO ₃	1.1144	10.04705
IO ₄	TIH.....	1.8941	10.27740	Fe ₂ O ₃ ...	Fe.....	0.69940	9.84472
	AgI.....	1.2298	10.08985		FeCl ₃	2.0317	10.30786
	PdI ₂	0.94422	9.97507		FeCO ₃	1.4510	10.16168
I ₂ O ₅	TIH.....	1.7353	10.23938		Fe(HCO ₃) ₂ ..	2.2279	10.34790
	AgI.....	1.4067	10.14819		Fe(HCO ₃) ₃ ...	2.9922	10.47599
	PdI ₂	1.0800	10.03342		FeO.....	0.89980	9.95415
I ₂ O ₇	TIH.....	1.9848	10.29773		Fe ₂ O ₄	0.96660	9.98525
	AgI.....	1.2836	10.10844		FePO ₄	1.8890	10.27624
	PdI ₂	0.98551	9.99366		FeS.....	1.1010	10.04177
	TIH.....	1.8112	10.25797		FeSO ₄	1.9026	10.27934
Pd.....	HI.....	2.3979	10.37983		FeSO ₄ .7H ₂ O..	3.4821	10.54185
	I.....	2.3790	10.37640		FeSO ₄ (NH ₄) ₂ SO ₄ 6H ₂ O.....	4.9115	10.69122
PdI ₂	HI.....	0.70965	9.85104	Fe ₂ O ₄	Fe ₂ O ₃	2.5041	10.39866
	I.....	0.70406	9.84761	FePO ₄ ...	Fe.....	1.0346	10.01475
	IO ₃	0.97032	9.98692		FeO.....	0.37024	9.56849
	IO ₄	1.0591	10.02493		FeO.....	0.47633	9.67791
	I ₂ O ₅	0.92594	9.96658		Fe ₂ O ₃	0.52940	9.72378
	I ₂ O ₇	1.0147	10.00634	FeS.....	Fe.....	0.63527	9.80296
TIH.....	HI.....	0.38613	9.58673		FeO.....	0.81729	9.91238
	I.....	0.38309	9.58330		Fe ₂ O ₃	0.90830	9.95823
	IO ₃	0.52796	9.72260	FeSO ₄ ...	Fe.....	0.36761	9.56539
	IO ₄	0.57626	9.76062		Fe ₂ O ₃	0.52561	9.72066
	I ₂ O ₅	0.50382	9.70227		SO ₃	0.52706	9.72186
	I ₂ O ₇	0.55211	9.74203	FeSO ₄ 7H ₂ O..	Fe.....	0.20085	9.30288
Iron:				FeSO ₄ (NH ₄) ₂ SO ₄ 6H ₂ O..	Fe ₂ O ₃	0.28718	9.45815
Fe=55.84							
Ag.....	Fe ₇ (CN) ₁₈ , prussian blue.	0.44247	9.64588				
CN.....	Fe ₇ (CN) ₁₈	1.8346	10.26355				
CO ₂	FeCO ₃	2.6324	10.42034				
	Fe(HCO ₃) ₂ ...	2.0209	10.30554				
	FeO.....	1.6324	10.21281				
Fe.....	Fe(HCO ₃) ₂ ...	3.1855	10.50317				
	FeO.....	1.2865	10.10942				
	Fe ₂ O ₃	1.4298	10.15528				
	FePO ₄	2.7009	10.43151				
	FeS.....	1.5741	10.19704				
	FeSO ₄	2.7203	10.43461				
	FeSO ₄ 7H ₂ O.....	4.9788	10.69712				
	FeSO ₄ (NH ₄) ₂ SO ₄ .6H ₂ O...	7.0225	10.84649				
FeAsO ₄ ...	Mg ₂ As ₂ O ₇	0.79707	9.90150				

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Lanthanum: La ₂ O ₃	La.....	0.85269	-10 9.93079	Lead: PbSO ₄	(PbCO ₃) ₂		-10
Lead: Pb=					Pb(OH) ₂	0.85256	9.93072
207.21					PbCrO ₄	1.0658	10.02767
BaSO ₄	PbSO ₄	1.2992	10.11369		Pb(NO ₃) ₂	1.0922	10.03829
Pb.....	PbCl ₂	1.3422	10.12783		PbO.....	0.73601	9.86688
	PbCO ₃	1.2896	10.11046		PbO ₂	0.78877	9.89695
	(PbCO ₃) ₂				Pb ₃ O ₄	0.75360	9.87714
	Pb(OH) ₂	1.2478	10.09614	Lithium:	PbS.....	0.78897	9.89706
	PbCrO ₄	1.5599	10.19309	Li= 6.940			
	PbO.....	1.0772	10.03230	CO ₂ ...	Li ₂ CO ₃	1.6789	10.22503
	PbO ₂	1.1544	10.06237		LiHCO ₃	1.5442	10.18869
	Pb(OH) ₂	1.1642	10.06601		Li ₂ O.....	0.67894	9.83183
	PbS.....	1.1547	10.06248	Li.....	LiCl.....	6.1091	10.78598
	PbSO ₄	1.4636	10.16542		Li ₂ CO ₃	5.3235	10.72620
Pb(C ₂ H ₃ O 2)2.3H ₂ O	PbCrO ₄	0.85204	9.93046		Li ₂ O.....	2.1527	10.33290
	PbSO ₄	0.79945	9.90279		Li ₃ PO ₄	5.5620	10.74523
PbCl ₂	Pb.....	0.74503	9.87217	LiCl.....	Li ₂ SO ₄	7.9207	10.89877
	PbO.....	0.80256	9.90448		Li.....	0.16369	9.21402
PbCO ₃ ...	Pb.....	0.77543	9.88954		Li ₂ CO ₃	0.87141	9.94022
	PbO.....	0.83530	9.92184		Li ₂ O.....	0.35238	9.54702
	PbSO ₄	1.1349	10.05496		Li ₃ PO ₄	0.91044	9.95925
(PbCO ₃) ₂ ..	Pb.....	0.80141	9.90386	Li ₂ CO ₃ ...	Li ₂ SO ₄	1.2966	10.11279
Pb(OH) ₂ ..	PbCrO ₄	1.2501	10.09694		CO ₂	0.59562	9.77497
	PbSO ₄	1.1729	10.06928		Li.....	0.18785	9.27380
PbCrO ₄ ...	Pb.....	0.64108	9.80691		LiCl.....	1.1476	10.05978
	Pb(C ₂ H ₃ O ₂) ₂ ..				LiHCO ₃	1.8394	10.26469
	3H ₂ O.....	1.1737	10.06954		Li ₂ O.....	0.40438	9.60679
	(PbCO ₃) ₂			LiHCO ₃ ..	Li ₃ PO ₄	1.0448	10.01903
	Pb(OH) ₂	0.79994	9.90306		CO ₂	0.64760	9.81131
	PbO.....	0.69058	9.83922		Li ₂ CO ₃	0.54364	9.73531
	Pb ₃ O ₄	0.70708	9.84947	Li ₂ O.....	Li ₂ O.....	0.21984	9.34211
	PbSO ₄	0.93828	9.97233		Li ₃ PO ₄	0.56800	9.75435
Pb(NO ₃) ₂	PbO.....	0.67389	9.82859		CO ₂	1.4729	10.16817
	PbO ₂	0.72220	9.85865	Li.....	Li.....	0.46452	9.66701
	PbSO ₄	0.91560	9.96171	LiCl.....	LiCl.....	2.8378	10.45298
PbO.....	Pb.....	0.92832	9.96770		Li ₂ CO ₃	2.4729	10.39321
	PbCl ₂	1.2460	10.09552		LiHCO ₃	4.5487	10.65789
	PbCO ₃	1.1972	10.07816		Li ₃ PO ₄	2.5837	10.41224
	PbCrO ₄	1.4481	10.16078	Li ₂ SO ₄ ...	Li ₂ SO ₄	3.6794	10.56578
	Pb(NO ₃) ₂	1.4839	10.17141		SO ₃	2.6794	10.42803
	PbO ₂	1.0717	10.03007	Li ₃ PO ₄ ...	Li.....	0.17979	9.25477
	PbS.....	1.0720	10.03017		LiCl.....	1.0984	10.04075
	PbSO ₄	1.3587	10.13312		Li ₂ CO ₃	0.95712	9.98097
PbO ₂	Pb.....	0.86623	9.93763		LiHCO ₃	1.7606	10.24565
	Pb(NO ₃) ₂	1.3847	10.14135		Li ₂ O.....	0.38705	9.58776
	PbO.....	0.93311	9.96993	Li ₂ SO ₄ ...	Li ₂ SO ₄	1.4241	10.15354
	PbSO ₄	1.2678	10.10305		Li ₂ SO ₄ .H ₂ O.....	1.6575	10.21944
Pb ₃ O ₄	PbCrO ₄	1.4143	10.15053		Li.....	0.12625	9.10123
	PbSO ₄	1.3270	10.12286		LiCl.....	0.77128	9.88721
Pb(OH) ₂ ..	Pb.....	0.85599	9.93399		Li ₂ O.....	0.27178	9.43422
PbS.....	Pb.....	0.86601	9.93752		Li ₃ PO ₄	0.70220	9.84646
	PbO.....	0.93288	9.96983	Li ₂ SO ₄ ..	SO ₃	0.72822	9.86226
	PbSO ₄	1.2675	10.10294	H ₂ O...			
PbSO ₄ ...	BaSO ₄	0.76968	9.88631	SO ₃	Li ₃ PO ₄	0.60333	9.78056
	Pb.....	0.68325	9.83458		Li ₂ O.....	0.37322	9.57197
	Pb(C ₂ H ₃ O ₂) ₂ ..			Magnesium:	Li ₂ SO ₄	1.3732	10.13774
	3H ₂ O.....	1.2509	10.09721	Mg=			
	PbCO ₃	0.88113	9.94504	24.32			
				BaSO ₄ ...	MgSO ₄	0.51572	9.71242
					MgSO ₄ .7H ₂ O...	1.0560	10.02367

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Magnesium:				Magnesium:			
—10				—10			
Br.....	Mg.....	0.15216	9.18230	MgSO ₄			
	MgBr ₂	1.1522	10.06151	7H ₂ O.....	Mg ₂ P ₂ O ₇	0.45153	9.65469
	MgBr ₂ ·6H ₂ O.....	1.8285	10.26209		SO ₃	0.32480	9.51161
Cl.....	Mg.....	0.34295	9.53523		MgO.....	0.50362	9.70210
	MgCl ₂	1.3430	10.12806		MgSO ₄	1.5036	10.17714
	MgCl ₂ ·6H ₂ O.....	2.8673	10.45747		MgSO ₄ ·7H ₂ O.....	3.0789	10.48839
CO ₂	MgCO ₃	1.9162	10.28243	Manganese:			
	MgO.....	0.91616	9.96197	Mn=			
I.....	Mg.....	0.095808	8.98140	54.93			
	MgI ₂	1.0958	10.03973	BaSO ₄	MnSO ₄	0.64686	9.81081
Mg.....	Br.....	6.5720	10.81770	CO ₂	MnCO ₃	2.6117	10.41692
	Cl.....	2.9159	10.46477		MnO.....	1.6117	10.20728
	I.....	10.438	11.01860	Mn.....	MnCO ₃	2.0925	10.32066
	MgCO ₃	3.4675	10.54002		MnO.....	1.2913	10.11102
	MgO.....	1.6579	10.21956		Mn ₂ O ₃	1.4369	10.15743
	Mg ₂ P ₂ O ₇	4.5765	10.66053		Mn ₃ O ₄	1.3884	10.14251
	MgSO ₄	4.9498	10.69459		Mn ₂ P ₂ O ₇	2.5835	10.41220
MgBr ₂ ...	Br.....	0.86794	9.93849	MnCO ₃ ...	CO ₂	0.38290	9.58302
MgBr ₂ ·6H ₂ O...	Br.....	0.54690	9.73791		Mn.....	0.47790	9.67934
MgCl ₂ ...	Cl.....	0.74463	9.87194		Mn(HCO ₃) ₂ ...	1.5396	10.18742
	Mg ₂ P ₂ O ₇	1.1687	10.06770		MnO.....	0.61710	9.79036
MgCl ₂ ·6H ₂ O...	Cl.....	0.34876	9.54253		Mn ₃ O ₄	0.66351	9.82184
	Mg ₂ P ₂ O ₇	0.54738	9.73829		Mn ₂ P ₂ O ₇	1.2346	10.09154
MgCl ₂ ·KCl.					MnS.....	0.75683	9.87906
6H ₂ O...	Mg ₂ P ₂ O ₇	0.40053	9.60263	Mn.....	MnSO ₄	1.3136	10.11848
MgCO ₃ ...	CO ₂	0.52188	9.71757	(HCO ₃) ₂	MnCO ₃	0.64950	9.81258
	Mg.....	0.28839	9.45998		MnO.....	0.40081	9.60294
	Mg(HCO ₃) ₂	1.7355	10.23943		Mn ₂ O ₃	0.43095	9.63443
	MgO.....	0.47812	9.67954	MnO.....	CO ₂	0.62047	9.79272
	Mg ₂ P ₂ O ₇	1.3198	10.12051		Mn.....	0.77443	9.88898
Mg.....	MgCO ₃	0.57620	9.76057		MnCO ₃	1.6205	10.20964
(HCO ₃) ₂	MgO.....	0.27549	9.44011		Mn(HCO ₃) ₂ ...	2.4949	10.39706
	Mg ₂ P ₂ O ₇	0.76047	9.88108		Mn ₂ O ₃	1.1128	10.04641
MgI ₂ ...	I.....	0.91257	9.96027		Mn ₃ O ₄	1.0752	10.03149
MgO.....	CO ₂	1.0915	10.03803		Mn ₂ P ₂ O ₇	2.0007	10.30118
	Mg.....	0.60317	9.78044		MnS.....	1.2264	10.08864
	MgCO ₃	2.0915	10.32046	MnO ₂ ...	MnSO ₄	2.1287	10.32812
	Mg(HCO ₃) ₂	3.6299	10.55989		SO ₃	1.1287	10.05259
	Mg ₂ P ₂ O ₇	2.7604	10.44097		Mn ₃ O ₄	0.87730	9.94315
	MgSO ₄	2.9856	10.47503		Mn ₂ P ₂ O ₇	1.6325	10.21284
	SO ₃	1.9856	10.29790	Mn ₂ O ₃ ...	Mn.....	0.69593	9.84257
Mg ₂ P ₂ O ₇ ...	Mg.....	0.21851	9.33947		MnO.....	0.98964	9.95359
	MgCl ₂	0.85565	9.93230		Mn ₃ O ₄	0.96621	9.98507
	MgCl ₂ ·6H ₂ O...	1.8269	10.26171	Mn ₃ O ₄ ...	Mn.....	0.72027	9.85749
	MgCl ₂ ·KCl.				MnCO ₃	1.5071	10.17816
	6H ₂ O.....	2.4967	10.39737		Mn(HCO ₃) ₂ ...	2.3205	10.36557
	MgCO ₃	0.75768	9.87949		MnO.....	0.93007	9.96851
	Mg(HCO ₃) ₂ ...	1.3150	10.11892		Mn ₂ O ₃	1.1399	10.05685
	MgO.....	0.36226	9.55903		Mn ₂ O ₃	1.0350	10.01493
	MgSO ₄	1.0816	10.03406		MnSO ₄	1.9799	10.29663
	MgSO ₄ ·7H ₂ O...	2.2147	10.34531	Mn ₂ P ₂ O ₇ ...	Mn.....	0.38708	9.58780
MgSO ₄ ...	BaSO ₄	1.9390	10.28758		MnCO ₃	0.80995	9.90846
	Mg.....	0.20203	9.30541		MnO.....	0.49982	9.69882
	MgO.....	0.33494	9.52497		Mn ₂ O ₃	0.61257	9.78716
	Mg ₂ P ₂ O ₇	0.92457	9.96594		MnSO ₄	1.0640	10.02694
	SO ₃	0.66506	9.82286	MnS.....	Mn.....	0.63145	9.80034
MgSO ₄ ·7H ₂ O...	BaSO ₄	0.94696	9.97633		MnCO ₃	1.3213	10.12100
					MnO.....	0.81538	9.91136
					MnSO ₄	1.7357	10.23948
				MnSO ₄ ...	BaSO ₄	1.5459	10.18919
					Mn.....	0.36380	9.56086

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Manganese:			-10	Molybde- num:			-10
MnSO ₄ ..	MnO.....	0.46977	9.67188	(NH ₄) ₂ MoO ₄ ..	MoO ₃	0.73432	9.86589
	Mn ₂ O ₄	0.50509	9.70337		MoS ₃	0.98010	9.99127
	Mn ₂ P ₂ O ₇	0.93986	9.97306		(NH ₄) ₃ PO ₄ ..		
	MnS.....	0.57613	9.76052		12MoO ₃	0.79771	9.90184
	SO ₃	0.53023	9.72447		PbMoO ₄	1.8730	10.27253
	MnO.....	0.88596	9.94741				
	MnSO ₄	1.8860	10.27553				
Mercury:				(NH ₄) ₃ PO ₄ ..			
Hg=				12MoO ₃ ..	MoO ₃	0.92054	9.96404
200.61					(NH ₄) ₂ MoO ₄ ..	1.2536	10.09816
Hg.....	HgCl.....	1.1767	10.07068	PbMoO ₄ ..	Mo.....	0.26133	9.41719
	HgCl ₂	1.3535	10.13146		MoO ₃	0.39206	9.59336
	HgO.....	1.0798	10.03333		(NH ₄) ₂ MoO ₄ ..	0.53391	9.72747
	HgS.....	1.1598	10.06439				
HgCl.....	Hg.....	0.84980	9.92932	Neody- mium:			
	HgCl ₂	1.1502	10.06077	Nd=			
	HgNO ₃	1.1125	10.04629	144.27			
	HgO.....	0.91758	9.96264	Nd.....	Nd ₂ O ₃	1.1664	10.06683
	Hg ₂ O.....	0.88369	9.94630		Nd.....	0.85737	9.93317
	HgS.....	0.98561	9.99371	Nickel:			
HgCl ₂ ..	Hg.....	0.73383	9.86854	Ni=			
	HgCl.....	0.86941	9.93923	58.69			
	HgS.....	0.85690	9.93293	Ni.....	Ni(C ₄ H ₇ N ₂ O ₂) ₂ ..		
Hg(CN) ₂	HgS.....	0.92093	9.96423		Ni-glyoxime..	4.9227	10.69221
HgNO ₃ ..	HgCl.....	0.89890	9.95371		Ni(NO ₃) ₂ .6H ₂ O	4.9549	10.69504
	HgS.....	0.88596	9.94742		NiO.....	1.2726	10.10470
Hg(NO ₃) ₂	HgS.....	0.71673	9.85536		NiSO ₄	2.6367	10.42107
Hg(NO ₃) ₂ ..					NiSO ₄ .7H ₂ O...	4.7855	10.67993
H ₂ O.....	HgS.....	0.67905	9.83190				
HgO.....	Hg.....	0.92613	9.96667	Ni(C ₄ H ₇ N ₂ O ₂) ₂ ..			
	HgCl.....	1.0898	10.03736	Ni-gly- oxime..	Ni.....	0.20314	9.30779
	HgS.....	1.0741	10.03106		NiO.....	0.25852	9.41249
Hg ₂ O.....	HgCl.....	1.1316	10.05370				
	HgS.....	1.1153	10.04741				
HgS.....	Hg.....	0.86221	9.93561	Ni(NO ₃) ₂ ..			
	HgCl.....	1.0146	10.00629	6H ₂ O.....	Ni.....	0.20182	9.30496
	HgCl ₂	1.1670	10.06707		NiO.....	0.25684	9.40966
	Hg(CN) ₂	1.0859	10.03577		NiSO ₄	0.53215	9.72603
	HgNO ₃	1.1287	10.05258		Ni.....	0.78578	9.89530
	Hg(NO ₃) ₂	1.3952	10.14464		Ni(C ₄ H ₇ N ₂ O ₂) ₂ ..		
	Hg(NO ₃) ₂ .H ₂ O...	1.4727	10.16810		Ni-glyoxime..	3.8682	10.58755
	HgO.....	0.93098	9.96894		Ni(NO ₃) ₂ .6H ₂ O	3.8935	10.59034
	Hg ₂ O.....	0.89659	9.95259		NiSO ₄	2.0719	10.31637
	HgSO ₄	1.2751	10.10553		NiSO ₄ .7H ₂ O...	3.7604	10.57523
	HgS.....	0.78427	9.89447	NiSO ₄	Ni.....	0.37926	9.57893
Molybde- num:					Ni(NO ₃) ₂ .6H ₂ O	1.8792	10.27397
Mo=					NiO.....	0.48265	9.68363
95.95					NiSO ₄ .7H ₂ O...	1.8149	10.25886
Mo.....	MoO ₃	1.5003	10.17617	NiSO ₄ ..	Ni.....	0.20896	9.32007
	MoS ₃	2.0024	10.30155	7H ₂ O.....	NiO.....	0.26593	9.42477
	PbMoO ₄	3.8266	10.58281		NiSO ₄	0.55098	9.74114
	Mo.....	0.66655	9.82383	Nitrogen:			
	MoS ₃	1.3347	10.12538	N=			
	(NH ₄) ₂ MoO ₄ ..	1.3618	10.13411	14.008			
	(NH ₄) ₃ PO ₄ ..			AgNO ₂ ..	HNO ₂	0.30552	9.48504
	12MoO ₃	1.0863	10.03596		N ₂ O ₃	0.24698	9.39267
	PbMoO ₄	2.5506	10.40664		AgNO ₂	3.2731	10.51496
	Mo.....	0.49940	9.69845	HNO ₂ ..	N.....	0.22229	9.34692
	MoO ₃	0.74923	9.87462	HNO ₃ ...	NH ₃	0.27028	9.43182
	(NH ₄) ₂ MoO ₄ ..	1.0203	10.00873		NH ₄ Cl.....	0.84895	9.92888
					(NH ₄) ₂ PtCl ₆ ...	3.5233	10.54699

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Nitrogen:			—10	Nitrogen:			—10
HNO ₃ ...	NO.....	0.47620	9.67779	Pt.....	NO ₃	0.63523	9.80293
	Pt.....	1.5490	10.19007		N ₂ O ₅	0.55328	9.74294
	SO ₃	0.63523	9.80293	SO ₃	HNO ₃	1.5742	10.19707
KNO ₃ ...	N ₂ O ₅	0.53418	9.72769		N.....	0.34994	9.54399
N.....	HNO ₃	4.4986	10.65308		N ₂ O ₅	1.3492	10.13007
	NaNO ₃	6.0683	10.78307	Osmium:			
	NH ₃	1.2159	10.08490	Os=			
	NH ₄ Cl.....	3.8191	10.58196	190.2			
	(NH ₄) ₂ PtCl ₆ ...	15.850	11.20003	Os.....	OsO ₄	1.3365	10.12597
	(NH ₄) ₂ SO ₄ ...	4.7166	10.67363	OsO ₄	Os.....	0.74823	9.87403
	NO ₂	3.2844	10.51646	Palladium:			
	NO ₃	4.4266	10.64607	Pd=			
	N ₂ O ₃	2.7133	10.43350	106.7			
	N ₂ O ₅	3.8555	10.58608	K ₂ PdCl ₆ ...	Pd.....	0.26834	9.42868
	Pt.....	6.9685	10.84314		PdCl ₂ ·2H ₂ O.....	0.53729	9.73021
	SO ₃	2.8577	10.45601	Pd.....	K ₂ PdCl ₆ ...	3.7267	10.57132
NaNO ₃ ...	N.....	0.16479	9.21693		PdCl ₂ ·2H ₂ O.....	2.0023	10.30153
	N ₂ O ₅	0.63535	9.80301		PdI ₂	3.3790	10.52879
NH ₃	HNO ₃	3.6998	10.56818		Pd(NO ₃) ₂	2.1623	10.33491
	N.....	0.82244	9.91510	PdCl ₂ ·			
	NO ₃	3.6406	10.56117	2H ₂ O.....	K ₂ PdCl ₆	1.8612	10.26979
	N ₂ O ₅	3.1709	10.50118		Pd.....	0.49942	9.69847
NH ₄ Cl...	HNO ₃	1.1779	10.07112	PdI ₂	Pd.....	0.29594	9.47121
	N.....	0.26184	9.41804	Pd(NO ₃) ₂	Pd.....	0.46247	9.66509
	NO ₃	1.1591	10.06412	Phosphorus:			
	N ₂ O ₅	1.0095	10.00413	P=30.98			
(NH ₄) ₂ Pt.				Ag ₃ PO ₄ ...	P.....	0.074005	8.86926
Cl ₆	HNO ₃	0.28382	9.45305		PO ₄	0.22689	9.35581
	N.....	0.063092	8.79997		P ₂ O ₅	0.16956	9.22932
	NO ₃	0.27928	9.44604	Ag ₄ P ₂ O ₇ ...	P.....	0.10233	9.01001
	N ₂ O ₅	0.24325	9.38605		PO ₄	0.31373	9.49656
(NH ₄) ₂					P ₂ O ₅	0.23446	9.37007
SO ₄	N.....	0.21202	9.32637	Al ₂ O ₃	P ₂ O ₅	1.3926	10.14382
	N ₂ O ₅	0.81743	9.91245	AlPO ₄	PO ₄	0.77884	9.89145
NO.....	HNO ₃	2.1000	10.32221		P ₂ O ₅	0.58204	9.76495
	NO ₂	1.5332	10.18560	Ca ₃ (PO ₄) ₂	P ₂ O ₅	0.45764	9.66052
	NO ₃	2.0664	10.31521	FePO ₄	PO ₄	0.62976	9.79917
	N ₂ O ₃	1.2666	10.10264		P ₂ O ₅	0.47063	9.67268
	N ₂ O ₅	1.7998	10.25522	Mg ₂ P ₂ O ₇ ...	Na ₂ HPO ₄ ...	1.2757	10.10574
NO ₂	N.....	0.30447	9.48354		Na ₂ HPO ₄ ·		
	NO.....	0.65223	9.81440		12H ₂ O.....	3.2181	10.50760
NO ₃	N.....	0.22591	9.35393		NaNH ₄ HPO ₄ ·		
	NH ₃	0.27468	9.43883		4H ₂ O.....	1.8786	10.27384
	NH ₄ Cl.....	0.86275	9.93588		P.....	0.27835	9.44459
	NO.....	0.48394	9.68479		PO ₄	0.85337	9.93114
	Pt.....	1.5742	10.19707		P ₂ O ₅	0.63774	9.80464
N ₂ O ₃ ...	AgNO ₂	4.0488	10.60733	Na ₂ HPO ₄	Mg ₂ P ₂ O ₇ ...	0.78390	9.89426
	N.....	0.36855	9.56650		P ₂ O ₅	0.49992	9.69890
	NO.....	0.78952	9.89736	Na ₂ HPO ₄ ·			
N ₂ O ₅ ...	KNO ₃	1.8720	10.27231	12H ₂ O.....	Mg ₂ P ₂ O ₇ ...	0.31074	9.49240
	N.....	0.25937	9.41392		P ₂ O ₅	0.19817	9.29704
	NaNO ₃	1.5739	10.19699	NaNH ₄ ·			
	NH ₃	0.31537	9.49882	HPO ₄			
	NH ₄ Cl.....	0.99055	9.99587	4H ₂ O.....	Mg ₂ P ₂ O ₇ ...	0.53231	9.72616
	(NH ₄) ₂ PtCl ₆ ...	4.1110	10.61395		P ₂ O ₅	0.33947	9.53080
	(NH ₄) ₂ SO ₄ ...	1.2233	10.08755	(NH ₄) ₃ ·			
	NO.....	0.55562	9.74478	PO ₄			
	Pt.....	1.8074	10.25706	12MoO ₃	P.....	0.016509	8.21773
	SO ₃	0.74119	9.86993		PO ₄	0.050615	8.70428
Pt.....	HNO ₃	0.64556	9.80993		P ₂ O ₅	0.037826	8.57779
	N.....	0.14350	9.15686	P.....	Ag ₃ PO ₄ ...	13.513	11.13074

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Phosphorus:			—10	Platinum:			—10
P.....	Ag ₄ P ₂ O ₇	9.7721	10.98999	PtCl ₄	Pt.....	0.57922	9.76284
	Mg ₂ P ₂ O ₇	3.5926	10.55541	PtCl ₄	K ₂ PtCl ₆	1.1382	10.05621
	(NH ₄) ₃ PO ₄	60.571	11.78227	5H ₂ O.....	Pt.....	0.45706	9.65998
	12MoO ₃	2.2912	10.36005	PtCl ₆	(NH ₄) ₂ PtCl ₆ ...	1.0884	10.03680
	P ₂ O ₅	58.050	11.76380	Potassium:			
	U ₂ P ₂ O ₁₁	11.525	11.06165	K=			
PO ₄	Ag ₃ PO ₄	4.4075	10.64419	39.096			
	Ag ₄ P ₂ O ₇	3.1874	10.50344	Ag.....	KBr.....	1.1032	10.04265
	AlPO ₄	1.2840	10.10855		KCl.....	0.69107	9.83952
	FePO ₄	1.5879	10.20083		KClO ₃	1.1360	10.05538
	Mg ₂ P ₂ O ₇	1.1718	10.06886		KClO ₄	1.2843	10.10867
	(NH ₄) ₃ PO ₄	19.757	11.29572		KCN.....	0.60358	9.78073
	12MoO ₃	18.934	11.27725		KI.....	1.5389	10.18721
	P ₂ O ₅ .24MoO ₃ ...	3.7592	10.57510	AgBr....	KBr.....	0.63373	9.80190
P ₂ O ₅	Ag ₃ PO ₄	5.8977	10.77068		KBrO ₃	0.88933	9.94906
	Ag ₄ P ₂ O ₇	4.2651	10.62993	AgCl....	KCl.....	0.52012	9.71611
	Al ₂ O ₃	0.71809	9.85618		KClO ₃	0.85500	9.93197
	AlPO ₄	1.7181	10.23505		KClO ₄	0.96662	9.98526
	Ca ₂ (PO ₄) ₂	2.1851	10.33948	AgCN....	KCN.....	0.48630	9.68690
	FePO ₄	2.1248	10.32732	AgI.....	KI.....	0.70705	9.84945
	Mg ₂ P ₂ O ₇	1.5680	10.19536		KIO ₃	0.91148	9.95975
	Na ₂ HPO ₄	2.0003	10.30110	BaCrO ₄ ..	K ₂ CrO ₄	0.76648	9.88450
	Na ₂ HPO ₄	5.0462	10.70296		K ₂ Cr ₂ O ₇	0.58060	9.76388
	4H ₂ O.....	2.9458	10.46920	BaSO ₄ ...	KHSO ₄	0.58334	9.76592
	(NH ₄) ₃ PO ₄	26.437	11.42221		K ₂ S.....	0.47233	9.67425
	12MoO ₃	0.43646	9.63995		K ₂ SO ₄	0.74652	9.87304
	P.....	25.336	11.40375	Br.....	K.....	0.48921	9.68950
	P ₂ O ₅ .24MoO ₃ ...	5.0303	10.70159		KBr.....	1.4892	10.17296
P ₂ O ₅	P.....	0.017227	8.23620	CaF ₂	KF.2H ₂ O....	2.4111	10.38221
24MoO ₃	PO ₄	0.052814	8.72275	CaSO ₄ ...	KF.2H ₂ O....	1.3828	10.14076
	P ₂ O ₅	0.039469	8.59625	Cl.....	K.....	1.1026	10.04243
U ₂ P ₂ O ₁₁ ..	P.....	0.086767	8.93835		KCl.....	2.1026	10.32276
	PO ₄	0.26601	9.42490		KClO ₃	3.4564	10.53862
	P ₂ O ₅	0.19880	9.29841	CO ₂	KClO ₄	3.9076	10.59191
Platinum:					K ₂ O.....	1.3283	10.12328
Pt=					K ₂ CO ₃	3.1402	10.49696
195.23					K ₂ O.....	2.1402	10.33046
H ₂ PtCl ₆ ..	K ₂ PtCl ₆	0.93839	9.97238	I.....	KI.....	1.3080	10.11662
6H ₂ O.....	Pt.....	0.37683	9.57615		KIO ₃	1.6862	10.22692
	H ₂ PtCl ₆ .6H ₂ O..	1.0657	10.02762	K.....	Br.....	2.0441	10.31050
	Pt.....	0.40157	9.60376		Cl.....	0.90692	9.95757
	PtCl ₄	0.69330	9.84092		KBr.....	3.0441	10.48346
	PtCl ₄ .5H ₂ O....	0.87859	9.94379		KCl.....	1.9069	10.28033
(NH ₄) ₂ PtCl ₆ ...					KClO ₃	3.1347	10.49619
	Pt.....	0.43965	9.64311		KClO ₄	3.5439	10.54948
	PtCl ₄	0.75905	9.88027		KI.....	4.2464	10.62802
	PtCl ₆	0.91875	9.96320		KNO ₃	2.5860	10.41264
Pt.....	H ₂ PtCl ₆ .6H ₂ O..	2.6537	10.42385		K ₂ O.....	1.2046	10.08085
	K ₂ O.....	0.48247	9.68347		K ₂ PtCl ₆	6.2176	10.79362
	K ₂ PtCl ₆	2.4902	10.39624		K ₂ SO ₄	2.2285	10.34802
	(NH ₄) ₂ PtCl ₆ ...	2.2745	10.35689		Pt.....	2.4968	10.39738
	PtCl ₄	1.7265	10.23716	K ₃ AsO ₄ ..	Mg ₂ As ₂ O ₇ ...	0.60590	9.78240
	PtCl ₄ .5H ₂ O....	2.1879	10.34002	KBr.....	Ag.....	0.90646	9.95735
PtCl ₄	K ₂ PtCl ₆	1.4424	10.15908		AgBr.....	1.5780	10.19810
	(NH ₄) ₂ PtCl ₆ ...	1.3174	10.11973		Br.....	0.67150	9.82704
					K.....	0.32850	9.51654
					K ₂ O.....	0.39572	9.59739
				KBrO ₃ ...	AgBr.....	1.1244	10.05094
				KCl.....	Ag.....	1.4470	10.16048
					AgCl.....	1.9226	10.28389

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Potassium:			—10	Potassium:			—10
KCl.....	Cl.....	0.47559	9.67724	KNO ₃ ...	N.....	0.13855	9.14161
	K.....	0.52441	9.71967		NH ₃	0.16846	9.22650
	KClO ₃	1.6438	10.21586		NO.....	0.29680	9.47247
	KClO ₄	1.8584	10.26915		N ₂ O ₅	0.53418	9.72769
	K ₂ CO ₃	0.92687	9.96702	K ₂ O.....	Cl.....	0.75287	9.87672
	K ₂ Cr ₂ O ₇	1.9732	10.29517		CO ₂	0.46724	9.66954
	KHCO ₃	1.3429	10.12803		K.....	0.83013	9.91915
	KNO ₃	1.3561	10.13230		KBr.....	2.5270	10.40261
	K ₂ O.....	0.63171	9.80052		KCl.....	1.5830	10.19948
	K ₂ PtCl ₆	3.2605	10.51329		KClO ₃	2.6022	10.41534
	K ₂ SO ₄	1.1686	10.06768		KClO ₄	2.9419	10.46863
	Pt.....	1.3093	10.11705		K ₂ CO ₃	1.4672	10.16650
KClO ₃ ...	Ag.....	0.88027	9.94462		K ₂ Cr ₂ O ₇	3.1235	10.49465
	AgCl.....	1.1696	10.06803		KHCO ₃	2.1257	10.32751
	Cl.....	0.28932	9.46138		KI.....	3.5251	10.54717
	KCl.....	0.60833	9.78414		KNO ₃	2.1468	10.33178
KClO ₄ ...	Ag.....	0.77862	9.89132		KOH.....	1.1913	10.07601
	AgCl.....	1.0345	10.01474		K ₂ PtCl ₆	5.1614	10.71277
	Cl.....	0.25591	9.40809		K ₂ SO ₄	1.8500	10.26716
	K.....	0.28217	9.45052		N ₂ O ₅	1.1468	10.05947
	KCl.....	0.53808	9.73085		K ₂ CO ₃	1.2317	10.09049
	K ₂ O.....	0.33991	9.53137		K ₂ O.....	0.83944	9.92399
KCN.....	Ag.....	1.6568	10.21927	K ₂ PtCl ₆ ...	K.....	0.16083	9.20638
	AgCN.....	2.0564	10.31310		KCl.....	0.30670	9.48671
K ₂ CO ₃ ...	CO ₂	0.31845	9.50304		KHCO ₃	0.28427	9.45373
	KCl.....	1.0789	10.03298		KHCO ₃	0.41185	9.61474
	K ₂ O.....	0.68155	9.83350		KNO ₃	0.41593	9.61902
	KOH.....	0.81191	9.90951		K ₂ O.....	0.19375	9.28723
	K ₂ PtCl ₆	3.5178	10.54627		K ₂ SO ₄	0.35842	9.55439
	K ₂ SO ₄	1.2609	10.10066		K ₂ SO ₄ .Al ₂ (SO ₄) ₃ 24H ₂ O.....	1.9515	10.29037
K ₂ CrO ₄ ...	BaCrO ₄	1.3047	10.11550		K ₂ SO ₄ .Cr ₂ (SO ₄) ₃ 24H ₂ O.....	2.0545	10.31271
K ₂ Cr ₂ O ₇ ...	BaCrO ₄	1.7224	10.23612	K ₂ S.....	BaSO ₄	2.1171	10.32575
	KCl.....	0.50680	9.70483		K ₂ SO ₄	1.5805	10.19879
	K ₂ O.....	0.32015	9.50535		K ₂ SiO ₃ ...	0.38936	9.59035
KF.2H ₂ O	CaF ₂	0.41475	9.61779	K ₂ SiO ₃ ...	SiO ₂	1.3396	10.12696
	CaSO ₄	0.72316	9.85924	K ₂ SO ₄ ...	BaSO ₄	0.44873	9.65198
K ₂ HAsO ₄ ...	Mg ₂ As ₂ O ₇	0.71170	9.85230		K.....	0.85569	9.93232
KHCO ₃ ...	KCl.....	0.74468	9.87197		KClO ₃	0.79312	9.89934
	K ₂ O.....	0.47042	9.67249		KHCO ₃	1.1491	10.06035
	K ₂ PtCl ₆	2.4280	10.38526		KHSO ₄	1.5628	10.19391
	K ₂ SO ₄	0.87027	9.93965		KNO ₃	0.97679	9.98980
KHSO ₄ ...	BaSO ₄	1.7143	10.23408		KNO ₃	1.1604	10.06462
	K ₂ SO ₄	0.63986	9.80609		K ₂ O.....	0.54055	9.73284
KI.....	Ag.....	0.64982	9.81279		K ₂ PtCl ₆	2.7900	10.44561
	AgI.....	1.4143	10.15055		K ₂ S.....	0.63272	9.80121
	I.....	0.76450	9.88338		SO ₃	0.45945	9.66224
	K.....	0.23550	9.37198				
	K ₂ O.....	0.28368	9.45283				
KIO ₃ ...	AgI.....	1.0971	10.04025				
	I.....	0.59304	9.77308				
KMnO ₄ ...	Mn ₂ O ₃	0.49947	9.69851	K ₂ SO ₄ .Al ₂ (SO ₄) ₃ 24H ₂ O.....	K ₂ PtCl ₆	0.51242	9.70963
	MnS.....	0.55048	9.74074				
K ₂ MnO ₄ ...	Mn ₂ O ₃	0.40041	9.60251				
	MnS.....	0.44130	9.64473				
KNO ₂ ...	K ₂ SO ₄	1.0238	10.01020				
	N ₂ O ₃	0.44661	9.64993				
KNO ₃ ...	K.....	0.38669	9.58736				
	KCl.....	0.73739	9.86770				
	K ₂ O.....	0.46582	9.66822				
	K ₂ PtCl ₆	2.4043	10.38098				
	K ₂ SO ₄	0.86175	9.93538				

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Potassium:			—10	Rubidium:			—10
MnS.....	KMnO ₄	1.8166	10.25926	Rb ₂ PtCl ₆ ..	RbHCO ₃	0.50610	9.70423
	K ₂ MnO ₄	2.2660	10.35527		Rb ₂ O.....	0.32294	9.50912
N.....	KNO ₃	7.2176	10.85839	Rb ₂ SO ₄	Rb.....	0.64025	9.80635
NH ₃	KNO ₃	5.9360	10.77350		RbCl.....	0.90583	9.96705
NO.....	KNO ₃	3.3692	10.52753		Rb ₂ CO ₃	0.86499	9.98701
N ₂ O ₃	KNO ₂	2.2391	10.35007		RbHCO ₃	1.0973	10.04032
N ₂ O ₅	KNO ₂	1.8720	10.27231		Rb ₂ O.....	0.70017	9.84520
	K ₂ O.....	0.87202	9.94053	Selenium:			
Pt.....	K.....	0.40051	9.60262	Se=			
	KCl.....	0.76375	9.88295	78.96			
SiO ₂	K ₂ SiO ₃	2.5683	10.40965	H ₂ SeO ₃	Se.....	0.61221	9.78690
SO ₃	K ₂ SO ₄	2.1765	10.33776	H ₂ SeO ₄	Se.....	0.54464	9.73611
Praseodym- ium:				Se.....	H ₂ SeO ₃	1.6334	10.21310
Pr=					H ₂ SeO ₄	1.8361	10.26389
140.92					SeO ₂	1.4053	10.14776
Pr.....	Pr ₂ O ₃	1.1703	10.06830		SeO ₃	1.6079	10.20626
Pr ₂ O ₃	Pr.....	0.85447	9.93170	SeO ₂	Se.....	0.71161	9.85224
Rhodium:				SeO ₃	Se.....	0.62193	9.79374
Rh=				Silicon:			
102.91				Si=28.06			
Na ₃ RhCl ₆	Rh.....	0.26755	9.42740	BaSiF ₆	SiF ₄	0.37241	9.57103
Rh.....	Na ₃ RhCl ₆	3.7377	10.57260		SiO ₂	0.21495	9.33233
	RhCl ₃	2.0336	10.30827	H ₂ SiO ₃	SiO ₂	0.76925	9.88607
RhCl ₃	Rh.....	0.49173	9.69173	K ₂ SiF ₆	SiF ₄	0.47246	9.67436
Rubidium:					SiO ₂	0.27269	9.43567
Rb=				Si.....	SiO ₂	2.1404	10.33050
85.48				SiF ₄	BaSiF ₆	2.6852	10.42897
AgCl.....	Rb.....	0.59636	9.77551		K ₂ SiF ₆	2.1166	10.32564
	RbCl.....	0.84372	9.92620	SiO ₂	SiO ₂	0.57717	9.76130
Cl.....	Rb.....	2.4108	10.38216		BaSiF ₆	4.6523	10.66767
	RbCl.....	3.4108	10.53286		H ₂ SiO ₃	1.3000	10.11393
Rb.....	AgCl.....	1.6768	10.22449		K ₂ SiF ₆	3.6672	10.56433
	Cl.....	0.41480	9.61784	Si.....	Si.....	0.46720	9.66950
	RbCl.....	1.4148	10.15069	SiF ₄	SiF ₄	1.7326	10.23870
	Rb ₂ CO ₃	1.3510	10.13066	SiO ₃	SiO ₃	1.2664	10.10257
	Rb ₂ O.....	1.0936	10.03885	SiO ₄	SiO ₄	1.5328	10.18549
	Rb ₂ PtCl ₆	3.3864	10.52973	SiO.....	SiO.....	0.60040	9.77844
	Rb ₂ SO ₄	1.5619	10.19365	Si(OH) ₄ ..	Si(OH) ₄	1.5999	10.20410
RbCl....	AgCl.....	1.1852	10.07380	SiO ₃	SiO ₃	0.78964	9.89743
	Cl.....	0.29319	9.46714	SiO ₄	SiO ₂	0.65240	9.81451
	Rb.....	0.70681	9.84931	SiO.....	SiO ₂	1.6656	10.22156
	Rb ₂ CO ₃	0.95492	9.97997	Si(OH) ₄ ..	SiO ₂	0.62502	9.79590
	Rb ₂ O.....	0.77296	9.88816	Silver:			
	Rb ₂ PtCl ₆	2.3935	10.37904	Ag=			
	Rb ₂ SO ₄	1.1040	10.04295	107.880			
Rb ₂ CO ₃ ..	Rb.....	0.74018	9.86934	Ag.....	AgBr.....	1.7408	10.24075
	RbCl.....	1.0472	10.02003		AgCl.....	1.3287	10.12342
	RbHCO ₃	1.2685	10.10331		AgCN.....	1.2412	10.09383
	Rb ₂ PtCl ₆	2.5065	10.39907		AgI.....	2.1765	10.33776
	Rb ₂ SO ₄	1.1561	10.06299		AgNO ₃	1.5748	10.19722
RbHCO ₃ ..	Rb ₂ CO ₃	0.78830	9.89669		Ag ₂ O.....	1.0742	10.03107
	Rb ₂ PtCl ₆	1.9759	10.29577		Ag ₃ PO ₄	1.2935	10.11176
	Rb ₂ SO ₄	0.91134	9.95968		Ag ₃ P ₂ O ₇	1.4031	10.14710
Rb ₂ O....	Rb.....	0.91442	9.96115		Br.....	0.74079	9.86969
	RbCl.....	1.2937	10.11184		Cl.....	0.32867	9.51676
	Rb ₂ PtCl ₆	3.0966	10.49088	AgBr....	I.....	1.1765	10.07059
	Rb ₂ SO ₄	1.4282	10.15480		Ag.....	0.57445	9.75925
Rb ₂ PtCl ₆ ..	Rb.....	0.29530	9.47027	AgCl....	Br.....	0.42555	9.62895
	RbCl.....	0.41779	9.62096		Ag.....	0.75263	9.87658
	Rb ₂ CO ₃	0.39896	9.60093		AgNO ₃	1.1852	10.07380
					Ag ₂ O.....	0.80844	9.90765

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Silver:			—10	Sodium:			—10
AgCl	Br	0.55754	9.74628	Mg ₂ As ₂ O ₇	Na ₂ HAsO ₃	1.0946	10.03925
	Cl	0.24737	9.39334		Na ₂ HAsO ₄	1.1977	10.07833
AgCN	Ag	0.80569	9.90617	MgCl ₂	NaCl	1.2276	10.08905
AgI	Ag	0.45945	9.66224	Mg ₂ P ₂ O ₇	Na ₂ HPO ₄	1.2757	10.10574
	I	0.54055	9.73283		Na ₂ HPO ₄		
AgNO ₃	Ag	0.63501	9.80278		12H ₂ O	3.2181	10.50760
	AgCl	0.84371	9.92620		NaNH ₄ HPO ₄		
Ag ₂ O	Ag	0.93096	9.96893		4H ₂ O	1.8786	10.27384
	AgCl	1.2369	10.09235		Na ₄ P ₂ O ₇		
Ag ₃ PO ₄	Ag	0.77311	9.88824		10H ₂ O	2.0041	10.30192
Ag ₃ P ₂ O ₇	Ag	0.71269	9.85290	N	NaNO ₃	6.0683	10.78307
Br	Ag	1.3499	10.13031	Na	Br	3.4751	10.54096
	AgBr	2.3499	10.37105		Cl	1.5418	10.18803
	AgCl	1.7936	10.25372		I	5.5190	10.74186
Cl	Ag	3.0426	10.48324		NaBr	4.4751	10.65080
	AgCl	4.0426	10.60666		NaCl	2.5418	10.40514
I	Ag	0.84998	9.92941		Na ₂ CO ₃	2.3047	10.36262
	AgI	1.8500	10.26717		NaHCO ₃	3.6533	10.56269
Sodium:					NaI	6.5190	10.81418
Na=					Na ₂ O	1.3479	10.12965
22.997					Na ₂ SO ₄	3.0885	10.48975
Ag	NaBr	0.95396	9.97953		(UO ₂) ₃ ZnNa		
	NaCl	0.54184	9.73387		(C ₂ H ₃ O ₂) ₃		
	NaI	1.3897	10.14291	Na ₂ B ₄ O ₇	6H ₂ O	66.882	11.82531
AgBr	NaBr	0.54800	9.73878		B ₂ O ₃	0.69199	9.84010
AgCl	NaCl	0.40781	9.61046		H ₃ BO ₃	1.2291	10.08957
	NaClO ₃	0.74268	9.87080		KBF ₄	2.5024	10.39835
	NaClO ₄	0.85431	9.93161	Na ₂ B ₄ O ₇			
AgI	NaI	0.63849	9.80515	10H ₂ O	B ₂ O ₃	0.36515	9.56247
BaSO ₄	NaHSO ₄	0.51437	9.71128		H ₃ BO ₃	0.64854	9.81194
	NaHSO ₄ ·H ₂ O	0.59156	9.77200		KBF ₄	1.3204	10.12072
	Na ₂ S	0.33439	9.52426	NaBr	Ag	1.0483	10.02047
	Na ₂ SO ₃	0.54003	9.73242		AgBr	1.8248	10.26122
	Na ₂ SO ₃ ·7H ₂ O	1.0803	10.03355		Br	0.77654	9.89016
	Na ₂ SO ₄	0.60858	9.78432		Na	0.22346	9.34920
	Na ₂ SO ₄ ·10H ₂ O	1.3804	10.14001		Na ₂ O	0.30120	9.47885
B ₂ O ₃	Na ₂ B ₄ O ₇	1.4451	10.15990		(UO ₂) ₃ ZnNa		
	10H ₂ O	2.7386	10.43753		(C ₂ H ₃ O ₂) ₃		
Br	Na	0.28776	9.45904	NaCl	6H ₂ O	14.945	11.17451
	NaBr	1.2878	10.10984		Ag	1.8456	10.26613
	Na ₂ O	0.38787	9.58869		AgCl	2.4521	10.38954
CaCl ₂	NaCl	1.0533	10.02254		Cl	0.60658	9.78289
CaCO ₃	Na ₂ CO ₃	1.0591	10.02493		Na	0.39342	9.59486
CaF ₂	NaF	1.0757	10.03171		NaClO ₃	1.8212	10.26035
CaO	Na ₂ CO ₃	1.8902	10.27651		NaClO ₄	2.0949	10.32116
CaSO ₄	Na ₂ CO ₃	0.77864	9.89134		Na ₂ CO ₃	0.90673	9.95748
Cl	Na	0.64859	9.81197		NaHCO ₃	1.4373	10.15754
	NaCl	1.6486	10.21711		Na ₂ HPO ₄	1.2145	10.08439
	Na ₂ O	0.87421	9.94162		Na ₂ O	0.53028	9.72451
CO ₂	Na ₂ CO ₃	2.4086	10.38177		Na ₂ SO ₄	1.2151	10.08461
	Na ₂ O	1.4086	10.14880		(UO ₂) ₃ ZnNa		
H ₃ BO ₃	Na ₂ B ₄ O ₇	0.81363	9.91043		(C ₂ H ₃ O ₂) ₃		
	10H ₂ O	1.5419	10.18806	NaClO ₃	6H ₂ O	26.313	11.42017
I	Na	0.18119	9.25814		AgCl	1.3465	10.12920
	NaI	1.1812	10.07232	NaClO ₄	NaCl	0.54910	9.73965
	Na ₂ O	0.24422	9.38779		AgCl	1.1705	10.06839
KBF ₄	Na ₂ B ₄ O ₇	0.39962	9.60165		NaCl	0.47735	9.67884
	10H ₂ O	0.75732	9.87928	Na ₂ CO ₃	CaCO ₃	0.94421	9.97507
					CaO	0.52904	9.72349
					CaSO ₄	1.2843	10.10866
					CO ₂	0.41517	9.61823

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Sodium:			—10	Sodium:			—10
Na ₂ CO ₃ ..	Na	0.43389	9.63738	Na ₂ O....	Cl.....	1.1439	10.05838
	NaCl.....	1.1029	10.04252		CO ₂	0.70991	9.85120
	NaHCO ₃	1.5851	10.20007		I.....	4.0946	10.61221
	Na ₂ O.....	0.58483	9.76703		Na.....	0.74191	9.87035
	NaOH.....	0.75478	9.87782		NaBr.....	3.3201	10.52115
	Na ₂ SO ₄	1.3401	10.12713		NaCl.....	1.8858	10.27549
	(UO ₂) ₃ ZnNa				Na ₂ CO ₃	1.7099	10.23297
	(C ₂ H ₃ O ₂) ₃				NaHCO ₃	2.7104	10.43304
	6H ₂ O.....	29.019	11.46269		Na ₂ HPO ₄	2.2903	10.35988
Na ₂ CO ₃ ..	Na ₂ SO ₄	0.49640	9.69584		NaI.....	4.8365	10.68453
10H ₂ O..					NaNO ₃	2.7424	10.43812
NaF.....	CaF ₂	0.92959	9.96829		NaOH.....	1.2906	10.11080
	(UO ₂) ₃ ZnNa				Na ₂ SO ₄	2.2914	10.36010
	(C ₂ H ₃ O ₂) ₃				N ₂ O ₅	1.7424	10.24114
	6H ₂ O.....	36.624	11.56376		SO ₃	1.2914	10.11107
Na ₂					(UO ₂) ₃ ZnNa		
HAsO ₃ ..	Mg ₂ As ₂ O ₇	0.91359	9.96075		(C ₂ H ₃ O ₂) ₃		
Na ₂					6H ₂ O.....	49.620	11.69566
HAsO ₄ ..	Mg ₂ As ₂ O ₇	0.83496	9.92167	NaOH....	Na ₂ CO ₃	1.3249	10.12218
NaHCO ₃ ..	Na.....	0.27372	9.43731		Na ₂ O.....	0.77483	9.88920
	NaCl.....	0.69576	9.84246		(UO ₂) ₃ ZnNa		
	Na ₂ CO ₃	0.63086	9.79993		(C ₂ H ₃ O ₂) ₃		
	Na ₂ O.....	0.36895	9.56696		6H ₂ O.....	38.447	11.58486
	(UO ₂) ₃ ZnNa			Na ₄ P ₂ O ₇ ..	Na ₂ HPO ₄	1.0677	10.02847
	(C ₂ H ₃ O ₂) ₃				Na ₂ HPO ₄		
	6H ₂ O.....	18.307	11.26262		12H ₂ O.....	2.6936	10.43033
Na ₂ HPO ₄ ..	Mg ₂ P ₂ O ₇	0.78390	9.89426	Na ₄ P ₂ O ₇ ..			
	NaCl.....	0.82340	9.91561	10H ₂ O..	Mg ₂ P ₂ O ₇	0.49898	9.69808
	Na ₂ O.....	0.43663	9.64012	Na ₂ S....	BaSO ₄	2.9905	10.47574
	Na ₄ P ₂ O ₇	0.93655	9.97153	Na ₂ SO ₃ ..	BaSO ₄	1.8517	10.26758
	P ₂ O ₅	0.49992	9.69890		SO ₂	0.50819	9.70603
Na ₂ HPO ₄ ..				Na ₂ SO ₃ ..			
12H ₂ O..	Mg ₂ P ₂ O ₇	0.31074	9.49240	7H ₂ O....	BaSO ₄	0.92565	9.96645
	Na ₄ P ₂ O ₇	0.37125	9.56967		SO ₂	0.25404	9.40490
	P ₂ O ₅	0.19817	9.29704	Na ₂ SO ₄ ..	BaSO ₄	1.6432	10.21568
NaHSO ₃ ..	SO ₂	0.61553	9.78928		Na.....	0.32378	9.51025
NaHSO ₄ ..	BaSO ₄	1.9441	10.28872		NaCl.....	0.82298	9.91539
NaHSO ₄ ..					Na ₂ CO ₃	0.74622	9.87287
H ₂ O....	BaSO ₄	1.6905	10.22800		Na ₂ CO ₃		
NaI.....	Ag.....	0.71960	9.85709		10H ₂ O.....	2.0145	10.30416
	AgI.....	1.5662	10.19485		Na ₂ O.....	0.43641	9.63990
	I.....	0.84660	9.92768		SO ₃	0.56359	9.75096
	Na.....	0.15340	9.18582		(UO ₂) ₃ ZnNa		
	Na ₂ O.....	0.20676	9.31547		(C ₂ H ₃ O ₂) ₃		
	(UO ₂) ₃ ZnNa				6H ₂ O.....	21.655	11.33556
	(C ₂ H ₃ O ₂) ₃			Na ₂ SO ₄ ..			
	6H ₂ O.....	10.260	11.01113	10H ₂ O..	BaSO ₄	0.72442	9.85999
NaNH ₄ ..				NH ₃	NaNH ₄ HPO ₄		
HPO ₄ ..					4H ₂ O.....	12.276	11.08906
4H ₂ O....	Mg ₂ P ₂ O ₇	0.53231	9.72616		NaNO ₃	4.9908	10.69817
	NH ₃	0.08146	8.91094	NO.....	NaNO ₃	2.8327	10.45221
	P ₂ O ₅	0.33947	9.53080	N ₂ O ₅	NaNO ₃	1.5739	10.19699
NaNO ₃ ..	N.....	0.16479	9.21693		Na ₂ O.....	0.57393	9.75886
	Na ₂ O.....	0.36465	9.56188	P ₂ O ₅	Na ₂ HPO ₄	2.0003	10.30110
	NH ₃	0.20037	9.30183		Na ₂ HPO ₄		
	NO.....	0.35301	9.54779		12H ₂ O.....	5.0462	10.70296
	N ₂ O ₅	0.63535	9.80301		NaNH ₄ HPO ₄		
	(UO ₂) ₃ ZnNa				4H ₂ O.....	2.9458	10.46920
	(C ₂ H ₃ O ₂) ₃			SO ₂	NaHSO ₃	1.6245	10.21072
	6H ₂ O.....	18.094	11.25754		Na ₂ SO ₃	1.9677	10.29397
Na ₂ O....	Br.....	2.5782	10.41131		Na ₂ SO ₃		
					7H ₂ O.....	3.9364	10.59510

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Sodium:			—10	Sulfur:			—10
SO ₃	Na ₂ O.....	0.77434	9.88893	BaSO ₄	FeS ₂	0.25696	9.40987
(UO ₂) ₃	Na ₂ SO ₄	1.7743	10.24904		H ₂ S.....	0.14599	9.16431
ZnNa.....					H ₂ SO ₃	0.35162	9.54608
(C ₂ H ₃ O ₂) ₃					H ₂ SO ₄	0.42017	9.62343
6H ₂ O.....	Na.....	0.014952	8.17469		S.....	0.13735	9.13783
	NaBr.....	0.066910	8.82549		SO ₂	0.27444	9.43845
	NaCl.....	0.038004	8.57983		SO ₃	0.34299	9.53528
	Na ₂ CO ₃	0.034460	8.53731		SO ₄	0.41153	9.61440
	NaF.....	0.027305	8.43624	CdS.....	H ₂ S.....	0.23587	9.37267
	NaHCO ₃	0.054623	8.73738		S.....	0.22191	9.34619
	NaI.....	0.097470	8.98887	FeS ₂	BaSO ₄	3.8916	10.59013
	NaNO ₃	0.055267	8.74246	H ₂ S.....	As ₂ S ₃	2.4064	10.38136
	Na ₂ O.....	0.020153	8.30434		BaSO ₄	6.8499	10.83569
	NaOH.....	0.026010	8.41514		CdS.....	4.2396	10.62733
	Na ₂ SO ₄	0.046179	8.66444		SO ₂	2.3494	10.37096
Sr					BaSO ₄	2.8439	10.45392
Sr=87.63					BaSO ₄	2.3800	10.37657
CO ₂	SrCO ₃	3.3547	10.52565		(NH ₄) ₂ SO ₄	1.3473	10.12947
SO ₃	SrO.....	1.2944	10.11207		SO ₃	0.81630	9.91185
	SrSO ₄	2.2944	10.36067	(NH ₄) ₂ SO ₄	H ₂ SO ₄	0.74221	9.87053
Sr.....	SrCO ₃	1.6848	10.22655	SO ₄	SO ₃	0.60587	9.78238
	Sr(NO ₃) ₂	2.4152	10.38296	S.....	As ₂ S ₃	2.5577	10.40785
	SrO.....	1.1826	10.07283		BaSO ₄	7.2807	10.86217
	SrSO ₄	2.0962	10.32143		CdS.....	4.5062	10.65381
SrCl ₂	SrCO ₃	0.93122	9.96905	SO ₂	BaSO ₄	3.6438	10.56155
	SrO.....	0.65364	9.81534	SO ₃	BaSO ₄	2.9156	10.46472
	SrSO ₄	1.1586	10.06394		H ₂ S.....	0.42563	9.62904
SrCO ₃	CO ₂	0.29809	9.47435		(NH ₄) ₂ SO ₄	1.6505	10.21762
	Sr.....	0.59354	9.77345	SO ₄	BaSO ₄	2.4299	10.38560
	SrCl ₂	1.0739	10.03095	Tantalum:			
	Sr(HCO ₃) ₂	1.4201	10.15232	Ta=			
	Sr(NO ₃) ₂	1.4335	10.15641	180.88			
	SrO.....	0.70191	9.84628	Ta.....	TaCl ₅	1.9801	10.29669
	SrSO ₄	1.2442	10.09488		Ta ₂ O ₆	1.2211	10.08677
Sr.....				TaCl ₅	Ta.....	0.50502	9.70331
(HCO ₃) ₂	SrCO ₃	0.70417	9.84768		Ta ₂ O ₆	0.61670	9.79007
	SrO.....	0.49426	9.69396	Ta ₂ O ₄	Ta ₂ O ₆	1.0376	10.01602
Sr.....				Ta ₂ O ₅	Ta.....	0.81891	9.91323
(NO ₃) ₂	Sr.....	0.41404	9.61704		TaCl ₅	1.6215	10.20993
	SrCO ₃	0.69758	9.84359		Ta ₂ O ₄	0.96378	9.98398
	SrO.....	0.48964	9.68988	Tellurium:			
	SrSO ₄	0.86791	9.93848	Te=			
SrO.....	SO ₃	0.77256	9.88793	127.61			
	Sr.....	0.84560	9.92717	H ₂ TeO ₄	Te.....	0.65905	9.81892
	SrCl ₂	1.5299	10.18466	H ₂ TeO ₄			
	SrCO ₃	1.4247	10.15372	2H ₂ O.....	Te.....	0.55565	9.74480
	Sr(HCO ₃) ₂	2.0232	10.30604	Te.....	H ₂ TeO ₄	1.5173	10.18108
	Sr(NO ₃) ₂	2.0423	10.31012		H ₂ TeO ₄ ·2H ₂ O.....	1.7997	10.25520
	SrSO ₄	1.7726	10.24860		TeO ₂	1.2508	10.09718
SrSO ₄	SO ₃	0.43584	9.63933		TeO ₃	1.3761	10.13866
	Sr.....	0.47705	9.67857		(TeO ₂) ₂ SO ₃	1.5645	10.19436
	SrCl ₂	0.86311	9.93606	TeO ₂	Te.....	0.79951	9.90282
	SrCO ₃	0.80375	9.90512	(TeO ₂) ₂ SO ₃	Te.....	0.72667	9.86134
	Sr(NO ₃) ₂	1.1522	10.06152	SO ₃	Te.....	0.63920	9.80564
	SrO.....	0.56416	9.75140	Thallium:			
Sulfur:				Tl=			
S=32.06				204.39			
As ₂ S ₃	H ₂ S.....	0.41556	9.61864	Tl.....	TlCl.....	1.1735	10.06947
	S.....	0.39098	9.59215		Tl ₂ CO ₃	1.1468	10.05949

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Thallium:				Tin:			
Tl.....	Tl ₂ CrO ₄	1.2838	10.10850	Tl.....	SnO.....	1.1188	10.04875
	TlHSO ₄	1.4749	10.16877		SnO ₂	0.78766	9.89634
	TlI.....	1.6210	10.20977		Sn.....	1.2582	10.09976
	TlNO ₃	1.3034	10.11507		SnCl ₂	1.4973	10.17532
	Tl ₂ O.....	1.0391	10.01667		SnCl ₂ ·2H ₂ O.....	1.7288	10.23774
	Tl ₂ PtCl ₆	1.9980	10.30060		SnCl ₄		
	Tl ₂ SO ₄	1.2350	10.09166		(NH ₄ Cl) ₂	2.4388	10.38717
TlCl.....	Tl.....	0.85217	9.93053		SnO.....	0.89383	9.95125
	Tl ₂ PtCl ₆	1.7027	10.23113	Titanium:			
Tl ₂ CO ₃	Tl.....	0.87199	9.94051	Ti=			
	Tl ₂ PtCl ₆	1.7423	10.24111		47.90		
Tl ₂ CrO ₄	Tl.....	0.77894	9.89150	Ti.....	TiO ₂	1.6681	10.22221
TlHSO ₄	Tl.....	0.67800	9.83123		Ti.....	0.59950	9.77779
TlI.....	Tl.....	0.61691	9.79023	Tungsten:			
	Tl ₂ PtCl ₆	1.2326	10.09083	W=			
TlNO ₃	Tl.....	0.76724	9.88493		183.92		
	Tl ₂ PtCl ₆	1.5330	10.18553	W.....	WO ₂	1.1740	10.06966
Tl ₂ O.....	Tl.....	0.96233	9.98333		WO ₃	1.2610	10.10071
	Tl ₂ PtCl ₆	1.9228	10.28393	WO ₂	W.....	0.85180	9.93034
Tl ₂ PtCl ₆	Tl.....	0.50049	9.69940	WO ₃	W.....	0.79303	9.89929
	TlCl.....	0.58732	9.76887	Uranium:			
	Tl ₂ CO ₃	0.57397	9.75889	U=238.07			
	TlI.....	0.81129	9.90917	U.....	UO ₂	1.1344	10.05477
	TlNO ₃	0.65234	9.81447		U ₃ O ₈	1.1792	10.07159
	Tl ₂ O.....	0.52008	9.71607		(UO ₂) ₂ P ₂ O ₇	1.4998	10.17602
	Tl ₂ SO ₄	0.61811	9.79106		U ₂ P ₂ O ₁₁	1.4998	10.17602
Tl ₂ SO ₄	Tl.....	0.80972	9.90834	UO ₂	U.....	0.88151	9.94523
	Tl ₂ PtCl ₆	1.6178	10.20894		U ₃ O ₈	1.0395	10.01682
Thorium:					U ₂ P ₂ O ₁₁	1.3221	10.12125
Th=					U.....	0.84802	9.92841
232.12					UO ₂	0.96200	9.98318
Th.....	ThO ₂	1.1379	10.05609		UO ₂ (NO ₃) ₂ ·		
ThCl ₄	ThO ₂	0.70630	9.84899		6H ₂ O.....	1.7888	10.25256
Th(NO ₃) ₄ ·				UO ₂			
6H ₂ O.....	ThO ₂	0.44899	9.65224	(NO ₃) ₂ ·			
ThO ₂	Th.....	0.87884	9.94391	6H ₂ O.....	U ₃ O ₈	0.55903	9.74744
	ThCl ₄	1.4158	10.15101	(UO ₂) ₂	U.....	0.66677	9.82398
	Th(NO ₃) ₄ ·			P ₂ O ₇	U.....	0.66677	9.82398
6H ₂ O.....		2.2272	10.34776	U ₂ P ₂ O ₁₁	UO ₂	0.75639	9.87875
Tin:				Vanadium:			
Sn=				V=50.95			
118.70				V.....	V ₂ O ₅	1.7851	10.25166
Sn.....	SnCl ₂	1.5974	10.20342	V.....	V ₂ O ₅	0.79121	9.89829
	SnCl ₂ ·2H ₂ O.....	1.9010	10.27898	VO ₄	V.....	0.56020	9.74834
	SnCl ₄	2.1948	10.34140	V ₂ O ₅	VO ₄	1.2639	10.10171
	SnCl ₄ ·			Ytterbium:			
	(NH ₄ Cl) ₂	3.0962	10.49083	Yb=			
	SnO.....	1.1348	10.05492		173.04		
	SnO ₂	1.2696	10.10366	Yb.....	Yb ₂ O ₃	1.1387	10.05641
SnCl ₂	Sn.....	0.62601	9.79658		Yb.....	0.87820	9.94359
	SnO ₂	0.79477	9.90024	Yb ₂ O ₃			
SnCl ₂ ·				Yttrium:			
2H ₂ O.....	Sn.....	0.52604	9.72102	Y=88.92			
	SnO ₂	0.66786	9.82468	Y.....	Y ₂ O ₃	1.2699	10.10377
SnCl ₄	Sn.....	0.45561	9.65860	Y ₂ O ₃	Y.....	0.78746	9.89623
	SnO ₂	0.57844	9.76226	Zinc:			
SnCl ₄ ·				Zn=			
(NH ₄ Cl) ₂	Sn.....	0.32297	9.50917		65.38		
	SnO ₂	0.41004	9.61283	BaSO ₄	ZnS.....	0.41744	9.62060
SnO.....	Sn.....	0.88122	9.94508		ZnSO ₄ ·7H ₂ O.....	1.2319	10.09058
				Zn.....	ZnNH ₄ PO ₄	2.7287	10.43595

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Loga- rithm	Weighed	Sought	Factor	Loga- rithm
Zinc:			—10	Zinc:			—10
Zn.....	ZnO.....	1.2447	10.09507	Zn ₂ P ₂ O ₇ ..	Zn.....	0.42912	9.63257
	Zn ₂ P ₂ O ₇	2.3304	10.36743		ZnO.....	0.53413	9.72765
	ZnS.....	1.4904	10.17329	ZnS.....	BaSO ₄	2.3955	10.37940
ZnCl ₂ ...	ZnO.....	0.59709	9.77604		Zn.....	0.67098	9.82671
ZnCO ₃ ...	ZnO.....	0.64902	9.81225		ZnO.....	0.83518	9.92178
ZnNH ₄ ..					ZnSO ₄ ·7H ₂ O...	2.9511	10.46998
PO ₄ ...	Zn.....	0.36648	9.56405	ZnSO ₄ ..			
	ZnO.....	0.45615	9.65912	7H ₂ O..	BaSO ₄	0.81174	9.90942
ZnO.....	Zn.....	0.80339	9.90493		ZnO.....	0.28301	9.45180
	ZnCl ₂	1.6748	10.22396		ZnS.....	0.33886	9.53002
	ZnCO ₃	1.5408	10.18775	Zirconium:			
	ZnNH ₄ PO ₄ ...	2.1922	10.34088	Zr=			
	Zn ₂ P ₂ O ₇	1.8722	10.27235	91.22			
	ZnS.....	1.1973	10.07822	Zr.....	ZrO ₂	1.3508	10.13059
	ZnSO ₄ ·7H ₂ O...	3.5335	10.54820	ZrO ₂	Zr.....	0.74030	9.86941

HEAT OF FORMATION AND SOLUTION

The following table gives the heat of formation of compounds from the elements in their standard states (18° C, 1 atm.) and the heat of solution in water in kilogram calories (mean) per gram-formula weight. To convert to B.T.U. multiply by 3.9685. To convert to kilojoules multiply by 4.186.

Values given are for 18° C and 1 atm. unless otherwise indicated. The heat of solution is given in most cases for a definite number of water molecules to one of the substance. Where this is not stated the dilution is understood to be such that additional dilution produces a negligible thermal effect.

The symbol ∞ indicates that the substance is formed in an "infinite" amount of water.

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Acetic acid	$\text{HC}_2\text{H}_3\text{O}_2$	solid ⁷⁰	120.2	150	-2.15°
		liquid	117.71		
		200	118.07		
Acetylene	C_2H_2	gas	- 54.337		
Aluminum					
bromide	AlBr_3	solid	+126.6	3000	+85.3°
		dil. sol.	211.9		
carbide	Al_4C_3	solid	81.48		
chloride	AlCl_3	solid	166.8		+77.90
		600	244.68		
	$\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$	solid	641.82	450	+13.1 ¹⁸⁰
fluoride	AlF_3	solid	329.03		
	$\text{AlF}_3 \cdot 5\text{H}_2\text{O}$	solid	375.39		
hydroxide	$\text{Al}(\text{OH})_3$	ppt.	304.66		
iodide	AlI_3	solid	71.21	2200	+88.89°
		dil. sol.	160.3		
nitride	AlN	solid	131.4		
oxide (corundum)	Al_2O_3	solid	399.05		
oxide (powder)	Al_2O_3	amorph.	389.49		
silicate	Al_2SiO_5	solid	767.5		
sulfate	$\text{Al}_2(\text{SO}_4)_3$	solid	714.46		
		dil. sol.	883.88		
	$\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$	solid	2106.6		+8.1
sulfide	Al_2S_3	solid	126.4		+75.03
Alum , see under appropriate metal					
Ammonia	NH_3	liquid	15.84		
		gas	10.94		
		200	19.43	200	+8.459 ¹⁸⁰
Ammonium					
acetate	$\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$	solid	150.25	200	+0.250 ²⁴⁰
bromide	NH_4Br	solid	64.708	200	-4.444 ¹⁸⁰
	$\text{NH}_3 + \text{HBr}$	solid	45.5		
carbonate	$(\text{NH}_4)_2\text{CO}_3$	dil. sol.	223.4		
carbonate, acid	NH_4HCO_3	solid	203.1	1200	-6.69 ¹⁸⁰
chloride	NH_4Cl	solid	75.080	200	-3.895 ¹⁸⁰
		∞	71.279		
chloroplatinite	$(\text{NH}_4)_2\text{PtCl}_4$	solid	194.0		-8.411
chromate	$(\text{NH}_4)_2\text{CrO}_4$	solid	274.31	700	-5.73 ¹⁸⁰
		dil. sol.	267.62		
cyanate	NH_4CNO	dil. sol.	68.9		
cyanide	NH_4CN	solid	0.956	400	-4.349
dichromate	$(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	solid	420.07	550	-12.9 ¹⁸⁰
		600	407.41		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation, Kilo-cal.	Water mols	Heat of solution, Kilo-cal.
Ammonium					
ferrocyanide.....	$(\text{NH}_4)_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$	solid	216.0		-6.69 ^{14°}
fluoride.....	NH_4F	solid	111.71		-1.51
		dil. sol.	110.20		
fluosilicate.....	$(\text{NH}_4)_2\text{SiF}_6$	solid	619.36	1200	-8.36 ^{7°}
hydroxide.....	NH_4OH	200	87.814		
iodide.....	NH_4I	solid	48.555	200	-3.560 ^{18°}
		200	44.994		
nitrate.....	NH_4NO_3	solid	87.93	200	-6.332 ^{18°}
nitrite.....	NH_4NO_2	solid	62.15	400	-4.755 ^{12°}
		400	57.491		
oxalate.....	$(\text{NH}_4)_2\text{C}_2\text{O}_4$	solid	267.15		-7.89
	$(\text{NH}_4)_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$	solid	339.07		-11.5
oxalate, acid.....	$\text{NH}_4\text{HC}_2\text{O}_4$	400	226.69		
perchlorate.....	NH_4ClO_4	solid	78.304	220	-6.356 ^{20°}
persulfate.....	$(\text{NH}_4)_2\text{S}_2\text{O}_8$	solid	382.80	1000	-9.08 ^{18°}
phosphate, mono.....	$\text{NH}_4\text{H}_2\text{PO}_4$	dil. sol.	339.07		
phosphate, ortho.....	$(\text{NH}_4)_2\text{PO}_4$	dil. sol.	397.61		
selenide.....	$(\text{NH}_4)_2\text{Se}$	dil. sol.	38.95		-2.39 ^{18°}
sulfate.....	$(\text{NH}_4)_2\text{SO}_4$	solid	277.66	400	-2.39 ^{18°}
		400	275.29		
sulfate, acid.....	NH_4HSO_4	solid	240.43	200	-0.024 ^{18°}
		800	240.98		
sulfhydrate.....	NH_4HS	solid	38.95		-3.3
		dil. sol.	35.675		
sulfide.....	$(\text{NH}_4)_2\text{S}$	200	55.245		
sulfide, penta.....	$(\text{NH}_4)_2\text{S}_5$	solid	64.76		-8.61 ^{18°}
		dil. sol.	56.15	1000	-8.61 ^{18°}
sulfite.....	$(\text{NH}_4)_2\text{SO}_3$	solid	210.20	440	-1.53 ^{18°}
		dil. sol.	208.70		
sulfite, acid.....	NH_4HSO_3	dil. sol.	179.2		
sulfocyanate.....	NH_4CNS	solid	19.4		-5.663 ^{12°}
Antimonic acid, ortho-	H_3SbO_4	dil. sol.	216.56		
Antimonous acid	H_3SbO_3	dil. sol.	166.8		
Antimony					
bromide.....	SbBr_3	solid	61.41		
		liquid	58.28		
chloride, tri.....	SbCl_3	solid	91.398		
		liquid	88.292		
chloride, penta.....	SbCl_5	solid	107.31		
		liquid	104.88		
		gas	93.812		
fluoride.....	SbF_3	solid	216.5	200	-1.67
		dil. sol.	214.8		
hydride (stibine).....	SbH_3	gas	-34.815		
iodide.....	SbI_3	solid	+44.21		
oxide, tri.....	Sb_2O_3	solid	165.4		
oxide, tetra.....	Sb_2O_4	solid	211.2		
oxide, penta.....	Sb_2O_5	solid	230.8		
		dil. sol.	227.96		
oxychloride (ous).....	SbOCl	solid	89.200		
sulfide (black).....	Sb_2S_3	solid	35.84		
Arsenic					
acid, ortho.....	H_3AsO_4	solid	214.98	300	-0.406 ^{18°}
		dil. sol.	214.6		
bromide (ous).....	AsBr_3	solid	46.36		
		liquid	43.49		
chloride (ous).....	AsCl_3	solid	72.40		
		liquid	71.390		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Arsenic					
hydride (arsine) . . .	AsH ₃	gas	- 43.49		
	AsH ₃ .6H ₂ O	solid -10°	+366.79		
iodide (ous)	AsI ₃	solid	14.3		
oxide, tri-	As ₂ O ₃	solid	147.9		
		dil. sol.	148.6		
oxide, penta-	As ₂ O ₅	solid	217.90		+5.998
		dil. sol.	223.9		
oxide	As ₄ O ₆	gas	267.86		
sulfide, di-	As ₂ S ₂	solid	19.1		
Arsenious acid, ortho-	H ₃ AsO ₃	dil. sol.	176.8		
Auric, see gold					
Barium					
acetate	Ba(C ₂ H ₃ O ₂) ₂	solid	358.4	600	+5.26 ^{11°}
arsenate	Ba ₃ (AsO ₄) ₂	ppt.	817.69		
bromide	BaBr ₂	solid	180.4	400	+4.97 ^{18°}
		400	185.4		
	BaBr ₂ .2H ₂ O	solid	326.4	400	-4.182 ^{18°}
carbonate	BaCO ₃	ppt.	290.85		
chlorate	Ba(ClO ₃) ₂	solid	174.0	600	-6.69 ^{10°}
	Ba(ClO ₃) ₂ .H ₂ O	solid	246.8	600	-11.23 ^{18°}
chloride	BaCl ₂	solid	205.33	400	+2.08 ^{18°}
		2000	207.55		
	BaCl ₂ .2H ₂ O	solid	349.08	400	-4.922 ^{18°}
chromate	BaCrO ₄	ppt.	334.05		
cyanide	Ba(CN) ₂	solid	57.11		+1.768 ^{9°}
		dil. sol.	59.02		
ferrocyanide	Ba ₂ Fe(CN) ₆	dil. sol.	135.0		
	Ba ₂ Fe(CN) ₆ .6H ₂ O	solid	556.51		-11.5 ^{14°}
fluoride	BaF ₂	ppt.	287.70		
fluosilicate	BaSiF ₆	solid	677.42		
hydride	BaH ₂	solid	40.86		
hydroxide	Ba(OH) ₂	solid	225.86	660	+11.40 ^{15°}
		400	237.49		
	Ba(OH) ₂ .8H ₂ O	solid	799.05	660	-14.5 ^{15°}
hypobromite	Ba(BrO) ₂	dil. sol.	174.4		
hypochlorite	Ba(ClO) ₂	dil. sol.	180.9		
hypophosphite	Ba(H ₂ PO ₂) ₂	dil. sol.	414.10		
	Ba(H ₂ PO ₂) ₂ .H ₂ O	solid	482.20	400	+0.287 ^{18°}
iodate	Ba(IO ₃) ₂	solid	245.16		
		dil. sol.	236.6		
	Ba(IO ₃) ₂ .H ₂ O	solid	316.37		
iodide	BaI ₂	solid	144.8		+10.30 ^{16°}
		dil. sol.	155.08		
nitrate	Ba(NO ₃) ₂	solid	238.28	400	-9.462 ^{18°}
		1600	228.44		
nitride	Ba ₃ N ₂	solid	90.80		
nitrite	Ba(NO ₂) ₂	solid	185.7	800	-5.687 ^{12°}
	Ba(NO ₂) ₂ .H ₂ O	solid	256.87	800	-8.60 ^{12°}
oxalate	BaC ₂ O ₄ .H ₂ O	ppt.	397.37		
oxide	BaO	solid	133.1	600	+35.84 ^{15°}
oxide, di-	BaO ₂	solid	151.7		
perchlorate	Ba(ClO ₄) ₂	solid	210.3	800	-1.67 ^{10°}
phosphate, mono-	BaH ₄ (PO ₄) ₂	solid	735.9		
phosphate, di-	BaHPO ₄	solid	424.6		
phosphate, tri-	Ba ₃ (PO ₄) ₂	solid	991.64		
platinochloride	BaPtCl ₆	solid	284.83	5000	+9.08 ^{19°}
selenide	BaSe	solid	88.17		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Barium					
silicate	BaSiO ₃	fused	356.04		
sulfate	BaSO ₄	ppt.	345.28		
		dil. sol.	339.31		
sulfhydrate	Ba(SH) ₂	dil. sol.	136.2		
sulfide	BaS	solid	111.1		
		dil. sol.	118.5		
sulfite	BaSO ₃	ppt.	279.57		
Beryllium					
chloride	BeCl ₂	solid	112.5		
	BeCl ₂ ·4H ₂ O	solid	188.1		
fluoride	BeF ₂	dil. sol.	240.84		
hydroxide	Be(OH) ₂	ppt.	206.7		
iodide	BeI ₂	sol.	67.38		
nitrate	Be(NO ₃) ₂	dil. sol.	184.7		
sulfate	BeSO ₄	solid	276.47		
	BeSO ₄ ·4H ₂ O	solid	567.51		+1.10
Bismuth					
chloride	BiCl ₃	solid	90.61		
hydroxide	Bi(OH) ₃	dil. sol.	171.1		
oxide	Bi ₂ O ₃	solid	135.5		
oxychloride	BiOCl	solid	87.69		
Boric acid	H ₃ BO ₃	solid	251.61	400	-5.401 ^{18°}
		dil. sol.	246.12		
Boron					
bromide	BBr ₃	liquid	42.77	400	+83.63
chloride	BCl ₃	liquid	93.67		
		gas	89.13		
fluoride	BF ₃	gas	256.87		+24.37
oxide	B ₂ O ₃	solid	279.81		
Bromic acid	HBrO ₃	200	12.7		
Bromine (atomic)	Br	gas	-26.691		
Bromine	Br ₂	solid	+2.581		
		gas	-7.646		
chloride	BrCl	liquid	0.700		
Bromous acid	HBrO	dil. sol.	25.57		
Cadmium					
bromide	CdBr ₂	solid	75.79	400	+0.43 ^{18°}
		400	76.23		
carbonate	CdCO ₃	ppt.	178.7		
chloride	CdCl ₂	solid	92.999	400	+3.106 ^{18°}
		400	96.08		
	CdCl ₂ ·2½H ₂ O	solid	269.99	400	-2.939 ^{18°}
cyanide	Cd(CN) ₂	solid	-36.80		
fluoride	CdF ₂	1200	172.50		
hydroxide (ord. ppt.)	Cd(OH) ₂	ppt.	133.57		
iodide	CdI ₂	solid	48.387		
		400	47.431	400	-0.956 ^{18°}
nitrate	Cd(NO ₃) ₂	400	117.06		
	Cd(NO ₃) ₂ ·4H ₂ O	solid	395.63	400	-5.042 ^{19°}
oxide	CdO	solid	65.23		
selenide	CdSe	solid	16.7		
		ppt.	22.		
sulfate	CdSO ₄	solid	217.92	400	+10.68 ^{18°}
		400	228.61		
sulfide	CdS	solid	33.93		
telluride	CdTe	solid	15.8		
Caesium					
bromide	CsBr	solid	97.468	110	-6.738 ^{25°}
		dil. sol.	90.80		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Caesium					
carbonate.....	Cs ₂ CO ₃	solid	273.14	220	+11.82 ¹⁵ ₀
		dil. sol.	285.21		
carbonate, acid.....	CsHCO ₃	solid	231.3	220	-4.30 ¹⁵ ₀
		dil. sol.	227.0		
chloride.....	CsCl.....	solid	106.48	220	-4.558 ¹⁹ ₀
		400	101.77		
fluoride.....	CsF.....	solid	131.97	110	+8.363 ¹⁵ ₀
		400	140.38		
hydroxide.....	CsOH.....	solid	100.26	110	+16.4 ¹⁵ ₀
		400	116.82		
iodide.....	CsI.....	solid	83.752	110	-8.24 ¹⁵ ₀
		dil. sol.	75.75		
nitrate.....	CsNO ₃	solid	121.79	400	-9.606 ²⁰ ₀
		400	112.19		
oxide, mono.....	Cs ₂ O.....	solid	82.20	600	+83.15 ¹⁸ ₀
oxide, tetra.....	Cs ₂ O ₄	solid	137.64		
sulfate.....	Cs ₂ SO ₄	solid	340.98	220	-4.97 ¹⁵ ₀
		440	335.96		
sulfate, acid.....	CsHSO ₄	solid	275.27	220	-3.728 ¹⁵ ₀
		220	271.69		
sulfide.....	Cs ₂ S.....	solid	87.46		+27.24
		dil. sol.	114.70		
Calcium					
acetate.....	Ca(C ₂ H ₃ O ₂) ₂	solid	357.95	440	+6.93 ¹⁶ ₀
		dil. sol.	364.88		
	Ca(C ₂ H ₃ O ₂) ₂ .H ₂ O.....	solid	427.43	600	+5.85 ¹⁷ ₀
aluminate, mono.....	CaO.Al ₂ O ₃	fused	549.59		
aluminate, di.....	2CaO.Al ₂ O ₃	fused	692.96		
aluminate, tri.....	3CaO.Al ₂ O ₃	fused	836.33		
aluminum silicate.....	3CaO.Al ₂ O ₃ .2SiO ₂	solid	1486.3		
arsenate.....	Ca ₃ (AsO ₄) ₂	ppt.	793.31		
bromide.....	CaBr ₂	solid	162.2		+24.37
		dil. sol.	186.9		
	CaBr ₂ .6H ₂ O.....	solid	598.09	400	-1.10 ²⁰ ₀
carbide.....	CaC ₂	solid	14.6		
carbonate.....	CaCO ₃	colloid	287.93		
chloride.....	CaCl ₂	solid	190.7	400	+17.99 ¹⁸ ₀
	CaCl ₂ .H ₂ O.....	solid	265.23	300	+11.71 ¹⁸ ₀
	CaCl ₂ .6H ₂ O.....	solid	623.44	400	-4.564 ¹⁸ ₀
cyanamide.....	CaCN ₂	solid	85.07		
cyanide.....	Ca(CN) ₂	dil. sol.	60.45		
ferrocyanide.....	Ca ₂ Fe(CN) ₆ .12H ₂ O.....	solid	963.21		-4.54 ¹⁰ ₀
fluoride.....	CaF ₂	ppt.	286.26		
formate.....	Ca(CHO ₂) ₂	solid	326.88	360	+0.689 ¹⁶ ₀
hydride.....	CaH ₂	solid	45.88		
hydroxide.....	Ca(OH) ₂	solid	236.1		
		dil. sol.	238.76		
hypochlorite.....	Ca(ClO) ₂	dil. sol.	181.60		
iodide.....	CaI ₂	solid	128.6	400	+27.69 ¹⁸ ₀
		dil. sol.	156.3		
	CaI ₂ .8H ₂ O.....	solid	701.56		+1.74 ²⁰ ₀
nitrate.....	Ca(NO ₃) ₂	solid	225.3	400	+3.943 ¹⁹ ₀
		400	229.15		
	Ca(NO ₃) ₂ .4H ₂ O.....	solid	509.92	400	-7.24 ¹⁹ ₀
nitride.....	Ca ₃ N ₂	solid	109.0		
nitrite.....	Ca(NO ₂) ₂ .4H ₂ O.....	solid	405.50		
oxalate.....	CaC ₂ O ₄	ppt.	333.3		
oxide.....	CaO.....	solid	151.71		
peroxide.....	CaO ₂	solid	155.8		
	CaO ₂ .8H ₂ O.....	solid	718.52		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Calcium					
phosphate, mono-	$\text{CaH}_4(\text{PO}_4)_2$	ppt.	743.13		
phosphate, tri-	$\text{Ca}_3(\text{PO}_4)_2$	solid	982.1		
phosphate, acid.	CaHPO_4	ppt.	432.50		
selenide.	CaSe	solid	88.41		
silicate.	CaSiO_3	fused	375.15		
silicide.	CaSi_2	solid	224.6		
sulfate (anhydrite)	CaSO_4	solid	335.72		+5.26
	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	solid	477.80		-0.24
sulfhydrate.	$\text{Ca}(\text{SH})_2$	dil. sol.	137.4		
sulfide.	CaS	solid	113.50		
		dil. sol.	119.71		
thiosulfate.	CaS_2O_3	=	270.49		
Carbon					
dichloride.	C_2Cl_4	liquid	6.0		
		gas	- 1.150		
dioxide.	CO_2	gas	+ 94.385		
		sat.	99.140		+4.755
disulfide.	CS_2	liquid	- 22.0		
		gas	- 28.67		
monoxide.	CO	gas	+ 26.428		
oxybromide.	COBr_2	gas	22.0		
oxychloride.	COCl_2	gas	52.09		
		liquid	57.993		
tetrachloride.	CCl_4	gas	25.400		
		liquid	33.190		
Carbonic acid.	H_2CO_3	dil. sol.	167.53		
Cerium					
chloride (ous).	CeCl_3	dil. sol.	164.9		
oxide (ic).	CeO_2	600	283.39		
		solid	234.9		
sulfate (ous).	$\text{Ce}_2(\text{SO}_4)_3$	dil. sol.	792.84		
Chloric acid.	HClO_3	400	19.1		
Chlorine (atomic).	Cl	gas	- 28.746		
oxide, mono-	Cl_2O	gas	- 18.26	800	+9.439 ¹⁸⁰
oxide, di-	ClO_2	liquid	- 30.11		
		gas	- 23.49		
Chlorous acid,	HClO	200	+ 29.773		
hypo-					
Chromic acid.	H_2CrO_4	dil. sol.	206.69		
Chromium					
bromide (ic) (blue)	CrBr_3	dil. sol.	146.5		
b r o m i d e (i c)	$[\text{CrBr}_2]\text{Br}$	dil. sol.	135.0		
(green)					
	$(\text{Cr}_4\text{H}_2\text{O}_6\text{Br}_2)\text{Br} \cdot 2\text{H}_2\text{O}$	solid	544.57	250	+0.669
bromide (ic).	$(\text{Cr}_6\text{H}_2\text{O})\text{Br}_3$	solid	542.42		-14.34
chloride (ic) (rose)	CrCl_3	solid	139.55		+30.59
(forms green solution)					
chloride (ic) (green)	$(\text{CrCl}_2 \cdot 4\text{H}_2\text{O})\text{Cl} \cdot 2\text{H}_2\text{O}$	solid	580.41	150	-0.048
chloride (ic) (gray)	$(\text{Cr}_6\text{H}_2\text{O})\text{Cl}_3$	solid	577.30		+12.02
chloride (ic).	$(\text{Cr}_4\text{H}_2\text{O} \cdot \text{Cl})\text{Cl}_2 \cdot 6\text{H}_2\text{O}$	solid	854.01		0
chloride (ic).	$(\text{Cr}_4\text{H}_2\text{O} \cdot \text{Cl})\text{Cl}_2$	solid	435.37		+8.36
chloride (ous).	CrCl_2	solid	99.64		+18.6
		dil. sol.	118.3		
	$\text{CrCl}_2 \cdot 4\text{H}_2\text{O}$	solid	389.73		+1.9
hydroxide (ic).	$\text{Cr}(\text{OH})_3$	ppt.	245.88		
oxide (ic).	Cr_2O_3	solid	267.39		
		amorph.	266.19		
oxide, tri-	CrO_3	solid	136.0	80	+2.461 ¹⁸⁰

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Chromium					
sulfate (ic) (violet)	$\text{Cr}_2(\text{SO}_4)_3$	dil. sol.	753.89		
sulfate (ic) (green)	$\text{Cr}_2(\text{SO}_4)_3$	dil. sol.	730.95		
sulfate (ic) (violet)	$(\text{Cr}.6\text{H}_2\text{O})_2(\text{SO}_4)_3.2\text{H}_2\text{O}$	solid	1701.1		+10.11
sulfate (ic)	$(\text{Cr}.6\text{H}_2\text{O})_2(\text{SO}_4)_3.3\text{H}_2\text{O}$	solid	1771.1		+8.29
sulfate (ic) (green)	$\text{Cr}_2(\text{SO}_4)_3.6\text{H}_2\text{O}$	solid	1127.4		+13.4
Cobalt					
bromide (ous)	CoBr_2	solid	54.96		+18.4
	$\text{CoBr}_2.6\text{H}_2\text{O}$	dil. sol.	73.36		
		solid	485.07		-1.29
chloride (ous)	CoCl_2	solid	76.942	400	+18.45 ^{17°}
fluoride (ous)	CoF_2	dil. sol.	172.81		
hydroxide (ic)	$\text{Co}(\text{OH})_3$	ppt.	219.36		
hydroxide (ous)	$\text{Co}(\text{OH})_2$	ppt.	128.32		
iodide (ous)	CoI_2	dil. sol.	42.77		
nitrate	$\text{Co}(\text{NO}_3)_2$	solid	104.2	300	+11.95 ^{18°}
	$\text{Co}(\text{NO}_3)_2.6\text{H}_2\text{O}$	solid	531.19	400	-4.97 ^{18°}
oxide (ous)	CoO	solid	57.49		
		amorph.	50.18		
oxide (ous) (ic)	Co_3O_4	solid	192.6		
selenide	CoSe	solid	13.4		
		ppt.	11.5		
sulfate	CoSO_4	solid	225.09		
	$\text{CoSO}_4.7\text{H}_2\text{O}$	solid	707.29	800	-3.560 ^{19°}
sulfide	CoS	ppt.	19.8		
telluride	CoTe	solid	11.5		
Copper					
acetate (ic)	$\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2$	solid	214.6	320	+2.39 ^{16°}
		dil. sol.	217.0		
	$\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2.\text{H}_2\text{O}$	solid	285.07	400	+0.167 ^{18°}
am. chloride (ic)	$\text{CuCl}_2.2\text{NH}_4\text{Cl}$	solid	197.6	550	+4.78 ^{15°}
	$\text{CuCl}_2.2\text{NH}_4\text{Cl}.2\text{H}_2\text{O}$	solid	332.86		-6.21
am. sulfate (ic)	$\text{CuSO}_4.4\text{NH}_3$	solid	295.10		
bromide (ic)	CuBr_2	solid	32.02	400	+8.244 ^{20°}
		400	40.14		
bromide (ous)	$\text{CuBr}_2.4\text{H}_2\text{O}$	solid	315.18		-1.43
	CuBr	solid	24.61		
carbonate	CuCO_3	ppt.	141.5		
chlorate (ic)	$\text{Cu}(\text{ClO}_3)_2$	400	22.2		
chloride (ic)	CuCl_2	solid	51.422	600	+11.11 ^{18°}
		800	62.605		
	$\text{CuCl}_2.2\text{H}_2\text{O}$	solid	195.03	200	+3.704 ^{18°}
chloride (ous)	CuCl	solid	32.50		
cyanide (ous)	CuCN	solid	-27.96		
fluoride (ic)	CuF_2	400	+139.8		
formate (ic)	$\text{Cu}(\text{CHO}_2)_2$	solid	179.5	600	+0.526 ^{15°}
		dil. sol.	179.9		
	$\text{Cu}(\text{CHO}_2)_2.4\text{H}_2\text{O}$	solid	461.17	500	-7.89 ^{10°}
hydroxide (ic)	$\text{Cu}(\text{OH})_2$	ppt.	104.97		
(green)					
iodide (ic)	CuI_2	solid	3.10		
		dil. sol.	9.08		
iodide (ous)	CuI	solid	15.8		
nitrate	$\text{Cu}(\text{NO}_3)_2$	solid	72.40	280	+10.47 ^{8°}
		200	82.796		
	$\text{Cu}(\text{NO}_3)_2.3\text{H}_2\text{O}$	solid	290.56		-2.39
	$\text{Cu}(\text{NO}_3)_2.6\text{H}_2\text{O}$	solid	503.80	400	-10.70 ^{18°}
oxide (ic)	CuO	solid	34.89		
oxide (ous)	Cu_2O	solid	39.90		
oxychloride	$\text{CuCl}_2.3\text{CuO}$	solid	160.57		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Copper					
selenate.....	CuSeO ₄	400	128.6	.....	.....
	CuSeO ₄ .5H ₂ O.....	solid	473.1	.....	-2.652
selenide (ic).....	CuSe.....	ppt.	4.78	.....	.....
selenide (ous).....	Cu ₂ Se.....	solid	7.41	.....	.....
sulfate (ic).....	CuSO ₄	solid	178.7	800	+15.89 ^{18°}
		800	194.65	.....	.....
	CuSO ₄ .5H ₂ O.....	solid	539.33	800	-2.796 ^{18°}
sulfate (ous).....	Cu ₂ SO ₄	solid	173.5	.....	.....
sulfide (ic).....	CuS.....	solid	11.61	.....	.....
sulfide (ous).....	Cu ₂ S.....	solid	18.97	.....	.....
telluride.....	Cu ₂ Te.....	solid	4.06	.....	.....
Cyanic acid	HCNO.....	dil. sol.	36.56	.....	.....
Cyanogen	C ₂ N ₂	liquid	-65.47	.....	.....
		gas	-70.73	.....	.....
chloride.....	CNCl.....	liquid	-28.20	.....	.....
		gas	-36.56	.....	.....
iodide.....	CNI.....	solid	-42.29	.....	.....
		dil. sol.	-44.92	100	-2.77 ^{20°}
Dysprosium					
sulfate.....	Dy ₂ (SO ₄) ₃ + 8H ₂ O.....	.....	.....	1200	+6.3
Erbium acetate	Er(C ₂ H ₃ O ₇) ₃ + 4H ₂ O.....	.....	.....	1500	+0.7
Ethane	C ₂ H ₆	gas	23.4	.....	.....
Ethyl alcohol	C ₂ H ₅ OH.....	liquid	65.902	.....	.....
		gas	55.795	.....	.....
Ethylene	C ₂ H ₄	gas	-9.56	.....	.....
Ferric and Ferrous salts, see under Iron					
Fluosilicic acid	H ₂ SiF ₆	200	545.04	.....	.....
	H ₂ SiF ₆ .4H ₂ O.....	liquid	789.25	.....	+7.9
Gold					
bromide (ic).....	AuBr ₃	solid	13.38	2000	-3.752 ^{18°}
bromide (ous).....	AuBr.....	solid	4.54	.....	.....
chloride (ic).....	AuCl ₃	solid	27.00	900	+4.444 ^{18°}
chloride (ous).....	AuCl.....	solid	10.27	.....	.....
iodide (ous).....	AuI.....	solid	0.96	.....	.....
Hydrazine	N ₂ H ₄	dil. sol.	-3.250	.....	.....
sulfate.....	N ₂ H ₄ .H ₂ SO ₄	solid	+224.37	.....	.....
		dil. sol.	215.77	1200	-8.531 ^{18°}
Hydrazoic acid	HN ₃	dil. sol.	-54.48	.....	.....
Hydrobromic acid	HBr.....	gas	+8.650	200	+19.88 ^{18°}
		∞	28.602	.....	.....
	HBr.2H ₂ O.....	solid -15°	164.40	.....	.....
Hydrochloric acid	HCl.....	gas	22.03	.....	.....
		∞	39.558	200	+17.44 ^{18°}
Hydrocyanic acid	HCN.....	gas	-30.108	.....	.....
		dil. sol.	-23.90	.....	+5.97
Hydroferri- cyanide acid	H ₃ Fe(CN) ₆	dil. sol.	-148.1	.....	.....
Hydroferro- cyanic acid	H ₄ Fe(CN) ₆	solid	-122.8	200	+0.406 ^{10°}
		dil. sol.	-122.3	.....	.....
Hydrofluoric acid	HF.....	liquid	+94.86	.....	+4.54
		600	75.699	.....	.....
		gas	63.991	.....	.....
Hydriiodic acid	HI.....	gas	-5.926	200	+19.24 ^{18°}
		=	+13.333	.....	.....
Hydrogen (atomic)	H.....	gas	-50.42	.....	.....
oxide (water).....	H ₂ O.....	liquid	+68.387	.....	.....
		gas	57.826	.....	.....

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Hydrogen					
peroxide.....	H ₂ O ₂	liquid	44.516	200	+0.454 ^{15°}
		gas	32.903		
		200	44.970		
selenide.....	H ₂ Se.....	dil. sol.	- 13.4		+2.39 ^{18°}
		gas	- 15.8		
sulfide.....	H ₂ S.....	liquid	+ 9.56		
		gas	5.26		
		dil. sol.	9.869		+4.564
telluride.....	H ₂ Te.....	gas	- 33.93		
Hydro-sulfurous acid	H ₂ S ₂ O ₄	dil. sol.	+166.1		
Hydroxylamine ..	NH ₂ OH.....	solid	27.60		
Indium					
bromide.....	InBr ₃	solid	97.25		
		dil. sol.	112.8		
chloride, mono.....	InCl.....	solid	44.68		
chloride, di.....	InCl ₂	solid	86.74		
chloride, tri.....	InCl ₃	solid	128.6		
		dil. sol.	145.28		
iodide.....	InI ₃	solid	32.50		
		dil. sol.	66.91		
oxide, sesqui.....	In ₂ O ₃	solid	23.90		
Iodic acid	HIO ₃	solid	56.392		-2.15
Iodine (atomic) ...	I.....	gas	- 25.470		
Iodine	I ₂	gas	- 15.1		
bromide, mono.....	IBr.....	liquid	+ 2.63		
chloride, mono.....	ICl.....	solid	6.69		
		liquid	4.54		
chloride, tri.....	ICl ₃	solid	16.7		
oxide, penta.....	I ₂ O ₅	solid	42.055	1500	-1.79 ^{18°}
Iridium					
chloride, di.....	IrCl ₂	solid	20.5		
chloride, tri.....	IrCl ₃	solid	60.45		
oxide, di.....	IrO ₂	solid	5.02		
Iron					
acetate.....	Fe(C ₂ H ₃ O ₂) ₃	1800	357.23		
ammonium sulfate	Fe ₂ (SO ₄) ₃ .(NH ₄) ₂ SO ₄	1000	458.55		
ammonium sulfate (ic)	FeNH ₄ (SO ₄) ₂ .12H ₂ O.....	solid	1295.8		
ammonium sulfate (ous)	FeSO ₄ .(NH ₄) ₂ SO ₄ .6H ₂ O.....	solid	927.36		
bromide (ic).....	FeBr ₃	1000	95.10		
bromide (ous).....	FeBr ₂	dil. sol.	77.90		
carbonate (ous)...	FeCO ₃	solid	185.2		
		ppt.	179.2		
chlorate (ic).....	Fe(ClO ₃) ₃	600	67.38		
chloride (ic).....	FeCl ₃	solid	96.30		+31.78
	FeCl ₃ .2½H ₂ O.....	solid	277.90	1200	+21.0 ^{18°}
	FeCl ₃ .6H ₂ O.....	solid	532.62	1200	+5.73 ^{21°}
chloride (ous).....	FeCl ₂	solid	81.864	400	+17.90 ^{18°}
	FeCl ₂ .2H ₂ O.....	solid	227.7	300	+8.6 ^{20°}
	FeCl ₂ .4H ₂ O.....	solid	370.37	400	+2.748 ^{18°}
ferrocyanide (ic)...	Fe ₄ [Fe(CN ₆) ₃].....	ppt.	-319.00		
fluoride (ic).....	FeF ₃	150	+242.53		
fluoride (ous).....	FeF ₂	1200	177.1		
hydroxide (ic).....	Fe(OH) ₃	ppt.	197.37		
hydroxide (ous)...	Fe(OH) ₂	ppt.	135.87		
iodide (ic).....	FeI ₃	1000	49.46		
iodide (ous).....	FeI ₂	dil. sol.	47.55		
nitrate (ic).....	Fe(NO ₃) ₃	800	158.4		
	Fe(NO ₃) ₃ .9H ₂ O.....	solid	782.80	150	-9.08

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Iron					
nitrate (ous)	$\text{Fe}(\text{NO}_3)_2$	dil. sol.	120.2		
oxide (ic) (ordinary)	Fe_2O_3	solid	190.7		
oxide (ous)	FeO	solid	64.04		
oxide (ous) (ic) (fused)	Fe_3O_4	solid	265.95		
oxide (ous) (ic) (magnetite)	Fe_3O_4	solid	266.91		
selenide (ous)	FeSe	solid	19.1		
		ppt.	14.3		
silicate	FeSiO_3	solid	264.52		
sulfate (ic)	$\text{Fe}_2(\text{SO}_4)_3$	1200	641.77		
sulfate (ous)	FeSO_4	solid	217.23	110	+14.901 ¹⁴⁰
		400	231.95		
	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	solid	715.11	200	-4.321 ¹⁴⁰
sulfide (ous)	FeS	solid	23.06		
sulfide, di- (pyrite)	FeS_2	solid	35.60		
telluride (ous)	FeTe	solid	7.65		
Lanthanum					
chloride	LaCl_3	solid	266.67	1200	+31.30 ¹⁶⁰
oxide	La_2O_3	solid	456.87		
sulfate	$\text{La}_2(\text{SO}_4)_3$	dil. sol.	987.10		
	$\text{La}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	solid	1530.0	2400	+4.068 ⁹
sulfide, di-	La_2S_3	solid	162.0		
sulfide	La_2S_3	solid	317.33		
Lead					
acetate	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$	solid	234.00	220	+1.41 ¹¹⁰
	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$	solid	446.12	100	-5.50 ¹¹⁰
bromide	PbBr_2	solid	66.261		
		dil. sol.	56.225	2500	-10.04 ¹⁸⁰
carbonate	PbCO_3	solid	168.9		
chloride	PbCl_2	solid	85.664		
		dil. sol.	79.116		-6.55
chromate	PbCrO_4	solid	218.2		
fluoride	PbF_2	solid	159.40		
hydroxide	$\text{Pb}(\text{OH})_2$	ppt.	137.6		
iodide	PbI_2	solid	41.840		
nitrate	$\text{Pb}(\text{NO}_3)_2$	solid	108.292	400	-7.599 ¹⁸⁰
		400	100.67		
nitride	Pb_3N_2	solid	-100.60		
oxalate	PbC_2O_4	solid	+206.2		
oxide, mono-	PbO	solid	52.473		
oxide, di-	PbO_2	solid	62.60		
oxide, sub-	Pb_2O_3	solid	51.255		
oxide, (red)	Pb_3O_4	solid	174.19		
oxybromide	$\text{PbBr}_2 \cdot \text{PbO}$	solid	119.7		
	$\text{PbBr}_2 \cdot 2\text{PbO}$	solid	171.3		
oxychloride	$\text{PbCl}_2 \cdot \text{PbO}$	solid	142.65		
	$\text{PbCl}_2 \cdot 2\text{PbO}$	solid	195.9		
	$\text{PbCl}_2 \cdot 3\text{PbO}$	solid	247.79		
oxyiodide	$\text{PbI}_2 + \text{PbO}$	solid	3.6		
phosphite	PbHPO_3	solid	231.8		
selenide	PbSe	solid	12.4		
		ppt.	23.7		
sulfate	PbSO_4	solid	214.6		
sulfide	PbS	ppt.	22.2		
sulfocyanate	$\text{Pb}(\text{CNS})_2$	solid	-28.67		
telluride	PbTe	solid	+5.5		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Lead					
thiosulfate.....	PbS ₂ O ₃	solid	147.2		
Lithium					
bromide.....	LiBr.....	solid	83.728	850	+11.25 ^{14°}
		200	95.064		
carbide.....	Li ₂ C ₂	solid	13.6		+37.04 ^{17°}
carbonate.....	Li ₂ CO ₃	solid	290.8	220	+3.06 ^{15°}
	Li ₂ CO ₃	dil. sol.	293.91		
carbonate, acid.....	LiHCO ₃	500	232.3		
chloride.....	LiCl.....	solid	97.420	200	+8.507 ^{18°}
		∞	106.04		
cyanide.....	LiCN.....	200	31.30		
fluoride.....	LiF.....	solid	145.54	110	-1.03 ^{15°}
		dil. sol.	144.49		
fluosilicate.....	Li ₂ SiF ₆	solid	677.49	800	+1.816
		dil. sol.	679.31		
hydride.....	LiH.....	solid	21.5	2000	+31.30 ^{18°}
hydroxide.....	LiOH.....	solid	116.4	110	+4.468 ^{24°}
		∞	121.00		
iodide.....	LiI.....	solid	64.994	200	+14.77 ^{18°}
		200	79.759		
nitrate.....	LiNO ₃	solid	115.82	400	+0.430 ^{21°}
		∞	116.27		
	LiNO ₃ ·3H ₂ O.....	solid	328.32		
nitride.....	Li ₃ N.....	solid	45.88		+131.2
oxide.....	Li ₂ O.....	solid	141.7	220	+31.30 ^{15°}
selenide.....	Li ₂ Se.....	solid	95.34		+10.66 ^{20°}
		dil. sol.	106.1		
silicate.....	Li ₂ SiO ₃	fused	372.76		
		solid	434.89		
sulfate.....	Li ₂ SO ₄	solid	337.9		+6.380
	Li ₂ SO ₄ ·H ₂ O.....	solid	409.08	400	+3.417 ^{18°}
sulphydrate.....	LiSH.....	dil. sol.	64.11		
sulfide.....	Li ₂ S.....	dil. sol.	115.4		
Magnesium					
ammonium arse- nate	MgNH ₄ AsO ₄ ·6H ₂ O.....	solid	763.92		
ammonium phos- phate	MgNH ₄ PO ₄ ·6H ₂ O.....	solid	901.56		
ammonium sulfate	MgSO ₄ ·(NH ₄) ₂ SO ₄ ·6H ₂ O.....	solid	1016.5		-9.80
ammonium sulfite	3MgSO ₃ ·(NH ₄) ₂ SO ₃ ·6H ₂ O.....	solid	1375.6		
arsenate.....	Mg ₃ (AsO ₄) ₂	solid	731.43		
arsenate, acid.....	MgHAsO ₄	dil. sol.	322.8		
bromide.....	MgBr ₂	solid	124.0		+43.25 ^{15°}
		400	167.3		
carbonate.....	MgCO ₃	solid	267.39		
chloride.....	MgCl ₂	solid	153.2	800	+35.986 ^{16°}
	MgCl ₂ ·6H ₂ O.....	solid	596.37	200	+2.939 ^{18°}
cyanamide.....	MgCN ₂	solid	59.26		
cyanide.....	Mg(CN) ₂	dil. sol.	40.38		
dithionate.....	MgS ₂ O ₆ ·6H ₂ O.....	solid	797.38	400	-2.963 ^{19°}
fluoride.....	MgF ₂	ppt.	263.80		
hydroxide (brucite)	Mg(OH) ₂	solid	223.4		
hydroxide.....	Mg(OH) ₂	ppt.	218.6		
iodide.....	MgI ₂	solid	86.74		+49.70
		dil. sol.	136.7		
nitrate.....	Mg(NO ₃) ₂	400	209.51		
	Mg(NO ₃) ₂ ·6H ₂ O.....	solid	623.90	400	-4.229 ^{18°}
nitride.....	Mg ₃ N ₂	solid	118.3		
oxide (bomb).....	MgO.....		145.76		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Magnesium					
phosphate.....	Mg ₃ (PO ₄) ₂	colloid	915.18		
silicate.....	MgSiO ₃	solid	346.48		
sulfate.....	MgSO ₄	solid	301.08	400	+20.3 ^{18°}
		400	321.33		
	MgSO ₄ ·7H ₂ O.....	solid	803.85	400	-3.871 ^{18°}
sulfide.....	MgS.....	solid	82.20		
sulfite.....	MgSO ₃	solid	238.5		
	MgSO ₃ ·6H ₂ O.....	solid	671.21		
sulfhydrate.....	Mg(SH) ₂	dil. sol.	117.3		
Manganese					
acetate.....	Mn(C ₂ H ₃ O ₂) ₂	solid	272.88	500	+12.2 ^{17°}
		dil. sol.	285.31		
	Mn(C ₂ H ₃ O ₂) ₂ ·4H ₂ O.....	solid	556.99	600	+1.671 ^{18°}
bromide.....	MnBr ₂	solid	90.80		
		dil. sol.	106.8		
carbide.....	Mn ₃ C.....	solid	12.4		
carbonate.....	MnCO ₃	solid	212.9		
chloride.....	MnCl ₂	solid	112.69	350	+16.01 ^{18°}
		400	128.79		
	MnCl ₂ ·4H ₂ O.....	solid	400.72	400	+1.531 ^{18°}
dithionate.....	MnS ₂ O ₆ ·6H ₂ O.....	solid	736.20	400	-1.91 ^{18°}
fluoride, di-.....	MnF ₂	dil. sol.	206.0		
fluoride, sesqui-.....	MnF ₃	dil. sol.	260.46		
formate.....	Mn(CHO ₂) ₂	solid	242.3	500	+4.302 ^{4°}
	Mn(CHO ₂) ₂ ·2H ₂ O.....	solid	386.38	300	-2.872 ^{4°}
hydroxide.....	Mn(OH) ₃	ppt.	219.8		
hydroxide (ous).....	Mn(OH) ₂	ppt.	163.4		
iodide.....	MnI ₂	dil. sol.	76.46		
nitrate.....	Mn(NO ₃) ₂	solid	136.2	300	+12.691 ^{4°}
		400	149.1		
	Mn(NO ₃) ₂ ·6H ₂ O.....	solid	565.59	400	-6.141 ^{18°}
oxalate.....	MnC ₂ O ₄	ppt.	259.50		
oxide (ic).....	Mn ₂ O ₃	solid	227.0		
oxide (ous).....	MnO.....	solid	90.8		
oxide, di-.....	MnO ₂	solid	125.4		
oxide, di- (hydrated ppt.).....	MnO ₂	amorph.	115.89		
oxide (ous) (ic).....	Mn ₃ O ₄	solid	327.84		
phosphate.....	Mn ₃ (PO ₄) ₂	solid	733.10		
selenide.....	MnSe.....	ppt.	27.		
		solid	23.9		
silicate.....	MnSiO ₃	solid	299.40		
sulfate (ous).....	MnSO ₄	solid	247.07	400	+13.791 ^{18°}
		400	261.01		
	MnSO ₄ ·H ₂ O.....	solid	321.39	400	+7.790 ^{18°}
	MnSO ₄ ·5H ₂ O.....	solid	602.87	400	+0.0478 ^{18°}
	MnSO ₄ ·7H ₂ O.....	solid	744.81		
sulfide (ous).....	MnS.....	ppt.	47.31		
		solid	60.		
Manganic acid					
	HMnO ₄	dil. sol.	123.3		
Methane					
	CH ₄	gas	19.1		
Methyl alcohol					
	CH ₃ OH.....	liquid	60.004		
		gas	50.896		
		dil. sol.	61.89		+2.01
Mercury					
acetate (ic).....	Hg(C ₂ H ₃ O ₂) ₂	solid	198.1		
acetate (ous).....	Hg ₂ (C ₂ H ₃ O ₂) ₂	solid	203.35		
bromide (ic).....	HgBr ₂	solid	41.58		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Mercury					
bromide (ous)....	Hg ₂ Br ₂	ppt.	49.22		
chloride (ic).....	HgCl ₂	solid	53.429	300	-3.321 ^{18°}
chloride (ous).....	Hg ₂ Cl ₂	ppt.	63.01		
cyanide (ic).....	Hg(CN) ₂	solid	-62.13		-3.11
dimercuri-diammonium chloride	NHg ₂ Cl.NH ₄ Cl.....	solid	141.5		
dimercuri-tetra ammonium chloride	NHg ₂ Cl.3NH ₄ Cl.....	solid	289.6		
fulminate (ic).....	HgC ₂ N ₂ O ₂	solid	-64.52		
iodide (ic) (red).....	HgI ₂	solid	25.33		
iodide (ic) (yellow).....	HgI ₂	solid	22.2		
iodide (ous) (yellow).....	Hg ₂ I ₂	solid	28.865		
nitrate (ic).....	Hg(NO ₃) ₂	dil. sol.	58.1		
nitrate (ous).....	Hg ₂ (NO ₃) ₂	dil. sol.	59.499		
	Hg ₂ (NO ₃) ₂ .2H ₂ O.....	solid	207.9		
nitride (ous).....	Hg ₂ N ₆	solid	-97.49		
oxalate (ic).....	HgC ₂ O ₄	solid	160.10		
oxide (ic) (red).....	Hg ₂ O.....	solid	21.7		
oxide (ous).....	Hg ₂ O.....	solid	21.5		
oxybromide (ic).....	HgBr ₂ .HgO.....	solid	64.52		
	HgBr ₂ .3HgO.....	solid	108.2		
oxychloride (ic).....	HgCl ₂ .HgO.....	solid	75.75		
	HgCl ₂ .2HgO.....	solid	97.73		
	HgCl ₂ .3HgO.....	solid	118.5		
	HgCl ₂ .4HgO.....	solid	139.3		
selenide (ic).....	HgSe.....	ppt.	5.26		
sulfate (ic).....	HgSO ₄	solid	162.5		
sulfate (ous).....	Hg ₂ SO ₄	solid	171.59		
sulfide (red).....	HgS.....	solid	10.90		
sulfide (black).....	HgS.....	amorph.	10.5		
sulfocyanate.....	Hg(CNS) ₂	solid	-50.42		
Molybdenum					
oxide, di-.....	MoO ₂	solid	131.4		
oxide, tri-.....	MoO ₃	solid	174.0		
Molybdic acid					
	H ₂ MoO ₄	solid	+247.07		
		dil. sol.	246.60		
Neodymium					
chloride.....	NdCl ₃	solid	246.60	2000	+35.60
		dil. sol.	282.20		
iodide.....	NdI ₃	solid	155.3	2000	+48.98 ^{18°}
		dil. sol.	204.3		
oxide.....	Nd ₂ O ₃	solid	434.89		
sulfate.....	Nd ₂ (SO ₄) ₃	solid	919.48	500	+36.56
		dil. sol.	956.04		
sulfide.....	Nd ₂ S ₃	solid	262.61		
Nickel					
bromide.....	NiBr ₂	solid	53.29		+18.9
		dil. sol.	72.40		
bromide ammonla.	NiBr ₂ .6NH ₃	solid	221.7		
chloride.....	NiCl ₂	solid	74.983	400	+19.16 ^{18°}
		800	94.266		
	NiCl ₂ .6H ₂ O.....	solid	505.55	400	-1.15 ^{19°}
chloride ammonla.	NiCl ₂ .6NH ₃	solid	248.75		
cyanide.....	Ni(CN) ₂	solid	-23.25		
dithionate.....	NiS ₂ O ₆	dil. sol.	+290.09		
	NiS ₂ O ₆ .6H ₂ O.....	solid	702.75	400	-2.413 ^{19°}

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Nickel					
fluoride.....	NiF ₂	dil. sol.	171.4		
hydroxide (ic).....	Ni(OH) ₃	ppt.	196.66		
hydroxide (ous).....	Ni(OH) ₂	ppt.	129.80		
iodide.....	NiI ₂	dil. sol.	41.82		
nitrate.....	Ni(NO ₃) ₂	solid	102.7	280	+11.718°
	Ni(NO ₃) ₂ .6H ₂ O.....	solid	532.26	400	-7.47918°
oxide.....	NiO.....	solid	57.83		
selenide.....	NiSe.....	solid	13.4		
		ppt.	14.8		
sulfate.....	NiSO ₄	400	227.05		
	NiSO ₄ .7H ₂ O.....	solid	710.11	800	-4.25319°
sulfide.....	NiS.....	ppt.	20.8		
telluride.....	NiTe.....	solid	10.8		
Nitric acid	HNO ₃	liquid	42.366		+7.16910°
		gas	35.341		
		∞	49.797		
Nitrogen (atomic).					
	N.....	gas	-129.0		
oxide (ic).....	NO.....	gas	-21.5		
oxide (ous).....	N ₂ O.....	gas	-17.0		
		liquid	-18.73		
oxide, tetra-.....	NO ₂	gas (ideal)	-7.431		
	N ₂ O ₄	gas (ideal)	-1.86		
oxide, penta-.....	N ₂ O ₅	solid	+14.6	400	+16.6810°
		gas	-1.2		+29.79710°
oxybromide.....	NOBr.....	gas	-17.54		
oxychloride.....	NOCl.....	gas	-12.66		
selenide.....	NSe.....	solid	-42.29		
sulfide.....	NS.....	solid	-31.78		
Nitrous acid	HNO ₂	200	+28.91		
Osmium					
oxide, tetra-.....	OsO ₄	solid	93.43		
		liquid ^{40°}	90.036		
Oxalic acid	H ₂ C ₂ O ₄	solid	197.04		
		dil. sol.	194.5	300	-2.2718°
Oxygen (atomic)	O.....	solid	339.79	300	-8.57820°
(ozone).....	O ₃	gas	-81.48		
		gas	-34.41		
		dil. sol.	-32.50		+1.9
Palladium					
am. chloride.....	PdCl ₂ .2NH ₃	solid	105.4		
	PdCl ₂ .4NH ₃	solid	158.2		
am. iodide.....	PdI ₂ .2NH ₃	solid	73.84		
	PdI ₂ .4NH ₃	solid	121.6		
bromide.....	PdBr ₂	solid	27.96		
chloride.....	PdCl ₂	solid	43.49		
cyanide.....	Pd(CN) ₂	solid	-49.0		
hydride.....	Pd ₂ H.....	solid	+17.7		
hydroxide (ic).....	Pd(OH) ₄	ppt.	168.0		
hydroxide (ous).....	Pd(OH) ₂	ppt.	91.76		
iodide.....	PdI ₂	solid	17.92		
oxide, mono-.....	PdO.....	solid	21.5		
Perchloric acid	HClO ₄	liquid	19.4	500	+20.319°
		200	39.67		
	HClO ₄ .2H ₂ O.....	solid	100.4		+7.65
Periodic acid	HIO ₄	dil. sol.	45.40		
Phosphonium					
bromide.....	PH ₃ .HBr.....	solid	25.57		-3.03
chloride.....	PH ₃ .HCl.....	solid	31.06		
iodide.....	PH ₃ .HI.....	solid	12.07		-4.78

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Phosphoric acid					
meta-.....	HPO_3	solid	224.90	.....	+9.749
ortho-.....	H_2PO_4	solid	303.13	150	+2.700 ¹⁹⁰
		liquid	300.74	200	+5.352 ²⁰⁰
		400	306.17	.....	.....
pyro-.....	$\text{H}_4\text{P}_2\text{O}_7$	solid	531.64	.....	+8.005
		liquid	529.37	.....	+10.23
Phosphorous acid					
hypo-.....	H_3PO_2	solid	141.36	150	-0.167 ¹²⁰
		liquid	139.02	150	+2.17 ¹⁹⁰
ortho-.....	H_2PO_3	solid	228.94	150	+0.119 ¹⁹⁰
		liquid	225.86	150	+2.939 ¹⁹⁰
pyro-.....	$\text{H}_4\text{P}_2\text{O}_5$	dil. sol.	384.23	.....	.....
Phosphorus					
bromide, tri-.....	PBr_3	liquid	45.40	.....	.....
bromide, penta-.....	PBr_5	solid	60.69	.....	.....
chloride, tri-.....	PCl_3	liquid	76.94	1000	+65.138 ¹⁹⁰
		gas	70.01	.....	.....
chloride, penta-.....	PCl_5	solid	106.6	1000	+123.44 ²²⁰
hydride (phosphine)	PH_3	gas	- 5.97	.....	.....
hydride (solid).....	P_2H_4	solid	+ 11.9	.....	.....
iodide, tri-.....	PI_3	solid	11.0	.....	.....
iodide, tetra-.....	P_2I_4	solid	19.8	.....	.....
nitride.....	P_3N_5	solid	75.03	.....	.....
oxide, penta-.....	P_2O_5	solid	365.83	.....	.....
oxybromide.....	POBr_3	solid	106.8	.....	.....
oxychloride.....	POCl_3	liquid	147.15	1000	+72.187 ²⁰⁰
Platinic acid					
bromo-.....	H_2PtBr_6	dil. sol.	115.4	.....	.....
	$\text{H}_2\text{PtBr}_6 \cdot 9\text{H}_2\text{O}$	solid	733.8	.....	-2.87
chloro-.....	H_2PtCl_6	dil. sol.	165.6	.....	.....
	$\text{H}_2\text{PtCl}_6 \cdot 6\text{H}_2\text{O}$	solid	571.57	500	+4.349
Platinum					
bromide.....	PtBr_4	solid	40.14	1000	+9.80
chloride, di-.....	PtCl_2	solid	35.84	.....	.....
chloride, tetra-.....	PtCl_4	solid	62.60	.....	.....
		dil. sol.	81.96	.....	.....
	$\text{PtCl}_4 \cdot 5\text{H}_2\text{O}$	solid	425.81	400	-1.84
hydroxide.....	$\text{Pt}(\text{OH})_2$	ppt.	87.69	.....	.....
iodide.....	PtI_4	solid	16.7	.....	.....
oxide, mono-.....	PtO	solid	17.0	.....	.....
Potassium					
acetate.....	$\text{KC}_2\text{H}_3\text{O}_2$	solid	174.48	200	+3.35 ²⁰⁰
aluminum sulfate.....	$\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	solid	1439.9	1200	-10.11 ¹⁸⁰
arsenate (tribasic).....	K_3AsO_4	400	389.73	.....	.....
arsenate (dibasic).....	K_2HAsO_4	400	335.01	.....	.....
arsenate (monobasic).....	KH_2AsO_4	dil. sol.	280.77	.....	-4.78
		400	275.99	.....	.....
arsenite, ortho-.....	KH_2AsO_3	800	230.1	.....	.....
bromate.....	KBrO_3	solid	83.107	400	-10.0 ¹⁸⁰
bromide.....	KBr	solid	94.027	200	-5.066 ¹⁸⁰
		∞	88.889	.....	.....
bromopalladite.....	K_2PdBr_4	dil. sol.	208.4	.....	.....
bromoplatinate.....	K_2PtBr_6	solid	248.51	.....	-12.26
		dil. sol.	236.1	.....	.....
bromoplatinite.....	K_2PtBr_4	solid	221.0	.....	-10.56
		dil. sol.	210.5	.....	.....

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Potassium					
carbonate	K_2CO_3	solid	274.96	400	+6.499 ¹⁵⁰
		400	281.46		
carbonate, acid	$KHCO_3$	solid	231.3	220	-5.329 ¹⁵⁰
		200	225.8		
chlorate	$KClO_3$	solid	89.869	400	-10.27 ¹⁸⁰
		∞	79.379		
chloride	KCl	solid	104.30	200	-4.444 ¹⁸⁰
		∞	99.879		
chloriridate	K_2IrCl_6	solid	279.57		
		dil. sol.	266.91		-3.11
	K_3IrCl_6	solid	365.59		
chloropalladate	K_2PdCl_6	solid	290.09		-15.1
		dil. sol.	275.03		
chloropalladite	K_2PdCl_4	solid	261.41	300	-13.62 ¹⁹⁰
		dil. sol.	247.79		
chloroplatinate	K_2PtCl_6	solid	299.64		
		dil. sol.	286.26		-13.76
chloroplatinite	K_2PtCl_4	solid	254.72		-12.11
		dil. sol.	242.53		
chromate	K_2CrO_4	solid	329.51	540	-5.26
		800	324.30		
cyanate	$KCNO$	solid	100.12	400	-5.161 ²⁰⁰
		dil. sol.	94.86		
cyanide	KCN	solid	28.20	200	-2.87 ¹⁸⁰
		200	25.09		
dichromate	$K_2Cr_2O_7$	solid	481.72	1000	-17.44 ¹⁸⁰
		∞	463.35		
dithionate, see under <i>thionate, di-</i>					
ferric sulfate	$KFe(SO_4)_2 \cdot 12H_2O$	solid	1323.5		-16.0
ferricyanide	$K_3Fe(CN)_6$	solid	48.98	400	-14.31 ¹⁸⁰
		dil. sol.	34.41		
ferrocyanide	$K_4Fe(CN)_6$	solid	131.7	1000	-12.41 ¹⁷⁰
		dil. sol.	119.24		
	$K_4Fe(CN)_6 \cdot 3H_2O$	solid	340.98	1000	-16.51 ¹⁷⁰
ferrous sulfate	$K_2Fe(SO_4)_2 \cdot 6H_2O$	solid	985.19		-11.0
fluoride	KF	solid	134.10	110	+4.110 ¹⁵⁰
		400	138.21		
	$KF \cdot 2H_2O$	solid	277.11	110	-2.21 ¹⁵⁰
fluoride, acid	KHF_2	solid	219.36	400	-5.97 ¹⁵⁰
fluosilicate	K_2SiF_6	solid	681.96		
		dil. sol.	667.63		
hydride	KH	solid	14.1		
hydroxide	KOH	solid	102.01	175	+12.95 ²¹⁰
		∞	114.85		
hypochlorite	$KClO$	400	86.141		
hypophosphite	KH_2PO_2	dil. sol.	202.9		
iodate	KIO_3	solid	121.48	400	-6.762 ¹⁸⁰
iodide	KI	solid	78.758	400	-5.114 ¹⁸⁰
		∞	73.62		
iodide, tri-	KI_3	dil. sol.	71.92		
magnesium chlor- ide (melt)	$KCl \cdot MgCl_2$	solid	260.69		+28.20 ¹⁸⁰
	$KCl \cdot MgCl_2 \cdot 6H_2O$	solid	702.27		-3.08 ¹⁵⁰
magnesium sulfate	$K_2Mg(SO_4)_2$	solid	642.78	600	+10.51 ⁹⁰
	$K_2Mg(SO_4)_2 \cdot 6H_2O$	solid	1073.6	600	-10.01 ¹⁸⁰
mercuric bromide	$KBr \cdot HgBr_2$	solid	137.9		
	$2KBr \cdot HgBr_2$	solid	229.9	660	-9.749 ¹⁸⁰
mercuric chloride	$KCl \cdot HgCl_2$	solid	159.9	700	-9.561 ⁴⁰
	$2KCl \cdot HgCl_2$	solid	266.67	1000	-15.031 ⁴⁰
	$2KCl \cdot HgCl_2 \cdot H_2O$	solid	336.44	600	-16.391 ⁸⁰

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Potassium					
nitrate.....	KNO ₃	solid	118.78	200	-8.459 ^{18°}
		∞	110.11		
nitrite.....	KNO ₂	dil. sol.	85.78		
oxalate.....	K ₂ C ₂ O ₄	solid	320.43		-4.78
oxalate, acid.....	KHC ₂ O ₄	solid	264.52		-9.56
oxalate, tetra-oxide.....	KHC ₂ O ₄ ·H ₂ C ₂ O ₄	solid	465.00		-15.8
	K ₂ O.....	solid	86.26	300	+75.03 ^{17°}
perchlorate.....	KClO ₄	dil. sol.	112.07		
		∞	99.236		
periodate.....	KIO ₄	dil. sol.	97.73		
permanganate.....	KMnO ₄	solid	194.3		
persulfate.....	K ₂ S ₂ O ₈	solid	444.69	3300	-14.6 ^{9°}
		dil. sol.	430.11		
phos. ortho-.....	K ₃ PO ₄	dil. sol.	479.33		
phos. hydrogen.....	K ₂ HPO ₄	dil. sol.	426.05		
phos. dihydrogen.....	KH ₂ PO ₄	solid	372.05		-4.78
		dil. sol.	367.27		
phosphite.....	K ₂ HPO ₃	dil. sol.	350.06		
selenide.....	K ₂ Se.....	solid	85.3	1800	+8.60 ^{13°}
	K ₂ Se·9H ₂ O.....	solid	728.32	4000	-19.1 ^{14°}
	K ₂ Se·14H ₂ O.....	solid	1071.5	4000	-20.3 ^{13°}
	K ₂ Se·19H ₂ O.....	solid	1422.2		-29.39 ^{14°}
silver bromide.....	AgBr + KBr.....	solid	-0.4		
silver cyanide.....	KAg(CN) ₂	solid	+6.69	400	-8.554 ^{11°}
silver iodide.....	KI·AgI.....	solid	97.49		
silver iodide.....	3KI·AgI.....	solid	255.92		
sulfate.....	K ₂ SO ₄	solid	338.62	400	-6.547 ^{18°}
		∞	331.93		
sulfate, acid.....	KHSO ₄	solid	272.88	200	-3.799 ^{17°}
		800	269.75		
sulfate, pyro-.....	K ₂ S ₂ O ₇	solid	466.91		-3.82
		dil. sol.	463.09		
sulfhydrate.....	KHS.....	400	63.967		
	KHS· $\frac{1}{2}$ H ₂ O.....	solid	80.29	1000	+0.765 ^{17°}
sulfide, mono-.....	K ₂ S.....	solid	88.17		+22.5
		400	110.59		
	K ₂ S·2H ₂ O.....	solid	243.49	1200	+3.82 ^{18°}
	K ₂ S·5H ₂ O.....	solid	457.59	1000	-5.26 ^{16°}
sulfide, tetra-.....	K ₂ S ₄	solid	113.7	100	+1.2 ^{10°}
	K ₂ S ₄ · $\frac{1}{2}$ H ₂ O.....	solid	151.3		-2.20 ^{12°}
sulfite.....	K ₂ SO ₃	solid	265.95	300	+1.4 ^{12°}
		600	267.39		
	K ₂ SO ₃ ·H ₂ O.....	solid	334.53		
sulfite, acid.....	KHSO ₃	400	207.74		
sulfocyanate.....	KCNS.....	solid	54.24	100	-12.2
		dil. sol.	42.06		
tartrate.....	K ₂ C ₄ H ₄ O ₆	solid	419.36	400	-2.844 ^{18°}
		dil. sol.	416.49		
	K ₂ C ₄ H ₄ O ₆ · $\frac{1}{2}$ H ₂ O.....	solid	456.87	400	-6.141 ^{18°}
tartrate, acid.....	KHC ₄ H ₄ O ₆	solid	369.18		
		dil. sol.	357.71		
thionate, di-.....	K ₂ S ₂ O ₆	solid	407.91		
thionate, tri-.....	K ₂ S ₃ O ₆	solid	394.27	500	-12.45 ^{18°}
thionate, tetra-.....	K ₂ S ₄ O ₆	solid	395.46	500	-13.14 ^{19°}
thionate, penta-.....	K ₂ S ₅ O ₆	solid	398.09		-10.0
		dil. sol.	388.05		
	K ₂ S ₅ O ₆ · $\frac{1}{2}$ H ₂ O.....	solid	503.7	2000	-13.14 ^{10°}
thiosulfate.....	K ₂ S ₂ O ₃	solid	266.67	800	-5.02 ^{10°}
		dil. sol.	261.65		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Potassium					
thiosulfate	$K_2S_2O_3 \cdot H_2O$	solid	336.20		-6.21 ¹⁴⁰
zinc sulfate	$K_2Zn(SO_4)_2$	solid	572.05	600	+7.909 ¹⁸⁰
	$K_2Zn(SO_4)_2 \cdot 6H_2O$	solid	1002.2	600	-11.80 ¹⁸⁰
Praseodymium					
chloride	$PrCl_3$	solid	240.38	2500	+33.45 ¹⁸⁰
	$PrCl_3 \cdot 7H_2O$	dil. sol.	273.84		
		solid	747.20	2000	+5.26 ¹⁷⁰
nitrate	$Pr(NO_3)_2$	dil. sol.	315.41		
oxide	PrO_2	solid	215.1		
oxide, tri-	Pr_2O_3	solid	416.97		
Rubidium					
bromide	$RbBr$	solid	96.06	110	-5.95 ¹⁵⁰
		400	89.61		
carbonate	Rb_2CO_3	solid	273.84		+8.746
		dil. sol.	282.68		
carbonate, acid	$RbHCO_3$	solid	230.6	110	-4.731 ¹⁵⁰
		dil. sol.	225.8		
chloride	$RbCl$	solid	104.97	400	-4.23 ²¹⁰
		400	100.53		
fluoride	RbF	solid	133.31	110	+5.806 ¹⁶⁰
		400	139.12		
hydroxide	$RbOH$	solid	101.20	110	+14.27 ¹⁵⁰
iodide	RbI	solid	80.77	110	-6.499 ¹⁵⁰
		dil. sol.	74.31		
nitrate	$RbNO_3$	solid	119.62	400	-8.769 ²¹⁰
		200	110.99		
oxide, mono-	Rb_2O	solid	82.92		+80.05 ¹⁹⁰
oxide, di-	Rb_2O_2	solid	107.05		
oxide, tetra-	Rb_2O_4	solid	135.0		
sulfate	Rb_2SO_4	solid	339.98	220	-6.667 ¹⁸⁰
		440	333.45		
sulfate, acid	$RbHSO_4$	solid	274.10	220	-3.728 ¹⁵⁰
		330	270.32		
sulfide	Rb_2S	solid	87.69		+24.61
		dil. sol.	112.31		
sulfocyanate	$RbCNS$	solid	56.87		-14.3
		dil. sol.	42.77		
Ruthenium					
chloride	$RuCl_3$	solid	62.84		
oxide, di-	RuO_2	solid	52.57		
Selenic acid	H_2SeO_4	solid	130.23	400	+13.36
		liquid	126.64	400	+16.7
Selenious acid	H_2SeO_3	solid	128.03		-4.110
		dil. sol.	123.92		
Selenium	Se_2	gas	34.89		
chloride, mono-	Se_2Cl_2	liquid	22.15		
chloride, tetra-	$SeCl_4$	solid	46.165		
hydride, see <i>hydrogen selenide</i>					
nitride, see <i>nitrogen selenide</i>					
oxide, di-	SeO_2	solid	56.416		-0.908
Silicic acid, ortho-	H_4SiO_4	colloid	333.81		
Silicon					
bromide, tetra-	$SiBr_4$	liquid	91.52	2000	+19.8 ⁹⁰
carbide	SiC	solid	1.43		
chloride, tetra-	$SiCl_4$	liquid	149.1		
		gas	142.7		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Silicon					
fluoride, tetra.	SiF ₄	gas	361.29		
hydride.	SiH ₄	gas	11.9		
iodide, tetra.	SiI ₄	solid	27.72	12,000	+20.5 ⁹⁰
oxide, di.	SiO ₂	fused	198.3		
oxide, di- (α quartz)	SiO ₂	solid	201.34		
sulfide (white)	SiS ₂	solid	32.02		+9.32 ¹⁰⁰
sulfide (yellow)	SiS ₂	solid	28.91		+10.8 ¹⁰⁰
Silver					
acetate	AgC ₂ H ₃ O ₂	solid	97.01		-4.397
bromide.	AgBr	solid	23.85		
carbide.	Ag ₂ C ₂	solid	-83.87		
carbonate.	Ag ₂ CO ₃	solid	+120.9		
chlorate.	AgClO ₃	solid	1.67		-7.53
		dil. sol.	-5.73		
chloride.	AgCl	solid	+30.59		
cyanate.	AgCNO	solid	23.7		
cyanide.	AgCN	solid	-33.45		
fluoride.	AgF	solid	+48.698		+4.301 ¹⁰⁰
	AgF.2H ₂ O	solid	191.26		-1.4 ¹⁰⁰
iodide.	AgI	ppt.	14.93		
nitrate.	AgNO ₃	solid	30.11	400	-5.472 ¹⁸⁰
		400	24.66		
nitride.	AgN ₃	solid	-66.19		
nitrite.	AgNO ₂	solid	+12.7		-8.84
oxalate.	Ag ₂ C ₂ O ₄	solid	159.6		
oxide.	Ag ₂ O	solid	6.953		
oxide, per.	Ag ₂ O ₂	solid	5.400		
perchlorate.	AgClO ₄	solid	12.23		+2.17
		dil. sol.	14.41		
selenide.	AgSe	ppt.	-0.956		
sulfate.	Ag ₂ SO ₄	solid	+166.1		
		dil. sol.	161.5		
sulfide.	Ag ₂ S	solid	5.02		
sulfocyanate.	AgCNS	solid	-21.03		
Sodium					
acetate.	NaC ₂ H ₃ O ₂	solid	+171.16	200	+3.943 ¹⁸⁰
		400	175.10		
	NaC ₂ H ₃ O ₂ .3H ₂ O.	solid	384.71	400	-4.588
aluminate.	NaAlO ₂	solid	271.69		
amide.	NaNH ₂	solid	32.26		+31.06 ²¹⁰
arsenate.	Na ₃ AsO ₄	solid	358.		
		500	381.60		
	Na ₃ AsO ₄ .12H ₂ O	solid	1214.8	600	-12.7 ¹⁸⁰
arsenate (disodium)	Na ₂ HAsO ₄	400	329.03		
arsenate, acid.	NaH ₂ AsO ₄	300	273.12		
arsenite.	Na ₂ HAsO ₃	400	271.69		
borate.	NaBO ₂	300	231.5		
borate, tetra.	Na ₂ B ₄ O ₇	solid	742.18		+10.27
		dil. sol.	752.45		
	Na ₂ B ₄ O ₇ .10H ₂ O.	solid	1462.14	1600	-25.854 ¹⁸⁰
bromide.	NaBr	solid	86.333	200	-0.191 ¹⁸⁰
		200	86.15		
	NaBr.2H ₂ O	solid	227.72	300	-4.71 ¹⁸⁰
bromoplatinate.	Na ₂ PtBr ₆	solid	220.8	800	+9.940 ¹⁸⁰
		dil. sol.	230.8		
	Na ₂ PtBr ₆ .6H ₂ O	solid	649.71	800	-8.60 ¹⁸⁰
carbide.	Na ₂ C ₂	solid	-4.78		
carbonate.	Na ₂ CO ₃	solid	+270.56	400	+5.639 ¹⁸⁰
		400	276.18		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Sodium					
carbonate.....	$\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$	solid	342.32	400	+2.25 ^{18°}
	$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	solid	976.16	400	-16.15 ^{18°}
carbonate, acid....	NaHCO_3	solid	227.5		-4.30 ^{15°}
		200	223.35		
chlorate.....	NaClO_3	solid	82.34		
		dil. sol.	77.06		
chloride.....	NaCl	solid	98.36	200	-1.28 ^{18°}
		∞	97.08		
chloroplatinate.....	Na_2PtCl_6	solid	271.93	800	+8.507 ^{18°}
		dil. sol.	280.29		
	$\text{Na}_2\text{PtCl}_6 \cdot 6\text{H}_2\text{O}$	solid	701.32	900	-10.61 ^{18°}
chloroplatinite.....	Na_2PtCl_4	solid	227.0		+10.04
		dil. sol.	237.0		
chromate.....	Na_2CrO_4	solid	316.61	600	+2.39 ^{11°}
		800	319.00		
	$\text{NaCrO}_4 \cdot 10\text{H}_2\text{O}$	solid	1018.4	1200	-15.79 ^{11°}
cyanate.....	NaCNO	solid	97.01	2000	-4.803 ^{18°}
		dil. sol.	92.23		
cyanide.....	NaCN	solid	22.9	100	-0.502 ^{2°}
		200	22.5		
	$\text{NaCN} \cdot \frac{1}{2}\text{H}_2\text{O}$	solid	57.59	110	-1.0 ^{6°}
	$\text{NaCN} \cdot 2\text{H}_2\text{O}$	solid	163.7	100	-4.421 ^{4°}
dichromate.....	$\text{Na}_2\text{Cr}_2\text{O}_7$	dil. sol.	458.86		
dithionate, see under <i>thionate, di-</i>					
fluoride.....	NaF	solid	136.30	400	-0.478 ^{12°}
		dil. sol.	135.70		
formate.....	NaCHO_2	solid	157.01	150	-0.526 ^{12°}
		400	156.49		
fluosilicate.....	Na_2SiF_6	solid	660.94		
		dil. sol.	658.31		
hydride.....	NaH	solid	13.14	200	+26.05 ^{18°}
hydroxide.....	NaOH	solid	101.91	160	+10.30 ^{22°}
		∞	112.04		
	$\text{NaOH} \cdot \text{H}_2\text{O}$	solid	173.24	180	+7.192 ^{22°}
hypochlorite.....	NaOCl	dil. sol.	83.39		
iodide.....	NaI	solid	69.46	200	+1.410 ^{18°}
		200	70.870		
	$\text{NaI} \cdot 2\text{H}_2\text{O}$	solid	211.64	200	-4.014 ^{18°}
iodoplatinate.....	Na_2PtI_6	dil. sol.	167.0		
manganate.....	Na_2MnO_4	solid	267.62		
manganese sulfate.....	$\text{Na}_2\text{SO}_4 \cdot \text{MnSO}_4$	solid	574.91		+12.9
molybdate.....	Na_2MoO_4	solid	361.77		
nitrate.....	NaNO_3	solid	112.45	200	-5.018 ^{17°}
		∞	107.33		
nitrite.....	NaNO_2	solid	86.50	250	-3.513
		dil. sol.	83.15		
oxalate.....	$\text{Na}_2\text{C}_2\text{O}_4$	solid	316.01	1500	-5.50
		450	310.44		
oxalate, acid.....	NaHC_2O_4	solid	257.83	300	-5.50
		400	252.33		
	$\text{NaHC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	solid	330.23	300	-9.56
oxide.....	Na_2O	solid	99.16		+56.39
perchlorate.....	NaClO_4	solid	100.60	400	-3.58 ^{10°}
		dil. sol.	97.25		
peroxide.....	Na_2O_2	solid	118.42		
phos. (trisod.).....	Na_3PO_4	solid	447.08		
		900	471.30		
	$\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$	solid	1306.3	600	-14.6 ^{18°}

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Sodium					
phos. (disod.)	Na_2HPO_4	solid	414.98	400	+5.639 ^{18°}
		600	420.62		
	$\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$	solid	557.78	400	-0.382 ^{18°}
	$\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$	solid	910.88	400	-11.518 [°]
phos., pyro-	$\text{Na}_4\text{P}_2\text{O}_7$	solid	755.08	800	+11.85 ^{18°}
		1600	767.03		
	$\text{Na}_4\text{P}_2\text{O}_7 \cdot 10\text{H}_2\text{O}$	solid	1462.4	800	-11.66 ^{18°}
phos., pyro- (disod.)	$\text{Na}_2\text{H}_2\text{P}_2\text{O}_7$	solid	657.83		-2.27
		1200	655.68		
	$\text{Na}_2\text{H}_2\text{P}_2\text{O}_7 \cdot 6\text{H}_2\text{O}$	solid	1079.8		-13.91
phosphite	Na_2HPO_3	solid	335.44	500	+9.152 ^{14°}
		dil. sol.	344.57		
	$\text{Na}_2\text{HPO}_3 \cdot 5\text{H}_2\text{O}$	solid	344.57	500	-4.588 ^{15°}
phosphite, acid	NaH_2PO_3	solid	286.50	500	+0.741 ^{15°}
		600	287.22		
	$\text{NaH}_2\text{PO}_3 \cdot 2\frac{1}{2}\text{H}_2\text{O}$	solid	463.56	500	-5.26 ^{15°}
		300	364.61		
selenate	Na_2SeO_4	solid	261.41		
selenate, acid	NaHSeO_4	dil. sol.	201.84		
selenide	Na_2Se	solid	69.53	200	+18.59 ^{14°}
	$\text{Na}_2\text{Se} \cdot 4\frac{1}{2}\text{H}_2\text{O}$	solid	403.83		-7.89
	$\text{Na}_2\text{Se} \cdot 9\text{H}_2\text{O}$	solid	714.22		-10.5
	$\text{Na}_2\text{Se} \cdot 16\text{H}_2\text{O}$	solid	1190.0	3000	-22.01 ^{4°}
selenide, acid	NaHSe	dil. sol.	44.68		
silicate	Na_2SiO_3	solid	368.94		
sulfate	Na_2SO_4	solid	326.31	400	+0.55 ^{18°}
		∞	326.67		
	$\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$	solid	1029.6	400	-18.90 ^{18°}
sulfate, acid	NaHSO_4	solid	265.19	200	+1.21 ^{7°}
		800	266.86		
sulfhydrate	NaHS_2	solid	57.11	600	+4.30 ^{16°}
		400	61.458		
sulfhydrate	$\text{NaHS} \cdot 2\text{H}_2\text{O}$	solid	199.8	400	-1.53 ^{18°}
sulfide, mono-	Na_2S	solid	89.85		+15.5
		400	105.21		
	$\text{Na}_2\text{S} \cdot 4\frac{1}{2}\text{H}_2\text{O}$	solid	417.92	1000	-5.02 ^{17°}
	$\text{Na}_2\text{S} \cdot 5\text{H}_2\text{O}$	solid	453.766	1000	-6.69 ^{13°}
	$\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$	solid	737.40	1000	-16.71 ^{13°}
sulfide, di-	Na_2S_2	dil. sol.	105.62		
sulfide, tri-	Na_2S_3	dil. sol.	107.3		
sulfide, tetra-	Na_2S_4	solid	98.93	1200	+9.80 ^{17°}
sulfite	Na_2SO_3	solid	259.26		+2.39 ^{10°}
		800	261.89		
	$\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$	solid	751.50	500	-10.99 ^{10°}
sulfite, acid	NaHSO_3	600	205.0		
sulfocyanate	NaCNS	solid	42.77	100	-3.321 ^{18°}
tartrate	$\text{Na}_2\text{C}_4\text{H}_4\text{O}_6$	solid	412.19		-1.12
		dil. sol.	411.23		
	$\text{Na}_2\text{C}_4\text{H}_4\text{O}_6 \cdot 2\text{H}_2\text{O}$	solid	553.89		-5.878
tartrate, acid	$\text{NaHC}_4\text{H}_4\text{O}_6$	solid	360.58		-5.663
		dil. sol.	355.08		
	$\text{NaHC}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$	solid	431.78		-8.531
thionate, di-	$\text{Na}_2\text{S}_2\text{O}_6$	solid	394.98	400	-5.687 ^{19°}
	$\text{Na}_2\text{S}_2\text{O}_6 \cdot 2\text{H}_2\text{O}$	solid	537.64		-11.66
thionate, tri-	$\text{Na}_2\text{S}_3\text{O}_6$	dil. sol.	376.35		
	$\text{Na}_2\text{S}_3\text{O}_6 \cdot 3\text{H}_2\text{O}$	solid	591.40	1000	-10.01 ^{19°}
thionate, tetra-	$\text{Na}_2\text{S}_4\text{O}_6$	dil. sol.	377.06		
	$\text{Na}_2\text{S}_4\text{O}_6 \cdot 2\text{H}_2\text{O}$	solid	523.54	600	-9.80 ^{10°}

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Sodium					
thiosulfate.....	$\text{Na}_2\text{S}_2\text{O}_3$	solid	254.24	440	+1.7 ^{15°}
		dil. sol.	255.92		
	$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$	solid	609.32	400	-11.37 ^{18°}
tungstate.....	Na_2WO_4	solid	388.05		
		dil. sol.	383.99		+4.06
uranate.....	Na_2UO_4	solid	420.31		
vanadate.....	Na_3VO_4	solid	449.23		
Stannic acid	$\text{SnO}_2 + \text{H}_2\text{O}$	solid	133.5		
Stannic and Stannous salts, see under Tin					
Strontium					
acetate.....	$\text{Sr}(\text{C}_2\text{H}_3\text{O}_2)_2$	solid	359.62	200	+5.568 ^{12°}
		dil. sol.	365.35		
	$\text{Sr}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \frac{1}{2}\text{H}_2\text{O}$	solid	394.27	220	+52.57 ^{18°}
arsenate.....	$\text{Sr}_3(\text{AsO}_4)_2$	ppt.	795.70		
bromide.....	SrBr_2	solid	171.09	400	+16.0 ^{18°}
		dil. sol.	187.34		
	$\text{SrBr}_2 \cdot 6\text{H}_2\text{O}$	solid	604.07	400	-6.452 ^{18°}
carbonate.....	SrCO_3	ppt.	291.28		
chloride.....	SrCl_2	solid	197.85	400	+11.16 ^{18°}
		2000	209.14		
	$\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$	solid	626.81	400	-7.503 ^{18°}
cyanide.....	$\text{Sr}(\text{CN})_2$	dil. sol.	60.69		
	$\text{Sr}(\text{CN})_2 \cdot 4\text{H}_2\text{O}$	solid	338.35	200	-4.153 ^{8°}
dithionate.....	SrS_2O_6	dil. sol.	404.54		
	$\text{SrS}_2\text{O}_6 \cdot 4\text{H}_2\text{O}$	solid	687.22	400	-9.247 ^{18°}
fluoride.....	SrF_2	ppt.	288.89		
hydride.....	SrH_2	solid	42.06		
hydroxide.....	$\text{Sr}(\text{OH})_2$	solid	228.7	1100	+10.32 ^{15°}
	$\text{Sr}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$	solid	800.48	1100	-14.27 ^{15°}
iodide.....	SrI_2	solid	136.2		+20.45 ^{12°}
		dil. sol.	156.8		
	$\text{SrI}_2 \cdot 7\text{H}_2\text{O}$	solid	639.91		-4.463 ^{15°}
nitrate.....	$\text{Sr}(\text{NO}_3)_2$	solid	234.4	400	-4.660 ^{15°}
		1000	229.82		
	$\text{Sr}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$	solid	515.65	400	-12.31 ^{18°}
oxide.....	SrO	solid	140.7	1100	+29.99 ^{15°}
peroxide.....	SrO_2	solid	153.2		
phosphate.....	$\text{Sr}_3(\text{PO}_4)_2$	ppt.	979.7		
selenide.....	SrSe	solid	90.08		
silicate.....	SrSiO_3	fused	363.20		
sulfate.....	SrSO_4	solid	341.22		
sulfhydrate.....	$\text{Sr}(\text{SH})_2$	dil. sol.	137.9		
sulfide, mono-	SrS	solid	113.02		
Sulfocyanic acid	HCNS	dil. sol.	-18.4		
Sulfur					
bromide, mono-	S_2Br_2	liquid	+2.01		
chloride, mono-	S_2Cl_2	liquid	14.34		
		gas	5.64		
chloride, di-	S_2Cl_4	liquid	14.		
iodide, mono-	S_2I_2	solid	0.0		
oxide, di-	SO_2	liquid	75.269		
		gas	69.3		
		2000	77.850		+8.554
oxide, tri-	SO_3	solid	103.2		+37.28
		liquid	101.1	1600	+39.164 ^{20°}
		gas	91.52		+49.22
		200	139.1		
oxychloride (ic)...	SO_2Cl_2	liquid	87.69	800	+62.84
		gas	80.76		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution Kilo-cal.
Sulfur					
oxychloride (ous) ..	SOCl_2	liquid	48.03		
		gas	41.58		
pentoxydichloride ..	$\text{S}_2\text{O}_5\text{Cl}_2$	liquid	161.8		
		gas	148.9		
Sulfuric acid	H_2SO_4	solid	192.24		
		liquid	189.75	200	+17.75 ^{18°}
		∞	210.28		
	$\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$	liquid	264.83		
per-.....	$\text{H}_2\text{S}_2\text{O}_8$	dil. sol.	309.92		
pyro-.....	$\text{H}_2\text{SO}_4 \cdot \text{SO}_3$	liquid	293.91		
thio-.....	$\text{H}_2\text{S}_2\text{O}_3$	1500	138.6		
Sulfurous acid	H_2SO_3	200	145.09		
(See also <i>thionic acids</i>)					
Tantalum					
oxide,	Ta_2O_5	solid	300.12		
Telluric acid	H_2TeO_4	dil. sol.	169.2		
Tellurium					
chloride,	TeCl_4	solid	77.42		
oxide, di-.....	TeO_2	solid	78.304		
	$\text{TeO}_2 \cdot \text{H}_2\text{O}$	solid	144.8		
oxide, tri-.....	TeO_3	solid	83.15		
Tellurous acid	H_2TeO_3	solid	145.6		
Thallium					
bromide, mono-.....	TlBr	solid	41.052		
bromide, tri-.....	TlBr_3	dil. sol.	56.416		
chloride, mono-.....	TlCl	solid	48.698		
		dil. sol.	38.47	4500	-10.04 ^{18°}
chloride, tri-.....	TlCl_3	solid	80.74	300	+ 8.435
		dil. sol.	89.176		
	$\text{TlCl}_3 \cdot 4\text{H}_2\text{O}$	solid	364.90	300	- 2.13
fluoride	TlF	dil. sol.	77.300		
hydroxide (ic)	$\text{Tl}(\text{OH})_3$	solid	145.07		
hydroxide (ous)	TlOH	solid	56.87	235	- 3.154 ^{18°}
iodide	TlI	solid	30.11		
nitrate (ous)	TlNO_3	solid	58.806	300	- 9.964 ^{18°}
		dil. sol.	48.841		
nitride	TlN_3	solid	- 54.72		
oxide (ous)	Tl_2O	solid	+ 42.151	570	- 3.082 ^{18°}
selenide	Tl_2Se	solid	11.9		
sulfate (ous)	Tl_2SO_4	solid	217.78	1600	- 8.268 ^{18°}
		800	209.51		
sulfide	Tl_2S	solid	22.0		
telluride	Tl_2Te	solid	7.17		
Thionic acid					
thionic, di-.....	$\text{H}_2\text{S}_2\text{O}_6$	400	274.31		
thionic, tri-.....	$\text{H}_2\text{S}_3\text{O}_6$	dil. sol.	261.89		
thionic, tetra-.....	$\text{H}_2\text{S}_4\text{O}_6$	dil. sol.	262.37		
thionic, penta-.....	$\text{H}_2\text{S}_5\text{O}_6$	dil. sol.	267.62		
(See also <i>sulfuric acids</i>)					
Thorium					
bromide	ThBr_4	solid	281.01		+70.180
		dil. sol.	351.26		
carbonate	$\text{Th}(\text{CO}_3)_2$		855.20		
chloride	ThCl_4	solid	335.01		+56.63 ^{16°}
		dil. sol.	392.12		
	$\text{ThCl}_4 \cdot 2\text{H}_2\text{O}$	solid	487.70		+41.076
hydroxide (dried ppt.)	$\text{Th}(\text{OH})_4$	ppt.	336.20		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Thorium					
iodide.....	ThI ₄	dil. sol.	291.76	.....	.....
oxide.....	ThO ₂	solid	330.95	.....	.....
sulfate.....	Th(SO ₄) ₂	dil. sol.	661.89	.....	.....
	Th(SO ₄) ₂ ·4H ₂ O.....	solid	930.23	.....	+ 5.02
Tin					
bromide (ic).....	SnBr ₄	solid	95.10	.....	+16.5
		liquid	92.23	.....	.....
bromide (ous).....	SnBr ₂	solid	61.41	.....	- 1.67
chloride (ic).....	SnCl ₄	liquid	127.4	250	+29.917 ^{20°}
chloride (ous).....	SnCl ₂	solid	81.147	300	+ 0.358 ^{18°}
	SnCl ₂ ·2H ₂ O.....	solid	223.7	200	- 5.28 ^{18°}
hydroxide (ous).....	Sn(OH) ₂	colloid	136.37	.....	.....
iodide (ous).....	SnI ₂	solid	35.84	.....	.....
oxide (ic) (fused).....	SnO ₂	solid	138.1	.....	.....
oxide (ous).....	SnO.....	solid	69.77	.....	.....
pot. chloride.....	K ₂ SnCl ₆	solid	360.17	800	- 3.369 ^{12°}
		600	356.80	.....	.....
Titanium					
chloride, tetra.....	TiCl ₄	liquid	183.5	2000	+57.83 ^{18°}
oxide, di.....	TiO ₂	solid	217.4	.....	.....
		amorph.	214.1	.....	.....
Tungsten					
oxide, di.....	WO ₂	solid	126.2	.....	.....
oxide, tri.....	WO ₃	solid	191.4	.....	.....
oxide, penta.....	W ₂ O ₅	solid	311.11	.....	.....
Tungstic acid	H ₂ WO ₄	solid	280.05	.....	.....
		dil. sol.	280.05	.....	.....
Uranium					
oxide, di.....	UO ₂	solid	256.63	.....	.....
oxide, tri.....	UO ₃	solid	290.09	.....	.....
oxide (ous) (ic).....	U ₃ O ₈	solid	845.17	.....	.....
oxide, per.....	UO ₄ ·2H ₂ O.....	solid	439.91	.....	.....
Uranyl					
acetate.....	UO ₂ (C ₂ H ₃ O ₂) ₂	dil. sol.	476.47	.....	.....
	UO ₂ (C ₂ H ₃ O ₂) ₂ ·2H ₂ O.....	solid	617.69	1000	- 4.30 ^{18°}
nitrate.....	UO ₂ (NO ₃) ₂	solid	322.10	220	+18.9 ^{12°}
	UO ₂ (NO ₃) ₂ ·6H ₂ O.....	solid	756.75	220	- 5.448 ^{12°}
sulfate.....	UO ₂ SO ₄	dil. sol.	449.46	.....	.....
	UO ₂ SO ₄ ·3H ₂ O.....	solid	649.94	1000	+ 5.02 ^{18°}
Vanadium					
chloride, di.....	VCl ₂	solid	147.2	.....	.....
chloride, tri.....	VCl ₃	liquid	187.1	.....	.....
chloride, tetra.....	VCl ₄	liquid	162.01	.....	.....
oxide, di.....	V ₂ O ₂	solid	209.08	.....	.....
oxide, tri.....	V ₂ O ₃	solid	349.58	.....	.....
oxide, tetra.....	V ₂ O ₄	solid	409.08	.....	.....
oxide, penta.....	V ₂ O ₅	solid	437.28	.....	.....
oxytrichloride.....	VOCl ₃	liquid	201.2	.....	.....
Water , see <i>hydrogen oxide</i>					
Zinc					
acetate.....	Zn(C ₂ H ₃ O ₂) ₂	solid	261.17	720	+ 9.80 ^{22°}
	Zn(C ₂ H ₃ O ₂) ₂ ·H ₂ O.....	solid	332.62	800	+ 6.93 ^{23°}
	Zn(C ₂ H ₃ O ₂) ₂ ·2H ₂ O.....	solid	403.59	500	+ 4.30 ^{10°}
bromide.....	ZnBr ₂	solid	77.90	.....	+15.03
		400	92.95	.....	.....
carbonate.....	ZnCO ₃	ppt.	193.3	.....	.....
chloride.....	ZnCl ₂	solid	99.547	600	+15.72 ^{18°}
		400	115.27	.....	.....

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Zinc					
cyanide.	$\text{Zn}(\text{CN})_2$	solid	- 16.2		
ethyl.	$\text{ZnC}_4\text{H}_{10}$	liquid	+ 7.41		
fluoride.	ZnF_2	dil. sol.	192.31		
dithionate.	ZnS_2O_6	400	310.87		
	$\text{ZnS}_2\text{O}_6 \cdot 6\text{H}_2\text{O}$	solid	723.54		-2.25
hydroxide.	$\text{Zn}(\text{OH})_2$	solid	158.4		
	$\text{Zn}(\text{OH})_2 \cdot \text{H}_2\text{O}$	amorph	221.87		
	$\text{ZnO} \cdot 2\text{H}_2\text{O}$	solid	252.33		
iodide.	ZnI_2	solid	49.70		+11.7
nitrate.	$\text{Zn}(\text{NO}_3)_2$	400	136.11		
	$\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	solid	552.24	400	-5.854 ^{18°}
oxide (fused)	ZnO	solid	84.35		
selenide.	ZnSe	solid	33.45		
		ppt.	31.30		
silicate.	ZnSiO_3	solid	286.50		
sulfate.	ZnSO_4	solid	229.51	400	+18.54 ^{17°}
		400	248.05		
	$\text{ZnSO}_4 \cdot 6\text{H}_2\text{O}$	solid	659.26	400	-0.836 ^{18°}
	$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$	solid	731.00	400	-4.277 ^{18°}
sulfide.	ZnS	solid	45.88		
telluride.	ZnTe	solid	33.21		
Zirconium					
oxide.	ZrO_2	fused	178.7		

HEAT OF COMBUSTION FOR ORGANIC COMPOUNDS

The heat of combustion is given in kilogram calories per gram molecular weight of the substance when combustion takes place at atmospheric pressure and 20° C. The final products of combustion are gaseous carbon dioxide, liquid water and nitrogen gas for C, H, N compounds. For method of computing heats of formation see statement following this table.

Selections from a compilation by Kharasch, Bureau of Standards Journal of Research 2, 359 (1929).

Name	Formula	Physical state	Heat of combustion, kg. calories
Acetaldehyde.....	CH ₃ CHO.....	liquid	279.0
Acetamide.....	CH ₃ CONH ₂	solid	282.6
Acetanilide.....	CH ₃ CONHC ₆ H ₅	solid	1,010.4
Acetic acid.....	CH ₃ CO ₂ H.....	liquid	209.4
Acetic anhydride.....	(CH ₃ CO) ₂ O.....	liquid	431.9
Acetone.....	(CH ₃) ₂ CO.....	liquid	426.8
Acetonitrile.....	CH ₃ CN.....	liquid	302.4
Acetophenone.....	C ₆ H ₅ COCH ₃	solid	988.9
Acetylacetone.....	CH ₃ COCH ₂ COCH ₃	liquid	615.9
Acetylene.....	(CH) ₂	gas	312.0
Acrolein.....	CH ₂ :CHCHO.....	liquid	389.6
Acrylic acid.....	CH ₂ :CHCO ₂ H.....	liquid	327.5
Adipic acid.....	(CH ₂) ₄ (CO ₂ H) ₂	solid	669.0
Alanine.....	CH ₃ CH(NH ₂)CO ₂ H.....	solid	387.7
Aldol, see <i>β</i> -hydroxybutyr-aldehyde			
Alizarin, see <i>Dihydroxyanthraquinone</i>			
Aliyl alcohol.....	CH ₂ :CHCH ₂ OH.....	liquid	442.4
Allylene.....	CH ₂ C:CH.....	gas	465.1
p-Aminoazobenzene.....	H ₂ NC ₆ H ₄ N ₂ C ₆ H ₅	solid	1,574.0
p-Aminophenol.....	HOC ₆ H ₄ NH ₂	solid	760.0
Amygdalin.....	C ₂₀ H ₂₇ O ₁₁ N.....	solid	2,348.4
Amyl acetate.....	C ₄ H ₉ CO ₂ C ₂ H ₅	liquid	1,042.5
Amyl alcohol (ferm.).....	(CH ₃) ₂ CH ₂ CH ₂ CH ₂ OH.....	liquid	793.7
Amylene.....	C ₆ H ₁₀	liquid	803.4
Anethole.....	C ₁₀ H ₁₂ O.....	solid	1,324.4
Aniline.....	C ₆ H ₅ NH ₂	liquid	811.7
p-Anisidine.....	CH ₃ OC ₆ H ₄ NH ₂	solid	924.0
Anisole.....	C ₆ H ₅ OCH ₃	liquid	905.1
Anthracene.....	C ₆ H ₄ :(CH) ₂ :C ₆ H ₄	solid	1,700.4
Anthraquinone.....	C ₁₄ H ₈ O ₂	solid	1,544.5
Arabinose.....	C ₅ H ₁₀ O ₅	solid	559.9
Arabitol.....	C ₅ H ₁₂ O ₆	solid	661.2
Arachidic acid.....	C ₂₀ H ₄₀ O ₂	solid	3,025.9
Azelaic acid.....	(CH ₂) ₇ (CO ₂ H) ₂	solid	1,141.7
Azobenzene.....	(C ₆ H ₅ N) ₂	solid	1,545.9
Azoxybenzene.....	(C ₆ H ₅ N) ₂ O.....	solid	1,534.5
Behenic acid.....	C ₂₂ H ₄₄ O ₂	solid	3,338.4
Benzalacetone.....	C ₆ H ₅ CH:CHCOCH ₃	solid	1,257.4
Benzaldehyde.....	C ₆ H ₅ CHO.....	liquid	841.3
Benzamide.....	C ₆ H ₅ CONH ₂	solid	847.6
Benzanilide.....	C ₆ H ₅ CONHC ₆ H ₅	solid	1,575.5
Benzene.....	C ₆ H ₆	liquid	782.3
Benzenediazonium nitrate.....	C ₆ H ₅ N ₂ NO ₃	solid	782.6
Benzidine.....	(C ₆ H ₄ NH ₂) ₂	solid	1,560.9
Benzil.....	(C ₆ H ₅ CO) ₂	solid	1,624.6
■ Benzoic acid.....	C ₆ H ₅ CO ₂ H.....	solid	771.2
Benzoic anhydride.....	(C ₆ H ₅ CO) ₂ O.....	solid	1,555.1
Benzooin.....	C ₆ H ₅ .CHOH.COC ₆ H ₅	solid	1,671.4
Benzonitrile.....	C ₆ H ₅ CN.....	liquid	865.5
Benzophenone.....	(C ₆ H ₅) ₂ CO.....	solid	1,556.5

■ Accepted value by Int. Union of Pure and Appld. Chem., Lyons, 1923

HEAT OF COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion, kg. calories
Benzoyl chloride.....	C_6H_5COCl	liquid	782.8
Benzoyl peroxide.....	$(C_6H_5CO)_2O_2$	solid	1,551.7
Benzyl alcohol.....	$C_6H_5CH_2OH$	liquid	894.3
Benzylamine.....	$C_6H_5CH_2NH_2$	liquid	969.4
Benzyl carbylamine.....	$C_6H_5CH_2NC$	liquid	1,046.5
Benzyl chloride.....	$C_6H_5CH_2Cl$	liquid	886.4
Benzyl cyanide.....	$C_6H_5CH_2CN$	liquid	1,023.5
Borneol.....	$C_{10}H_{18}O$	liquid	1,469.6
Brucine.....	$C_{23}H_{26}O_4N_2$	solid	2,933.0
n-Butyl alcohol.....	C_4H_9OH	liquid	638.6
tert.-Butyl alcohol, see Trimethyl carbinol			
n-Butylamine.....	$C_4H_9NH_2$	liquid	710.6
sec.-Butylamine.....	$(CH_3)(C_2H_5)CHNH_2$	liquid	713.0
tert.-Butylamine.....	$(CH_3)_3CNH_2$	liquid	716.0
tert.-Butylbenzene.....	$C_6H_5C(CH_3)_3$	liquid	1,400.4
n-Butyramide.....	$C_3H_7CONH_2$	solid	596.0
n-Butyric acid.....	$C_3H_7CO_2H$	liquid	524.3
n-Butyronitrile.....	C_3H_7CN	liquid	613.3
Caffeine.....	$C_8H_{10}O_2N_4$	solid	1,014.2
Camphene.....	$C_{10}H_{16}$	solid	1,468.8
Camphor.....	$C_{10}H_{16}O$	solid	1,411.0
Cane sugar, see Sucrose			
Capric acid.....	$C_9H_{18}O_2$	solid	1,458.1
Caproic acid.....	$C_5H_{11}CO_2H$	liquid	831.0
Carbon disulfide.....	CS_2	liquid	246.6
Carbon subnitride.....	$(C.CN)_2$	solid	514.8
Carbon tetrachloride.....	CCl_4	liquid	37.3
Carbonyl sulfide.....	COS	gas	130.5
Carvacrol.....	$C_{10}H_{14}O$	liquid	1,354.5
Cetyl alcohol.....	$C_{16}H_{34}O$	solid	2,504.5
Cetyl palmitate.....	$C_{32}H_{64}O_2$	solid	4,872.8
Chloroacetic acid.....	$ClCH_2CO_2H$	solid	171.0
o-Chlorobenzoic acid.....	$ClC_6H_4CO_2H$	solid	734.5
Chloroform.....	$CHCl_3$	liquid	89.2
Chrysene.....	$C_{14}H_{10}$	solid	2,139.1
Cinnamic acid (trans).....	$C_6H_5CH:CHCO_2H$	solid	1,040.2
Cinnamic aldehyde.....	$C_6H_5CH:CHCHO$	liquid	1,112.3
Cinnamic anhydride.....	$C_{18}H_{14}O_3$	solid	2,091.3
d-Citrene.....	$C_{10}H_{16}$	liquid	1,473.0
Citric acid (anhydr.).....	$C_6H_8O_7$	solid	474.5
Codeine.....	$C_{18}H_{21}O_3N.H_2O$	solid	2,327.6
Coniine.....	$C_8H_{17}N$	liquid	1,275.5
Creatine (anhydr.).....	$C_4H_9O_2N_3$	solid	559.8
Creatinine.....	$C_4H_7ON_3$	solid	563.4
o-Cresol.....	$CH_3C_6H_4OH$	liquid	882.6
o-Cresol.....	$CH_3C_6H_4OH$	solid	879.5
m-Cresol.....	$CH_3C_6H_4OH$	liquid	880.5
p-Cresol.....	$CH_3C_6H_4OH$	liquid	882.5
p-Cresol.....	$CH_3C_6H_4OH$	solid	880.0
m-Cresolmethyl ether.....	$CH_3C_6H_4OCH_3$	liquid	1,057.0
Crotonaldehyde.....	C_3H_5CHO	liquid	542.1
Cyanoacetic acid.....	$NCCH_2CO_2H$	solid	298.8
Cyanogen.....	$(CN)_2$	gas	258.3
Cycloheptanol.....	$CH_2(CH_2)_5CHOH$	liquid	1,050.2
Cyclohexanol.....	$CH_2(CH_2)_4CHOH$	liquid	890.7
Cycloheptene.....	C_7H_{12}	liquid	1,049.9
Cycloheptane.....	$(CH_2)_7$	liquid	1,087.3

HEAT OF COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion, kg. calories
Cyclohexane.....	(CH ₂) ₆	liquid	937.8
Cyclohexene, <i>see Tetrahydrobenzene</i>			
Cyclopentane.....	(CH ₂) ₅	liquid	783.6
Cyclopropane, <i>see Trimethylene</i>			
Cymene.....	C ₆ H ₄ (CH ₃)(CH ₃ CHCH ₃)— (1, 4)	liquid	1,402.8
Decahydronaphthalene (<i>cis</i>)	C ₁₀ H ₁₈	liquid	1,502.5
Decahydronaphthalene..... (<i>trans</i>)	C ₁₀ H ₁₈	liquid	1,499.5
Decane.....	C ₁₀ H ₂₂	liquid	1,610.2
Dextrose, <i>see Glucose</i>			
Diallyl.....	(CH ₃ CH:CH ₂) ₂	vapor	903.4
Diamyl ether.....	(C ₅ H ₁₁) ₂ O.....	liquid	1,609.3
Diamylene.....	C ₁₀ H ₂₀	liquid	1,582.2
Dibenzyl.....	(C ₆ H ₅ CH ₂) ₂	solid	1,810.6
Dibenzyl amine.....	(C ₆ H ₅ CH ₂) ₂ NH.....	solid	1,853.0
<i>o</i> -Dichlorobenzene.....	C ₆ H ₄ Cl ₂	liquid	671.8
Diethylacetic acid.....	(C ₂ H ₅) ₂ CHCO ₂ H.....	liquid	830.8
Diethyl amine.....	(C ₂ H ₅) ₂ NH.....	liquid	716.9
Diethylaniline.....	C ₆ H ₅ N(C ₂ H ₅) ₂	liquid	1,451.6
Diethyl carbonate.....	CO(OC ₂ H ₅) ₂	liquid	647.9
Diethyl ether.....	(C ₂ H ₅) ₂ O.....	liquid	651.7
Diethyl ketone.....	(C ₂ H ₅) ₂ CO.....	liquid	735.6
Diethyl malonate.....	H ₂ (CO ₂ C ₂ H ₅) ₂	liquid	860.4
Diethyl oxalate.....	(CO ₂ C ₂ H ₅) ₂	liquid	716.0
Diethyl succinate.....	(CH ₂ CO ₂ C ₂ H ₅) ₂	liquid	1,007.3
Dihydrobenzene.....	C ₆ H ₆	liquid	847.8
Δ -1-Dihydronaphthalene.....	C ₁₀ H ₁₀	liquid	1,296.3
Δ -1-Dihydronaphthalene.....	C ₁₀ H ₁₀	solid	1,298.3
Dihydroxyanthraquinone.....	C ₁₄ H ₈ O ₂ (OH) ₂ —(1, 2).....	solid	1,448.9
Diisobutyl.....	[(CH ₃) ₂ CHCH ₂ CH ₂] ₂	liquid	1,615.8
Diisobutylene.....	[(CH ₃) ₂ CHCH ₂] ₂	liquid	1,252.4
Diisopropyl.....	[(CH ₃) ₂ CH] ₂	vapor	993.9
Diisopropyl ketone.....	[(CH ₃) ₂ CH] ₂ CO.....	liquid	1,045.5
Dimethyl amine.....	(CH ₃) ₂ NH.....	liquid	416.7
Dimethylaniline.....	C ₆ H ₅ N(CH ₃) ₂	liquid	1,142.7
Dimethyl carbonate.....	CO(OCH ₃) ₂	liquid	340.8
Dimethyl ether.....	(CH ₃) ₂ O.....	gas	347.6
Dimethylethyl carbinol.....	C ₂ H ₅ (CH ₃) ₂ CHOH.....	liquid	784.6
Dimethyl fumarate.....	(CHCO ₂ CH ₃) ₂	solid	664.3
2, 5-Dimethylhexane.....	(CH ₃) ₂ CH.C ₂ H ₄ .CH(CH ₃).....	liquid	1,303.3
3, 4-Dimethylhexane.....	[(C ₂ H ₅)(CH ₃)CH] ₂	liquid	1,303.7
Dimethyl maleate.....	(CHCO ₂ CH ₃) ₂	solid	669.2
Dimethyl oxalate.....	(CO ₂ CH ₃) ₂	solid	401.9
2, 2-Dimethylpentane.....	(CH ₃) ₃ C.C ₃ H ₇	liquid	1,148.9
2, 3-Dimethylpentane.....	(CH ₃) ₂ CHCH(CH ₃)C ₂ H ₅	liquid	1,148.9
2, 4-Dimethylpentane.....	(CH ₃) ₂ CHCH ₂ CH(CH ₃) ₂	liquid	1,148.9
3, 3-Dimethylpentane.....	(CH ₃) ₃ C(C ₂ H ₅) ₂	liquid	1,147.9
Dimethyl phthalate.....	C ₆ H ₄ (CO ₂ CH ₃) ₂	liquid	1,119.7
Dimethyl succinate.....	(CH ₂ CO ₂ CH ₃) ₂	solid	703.3
<i>m</i> -Dinitrobenzene.....	C ₆ H ₄ (NO ₂) ₂	solid	696.8
Dinitrophenol.....	C ₆ H ₃ (OH)(NO ₂) ₂ —(1, 2, 4).....	solid	648.0
Dinitrotoluene.....	C ₆ H ₃ (CH ₃)(NO ₂) ₂ —(1, 2, 4).....	solid	852.8
Diphenyl.....	(C ₆ H ₅) ₂	solid	1,493.6
Diphenyl amine.....	(C ₆ H ₅) ₂ NH.....	solid	1,536.2
Diphenyl carbinol.....	(C ₆ H ₅) ₂ CHOH.....	solid	1,615.4
Diphenylmethane.....	(C ₆ H ₅) ₂ CH ₂	solid	1,655.0
Diphenylnitrosamine.....	(C ₆ H ₅) ₂ N.NO.....	solid	1,532.6

HEAT OF COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion, kg. calories
Dipropargyl.....	$(\text{CH} \equiv \text{C} \cdot \text{CH}_2)_2$	vapor	882.9
Dipropyl ketone.....	$(\text{C}_3\text{H}_7)_2\text{CO}$	liquid	1,050.5
Dulcitol.....	$\text{C}_6\text{H}_{14}\text{O}_6$	solid	729.1
Durene.....	$\text{C}_6\text{H}_2(\text{CH}_3)_4$ —(1, 2, 4, 5)	solid	1,393.6
Eicosane.....	$\text{C}_{20}\text{H}_{42}$	solid	3,183.1
Erythritol.....	$\text{C}_4\text{H}_{10}\text{O}_4$	solid	504.1
Ethane.....	C_2H_6	gas	368.4
Ethine, <i>see Acetylene</i>			
Ethyl acetate.....	$\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$	liquid	536.9
Ethyl acetoacetate.....	$\text{CH}_3\text{COCH}_2\text{CO}_2\text{C}_2\text{H}_5$	liquid	690.8
Ethyl alcohol.....	$\text{C}_2\text{H}_5\text{OH}$	liquid	327.6
Ethyl amine.....	$\text{C}_2\text{H}_5\text{NH}_2$	liquid	408.5
Ethylaniline.....	$\text{C}_6\text{H}_5\text{NHC}_2\text{H}_5$	liquid	1,121.5
Ethylbenzene.....	$\text{C}_2\text{H}_5\text{C}_6\text{H}_5$	liquid	1,091.2
Ethyl benzoate.....	$\text{C}_6\text{H}_5\text{CO}_2\text{C}_2\text{H}_5$	liquid	1,098.7
Ethyl bromide.....	$\text{C}_2\text{H}_5\text{Br}$	vapor	340.5
Ethyl <i>n</i> -butyrate.....	$\text{C}_5\text{H}_7\text{CO}_2\text{C}_2\text{H}_5$	liquid	851.2
Ethyl carbylamine.....	$\text{C}_2\text{H}_5\text{NC}$	liquid	477.1
Ethyl chloride.....	$\text{C}_2\text{H}_5\text{Cl}$	vapor	316.7
Ethylcycloheptane.....	$\text{C}_2\text{H}_5\text{C}_7\text{H}_{13}$	liquid	1,406.8
Ethyl formate.....	$\text{HCO}_2\text{C}_2\text{H}_5$	liquid	391.7
3-Ethylhexane.....	$(\text{C}_2\text{H}_5)_2\text{CH} \cdot \text{C}_3\text{H}_7$	liquid	1,302.3
Ethyl iodide.....	$\text{C}_2\text{H}_5\text{I}$	liquid	356.0
Ethyl isobutyrate.....	$(\text{CH}_3)_2\text{CHCH}_2\text{CO}_2\text{C}_2\text{H}_5$	liquid	845.7
Ethyl isocyanate.....	$\text{C}_2\text{H}_5\text{NCO}$	liquid	424.5
Ethyl nitrate.....	$\text{C}_2\text{H}_5\text{ONO}_2$	vapor	322.4
Ethyl nitrite.....	$\text{C}_2\text{H}_5\text{ONO}$	vapor	332.6
3-Ethylpentane.....	$(\text{C}_2\text{H}_5)_3\text{CH}$	liquid	1,149.9
Ethyl propionate.....	$\text{C}_2\text{H}_5\text{CO}_2\text{C}_2\text{H}_5$	liquid	690.8
Ethyl salicylate.....	$\text{HOC}_6\text{H}_4\text{CO}_2\text{C}_2\text{H}_5$	liquid	1,051.2
Ethyl valerate.....	$\text{C}_4\text{H}_9\text{CO}_2\text{C}_2\text{H}_5$	liquid	1,017.5
Ethylene.....	$\text{CH}_2 \cdot \text{CH}_2$	gas	331.6
Ethylene chloride.....	$(\text{CH}_2\text{Cl})_2$	vapor	271.0
Ethylene diamine.....	$(\text{CH}_2\text{NH}_2)_2$	liquid	452.6
Ethylene glycol.....	$(\text{CH}_2\text{OH})_2$	liquid	281.9
Ethylene iodide.....	$(\text{CH}_2\text{I})_2$	solid	324.8
Ethylene oxide.....	$\text{CH}_2\text{CH}_2\text{O}$	liquid	302.1
Ethylidene chloride.....	CH_3CHCl_2	liquid	267.1
Eugenol.....	$\text{C}_{10}\text{H}_{12}\text{O}_2$	liquid	1,286.6
Fenchane.....	$\text{C}_{10}\text{H}_{18}$	liquid	1,502.6
Fluorene.....	$(\text{C}_6\text{H}_4)_2 \cdot \text{CH}_2$	solid	1,584.9
Fluorobenzene.....	$\text{C}_6\text{H}_5\text{F}$	liquid	747.2
Formaldehyde.....	CH_2O	gas	134.1
Formamide.....	HCONH_2	solid	134.9
Formic acid.....	HCO_2H	liquid	62.8
<i>l</i> -Fructose.....	$\text{C}_6\text{H}_{12}\text{O}_6$	solid	675.6
Fumaric acid (<i>trans</i>).....	$(\text{CHCO}_2\text{H})_2$	solid	320.0
Furfural.....	$\text{C}_4\text{H}_3\text{OCHO}$	liquid	559.5
Galactose.....	$\text{C}_6\text{H}_{12}\text{O}_6$	solid	670.7
Gallic acid.....	$\text{C}_6\text{H}_2(\text{OH})_3\text{CO}_2\text{H}$ —(1, 3, 5, 6)	solid	633.7
<i>d</i> -Glucose.....	$\text{C}_6\text{H}_{12}\text{O}_6$	solid	673.0
Glutaric acid.....	$(\text{CH}_2)_3(\text{CO}_2\text{H})_2$	solid	514.9
Glycerol.....	$(\text{CH}_2\text{OH})_2\text{CHOH}$	liquid	397.0
Glyceryl tributyratc.....	$\text{C}_{15}\text{H}_{26}\text{O}_6$	liquid	1,941.1
Glycine.....	$\text{H}_2\text{NCH}_2\text{CO}_2\text{H}$	solid	234.5
Glycogen.....	$(\text{C}_6\text{H}_{10}\text{O}_5)_x$ per kg	solid	4,186.8
Glycollic acid.....	$\text{CH}_2\text{OHCO}_2\text{H}$	solid	166.6
Glycylglycine.....	$\text{C}_4\text{H}_8\text{O}_3\text{N}_2$	solid	470.7

HEAT OF COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion, kg. calories
<i>n</i> -Heptaldehyde.....	$\text{CH}_3(\text{CH}_2)_5\text{CHO}$	liquid	1,062.4
<i>n</i> -Heptane.....	C_7H_{16}	liquid	1,149.9
Heptene-1.....	$\text{CH}_2\text{C}(\text{CH}_2)_4\text{CH}_3$	liquid	1,091.2
<i>n</i> -Heptyl alcohol.....	$\text{CH}_3(\text{CH}_2)_5\text{CH}_2\text{OH}$	liquid	1,104.9
Heptyl amine.....	$\text{C}_7\text{H}_{15}\text{NH}_2$	liquid	1,178.9
Heptylio acid.....	$\text{C}_7\text{H}_{14}\text{O}_2$	liquid	986.1
<i>n</i> -Hexane.....	C_6H_{14}	liquid	989.8
Hexachlorbenzene.....	C_6Cl_6	solid	509.0
Hexachlorethane.....	C_2Cl_6	solid	110.0
Hexadecane.....	$\text{C}_{16}\text{H}_{34}$	solid	2,559.1
Hexahydronaphthalene.....	$\text{C}_{10}\text{H}_{14}$	liquid	1,419.3
Hexamethylbenzene.....	$\text{C}_6(\text{CH}_3)_6$	solid	1,711.9
Hexamethylenetetramine.....	$(\text{CH}_2)_6\text{N}_4$	solid	1,006.7
Hexamethylethane.....	$[(\text{CH}_3)_3\text{C}]_2$	solid	1,301.8
Hexyl amine.....	$\text{C}_6\text{H}_{13}\text{NH}_2$	liquid	1,022.2
Hexylene.....	C_6H_{12}	liquid	952.6
Hippuric acid.....	$\text{C}_6\text{H}_5\text{CONHCH}_2\text{CO}_2\text{H}$	solid	1,012.4
Hydantoic acid.....	$\text{C}_3\text{H}_5\text{O}_2\text{N}_2$	solid	308.6
Hydrazobenzene.....	$(\text{C}_6\text{H}_5\text{NH})_2$	solid	1,597.3
Hydroquinol.....	$\text{C}_6\text{H}_4(\text{OH})_2$	solid	683.7
Hydroquinoldimethyl ether.....	$(\text{CH}_3\text{O})_2\text{C}_6\text{H}_4$	solid	1,014.7
<i>p</i> -Hydroxyazobenzene.....	$\text{HOC}_6\text{H}_4\text{N}_2\text{C}_6\text{H}_5$	solid	1,502.0
<i>o</i> -Hydroxybenzaldehyde.....	$\text{C}_6\text{H}_4(\text{OH})\text{CHO}$	liquid	796.0
<i>m</i> -Hydroxybenzaldehyde.....	$\text{C}_6\text{H}_4(\text{OH})\text{CHO}$	solid	788.7
<i>p</i> -Hydroxybenzaldehyde.....	$\text{C}_6\text{H}_4(\text{OH})\text{CHO}$	solid	792.7
<i>m</i> -Hydroxybenzoic acid.....	$\text{HOC}_6\text{H}_4\text{CO}_2\text{H}$	solid	726.1
<i>p</i> -Hydroxybenzoic acid.....	$\text{HOC}_6\text{H}_4\text{CO}_2\text{H}$	solid	725.4
β -Hydroxybutyraldehyde.....	$\text{CH}_3\text{CHOHCH}_2\text{CHO}$	liquid	546.6
Indigo.....	$\text{C}_{16}\text{H}_{10}\text{O}_2\text{N}_2$	solid	1,815.0
Indole.....	$\text{C}_8\text{H}_7\text{N}$	solid	1,022.2
Inositol.....	$\text{C}_6\text{H}_{12}\text{O}_6$	solid	662.1
Iodoform.....	CHI_3	solid	161.9
Isoamyl amine.....	$(\text{CH}_3)_2\text{CHC}_2\text{H}_4\text{NH}_2$	liquid	866.8
Isobutane.....	$(\text{CH}_3)_3\text{CH}$	gas	683.4
Isobutyl alcohol.....	$(\text{CH}_3)_2\text{CH}_2\text{CH}_2\text{OH}$	liquid	638.2
Isobutyl amine.....	$\text{C}_4\text{H}_9\text{NH}_2$	liquid	713.6
Isobutylene.....	$(\text{CH}_3)_2\text{C}:\text{CH}_2$	gas	647.2
Isobutyraldehyde.....	$(\text{CH}_3)_2\text{CHCHO}$	vapor	596.8
Isobutyramide.....	$(\text{CH}_3)_2\text{CHCONH}_2$	solid	595.9
Isobutyric acid.....	$(\text{CH}_3)_2\text{CHCO}_2\text{H}$	liquid	517.4
Isoeugenol.....	$\text{C}_{10}\text{H}_{12}\text{O}_2$	liquid	1,277.6
Isopentane.....	C_5H_{12}	gas	843.5(?)
Isopentane.....	C_5H_{12}	liquid	838.3(?)
Isophthalic acid.....	$\text{C}_6\text{H}_4(\text{CO}_2\text{H})_2$	solid	768.3
Isopropyl alcohol.....	$(\text{CH}_3)_2\text{CHOH}$	liquid	474.8
Isopropylbenzene.....	$(\text{CH}_3)_2\text{CHC}_6\text{H}_5$	liquid	1,247.3
Isopropyltoluene.....	$\text{C}_6\text{H}_4(\text{CH}_3)(\text{CH}_3\text{CHCH}_3)-$ (1, 3)	liquid	1,409.5
Isopropyltoluene, see <i>Cymene</i>			
Isosafrole.....	$\text{C}_{10}\text{H}_{10}\text{O}_2$	liquid	1,233.9
Lactic acid.....	$\text{CH}_3\text{CHOHCO}_2\text{H}$	liquid	326.0
Lactose (anhydr.).....	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	solid	1,350.8
Lauric acid.....	$\text{C}_{12}\text{H}_{24}\text{O}_2$	solid	1,771.7
Leucine.....	$\text{C}_6\text{H}_{13}\text{O}_2\text{N}$	solid	855.6
<i>d</i> -Limonene.....	$\text{C}_{10}\text{H}_{16}$	liquid	1,471.2
Maleic acid (<i>cis</i>).....	$(\text{CHCO}_2\text{H})_2$	solid	326.1
Maleic anhydride.....	$(\text{CHCO})_2\text{O}$	solid	333.9
<i>l</i> -Malic acid.....	$(\text{CHOHCH}_2)_2(\text{CO}_2\text{H})_2$	solid	320.1

HEAT OF COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion kg. calories
Malonic acid.....	$\text{CH}_2(\text{CO}_2\text{H})_2$	solid	207.2
Maltose.....	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	solid	1,350.2
Mandelic acid.....	$\text{C}_6\text{H}_5\text{CHOHCO}_2\text{H}$	solid	890.3
d-Mannitol.....	$\text{C}_6\text{H}_{14}\text{O}_6$	solid	727.6
Menthene.....	$\text{C}_{10}\text{H}_{18}$	liquid	1,523.2
Menthol.....	$\text{C}_{10}\text{H}_{20}\text{O}$	solid	1,508.8
Mesitylene.....	$(\text{CH}_3)_3\text{C}_6\text{H}_3-(1, 3, 5)$	liquid	1,243.6
Mesityl oxide.....	$(\text{CH}_3)_2\text{C}:\text{CHCOCH}_3$	liquid	846.7
Mesotartaric acid.....	$(\text{CHOH})_2(\text{CO}_2\text{H})_2$	solid	276.0
Methane.....	CH_4	gas	210.8
Methyl acetate.....	$\text{CH}_3\text{CO}_2\text{CH}_3$	liquid	381.2
Methyl alcohol.....	CH_3OH	liquid	170.9
Methyl amine.....	CH_3NH_2	liquid	256.1
Methylaniline.....	$\text{C}_6\text{H}_5\text{NHCH}_3$	liquid	973.5
Methyl benzoate.....	$\text{C}_6\text{H}_5\text{CO}_2\text{CH}_3$	liquid	943.5
Methyl bromide.....	CH_3Br	vapor	184.0
Methyl butyl ketone.....	$\text{CH}_3\text{COC}_4\text{H}_9$	liquid	895.2
Methyl <i>tert</i> -butyl ketone, <i>see</i> Pinacolone			
Methyl butyrate.....	$\text{C}_3\text{H}_7\text{COC}_2\text{H}_5$	liquid	692.8
Methyl carbylamine.....	CH_3NC	liquid	320.1
Methyl chloride.....	CH_3Cl	gas	164.2
Methyl cinnamate.....	$\text{C}_{10}\text{H}_{10}\text{O}_2$	solid	1,213.0
Methylcyclobutane.....	$\text{CH}_3\text{CHCH}_2\text{CH}_2\text{CH}_3$	liquid	784.2
Methylcycloheptane.....	$\text{CH}_3\text{C}_7\text{H}_{13}$	liquid	1,244.5
Methylcyclohexane.....	$\text{CH}_3\text{C}_6\text{H}_{11}$	liquid	1,091.8
Methylcyclopentane.....	$\text{CH}_3\text{CH}_2\text{C}_4\text{H}_9$	liquid	937.9
Methyldiethyl carbinol.....	$\text{CH}_3(\text{C}_2\text{H}_5)_2\text{CHOH}$	liquid	927.0
Methylene chloride.....	CH_2Cl_2	vapor	106.8
Methylene iodide.....	CH_2I_2	liquid	178.4
Methylethyl ether.....	$\text{CH}_3\text{OC}_2\text{H}_5$	vapor	503.4
Methylethyl ketone.....	$\text{CH}_3\text{COC}_2\text{H}_5$	liquid	582.3
Methyl formate.....	HCO_2CH_3	liquid	233.1
2-Methylheptane.....	$(\text{CH}_3)_2\text{CH.C}_5\text{H}_{11}$	liquid	1,306.1
2-Methylhexane.....	$(\text{CH}_3)_2\text{CHC}_4\text{H}_9$	liquid	1,148.9
3-Methylhexane.....	$(\text{C}_2\text{H}_5)(\text{CH}_3)\text{CHC}_3\text{H}_7$	liquid	1,148.9
Methylhexyl ketone.....	$\text{CH}_3\text{COC}_6\text{H}_{13}$	liquid	1,205.1
Methyl iodide.....	CH_3I	liquid	194.7
Methyl isobutyrate.....	$(\text{CH}_3)_2\text{CHCO}_2\text{CH}_3$	liquid	694.2
Methyl isocyanate.....	CH_3NCO	liquid	269.4
Methylisopropyl ketone.....	$\text{CH}_3\text{COCH}(\text{CH}_3)_2$	liquid	733.9
Methyl lactate.....	$\text{CH}_3\text{CHOHCO}_2\text{CH}_3$	liquid	497.2
Methyl propionate.....	$\text{C}_2\text{H}_5\text{CO}_2\text{CH}_3$	vapor	552.3
Methylpropyl ketone.....	$\text{CH}_3\text{COC}_3\text{H}_7$	liquid	735.6
Methyl salicylate.....	$\text{HOC}_6\text{H}_4\text{CO}_2\text{CH}_3$	liquid	898.3
Milk sugar, <i>see</i> Lactose			
Morphine.....	$\text{C}_{17}\text{H}_{19}\text{O}_3\text{N.H}_2\text{O}$	solid	2,146.3
Mucic acid.....	$\text{C}_6\text{H}_{10}\text{O}_8$	solid	483.6
Myristic acid.....	$\text{C}_{14}\text{H}_{25}\text{O}_2$	solid	2,085.8
Naphthalene.....	C_{10}H_8	solid	1,232.5
α -Naphthoic acid.....	$\text{C}_{10}\text{H}_7\text{CO}_2\text{H}$	solid	1,231.8
β -Naphthoic acid.....	$\text{C}_{10}\text{H}_7\text{CO}_2\text{H}$	solid	1,227.6
α -Naphthol.....	$\text{C}_{10}\text{H}_7\text{OH}$	solid	1,185.4
β -Naphthol.....	$\text{C}_{10}\text{H}_7\text{OH}$	solid	1,187.2
α -Naphthonitrile.....	$\text{C}_{10}\text{H}_7\text{CN}$	solid	1,326.2
β -Naphthonitrile.....	$\text{C}_{10}\text{H}_7\text{CN}$	solid	1,321.0
α -Naphthoquinone.....	$\text{C}_{10}\text{H}_6\text{O}_2$	solid	1,100.8
β -Naphthoquinone.....	$\text{C}_{10}\text{H}_6\text{O}_2$	solid	1,106.4
α -Naphthyl amine.....	$\text{C}_{10}\text{H}_7\text{NH}_2$	solid	1,263.5

HEAT OF COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion, kg. calories
β -Naphthyl amine.....	$C_{10}H_7NH_2$	solid	1,261.0
Narceine.....	$C_{23}H_{27}O_8N \cdot 2H_2O$	solid	2,802.9
Narcotine.....	$C_{22}H_{23}O_7N$	solid	2,644.5
Nicotine.....	$C_{10}H_{14}N_2$	liquid	1,427.7
<i>o</i> -Nitraniiline.....	$C_6H_4(NH_2)(NO_2)$	solid	765.8
<i>m</i> -Nitraniiline.....	$C_6H_4(NH_2)(NO_2)$	solid	765.2
<i>p</i> -Nitraniiline.....	$C_6H_4(NH_2)(NO_2)$	solid	761.0
<i>m</i> -Nitrobenzaldehyde.....	$O_2NC_6H_4CHO$	solid	800.4
Nitrobenzene.....	$C_6H_5NO_2$	liquid	739.2
<i>m</i> -Nitrobenzoic acid.....	$O_2NC_6H_4CO_2H$	solid	729.1
Nitroethane.....	$C_2H_5NO_2$	liquid	322.2
<i>Nitroglycerine, see Trinitroglycerol</i>			
Nitromethane.....	CH_3NO_2	liquid	169.4
<i>o</i> -Nitrophenol.....	$HOC_6H_4NO_2$	solid	689.1
<i>m</i> -Nitrophenol.....	$HOC_6H_4NO_2$	solid	684.4
<i>p</i> -Nitrophenol.....	$HOC_6H_4NO_2$	solid	688.8
Nitropropane.....	$C_3H_7NO_2$	liquid	477.9
<i>o</i> -Nitrotoluene.....	$CH_3C_6H_4NO_2$	liquid	897.0
<i>p</i> -Nitrotoluene.....	$CH_3C_6H_4NO_2$	solid	888.6
Octahydronaphthalene.....	$C_{10}H_{16}$	liquid	1,461.7
<i>n</i> -Octane.....	C_8H_{18}	liquid	1,302.7
Octyl alcohol.....	$C_8H_{18}O$	liquid	1,262.0
Oleic acid.....	$C_{18}H_{34}O_2$	liquid	2,657.0
Oxalic acid.....	$(CO_2H)_2$	solid	60.2
Oxamide.....	$(CONH_2)_2$	solid	203.2
Palmitic acid.....	$C_{16}H_{32}O_2$	solid	2,398.4
Papaverine.....	$C_{20}H_{21}O_4N$	solid	2,478.1
Pentamethylbenzene.....	$C_5H(CH_3)_5$	solid	1,554.0
<i>n</i> -Pentane.....	C_5H_{12}	gas	838.3
<i>np</i> -Pentane.....	C_5H_{12}	liquid	833.4
Phenacetin.....	$C_{10}H_{13}O_2N$	solid	1,285.2
Phenanthraquinone.....	$C_{14}H_8O_2$	solid	1,544.0
Phenanthrene.....	$C_{14}H_{10}$	solid	1,692.5
Phenetole.....	$C_6H_5OC_2H_5$	liquid	1,060.3
Phenol.....	C_6H_5OH	solid	732.2
Phenylacetic acid.....	$C_6H_5CH_2CO_2H$	solid	930.2
Phenylacetylene.....	$C_6H_5C \equiv CH$	liquid	1,024.2
Phenylalanine.....	$C_9H_{11}O_2N$	solid	1,111.3
<i>p</i> -Phenylenediamine.....	$C_6H_4(NH_2)_2$	solid	843.4
<i>Phenylethylene, see Styrene</i>			
Phenylglycine.....	$C_2H_5NHCH_2CO_2H$	solid	955.1
Phenylhydrazine.....	$C_6H_5N_2H_3$	solid	875.4
Phenylhydroxylamine.....	C_6H_5NHOH	liquid	803.7
Phenyl iodide.....	C_6H_5I	liquid	770.7
Phloroglucinol.....	$C_6H_3(OH)_3$	solid	635.7
Phthalic acid.....	$C_6H_4(CO_2H)_2$	solid	771.0
Phthalic anhydride.....	$C_6H_4(CO)_2O$	solid	783.4
Phthalimide.....	$C_8H_5O_2N$	solid	849.5
Picric acid.....	$C_6H_2(OH)(NO_2)_3$ —(1, 2, 4, 6).....	solid	611.8
Pinacolone.....	$CH_3COC(CH_3)_3$	solid	891.8
Piperidine.....	$C_5H_{11}N$	liquid	826.6
Piperonal.....	$C_8H_6O_3$	solid	870.7
Propene.....	C_3H_6	gas	526.3
<i>Propine, see Allene</i>			
Propionaldehyde.....	C_2H_5CHO	liquid	434.2
Propionamide.....	$C_2H_5CONH_2$	solid	439.9
Propionic acid.....	$C_2H_5CO_2H$	liquid	367.2
Propionic anhydride.....	$(C_2H_5CO)_2O$	liquid	746.6

HEAT OF COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion, kg. calories
Propionitrile.....	C_2H_5CN	liquid	456.4
<i>n</i> -Propyl alcohol.....	C_3H_7OH	liquid	480.5
Propyl amine.....	$C_3H_7NH_2$	liquid	558.3
<i>n</i> -Propylbenzene.....	$C_3H_7C_6H_5$	liquid	1,246.4
Propyl bromide.....	C_3H_7Br	vapor	497.3
Propyl carbylamine.....	C_3H_7NC	liquid	639.6
Propyl chloride.....	C_3H_7Cl	vapor	478.3
Propylene.....	$CH_3CH:CH_2$	gas	490.2
Propylene glycol.....	$CH_3CHOHCH_2OH$	liquid	431.0
<i>n</i> -Propyl iodide.....	C_3H_7I	liquid	514.3
<i>n</i> -Propyltoluene.....	$C_6H_4(CH_3)(C_3H_7)-(1, 3)$	liquid	1,405.4
Pseudocumene.....	$C_6H_3(CH_3)_3-(1, 2, 4)$	liquid	1,241.7
Pyridine.....	C_5H_5N	liquid	658.5
Pyrocatechol.....	$C_6H_4(OH)_2$	solid	684.8
Pyrogallol.....	$C_6H_3(OH)_3$	solid	638.7
Pyrrrole.....	C_4H_5N	liquid	567.7
Quercitol.....	$C_6H_{12}O_6$	solid	704.2
Quinoline.....	C_9H_7N	liquid	1,123.5
Quinone.....	$O:C_6H_4:O$	solid	656.6
Raffinose.....	$C_{18}H_{32}O_{16}$	solid	2,025.5
Retene.....	$C_{18}H_{18}$	solid	2,306.8
Resorcinol.....	$C_6H_4(OH)_2$	solid	683.0
Resorcinoldimethyl ether...	$(CH_3O)_2C_6H_4$	liquid	1,022.6
Rhamnose.....	$C_6H_{12}O_6$	solid	718.3
Safrole.....	$C_{10}H_{10}O_2$	liquid	1,244.1
Salicylaldehyde, <i>see o</i> -Hydroxybenzaldehyde			
* Salicylic acid.....	$HOC_6H_4CO_2H-(1, 2)$	solid	723.1
Sarcosine.....	$CH_3NHCH_2CO_2H$	solid	401.1
Sebacic acid.....	$(CH_2)_8(CO_2H)_2$	solid	1,297.3
Skatole.....	C_9H_9N	liquid	1,170.5
<i>d</i> -Sorbitose.....	$C_6H_{12}O_6$	solid	668.3
Starch.....	$(C_6H_{10}O_5)_x$ per kg	solid	4,178.8
Stearic acid.....	$C_{18}H_{36}O_2$	solid	2,711.8
Strychnine.....	$C_{21}H_{22}O_2N_2$	solid	2,685.7
Styrene.....	$C_6H_5CH:CH_2$	liquid	1,047.1
Suberic acid.....	$(CH_2)_6(CO_2H)_2$	solid	985.2
Succinic acid.....	$(CH_2CO_2H)_2$	solid	357.1
Succinic acid nitrile.....	$(CH_2CN)_2$	liquid	545.7
Succinic anhydride.....	$(CH_2CO)_2O$	solid	369.6
Succinimide.....	$C_4H_5O_2N$	solid	437.9
Sucrose.....	$C_{12}H_{22}O_{11}$	solid	1,349.6
Sylvestrene.....	$C_{10}H_{16}$	liquid	1,464.7
<i>d</i> -Tartaric acid.....	$(CHOH)_2(CO_2H)_2$	solid	275.1
<i>d, l</i> -Tartaric acid (anhydr.)...	$(CHOH)_2(CO_2H)_2$	solid	278.4
Terephthalic acid.....	$C_6H_4(CO_2H)_2$	solid	770.4
Terpin hydrate.....	$C_{10}H_{22}O_3$	solid	1,451.0
Terpineol.....	$C_{10}H_{18}O$	solid	1,469.5
Tetrahydrobenzene.....	C_6H_{10}	liquid	891.9
Tetrahydronaphthalene.....	$C_{10}H_{12}$	liquid	1,352.4
Tetramethylmethane.....	$(CH_3)_4C$	gas	842.6
Tetraphenylmethane.....	$(C_6H_5)_4C$	solid	3,102.4
Tetryl.....	$C_7H_5N_6O_8$	solid	842.3
Thebaine.....	$C_{19}H_{21}O_3N$	solid	2,441.3
Thiophene.....	C_4H_4S	liquid	670.5
Thujane.....	$C_{10}H_{18}$	liquid	1,506.4
Thymol.....	$C_{10}H_{14}O$	liquid	1,353.4
Thymol.....	$C_{10}H_{14}O$	solid	1,349.7
Thymoquinone.....	$C_{10}H_{12}O_2$	solid	1,271.3

* Recommended as a secondary thermochemical standard.

HEAT OF COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion, kg. calories
Toluene.....	$\text{CH}_3\text{C}_6\text{H}_5$	liquid	934.2
<i>o</i> -Toluic acid.....	$\text{CH}_3\text{C}_6\text{H}_4\text{CO}_2\text{H}$	solid	928.9
<i>m</i> -Toluic acid.....	$\text{CH}_3\text{C}_6\text{H}_4\text{CO}_2\text{H}$	solid	928.6
<i>p</i> -Toluic acid.....	$\text{CH}_3\text{C}_6\text{H}_4\text{CO}_2\text{H}$	solid	926.9
<i>o</i> -Toluidine.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NH}_2$	liquid	964.3
<i>m</i> -Toluidine.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NH}_2$	liquid	965.3
<i>p</i> -Toluidine.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NH}_2$	solid	958.4
<i>o</i> -Tolunitrile.....	$\text{CH}_3\text{C}_6\text{H}_4\text{CN}$	liquid	1,030.3
Toluquinone.....	$\text{C}_7\text{H}_6\text{O}_2$	solid	803.2
Triaminotriphenyl carbinol.	$(\text{C}_6\text{H}_4\text{NH}_2)_3\text{COH}$	solid	2,483.5
Tribenzyl amine.....	$(\text{C}_6\text{H}_5\text{CH}_2)_3\text{N}$	solid	2,762.1
Trichloroacetic acid.....	$\text{Cl}_3\text{C}\cdot\text{CO}_2\text{H}$	solid	92.8
Triethyl amine.....	$(\text{C}_2\text{H}_5)_3\text{N}$	liquid	1,036.8
Triethyl carbinol.....	$(\text{C}_2\text{H}_5)_3\text{CHOH}$	liquid	1,080.0
Triisoamyl amine.....	$[(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2]_3\text{N}$	liquid	2,459.3
Triisobutyl amine.....	$[(\text{CH}_3)_2\text{CHCH}_2]_3\text{N}$	liquid	1,973.6
Trimethyl amine.....	$(\text{CH}_3)_3\text{N}$	liquid	578.6
2, 2, 3-Trimethylbutane.....	$(\text{CH}_3)_3\text{C}\cdot\text{CH}(\text{CH}_3)_2$	liquid	1,147.9
Trimethyl carbinol.....	$(\text{CH}_3)_3\text{COH}$	liquid	629.3
Trimethylene.....	$\text{CH}_2\text{CH}_2\text{CH}_2$	gas	496.8
Trimethylethylene.....	$(\text{CH}_3)_2\text{C}:\text{CHCH}_3$	liquid	796.0
Trimethylethylene.....	$(\text{CH}_3)_2\text{C}:\text{CHCH}_3$	vapor	803.6
2, 2, 4-Trimethylpentane.....	$(\text{CH}_3)_3\text{C}\cdot\text{CH}_2\text{CH}(\text{CH}_3)_2$	liquid	1,303.9
Trinitrobenzene.....	$\text{C}_6\text{H}_3(\text{NO}_2)_3$ —(1, 3, 5).....	solid	663.7
Trinitroglycerol.....	$\text{C}_3\text{H}_5(\text{NO}_3)_3$	liquid	368.4
Trinitrotoluene.....	$\text{C}_6\text{H}_2(\text{CH}_3)(\text{NO}_2)_3$ — (1, 2, 4, 6)	solid	820.7
Triphenyl amine.....	$(\text{C}_6\text{H}_5)_3\text{N}$	solid	2,267.8
Triphenylbenzene.....	$\text{C}_6\text{H}_2(\text{C}_6\text{H}_5)_3$ —(1, 3, 5).....	solid	2,936.7
Triphenyl carbinol.....	$(\text{C}_6\text{H}_5)_3\text{CHOH}$	solid	2,340.8
Triphenylmethane.....	$(\text{C}_6\text{H}_5)_3\text{CH}$	solid	2,388.7
Triphenyl methyl.....	$(\text{C}_6\text{H}_5)_3\text{C}$	solid	2,378.5
Tyrosine.....	$\text{C}_9\text{H}_{11}\text{O}_3\text{N}$	solid	1,070.2
Undecylic acid.....	$\text{C}_{11}\text{H}_{22}\text{O}_2$	solid	1,615.9
Urea.....	$(\text{NH}_2)_2\text{CO}$	solid	151.6
Urethane.....	$\text{NH}_2\text{CO}_2\text{C}_2\text{H}_5$	solid	397.2
Uric acid.....	$\text{C}_5\text{H}_4\text{O}_3\text{N}_4$	solid	460.2
<i>n</i> -Valeric acid.....	$\text{C}_4\text{H}_9\text{CO}_2\text{H}$	liquid	681.6
Vanillin.....	$\text{C}_6\text{H}_3(\text{OH})(\text{OCH}_3)\text{CHO}$ — (1, 2, 4)	solid	914.1
<i>o</i> -Xylene.....	$(\text{CH}_3)_2\text{C}_6\text{H}_4$	liquid	1,091.7
<i>m</i> -Xylene.....	$(\text{CH}_3)_2\text{C}_6\text{H}_4$	liquid	1,088.4
<i>p</i> -Xylene.....	$(\text{CH}_3)_2\text{C}_6\text{H}_4$	liquid	1,089.1
Xylose.....	$\text{C}_5\text{H}_{10}\text{O}_5$	solid	561.5

HEAT OF FORMATION

FOR ORGANIC COMPOUNDS

The heat of formation of a compound "A" is equal to the sum of the heats of formation of the products of combustion minus the heat of combustion (see preceding table) of the compound "A." The heat of formation of:

Free elements.....	0	kg-cal
CO ₂ (gas).....	94.38	"
$\frac{1}{2}$ H ₂ O (liquid from 1 H).....	34.19	"
HF (dilute aqueous solution).....	75.6	"
SO ₂ (gas).....	69.3	"
HBr (aqueous solution).....	28.54	"
HCl (aqueous solution).....	39.46	"
HNO ₃ (aqueous solution).....	49.80	"
H ₂ SO ₄ (aqueous solution).....	207.5	"

Example I

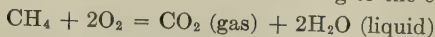
To calculate the heat of formation of methane (CH₄) where

$$\text{Heat of combustion of methane} = 210.8$$

$$\text{Heat of formation of CO}_2 = 94.38$$

$$\text{Heat of formation of } \frac{1}{2}\text{H}_2\text{O} = 34.19$$

and where the combustion occurs according to the equation:



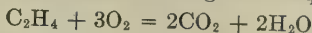
Then the heat of formation of CH₄ = 94.38 + 4(34.19) - 210.8 = +20.34 kg-cal. per gram molecular weight.

Example II

To calculate the heat of formation of ethylene (C₂H₄) where

$$\text{Heat of combustion of ethylene} = 331.6$$

and the combustion occurs according to the equation:



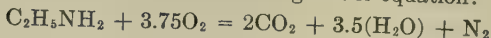
The heat of formation of C₂H₄ = 2(94.38) + 4(34.19) - 331.6 = -6.08 kg-cal. per gram molecular weight.

Example III

To calculate the heat of formation of ethylamine (C₂H₅NH₂) where

$$\text{Heat of combustion of ethylamine} = 408.5$$

and the combustion occurs according to the equation:



The heat of formation of C₂H₅NH₂ = 2(94.38) + 7(34.19) + O(N₂) - 408.5 = +19.59 kg-cal. per gram molecular weight.

COMBUSTION CONSTANTS OF GASES

The flue products are based upon air with 21 % oxygen and 79 % nitrogen; flame temperatures are not corrected for dissociation; the high or gross heat value is one which would be obtained by burning in a Junker's calorimeter; it includes the heat of condensation of the water formed by combustion and assumes that all products of combustion are cooled to the initial temperature; the low or net heat value assumes that all of the products of combustion except water have been cooled to the initial temperature; the difference between the gross and the net is equal to the heat of vaporization of water at the initial temperature.

	Formula	Mol. wt.	Sp. gr. air 1	Wt. per cu. ft. dry	B.t.u. per mol. high (gross)	B.t.u. per mol. low (net)	B.t.u. per cu. ft. high (gross) 60° F. 30 in. std. H ₂ O
Acetylene.....	C ₂ H ₂	26.02	0.8981	0.06858	562,000	543,000	1456
Ammonia.....	NH ₃	17.03	0.5878	0.04489			
Benzene.....	C ₆ H ₆	78.05	2.6940	0.2057	1,413,000	1,356,000	3658
Butane.....	C ₄ H ₁₀	58.08	2.0047	0.15309	1,237,000	1,142,000	3204
Butylene.....	C ₄ H ₈	56.06	1.9352	0.14778	1,171,000	1,095,000	3033
Carbon dioxide.....	CO ₂	44.00	1.5288	0.11598			
Carbon monoxide.....	CO	28.00	0.9665	0.07381	122,400	122,400	317.1
Ethane.....	C ₂ H ₆	30.05	1.0371	0.07920	668,300	611,300	1731
Ethylene.....	C ₂ H ₄	28.03	0.9676	0.07389	622,400	584,400	1613
Hydrogen.....	H ₂	2.02	0.0695	0.00531	123,100	104,100	318.8
Hydrogen sulfide.....	H ₂ S	34.08	1.1767	0.08986			
Methane.....	CH ₄	16.03	0.5534	0.04226	384,000	346,000	995
Naphthalene.....	C ₁₀ H ₈	128.06			2,219,000	2,143,000	
Nitrogen.....	N ₂	28.02	0.9671	0.07385			
Oxygen.....	O ₂	32.00	1.1046	0.08435			
Propane.....	C ₃ H ₈	44.06	1.5210	0.11615	952,000	876,000	2465
Propylene.....	C ₃ H ₆	42.05	1.4513	0.11083	893,000	836,000	2313
Toluene.....	C ₇ H ₈	92.06	3.1778	0.2427	1,685,000	1,609,000	4364
Xylene.....	C ₈ H ₁₀	106.08	3.6616	0.27962	1,955,000	1,860,000	5064
Water.....	H ₂ O	18.02	0.6219	0.04749			

HEAT OF COMBUSTION OF LIQUID FUELS

Fuel	B.t.u. per lb	Gram-calories per gram	Ultimate analysis					Lbs. per gallon	Specific gravity at 60° F
			C	H	S	N	O		
Alcohol, fuel or denatured.....	11,620	6,456						6.836	0.820
Crude oil, California.....	18,910	10,506	84.00	12.70	0.75	1.70	1.20	7.636	0.917
Kansas.....	19,130	10,628	84.15	13.00	1.90	0.45		7.670	0.921
Mexico.....	18,755	10,419	83.70	10.20	4.15			8.120	0.975
Oklahoma.....	19,502	10,834	85.70	13.11	0.40	0.30		7.236	0.869
Pennsylvania.....	19,505	10,836	86.06	13.88	0.06	0.00	0.09	6.769	0.813
Texas.....	19,460	10,811	85.05	12.30	1.75	0.70	0.00	7.286	0.875
Wyoming.....	19,510	10,839						7.228	0.868
Gas oil.....	19,200	10,667						7.184	0.863
Gasoline.....	20,750	11,528	84.90	14.76	0.08			6.152	0.739
Fuel oil, California.....	18,835	10,464	84.67	12.36	1.16			7.956	0.9554
Mexico.....	18,510	10,283	84.02	10.06	4.93			8.223	0.987
Mid-continent.....	19,376	10,764	85.62	11.98	0.35	0.50	0.60	7.428	0.892
Furnace oil.....	19,025	10,569						7.462	0.896
Kerosene.....	19,810	11,006						6.822	0.819

COMBUSTION CONSTANTS OF GASES (Continued)

	B.t.u. per cu. ft. low (net) 60° F. 30 in. satd. H ₂ O	B.t.u. per cu. ft. high (gross) 60° F. 30 in. dry	B.t.u. per cu. ft. low (net) 60° F. 30 in. dry	B.t.u. per cu. ft. high (gross) 32° F. 30 in.	B.t.u. per cu. ft. low (net) 32° F. 30 in.	Theoretical flame temp. deg. F.	Cu. ft. per cu. ft. fuel gas or mol. per mol.	
							Required for com- bustion	
							Oxygen	Air
Acetylene.....	1396	1483	1433	1567	1514	4770	2.5	11.96
Ammonia.....								
Benzene.....	3509	3722	3577	3933	3774	4110	7.5	35.70
Butane.....	2955	3261	3010	3445	3180	3870	6.5	30.95
Butylene.....	2834	3087	2887	3262	3050	4030	6.0	28.58
Carbon dioxide.....								
Carbon monoxide.....	317.1	322.6	322.6	341.0	341.0	4475	0.5	2.38
Ethane.....	1582	1762	1612	1862	1703	3820	3.5	16.67
Ethylene.....	1514	1641	1541	1734	1631	4250	3.0	14.29
Hydrogen.....	269.1	324.5	274.5	343.0	290.0	4010	0.5	2.38
Hydrogen sulfide.....							1.5	7.14
Methane.....	896	1012	912	1069	963	3750	2.0	9.52
Naphthalene.....						4100	12.0	57.10
Nitrogen.....								
Oxygen.....								
Propane.....	2266	2509	2309	2652	2440	3840	5.0	23.80
Propylene.....	2164	2354	2204	2487	2328	4090	4.5	21.43
Toluene.....	4165	4441	4241	4693	4481	4050	9.0	42.87
Xylene.....	4815	5153	4902	5446	5181	4010	10.5	50.00
Water.....								

COMBUSTION CONSTANTS OF GASES (Continued)

	Cu. ft. per cu. ft. fuel gas or mol. per mol.			Ignition temp. at atmospheric pressure				Inflam- mability in air at atmos- pheric pres- sure and ordinary temp	
	Flue products			In air		In oxygen			
	CO ₂	H ₂ O	N ₂	Deg. F.	Deg. C.	Deg. F.	Deg. C.	% lower limit mixture	% upper limit mixture
Acetylene.....	2.0	1.0	9.40	763-824	406-440	781-824	416-440		
Ammonia.....									
Benzene.....	6.0	3.0	28.20	1364	740	1224	662	1.4	5.5
Butane.....	4.0	5.0	24.45						
Butylene.....	4.0	4.0	22.58						
Carbon dioxide.....									
Carbon monoxide.....	1.0		1.88	1191-1216	644-658	1179-1216	637-658	16.3	71.2
Ethane.....	2.0	3.0	13.17	968-1166	520-630	968-1166	520-630	3.3	10.6
Ethylene.....	2.0	2.0	11.29	1008-1018	542-547	932-966	500-519	3.4	14.1
Hydrogen.....		1.0	1.88	1076-1094	580-590	1076-1094	580-590	6.2	71.4
Hydrogen sulfide.....	1.0	1.0	5.64						
	SO ₂								
Methane.....	1.0	2.0	7.52	1202-1332	650-750	1033-1292	556-700	5.8	13.3
Naphthalene.....	10.0	4.0	45.00						
Nitrogen.....									
Oxygen.....									
Propane.....	3.0	4.0	18.80			914-1058	490-576		
Propylene.....	3.0	3.0	16.93						
Toluene.....	7.0	4.0	33.87	1490	810	1026	552		
Xylene.....	8.0	5.0	39.50						
Water.....									

FUEL GASES

HEATS OF COMBUSTION AND COMPOSITION OF MANUFACTURED AND NATURAL GASES

Products of combustion, theoretical flame temperatures, air required and B.T.U. of gas-air mixture are based upon air with 21 % oxygen and 79 % nitrogen; heat values are calculated from the table given under "Combustion Constants of Gases," flame temperatures are not corrected for dissociation; carburetted water gas, coal gas, coke-oven gases and oil gas contain a small amount of benzene and oxygen.

	Combustion Values										Composition							
	Theoretical flame temp. ° F.	B.T.U. per cu. ft., high (gross) 60° F., 30 in. Hg, satd. H ₂ O	B.T.U. per cu. ft., low (net) 60° F., 30 in. Hg, satd. H ₂ O	Cu. ft. air required per cu. ft. gas	Cu. ft. CO ₂ per cu. ft. of gas burned	Cu. ft. H ₂ O per cu. ft. of gas burned	Cu. ft. of N ₂ per cu. ft. of gas burned	High (gross) B.T.U. per cu. ft. gas-air mixture	% CO ₂	% CO	% C ₂ H ₆ (ethane)	% C ₂ H ₄ (ethylene)	% H ₂	% CH ₄ (methane)	% N ₂	% O ₂	% C ₃ H ₈ (propane)	
Blast-furnace gas.....	2660	93	91.6	0.70	0.392	0.032	0.55	54.7	13.0	26.2	.....	.....	3.2	.....	57.6	.....	.....
Blue water gas.....	4167	310	285	2.28	0.469	0.518	1.81	94.5	3.5	43.4	.....	.....	51.8	.....	1.3	.....	.....
Carburetted water gas...	4090	578	529	4.85	0.758	0.904	3.85	98.8	1.5	33.9	.....	12.8	35.2	14.8	1.8	.....	.....
Coal gas.....	3910	634	560	5.50	0.573	1.282	4.36	97.5	1.1	9.0	.....	6.6	47.0	34.0	2.3	.....	.....
Coke-oven gas.....	3430	536	476	4.65	0.420	1.205	4.71	95.0	1.4	5.1	.....	2.9	57.4	28.5	4.2	0.5	.....
Coke-oven gas.....	3860	600	538	5.28	0.529	1.206	4.21	95.6	2.6	6.1	.....	5.2	47.9	33.9	3.7	0.6	.....
Natural gas at Follansbee, W. Va.....	3835	2221	1970	21.55	2.667	3.662	17.00	98.6	.....	.....	31.8	.....	.....	.....	0.5	.....	67.7
Natural gas, Follansbee residual gas at McKean County, Pa.....	3830	1868	1711	17.97	2.188	3.182	14.21	98.5	.....	.....	79.4	.....	.....	.....	0.6	.....	20.0
Natural gas at Sandusky, Ohio.....	3770	1482	1350	14.25	1.663	2.756	11.29	97.3	.....	.....	67.0	.....	.....	32.3	0.7	.....	.....
Oil gas.....	3740	1047	946	10.04	1.087	2.045	7.98	94.7	0.2	.....	12.5	.....	.....	83.5	3.8	.....	.....
Producer gas.....	3970	516	461	4.25	0.458	1.129	3.39	98.3	2.8	10.6	.....	2.7	53.5	27.0	3.4	.....	.....
	3050	136	128	1.08	0.311	0.165	1.44	65.3	5.7	22.0	.....	0.4	10.5	2.6	58.8	.....	.....

HEATS OF COMBUSTION AND COMPOSITION OF REPRESENTATIVE COALS

Analysis on coal "as received." First name is that of the county, second name that of the mine.

	Type	B.t.u. per pound	Ultimate analysis					Proximate analysis			
			% C	% H	% N	% O	% S	% Moisture	% Volatile matter	% Fixed carbon	% Ash
Alabama:											
Bibb, Belle Ellen.....	Bituminous	14,140	78.3	5.3	1.4	7.6	1.2	3.2	31.0	59.6	6.2
Jefferson, Bessemer.....	"	14,620	81.7	4.7	1.5	6.5	1.7	2.4	24.4	68.4	4.8
Shelby, Aldrich.....	"	13,650	75.0	5.2	1.0	10.0	0.8	2.3	38.6	51.9	7.2
Alaska:											
Moose Creek.....	"	12,150	67.6	5.3	1.9	15.9	0.3	4.7	35.5	50.9	8.9
Arkansas:											
Hartford, Central No. 10	"	13,270	77.4	4.1	1.6	5.3	1.1	2.9	19.3	67.3	10.5
Huntington, No. 6 Central.....	Semi-bituminous	13,700	78.7	4.4	1.6	4.4	1.9	3.2	18.1	69.7	9.0
Colorado:											
Gunnison, Somerset.....	Bituminous	12,630	70.6	5.5	1.5	12.7	0.4	4.3	39.7	46.7	9.3
Weld, Erie.....	Sub-bituminous	9,520	54.8	6.3	1.2	33.8	0.3	24.6	29.8	42.0	3.6
Illinois:											
Christian, Pana.....	Bituminous	10,860	59.8	5.6	1.1	19.1	3.7	13.0	37.0	39.3	10.7
Franklin, Orient.....	"	12,160	69.0	5.4	1.6	15.0	1.0	7.3	36.7	47.9	8.1
Williamson, Herrin.....	"	11,860	67.1	5.2	1.5	16.7	0.9	9.4	33.0	49.0	8.6
Indiana:											
Green, Jasonville.....	"	11,540	64.5	5.8	1.5	19.8	1.1	13.5	36.3	42.9	7.3
Knox, South Bruceville..	"	11,540	62.3	5.5	1.0	17.1	3.2	9.5	38.3	41.4	10.9
Sullivan, Vandalia.....	"	11,420	63.8	5.9	1.4	20.9	1.3	14.9	34.3	44.1	6.7
Iowa:											
Lucas, Chariton.....	"	10,240	55.8	5.7	1.1	21.5	3.2	15.4	30.5	41.5	12.6
Polk, Altoona.....	"	10,240	54.7	5.5	0.8	18.8	6.2	13.9	37.0	35.2	14.0
Kansas:											
Cherokee, Stone City...	"	13,080	71.8	5.2	1.2	10.2	3.3	5.1	34.5	52.2	8.3
Crawford, Edison.....	"	12,500	68.8	4.9	1.2	8.7	4.6	3.9	34.2	50.1	11.8
Kentucky:											
Christian, Mannington..	"	11,680	.....	.....	.....	.....	3.1	9.2	33.7	46.4	10.7
Webster.....	"	12,500	70.4	5.1	1.6	12.6	1.1	5.4	34.9	50.4	9.3
Maryland:											
Allegany, Frostburg.....	Semi-bituminous	13,430	76.9	4.3	1.9	4.9	1.1	2.2	17.2	69.1	10.9
Allegany, Ocean.....	Semi-bituminous	14,190	81.0	4.5	1.9	4.0	1.0	1.2	17.9	73.2	7.7
Montana:											
Carbon, Washoe.....	Sub-bituminous	10,550	59.8	5.6	1.3	21.0	1.1	10.5	34.7	43.7	11.2
Musselshell, Roundup...	"	10,690	62.0	5.6	1.0	22.7	0.7	13.6	32.9	45.5	8.1
New Mexico:											
San Juan, Farmington..	Bituminous	11,630	.....	.....	.....	.....	1.3	6.9	38.1	43.0	11.9
North Dakota:											
Ward, Burlington.....	Lignite	6,010	37.4	6.4	0.6	45.0	0.2	36.9	24.9	27.7	10.4
Williams, Wheelock.....	"	5,990	35.2	7.1	0.5	47.5	1.3	42.1	25.0	24.4	8.5
Ohio:											
Columbian, New Salisbury.....	Bituminous	12,730	69.9	5.2	1.4	8.3	4.3	3.5	36.7	48.9	10.9
Jefferson, Yellow Creek..	"	12,720	69.7	5.2	1.4	8.0	5.1	3.4	36.3	49.6	10.7
Oklahoma:											
Coal, Lehigh.....	"	11,260	62.8	5.0	1.5	14.5	4.3	6.6	38.6	42.9	11.9
Latimer, Degnan.....	"	13,630	.....	.....	.....	.....	0.9	3.7	36.8	53.8	5.6
Pittsburg, Ridgway.....	"	13,280	73.8	5.4	1.8	9.6	1.7	3.8	38.0	50.6	7.6

HEATS OF COMBUSTION AND COMPOSITION OF REPRESENTATIVE COALS (Continued)

	Type	B.t.u. per pound	Ultimate analysis					Proximate analysis			
			% C	% H	% N	% O	% S	% Moisture	% Volatile matter	% Fixed carbon	% Ash
Oregon:											
Coos, Beaverhill.....	Sub-bituminous	9,030	51.1	5.5	1.2	28.2	0.8	16.1	31.1	39.6	13.2
Pennsylvania:											
Armstrong, Montgome- ryville.....	Cannel	10,460	56.9	4.5	1.1	5.6	3.7	1.8	32.8	37.3	28.2
Armstrong, W. Kittann- ing.....	Bituminous	13,040	71.4	5.3	1.3	9.1	3.1	3.4	35.5	51.3	9.7
Bedford, Hopewell.....	"	13,810	77.4	4.1	1.4	3.4	1.0	1.6	16.3	70.0	12.1
Cambria, Bakerton.....	Semi-bituminous	14,460	.....	.....	.....	.....	1.1	2.2	22.2	70.3	5.3
Cambria, Nanty Glo....	"	14,380	.....	.....	.....	.....	1.9	2.5	20.0	71.5	6.1
Cambria, Windber.....	"	14,620	83.9	4.3	1.3	2.4	1.2	2.6	17.0	73.7	6.9
Jefferson, Punxsutawney	Bituminous	13,860	76.6	5.1	1.2	7.2	2.0	2.6	30.4	59.1	7.9
Somerset, Seanor.....	Semi-bituminous	13,740	78.5	4.3	1.2	4.5	2.5	2.4	17.3	71.4	9.0
Rhode Island:											
Providence, Cranston...	Anthracite	11,620	82.4	0.5	0.1	1.8	0.9	4.5	3.0	78.7	13.8
Texas:											
Webb, Dolores.....	Cannel	11,070	59.3	5.8	1.2	12.7	2.1	4.4	46.0	30.5	19.0
Virginia:											
Montgomery, Blacks- burg.....	Semi-bituminous	12,740	75.3	3.6	0.9	4.8	0.5	1.9	14.0	68.9	15.2
Pulaski, Guntan Park...	Semi-anthracite	10,960	.....	.....	.....	.....	0.8	3.8	9.4	62.2	24.0
Tazewell, Pocahontas...	Semi-bituminous	14,610	84.0	4.7	1.2	5.2	0.5	3.0	20.3	72.2	4.5
Wise, Josephine.....	Bituminous	13,270	73.7	5.1	1.6	8.8	0.9	2.6	33.8	53.6	10.0
Washington:											
Kittitas, Ellensburg....	"	11,010	61.3	5.5	1.5	14.4	1.4	10.3	30.4	43.4	15.9
Thurston, Tono.....	Sub-bituminous	8,700	49.9	6.3	0.9	32.4	1.2	21.7	34.8	33.3	10.3
West Virginia:											
Brook, Collier.....	Bituminous	12,940	72.1	5.3	1.4	10.5	2.6	4.4	37.4	50.1	8.1
Grant, Bismarck.....	Semi-bituminous	13,590	.....	.....	.....	.....	2.7	3.0	16.7	71.0	9.3
Mineral, Emoryville....	"	12,600	.....	.....	.....	.....	2.5	2.4	16.1	65.9	15.6
Ohio, Elm Grove.....	Bituminous	13,200	72.8	5.3	1.4	8.8	3.6	3.0	41.4	45.6	8.1
Wyoming:											
Lincoln, Elkol.....	Sub-bituminous	10,080	57.8	6.3	0.9	31.1	0.7	20.8	35.4	40.6	3.2
Lincoln, Green River...	Bituminous	13,310	74.5	5.3	1.3	12.5	1.0	3.6	38.4	52.5	5.5

HEAT OF COMBUSTION, VARIOUS SUBSTANCES

Approximate values of heat of combustion in kilogram calories per gram of substance. Products of combustion are gaseous unless otherwise stated.

Substance	Kg-cal. per gram of substance	Observer
Asphalt.....	9.530	Slossen, Colburn
Bagasse (refuse from sugar cane), 12 % H ₂ O.....	4.045	Aufhäuser—1931, 1935
Bamboo, 10.5 % H ₂ O.....	4.110	
Buckwheat hulls, 10 % H ₂ O.....	4.219	Aufhäuser—1931, 1935
Butter.....	9.200	
Carbon:		
amorphous.....	8.080	Mean
charcoal.....	8.100	Mean
diamond.....	7.860	Berthelot
graphite.....	7.900	Berthelot
Casein.....	5.860	
Charcoal, 4 % H ₂ O.....	7.260	
Coconut shells, 13 % H ₂ O.....	4.200	Freise—1932
Copper (to CuO).....	.590	Thomsen
Dynamite, 75 %.....	1.290	Roux, Sarrau
Egg white.....	5.700	
Egg yolk.....	8.100	
Fats, animal, mean.....	9.500	
Gunpowder.....	0.720–0.750	
Hemoglobin.....	5.900	
Hydrogen, to liquid.....	33.900	Mean
Hydrogen, to gas.....	29.150	Berthelot
Iron (to Fe ₂ O ₃).....	1.582	
Leather, cuttings 13.7 % H ₂ O.....	4.729	Aufhäuser
Magnesium (to MgO).....	6.080	
Nitrocellulose, 11.29 % N.....	2.576	Ball—1931
Oak bark, 7 % H ₂ O.....	4.522	Fieldner
Oil:		
cotton seed.....	9.500	
lard.....	9.300	Mean
linseed.....	9.434	Caldwell, Mattiello—1932
olive.....	9.400	Mean
paraffin.....	9.800	Mohler
petroleum:		
crude.....	11.500	Mean
heavy.....	10.200	Mean
light.....	10.000	Mean
rape.....	9.500	Stohmann
sperm.....	10.000	Gibson
Paraffin (to CO ₂ , H ₂ O l).....	11.140	Stohmann
Paraffin (to CO ₂ , H ₂ O g).....	10.340	Stohmann
Pitch.....	8.400	
Rubber.....	3.349	Aufhäuser
Sulfur:		
monoclinic.....	2.240	Thomsen
rhombic.....	2.200	Mean
Tallow.....	9.500	Stohmann
Woods:		
beech, 13 % H ₂ O.....	4.170	Gottlieb
birch, 12 % H ₂ O.....	4.210	Gottlieb
oak, 13 % H ₂ O.....	3.990	Gottlieb
pine, 12 % H ₂ O.....	4.420	Gottlieb

FREE ENERGY

The free energy change of a chemical reaction is the sum of the free energies of formation from their elements of the products of the reaction less the free energy of formation of the reacting substances.

The free energy values ΔF° given in the following table refer to the energy of formation from the elements in their standard states at 25° C. The free energy of all elements in their standard states and of H^+ is taken as zero.

Values are in kilogram calories per mole at 25 °C.

Substance	ΔF° kg cal.	Substance	ΔF° kg cal.
Ag ⁺	18.448	Cd (g).....	18.616
AgBr (s).....	-22.910	(l).....	.563
AgCN (s).....	38.499	Cd ⁺⁺	-18.348
Ag(CN) ₂ ⁻	72.047	CdBr ₂ ·4H ₂ O (s).....	-72.070
AgCl (s).....	-26.220	CdCl ₂ (s).....	-82.260
AgI (s).....	-15.820	CdI ₂ (s).....	-48.169
AgNO ₂ (s).....	4.900	Cl ₂ (l).....	1.146
Ag(SO ₃) ₂ ⁻⁻	-226.545	(aq).....	1.650
Ag ₂ O (s).....	-2.395	Cl ⁻	-31.345
Au ₂ O ₃ (s).....	19.100	ClO ⁻	-6.500
Br (g).....	18.250	ClO ₃ ⁻	- .250
Br ₂ (g).....	.755	ClO ₄ ⁻	-9.000
(s).....	.314	Cu (g).....	63.210
(aq).....	.977	(l).....	4.300
Br ⁻	-24.595	Cu ⁺⁺	15.912
Br ₃	-25.230	CuCl (s).....	-28.440
BrO ₃ ⁻	2.300	CuO (s).....	-30.300
C (diamond).....	.390	Cu(OH) ₂ (s).....	-85.090
CCl ₄ (l).....	-15.600	CuS.....	-11.620
CH ₃ CO ₂ ⁻ , acetate ion....	-89.720	CuSO ₄ (s).....	-155.850
CH ₄ (g).....	-11.617	CuSO ₄ ·H ₂ O (s).....	-216.610
CH ₄ O, methyl alcohol (g)	-38.890	CuSO ₄ ·3H ₂ O (s).....	-331.530
(l).....	-39.960	CuSO ₄ ·5H ₂ O (s).....	-445.960
CN ⁻	39.370	Cu ₂ O (s).....	-35.000
(CN) ₂ (g).....	92.000	Cu ₂ S (α).....	-19.110
CNI (s).....	42.790	(β).....	-18.970
CNO ⁻	-23.750	Fe ⁺⁺	-20.240
CO (g).....	-32.510	Fe ⁺⁺⁺	-3.120
COCl ₂ (g).....	-48.770	H ₂ (aq).....	4.182
CO(NH ₂) ₂ , urea (s).....	-47.280	H ⁺	0
(aq).....	-48.840	HBr (g).....	-12.540
COS (g).....	-39.600	(aq).....	-24.574
CO ₂ (g).....	-94.260	HBrO (aq).....	-19.680
(aq).....	-92.250	HBrO ₃ (aq).....	2.300
CO ₃ ⁻	-125.760	HCN (g).....	28.910
CS ₂ (g).....	17.600	(l).....	28.870
(l).....	17.150	(aq).....	27.510
C ₂ H ₂ , acetylene (g).....	50.840	HCNO (aq).....	-29.100
C ₂ H ₄ , ethylene (g).....	12.300	HCOOH, formic acid (l).....	-84.040
C ₂ H ₄ O ₂ , acetic acid (g).....	-91.230	(aq).....	-87.920
(l).....	-94.500	HCO ₃ ⁻	-140.000
(aq).....	-96.210	HCl (g).....	-22.741
(C ₂ H ₅) ₂ O, ether (g).....	-28.090	(aq).....	-31.345
(l).....	-28.300	HClO (aq).....	-19.018
C ₂ H ₅ OH, ethyl alcohol (g)	-38.690	HClO ₃ (aq).....	- .250
(l).....	-45.100	HF (g).....	-64.91
C ₂ H ₆ , ethane (α).....	-10.700	(aq).....	1.000
C ₆ H ₆ , benzene (g).....	30.640	(HF) ₆ (g).....	-210.000
(l).....	27.100	HI (g).....	.315
C ₁₂ H ₂₂ O ₁₁ , sucrose (s).....	-371.600	(aq).....	-12.361
Ca (β).....	.078	HIO (aq).....	-23.170

FREE ENERGY (Continued)

Substance	ΔF° kg cal.	Substance	ΔF° kg cal.
HIO ₃ (aq)	-31.580	NO ₂ ⁻	-8.500
HNO ₂ (aq)	-13.070	NO ₃ ⁻	-26.500
HNO ₃ (g)	-18.210	N ₂ O ₄ (g)	22.640
(aq)	-26.500	Na ⁺	-62.588
HO ₂ ⁻	-15.610	NaCl (s)	-91.792
HPbCl ₅ (aq)	-104.700	O ₂ (aq)	3.904
HPbO ₂ ⁻	-80.602	O ₃ (g)	32.400
HS ⁻	2.980	OH ⁻	-37.455
HSO ₃ ⁻	-123.920	Pb (g)	41.764
H ₂ CO ₃ (aq)	-148.810	(l)	533
H ₂ C ₂ O ₄ , oxalic acid (s)	-165.900	Pb ⁺⁺	-5.551
H ₂ O (g)	-54.507	PbBr ₂ (s)	-62.063
(l)	-56.560	PbCO ₃ (s)	-149.000
(s)	-56.418	PbCl ₂ (s)	-75.056
H ₂ O ₂ (g)	-24.730	PbCl ₃ ⁻	-104.700
(l)	-28.230	PbI ₂ (s)	-41.510
(aq)	-31.470	PbO (red)	-45.050
H ₂ S (g)	-7.840	(yellow)	-44.896
(aq)	-6.490	PbOH ⁺	-53.440
H ₂ SO ₃ (aq)	-126.330	Pb(OH) ₂ (aq)	-96.888
H ₂ SO ₄ (aq)	-176.500	PbO ₂ (s)	-52.070
Hg (g)	7.632	PbS (s)	18.000
(s)	1493	PbSO ₄ (s)	-176.500
Hg ₂ ⁺⁺	36.854	Pb ₃ (CO ₃) ₂ (OH) ₂ (s)	-407.700
HgBr (s)	-21.351	Pb ₃ O ₄ (s)	-147.342
HgCl (s)	-25.163	S (g)	30.240
HgCl ₂ (g)	-34.569	(λ) (l)	.094
(l)	-41.932	(monocl)	.0183
(s)	-43.550	S ⁻	23.450
HgI (s)	-13.290	S ₂ (g)	18.280
HgO (red)	-13.808	S ₈ (g)	11.900
Hg ₂ Cl ₂ (s)	-50.274	S ₈ (g)	10.000
Hg ₂ SO ₄ (s)	-162.100	SO ₂ (g)	-69.660
I (g)	15.470	(aq)	-69.770
I ₂ (l)	.920	SO ₂ Cl ₂ (g)	-71.560
(aq)	3.926	SO ₃ (g)	-85.890
I ⁻	-12.361	SO ₃ ⁻	-116.680
I ₃ ⁻	-12.315	SO ₄ ⁻	-176.500
IO ₃ ⁻	-31.580	S ₂ O ₃ ⁻	-125.110
K ⁺	-67.431	SiCl ₄ (l)	-113.710
KClO ₃ (s)	-69.250	Sn (gray)	.0095
N ₂ (aq)	4.358	Sn ⁺	-3.138
NH ₃ (g)	-3.910	SnCl ₄ (l)	-113.210
(l)	-2.620	Tl (α)	-.004
(s)	-1.585	(β)	.035
(aq)	-6.300	(l)	.468
NH ₄ ⁺	-18.930	TlBr (s)	-39.770
NH ₄ Cl (s)	-47.810	TlCl (s)	-44.195
NH ₄ OH (aq)	-62.860	TlI (s)	-30.020
NO (g)	20.869	TlOH (s)	-45.400
(l)	24.594	Tl ₂ O (s)	-32.410
(s)	26.398	Zn (g)	22.885
NOCl (g)	16.010	Zn ⁺	-17.492
NO ₂ (g)	11.920	ZnO (s)	-75.720

VITAMINS

CHARACTERISTICS AND FUNCTIONS OF THE VITAMINS

Compiled by H. J. Prebluda

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Vitamin A (animal sources) Carotenes (plant sources) (provitamin A)	<p><i>Vitamin A₁</i> ($C_{20}H_{29}OH$) <i>Vitamin A₂</i> ($C_{22}H_{31}OH$) Pale, viscous, fat-soluble, heat- and oxygen labile liquids found in fish liver oils.</p> <p><i>Carotenes</i>—orange red pigments—Kryptoxanthin, alpha and beta carotene—found in plants and are precursors of vitamin A being changed to this vitamin in the human body. Have same fat soluble and labile properties of vitamin A especially to oxidation. One molecule of beta carotene has physiological potency of two molecules of vitamin A. Alpha carotene has 50% activity of beta carotene.</p>	<p>Vitamin A is essential for growth, normal vision and for maintenance of normal condition of epithelial tissue.</p> <p>Prevention of nyctalopia (night blindness) and regeneration of retinal visual purple bleached by light.</p> <p>Dried out epithelial tissue deficient in vitamin A seems to have less resistance to invasion by bacteria.</p> <p>Requirements are greatest during periods of rapid growth, pregnancy, lactation or illness.</p>	<p>Dryness and keratinization of the eye conjunctiva (xerophthalmia) hyperkeratosis of mucous membrane and dermal structures. Dryness of skin. Retardation of growth.</p>	<p>Leafy portions of green plants Salt water fish liver oils—A₁ Fresh water fish liver oils—A₂ Eggs Butter Cream Provitamin A found in pigmented plants such as carrots, sweet potatoes, yellow corn, etc. Apricots</p>
Fat soluble A Anti-Xerophthalmic vitamin				
Vitamin B₁ Thiamin chloride Thiamin hydrochloride Aneurin Anti-beri-beri vitamin Anti-neuritic vitamin	<p>A white crystalline powder having the formula $C_{12}H_{17}ON_4SCl \cdot HCl$, soluble in alcohol and water. Heat and alkali labile stable to aeration.</p>	<p>Necessary in formation of enzymes participating in carbohydrate metabolism.</p> <p>Essential for maintenance of good appetite, normal</p>	<p>Retarded growth, loss of appetite, leg weakness, convulsive seizures associated with spastic paralysis and focal accumulation</p>	<p>Liver Yeast Milk Eggs Fruits Legumes</p>

VITAMINS (Continued)

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Vitamin B₂ (Member of the vitamin B Complex) Riboflavin Vitamin G Lactoflavin (from milk) Ovoflavin (from eggs) Hepatoflavin (from liver)	Molecular structure includes a pyridine and thiazole group which is broken down by sulfite treatment. An orange yellow pigment ($C_{17}H_{20}N_4O_6$) containing an iso-alloxazine nucleus combined with <i>d</i> -ribose. Solutions of riboflavin exhibit a strong greenish-yellow fluorescence in ultra violet which is the basis for fluorometric assay of this vitamin. Riboflavin is water soluble, heat stable in acid or neutral solutions and readily destroyed in an alkaline medium. Visible light (blue and violet regions) destroys this vitamin.	Digestion and gastric tonicity. Necessary for lactation and reproduction. B_2 has been responsible for various forms of nerve disturbances and suboptimal growth of infants and children. Necessary for growth and respiration of all tissues and cells. Has been demonstrated to increase vitality and postpone senility in succeeding generations of experimental animals. Necessary for growth of domestic animals. Necessary for egg hatchability.	of pyruvic acid in central nervous systems with accompanying polyneuritis. Emotional instability and enlargement of heart.	Leafy vegetables Lean meat Embryos of cereal grains
Niacin Nicotinic acid Pellagra preventive P-P factor	3-pyridine carboxylic acid which is somewhat soluble in hot water. The amide derivative is	A component of co-enzymes important in glycolysis and cellular respiration.	Pellagra with burning soreness of mouth, loss of appetite, loss of weight, and diges-	Liver Kidney Lean meat Peanuts

VITAMINS (Continued)

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Anti-black tongue factor (Member of vitamin B complex)	more soluble and called niacinamide. Relatively stable to heat.	Essential for health and growth. Necessary for maintaining normal function of skin and gastro-intestinal tract.	typical nervous disturbances.	Yeast Eggs Fish Bran Green leafy vegetables
Vitamin B₆ (Member of vitamin B complex) Pyridoxin Adernin Rat acrodynia factor	Derivative of pyridine. Commercially available as hydrochloride—white powder ($C_5H_7NO_3 \cdot HCl$) which is stable in solution in absence of strong light. Acid solutions stable to autoclaving below pH5.	Significance in human nutrition not fully established. Has been found useful in alleviating certain nervous and muscular disorders. Probably plays role in unsaturated fatty acid utilization and liver metabolism. Important in chick, hog, and dog nutrition.	Microcytic hypochromic anemia in dogs, lack of coordination of gait of pigs. One of the vitamins lacking in individuals having multiple deficiencies in pellagra.	Liver Yeast Crude cane molasses Cereals Legumes Milk
Pantothenic Acid Pantothen Filtrate factor Chick anti-dermatitis factor Factor II (Member of vitamin B complex)	Beta-alanine derivative of a substituted butyryl lactone. A white solid not readily soluble in water. Commercially available as calcium salt $Ca(C_9H_{16}O_8N)_2$ which is water soluble. Stable to autoclaving, light oxidizing and reducing agents. Unstable to alkali.	Significance in human nutrition not established. Essential for certain bacteria, rats, chickens, and dogs, as well as humans. Necessary for maintaining normal adrenal activity. Thought to be one of several substances playing a role in preventing grey hair. Essential for growth and reproduction of chicks.	Dermatitis in chicks. Retarded growth and greying of hair in rats. Deficiency usually occurs along with pellagra.	Yeast Liver Kidney Eggs Cane Molasses Milk Wheat germ

VITAMINS (Continued)

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Choline (Member of vitamin B complex)	Hydroxyethyl trimethyl ammonium hydroxide—a colorless viscous liquid which has strong basic properties. Basic constituent of lecithin and the chloride is available commercially. The latter is a colorless crystalline hygroscopic solid—very soluble in water. Salty, bitter taste.	Essential in fat metabolism to mobilize fatty acids, supplies "labile" methyl groups.	Impairment of liver and renal functions. "Slipped tendon" of fowl.	Liver Egg yolk Brain Kidney Heart Sweet breads Yeast Cereal germs Legumes Green leafy vegetables Potatoes Milk
Vitamin C Ascorbic acid Anti-scorbutic vitamins Cevitic acid	A hexuronic acid. A white, crystalline solid soluble in water with sour acid taste. Insoluble in oils. Destroyed by exposure to air, light, and alkali. Deterioration accelerated by metals such as iron and copper. Strong reducing agent. Cannot be stored in the body.	Prevents and cures scurvy. Necessary for formation and maintenance of intercellular tooth and bone structure. Prevents capillary fragility. Increases resistance to bacterial toxins and infections. Infection increases vitamin C requirement of body.	Scurvy. Dental caries. Gum infections. Slow healing of wounds. Defective formation of bones and teeth.	Citrus fruits Alfalfa Cabbage Green and red peppers Raw turnip Tomato Pineapple
Vitamin D Anti-rachitic vitamin	At least ten active vitamin D sterols are known. The two important sterols are vitamin D ₂ (activated ergosterol, calciferol) derived mainly from vegetable sources and vitamin	Regulation of calcification of bone structure. Regulates absorption and utilization of calcium and phosphorus.	Rickets. Poor bone development. Tooth decay. Osteomalacia.	Fish liver oils Mackerel Herring Sardines Egg yolk Tuna Liver

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Vitamin E Alpha tocopherol Anti-sterility vitamin	<p>D₂ (activated 7-dihydrocholesterol) derived mainly from animal sources. Vitamin D is fat soluble, heat stable and not readily destroyed by oxidation. Can be produced in many foodstuffs by irradiation or exposure to sunlight. Light energy activates sterols present to active vitamin D. In similar fashion sterols beneath skin are activated to form vitamin D upon exposure to ultra violet or sunlight. Activated ergosterol dissolved in vegetable oils = viosterol.</p> <p>Has chromane structure (C₂₈H₄₆O₂). Thick viscous oil-soluble in fat solvents. Heat stable and resistant to mild oxidation. Ferric salts and rancid fats destroy physiological activity. Obtained from natural sources in unsaponifiable fraction.</p>	<p>Has anti-oxidant properties. Has not been demonstrated to be effective in humans but has been shown to prevent sterility in male and female rats. Important in muscular and nervous systems.</p>	<p>No definite deficiency symptoms in humans. Has been used with success in habitual and threatened abortion as well as certain neuro-muscular disorders.</p>	<p>Wheat germ oil Corn oil Lettuce Spinach Egg yolk Meat Legume Seeds</p>

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Vitamin K Anti-hemorrhagic factor Coagulation vitamin	Natural product is naphthoquinone compound—oily liquid and insoluble in H ₂ O. Fat-soluble, stable to heat and reducing agents. Labile to alcoholic alkali, oxidizing agents, strong acids, and AlCl ₃ . Occurs in nature as a phytyl derivative (vitamin K ₁) in green leaves. The diarnesyl derivative (vitamin K ₂) is formed by putrefaction. A commercial synthetic 2, methyl 1,4 naphthoquinone has vitamin K activity and is called Menadione.	Aids in prevention of hemorrhage in newborn. Essential in promoting normal prothrombin content and clotting of blood.	Obstructive jaundice. Hemorrhagic tendency. Poor healing of wounds after post-operative conditions.	Alfalfa concentrate Spinach Cabbage Cauliflower Kale Carrot greens Tomatoes

VITAMINS (Continued)

Vitamin Unit Table

Vitamin A	1 International Unit = 1 USP Unit Activity of 0.6 micrograms* of beta-carotene
Vitamin B ₁	1 International Unit = 1 USP Unit Activity of 3.0 micrograms of crystalline thiamin chloride
Riboflavin	Quantities expressed in micrograms or milligrams
Niacin } Niacin amide }	Quantities expressed in micrograms or milligrams
Pantothenic acid	Quantities expressed in micrograms or milligrams
Choline	Quantities expressed in milligrams
Pyridoxine	Quantities expressed in micrograms or milligrams
Vitamin C	Expressed in milligrams 1 International Unit = 1 USP Unit and is equal to activity of 0.05 milligrams of synthetic ascorbic acid.
Vitamin D (For humans and four-footed animals)	1 International Unit = 1 USP Unit Potency of 0.025 micrograms of pure Vitamin D ₂ (calciferol) made by irradiation of ergosterol.
Vitamin E	Measured in micrograms or milligrams One I.U. is the alpha tocopherol activity of 0.1 gm of the International standard solution containing 1 mg. of pure synthetic alpha tocopherol acetate.

* Note.—One microgram = 0.000001 grams.

Abbreviations

A = Vitamin A	E = Vitamin E
B = Vitamin B ₁	K = Vitamin K
C = Vitamin C	N = Nicotinic Acid or Niacin
D = Vitamin D	R = Riboflavin

Reaction indicates the type and degree of reaction of the food in the body. The relative acidity or basicity is indicated by the designation h, high; m, medium; and l, low

VITAMINS (Continued)

Recommended Dietary Allowances¹

	Calories	Protein grams	Cal- cium grams	Iron mg	Vitamin A I.U. ²	Thia- min mg. ³	Ribo- flavin mg. ⁴	Niacin (nicotinic acid) mg. ³	Ascor- bic acid mg.	Vitamin D I.U.
Man (154 lb., 70 kg.)										
Sedentary.....	2500	70	0.8	12 ⁴	5000	1.2	1.6	12	75	5
Moderately active.....	3000	70	0.8	12 ⁴	5000	1.5	2.0	15	75	5
Very active.....	4500	70	0.8	12 ⁴	5000	2.0	2.6	20	75	5
Woman (123 lb., 56 kg.)										
Sedentary.....	2100	60	0.8	12	5000	1.1	1.5	11	70	5
Moderately active.....	2500	60	0.8	12	5000	1.2	1.6	12	70	5
Very active.....	3000	60	0.8	12	5000	1.5	2.0	15	70	5
Pregnancy (latter half).....	2500*	85	1.5	15	6000	1.8	2.5	18	100	400 to 800
Lactation.....	3000	100	2.0	15	8000	2.0	3.0	20	150	400 to 800
Children up to 12 yrs. ⁷										
Under 1 yr. ⁸	100/2.2 lb. (1 kg.)	3.5/2.2 lb. (1 kg.)	1.0	6	1500	0.4	0.6	4	30	400 to 800
1-3 yrs. (29 lb., 13 kg.).....	1200	40	1.0	7	2000	0.6	0.9	6	35	400
4-6 yrs. (42 lb., 19 kg.).....	1600	50	1.0	8	2500	0.8	1.2	8	50	400
7-9 yrs. (55 lb., 25 kg.).....	2000	60	1.0	10	3500	1.0	1.5	10	60	400
10-12 yrs. (75 lb., 34 kg.).....	2500	70	1.2	12	4500	1.2	1.8	12	75	400
Children over 12 yrs. ⁷										
Girls, 12-15 yrs. (108 lb., 49 kg.).....	2600	80	1.3	15	5000	1.3	2.0	13	80	400
16-20 yrs. (119 lb., 54 kg.).....	2400	75	1.0	15	5000	1.2	1.8	12	80	400
Boys, 13-15 yrs. (103 lb., 47 kg.).....	3200	85	1.4	15	5000	1.5	2.0	15	90	400
16-20 yrs. (141 lb., 64 kg.).....	3800	100	1.4	15	6000	1.8	2.5	18	100	400

Recommended Dietary Allowances¹ (Continued)

¹ Revised 1945 Food and Nutrition Board, National Research Council.

² The allowance depends on the relative amounts of vitamin A and carotene. The allowances of the table are based on the premise that approximately two-thirds of the vitamin A value of the average diet in this country is contributed by carotene and that carotene has half or less than half the value of vitamin A.

³ For adults (except pregnant and lactating women) receiving diets supplying 2,000 calories or less, such as reducing diets, the allowances of thiamin, riboflavin, and niacin may be 1 mg., 1.5 mg., and 10 mg. respectively. The fact that figures are given for different calorie levels for thiamin, riboflavin, and niacin does not imply that we can estimate the requirement of these factors within 500 calories, but they are added merely for simplicity of calculation. Other members of the B complex also are required, though no values can be given. Foods supplying adequate thiamin, riboflavin, and niacin will tend to supply sufficient of the remaining B vitamins.

⁴ There is evidence that the male adult needs little or no iron. The allowance will be provided if the diet is satisfactory in other respects.

⁵ For persons who have no opportunity for exposure to clear sunshine and for elderly persons, the ingestion of small amounts of vitamin D may be desirable. Other adults probably have little need for vitamin D.

⁶ During the latter part of pregnancy the allowance should increase approximately 20 percent over the preceding level. The value of 2500 calories represents the allowance for pregnant, sedentary women.

⁷ Allowances for children are based on the needs for the middle year of the age group.

⁸ Needs of infants increase from month to month with size and activity. The amounts given are for approximately 6 to 8 months. The allowance in calories and the protein in grams are indicated per kilogram weight. The values should be divided by 2.2 to obtain the figures per pound weight. The dietary requirements for some of the nutrients such as protein and calcium are less if derived largely from human milk.

COMPOSITION AND VALUE OF FOODS

Compiled mainly from the publications of the U. S. Department of Agriculture.

The proportions of **protein**, **fat**, **carbohydrate** and **mineral matter** are given as percent by weight of the food named. The fuel value is stated in kilogram calories per 100 grams.

The standard daily requirement for an average adult has been accepted as 3000 calories; 75 g of protein, 0.69 g of calcium, 1.32 g of phosphorus, 0.015 g of iron.

The relative value of the food as a source of **vitamins** is shown by letters indicating the vitamins present with subscripts showing the relative abundance. Symbol **N** is used to indicate nicotinic acid and **R**, riboflavin. The best sources are indicated as rich in the particular vitamin by the subscript **r**. Other classifications are shown by the subscripts **e**, **g** and **f** for excellent, good and fair respectively.

COMPOSITION AND VALUE OF FOODS (Continued)

COMPOSITION OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins r = rich e = excellent g = good f = fair	Reaction h = high m = med. l = low
	Protein	Fat	Carbohy- drate		Cal- cium	Phos- phorus	Iron		
Animal Foods									
Cheese:									
American, pale.....	28.8	35.9	.3	453	.93	.68	.0013	Ar, Rf	Acid l
Camembert.....	21	22	...	282	.93	.68	.0013	Ar	Acid l
Cheddar.....	27.7	36.8	4.1	473	.92	.68	.0013	Ar, Rg, Rf	...
Cottage.....	20.9	1.0	4.3	112	.11	.37	...	Ar, Bf, Rf	...
Cream, full.....	25.9	33.7	2.4	430	.92	.68	.0013	Ar, Rg	...
Neuchâtel.....	18.7	27.4	1.5	337	.93	.68	.0013	Ar, Rf	...
Roquefort.....	22.6	29.5	1.8	375	.93	.68	.0013	Ar, Rf	...
Swiss.....	27.6	34.9	1.3	443	1.1	.81	.0014	Ar, Rf	...
Eggs:									
Plain.....	13.4	10.5	...	159	.067	.18	.0030	Ar, Be, De, Eg, Rf	Acid m
Scrambled.....	12	18	...	210	.087	.24	.0041	Ar, Bf, De, Eg, Rf	Acid m
Whites, boiled.....	12.3	2	...	55.1	.015	.014	.0010	Rf	Acid l
Yolks, boiled.....	15.7	33.3	...	376	.14	.53	.0086	Ar, Be, De, Eg, Rf	Acid h
Fish:									
Caviar.....	30	20	...	300	.14	.18	...	Ag, Bg, Dg, Eg	...
Clams.....	6.5	4	4.2	47.4	.11	.044	.0044	Ar, Bf, Cl, Dr, Rf	Acid
Codfish, salt, cooked.....	21.5	3	...	90.4	.030	.32	.0015	Ar, Bf, Dr	Acid m
Crab, canned.....	15.8	1.5	.7	81.6	.018	.19	...	Bf	Acid
Haddock, fresh, raw.....	16.8	3	...	73.9	.019	.19	.00090	Ar, Bg, Rf	Acid
Halibut, fresh.....	18.4	5.2	...	125	.021	.22	.0010	Ar, Bf	Acid m
Herring, smoked.....	20.6	15.0	...	225	.023	.24	.0013	Ar, Bf	Acid m
Herring, fresh.....	18.9	7.1	...	146	.021	.22	.0011	Ag, Bf, Dg	Acid
smoked.....	36.4	15.8	...	299	.039	.34	.0023	Ag, Bf, Dg	Acid

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Animal Foods (Cont.)									
Fish: (Cont.)									
Lobster, canned	18.1	1.1	.5	86.0	.018	.18	.00090	Bf	Acid m
Mackerel, fresh	11.4	3.5	...	80.5	.021	.22	.0010	Ag, Bf	Acid m
Oysters, raw	6.0	1.3	3.3	50.7	.051	.15	.0045	Ag, Bf, Cf, Dg, Rg	Acid m
Salmon, canned	21.8	12.1	...	202	.024	.25	.0012	Ag, Bf, Dg, Nf	Acid m
fresh	13.5	8.1	...	132	.024	.25	.0012	Ag, Bf, Dg, Nf	Acid m
Sardines, canned	22.4	19.7	...	278	.025	.28	.0013	Ag, Bf, Dg	Acid m
Shrimp, canned	25.4	1.0	.2	115	.094	.29	.0027	Af	Acid m
Trout, fresh	17.7	10.3	...	169	.019	.20	.0013	Bf	Acid m
Tuna, canned, oil	23.8	20.0	.6	287	.028	.29	.0014	Af, Bf, Df	Acid
fresh	17	3	...	95	.019	.20	.00090	Af, Bf, Df	Acid
Whitefish	22.1	6.5	...	154	...	...	...	...	...
Gelatin	84.2	.1	...	376	...	...	...	...	...
Meats:									
Beef:									
Chipped, dried	29.7	6.5	.4	185	.015	.32	.0045	Af, Bf, Ef, Rg	Acid
Corned, cooked	15.3	26.2	...	308	.020	.36	.0051	Af, Bf, Ef, Rg	Acid
Kidneys	16.9	4.8	.4	115	.0099	.19	.0024	Ag, Bf, Cf, Ef, Ng, Rg	Acid m
Liver	21.0	4.5	1.7	133	.017	.21	.0079	Ag, Bf, Cf, Ef, Ng, Rg	Acid m
Miscellaneous cuts, fat free	22.1	2.9	...	119	.015	.24	.0033	Bf, Ef, Re	Acid m
Roast, loin	18.6	19.1	...	255	.0090	.18	.0025	Af, Bf, Ef, Rg	Acid m
Rump, lean	19.6	18.7	...	213	.018	.29	.0031	Af, Bf, Ef, Rg	Acid m
Steak, round	20.5	16.6	...	184	.013	.20	.0023	Af, Bf, Ef, Ng, Rg	Acid m
sirloin	18.6	18.5	...	249	.014	.17	.0036	Af, Bf, Ef, Ng, Rg	Acid m

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Animal Foods (Cont.)									
Meats: (Cont.)									
Lamb:									
Chops, broiled.....	21.2	29.9	6.7	367	.016	.22	.0030	Af, B ₆ , Rf	h = high m = med.
Leg, roast.....	19.4	12.7	.....	198	.0097	.23	.0033	Af, B ₆ , Rf	l = low
Miscellaneous:									
Bologna.....	18.4	17.6	.3	241	.....	.....	.....	Af, Bf, Rf	Acid m
Frankfurters.....	19.7	18.6	1.1	258	.012	.22	.0031	Al, Bf, Rf	Acid m
Mutton:									
Chop.....	23.9	18.5	.....	270	.0097	.16	.0023	Af, B ₆ , Rg	Acid m
Leg, roast.....	25.3	22.6	.....	313	.0048	.27	.0023	Al, B ₆ , Rg	Acid m
Pork:									
Bacon, smoked.....	9.9	64.8	.....	646	.012	.22	.0030	Af, B ₆ , Rf	Acid m
Chop, loin, lean.....	19.7	19.0	.....	260	.022	.032	.0005	Af, B ₆ , Rf	Acid m
Ham, smoked, lean.....	20.2	20.8	.....	274	.012	.22	.0030	Af, B ₆ , Rf	Acid m
Liver.....	21.3	4.5	1.4	136	.....	.....	.....	Ae, B ₆ , Cf, Dr, Ne, Re	Acid m
Roast.....	19.5	17.5	.....	235	.0094	.17	.0025	Bg, Rg	Acid m
Veal:									
Chops.....	19.4	10.0	.....	174	.012	.22	.0030	Bf, Rg	Acid m
Liver.....	20.4	5.3	.....	127	.....	.....	.....	Ag, Bf, Cg, Ef, Ne, Re	Acid m
Roast, leg.....	20.5	6.7	.....	148	.013	.24	.0033	Bf, Rf	Acid m
Milk:									
Buttermilk, plain.....	3.0	.5	4.8	36.4	.10	.095	.00030	Af, B ₆ , Rg	Basic l
Condensed, sweetened.....	8.8	8.3	54.1	335	.30	.23	.00060	Ae, Bf, Rg	Basic l
unsweetened.....	9.6	9.3	11.2	172	.32	.24	.00070	Ae, Bf, Rg	Basic l

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Animal Foods (Cont.)									
Milk: (Cont.)									
Cream, 18 per cent.	2.5	18.5	4.5	201	.085	.069	.00020		
40 per cent.	2.2	40	3	381	.085	.069	.00020		
Human.	1.5	3.3	6.5	62					
Ice cream, plain.	5	12	20	208	.10	.088	.00020	Ar, Bf, Df, Rf	Neutral
Skimmed.	3.4	3	5.1	37.5	.12	.096	.00030	Ar, Bf, Df, Rf	Basic
Whole.	3.3	4.0	5.0	71.6	.12	.093	.00020	Ag, Bf, Df	Basic
Poultry:								Bf, Rg	Basic
Chicken, broiled.	21.6	2.5		111	.012	.23	.0032	Ar, Bf, Df, Rf	Neutral
liver.	22.4	4.2	2.4	141				Ar, Bf, Df, Rf	Neutral
roast.	25	11.1		200	.011	.20	.0024	Ag, Bf, Df, Rf	Basic
Duck.	18	19		243	.0099	.20	.0028	Ag, Bf, Df, Rf	Basic
Goose.	16.3	36.2		403	.0092	.18	.0025	Ag, Bf, Df, Rf	Basic
Quail.	24	6.4		154	.015	.27	.00077	Ag, Bf, Df, Rf	Basic
Squab.	19	22		274	.012	.22	.0030	Ag, Bf, Df, Rf	Basic
Turkey, liver.	22.9	5.2	.6	144				Ag, Bf, Df, Rf	Basic
roast.	28.4	18.4		285	.023	.43	.00030	Ag, Bf, Df, Rf	Acid
Vegetable Foods									
Bread:									
Biscuits.	9.3	13.7	52.6	381	.072	.14	.0015		Acid
Brown.	5.4	1.8	47.1	231	.11	.16	.0026		Basic
Corn.	7.9	4.7	46.3	266	.082	.13	.00086	Ar, Bf, Rg, Rf	Acid
Gluten.	9.3	1.4	49.8	256					Acid

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Bread: (Cont.)									
Graham.....	8.9	1.8	51.0	267	.050	.22	.0025	At, Bg, Eg	Acid l
Griddle cakes, plain.....	7	.5	31.6	200	.075	.11	.0088	Ag, Bf, Ef	Acid l
Muffins, corn meal.....	8.5	7	44	273	.11	.20	.0017	Ag, Bg	Acid l
graham.....	8	.4	46	252	.074	.17	.0016	Ag, Bg	Acid l
Rye.....	9.0	.6	52.7	260	.024	.14	.0016	At, Bg, Rf	Acid l
Rye and wheat.....	11.9	.3	51.5	262	.10	.17	.0015	At, Bg, Rf	Acid l
Toast, plain.....	11.5	1.6	61.2	313	.077	.21	.0018	At, Bf	Acid l
Waffles, plain.....	13.2	15.5	48	385	.077	.11	.0010	At, Bf	Acid l
Wheat, cracked.....	8.7	1.7	50	250	.063	.17	.0015	Ag, Bg, Rf	Acid l
white.....	9.3	1.2	52.2	266	.027	.092	.00090	Ag, Bf	Acid l
whole.....	9.7	.9	48.5	251	.048	.17	.0016	Ag, Bg, Eo, Rf	Acid l
Zwieback.....	9.8	9.9	73.5	434	.053	.14	.0016	Bf	Acid l
Cake:									
Angel food.....	9	.3	66	300	.030	.078	.00030	.....	Acid l
Cream puffs.....	11	17	50	397	.....	.....	.....	Ae, Bf	Acid
Devil's food.....	11.6	17	42.9	371	.12	.20	.0059	Ae, Bf	Acid l
Doughnuts.....	7.9	23.9	65.5	523.8	.11	.38	.001	Ag, Bf, Rf	Acid l
Fruit.....	5.9	10.9	64.1	388	.11	.17	.0052	Ag, Bf	Basic m
Gingerbread.....	5.8	9.0	62.6	368	.11	.059	.0038	At, Bf	Basic m
Sponge.....	6.3	10.7	65.9	396	.073	.22	.0033	Ag, Bf, Ef, Rf	Acid m
Cereals:									
Barley, pearl.....	8.5	1.1	77.5	364	.039	.18	.0020	At, Be, Eg, Rg	Acid m
Bran, unwashed.....	16.3	8.5	54.4	359	.12	1.2	.0076	Bg, Rg	Acid
Corn flakes.....	8.2	.4	86.7	383	.0071	.11	.00075	.....	Acid l

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohy- drate		Cal- cium	Phos- phorus	Iron		
Vegetable Foods (Cont.)									
Cereals: (Cont.)									
Corn meal	8.4	4.7	74.0	381	.0048	.039	.00025	Ar, Br, Rf	h = high m = med. l = low
Cream of wheat, raw	11	.9	78.6	366	.021	.12	.00055	Bg	Acid
Farina, light	11.0	1.4	76.4	371	.0030	.020	.00010	Br	Acid
Grapenuts	11.5	1	79	371				Bg	Acid
Macaroni	13.7	2.0	73.3	367	.040	.184	.0025		Acid
Noodles	11.7	1.0	75.2	367				Ar, Ef	Acid
Oats, rolled	16.6	6.6	65.2	387	.054	.442	.0041	Bg, Ef	Acid l
Pop corn	10.7	5.0	77.3	413					Acid l
Puffed rice	8.3	3	83.7	370	.00092	.0088	.00010		Acid l
Puffed wheat	16.2	1.8	73.2	374	.028	.044	.0045	Ar, Rf	Acid l
Rice, cooked	2.8	1	24.4	112	.0018	.044	.00025		Acid l
Spaghetti	12.1	4	75.9	366	.0039	.031	.00022		Acid l
Tapioca	4	1	87.9	364	.023	.088	.0016		Acid
Wheatena, raw	11.5	1.47	70.6	342	.044	.42	.0050	Br, Rg	Neutral
Wheat germ meal	25.36	8.10	47	374		.130		Br, Rg	Acid
Wheat, shredded	12.1	1.8	75.2	365	.041	.32	.0045	Ar, Rg, Rf	Acid
Chocolate, sweet	10	32.5	42.5	505	.092	.45	.0032	Ag, Bg, Ee, Rf	Acid
Chocolate, unsweetened	12.9	48.7	30.3	631	.092	.45	.0032	Df	
Cocoa	21.6	28.9	37.7	511				Df	
Cookies:									
Gingersnaps	6.5	8.6	75.3	418	.030	.031	.0016		Basic m
Hermits	8	12	64.8	400	.013	.014	.00020	Ar, Br	Acid l
Macaroons	6.5	15.2	64.1	435	.016	.065	.00075	Ar, Br	Acid l
Molasses	7.2	8.7	75.7	421	.099	.020	.0034	Ar, Br	Basic h

COMPOSITION AND VALUE OF FOODS (Continued)

COMPOSITION OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Cookies: (Cont.)									
Oatmeal.....	12	12	86	500	.045	.12	.0010	Af, Bf	Acid l
Sugar.....	7.0	10.2	72.1	423	.014	.021	.00032		Acid l
Vanilla wafers.....	6.6	14.0	71.3	451	.0041	.0097	.00011		Acid l
Crackers:									
Boston.....	11.0	8.5	70.3	416					Acid
Butter.....	9.6	10.1	71.2	427					Acid
Educator.....	11.7	13.5	79	484					Acid
Graham.....	10.0	9.4	72.3	431	.020	.097	.0010	Bf	Acid
Oatmeal.....	11.8	11.1	67.1	434				Bf	Acid
Oyster.....	11.3	10.5	70.3	433					Acid
Pretzels.....	9.7	3.9	72.3	375					Acid
Saltines.....	10.6	12.7	68.0	442	.023	.092	.0013		Acid m
Soda.....	9.8	9.1	72.6	424	.023	.12	.00025		Acid m
Flour:									
Arrowroot.....			97.5	400					Acid
Barley.....	10.5	2.2	66.3	362				Bf	Acid
Buckwheat.....	6.4	1.2	77.5	357	.040	.23	.0012		Acid
Corn flour.....	7.1	1.3	77.5	363				Bf	Acid
Gluten (high) starch.....			90.0	369					Acid
Gluten (low) starch.....			70.5	367					Acid
Graham.....	14.2	1.8	70.5	367					Acid m
Rice.....	13.3	2.2	69.5	368	.040	.37	.0037	Bf	Acid l
Rye.....	8.6	6.1	51.9	370					Acid l
	6.8	.9	78.3	359	.018	.29	.0013	Bf	Acid

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Flour: (Cont.)									
Wheat, patent.	10.8	1.1	74.6	362	.020	.088	.0010	Bf	h = high m = med.
Wheat, whole.	13.8	1.9	71.0	369	.031	.24	.0025	Bg, Rf	l = low
Fruits:									
Apple, baked.	.2	.8	29.2	125	.0074	.013	.00030	Af, Rf	Basic l
Apple, raw.	.4	.5	13.0	63.9	.0074	.013	.00030	Af, Bg, Ce, Rf	Basic l
Apple, sauce.	.2	.8	37.2	161	.0058	.0097	.00020	Af, Rf	Basic l
Apricots, canned.	.9	....	17.3	75.0	.014	.025	.00030	Ae, Cf	Basic
Apricots, fresh.	1.1	....	13.4	59.5	.014	.025	.00030	Ae, Ce	Basic
Bananas.	1.3	.6	21.0	101	.0062	.027	.00055	Ag, Bg, Ce, Rf	Basic l
Blackberries, canned.	.8	2.1	56.4	254	.012	.026	.0005	Ag	Basic
Blackberries, canned.	.6	.6	12.8	60.6	.020	.084	.00090	Af	Basic
Cantaloupe.	.6	....	9.3	40	.018	.015	.0005	Af, Bf, Cg	Basic m
Cherries, canned.	1.1	.1	21.1	91.5	.020	.030	.00040	Ag, Cf	Basic
Cherries, fresh.	1.0	.8	16.5	80.5	.020	.030	.00040	Ag, Cg	Basic
Cranberries, raw.	.4	.6	8.4	47.4	.020	.013	.00060	Af, Cf	Acid
Cranberry sauce.	.2	.2	62	250	.018	.012	.00060	Cf	Acid
Currants, fresh.	1.5	....	12.8	58.4	.026	.038	.0005	Cg	Basic
Dates.	2.1	2.8	78.4	356	.065	.056	.0030	Ag, Bf	Basic m
Figs, dried.	4.3	.3	74.2	325	.16	.12	.0030	Af, Bf, Rf	Basic m
Figs, fresh.	1.5	....	18.8	83.8	.053	.037	.0030	Af, Bf, Rf	Basic
Grapefruit.	.8	.2	10.4	47	.028	.026	.00045	Bf, Cg, Rf	Basic
Grape juice.	....	....	25	100	.011	.011	.00030	Af, Bf, Cf	Basic
Grapes, Concord.	1.3	1.6	14.9	99.2	.020	.031	.00030	Af, Bf, Cf	Basic
Grapes, Malaga.	.8	1.4	20	96	.020	.031	.0023	Af, Bf, Cf	Basic

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Fruits: (Cont.)									
Lemon juice.....	1.0	.7	9.8	39.7	.0041	.0026	.000075	At, Bf, Cg	h
Lemons.....	4.6	.6	7.4	45.2	.036	.022	.0005	Ag, Bf, Cr	h
Loganberries.....	.6	.6	7.2	53	.018	.015	.00030	Bf, Cg	h
Muskmelon.....	.6	.6	15.9	40.8	.018	.015	.00030	Ar, Eg, Cr	h
Nectarines.....	.6	.6	15.9	67.2	.018	.015	.00030	Ar, Eg, Cr	h
Orange juice.....	.8	.2	10.8	43	.029	.016	.00020	Cg	h
Oranges.....	.7	.1	11.6	52	.044	.020	.00020	Ag, Bf, Cr, Rf	h
Peaches, canned.....	.7	.1	10.8	48.5	.012	.022	.00030	Ag, Bf, Ce, Rf	h
Peaches, fresh.....	.7	.1	5.8	41.9	.016	.023	.00036	Ag, Bf, Ce, Rf	h
Pears, canned.....	.3	.3	18.0	78.3	.018	.031	.00030	At, Bf, Cf, Rf	h
Pears, fresh.....	.6	.5	11.4	65.0	.018	.031	.00031	At, Bf, Cg, Rf	h
Pineapple, canned.....	.4	.7	36.4	158	.018	.034	.0005	At, Bf, Cg, Rf	h
Pineapple, fresh.....	.4	.3	9.3	44.1	.032	.062	.0011	Ag, Eg, Cr, Rf	h
Plums, fresh.....	1.0	.3	20.1	87.1	.020	.032	.0005	Cf	h
Prunes, stewed.....	.5	.1	22.3	94.8	.025	.053	.0015	Ae, Cf, Rg	h
Raisins.....	2.6	3.3	76.1	334	.066	.13	.0021	Ae, Cf, Rg	h
Raspberries, fresh.....	1.7	1.0	12.6	68.3	.049	.048	.00060	Cg	h
Rhubarb.....	.6	.7	2.5	23.1	.047	.011	.0011	Cg	h
cooked (with sugar).....	.5	.4	66	272	.047	.011	.0011	Cg	h
Strawberries, cooked.....	.7	.6	24.0	101	.041	.028	.00080	Cf	h
Strawberries, raw.....	1.0	.6	6.0	39.7	.041	.028	.00080	Ag, Bf, Cr	h
Tangerines.....	2	1	9	125	.011	.026	.00061	Cr	h
Watermelon.....	.4	.2	6.7	30.9	.011	.026	.00030	At, Bf, Cg, Rf	h

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Nuts:									
Almonds	21.0	54.9	15.8	679	.24	.46	.0039	At, B _g	Basic m
Brazil	17.0	66.8	7.0	720			.0039	At, B _g	
Butternuts	27.9	61.2	3.5	698			.0068	At, B _g	
Chestnuts, dried	10.7	7.0	71.5	413	.034	.092	.00070	B _g At, B _f , D _g	Basic l
Cocoanut, prepared	6.3	57.4	31.5	689	.059	.14	.0027	At, B _f , D _g	Basic m
Filberts	15.6	65.3	13.0	725	.29	.35	.0041	B _f	
Hickory	15.4	67.4	11.4	737			.0029	B _f	
Peanuts, shelled	25.8	38.6	21.9	564	.069	.40	.0023	B _g , N _g	Acid l
Pecans	9.6	70.5	15.3	757	.089	.35	.0026	At, B _f	
Pine	33.9	49.4	6.9	627			.0079		
Pistachios	22.3	54.0	16.3	660			.0060	At, P _g	
Walnuts, black	27.6	56.3	10.0	685	.089	.36	.0021	At, B _g	Acid l
Walnuts, English	18.4	64.4	11.6	728					
Pie:									
Apple	3.1	9.8	42.8	280	.011	.022	.00030	At, B _f , R _f	Basic
Custard	4.2	6.3	26.1	183	.14	.16	.0012	Ag, B _g	Acid
Lemon meringue	3.6	10.1	37.4	262	.014	.038	.00058	Ag, B _f , C _f , R _g	Acid
Mince	5.8	12.3	38.1	308	.083	.17	.0025	Ag, B _g	Acid
Pumpkin	4	5.4	34	200	.054	.081	.00079	Ag, B _g	Acid
Squash	4.4	8.4	21.7	185	.063	.073	.00059	At, B _g	Acid
Pudding:									
Apple tapioca	.3	.1	29.3	122	.0081	.020	.00041	B _f , E _f , R _f	Basic l
Bread	5.04	8.07	15.9	156	.11	.090	.000010	At, B _f , E _f	Acid l

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight		Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus		
Vegetable Foods (Cont.)								
Pudding (Cont.)								
Cottage.	6	9	56.1	329	.16	.23	Af, Bf	Acid l
Rice.	4.0	4.6	31.4	182	.041	.042	.....	Basic l
Tapioca, cream.	3.3	3.2	28.2	159	.032	.053	A _g , Bf	Basic l
Vegetables:								
Artichoke, French.	2.9	.4	8.7	62.8	.031	.087	A _e , B _g , C _g , R _g	Basic
Asparagus, canned.	1.5	.1	2.3	18.7	.027	.039	A _g , B _g , C _g , R _g	Basic l
Asparagus, fresh.	2.2	.2	3.2	26.2	.027	.039	A _g , B _e , C _g , R _g	Basic l
Beans, kidney, canned.	7.0	1.5	17.3	106	.039	.14	A _g , B _g , E _g , Rf	Basic l
lima, dried.	18.1	1.5	65.9	358	.069	.33	A _g , B _g , E _g , Rf	Basic m
lima, fresh.	7.5	.8	22.0	131	.028	.13	A _g , B _g , E _g , Rf	Basic m
navy, dried.	22.5	1.8	55.2	354	.17	.44	A _g , B _g , C _f , E _g , Rf	Basic m
string, fresh.	2.3	.3	5.5	43.0	.046	.052	A _e , B _f , C _f , E _g , Rf	Basic l
Beet greens, cooked.	2.2	3.4	3.2	54.0	.10	.....	A _g , B _f , C _f , D _f , E _f , R _g	Basic m
Beets, cooked.	2.3	.1	7.4	40.8	.029	.038	A _f , B _g , C _f , Rf	Acid
Brussel sprouts.	4.4	.5	7.6	57.7	.031	.12	A _f , B _g , C _e , Rf, K _g	Basic l
Cabbage.	1.6	.3	4.5	31.9	.045	.013	A _r , B _g , C _e , Rf	Basic m
Carrots.	1.1	.4	8.2	46.3	.055	.044	A _r , B _g , C _f , Rf	Basic l
Cauliflower.	2.4	.2	4.0	31.0	.12	.057	A _f , B _g , C _f , Rf	Basic l
Celery.	1.1	.1	3.3	18.7	.078	.037	A _g , B _f , C _g , E _g , Rf	Basic l
Chard, Swiss.	1.4	.2	3.5	25.0	.15	.040	A _e , B _g , C _f , D _f , R _g	Basic m
Corn, canned.	2.8	1.2	18.2	100	.060	.10	A _g , B _f , C _f	Acid l
fresh on cob.	3.1	1.1	19.2	104	.065	.10	A _g , B _f , C _f	Acid l
Cucumbers.	.8	.2	2.4	17.6	.016	.033	A _f , B _i , C _g	Basic l
Egg plant.	1.2	.3	4.3	28.7	.011	.034	A _f , B _f , C _f	Basic

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Vegetables: (Cont.)									
Lentils, dried.....	25.7	1.0	59.2	357	.053	.25	.0043	Ag, B ₆ , E _g , R _g	Acid l
Lettuces, green leaf.....	1.2	.3	2.2	19.8	.043	.043	.0027	Ar, B ₆ , C _r , D _r , E _r , R _g	Basic l
Mushrooms.....	3.5	.4	6.0	46.3	.017	.11	.0031	B ₆	Basic l
Okra.....	1.6	.2	4.0	38.6	.037	.037	.00063	Ag, B _r , C _g , R _f	Basic
Olives, green.....	1.1	27.6	11.6	309	.12	.014	.0029	Ag	Basic
Olives, ripe.....	1.7	25.9	4.3	266	.12	.014	.0029	Ag	Basic
Onions.....	1.6	.3	9.1	49.6	.035	.046	.00060	B _f , C _g , R _f	Basic l
Parsnips.....	1.6	.5	11.0	66.1	.061	.073	.00060	Ar, B ₆	Basic m
Peas, canned	3.6	.2	8.6	56.2	.013	.064	.00083	Ar, B ₆ , C _r , E _g , R _g	Basic l
dried.....	24.6	1.0	57.5	365	.085	.40	.0057	Ar, B _r , E _r , R _g	Basic l
green.....	7.0	.5	15.2	103	.026	.13	.0017	Ar, B ₆ , C _r , E _g , R _g	Basic l
Potatoes, boiled.....	2.5	.1	20.3	97.0	.013	.057	.0013	Ag, B _r , C _r , R _f	Basic l
sweet.....	1.8	.7	26.1	126	.020	.045	.0005	Ar, B _r , C _r , R _f	Basic l
Pumpkin.....	1.0	.1	4.0	26.5	.023	.059	.00080	Ag, B _r , C _g	Basic l
Radishes.....	1.3	.1	5.1	29.8	.021	.029	.00060	B ₆ , C _g	Basic l
Rutabagas.....	1.3	.2	7.3	41.9	.077	.056	.0005	Ar, B _r , C _r , R _f	Basic m
Sauerkraut.....	1.7	.5	3.8	27.6	.046	.029	.0011	Ar, B _r , C _r , R _f	Basic
Spinach, cooked.....	2.1	4.1	2.6	57.3	.067	.066	.0036	Ar, B ₆ , C _g , D _g , E _f , K _e , R _f	Basic h
Squash.....	1.4	.5	8.2	47.4	.020	.030	.00060	Ag	Basic
Tomatoes, canned.....	1.2	.2	3.5	23.1	.011	.026	.00040	Ar, B ₆ , C _r , K _g , R _f	Basic l
fresh.....	.9	.4	3.3	23.1	.011	.026	.00040	Ar, B ₆ , C _r , K _g , R _f	Basic l
Turnips.....	1.3	.2	6.8	40.8	.064	.046	.0005	Ar, B _r , C _g , R _f	Basic l
Watercress.....	1.7	.3	2.8	22.7	.17	.0044	.0018	Ag, B ₆ , C _r , D _r , N _g , R _g	Basic
Yeast, compressed.....	11.7	.4	21.0	138	.011	.445	.0003	Br, N _g , R _g	.....

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel values, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Miscellaneous									
Candy:									
Butterscotch.....	1	45	95	789	.031	.0066	.0014	Af	Neutral
Chocolate creams.....	1.4	10.5	62.5	350	.....	.....	.....	.....	Neutral
fudge.....	2	9.6	76.2	400	.032	.039	.00014	Af	Neutral
sweet milk.....	10	31	45	500	.21	.062	.0053	Af, Rf	Neutral
Gum drops.....	10.5	.....	77	350	.....	.....	.....	.....	Neutral
Marshmallows.....	6.66	.....	80	346	.....	.....	.....	.....	.....
Mints, after dinner.....	.....	.....	87.5	350	.....	.....	.....	.....	.....
Molasses candy.....	2.2	4.5	99.5	447	.086	.18	.0030	Bf	Neutral
Nougat, chocolate.....	.....	5	115	505	.....	.....	.....	.....	Basic
Nut bar.....	5.3	18.6	62	437	.067	.26	.0015	Bg	.....
Peanut brittle.....	12	21	75	537	.12	.17	.0039	Bg	.....
Fats:									
Butter.....	1.0	85.0	.....	795	.015	.017	.00025	Ar, Dg, Ef	Neutral
Cod liver oil.....	.....	100	.....	900	.....	.....	.....	Ar, Dr	Neutral
Corn oil.....	.....	100	.....	900	.....	.....	.....	Af, Eg	Neutral
Crisco.....	.....	100	.....	900	.....	.....	.....	Ef	Neutral
Lard.....	.....	100	.....	930	.....	.....	.....	Af, Ee	Neutral
Oleomargarine.....	1.2	83.0	.....	777	.....	.....	.....	Ag, Eg	Neutral
Olive oil.....	.....	100	.....	900	.....	.....	.....	Af, Ef	Neutral
Peanut oil.....	.....	100	.....	900	.....	.....	.....	Af, Ef	Neutral
Jelly, cherry.....	1.1	.....	77.2	321	.015	.010	.0005	Ag, Cf	Neutral
Salad dressing:									
Cream.....	7	21.7	31.5	350	.081	.12	.0010	Ag, Bf, Df, Rf	Acid
French.....	.....	60	2	548	.....	.....	.....	Af, Rf	Neutral

COMPOSITION OF FOODS (Continued)

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction h = high m = med. l = low
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Miscellaneous (Cont.)									
Salad Dressing: (Cont.)									
Mayonnaise.....	4	80	4	752	.0992	.053	.0080	Ae, Bf, Df, Rf	Acid l
Thousand Island.....	3.3	43	3.3	413	.043	.084	.0014	Af, Bf, Df, Rf	Acid
Soup:									
Asparagus, cream of.....	2.5	3.2	5.5	62.8	.13	.10	.00048	Af, Bf, Df, Ef	Basic l
Bouillon.....	2.2	1	.2	11.0	.11	.076	.00030	Af, Bf, Df, Ef	Basic l
Celery, cream of.....	2.1	2.8	5.0	55.1	.13	.0088	.00012	Ag, Bf, Rf	Acid
Chicken.....	10.5	.8	2.4	60.6	.13	.11	.00051	Ag, Bf, Rf	Acid
Chowder, clam.....	1.8	.8	6.7	43.0	.11	.11	.00041	Ag, Bf, Rf	Acid
corn.....	2.1	4.5	10.5	91	.11	.11	.00041	Ag, Bf, Rf	Acid
Consommé.....	2.5	.4	.4	12.1	.14	.025	.00078	Ag, Bg, Rf	Neutral
Oyster stew.....	4.8	6.3	7.2	105	.12	.099	.0005	Af, Bf	Acid l
Potato.....	3.2	3.6	10	85	.07	.064	.00015	Ag, Bg, Cf, Rg	Basic l
Tomato.....	1.8	1.1	5.6	40.8	.07	.064	.00015	Ag, Bg, Rg	Basic l
Vegetable.....	2.9	.5	.5	14.3	.11	.0092	.0030	Ag, Bg, Rg	Basic l
Sugar:									
Brown.....	...	...	95.0	389	.11	.0092	.0030	...	Neutral
Granulated.....	...	...	100	410	.11	.0092	.0030	...	Neutral
Maple.....	...	...	82.8	340	.11	.0092	.0030	...	Neutral
Syrup:									
Corn.....	...	...	85	340	.0060	.0092	.00060	...	Neutral
Honey.....	...	...	81.2	335	.0041	.019	.00070	...	Neutral
Maple.....	...	...	71.4	293	.11	.013	.0030	...	Neutral
Molasses.....	2.4	...	69.3	284	.22	.045	.0077	Bf	Basic

DEHYDRATION OF METALLIC SULPHATES

Metallic sulphates.	Temp. of beginning of decomposition, °C.	Products formed.	Color of products.
$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	38	$\text{CaSO}_4 \cdot \text{H}_2\text{O}$	White
$\text{CaSO}_4 \cdot \text{H}_2\text{O}$	80	$2\text{CaSO}_4 \cdot \text{H}_2\text{O}$	White
$2\text{CaSO}_4 \cdot \text{H}_2\text{O}$	149	CaSO_4	White
$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$	19	$\text{MgSO}_4 \cdot 6\text{H}_2\text{O}$	White
$\text{MgSO}_4 \cdot 6\text{H}_2\text{O}$	38	$\text{MgSO}_4 \cdot 2\text{H}_2\text{O}$	White
$\text{MgSO}_4 \cdot 2\text{H}_2\text{O}$	112	$\text{MgSO}_4 \cdot \text{H}_2\text{O}$	White
$\text{MgSO}_4 \cdot \text{H}_2\text{O}$	203	MgSO_4	White
$\text{CdSO}_4 \cdot 8\text{H}_2\text{O}$	30	$\text{CdSO}_4 \cdot 2\text{H}_2\text{O}$	White
$\text{CdSO}_4 \cdot 2\text{H}_2\text{O}$	41	$\text{CdSO}_4 \cdot \text{H}_2\text{O}$	White
$\text{CdSO}_4 \cdot \text{H}_2\text{O}$	170	CdSO_4	White
$\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$	14	$\text{CoSO}_4 \cdot 4\text{H}_2\text{O}$	Rose
$\text{CoSO}_4 \cdot 4\text{H}_2\text{O}$	58	$\text{CoSO}_4 \cdot \text{H}_2\text{O}$	Lilac
$\text{CoSO}_4 \cdot \text{H}_2\text{O}$	276	CoSO_4	Lilac
$\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$	40	$\text{NiSO}_4 \cdot 4\text{H}_2\text{O}$	Green
$\text{NiSO}_4 \cdot 4\text{H}_2\text{O}$	106	$\text{NiSO}_4 \cdot \text{H}_2\text{O}$	Yellow
$\text{NiSO}_4 \cdot \text{H}_2\text{O}$	279	NiSO_4	Orange
$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$	25	$\text{ZnSO}_4 \cdot 6\text{H}_2\text{O}$	White
$\text{ZnSO}_4 \cdot 6\text{H}_2\text{O}$	28	$\text{ZnSO}_4 \cdot 2\text{H}_2\text{O}$	White
$\text{ZnSO}_4 \cdot 2\text{H}_2\text{O}$	115	$\text{ZnSO}_4 \cdot \text{H}_2\text{O}$	White
$\text{ZnSO}_4 \cdot \text{H}_2\text{O}$	225	ZnSO_4	White
$\text{MnSO}_4 \cdot 5\text{H}_2\text{O}$	25	$\text{MnSO}_4 \cdot 2\text{H}_2\text{O}$	Pale peach blossom
$\text{MnSO}_4 \cdot 2\text{H}_2\text{O}$	60	$\text{MnSO}_4 \cdot \text{H}_2\text{O}$	Paler than above
$\text{MnSO}_4 \cdot \text{H}_2\text{O}$	152	MnSO_4	Paler than above
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	27	$\text{CuSO}_4 \cdot 3\text{H}_2\text{O}$	Blue
$\text{CuSO}_4 \cdot 3\text{H}_2\text{O}$	93	$\text{CuSO}_4 \cdot \text{H}_2\text{O}$	Pale blue
$\text{CuSO}_4 \cdot \text{H}_2\text{O}$	155	CuSO_4	White
$\text{Al}_2(\text{SO}_4)_3 \cdot 16\text{H}_2\text{O}$	51	$\text{Al}_2(\text{SO}_4)_3 \cdot 13\text{H}_2\text{O}$	White
$\text{Al}_2(\text{SO}_4)_3 \cdot 13\text{H}_2\text{O}$	82	$\text{Al}_2(\text{SO}_4)_3 \cdot 10\text{H}_2\text{O}$	White
$\text{Al}_2(\text{SO}_4)_3 \cdot 10\text{H}_2\text{O}$	97	$\text{Al}_2(\text{SO}_4)_3 \cdot 7\text{H}_2\text{O}$	White
$\text{Al}_2(\text{SO}_4)_3 \cdot 7\text{H}_2\text{O}$	109	$\text{Al}_2(\text{SO}_4)_3 \cdot 4\text{H}_2\text{O}$	White
$\text{Al}_2(\text{SO}_4)_3 \cdot 4\text{H}_2\text{O}$	180	$\text{Al}_2(\text{SO}_4)_3 \cdot \text{H}_2\text{O}$	White
$\text{Al}_2(\text{SO}_4)_3 \cdot \text{H}_2\text{O}$	316	$\text{Al}_2(\text{SO}_4)_3$	White
$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	21	$\text{FeSO}_4 \cdot 4\text{H}_2\text{O}$	Light apple green
$\text{FeSO}_4 \cdot 4\text{H}_2\text{O}$	80	$\text{FeSO}_4 \cdot \text{H}_2\text{O}$	White
$\text{FeSO}_4 \cdot \text{H}_2\text{O}$	406	$\text{Fe}_2\text{O}_3, \text{SO}_3$	Yellowish green

DECOMPOSITION OF ANHYDROUS METALLIC SULPHATES

Metallic sulphate.	Temp. at beginning of decomposition, °C.	Temp. of energetic decomposition, °C.	Products of decomposition.	Color of product.
FeSO ₄	167	480	Fe ₂ O ₃ , 2SO ₄	Yellow brown
Fe ₂ O ₃ , 2SO ₃ ...	492	560	Fe ₂ O ₃	Red
Bi ₂ (SO ₄) ₃	570	639	5Bi ₂ O ₃ , 4(SO ₃) ₃ .	White
Al ₂ (SO ₄) ₃	590	639	Al ₂ O ₃	White
PbSO ₄	637	705	6PbO, 5SO ₃ ...	White
CuSO ₄	653	670	2CuO, SO ₃	Orange
MnSO ₄	699	790	Mn ₂ O ₄	Dark red to black
ZnSO ₄	702	720	3ZnO, 2SO ₃	White
2CuO, SO ₃	702	736	CuO.....	Black
NiSO ₄	703	764	NiO.....	Brownish green
CoSO ₄	720	770	CoO.....	Brown to black
3ZnO, 2SO ₃ ...	755	767	ZnO.....	White
CdSO ₄	827	846	5CdO, SO ₃	White
5Bi ₂ O ₃ , 4(SO ₃) ₃	870	890	Bi ₂ O ₃ (?).....	Yellow
5CdO, SO ₃	878	890	CdO.....	Brown
MgSO ₄	890	972	MgO.....	White
Ag ₂ SO ₄	917	925	Ag.....	Silver white
6PbO, 5SO ₃ ...	952	962	2PbO, SO ₃ (?)..	White to yellow
CaSO ₄	1200	.....	CaO.....	White
BaSO ₄	1510	.....	BaO.....	White

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

The following collections of tables gives the specific gravity, grams per liter, pounds per cubic foot, and pounds per gallon for a large number of substances in aqueous solution. The three latter quantities have been computed from the per cent of the substance in solution and the specific gravity, assuming the density of water at 4° C. as unity. The U. S. gallon, cubic foot, and pound avoirdupois equivalents were used. The degree Baumé corresponding to the specific gravity is given according to the relation,

$$\text{Bé.} = 145 - \frac{145}{\text{Sp. Gr.}}$$

The per cent by weight is indicated in every case.

The substances are arranged in alphabetical order. The specific gravity of alcohol solutions will be found in a separate group. Another table gives, with less detail, the specific gravity of solutions of many other substances. Tables indicated by the symbol * have been computed on the basis of values for the specific gravity found in the International Critical Tables.

ACETIC ACID

SPECIFIC GRAVITY OF AQUEOUS ACETIC ACID SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HC ₂ H ₃ O ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
.....	0.9982	0	.....	.....	.....
.....	0.9996	1	9.996	0.6240	0.0834
0.2	1.0012	2	20.02	1.250	0.1671
0.4	1.0025	3	30.08	1.877	0.2510
0.6	1.0040	4	40.16	2.507	0.3351
0.8	1.0055	5	50.28	3.139	0.4196
1.0	1.0069	6	60.41	3.771	0.5042
1.2	1.0083	7	70.58	4.406	0.5890
1.4	1.0097	8	80.78	5.043	0.6741
1.6	1.0111	9	91.00	5.681	0.7594
1.8	1.0125	10	101.3	6.321	0.8450
2.0	1.0139	11	111.5	6.962	0.9307
2.2	1.0154	12	121.8	7.607	1.017
2.4	1.0168	13	132.2	8.252	1.103
2.6	1.0182	14	142.5	8.899	1.190
2.8	1.0195	15	152.9	9.547	1.276
3.0	1.0209	16	163.3	10.20	1.363
3.2	1.0223	17	173.8	10.85	1.450
3.3	1.0236	18	184.2	11.50	1.538
3.5	1.0250	19	194.8	12.16	1.625
3.7	1.0263	20	205.3	12.81	1.713
3.9	1.0276	21	215.8	13.47	1.801
4.1	1.0288	22	226.3	14.13	1.889
4.2	1.0301	23	236.9	14.79	1.977
4.4	1.0313	24	247.5	15.45	2.066
4.6	1.0326	25	258.2	16.12	2.154
4.7	1.0338	26	268.8	16.78	2.243
4.9	1.0349	27	279.4	17.44	2.332
5.1	1.0361	28	290.1	18.11	2.421
5.2	1.0372	29	300.8	18.78	2.510
5.4	1.0384	30	311.5	19.45	2.600
5.5	1.0395	31	322.2	20.12	2.689
5.7	1.0406	32	333.0	20.79	2.779
5.8	1.0417	33	343.8	21.46	2.869
6.0	1.0428	34	354.6	22.13	2.959
6.1	1.0438	35	365.3	22.81	3.049
6.2	1.0449	36	376.2	23.48	3.139
6.4	1.0459	37	387.0	24.16	3.229
6.5	1.0469	38	397.8	24.83	3.320
6.6	1.0479	39	408.7	25.51	3.411
6.8	1.0488	40	419.5	26.19	3.501

ACETIC ACID (Continued)

SPECIFIC GRAVITY OF AQUEOUS ACETIC ACID SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HC ₂ H ₃ O ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
6.9	1.0498	41	430.4	26.87	3.592
7.0	1.0507	42	441.3	27.55	3.683
7.1	1.0516	43	452.2	28.23	3.774
7.2	1.0525	44	463.1	28.91	3.865
7.4	1.0534	45	474.0	29.59	3.956
7.5	1.0542	46	484.9	30.27	4.047
7.6	1.0551	47	495.9	30.96	4.138
7.7	1.0559	48	506.8	31.64	4.230
7.8	1.0567	49	517.8	32.32	4.321
7.9	1.0575	50	528.8	33.01	4.413
8.0	1.0582	51	539.7	33.69	4.504
8.1	1.0590	52	550.7	34.38	4.596
8.2	1.0597	53	561.6	35.06	4.687
8.3	1.0604	54	572.6	35.75	4.779
8.4	1.0611	55	583.6	36.44	4.870
8.4	1.0618	56	594.6	37.12	4.962
8.5	1.0624	57	605.6	37.80	5.054
8.6	1.0631	58	616.6	38.49	5.146
8.7	1.0637	59	627.6	39.18	5.237
8.8	1.0642	60	638.5	39.86	5.329
8.8	1.0648	61	649.5	40.55	5.420
8.9	1.0653	62	660.5	41.23	5.512
9.0	1.0658	63	671.5	41.92	5.603
9.0	1.0662	64	682.4	42.60	5.695
9.1	1.0666	65	693.3	43.28	5.786
9.1	1.0671	66	704.3	43.97	5.877
9.2	1.0675	67	715.2	44.65	5.969
9.2	1.0678	68	726.1	45.33	6.059
9.3	1.0682	69	737.1	46.01	6.151
9.3	1.0685	70	748.0	46.69	6.242
9.3	1.0687	71	758.8	47.37	6.332
9.4	1.0690	72	769.7	48.05	6.423
9.4	1.0693	73	780.6	48.73	6.514
9.4	1.0694	74	791.4	49.40	6.604
9.4	1.0696	75	802.2	50.08	6.695
9.5	1.0698	76	813.0	50.76	6.785
9.5	1.0699	77	823.8	51.43	6.875
9.5	1.0700	78	834.6	52.10	6.965
9.5	1.0700	79	845.3	52.77	7.054
9.5	1.0700	80	856.0	53.44	7.143
9.5	1.0699	81	866.6	54.10	7.232
9.5	1.0698	82	877.2	54.76	7.321
9.4	1.0696	83	887.8	55.42	7.409
9.4	1.0693	84	898.2	56.07	7.496
9.4	1.0689	85	908.6	56.72	7.582
9.3	1.0685	86	918.9	57.36	7.668
9.2	1.0680	87	929.2	58.00	7.754
9.2	1.0675	88	939.4	58.64	7.839
9.1	1.0668	89	949.5	59.27	7.923
9.0	1.0661	90	959.5	59.90	8.007
8.9	1.0652	91	969.3	60.51	8.089
8.8	1.0643	92	979.2	61.13	8.171
8.6	1.0632	93	988.8	61.73	8.252
8.5	1.0619	94	998.2	62.31	8.330
8.3	1.0605	95	1007	62.89	8.408
8.1	1.0588	96	1016	63.45	8.482
7.8	1.0570	97	1025	64.01	8.556
7.6	1.0549	98	1034	64.54	8.627
7.2	1.0524	99	1042	65.04	8.695
6.9	1.0498	100	1050	65.54	8.761

ALBUMEN

SPECIFIC GRAVITY OF AQUEOUS ALBUMEN SOLUTIONS AT 15.5° C.

Bé.	Sp. gr.	Per cent Albumen	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.37	1.0026	1	10.03	0.6259	0.0837
0.77	1.0054	2	20.11	1.255	0.1678
1.12	1.0078	3	30.23	1.887	0.2523
1.85	1.0130	5	50.65	3.162	0.4227
3.66	1.0261	10	102.6	6.406	0.8563
5.32	1.0384	15	155.8	9.724	1.300
7.06	1.0515	20	210.3	13.13	1.755
8.72	1.0644	25	266.1	16.61	2.221
10.42	1.0780	30	323.4	20.19	2.699
13.12	1.0919	35	382.2	23.86	3.189
13.78	1.1058	40	442.3	27.61	3.691
15.48	1.1204	45	504.2	31.47	4.207
17.16	1.1352	50	567.6	35.43	4.737
18.90	1.1511	55	633.1	39.52	5.283

ALUMINUM CHLORIDE

SPECIFIC GRAVITY OF AQUEOUS ALUMINUM CHLORIDE SOLUTIONS AT $\frac{18^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent AlCl ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0075	1	10.08	0.6290	0.0841
2.3	1.0164	2	20.33	1.269	0.1696
4.8	1.0344	4	41.38	2.583	0.3453
7.3	1.0526	6	63.16	3.943	0.5271
9.6	1.0711	8	85.69	5.349	0.7151
12.0	1.0900	10	109.0	6.805	0.9096
14.3	1.1093	12	133.1	8.310	1.111
16.6	1.1290	14	158.1	9.867	1.319
18.8	1.1491	16	183.9	11.48	1.534

ALUMINUM CHLORIDE
SPECIFIC GRAVITY OF ALUMINUM CHLORIDE SOLUTIONS AT
15° C. (GERLACH)

Bé.	Sp. gr.	Per cent Al ₂ Cl ₆	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.0072	1	10.07	0.6288	0.0841
2.1	1.0144	2	20.29	1.267	0.1693
3.1	1.0216	3	30.65	1.913	0.2558
4.1	1.0289	4	41.16	2.570	0.3437
5.0	1.0360	5	51.80	3.234	0.4323
6.0	1.0435	6	62.61	3.909	0.5225
7.0	1.0510	7	73.57	4.593	0.6140
8.0	1.0585	8	84.68	5.286	0.7067
9.0	1.0659	9	95.93	5.989	0.8006
9.9	1.0734	10	107.3	6.701	0.8958
10.9	1.0812	11	118.9	7.425	0.9925
11.9	1.0890	12	130.7	8.158	1.091
12.8	1.0968	13	142.6	8.901	1.190
13.7	1.1047	14	154.7	9.655	1.291
14.7	1.1125	15	166.9	10.42	1.393
15.6	1.1207	16	179.3	11.19	1.496
16.6	1.1290	17	191.9	11.98	1.602
17.5	1.1372	18	204.7	12.78	1.708
18.4	1.1455	19	217.6	13.59	1.816
19.3	1.1537	20	230.7	14.40	1.926
20.2	1.1623	21	244.1	15.24	2.037
21.2	1.1709	22	257.6	16.08	2.150
22.1	1.1795	23	271.3	16.94	2.264
23.0	1.1882	24	285.2	17.80	2.380
23.8	1.1968	25	299.2	18.68	2.497
24.8	1.2058	26	313.5	19.57	2.616
25.7	1.2149	27	328.0	20.48	2.737
26.5	1.2241	28	342.7	21.40	2.860
27.4	1.2331	29	357.6	22.32	2.984
28.3	1.2422	30	372.7	23.26	3.110
29.2	1.2518	31	388.1	24.23	3.238
30.1	1.2615	32	403.7	25.20	3.369
30.9	1.2712	33	419.5	26.19	3.501
31.8	1.2808	34	435.5	27.19	3.634
32.6	1.2905	35	451.7	28.20	3.769
33.5	1.3007	36	468.3	29.23	3.908
34.4	1.3109	37	485.0	30.28	4.048
35.2	1.3211	38	502.0	31.34	4.189
36.1	1.3313	39	519.2	32.41	4.333
36.9	1.3415	40	536.6	33.50	4.478
37.8	1.3522	41	554.4	34.61	4.627

ALUMINUM SULFATE
SPECIFIC GRAVITY OF AQUEOUS ALUMINUM SULFATE SOLUTIONS
 AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $\text{Al}_2(\text{SO}_4)_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.0093	1	10.09	0.6301	0.0842
2.8	1.0195	2	20.39	1.273	0.1702
5.6	1.0404	4	41.62	2.598	0.3473
8.4	1.0618	6	63.71	3.977	0.5317
11.2	1.0837	8	86.70	5.412	0.7235
13.9	1.1062	10	110.6	6.906	0.9232
16.6	1.1293	12	135.5	8.460	1.131
19.2	1.1529	14	161.4	10.08	1.347
21.8	1.1770	16	188.3	11.76	1.572
24.3	1.2017	18	216.3	13.50	1.805
26.8	1.2272	20	245.4	15.32	2.048
29.3	1.2534	22	275.7	17.21	2.301
31.7	1.2803	24	307.3	19.18	2.564
34.1	1.3079	26	340.1	21.23	2.838

Bé	Sp. gr.	Per cent $\text{Al}_2(\text{SO}_4)_3$ + $18\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.0093	1.948	19.66	1.227	0.1641
2.8	1.0195	3.896	39.72	2.479	0.3314
5.6	1.0404	7.791	81.06	5.060	0.6765
8.4	1.0618	11.69	124.1	7.747	1.036
11.2	1.0837	15.58	168.9	10.54	1.409
13.9	1.1062	19.48	215.5	13.45	1.798
16.6	1.1293	23.37	264.0	16.48	2.203
19.2	1.1529	27.27	314.4	19.63	2.624
21.8	1.1770	31.16	366.8	22.90	3.061
24.3	1.2017	35.06	421.3	26.30	3.516
26.8	1.2272	38.96	478.1	29.84	3.990
29.3	1.2534	42.85	537.1	33.53	4.482
31.7	1.2803	46.75	598.5	37.36	4.995
34.1	1.3079	50.64	662.4	41.35	5.528

ALUMINUM SULFATE
SPECIFIC GRAVITY OF ALUMINUM SULFATE SOLUTIONS AT
15° C. (LARSSON)
Alum-maker's Table

Bé.	Sp. gr.	100 kg. of solution contain				
		Kg. Al ₂ O ₃	Kg. SO ₃	Kg. sulfate with 13 per cent Al ₂ O ₃	Kg. sulfate with 14 per cent Al ₂ O ₃	Kg. sulfate with 15 per cent Al ₂ O ₃
0.7	1.005	0.14	0.32	1.1	1.0	0.9
1.4	1.010	0.27	0.64	2.1	2.0	1.8
2.3	1.016	0.41	0.95	3.1	2.9	2.7
3.0	1.021	0.55	1.27	4.2	3.9	3.6
3.7	1.026	0.68	1.59	5.3	4.9	4.6
4.4	1.031	0.81	1.89	6.3	5.8	5.4
5.0	1.036	0.94	2.20	7.3	6.7	6.3
5.6	1.040	1.07	2.50	8.3	7.7	7.2
6.2	1.045	1.20	2.80	9.3	8.6	8.0
6.9	1.050	1.33	3.11	10.3	9.5	8.9
7.6	1.055	1.46	3.40	11.2	10.4	9.7
8.1	1.059	1.58	3.69	12.2	11.3	10.6
8.7	1.064	1.71	3.98	13.1	12.2	11.4
9.2	1.068	1.83	4.27	14.1	13.1	12.2
9.9	1.073	1.96	4.56	15.1	14.0	13.1
10.5	1.078	2.08	4.84	16.0	14.8	13.9
11.0	1.082	2.20	5.12	16.9	15.7	14.6
11.6	1.087	2.32	5.40	17.8	16.5	15.4
12.2	1.092	2.44	5.67	18.7	17.4	16.2
12.7	1.096	2.55	5.95	19.6	18.3	17.0
13.3	1.101	2.67	6.22	20.5	19.1	17.8
13.8	1.105	2.78	6.49	21.4	19.9	18.6
14.4	1.110	2.90	6.76	22.3	20.7	19.3
14.8	1.114	3.01	7.02	23.2	21.5	20.1
15.4	1.119	3.13	7.29	24.1	22.4	20.9
15.9	1.123	3.24	7.55	24.9	23.1	21.6
16.5	1.128	3.35	7.81	25.8	23.9	22.3
16.9	1.132	3.46	8.06	26.6	24.7	23.1
17.5	1.137	3.57	8.32	27.5	25.5	23.8
17.9	1.141	3.68	8.58	28.3	26.3	24.5
18.4	1.145	3.79	8.83	29.1	27.1	25.3
18.9	1.150	3.89	9.07	30.0	27.8	26.0
19.4	1.154	4.00	9.32	30.8	28.6	26.7
19.9	1.159	4.11	9.57	31.6	29.3	27.4
20.3	1.163	4.21	9.82	32.4	30.1	28.1
20.9	1.168	4.32	10.06	33.2	30.8	28.9
21.3	1.172	4.42	10.29	34.0	31.6	29.5
21.7	1.176	4.52	10.53	34.8	32.3	30.1

ALUMINUM SULFATE (Continued)
SPECIFIC GRAVITY OF ALUMINUM SULFATE SOLUTIONS AT
15° C. (LARSSON)
Alum-maker's Table

Bé.	Sp. gr.	100 liters of solution contain				
		Kg. Al ₂ O ₃	Kg. SO ₃	Kg. sulfate with 13 per cent Al ₂ O ₃	Kg. sulfate with 14 per cent Al ₂ O ₃	Kg. sulfate with 15 per cent Al ₂ O ₃
0.7	1.005	0.14	0.33	1.1	1	0.9
1.4	1.010	0.28	0.65	2.2	2	1.9
2.3	1.016	0.42	0.98	3.2	3	2.8
3.0	1.021	0.56	1.31	4.3	4	3.7
3.7	1.026	0.70	1.63	5.4	5	4.7
4.4	1.031	0.84	1.96	6.5	6	5.6
5.0	1.036	0.98	2.28	7.5	7	6.5
5.6	1.040	1.12	2.61	8.6	8	7.5
6.2	1.045	1.26	2.94	9.7	9	8.4
6.9	1.050	1.40	3.26	10.8	10	9.3
7.6	1.055	1.54	3.59	11.8	11	10.3
8.1	1.059	1.68	3.91	12.9	12	11.2
8.7	1.064	1.82	4.24	14.0	13	12.1
9.2	1.068	1.96	4.57	15.1	14	13.1
9.9	1.073	2.10	4.89	16.2	15	14.0
10.5	1.078	2.24	5.22	17.2	16	14.9
11.0	1.082	2.38	5.55	18.3	17	15.9
11.6	1.087	2.52	5.87	19.4	18	16.8
12.2	1.092	2.66	6.20	20.5	19	17.7
12.7	1.096	2.80	6.52	21.5	20	18.7
13.3	1.101	2.94	6.85	22.6	21	19.6
13.8	1.105	3.08	7.18	23.7	22	20.5
14.4	1.110	3.22	7.50	24.8	23	21.5
14.8	1.114	3.36	7.83	25.9	24	22.4
15.4	1.119	3.50	8.16	26.9	25	23.3
15.9	1.123	3.64	8.48	28.0	26	24.3
16.5	1.128	3.78	8.81	29.1	27	25.2
16.9	1.132	3.92	9.13	30.2	28	26.1
17.5	1.137	4.06	9.46	31.2	29	27.1
17.9	1.141	4.20	9.79	32.3	30	28.0
18.4	1.145	4.34	10.11	33.4	31	28.9
18.9	1.150	4.48	10.44	34.5	32	29.9
19.4	1.154	4.64	10.76	35.5	33	30.8
19.9	1.159	4.76	11.09	36.6	34	31.7
20.3	1.163	4.90	11.42	37.7	35	32.7
20.9	1.168	5.04	11.74	38.8	36	33.6
21.3	1.172	5.18	12.07	39.9	37	34.5
21.7	1.176	5.32	12.40	40.9	38	35.5

AMMONIA
SPECIFIC GRAVITY OF AQUEOUS AMMONIUM HYDROXIDE
SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NH ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
10.9	0.9939	1	9.939	0.6205	0.0829
11.5	0.9895	2	19.79	1.235	0.1652
11.7	0.9811	4	39.24	2.450	0.3275
13.9	0.9730	6	58.38	3.644	0.4872
15.1	0.9651	8	77.21	4.820	0.6443
16.2	0.9575	10	95.75	5.977	0.7991
17.3	0.9501	12	114.0	7.117	0.9515
18.5	0.9430	14	132.0	8.242	1.102
19.5	0.9362	16	149.8	9.351	1.250
20.6	0.9295	18	167.3	10.44	1.396
21.7	0.9229	20	184.6	11.52	1.540
22.8	0.9164	22	201.6	12.59	1.682
23.8	0.9101	24	218.4	13.64	1.823
24.9	0.9040	26	235.0	14.67	1.961
25.9	0.8980	28	251.4	15.70	2.098
27.0	0.8920	30	267.6	16.71	2.233

VALUES DETERMINED IN SEALED TUBES, AT $\frac{15^{\circ}}{4^{\circ}}$ C.

Bé.	Sp. gr.	Per cent NH ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
34.9	0.849	45	382.1	23.85	3.188
38.3	0.832	50	416.0	25.97	3.472
41.8	0.815	55	448.3	27.98	3.741
45.9	0.796	60	477.6	29.82	3.985
50.4	0.776	65	504.4	31.49	4.209
55.4	0.755	70	528.5	32.99	4.410
61.0	0.733	75	549.8	34.32	4.588
66.9	0.711	80	568.8	35.51	4.747
73.5	0.688	85	584.8	36.51	4.880
80.5	0.665	90	598.5	37.36	4.995
88.1	0.642	95	609.9	38.07	5.090
96.5	0.618	100	618.0	38.58	5.157

AMMONIUM HYDROXIDE

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS AT 15° C.

Specific gravity	Per cent NH ₃	Total NH ₃ g. per liter	Specific gravity	Per cent NH ₃	Total NH ₃ g. per liter
1.000	0.00	0.0	0.940	15.63	146.9
0.998	0.45	4.5	0.938	16.22	152.1
0.996	0.91	9.1	0.936	16.82	157.4
0.994	1.37	13.6	0.934	17.42	162.7
0.992	1.84	18.2	0.932	18.03	168.1
0.990	2.31	22.9	0.930	18.64	173.4
0.988	2.80	27.7	0.928	19.25	178.6
0.986	3.30	32.5	0.926	19.87	184.2
0.984	3.80	37.4	0.924	20.49	189.3
0.982	4.30	42.2	0.922	21.12	194.7
0.980	4.80	47.0	0.920	21.75	200.1
0.978	5.30	51.8	0.918	22.39	205.6
0.976	5.80	56.6	0.916	23.03	210.9
0.974	6.30	61.4	0.914	23.68	216.3
0.972	6.80	66.1	0.912	24.33	221.9
0.970	7.31	70.9	0.910	24.99	227.4
0.968	7.82	75.7	0.908	25.65	232.9
0.966	8.33	80.5	0.906	26.31	238.3
0.964	8.84	85.2	0.904	26.98	243.9
0.962	9.35	89.9	0.902	27.65	249.4
0.960	9.91	95.1	0.900	28.33	255.0
0.958	10.47	100.3	0.898	29.01	260.5
0.956	11.03	105.4	0.896	29.69	266.0
0.954	11.60	110.7	0.894	30.37	271.5
0.952	12.17	115.9	0.892	31.05	277.0
0.950	12.72	121.0	0.890	31.75	282.6
0.948	13.31	126.2	0.888	32.50	288.6
0.946	13.88	131.3	0.886	33.25	294.6
0.944	14.46	136.5	0.884	34.10	301.4
0.942	15.04	141.7	0.882	34.95	308.3

AQUA AMMONIA

Authority — W. C. FERGUSON

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = \frac{140}{\text{Sp. Gr.}} - 130.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

The coefficient of expansion for Ammonia Solutions varying with the temperature, correction must be applied according to the following table:

Corrections to be added for each degree below 60° F.			Corrections to be subtracted for each degree above 60° F.			
Degrees Baumé	40° F.	50° F.	70° F.	80° F.	90° F.	100° F
14	0.015 Bé.	0.017 Bé.	0.020 Bé.	0.022 Bé.	0.024 Bé.	0.026 Bé.
16	0.021 "	0.023 "	0.026 "	0.028 "	0.030 "	0.032 "
18	0.027 "	0.029 "	0.031 "	0.033 "	0.035 "	0.037 "
20	0.033 "	0.036 "	0.037 "	0.038 "	0.040 "	0.042 "
22	0.039 "	0.042 "	0.043 "	0.045 "	0.047 "	
26	0.053 "	0.057 "	0.057 "	0.059 "		

Bé.°	Sp. gr.	Per cent NH ₃ .	Bé.°	Sp. gr.	Per cent NH ₃ .
10.00	1.0000	0.00	12.25	0.9842	3.73
10.25	0.9982	0.40	12.50	0.9825	4.16
10.50	0.9964	0.80	12.75	0.9807	4.59
10.75	0.9947	1.21	13.00	0.9790	5.02
11.00	0.9929	1.62	13.25	0.9773	5.45
11.25	0.9912	2.04	13.50	0.9756	5.88
11.50	0.9894	2.46	13.75	0.9739	6.31
11.75	0.9876	2.88	14.00	0.9722	6.74
12.00	0.9859	3.30	14.25	0.9705	7.17

AQUA AMMONIA (Continued)

Be.°	Sp. Gr.	Per cent NH ₃ .	Be.°	Sp. gr.	Per cent NH ₃ .
14.50	0.9689	7.61	22.00	0.9211	21.60
14.75	0.9672	8.05	22.25	0.9195	22.08
15.00	0.9655	8.49	22.50	0.9180	22.56
15.25	0.9639	8.93	22.75	0.9165	23.04
15.50	0.9622	9.38	23.00	0.9150	23.52
15.75	0.9605	9.83	23.25	0.9135	24.01
16.00	0.9589	10.28	23.50	0.9121	24.50
16.25	0.9573	10.73	23.75	0.9106	24.99
16.50	0.9556	11.18	24.00	0.9091	25.48
16.75	0.9540	11.64	24.25	0.9076	25.97
17.00	0.9524	12.10	24.50	0.9061	26.46
17.25	0.9508	12.56	24.75	0.9047	26.95
17.50	0.9492	13.02	25.00	0.9032	27.44
17.75	0.9475	13.49	25.25	0.9018	27.93
18.00	0.9459	13.96	25.50	0.9003	28.42
18.25	0.9444	14.43	25.75	0.8989	28.91
18.50	0.9428	14.90	26.00	0.8974	29.40
18.75	0.9412	15.37	26.25	0.8960	29.89
19.00	0.9396	15.84	26.50	0.8946	30.38
19.25	0.9380	16.32	26.75	0.8931	30.87
19.50	0.9365	16.80	27.00	0.8917	31.36
19.75	0.9349	17.28	27.25	0.8903	31.85
20.00	0.9333	17.76	27.50	0.8889	32.34
20.25	0.9318	18.24	27.75	0.8875	32.83
20.50	0.9302	18.72	28.00	0.8861	33.32
20.75	0.9287	19.20	28.25	0.8847	33.81
21.00	0.9272	19.68	28.50	0.8833	34.30
21.25	0.9256	20.16	28.75	0.8819	34.79
21.50	0.9241	20.64	29.00	0.8805	35.28
21.75	0.9226	21.12			

AMMONIUM CHLORIDE

SPECIFIC GRAVITY OF AQUEOUS AMMONIUM CHLORIDE SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NH ₄ Cl	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.2	1.0013	1	10.01	0.6251	0.0836
0.6	1.0045	2	20.09	1.254	0.1677
1.5	1.0107	4	40.43	2.524	0.3374
2.4	1.0168	6	61.01	3.809	0.5091
3.2	1.0227	8	81.82	5.108	0.6828
4.0	1.0286	10	102.9	6.421	0.8584
4.8	1.0344	12	124.1	7.749	1.036
5.6	1.0401	14	145.6	9.090	1.215
6.3	1.0457	16	167.3	10.44	1.396
7.1	1.0512	18	189.2	11.81	1.579
7.8	1.0567	20	211.3	13.19	1.764
8.5	1.0621	22	233.7	14.59	1.950
9.2	1.0674	24	256.2	15.99	2.138

AMMONIUM NITRATE

SPECIFIC GRAVITY OF AQUEOUS AMMONIUM NITRATE SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NH ₄ NO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.3	1.0023	1	10.02	0.6257	0.0836
0.9	1.0064	2	20.13	1.257	0.1680
2.1	1.0147	4	40.59	2.534	0.3387
3.3	1.0230	6	61.38	3.832	0.5122
4.4	1.0313	8	82.50	5.150	0.6885
5.5	1.0397	10	104.0	6.491	0.8677
6.7	1.0482	12	125.8	7.852	1.050
7.8	1.0567	14	147.9	9.235	1.235
8.9	1.0653	16	170.4	10.64	1.422
10.0	1.0740	18	193.3	12.07	1.613
11.1	1.0828	20	216.6	13.52	1.807
12.2	1.0916	22	240.2	14.99	2.004
13.2	1.1005	24	264.1	16.49	2.204
14.3	1.1095	26	288.5	18.01	2.407
15.4	1.1186	28	313.2	19.55	2.614
16.4	1.1277	30	338.3	21.12	2.823
19.0	1.1512	35	402.9	25.15	3.362
21.6	1.1754	40	470.2	29.35	3.924
24.2	1.2003	45	540.1	33.72	4.508
26.7	1.2258	50	612.9	38.26	5.115

AMMONIUM NITRATE

SPECIFIC GRAVITY OF AQUEOUS AMMONIUM NITRATE SOLUTIONS AT 17.5° C. (GERLACH)

Bé.	Sp. gr.	Per cent NH ₄ NO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0042	1	10.04	0.6269	0.0838
1.2	1.0085	2	20.17	1.259	0.1683
1.8	1.0127	3	30.38	1.897	0.2535
2.4	1.0170	4	40.68	2.540	0.3395
3.0	1.0212	5	51.06	3.188	0.4261
3.6	1.0255	6	61.53	3.841	0.5135
4.2	1.0297	7	72.08	4.500	0.6015
4.8	1.0340	8	82.72	5.164	0.6903
5.3	1.0382	9	93.44	5.833	0.7798
5.9	1.0425	10	104.3	6.508	0.8700
6.5	1.0468	11	115.1	7.188	0.9609
7.1	1.0512	12	126.1	7.875	1.053
7.6	1.0555	13	137.2	8.566	1.145
8.2	1.0599	14	148.4	9.263	1.238
8.8	1.0642	15	159.6	9.965	1.332
9.3	1.0686	16	171.0	10.67	1.427
9.9	1.0729	17	182.4	11.39	1.522
10.4	1.0773	18	193.9	12.11	1.618
10.9	1.0816	19	205.5	12.83	1.715
11.5	1.0860	20	217.2	13.56	1.813
12.0	1.0905	21	229.0	14.30	1.911
12.6	1.0950	22	240.9	15.04	2.010
13.1	1.0995	23	252.9	15.79	2.110
13.7	1.1040	24	265.0	16.54	2.211
14.2	1.1085	25	277.1	17.30	2.313
14.7	1.1130	26	289.4	18.07	2.415
15.2	1.1175	27	301.7	18.84	2.518
15.8	1.1220	28	314.2	19.61	2.622
16.3	1.1265	29	326.7	20.39	2.726
16.8	1.1310	30	339.3	21.18	2.832
17.3	1.1358	31	352.1	21.98	2.938
17.9	1.1406	32	365.0	22.79	3.046
18.4	1.1454	33	378.0	23.60	3.154
18.9	1.1502	34	391.1	24.41	3.264
19.5	1.1550	35	404.3	25.24	3.374
20.0	1.1598	36	417.5	26.07	3.484
20.5	1.1646	37	430.9	26.90	3.596
21.0	1.1694	38	444.4	27.74	3.708
21.5	1.1743	39	457.9	28.59	3.822
22.0	1.1790	40	471.6	29.44	3.936
22.5	1.1841	41	485.5	30.31	4.051
23.1	1.1892	42	499.5	31.18	4.168

AMMONIUM NITRATE (Continued)
SPECIFIC GRAVITY OF AQUEOUS AMMONIUM NITRATE SOLUTIONS AT 17.5° C. (GERLACH)

Re.	Sp. gr.	Per cent NH ₄ NO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
23.6	1.1942	43	513.5	32.06	4.285
24.1	1.1994	44	527.7	32.94	4.404
24.6	1.2045	45	542.0	33.84	4.523
25.1	1.2096	46	556.4	34.74	4.643
25.6	1.2147	47	570.9	35.64	4.764
26.1	1.2198	48	585.5	36.55	4.886
26.6	1.2249	49	600.2	37.47	5.009
27.1	1.2300	50	615.0	38.39	5.132
27.6	1.2353	51	630.0	39.33	5.258
28.1	1.2407	52	645.2	40.28	5.384
28.6	1.2460	53	660.4	41.23	5.511
29.1	1.2514	54	675.8	42.19	5.639
29.6	1.2567	55	691.2	43.15	5.768
30.1	1.2621	56	706.8	44.12	5.898
30.6	1.2674	57	722.4	45.10	6.029
31.1	1.2728	58	738.2	46.09	6.161
31.6	1.2781	59	754.1	47.07	6.293
32.0	1.2835	60	770.1	48.08	6.427
32.5	1.2888	61	786.2	49.08	6.561
33.0	1.2942	62	802.4	50.09	6.696
33.5	1.3005	63	819.3	51.15	6.837
34.0	1.3059	64	835.8	52.17	6.975

AMMONIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS AMMONIUM SULFATE SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent (NH ₄) ₂ SO ₄	G. per — liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0041	1	10.04	0.6283	0.08379
1.5	1.0101	2	20.20	1.621	0.1686
3.1	1.0220	4	40.88	2.552	0.3412
4.7	1.0338	6	62.03	3.872	0.5176
6.3	1.0456	8	83.65	5.222	0.6981
7.9	1.0574	10	105.7	6.601	0.8324
9.4	1.0691	12	128.3	8.009	1.071
10.8	1.0808	14	151.3	9.446	1.263
12.3	1.0924	16	174.8	10.91	1.459
13.7	1.1039	18	198.7	12.40	1.658
15.0	1.1154	20	223.1	13.93	1.862
16.3	1.1269	22	247.9	15.48	2.069
17.6	1.1383	24	273.2	17.05	2.280
18.9	1.1496	26	298.9	18.66	2.494
20.1	1.1609	28	325.1	20.29	2.713
21.3	1.1721	30	351.6	21.95	2.934
24.2	1.2000	35	420.0	26.22	3.505
26.9	1.2277	40	491.1	30.66	4.098
29.5	1.2552	45	564.8	35.26	4.714
31.9	1.2825	50	641.3	40.03	5.351

AMMONIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS AMMONIUM SULFATE SOLUTIONS AT 19° C. (SCHIFF)

Bé.	Sp. gr.	Per cent (NH ₄) ₂ SO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0057	1	10.06	0.6278	0.0839
1.6	1.0115	2	20.23	1.263	0.1688
2.5	1.0172	3	30.52	1.905	0.2547
3.3	1.0230	4	40.92	2.555	0.3415
4.0	1.0287	5	51.44	3.211	0.4292
4.8	1.0345	6	62.07	3.875	0.5180
5.6	1.0403	7	72.82	4.546	0.6077
6.4	1.0460	8	83.68	5.224	0.6983
7.1	1.0518	9	94.66	5.909	0.7900
7.9	1.0575	10	105.8	6.602	0.8825
8.6	1.0632	11	117.0	7.301	0.9760
9.4	1.0690	12	128.3	8.008	1.071
10.1	1.0747	13	139.7	8.722	1.166
10.8	1.0805	14	151.3	9.443	1.262
11.5	1.0862	15	162.9	10.17	1.360
12.2	1.0920	16	174.7	10.91	1.458
12.9	1.0977	17	186.6	11.65	1.557
13.6	1.1035	18	198.6	12.40	1.658
14.3	1.1092	19	210.7	13.16	1.759
14.9	1.1149	20	223.0	13.92	1.861
15.6	1.1207	21	235.3	14.69	1.964
16.3	1.1265	22	247.8	15.47	2.068
16.9	1.1323	23	260.4	16.26	2.173
17.6	1.1381	24	273.1	17.05	2.279
18.2	1.1439	25	286.0	17.85	2.387
18.9	1.1496	26	298.9	18.66	2.494
19.5	1.1554	27	312.0	19.47	2.603
20.1	1.1612	28	325.1	20.30	2.713
20.8	1.1670	29	338.4	21.13	2.824
21.3	1.1724	30	351.7	21.96	2.935
21.9	1.1780	31	365.2	22.80	3.048
22.5	1.1836	32	378.8	23.64	3.161
23.1	1.1892	33	392.4	24.50	3.275
23.6	1.1948	34	406.2	25.36	3.390
24.2	1.2004	35	420.1	26.23	3.506
24.8	1.2060	36	434.2	27.10	3.623
25.3	1.2116	37	448.3	27.99	3.741
25.9	1.2172	38	462.5	28.87	3.860
26.4	1.2228	39	476.9	29.77	3.980
27.0	1.2284	40	491.4	30.67	4.101
27.5	1.2343	41	506.1	31.59	4.223
28.1	1.2402	42	520.9	32.52	4.347
28.6	1.2462	43	535.9	33.45	4.472
29.2	1.2522	44	551.0	34.40	4.598
29.8	1.2583	45	566.2	35.35	4.725
30.3	1.2644	46	581.6	36.31	4.854
30.9	1.2705	47	597.1	37.28	4.983
31.4	1.2766	48	612.8	38.25	5.114
32.0	1.2828	49	628.6	39.24	5.246
32.5	1.2890	50	644.5	40.23	5.378

ARSENIC ACID

SPECIFIC GRAVITY OF AQUEOUS ARSENIC ACID SOLUTIONS

AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent H_3AsO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0057	1	10.06	0.6278	0.0839
1.8	1.0124	2	20.25	1.264	0.1690
3.7	1.0260	4	41.04	2.562	0.3425
5.6	1.0398	6	62.39	3.895	0.5206
7.4	1.0538	8	84.30	5.263	0.7035
9.3	1.0681	10	106.8	6.668	0.8914
11.1	1.0826	12	129.9	8.110	1.084
12.9	1.0975	14	153.7	9.592	1.282
14.7	1.1128	16	178.0	11.12	1.486
16.5	1.1285	18	203.1	12.68	1.695
18.3	1.1447	20	228.9	14.29	1.911
20.2	1.1614	22	255.5	15.95	2.132
22.0	1.1785	24	282.8	17.66	2.360
23.8	1.1961	26	311.0	19.41	2.595
25.6	1.2143	28	340.0	21.23	2.837
27.4	1.2331	30	369.9	23.09	3.087
32.0	1.2829	35	449.0	28.03	3.747
36.6	1.3370	40	534.8	33.39	4.463
41.1	1.3959	45	628.2	39.21	5.242
45.7	1.4602	50	730.1	45.58	6.093
50.3	1.5304	55	841.7	52.55	7.024
54.8	1.6070	60	964.2	60.19	8.046
59.2	1.6904	65	1099	68.59	9.169
63.6	1.7811	70	1247	77.83	10.40

Bé.	Sp. gr.	Per cent As_2O_5	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0057	0.810	8.143	0.5083	0.0680
1.8	1.0124	1.62	16.39	1.023	0.1368
3.7	1.0260	3.24	33.23	2.074	0.2773
5.6	1.0398	4.86	50.51	3.153	0.4216
7.4	1.0538	6.48	68.26	4.261	0.5696
9.3	1.0681	8.10	86.48	5.399	0.7217
11.1	1.0826	9.72	105.2	6.566	0.8778
12.9	1.0975	11.3	124.4	7.766	1.038
14.7	1.1128	13.0	144.2	8.999	1.203
16.5	1.1285	14.6	164.5	10.27	1.373
18.3	1.1447	16.2	185.4	11.57	1.547
20.2	1.1614	17.8	206.9	12.91	1.726
22.0	1.1785	19.4	229.0	14.30	1.911
23.8	1.1961	21.1	251.8	15.72	2.101
25.6	1.2143	22.7	275.3	17.19	2.297
27.4	1.2331	24.3	299.5	18.70	2.500
32.0	1.2829	28.3	363.6	22.70	3.034
36.6	1.3370	32.4	433.0	27.03	3.614
41.1	1.3959	36.4	508.6	31.75	4.244
45.7	1.4602	40.5	591.1	36.90	4.933
50.3	1.5304	44.5	681.5	42.54	5.687
54.8	1.6070	48.6	780.7	48.74	6.515
59.2	1.6904	52.6	889.6	55.54	7.424
63.6	1.7811	56.7	1009	63.02	8.424

BARIUM CHLORIDE
SPECIFIC GRAVITY OF AQUEOUS BARIUM CHLORIDE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent BaCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.3	1.0159	2	20.32	1.268	0.1696
4.8	1.0341	4	41.36	2.582	0.3452
7.3	1.0528	6	63.17	3.943	0.5272
9.8	1.0721	8	85.77	5.354	0.7158
12.2	1.0921	10	109.2	6.818	0.9114
14.7	1.1128	12	133.5	8.336	1.114
17.2	1.1342	14	158.8	9.913	1.325
19.6	1.1564	16	185.0	11.55	1.544
22.0	1.1793	18	212.3	13.25	1.771
24.5	1.2031	20	240.6	15.02	2.008
26.9	1.2277	22	270.1	16.86	2.254
29.3	1.2531	24	300.7	18.77	2.510
31.7	1.2793	26	332.6	20.76	2.776

Bé.	Sp. gr.	Per cent BaCl ₂ + 2H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.3	1.0159	2.343	23.83	1.488	0.1989
4.8	1.0341	4.692	48.52	3.029	0.4049
7.3	1.0528	7.038	74.10	4.626	0.6184
9.8	1.0721	9.384	100.6	6.281	0.8396
12.2	1.0921	11.73	128.1	7.997	1.069
14.7	1.1128	14.08	156.6	9.778	1.307
17.2	1.1342	16.42	186.3	11.63	1.554
19.6	1.1564	18.77	217.0	13.55	1.811
22.0	1.1793	21.11	249.0	15.54	2.078
24.5	1.2031	23.46	282.2	17.62	2.355
26.9	1.2277	25.81	316.8	19.78	2.644
29.3	1.2531	28.15	352.8	22.02	2.944
31.7	1.2793	30.50	390.2	24.36	3.256

CADMIUM NITRATE
SPECIFIC GRAVITY OF AQUEOUS CADMIUM NITRATE SOLUTIONS
 AT $\frac{18^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Cd(NO ₃) ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.2	1.0154	2	20.31	1.268	0.1695
4.6	1.0326	4	41.30	2.578	0.3447
6.9	1.0502	6	63.01	3.934	0.5259
9.3	1.0683	8	85.46	5.335	0.7132
11.6	1.0869	10	108.7	6.785	0.9070
13.9	1.1061	12	132.7	8.286	1.108
16.2	1.1261	14	157.7	9.842	1.316
18.6	1.1468	16	183.5	11.45	1.531
20.9	1.1682	18	210.3	13.13	1.755
23.2	1.1904	20	238.1	14.86	1.987
28.9	1.2488	25	312.2	19.50	2.605
34.5	1.3124	30	393.7	24.58	3.286
40.1	1.3822	35	483.8	30.20	4.037
45.6	1.4590	40	583.6	36.43	4.870
51.1	1.5438	45	694.7	43.37	5.797
56.4	1.6356	50	817.8	51.05	6.825

CALCIUM CHLORIDE
SPECIFIC GRAVITY OF AQUEOUS CALCIUM CHLORIDE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent CaCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.1	1.0148	2	20.30	1.267	0.1694
4.4	1.0316	4	41.26	2.576	0.3444
6.7	1.0486	6	62.92	3.928	0.5251
9.0	1.0659	8	85.27	5.323	0.7116
11.2	1.0835	10	108.4	6.764	0.9042
13.4	1.1015	12	132.2	8.252	1.103
15.5	1.1198	14	156.8	9.787	1.308
17.7	1.1386	16	182.2	11.37	1.520
19.8	1.1578	18	208.4	13.01	1.739
21.9	1.1775	20	235.5	14.70	1.965
27.0	1.2284	25	307.1	19.17	2.563
31.9	1.2816	30	384.5	24.00	3.209
36.6	1.3373	35	468.1	29.22	3.906
41.1	1.3957	40	558.3	34.85	4.659

Bé.	Sp. gr.	Per cent CaCl ₂ + 6H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.1	1.0148	3.948	40.06	2.501	0.3343
4.4	1.0316	7.896	81.46	5.085	0.6800
6.7	1.0486	11.84	124.2	7.753	1.036
9.0	1.0659	15.79	168.3	10.51	1.405
11.2	1.0835	19.74	213.9	13.35	1.785
13.4	1.1015	23.69	260.9	16.29	2.177
15.5	1.1198	27.64	309.5	19.32	2.583
17.7	1.1386	31.58	359.6	22.45	3.001
19.8	1.1578	35.53	411.4	25.68	3.433
21.9	1.1775	39.48	465.9	29.02	3.879
27.0	1.2284	49.35	606.2	37.84	5.059
31.9	1.2816	59.22	759.0	47.38	6.334
36.6	1.3373	69.09	923.9	57.68	7.710
41.1	1.3957	78.96	1102.0	68.80	9.197

CHROMIC ACID

SPECIFIC GRAVITY OF AQUEOUS CHROMIC ACID SOLUTIONS

AT $\frac{15^{\circ}}{4^{\circ}}$ C. °

Bé.	Sp. gr.	Per cent CrO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	1	10.06	0.6280	0.0840
2.0	1.014	2	20.28	1.266	0.1692
4.2	1.030	4	41.20	2.572	0.3438
6.2	1.045	6	62.70	3.914	0.5232
8.2	1.060	8	84.80	5.294	0.7077
10.2	1.076	10	107.6	6.717	0.8979
12.3	1.093	12	131.2	8.188	1.095
14.4	1.110	14	155.4	9.701	1.297
16.3	1.127	16	180.3	11.26	1.505
18.4	1.145	18	206.1	12.87	1.720
20.3	1.163	20	232.6	14.52	1.941
22.2	1.181	22	259.8	16.22	2.168
24.2	1.200	24	288.0	17.98	2.403
26.2	1.220	26	317.2	19.80	2.647
28.1	1.240	28	347.2	21.67	2.897
29.9	1.260	30	378.0	23.60	3.154
34.6	1.313	35	459.6	28.69	3.835
39.2	1.371	40	548.4	34.24	4.577
44.0	1.435	45	645.8	40.31	5.389
48.7	1.505	50	752.5	46.98	6.280
53.3	1.581	55	869.6	54.28	7.257
57.8	1.663	60	997.8	62.29	8.327

CHROMIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS CHROMIUM SULFATE SOLUTIONS

AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $\text{Cr}_2(\text{SO}_4)_3$ (green)	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0081	1	10.08	0.6293	0.0841
2.5	1.0172	2	20.34	1.270	0.1698
5.0	1.0358	4	41.43	2.586	0.3458
7.6	1.0551	6	63.31	3.952	0.5283
10.1	1.0751	8	86.01	5.369	0.7178
12.7	1.0958	10	109.6	6.841	0.9145
15.2	1.1172	12	134.1	8.369	1.119
17.7	1.1392	14	159.5	9.956	1.331
20.2	1.1618	16	185.9	11.60	1.551
22.7	1.1851	18	213.3	13.32	1.780
25.1	1.2091	20	241.8	15.10	2.018
27.5	1.2339	22	271.5	16.95	2.265
29.9	1.2594	24	302.3	18.87	2.522
32.2	1.2856	26	334.3	20.87	2.789
34.5	1.3125	28	367.5	22.94	3.067
36.8	1.3401	30	402.0	25.10	3.355
42.3	1.4123	35	494.3	30.86	4.125
47.6	1.4893	40	595.7	37.19	4.971

Bé.	Sp. gr.	Per cent $\text{Cr}_2(\text{SO}_4)_3$ (violet)	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.0091	1	10.09	0.6300	0.084
2.7	1.0191	2	20.38	1.272	0.1701
5.5	1.0395	4	41.58	2.596	0.3470
8.3	1.0604	6	63.62	3.972	0.5310
11.0	1.0817	8	86.54	5.402	0.7222
13.6	1.1034	10	110.3	6.888	0.9208
16.2	1.1257	12	135.1	8.433	1.127
18.8	1.1486	14	160.8	10.04	1.342
21.3	1.1722	16	187.6	11.71	1.565
23.8	1.1966	18	215.4	13.45	1.797
26.3	1.2218	20	244.4	15.25	2.039
28.8	1.2479	22	274.5	17.14	2.291
31.3	1.2750	24	306.0	19.10	2.554
33.7	1.3032	26	338.8	21.15	2.828
36.2	1.3325	28	373.1	23.29	3.114

CITRIC ACID

SPECIFIC GRAVITY OF CITRIC ACID SOLUTIONS AT 15° C.
(GERLACH)

Bé.	Sp. gr.	Per cent $C_6H_8O_7$ + H_2O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0074	2	20.15	1.258	0.1681
2.1	1.0149	4	40.60	2.534	0.3388
3.2	1.0227	6	61.36	3.831	0.5121
4.3	1.0309	8	82.47	5.148	0.6883
5.5	1.0392	10	103.9	6.487	0.8672
6.5	1.0470	12	125.6	7.843	1.048
7.6	1.0549	14	147.7	9.220	1.232
8.6	1.0632	16	170.1	10.62	1.420
9.7	1.0718	18	192.9	12.04	1.610
10.8	1.0805	20	216.1	13.49	1.803
11.8	1.0889	22	239.6	14.95	1.999
12.8	1.0972	24	263.3	16.44	2.198
13.9	1.1060	26	287.6	17.95	2.400
15.0	1.1152	28	312.3	19.49	2.606
16.0	1.1244	30	337.3	21.06	2.815
17.1	1.1333	32	362.7	22.64	3.026
18.1	1.1422	34	388.3	24.24	3.241
19.1	1.1515	36	414.5	25.88	3.459
20.1	1.1612	38	441.3	27.55	3.682
21.2	1.1709	40	468.4	29.24	3.909
22.3	1.1814	42	496.2	30.98	4.141
23.1	1.1899	44	523.6	32.68	4.369
24.2	1.1998	46	551.9	34.45	4.606
25.2	1.2103	48	580.9	36.27	4.848
26.2	1.2204	50	610.2	38.09	5.092
27.2	1.2307	52	640.0	39.95	5.341
28.2	1.2410	54	670.1	41.83	5.592
29.1	1.2514	56	700.8	43.75	5.848
30.2	1.2627	58	732.4	45.72	6.112
31.2	1.2738	60	764.3	47.71	6.378
32.2	1.2849	62	796.6	49.73	6.648
33.1	1.2960	64	829.4	51.78	6.922
34.1	1.3071	66	862.7	53.85	7.199

COPPER NITRATE
SPECIFIC GRAVITY OF AQUEOUS CUPRIC NITRATE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Cu(NO ₃) ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.1	1.015	2	20.30	1.267	0.1694
4.5	1.032	4	41.28	2.577	0.3445
6.9	1.050	6	63.00	3.933	0.5258
9.4	1.069	8	85.52	5.339	0.7137
11.7	1.088	10	108.8	6.792	0.9080
14.0	1.107	12	132.8	8.293	1.109
16.2	1.126	14	157.6	9.841	1.316
18.6	1.147	16	183.5	11.46	1.532
20.9	1.168	18	210.2	13.12	1.754
23.1	1.189	20	237.8	14.85	1.984
28.8	1.248	25	312.0	19.48	2.604

COPPER SULFATE
SPECIFIC GRAVITY OF AQUEOUS COPPER SULFATE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent CuSO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.009	1	10.09	0.6299	0.0842
2.7	1.019	2	20.38	1.272	0.1701
5.6	1.040	4	41.60	2.597	0.3472
8.5	1.062	6	63.72	3.978	0.5318
11.2	1.084	8	86.72	5.414	0.7237
14.0	1.107	10	110.7	6.911	0.9238
16.8	1.131	12	135.7	8.473	1.133
19.4	1.154	14	161.6	10.09	1.348
22.1	1.180	16	188.8	11.79	1.576
24.8	1.206	18	217.1	13.55	1.812

COPPER SULFATE (Continued)

SPECIFIC GRAVITY OF AQUEOUS COPPER SULFATE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent CuSO ₄ + 5H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.009	1.564	15.78	0.9853	0.1317
2.7	1.019	3.129	31.88	1.990	0.2661
5.6	1.040	6.257	65.07	4.062	0.5431
8.5	1.062	9.386	99.68	6.223	0.8318
11.2	1.084	12.51	135.7	8.469	1.132
14.0	1.107	15.64	173.2	10.81	1.445
16.8	1.131	18.77	212.3	13.25	1.772
19.4	1.154	21.90	252.7	15.78	2.110
22.1	1.180	25.03	295.3	18.44	2.465
24.8	1.206	28.16	339.6	21.20	2.834

SPECIFIC GRAVITY OF AQUEOUS COPPER SULFATE SOLUTIONS AT 18° C. (SCHIFF AND GERLACH)

Bé.	Sp. gr.	Per cent CuSO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0063	0.6393	6.433	0.4016	0.0537
1.8	1.0126	1.279	12.95	0.8082	0.1080
2.7	1.0190	1.918	19.54	1.220	0.1631
3.6	1.0254	2.557	26.22	1.637	0.2188
4.5	1.0319	3.196	32.98	2.059	0.2753
5.4	1.0384	3.836	39.83	2.486	0.3324
6.2	1.0450	4.475	46.76	2.919	0.3902
7.1	1.0516	5.114	53.78	3.357	0.4488
8.0	1.0582	5.753	60.88	3.801	0.5081
8.8	1.0649	6.393	68.08	4.250	0.5681
9.7	1.0716	7.032	75.35	4.704	0.6289
10.6	1.0785	7.671	82.73	5.165	0.6904
11.4	1.0854	8.311	90.20	5.631	0.7528
12.3	1.0923	8.950	97.76	6.103	0.8158
13.1	1.0993	9.589	105.4	6.581	0.8797
13.9	1.1063	10.23	113.2	7.064	0.9443
14.8	1.1135	10.87	121.0	7.554	1.010
15.6	1.1208	11.51	129.0	8.051	1.076
16.5	1.1281	12.15	137.0	8.554	1.143
17.3	1.1354	12.79	145.2	9.062	1.211
18.1	1.1427	13.42	153.4	9.577	1.280
18.9	1.1501	14.06	161.7	10.10	1.350
19.8	1.1585	14.70	170.3	10.63	1.421

COPPER SULFATE (Continued)

SPECIFIC GRAVITY OF AQUEOUS COPPER SULFATE SOLUTIONS AT 19° C. (SCHIFF AND GERLACH)

Bé.	Sp. gr.	Per cent CuSO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
20.6	1.1659	15.34	178.9	11.17	1.493
21.5	1.1738	15.98	187.6	11.71	1.566
22.3	1.1817	16.62	196.4	12.26	1.639
23.1	1.1898	17.26	205.4	12.82	1.714
24.0	1.1980	17.90	214.4	13.39	1.790
24.8	1.2063	18.54	223.6	13.96	1.866
25.6	1.2146	19.18	232.9	14.54	1.944

SPECIFIC GRAVITY OF AQUEOUS COPPER SULFATE SOLUTIONS AT 18° C. (SCHIFF AND GERLACH)

Bé.	Sp. gr.	Per cent CuSO ₄ + 5H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0063	1	10.06	0.6282	0.0840
1.8	1.0126	2	20.25	1.264	0.1690
2.7	1.0190	3	30.57	1.908	0.2551
3.6	1.0254	4	41.02	2.561	0.3423
4.5	1.0319	5	51.60	3.221	0.4306
5.4	1.0384	6	62.30	3.889	0.5199
6.2	1.0450	7	73.15	4.567	0.6105
7.1	1.0516	8	84.13	5.252	0.7021
8.0	1.0582	9	95.24	5.945	0.7948
8.8	1.0649	10	106.5	6.648	0.8887
9.7	1.0716	11	117.9	7.359	0.9837
10.6	1.0785	12	129.4	8.079	1.080
11.4	1.0854	13	141.1	8.809	1.178
12.3	1.0923	14	152.9	9.546	1.276
13.1	1.0993	15	164.9	10.29	1.376
13.9	1.1063	16	177.0	11.05	1.477
14.8	1.1135	17	189.3	11.82	1.580
15.6	1.1208	18	201.7	12.59	1.684
16.5	1.1281	19	214.3	13.38	1.789
17.3	1.1354	20	227.1	14.18	1.895
18.1	1.1427	21	240.0	14.98	2.003
18.9	1.1501	22	253.0	15.80	2.112
19.8	1.1585	23	266.5	16.63	2.224
20.6	1.1659	24	279.8	17.47	2.335
21.5	1.1738	25	293.5	18.32	2.449
22.3	1.1817	26	307.2	19.18	2.564
23.1	1.1898	27	321.2	20.05	2.681
24.0	1.1980	28	335.4	20.94	2.799
24.8	1.2063	29	349.8	21.84	2.919
25.6	1.2146	30	364.4	22.75	3.041

CUPRIC CHLORIDE

SPECIFIC GRAVITY OF AQUEOUS CUPRIC CHLORIDE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent CuCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.4	1.017	2	20.34	1.270	0.1697
5.0	1.036	4	41.44	2.587	0.3458
7.7	1.056	6	63.36	3.955	0.5288
10.1	1.075	8	86.00	5.369	0.7177
12.7	1.096	10	109.6	6.842	0.9146
15.2	1.117	12	134.0	8.368	1.119
17.6	1.138	14	159.3	9.946	1.330
20.0	1.160	16	185.6	11.59	1.549
22.3	1.182	18	212.8	13.28	1.776
24.7	1.205	20	241.0	15.04	2.011

SPECIFIC GRAVITY OF AQUEOUS CUPRIC CHLORIDE SOLUTIONS AT 17.5° C. (FRANZ)

Bé.	Sp. gr.	Per cent CuCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.0091	1	10.09	0.6300	0.0842
2.6	1.0182	2	20.36	1.271	0.1699
3.9	1.0273	3	30.82	1.924	0.2572
5.1	1.0364	4	41.46	2.588	0.3460
6.3	1.0455	5	52.28	3.263	0.4363
7.5	1.0548	6	63.29	3.951	0.5282
8.7	1.0641	7	74.49	4.650	0.6216
9.9	1.0734	8	85.87	5.361	0.7166
11.1	1.0827	9	97.44	6.083	0.8132
12.2	1.0920	10	109.2	6.817	0.9113
13.8	1.1049	11	121.5	7.587	1.014
15.3	1.1178	12	134.1	8.374	1.119
16.8	1.1307	13	147.0	9.176	1.227
18.2	1.1436	14	160.1	9.995	1.336
19.6	1.1565	15	173.5	10.83	1.448
21.0	1.1696	16	187.1	11.68	1.562
22.4	1.1827	17	201.1	12.55	1.678
23.7	1.1958	18	215.2	13.44	1.796
25.1	1.2089	19	229.7	14.34	1.917
26.4	1.2223	20	244.5	15.26	2.040
27.7	1.2362	21	259.6	16.21	2.166
29.0	1.2501	22	275.0	17.17	2.295

CUPRIC CHLORIDE (Continued)
SPECIFIC GRAVITY OF AQUEOUS CUPRIC CHLORIDE SOLUTIONS
AT 17.5° C. (FRANZ)

Bé.	Sp. gr.	Per cent CuCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
30.3	1.2640	23	290.7	18.15	2.426
31.5	1.2779	24	306.7	19.15	2.559
32.8	1.2918	25	323.0	20.16	2.695
34.0	1.3058	26	339.5	21.19	2.833
35.1	1.3198	27	356.3	22.25	2.974
36.3	1.3338	28	373.4	23.31	3.117
37.4	1.3478	29	390.9	24.40	3.262
38.5	1.3618	30	408.5	25.50	3.409
39.8	1.3784	31	427.3	26.68	3.566
41.1	1.3950	32	446.4	27.87	3.725
42.3	1.4116	33	465.8	29.08	3.887
43.5	1.4287	34	485.8	30.32	4.054
44.6	1.4447	35	505.6	31.57	4.220
45.8	1.4615	36	526.1	32.85	4.391
46.9	1.4782	37	546.9	34.14	4.564
48.0	1.4949	38	568.1	35.46	4.741
49.1	1.5116	39	589.5	36.80	4.920
50.1	1.5284	40	611.4	38.17	5.102

FERRIC CHLORIDE
SPECIFIC GRAVITY OF AQUEOUS FERRIC CHLORIDE SOLUTIONS
AT $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent FeCl ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.1	1.015	2	20.30	1.267	0.1694
4.5	1.032	4	41.28	2.577	0.3445
6.8	1.049	6	62.94	3.929	0.5253
9.1	1.067	8	85.36	5.329	0.7124
11.4	1.085	10	108.5	6.773	0.9055
13.7	1.104	12	132.5	8.270	1.106
15.9	1.123	14	157.2	9.815	1.312
18.0	1.142	16	182.7	11.41	1.525
20.2	1.162	18	209.2	13.06	1.745
22.3	1.182	20	236.4	14.76	1.973
27.5	1.234	25	308.5	19.26	2.574
32.7	1.291	30	387.3	24.18	3.232
37.8	1.353	35	473.6	29.56	3.952
42.7	1.418	40	567.2	35.41	4.733
47.4	1.485	45	668.3	41.72	5.577
51.5	1.551	50	775.5	48.41	6.472

FERRIC CHLORIDE

SPECIFIC GRAVITY OF AQUEOUS FERRIC CHLORIDE SOLUTIONS
AT 17.5° C. (FRANZ)

Bé.	Sp. gr.	Per cent Fe ₂ Cl ₆	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0073	1	10.07	0.6288	0.0841
2.1	1.0146	2	20.29	1.267	0.1693
3.1	1.0219	3	30.66	1.914	0.2558
4.1	1.0292	4	41.17	2.570	0.3436
5.1	1.0365	5	51.83	3.235	0.4325
6.1	1.0439	6	62.63	3.910	0.5227
7.0	1.0513	7	73.59	4.594	0.6141
8.0	1.0587	8	84.70	5.287	0.7068
9.0	1.0661	9	95.95	5.990	0.8007
9.9	1.0734	10	107.3	6.701	0.8958
10.9	1.0814	11	119.0	7.426	0.9927
11.9	1.0894	12	130.7	8.161	1.091
12.9	1.0974	13	142.7	8.906	1.191
13.8	1.1054	14	154.8	9.661	1.291
14.8	1.1134	15	167.0	10.43	1.394
15.7	1.1215	16	179.4	11.20	1.497
16.6	1.1297	17	192.0	11.99	1.603
17.6	1.1378	18	204.8	12.79	1.709
18.4	1.1458	19	217.7	13.59	1.817
19.4	1.1542	20	230.8	14.41	1.926
20.5	1.1644	21	244.5	15.26	2.041
21.6	1.1746	22	258.4	16.13	2.157
22.6	1.1848	23	272.5	17.01	2.274
23.7	1.1950	24	286.8	17.90	2.393
24.7	1.2052	25	301.3	18.81	2.514
25.7	1.2155	26	316.0	19.73	2.637
26.7	1.2258	27	331.0	20.66	2.762
27.7	1.2365	28	346.2	21.61	2.889
28.7	1.2464	29	361.5	22.56	3.016
29.6	1.2568	30	377.0	23.54	3.146
30.6	1.2673	31	392.9	24.53	3.279
31.5	1.2778	32	408.9	25.53	3.412
32.5	1.2883	33	425.1	26.54	3.548
33.4	1.2988	34	441.6	27.57	3.685
34.3	1.3093	35	458.3	28.61	3.824
35.1	1.3199	36	475.2	29.66	3.965
36.0	1.3305	37	492.3	30.73	4.108
36.9	1.3411	38	509.6	31.81	4.253
37.7	1.3517	39	527.2	32.91	4.399
38.6	1.3622	40	544.9	34.02	4.547
39.5	1.3746	41	563.6	35.18	4.703
40.5	1.3870	42	582.5	36.37	4.861

FERRIC CHLORIDE (Continued)
SPECIFIC GRAVITY OF AQUEOUS FERRIC CHLORIDE SOLUTIONS
AT 17.5° C. (FRANZ)

Bé.	Sp. gr.	Per cent Fe ₂ Cl ₆	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
41.4	1.3994	43	601.7	37.56	5.022
42.3	1.4118	44	621.2	38.78	5.184
43.2	1.4242	45	640.9	40.01	5.348
44.1	1.4367	46	660.9	41.26	5.515
44.9	1.4492	47	681.1	42.52	5.684
45.8	1.4617	48	701.6	43.80	5.855
46.6	1.4742	49	722.4	45.09	6.028
47.5	1.4867	50	743.4	46.41	6.203
48.4	1.5010	51	765.5	47.79	6.388
49.3	1.5153	52	788.0	49.19	6.576
50.2	1.5296	53	810.7	50.61	6.765
51.1	1.5439	54	833.7	52.05	6.957
51.9	1.5582	55	857.0	53.50	7.152
52.8	1.5729	56	880.8	54.99	7.351
53.7	1.5876	57	904.9	56.49	7.552
54.5	1.6023	58	929.3	58.02	7.755
55.3	1.6170	59	954.0	59.56	7.962
56.1	1.6317	60	979.0	61.12	8.170

FERRIC NITRATE
SPECIFIC GRAVITY OF AQUEOUS FERRIC NITRATE SOLUTIONS
AT $\frac{18^\circ}{4^\circ}$ C. °

Bé.	Sp. gr.	Per cent Fe(NO ₃) ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0065	1	10.07	0.6283	0.0840
2.1	1.0144	2	20.29	1.267	0.1693
4.3	1.0304	4	41.22	2.573	0.3440
6.5	1.0468	6	62.81	3.921	0.5242
8.7	1.0636	8	85.09	5.312	0.7101
10.9	1.0810	10	108.1	6.748	0.9021
13.1	1.0989	12	131.9	8.232	1.101
15.2	1.1172	14	156.4	9.764	1.305
17.3	1.1359	16	181.7	11.35	1.517
19.5	1.1551	18	207.9	12.98	1.735
21.6	1.1748	20	235.0	14.67	1.961
26.9	1.2281	25	307.0	19.17	2.562

FERRIC NITRATE

SPECIFIC GRAVITY OF AQUEOUS FERRIC NITRATE SOLUTIONS
AT 17.5° C. (FRANZ)

Bé.	Sp. gr.	Per cent $\text{Fe}(\text{NO}_3)_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0080	1	10.08	0.6293	0.0841
2.3	1.0160	2	20.32	1.269	0.1696
3.4	1.0240	3	30.72	1.918	0.2564
4.5	1.0320	4	41.28	2.577	0.3445
5.6	1.0398	5	51.99	3.246	0.4339
6.5	1.0472	6	62.83	3.922	0.5244
7.5	1.0546	7	73.82	4.608	0.6161
8.5	1.0620	8	84.96	5.304	0.7090
9.4	1.0694	9	96.25	6.008	0.8032
10.4	1.0770	10	107.7	6.723	0.8988
11.4	1.0852	11	119.4	7.452	0.9962
12.4	1.0934	12	131.2	8.191	1.095
13.4	1.1016	13	143.2	8.940	1.195
14.3	1.1098	14	155.4	9.699	1.297
15.3	1.1182	15	167.7	10.47	1.400
16.3	1.1268	16	180.3	11.25	1.505
17.3	1.1354	17	193.0	12.05	1.611
18.3	1.1440	18	205.9	12.85	1.718
19.2	1.1526	19	219.0	13.67	1.828
20.1	1.1612	20	232.2	14.50	1.938
21.2	1.1712	21	246.0	15.35	2.053
22.2	1.1812	22	259.9	16.22	2.169
23.3	1.1912	23	274.0	17.10	2.286
24.3	1.2012	24	288.3	18.00	2.406
25.3	1.2110	25	302.8	18.90	2.527
26.3	1.2212	26	317.5	19.82	2.650
27.3	1.2314	27	332.5	20.76	2.775
28.2	1.2416	28	347.6	21.70	2.901
29.2	1.2518	29	363.0	22.66	3.029
30.1	1.2622	30	378.7	23.64	3.160
31.1	1.2730	31	394.6	24.64	3.293
32.1	1.2838	32	410.8	25.65	3.428
33.0	1.2946	33	427.2	26.67	3.565
33.9	1.3054	34	443.8	27.71	3.704
34.9	1.3164	35	460.7	28.76	3.845
35.8	1.3280	36	478.1	29.85	3.990
36.8	1.3396	37	495.7	30.94	4.136
37.7	1.3512	38	513.5	32.05	4.285
38.6	1.3628	39	531.5	33.18	4.435
39.5	1.3746	40	549.8	34.32	4.589
40.4	1.3864	41	568.4	35.49	4.744
41.3	1.3982	42	587.2	36.66	4.901

FERRIC NITRATE (Continued)
SPECIFIC GRAVITY OF AQUEOUS FERRIC NITRATE SOLUTIONS
AT 17.5° C. (FRANZ)

Bé.	Sp. gr.	Per cent Fe(NO ₃) ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
42.2	1.4100	43	606.3	37.85	5.060
43.0	1.4218	44	625.6	39.05	5.221
43.9	1.4338	45	645.2	40.28	5.384
44.8	1.4465	46	665.4	41.54	5.553
45.6	1.4592	47	685.8	42.81	5.723
46.5	1.4719	48	706.5	44.11	5.896
47.3	1.4846	49	727.5	45.41	6.071
48.2	1.4972	50	748.6	46.73	6.247
49.1	1.5122	51	771.2	48.15	6.436
50.1	1.5272	52	794.1	49.58	6.627
51.0	1.5422	53	817.4	51.03	6.821
51.9	1.5572	54	840.9	52.49	7.017
52.8	1.5722	55	864.7	53.98	7.216
53.8	1.5892	56	890.0	55.56	7.427
54.7	1.6062	57	915.5	57.15	7.640
55.7	1.6232	58	941.5	58.77	7.857
56.6	1.6402	59	967.7	60.41	8.076
57.5	1.6572	60	994.3	62.07	8.298
58.5	1.6764	61	1023	63.84	8.534
59.5	1.6956	62	1051	65.63	8.773
60.4	1.7148	63	1080	67.44	9.016
61.4	1.7340	64	1110	69.28	9.261
62.3	1.7532	65	1140	71.14	9.510

FERRIC SULFATE

SPECIFIC GRAVITY OF AQUEOUS FERRIC SULFATE SOLUTIONS

AT $\frac{17.5^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $\text{Fe}_2(\text{SO}_4)_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.3	1.016	2	20.32	1.269	0.1696
4.7	1.033	4	41.32	2.579	0.3448
6.9	1.050	6	63.00	3.933	0.5258
9.1	1.067	8	85.36	5.329	0.7124
11.2	1.084	10	108.4	6.767	0.9046
13.5	1.103	12	132.4	8.263	1.105
15.8	1.122	14	157.1	9.806	1.311
17.9	1.141	16	182.6	11.40	1.524
20.1	1.161	18	209.0	13.05	1.744
22.2	1.181	20	236.2	14.75	1.971
28.2	1.241	25	310.3	19.37	2.590
34.1	1.307	30	392.1	24.48	3.272
39.6	1.376	35	481.6	30.06	4.019
44.9	1.449	40	579.6	36.18	4.837
50.1	1.528	45	687.6	42.92	5.738
55.1	1.613	50	806.5	50.35	6.730
59.9	1.703	55	936.7	58.47	7.817
64.4	1.798	60	1079	67.35	9.003

FERROUS SULFATE
SPECIFIC GRAVITY OF AQUEOUS FERROUS SULFATE SOLUTIONS
 AT $\frac{18^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent FeSO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.1	1.0007	0.2	2.001	0.1249	0.0167
0.4	1.0028	0.4	4.011	0.2504	0.0335
0.7	1.0046	0.6	6.028	0.3763	0.0503
0.9	1.0065	0.8	8.052	0.5027	0.0672
1.2	1.0085	1.0	10.09	0.6296	0.0842
2.6	1.0180	2	20.36	1.271	0.1699
5.2	1.0375	4	41.50	2.591	0.3463
7.9	1.0575	6	63.45	3.961	0.5295
10.6	1.0785	8	86.28	5.386	0.7200
13.2	1.1000	10	110.0	6.867	0.9180
15.8	1.1220	12	134.6	8.405	1.124
18.3	1.1445	14	160.2	10.00	1.337
20.8	1.1675	16	186.8	11.66	1.559
23.2	1.1905	18	214.3	13.38	1.788
25.5	1.2135	20	242.7	15.15	2.025

Bé.	Sp. gr.	Per cent FeSO ₄ + 7H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.1	1.0007	0.366	3.663	0.2287	0.0306
0.4	1.0028	0.732	7.341	0.4583	0.0613
0.7	1.0046	1.10	11.03	0.6887	0.0921
0.9	1.0065	1.46	14.74	0.9200	0.1230
1.2	1.0085	1.83	18.46	1.152	0.1540
2.6	1.0180	3.66	37.26	2.326	0.3110
5.2	1.0375	7.32	75.95	4.742	0.6339
7.9	1.0575	11.0	116.1	7.249	0.9691
10.6	1.0785	14.6	157.9	9.858	1.318
13.2	1.1000	18.3	201.3	12.57	1.680
15.8	1.1220	22.0	246.4	15.38	2.056
18.3	1.1445	25.6	293.3	18.31	2.447
20.8	1.1675	29.3	341.9	21.34	2.853
23.2	1.1905	32.9	392.2	24.48	3.273
25.5	1.2135	36.6	444.2	27.73	3.707

FORMIC ACID

SPECIFIC GRAVITY OF AQUEOUS FORMIC ACID SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HCO ₂ H	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
.....	0.9982	0	.....	.....	.....
0.3	1.0019	1	10.02	0.6255	0.0836
0.6	1.0044	2	20.09	1.254	0.1676
1.0	1.0070	3	30.21	1.886	0.2521
1.3	1.0093	4	40.37	2.520	0.3369
1.6	1.0115	5	50.58	3.157	0.4221
2.0	1.0141	6	60.85	3.798	0.5078
2.4	1.0170	7	71.19	4.444	0.5941
2.8	1.0196	8	81.57	5.092	0.6807
3.1	1.0221	9	91.99	5.743	0.7677
3.5	1.0246	10	102.5	6.396	0.8551
3.8	1.0271	11	113.0	7.053	0.9429
4.2	1.0296	12	123.6	7.713	1.031
4.5	1.0321	13	134.2	8.376	1.120
4.8	1.0345	14	144.8	9.041	1.209
5.2	1.0370	15	155.6	9.711	1.298
5.5	1.0393	16	166.3	10.38	1.388
5.8	1.0417	17	177.1	11.06	1.478
6.1	1.0441	18	187.9	11.73	1.568
6.4	1.0464	19	198.8	12.41	1.659
6.8	1.0488	20	209.8	13.09	1.750
7.1	1.0512	21	220.8	13.78	1.842
7.4	1.0537	22	231.8	14.47	1.935
7.7	1.0561	23	242.9	15.16	2.027
8.0	1.0585	24	254.0	15.86	2.120
8.3	1.0609	25	265.2	16.56	2.213
8.6	1.0633	26	276.5	17.26	2.307
8.9	1.0656	27	287.7	17.96	2.401
9.3	1.0681	28	299.1	18.67	2.496
9.6	1.0705	29	310.4	19.38	2.591
9.9	1.0729	30	321.9	20.09	2.686
10.2	1.0753	31	333.3	20.81	2.782
10.5	1.0777	32	344.9	21.53	2.878
10.7	1.0800	33	356.4	22.25	2.974
11.0	1.0823	34	368.0	22.97	3.071
11.3	1.0847	35	379.6	23.70	3.168
11.6	1.0871	36	391.4	24.43	3.266
11.9	1.0895	37	403.1	25.17	3.364
12.2	1.0919	38	414.9	25.90	3.463
12.5	1.0940	39	426.7	26.64	3.561
12.7	1.0963	40	438.5	27.38	3.660
13.1	1.0990	41	450.6	28.13	3.760
13.4	1.1015	42	462.6	28.88	3.861
13.6	1.1038	43	474.6	29.63	3.961
13.9	1.1062	44	486.7	30.38	4.062
14.2	1.1085	45	498.8	31.14	4.163
14.5	1.1108	46	511.0	31.90	4.264
14.7	1.1130	47	523.1	32.66	4.365
15.0	1.1157	48	535.5	33.43	4.469
15.4	1.1185	49	548.1	34.21	4.574
15.6	1.1207	50	560.4	34.98	4.676
15.8	1.1223	51	572.4	35.73	4.777
16.0	1.1244	52	584.7	36.50	4.879
16.3	1.1269	53	597.3	37.28	4.984
16.6	1.1295	54	609.9	38.08	5.090

FORMIC ACID (Continued)
SPECIFIC GRAVITY OF AQUEOUS FORMIC ACID SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HCO ₂ H	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
16.9	1.1320	55	622.6	38.87	5.196
17.2	1.1342	56	635.2	39.65	5.300
17.4	1.1361	57	647.6	40.43	5.404
17.6	1.1381	58	660.1	41.21	5.509
17.8	1.1401	59	672.7	41.99	5.613
18.1	1.1424	60	685.4	42.79	5.720
18.3	1.1448	61	698.3	43.59	5.828
18.6	1.1473	62	711.3	44.41	5.936
18.8	1.1493	63	724.1	45.20	6.042
19.1	1.1517	64	737.1	46.01	6.151
19.4	1.1543	65	750.3	46.84	6.261
19.6	1.1565	66	763.3	47.65	6.370
19.8	1.1584	67	776.1	48.45	6.477
20.0	1.1604	68	789.1	49.26	6.585
20.3	1.1628	69	802.3	50.09	6.696
20.6	1.1655	70	815.9	50.93	6.808
20.8	1.1677	71	829.1	51.76	6.919
21.1	1.1702	72	842.5	52.60	7.031
21.4	1.1728	73	856.1	53.45	7.145
21.6	1.1752	74	869.6	54.29	7.257
21.8	1.1769	75	882.7	55.10	7.366
22.0	1.1785	76	895.7	55.91	7.474
22.1	1.1801	77	908.7	56.73	7.583
22.3	1.1818	78	921.8	57.55	7.693
22.5	1.1837	79	935.1	58.38	7.804
22.7	1.1860	80	948.8	59.23	7.918
22.9	1.1876	81	962.0	60.05	8.028
23.1	1.1896	82	975.5	60.90	8.141
23.3	1.1914	83	988.9	61.73	8.252
23.5	1.1929	84	1002	62.55	8.362
23.7	1.1953	85	1016	63.43	8.479
23.9	1.1976	86	1030	64.30	8.595
24.1	1.1994	87	1043	65.14	8.708
24.3	1.2012	88	1057	65.99	8.821
24.5	1.2028	89	1070	66.83	8.933
24.6	1.2044	90	1084	67.67	9.046
24.8	1.2059	91	1097	68.51	9.158
25.0	1.2078	92	1111	69.37	9.273
25.2	1.2099	93	1125	70.24	9.390
25.3	1.2117	94	1139	71.10	9.505
25.6	1.2140	95	1153	72.00	9.625
25.7	1.2158	96	1167	72.86	9.740
25.9	1.2170	97	1180	73.69	9.851
26.0	1.2183	98	1194	74.53	9.964
26.2	1.2202	99	1208	75.41	10.08
26.3	1.2212	100	1221	76.24	10.19

GLYCEROL

SPECIFIC GRAVITY OF AQUEOUS GLYCEROL (GLYCERIN) SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $C_3H_8O_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
....	0.9982	0	....	0.6246	0.0835
0.1	1.0006	1	10.01	1.252	0.1674
0.4	1.0030	2	20.06	1.883	0.2517
0.8	1.0053	3	30.16	2.516	0.3364
1.1	1.0077	4	40.31	3.153	0.4215
1.5	1.0101	5	50.51	3.792	0.5070
1.8	1.0125	6	60.75	4.435	0.5929
2.1	1.0149	7	71.04	5.081	0.6792
2.5	1.0173	8	81.38	5.729	0.7659
2.8	1.0197	9	91.77	6.381	0.8530
3.1	1.0221	10	102.2	7.036	0.9406
3.5	1.0246	11	112.7	7.694	1.029
3.8	1.0271	12	123.3	8.355	1.117
4.1	1.0295	13	133.8	9.019	1.206
4.5	1.0320	14	144.5	9.687	1.295
4.8	1.0345	15	155.2	10.36	1.385
5.2	1.0370	16	165.9	11.03	1.475
5.5	1.0395	17	176.7	11.71	1.565
5.8	1.0420	18	187.6	12.39	1.656
6.2	1.0445	19	198.5	13.07	1.747
6.5	1.0470	20	209.4	13.76	1.839
6.8	1.0495	21	220.4	14.45	1.931
7.2	1.0520	22	231.4	15.14	2.024
7.5	1.0545	23	242.5	15.84	2.117
7.8	1.0571	24	253.7	16.54	2.211
8.2	1.0597	25	264.9	17.24	2.305
8.5	1.0622	26	276.2	17.95	2.399
8.8	1.0648	27	287.5	18.66	2.494
9.2	1.0674	28	298.9	19.37	2.590
9.5	1.0700	29	310.3	20.09	2.686
9.8	1.0727	30	321.8	20.81	2.782
10.2	1.0753	31	333.3	21.53	2.879
10.5	1.0780	32	345.0	22.26	2.976
10.8	1.0806	33	356.6	22.99	3.074
11.2	1.0833	34	368.3	23.73	3.172
11.5	1.0860	35	380.1	24.47	3.271
11.8	1.0887	36	391.9	25.21	3.370
12.1	1.0914	37	403.8	25.95	3.470
12.5	1.0941	38	415.8	26.70	3.570
12.8	1.0968	39	427.8	27.46	3.670
13.1	1.0995	40	439.8	28.21	3.771
13.4	1.1022	41	451.9	28.97	3.873
13.8	1.1049	42	464.1	29.73	3.974
14.1	1.1075	43	476.2	30.49	4.077
14.4	1.1102	44	488.5	31.26	4.179
14.7	1.1128	45	500.8	32.03	4.282
15.0	1.1155	46	513.1	32.81	4.386
15.3	1.1182	47	525.6	33.59	4.490
15.6	1.1209	48	538.0	34.37	4.595
16.0	1.1236	49	550.6	35.16	4.700
16.3	1.1263	50	563.2	35.94	4.805
16.6	1.1290	51	575.8	36.74	4.911
16.9	1.1317	52	588.5	37.53	5.017
17.2	1.1344	53	601.2	38.33	5.124
17.5	1.1371	54	614.0		

GLYCEROL (Continued)
SPECIFIC GRAVITY OF AQUEOUS GLYCEROL (GLYCERIN) SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $C_3H_8O_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
17.8	1.1398	55	626.9	39.13	5.232
18.1	1.1425	56	639.8	39.94	5.339
18.4	1.1452	57	652.8	40.75	5.447
18.7	1.1479	58	665.8	41.56	5.550
19.0	1.1506	59	678.9	42.38	5.665
19.3	1.1533	60	692.0	43.20	5.775
19.6	1.1560	61	705.2	44.02	5.885
19.9	1.1587	62	718.4	44.85	5.995
20.2	1.1614	63	731.7	45.68	6.106
20.5	1.1642	64	745.1	46.51	6.218
20.8	1.1670	65	758.6	47.35	6.330
21.0	1.1697	66	772.0	48.19	6.443
21.3	1.1724	67	785.5	49.04	6.555
21.6	1.1752	68	799.1	49.89	6.669
21.9	1.1780	69	812.8	50.74	6.783
22.2	1.1808	70	826.6	51.60	6.898
22.5	1.1836	71	840.4	52.46	7.013
22.8	1.1863	72	854.1	53.32	7.128
23.1	1.1890	73	868.0	54.18	7.243
23.3	1.1917	74	881.9	55.05	7.359
23.6	1.1944	75	895.8	55.92	7.476
23.9	1.1971	76	909.8	56.80	7.592
24.2	1.1998	77	923.8	57.67	7.710
24.4	1.2025	78	938.0	58.55	7.827
24.7	1.2052	79	952.1	59.44	7.945
25.0	1.2079	80	966.3	60.32	8.064
25.2	1.2106	81	980.6	61.22	8.183
25.5	1.2133	82	994.9	62.11	8.303
25.8	1.2160	83	1009	63.01	8.423
26.0	1.2187	84	1024	63.91	8.543
26.3	1.2214	85	1038	64.81	8.664
26.5	1.2241	86	1053	65.72	8.785
26.8	1.2268	87	1067	66.63	8.907
27.1	1.2294	88	1082	67.54	9.028
27.3	1.2320	89	1096	68.45	9.150
27.6	1.2347	90	1111	69.37	9.273
27.8	1.2374	91	1126	70.29	9.397
28.1	1.2401	92	1141	71.22	9.521
28.3	1.2428	93	1156	72.15	9.645
28.6	1.2455	94	1171	73.09	9.770
28.8	1.2482	95	1186	74.03	9.896
29.1	1.2508	96	1201	74.96	10.02
29.3	1.2534	97	1216	75.90	10.15
29.5	1.2559	98	1231	76.83	10.27
29.8	1.2584	99	1246	77.77	10.40
30.0	1.2609	100	1261	78.71	10.52

HYDROCHLORIC ACID

SPECIFIC GRAVITY OF AQUEOUS HYDROCHLORIC ACID SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HCl	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0032	1	10.03	0.6263	0.0837
1.2	1.0082	2	20.16	1.259	0.1683
2.6	1.0181	4	40.72	2.542	0.3399
3.9	1.0279	6	61.67	3.850	0.5147
5.3	1.0376	8	83.01	5.182	0.6927
6.6	1.0474	10	104.7	6.539	0.8741
7.9	1.0574	12	126.9	7.921	1.059
9.2	1.0675	14	149.5	9.330	1.247
10.4	1.0776	16	172.4	10.76	1.439
11.7	1.0878	18	195.8	12.22	1.634
12.9	1.0980	20	219.6	13.71	1.833
14.2	1.1083	22	243.8	15.22	2.035
15.4	1.1187	24	268.5	16.76	2.241
16.6	1.1290	26	293.5	18.32	2.450
17.7	1.1392	28	319.0	19.91	2.662
18.8	1.1493	30	344.8	21.52	2.877
19.9	1.1593	32	371.0	23.16	3.096
21.0	1.1691	34	397.5	24.81	3.317
22.0	1.1789	36	424.4	26.49	3.542
23.0	1.1885	38	451.6	28.19	3.769
24.0	1.1980	40	479.2	29.92	3.999

HYDROCHLORIC ACID

Authority—W. C. FERGUSON

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}$$

Baumé Hydrometers for use with this table must be graduated by the above formula which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

10° — 15° Bé.—1/40° Bé. or .0002 Sp. Gr. for 1° F.
 15° — 22° Bé.—1/30° Bé. or .0003 " " " 1° F.
 22° — 25° Bé.—1/28° Bé. or .00035 " " " 1° F.

Bé.°	Sp. gr.	Tw.°	Per cent HCl	Bé.°	Sp. gr.	Tw.°	Per cent HCl
1.00	1.0069	1.38	1.40	10.25	1.0761	15.22	15.22
2.00	1.0140	2.80	2.82	10.50	1.0781	15.62	15.62
3.00	1.0211	4.22	4.25	10.75	1.0801	16.02	16.01
4.00	1.0284	5.68	5.69	11.00	1.0821	16.42	16.41
5.00	1.0357	7.14	7.15	11.25	1.0841	16.82	16.81
5.25	1.0375	7.50	7.52	11.50	1.0861	17.22	17.21
5.50	1.0394	7.88	7.89	11.75	1.0881	17.62	17.61
5.75	1.0413	8.26	8.26	12.00	1.0902	18.04	18.01
6.00	1.0432	8.64	8.64	12.25	1.0922	18.44	18.41
6.25	1.0450	9.00	9.02	12.50	1.0943	18.86	18.82
6.50	1.0469	9.38	9.40	12.75	1.0964	19.28	19.22
6.75	1.0488	9.76	9.78	13.00	1.0985	19.70	19.63
7.00	1.0507	10.14	10.17	13.25	1.1006	20.12	20.04
7.25	1.0526	10.52	10.55	13.50	1.1027	20.54	20.45
7.50	1.0545	10.90	10.94	13.75	1.1048	20.96	20.86
7.75	1.0564	11.28	11.32	14.00	1.1069	21.38	21.27
8.00	1.0584	11.68	11.71	14.25	1.1090	21.80	21.68
8.25	1.0603	12.06	12.09	14.50	1.1111	22.22	22.09
8.50	1.0623	12.46	12.48	14.75	1.1132	22.64	22.50
8.75	1.0642	12.84	12.87	15.00	1.1154	23.08	22.92
9.00	1.0662	13.24	13.26	15.25	1.1176	23.52	23.33
9.25	1.0681	13.62	13.65	15.50	1.1197	23.94	23.75
9.50	1.0701	14.02	14.04	15.75	1.1219	24.38	24.16
9.75	1.0721	14.42	14.43	16.0	1.1240	24.80	24.57
10.00	1.0741	14.82	14.83	16.1	1.1248	24.96	24.73

HYDROCHLORIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HCl	Bé.°	Sp. gr.	Tw.°	Per cent HCl
16.2	1.1256	25.12	24.90	20.9	1.1684	33.68	33.12
16.3	1.1265	25.30	25.06	21.0	1.1694	33.88	33.31
16.4	1.1274	25.48	25.23	21.1	1.1703	34.06	33.50
16.5	1.1283	25.66	25.39	21.2	1.1713	34.26	33.69
16.6	1.1292	25.84	25.56	21.3	1.1722	34.44	33.88
16.7	1.1301	26.02	25.72	21.4	1.1732	34.64	34.07
16.8	1.1310	26.20	25.89	21.5	1.1741	34.82	34.26
16.9	1.1319	26.38	26.05	21.6	1.1751	35.02	34.45
17.0	1.1328	26.56	26.22	21.7	1.1760	35.20	34.64
17.1	1.1336	26.72	26.39	21.8	1.1770	35.40	34.83
17.2	1.1345	26.90	26.56	21.9	1.1779	35.58	35.02
17.3	1.1354	27.08	26.73	22.0	1.1789	35.78	35.21
17.4	1.1363	27.26	26.90	22.1	1.1798	35.96	35.40
17.5	1.1372	27.44	27.07	22.2	1.1808	36.16	35.59
17.6	1.1381	27.62	27.24	22.3	1.1817	36.34	35.78
17.7	1.1390	27.80	27.41	22.4	1.1827	36.54	35.97
17.8	1.1399	27.98	27.58	22.5	1.1836	36.72	36.16
17.9	1.1408	28.16	27.75	22.6	1.1846	36.92	36.35
18.0	1.1417	28.34	27.92	22.7	1.1856	37.12	36.54
18.1	1.1426	28.52	28.09	22.8	1.1866	37.32	36.73
18.2	1.1435	28.70	28.26	22.9	1.1875	37.50	36.93
18.3	1.1444	28.88	28.44	23.0	1.1885	37.70	37.14
18.4	1.1453	29.06	28.61	23.1	1.1895	37.90	37.36
18.5	1.1462	29.24	28.78	23.2	1.1904	38.08	37.58
18.6	1.1471	29.42	28.95	23.3	1.1914	38.28	37.80
18.7	1.1480	29.60	29.13	23.4	1.1924	38.48	38.03
18.8	1.1489	29.78	29.30	23.5	1.1934	38.68	38.26
18.9	1.1498	29.96	29.48	23.6	1.1944	38.88	38.49
19.0	1.1508	30.16	29.65	23.7	1.1953	39.06	38.72
19.1	1.1517	30.34	29.83	23.8	1.1963	39.26	38.95
19.2	1.1526	30.52	30.00	23.9	1.1973	39.46	39.18
19.3	1.1535	30.70	30.18	24.0	1.1983	39.66	39.41
19.4	1.1544	30.88	30.35	24.1	1.1993	39.86	39.64
19.5	1.1554	31.08	30.53	24.2	1.2003	40.06	39.86
19.6	1.1563	31.26	30.71	24.3	1.2013	40.26	40.09
19.7	1.1572	31.44	30.90	24.4	1.2023	40.46	40.32
19.8	1.1581	31.62	31.08	24.5	1.2033	40.66	40.55
19.9	1.1590	31.80	31.27	24.6	1.2043	40.86	40.78
20.0	1.1600	32.00	31.45	24.7	1.2053	41.06	41.01
20.1	1.1609	32.18	31.64	24.8	1.2063	41.26	41.24
20.2	1.1619	32.38	31.82	24.9	1.2073	41.46	41.48
20.3	1.1628	32.56	32.01	25.0	1.2083	41.66	41.72
20.4	1.1637	32.74	32.19	25.1	1.2093	41.86	41.99
20.5	1.1647	32.94	32.38	25.2	1.2103	42.06	42.30
20.6	1.1656	33.12	32.56	25.3	1.2114	42.28	42.64
20.7	1.1666	33.32	32.75	25.4	1.2124	42.48	43.01
20.8	1.1675	33.50	32.93	25.5	1.2134	42.68	43.40

HYDROCYANIC ACID

SPECIFIC GRAVITY OF AQUEOUS HYDROCYANIC ACID SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HCN	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
54.4	0.759	80	607.2	37.91	5.067
56.2	0.752	82	616.6	38.49	5.146
57.9	0.745	84	625.8	39.07	5.222
59.7	0.738	86	634.7	39.62	5.297
61.5	0.731	88	643.3	40.16	5.368
63.4	0.724	90	651.6	40.68	5.438
65.3	0.717	92	659.6	41.18	5.505
66.9	0.711	94	668.3	41.72	5.577
68.9	0.704	96	675.8	42.19	5.640
70.9	0.697	98	683.1	42.64	5.700
72.6	0.691	100	691.0	43.14	5.767

SPECIFIC GRAVITY OF AQUEOUS HYDROCYANIC ACID SOLUTIONS

AT $\frac{15^{\circ}}{4^{\circ}}$ C.

Bé.	Sp. gr.	Per cent HCN	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
10.3	0.998	1	9.98	0.6230	0.0833
10.6	0.996	2	19.92	1.244	0.1662
11.0	0.993	4	39.72	2.480	0.3315
11.4	0.989	6	59.34	3.704	0.4952
12.3	0.984	8	78.72	4.914	0.6569
13.2	0.978	10	97.80	6.105	0.8162
14.2	0.971	12	116.5	7.274	0.9724
15.2	0.964	14	135.0	8.425	1.126
16.4	0.956	16	153.0	9.549	1.276

HYDROFLUORIC ACID

SPECIFIC GRAVITY OF AQUEOUS HYDROFLUORIC ACID SOLUTION

AT $\frac{0^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HF	Grams per liter	Lbs. per cu. ft.	Lbs. per gal.
2.8	1.020	5	51.00	3.184	0.4256
5.6	1.040	10	104.0	6.492	0.8679
8.2	1.060	15	159.0	9.926	1.327
10.7	1.080	20	216.0	13.48	1.803
13.1	1.099	25	274.8	17.15	2.293
15.4	1.119	30	335.7	20.96	2.801
17.7	1.139	35	398.7	24.89	3.327
19.9	1.159	40	463.6	28.94	3.869
21.9	1.178	45	530.1	33.09	4.424
24.0	1.198	50	599.0	37.39	4.999
25.9	1.217	55	669.4	41.78	5.586
27.6	1.235	60	741.0	46.26	6.184
28.8	1.248	65	811.2	50.64	6.770
29.7	1.258	70	880.6	54.97	7.349
30.0	1.261	72	907.9	56.68	7.577
30.1	1.262	74	933.9	58.30	7.793
30.1	1.262	76	959.1	59.87	8.004
30.0	1.261	78	983.6	61.40	8.208
29.8	1.259	80	1007	62.88	8.405
29.5	1.255	82	1029	64.24	8.588
28.6	1.246	84	1047	65.34	8.734
27.4	1.233	86	1060	66.20	8.849
25.5	1.213	88	1067	66.64	8.908
21.9	1.178	90	1060	66.18	8.848
11.9	1.089	95	1035	64.58	8.633
0.07	1.0005	100	1001	62.46	8.349

SPECIFIC GRAVITY OF AQUEOUS HYDROFLUORIC ACID SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HF	Grams per liter	Lbs. per cu. ft.	Lbs. per gal.
2.4	1.017	5	50.85	3.174	0.4244
4.9	1.035	10	103.5	6.461	0.8637
7.3	1.053	15	158.0	9.860	1.318
9.5	1.070	20	214.0	13.36	1.786
11.5	1.086	25	271.5	16.95	2.266
13.3	1.101	30	330.3	20.62	2.756
15.1	1.116	35	390.6	24.38	3.260
16.7	1.130	40	452.0	28.22	3.772
18.1	1.143	45	514.4	32.11	4.292
19.5	1.155	50	577.5	36.05	4.819

HYDROFLUOSILICIC ACID

SPECIFIC GRAVITY OF AQUEOUS HYDROFLUOSILICIC ACID
SOLUTIONS AT 17.5° C. (STOLBA)

Bé.	Sp. gr.	Per cent H_2SiF_6	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0040	0.5	5.020	0.3134	0.0419
1.2	1.0080	1.0	10.08	0.6293	0.0841
1.7	1.0120	1.5	15.18	0.9476	0.1267
2.3	1.0161	2.0	20.32	1.269	0.1696
2.9	1.0201	2.5	25.50	1.592	0.2128
3.4	1.0242	3.0	30.73	1.918	0.2564
4.0	1.0283	3.5	35.99	2.247	0.3004
4.6	1.0324	4.0	41.30	2.578	0.3446
5.1	1.0366	4.5	46.65	2.912	0.3893
5.7	1.0407	5.0	52.04	3.248	0.4342
6.2	1.0449	5.5	57.47	3.588	0.4796
6.8	1.0491	6.0	62.95	3.930	0.5253
7.3	1.0533	6.5	68.46	4.274	0.5714
7.9	1.0576	7.0	74.03	4.622	0.6178
8.4	1.0618	7.5	79.64	4.971	0.6646
9.0	1.0661	8.0	85.29	5.324	0.7118
9.5	1.0704	8.5	90.98	5.680	0.7593
10.1	1.0747	9.0	96.72	6.038	0.8072
10.6	1.0791	9.5	102.5	6.400	0.8555
11.2	1.0834	10.0	108.3	6.763	0.9041
11.7	1.0878	10.5	114.2	7.130	0.9532
12.2	1.0922	11.0	120.1	7.500	1.003
12.8	1.0966	11.5	126.1	7.873	1.052
13.3	1.1011	12.0	132.1	8.249	1.103
13.8	1.1055	12.5	138.2	8.627	1.153
14.4	1.1100	13.0	144.3	9.008	1.204
14.9	1.1145	13.5	150.5	9.393	1.256
15.4	1.1190	14.0	156.7	9.780	1.307
16.0	1.1236	14.5	162.9	10.17	1.360
16.5	1.1281	15.0	169.2	10.56	1.412
17.0	1.1327	15.5	175.6	10.96	1.465
17.5	1.1373	16.0	182.0	11.36	1.519
18.0	1.1419	16.5	188.4	11.76	1.572
18.5	1.1466	17.0	194.9	12.17	1.627
19.0	1.1512	17.5	201.5	12.58	1.681
19.6	1.1559	18.0	208.1	12.99	1.736
20.1	1.1606	18.5	214.7	13.40	1.792
20.6	1.1653	19.0	221.4	13.82	1.848
21.1	1.1701	19.5	228.2	14.24	1.904
21.6	1.1748	20.0	235.0	14.67	1.961
22.1	1.1796	20.5	241.8	15.10	2.018
22.6	1.1844	21.0	248.7	15.53	2.076

HYDROFLUOSILICIC ACID (Continued)
SPECIFIC GRAVITY OF AQUEOUS HYDROFLUOSILICIC ACID
SOLUTIONS AT 17.5° C. (STOLBA)

Bé.	Sp. gr.	Per cent H ₂ SiF ₆	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
23.1	1.1892	21.5	255.7	15.96	2.134
23.6	1.1941	22.0	262.7	16.40	2.192
24.1	1.1989	22.5	269.8	16.84	2.251
24.6	1.2038	23.0	276.9	17.28	2.311
25.0	1.2087	23.5	284.0	17.73	2.370
25.5	1.2136	24.0	291.3	18.18	2.431
26.0	1.2186	24.5	298.6	18.64	2.492
26.5	1.2235	25.0	305.9	19.09	2.553
27.0	1.2285	25.5	313.3	19.56	2.614
27.5	1.2335	26.0	320.7	20.02	2.676
27.9	1.2385	26.5	328.2	20.49	2.739
28.4	1.2436	27.0	335.8	20.96	2.802
28.9	1.2486	27.5	343.4	21.44	2.865
29.3	1.2537	28.0	351.0	21.91	2.929
29.8	1.2588	28.5	358.8	22.40	2.994
30.3	1.2639	29.0	366.5	22.88	3.059
30.7	1.2691	29.5	374.4	23.37	3.124
31.2	1.2742	30.0	382.3	23.86	3.190
31.7	1.2794	30.5	390.2	24.36	3.256
32.1	1.2846	31.0	398.2	24.86	3.323
32.6	1.2898	31.5	406.3	25.36	3.391
33.0	1.2951	32.0	414.4	25.87	3.459
33.5	1.3003	32.5	422.6	26.38	3.527
34.0	1.3056	33.0	430.8	26.90	3.596
34.4	1.3109	33.5	439.2	27.41	3.665
34.8	1.3162	34.0	447.5	27.94	3.735

MAGNESIUM CHLORIDE
SPECIFIC GRAVITY OF AQUEOUS MAGNESIUM CHLORIDE SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent MgCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.1	1.0146	2	20.29	1.267	0.1693
4.4	1.0311	4	41.24	2.575	0.3442
6.6	1.0478	6	62.87	3.925	0.5247
8.8	1.0646	8	85.17	5.317	0.7107
10.9	1.0816	10	108.2	6.752	0.9026
13.1	1.0989	12	131.9	8.232	1.100
15.1	1.1164	14	156.3	9.757	1.304
17.2	1.1342	16	181.5	11.33	1.514
19.2	1.1523	18	207.4	12.95	1.731
21.1	1.1706	20	234.1	14.62	1.954
26.0	1.2184	25	304.6	19.02	2.542
30.7	1.2688	30	380.6	23.76	3.177

Bé.	Sp. gr.	Per cent MgCl ₂ + 6H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.1	1.0146	4.270	43.32	2.705	0.3616
4.4	1.0311	8.540	88.06	5.497	0.7349
6.6	1.0478	12.81	134.2	8.380	1.120
8.8	1.0646	17.08	181.8	11.35	1.518
10.9	1.0816	21.35	230.9	14.42	1.927
13.1	1.0989	25.62	281.6	17.58	2.350
15.1	1.1164	29.89	333.7	20.83	2.785
17.2	1.1342	34.16	387.5	24.19	3.233
19.2	1.1523	38.43	442.8	27.65	3.696
21.1	1.1706	42.70	499.9	31.21	4.172
26.0	1.2184	53.38	650.4	40.60	5.427
30.7	1.2688	64.05	812.7	50.73	6.782

MAGNESIUM CHLORIDE
SPECIFIC GRAVITY OF AQUEOUS MAGNESIUM CHLORIDE SOLUTIONS AT 14° C. (OUDEMANS)

Bé.	Sp. gr.	Per cent MgCl ₂ + 6H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0033	1	10.03	0.6263	0.0837
1.1	1.0073	2	20.15	1.258	0.1681
1.6	1.0113	3	30.34	1.894	0.2532
2.2	1.0154	4	40.62	2.536	0.3390
2.8	1.0194	5	50.97	3.182	0.4254
3.3	1.0234	6	61.40	3.833	0.5124
3.9	1.0274	7	71.92	4.490	0.6002
4.4	1.0314	8	82.51	5.151	0.6886
5.0	1.0355	9	93.20	5.818	0.7777
5.5	1.0395	10	104.0	6.489	0.8675
6.0	1.0435	11	114.8	7.166	0.9579
6.6	1.0476	12	125.7	7.848	1.049
7.1	1.0517	13	136.7	8.535	1.141
7.7	1.0558	14	147.8	9.227	1.234
8.2	1.0599	15	159.0	9.925	1.327
8.7	1.0641	16	170.3	10.63	1.421
9.3	1.0682	17	181.6	11.34	1.515
9.8	1.0724	18	193.0	12.05	1.611
10.3	1.0765	19	204.5	12.77	1.707
10.8	1.0807	20	216.1	13.49	1.804
11.4	1.0849	21	227.8	14.22	1.901
11.9	1.0891	22	239.6	14.96	2.000
12.4	1.0933	23	251.5	15.70	2.098
12.9	1.0976	24	263.4	16.44	2.198
13.4	1.1018	25	275.5	17.20	2.299
13.9	1.1061	26	287.6	17.95	2.400
14.4	1.1103	27	299.8	18.71	2.502
14.9	1.1146	28	312.1	19.48	2.604
15.4	1.1189	29	324.5	20.26	2.708
15.9	1.1232	30	337.0	21.04	2.812
16.4	1.1275	31	349.5	21.82	2.917
16.9	1.1319	32	362.2	22.61	3.023
17.4	1.1363	33	375.0	23.41	3.129
17.9	1.1407	34	387.8	24.21	3.237
18.4	1.1451	35	400.8	25.02	3.345
18.9	1.1495	36	413.8	25.83	3.453
19.4	1.1540	37	427.0	26.66	3.563
19.8	1.1584	38	440.2	27.48	3.673
20.3	1.1628	39	453.5	28.31	3.784
20.8	1.1673	40	466.9	29.15	3.897
21.3	1.1718	41	480.4	29.99	4.009
21.7	1.1763	42	494.0	30.84	4.123
22.2	1.1809	43	507.8	31.70	4.238
22.7	1.1855	44	521.6	32.56	4.353
23.2	1.1901	45	535.5	33.43	4.469
23.6	1.1948	46	549.6	34.31	4.587
24.1	1.1995	47	563.8	35.19	4.705
24.6	1.2042	48	578.0	36.08	4.824

MAGNESIUM CHLORIDE (Continued)
SPECIFIC GRAVITY OF AQUEOUS MAGNESIUM CHLORIDE SOLUTIONS AT 14° C. (OUDEMANS)

Bé.	Sp. gr.	Per cent MgCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0033	0.47	4.699	0.2934	0.0392
1.1	1.0073	0.94	9.436	0.5891	0.0787
1.6	1.0113	1.41	14.21	0.8871	0.1186
2.2	1.0154	1.87	19.02	1.188	0.1588
2.8	1.0194	2.34	23.87	1.490	0.1992
3.3	1.0234	2.81	28.76	1.795	0.2400
3.9	1.0274	3.28	33.68	2.103	0.2811
4.4	1.0314	3.75	38.65	2.413	0.3225
5.0	1.0355	4.22	43.65	2.725	0.3643
5.5	1.0395	4.68	48.69	3.039	0.4063
6.0	1.0435	5.15	53.76	3.356	0.4487
6.6	1.0476	5.62	58.88	3.676	0.4914
7.1	1.0517	6.09	64.04	3.998	0.5344
7.7	1.0558	6.56	69.23	4.322	0.5777
8.2	1.0599	7.03	74.46	4.649	0.6214
8.7	1.0641	7.49	79.74	4.978	0.6655
9.3	1.0682	7.96	85.05	5.310	0.7098
9.8	1.0724	8.43	90.41	5.644	0.7545
10.3	1.0765	8.90	95.80	5.980	0.7995
10.8	1.0807	9.37	101.2	6.320	0.8448
11.4	1.0849	9.84	106.7	6.661	0.8905
11.9	1.0891	10.3	112.2	7.006	0.9365
12.4	1.0933	10.8	117.8	7.352	0.9829
12.9	1.0976	11.2	123.4	7.702	1.030
13.4	1.1018	11.7	129.0	8.054	1.077
13.9	1.1061	12.2	134.7	8.409	1.124
14.4	1.1103	12.6	140.4	8.765	1.172
14.9	1.1146	13.1	146.2	9.125	1.220
15.4	1.1189	13.6	152.0	9.487	1.268
15.9	1.1232	14.1	157.8	9.862	1.317
16.4	1.1275	14.5	163.7	10.22	1.366
16.9	1.1319	15.0	169.6	10.59	1.416
17.4	1.1363	15.5	175.6	10.96	1.466
17.9	1.1407	15.9	181.7	11.34	1.516
18.4	1.1451	16.4	187.7	11.72	1.567
18.9	1.1495	16.9	193.8	12.10	1.617
19.4	1.1540	17.3	200.0	12.48	1.669
19.8	1.1584	17.8	206.2	12.87	1.721
20.3	1.1628	18.3	212.4	13.26	1.773
20.8	1.1673	18.7	218.7	13.65	1.825
21.3	1.1718	19.2	225.0	14.05	1.878
21.7	1.1763	19.7	231.4	14.45	1.931
22.2	1.1809	20.1	237.8	14.85	1.985
22.7	1.1855	20.6	244.3	15.25	2.039
23.2	1.1901	21.1	250.8	15.66	2.093
23.6	1.1948	21.5	257.4	16.07	2.148
24.1	1.1995	22.0	264.1	16.48	2.204
24.6	1.2042	22.5	270.7	16.90	2.259

MAGNESIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS MAGNESIUM SULFATE SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent MgSO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.6	1.0186	2	20.37	1.272	0.1700
5.5	1.0392	4	41.57	2.595	0.3469
8.2	1.0602	6	63.61	3.971	0.5309
10.9	1.0816	8	86.53	5.402	0.7221
13.6	1.1034	10	110.3	6.889	0.9208
16.2	1.1256	12	135.1	8.432	1.127
18.7	1.1484	14	160.8	10.04	1.342
21.3	1.1717	16	187.5	11.70	1.564
23.3	1.1955	18	215.2	13.43	1.796
26.1	1.2198	20	244.0	15.23	2.036
28.5	1.2447	22	273.8	17.09	2.285
30.8	1.2701	24	304.8	19.03	2.544
33.1	1.2961	26	337.0	21.04	2.812

Bé.	Sp. gr.	Per cent MgSO ₄ + 7H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.6	1.0186	4.095	41.71	2.604	0.3481
5.5	1.0392	8.190	85.11	5.314	0.7103
8.2	1.0602	12.29	130.3	8.131	1.087
10.9	1.0816	16.38	177.2	11.06	1.479
13.6	1.1034	20.48	225.9	14.10	1.886
16.2	1.1256	24.57	276.6	17.27	2.308
18.7	1.1484	28.67	329.2	20.55	2.747
21.3	1.1717	32.76	383.9	23.96	3.203
23.3	1.1955	36.86	440.6	27.51	3.677
26.1	1.2198	40.95	499.5	31.18	4.169
28.5	1.2447	45.05	560.7	35.00	4.679
30.8	1.2701	49.14	624.2	38.96	5.209
33.1	1.2961	53.24	690.0	43.08	5.758

NICKEL CHLORIDE
SPECIFIC GRAVITY OF AQUEOUS NICKEL CHLORIDE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NiCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.008	1	10.08	0.6293	0.0841
2.6	1.018	2	20.36	1.271	0.1699
5.2	1.037	4	41.48	2.589	0.3462
7.8	1.057	6	63.42	3.959	0.5293
10.5	1.078	8	86.24	5.384	0.7197
13.1	1.099	10	109.9	6.861	0.9171
15.7	1.121	12	134.5	8.398	1.123
18.1	1.143	14	160.0	9.990	1.335
20.8	1.167	16	186.7	11.66	1.558
23.3	1.191	18	214.4	13.38	1.789
25.7	1.215	20	243.0	15.17	2.028
31.7	1.280	25	320.0	19.98	2.670
37.8	1.353	30	405.9	25.34	3.387

NICKEL NITRATE

SPECIFIC GRAVITY OF AQUEOUS NICKEL NITRATE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Ni(NO ₃) ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.1	1.015	2	20.30	1.267	0.1694
4.6	1.033	4	41.32	2.579	0.3448
6.9	1.050	6	63.00	3.933	0.5258
9.4	1.069	8	85.52	5.339	0.7137
11.7	1.088	10	108.8	6.792	0.9080
14.0	1.107	12	132.8	8.293	1.109
16.3	1.127	14	157.8	9.850	1.317
18.7	1.148	16	183.7	11.47	1.533
21.0	1.169	18	210.4	13.14	1.756
23.3	1.191	20	238.2	14.87	1.988
28.9	1.249	25	312.3	19.49	2.606
34.4	1.311	30	393.3	24.55	3.282
39.7	1.377	35	482.0	30.09	4.022

NICKEL SULFATE

SPECIFIC GRAVITY OF AQUEOUS NICKEL SULFATE SOLUTIONS

AT $\frac{18^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NiSO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.009	1	10.09	0.6299	0.0842
2.8	1.020	2	20.40	1.274	0.1702
5.8	1.042	4	41.68	2.602	0.3478
8.6	1.063	6	63.78	3.982	0.5323
11.4	1.085	8	86.80	5.419	0.7244
14.3	1.109	10	110.9	6.923	0.9255
17.0	1.133	12	136.0	8.488	1.135
19.8	1.158	14	162.1	10.12	1.353
22.4	1.183	16	189.3	11.82	1.580
25.1	1.209	18	217.6	13.59	1.816

NITRIC ACID
SPECIFIC GRAVITY OF AQUEOUS NITRIC ACID SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HNO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0036	1	10.04	0.6265	0.0838
1.3	1.0091	2	20.18	1.260	0.1684
2.1	1.0146	3	30.44	1.900	0.2540
2.9	1.0201	4	40.80	2.547	0.3405
3.6	1.0256	5	51.28	3.201	0.4279
4.4	1.0312	6	61.87	3.862	0.5163
5.2	1.0369	7	72.58	4.531	0.6057
5.9	1.0427	8	83.42	5.207	0.6961
6.7	1.0485	9	94.37	5.891	0.7875
7.5	1.0543	10	105.4	6.582	0.8798
8.2	1.0602	11	116.6	7.280	0.9732
9.0	1.0661	12	127.9	7.986	1.068
9.8	1.0721	13	139.4	8.701	1.163
10.5	1.0781	14	150.9	9.422	1.260
11.3	1.0842	15	162.6	10.15	1.357
12.0	1.0903	16	174.4	10.89	1.456
12.8	1.0964	17	186.4	11.64	1.555
13.5	1.1026	18	198.5	12.39	1.656
14.2	1.1088	19	210.7	13.15	1.758
15.0	1.1150	20	223.0	13.92	1.861
15.7	1.1213	21	235.5	14.70	1.965
16.4	1.1276	22	248.1	15.49	2.070
17.1	1.1340	23	260.8	16.28	2.177
17.9	1.1404	24	273.7	17.09	2.284
18.6	1.1469	25	286.7	17.90	2.393
19.4	1.1534	26	299.9	18.72	2.503
20.0	1.1600	27	313.2	19.55	2.614
20.7	1.1666	28	326.6	20.39	2.726
21.4	1.1733	29	340.3	21.24	2.840
22.1	1.1800	30	354.0	22.10	2.954
22.8	1.1867	31	367.9	22.97	3.070
23.5	1.1934	32	381.9	23.84	3.187
24.2	1.2002	33	396.1	24.73	3.305
24.9	1.2071	34	410.4	25.62	3.425
25.6	1.2140	35	424.9	26.53	3.546
26.2	1.2205	36	439.4	27.43	3.667
26.8	1.2270	37	454.0	28.34	3.789
27.5	1.2335	38	468.7	29.26	3.912
28.1	1.2399	39	483.6	30.19	4.035
28.7	1.2463	40	498.5	31.12	4.160
29.3	1.2527	41	513.6	32.06	4.286
29.8	1.2591	42	528.8	33.01	4.413
30.4	1.2655	43	544.2	33.97	4.541
31.0	1.2719	44	559.6	34.94	4.670
31.6	1.2783	45	575.2	35.91	4.800
32.1	1.2847	46	591.0	36.89	4.932
32.7	1.2911	47	606.8	37.88	5.064
33.2	1.2975	48	622.8	38.88	5.197
33.8	1.3040	49	639.0	39.89	5.332
34.3	1.3100	50	655.0	40.89	5.466
34.8	1.3160	51	671.2	41.90	5.601
35.3	1.3219	52	687.4	42.91	5.736
35.8	1.3278	53	703.7	43.93	5.873
36.3	1.3336	54	720.1	44.96	6.010

NITRIC ACID (Continued)
SPECIFIC GRAVITY OF AQUEOUS NITRIC ACID SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent HNO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
36.7	1.3393	55	736.6	45.98	6.147
37.2	1.3449	56	753.1	47.02	6.285
37.6	1.3505	57	769.8	48.06	6.424
38.1	1.3560	58	786.5	49.10	6.563
38.5	1.3614	59	803.2	50.14	6.703
38.9	1.3667	60	820.0	51.19	6.843
39.3	1.3719	61	836.9	52.24	6.984
39.7	1.3769	62	853.7	53.29	7.124
40.1	1.3818	63	870.5	54.34	7.265
40.4	1.3866	64	887.4	55.40	7.406
40.8	1.3913	65	904.3	56.46	7.547
41.1	1.3959	66	921.3	57.51	7.688
41.5	1.4004	67	938.3	58.57	7.830
41.8	1.4048	68	955.3	59.63	7.972
42.1	1.4091	69	972.3	60.70	8.114
42.4	1.4134	70	989.4	61.76	8.257
42.7	1.4176	71	1006	62.83	8.399
43.0	1.4218	72	1024	63.91	8.543
43.3	1.4258	73	1041	64.98	8.686
43.6	1.4298	74	1058	66.05	8.830
43.9	1.4337	75	1075	67.13	8.973
44.1	1.4375	76	1093	68.20	9.117
44.4	1.4413	77	1110	69.28	9.262
44.7	1.4450	78	1127	70.36	9.406
44.9	1.4486	79	1144	71.44	9.550
45.1	1.4521	80	1162	72.52	9.694
45.4	1.4555	81	1179	73.60	9.839
45.6	1.4589	82	1196	74.68	9.983
45.8	1.4622	83	1214	75.76	10.13
46.1	1.4655	84	1231	76.85	10.27
46.3	1.4686	85	1248	77.93	10.42
46.5	1.4716	86	1266	79.01	10.56
46.7	1.4745	87	1283	80.08	10.71
46.8	1.4773	88	1300	81.16	10.85
47.0	1.4800	89	1317	82.23	10.99
47.2	1.4826	90	1334	83.30	11.14
47.4	1.4850	91	1351	84.36	11.28
47.5	1.4873	92	1368	85.42	11.42
47.6	1.4892	93	1385	86.46	11.56
47.8	1.4912	94	1402	87.51	11.70
47.9	1.4932	95	1419	88.56	11.84
48.0	1.4952	96	1435	89.61	11.98
48.2	1.4974	97	1452	90.67	12.12
48.4	1.5008	98	1471	91.82	12.27
48.7	1.5056	99	1491	93.05	12.44
49.2	1.5129	100	1513	94.45	12.63

NITRIC ACID

Authority — W. C. FERGUSON

This table has been approved and adopted as a Standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

At 10°–20° Bé. — 1/30° Bé. or .00029 Sp. Gr. = 1° F.
 20°–30° Bé. — 1/23° Bé. or .00044 " " = 1° F.
 30°–40° Bé. — 1/20° Bé. or .00060 " " = 1° F.
 40°–48.5° Bé. — 1/17° Bé. or .00084 " " = 1° F.

Bé.°	Sp. gr.	Tw.°	Per cent HNO ₃	Bé.°	Sp. gr.	Tw.°	Per cent HNO ₃
10.00	1.0741	14.82	12.86	15.25	1.1176	23.52	19.70
10.25	1.0761	15.22	13.18	15.50	1.1197	23.94	20.02
10.50	1.0781	15.62	13.49	15.75	1.1219	24.38	20.36
10.75	1.0801	16.02	13.81	16.00	1.1240	24.80	20.69
11.00	1.0821	16.42	14.13	16.25	1.1262	25.24	21.03
11.25	1.0841	16.82	14.44	16.50	1.1284	25.68	21.36
11.50	1.0861	17.22	14.76	16.75	1.1306	26.12	21.70
11.75	1.0881	17.62	15.07	17.00	1.1328	26.56	22.04
12.00	1.0902	18.04	15.41	17.25	1.1350	27.00	22.38
12.25	1.0922	18.44	15.72	17.50	1.1373	27.46	22.74
12.50	1.0943	18.86	16.05	17.75	1.1395	27.90	23.08
12.75	1.0964	19.28	16.39	18.00	1.1417	28.34	23.42
13.00	1.0985	19.70	16.72	18.25	1.1440	28.80	23.77
13.25	1.1006	20.12	17.05	18.50	1.1462	29.24	24.11
13.50	1.1027	20.54	17.38	18.75	1.1485	29.70	24.47
13.75	1.1048	20.96	17.71	19.00	1.1508	30.16	24.82
14.00	1.1069	21.38	18.04	19.25	1.1531	30.62	25.18
14.25	1.1090	21.80	18.37	19.50	1.1554	31.08	25.53
14.50	1.1111	22.22	18.70	19.75	1.1577	31.54	25.88
14.75	1.1132	22.64	19.02	20.00	1.1600	32.00	26.24
15.00	1.1154	23.08	19.36	20.25	1.1624	32.48	26.61

NITRIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO ₃ .	Bé.°	Sp. gr.	Tw.°	Per cent HNO ₃ .
20.50	1.1647	32.94	26.96	31.50	1.2775	55.50	43.89
20.75	1.1671	33.42	27.33	31.75	1.2804	56.08	44.34
21.00	1.1694	33.88	27.67	32.00	1.2832	56.64	44.78
21.25	1.1718	34.36	28.02	32.25	1.2861	57.22	45.24
21.50	1.1741	34.82	28.36	32.50	1.2889	57.78	45.68
21.75	1.1765	35.30	28.72	32.75	1.2918	58.36	46.14
22.00	1.1789	35.78	29.07	33.00	1.2946	58.92	46.58
22.25	1.1813	36.26	29.43	33.25	1.2975	59.50	47.04
22.50	1.1837	36.74	29.78	33.50	1.3004	60.08	47.49
22.75	1.1861	37.22	30.14	33.75	1.3034	60.68	47.95
23.00	1.1885	37.70	30.49	34.00	1.3063	61.26	48.42
23.25	1.1910	38.20	30.86	34.25	1.3093	61.86	48.90
23.50	1.1934	38.68	31.21	34.50	1.3122	62.44	49.35
23.75	1.1959	39.18	31.58	34.75	1.3152	63.04	49.83
24.00	1.1983	39.66	31.94	35.00	1.3182	63.64	50.32
24.25	1.2008	40.16	32.31	35.25	1.3212	64.24	50.81
24.50	1.2033	40.66	32.68	35.50	1.3242	64.84	51.30
24.75	1.2058	41.16	33.05	35.75	1.3273	65.46	51.80
25.00	1.2083	41.66	33.42	36.00	1.3303	66.06	52.30
25.25	1.2109	42.18	33.80	36.25	1.3334	66.68	52.81
25.50	1.2134	42.68	34.17	36.50	1.3364	67.28	53.32
25.75	1.2160	43.20	34.56	36.75	1.3395	67.90	53.84
26.00	1.2185	43.70	34.94	37.00	1.3426	68.52	54.36
26.25	1.2211	44.22	35.33	37.25	1.3457	69.14	54.89
26.50	1.2236	44.72	35.70	37.50	1.3488	69.76	55.43
26.75	1.2262	45.24	36.09	37.75	1.3520	70.40	55.97
27.00	1.2288	45.76	36.48	38.00	1.3551	71.02	56.52
27.25	1.2314	46.28	36.87	38.25	1.3583	71.66	57.08
27.50	1.2340	46.80	37.26	38.50	1.3615	72.30	57.65
27.75	1.2367	47.34	37.67	38.75	1.3647	72.94	58.23
28.00	1.2393	47.86	38.06	39.00	1.3679	73.58	58.82
28.25	1.2420	48.40	38.46	39.25	1.3712	74.24	59.43
28.50	1.2446	48.92	38.85	39.50	1.3744	74.88	60.06
28.75	1.2473	49.46	39.25	39.75	1.3777	75.54	60.71
29.00	1.2500	50.00	39.66	40.00	1.3810	76.20	61.38
29.25	1.2527	50.54	40.06	40.25	1.3843	76.86	62.07
29.50	1.2554	51.08	40.47	40.50	1.3876	77.52	62.77
29.75	1.2582	51.64	40.89	40.75	1.3909	78.18	63.48
30.00	1.2609	52.18	41.30	41.00	1.3942	78.84	64.20
30.25	1.2637	52.74	41.72	41.25	1.3976	79.52	64.93
30.50	1.2664	53.28	42.14	41.50	1.4010	80.20	65.67
30.75	1.2692	53.84	42.58	41.75	1.4044	80.88	66.42
31.00	1.2719	54.38	43.00	42.00	1.4078	81.96	67.18
31.25	1.2747	54.94	43.44	42.25	1.4112	82.24	67.95

NITRIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO ₃ .	Bé.°	Sp. gr.	Tw.°	Per cent HNO ₃ .
42.50	1.4146	82.92	68.73	45.50	1.4573	91.46	79.03
42.75	1.4181	83.62	69.52	45.75	1.4610	92.20	80.04
43.00	1.4216	84.32	70.33	46.00	1.4646	92.92	81.08
43.25	1.4251	85.02	71.15	46.25	1.4684	93.68	82.18
43.50	1.4286	85.72	71.98	46.50	1.4721	94.42	83.33
43.75	1.4321	86.42	72.82	46.75	1.4758	95.16	84.48
44.00	1.4356	87.12	73.67	47.00	1.4796	95.92	85.70
44.25	1.4392	87.84	74.53	47.25	1.4834	96.68	86.98
44.50	1.4428	88.56	75.40	47.50	1.4872	97.44	88.32
44.75	1.4464	89.28	76.28	47.75	1.4910	98.20	89.76
45.00	1.4500	90.00	77.17	48.00	1.4948	98.96	91.35
45.25	1.4536	90.72	78.07	48.25	1.4987	99.74	93.13
				48.50	1.5026	100.52	95.11

OXALIC ACID

SPECIFIC GRAVITY OF AQUEOUS OXALIC ACID SOLUTIONS
AT 17.5° C. (GERLACH)

Bé.	Sp. gr.	Per cent $\text{H}_2\text{C}_2\text{O}_4 + 2\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0035	1	10.04	0.6265	0.0837
1.0	1.0070	2	20.14	1.257	0.1681
1.5	1.0105	3	30.32	1.892	0.2530
2.0	1.0140	4	40.56	2.532	0.3385
2.5	1.0175	5	50.88	3.176	0.4246
3.0	1.0210	6	61.26	3.824	0.5112
3.5	1.0245	7	71.72	4.477	0.5985
4.0	1.0280	8	82.24	5.134	0.6863
4.4	1.0315	9	92.84	5.795	0.7747
4.9	1.0350	10	103.5	6.461	0.8637
5.4	1.0385	11	114.2	7.131	0.9533
5.8	1.0420	12	125.0	7.806	1.043
6.3	1.0455	13	135.9	8.485	1.134

Bé.	Sp. gr.	Per cent $\text{H}_2\text{C}_2\text{O}_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0035	0.71	7.166	0.4474	0.0598
1.0	1.0070	1.43	14.38	0.8979	0.1200
1.5	1.0105	2.14	21.65	1.351	0.1807
2.0	1.0140	2.86	28.97	1.808	0.2417
2.5	1.0175	3.57	36.33	2.268	0.3032
3.0	1.0210	4.28	43.75	2.731	0.3651
3.5	1.0245	5.00	51.21	3.197	0.4274
4.0	1.0280	5.71	58.73	3.666	0.4901
4.4	1.0315	6.43	66.30	4.139	0.5533
4.9	1.0350	7.14	73.91	4.614	0.6168
5.4	1.0385	7.86	81.58	5.093	0.6808
5.8	1.0420	8.57	89.30	5.574	0.7452
6.3	1.0455	9.28	97.06	6.059	0.8100

PERCHLORIC ACID

SPECIFIC GRAVITY OF AQUEOUS PERCHLORIC ACID SOLUTIONS

AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Sp. gr.	Per cent HClO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.005	1	10.05	.6274	.0839
1.011	2	20.22	1.262	.1687
1.023	4	40.91	2.554	.3414
1.035	6	62.09	3.876	.5181
1.047	8	83.77	5.229	.6991
1.060	10	106.0	6.615	.8843
1.073	12	128.7	8.035	1.074
1.086	14	152.0	9.490	1.269
1.100	16	175.9	10.98	1.468
1.114	18	200.4	12.51	1.673
1.128	20	225.6	14.08	1.882
1.143	22	251.4	15.69	2.098
1.158	24	277.9	17.35	2.319
1.174	26	305.2	19.06	2.547
1.190	28	333.2	20.80	2.781
1.207	30	362.0	22.60	3.021
1.224	32	391.6	24.45	3.268
1.242	34	422.2	26.36	3.523
1.260	36	453.7	28.32	3.786
1.279	38	486.2	30.35	4.057
1.299	40	519.6	32.44	4.336
1.352	45	608.4	37.98	5.078
1.410	50	705.2	44.02	5.885
1.473	55	810.3	50.58	6.762
1.539	60	923.3	57.64	7.705
1.606	65	1044.	65.16	8.711
1.674	70	1172.	73.13	9.777

SPECIFIC GRAVITY OF 65 TO 75% SOLUTION AT $\frac{25^{\circ}}{4^{\circ}}$ C.

Based on values reported by G. Frederick Smith and O. E. Goehler, Ind. and Eng. Chem. **3**, 61, 1931

1.597	65.0	1038.	64.79	8.661
1.603	65.5	1050.	65.56	8.764
1.610	66.0	1063.	66.34	8.868
1.617	66.5	1075.	67.12	8.973
1.624	67.0	1088.	67.91	9.078
1.630	67.5	1101.	68.70	9.184
1.637	68.0	1113.	69.50	9.290
1.644	68.5	1126.	70.30	9.397
1.651	69.0	1139.	71.10	9.504
1.657	69.5	1152.	71.91	9.613
1.664	70.0	1165.	72.72	9.722
1.671	70.5	1178.	73.54	9.831
1.678	71.0	1191.	74.36	9.940
1.684	71.5	1204.	75.18	10.05
1.691	72.0	1218.	76.01	10.16
1.698	72.5	1231.	76.84	10.27
1.704	73.0	1244.	77.68	10.38
1.711	73.5	1258.	78.52	10.50
1.718	74.0	1271.	79.36	10.61
1.725	74.5	1285.	80.21	10.72
1.731	75.0	1298.	81.06	10.84

PHOSPHORIC ACID
SPECIFIC GRAVITY OF AQUEOUS PHOSPHORIC ACID SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent H ₃ PO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0038	1	10.04	0.6266	0.0838
1.3	1.0092	2	20.18	1.260	0.1684
2.8	1.0200	4	40.80	2.547	0.3405
4.3	1.0309	6	61.85	3.861	0.5162
5.8	1.0420	8	83.36	5.204	0.6957
7.3	1.0532	10	105.3	6.575	0.8789
8.8	1.0647	12	127.8	7.976	1.066
10.3	1.0764	14	150.7	9.408	1.258
11.8	1.0884	16	174.1	10.87	1.453
13.3	1.1008	18	198.1	12.37	1.654
14.8	1.1134	20	222.7	13.90	1.858
16.3	1.1263	22	247.8	15.47	2.068
17.8	1.1395	24	273.5	17.07	2.282
19.2	1.1529	26	299.8	18.71	2.501
20.7	1.1665	28	326.6	20.39	2.726
22.2	1.1805	30	354.2	22.11	2.955
25.8	1.216	35	425.6	26.57	3.552
29.4	1.254	40	501.6	31.31	4.186
32.9	1.293	45	581.9	36.32	4.856
36.4	1.335	50	667.5	41.67	5.570
39.9	1.379	55	758.5	47.35	6.329
43.3	1.426	60	855.6	53.41	7.140
46.7	1.475	65	958.8	59.85	8.001
50.0	1.526	70	1068	66.68	8.914
53.2	1.579	75	1184	73.93	9.883
56.2	1.633	80	1306	81.55	10.90
59.2	1.689	85	1436	89.62	11.98
62.0	1.746	90	1571	98.10	13.11
63.1	1.770	92	1628	101.7	13.59
64.2	1.794	94	1686	105.3	14.07
65.3	1.819	96	1746	109.0	14.57
66.4	1.844	98	1807	112.8	15.08
67.5	1.870	100	1870	116.7	15.61

PHOSPHORIC ACID
SPECIFIC GRAVITY OF AQUEOUS PHOSPHORIC ACID SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent P ₂ O ₅	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0038	0.72	7.271	0.4539	0.0607
1.3	1.0092	1.4	14.62	0.9128	0.1220
2.8	1.0200	2.9	29.56	1.845	0.2466
4.3	1.0309	4.3	44.81	2.797	0.3739
5.8	1.0420	5.8	60.39	3.770	0.5039
7.3	1.0532	7.2	76.29	4.763	0.6367
8.8	1.0647	8.7	92.55	5.778	0.7724
10.3	1.0764	10.1	109.2	6.815	0.9110
11.8	1.0884	11.6	126.1	7.875	1.053
13.3	1.1008	13.0	143.5	8.960	1.198
14.8	1.1134	14.5	161.3	10.07	1.346
16.3	1.1263	15.9	179.5	11.21	1.498
17.8	1.1395	17.4	198.1	12.37	1.653
19.2	1.1529	18.8	217.1	13.56	1.812
20.7	1.1665	20.3	236.6	14.77	1.975
22.2	1.1805	21.7	256.5	16.02	2.141
25.8	1.216	25.4	308.3	19.25	2.573
29.4	1.254	29.0	363.4	22.68	3.032
32.9	1.293	32.6	421.5	26.31	3.517
36.4	1.335	36.2	483.5	30.19	4.035
39.9	1.379	39.8	549.4	34.30	4.585
43.3	1.426	43.5	619.8	38.69	5.172
46.7	1.475	47.1	694.5	43.36	5.796
50.0	1.526	50.7	773.8	48.31	6.458
53.2	1.579	54.3	857.9	53.55	7.159
56.2	1.633	58.0	946.4	59.08	7.898
59.2	1.689	61.6	1040	64.92	8.679
62.0	1.746	65.2	1138	71.06	9.500
63.1	1.770	66.6	1180	73.64	9.844
64.2	1.794	68.1	1222	76.26	10.19
65.3	1.819	69.5	1265	78.97	10.56
66.4	1.844	71.0	1309	81.72	10.92
67.5	1.870	72.4	1355	84.57	11.30

POTASSIUM BROMIDE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM BROMIDE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent KBr	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0054	1	10.05	0.6276	0.0839
1.8	1.0127	2	20.25	1.264	0.1690
3.9	1.0275	4	41.10	2.566	0.3430
5.9	1.0426	6	62.56	3.905	0.5220
8.0	1.0581	8	84.65	5.284	0.7064
10.0	1.0740	10	107.4	6.705	0.8963
12.0	1.0903	12	130.8	8.168	1.092
14.0	1.1070	14	155.0	9.675	1.293
16.0	1.1242	16	179.9	11.23	1.501
18.0	1.1419	18	205.5	12.83	1.715
20.0	1.1601	20	232.0	14.48	1.936
22.0	1.1788	22	259.3	16.19	2.164
24.0	1.1980	24	287.5	17.95	2.399
25.9	1.2178	26	316.6	19.77	2.642
27.9	1.2383	28	346.7	21.64	2.893
29.9	1.2593	30	377.8	23.58	3.153
34.7	1.3147	35	460.1	28.73	3.840
39.5	1.3746	40	549.8	34.32	4.589

POTASSIUM CARBONATE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM CARBONATE SOLUTIONS AT

$\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent K ₂ CO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.0072	1	10.07	0.6288	0.0841
2.3	1.0163	2	20.33	1.269	0.1696
4.8	1.0345	4	41.38	2.583	0.3453
7.3	1.0529	6	63.17	3.944	0.5272
9.7	1.0715	8	85.72	5.351	0.7154
12.0	1.0904	10	109.0	6.807	0.9100
14.3	1.1096	12	133.2	8.312	1.111
16.6	1.1291	14	158.1	9.868	1.319
18.8	1.1490	16	183.8	11.48	1.534
21.0	1.1692	18	210.5	13.14	1.756

POTASSIUM CARBONATE (Continued)
SPECIFIC GRAVITY OF AQUEOUS POTASSIUM CARBONATE SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent K ₂ CO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
23.1	1.1898	20	238.0	14.86	1.986
25.2	1.2107	22	266.4	16.63	2.223
27.3	1.2320	24	295.7	18.46	2.468
29.3	1.2536	26	325.9	20.35	2.720
31.3	1.2756	28	357.2	22.30	2.981
33.3	1.2979	30	389.4	24.31	3.249
38.0	1.3548	35	474.2	29.60	3.957
42.5	1.4141	40	565.6	35.31	4.720
46.8	1.4759	45	664.2	41.46	5.543
50.9	1.5404	50	770.2	48.08	6.427

POTASSIUM CHLORIDE
SPECIFIC GRAVITY OF AQUEOUS POTASSIUM CHLORIDE SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent KCl	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0046	1	10.05	0.6271	0.0838
1.6	1.0110	2	20.22	1.262	0.1687
3.4	1.0239	4	40.96	2.557	0.3418
5.2	1.0369	6	62.21	3.884	0.5192
6.9	1.0500	8	84.00	5.244	0.7010
8.6	1.0633	10	106.3	6.638	0.8874
10.3	1.0768	12	129.2	8.067	1.078
12.0	1.0905	14	152.7	9.531	1.274
13.7	1.1043	16	176.7	11.03	1.475
15.4	1.1185	18	201.3	12.57	1.680
17.0	1.1328	20	226.6	14.14	1.891
18.6	1.1474	22	252.4	15.76	2.107
20.2	1.1623	24	279.0	17.41	2.328

POTASSIUM CHROME ALUM
SPECIFIC GRAVITY OF AQUEOUS POTASSIUM CHROME ALUM
 SOLUTIONS AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $K_2Cr_2(SO_4)_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.3	1.016	2	20.32	1.269	0.1696
4.8	1.034	4	41.36	2.582	0.3452
7.2	1.052	6	63.12	3.940	0.5267
9.5	1.070	8	85.60	5.344	0.7143
11.9	1.089	10	108.9	6.798	0.9088
14.3	1.109	12	133.1	8.308	1.111
16.6	1.129	14	158.1	9.867	1.319
18.9	1.150	16	184.0	11.49	1.536
21.2	1.171	18	210.8	13.16	1.759
23.5	1.193	20	238.6	14.90	1.991
25.8	1.216	22	267.5	16.70	2.233
28.0	1.239	24	297.4	18.56	2.482
30.2	1.263	26	328.4	20.50	2.740
32.5	1.289	28	360.9	22.53	3.012
34.7	1.315	30	394.5	24.63	3.292
40.2	1.383	35	484.1	30.22	4.040
45.4	1.456	40	582.4	36.36	4.860
50.4	1.533	45	689.9	43.07	5.757
55.2	1.615	50	807.5	50.41	6.739

Bé.	Sp. gr.	Per cent $K_2Cr_2(SO_4)_4$ + 24H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1.763	17.76	1.108	0.1481
2.3	1.016	3.527	35.83	2.237	0.2991
4.8	1.034	7.053	72.93	4.553	0.6087
7.2	1.052	10.58	111.30	6.948	0.9287
9.5	1.070	14.11	150.9	9.423	1.260
11.9	1.089	17.63	192.0	11.99	1.603
14.3	1.109	21.16	234.7	14.65	1.958
16.6	1.129	24.69	278.7	17.40	2.326
18.9	1.150	28.21	324.4	20.25	2.708
21.2	1.171	31.74	371.7	23.20	3.102
23.5	1.193	35.27	420.7	26.26	3.511
25.8	1.216	38.79	471.7	29.45	3.937
28.0	1.239	42.32	524.3	32.73	4.376
30.2	1.263	45.85	579.0	36.15	4.832
32.5	1.289	49.37	636.4	39.73	5.311
34.7	1.315	52.90	695.3	43.43	5.805
40.2	1.383	61.72	853.5	53.28	7.123
45.4	1.456	70.53	1026.9	64.11	8.570
50.4	1.533	79.35	1216.4	75.94	10.15
55.2	1.615	88.17	1423.9	88.89	11.88

POTASSIUM CHROMATE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM CHROMATE SOLUTIONS AT $\frac{18^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent K ₂ CrO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.0066	1	10.07	0.6284	0.0840
2.1	1.0147	2	20.29	1.267	0.1694
4.4	1.0311	4	41.24	2.575	0.3442
6.6	1.0477	6	62.86	3.924	0.5246
8.8	1.0647	8	85.18	5.317	0.7108
11.0	1.0821	10	108.2	6.755	0.9030
13.2	1.0999	12	132.0	8.240	1.101
15.3	1.1181	14	156.5	9.772	1.306
17.4	1.1366	16	181.9	11.35	1.518
19.5	1.1555	18	208.0	12.98	1.736
21.6	1.1748	20	235.0	14.67	1.961
23.6	1.1945	22	262.8	16.41	2.193
25.6	1.2147	24	291.5	18.20	2.433
27.6	1.2354	26	321.2	20.05	2.681
29.6	1.2566	28	351.8	21.96	2.936
31.6	1.2784	30	383.5	23.94	3.201

SPECIFIC GRAVITY OF POTASSIUM CHROMATE SOLUTIONS AT 19.5° C. (SCHIFF)

Bé.	Sp. gr.	Per cent K ₂ CrO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0080	1	10.08	0.6293	0.0841
2.3	1.0161	2	20.32	1.269	0.1696
3.4	1.0243	3	30.73	1.918	0.2564
4.6	1.0325	4	41.30	2.578	0.3447
5.7	1.0408	5	52.04	3.249	0.4343
6.8	1.0492	6	62.95	3.930	0.5254
7.9	1.0576	7	74.03	4.622	0.6178
9.0	1.0663	8	85.30	5.325	0.7119
10.1	1.0750	9	96.75	6.040	0.8074
11.2	1.0837	10	108.4	6.765	0.9044
12.3	1.0925	11	120.2	7.502	1.003
13.4	1.1014	12	132.2	8.251	1.103
14.4	1.1104	13	144.4	9.011	1.205
15.5	1.1195	14	156.7	9.784	1.308

POTASSIUM CHROMATE (Continued)

SPECIFIC GRAVITY OF POTASSIUM CHROMATE SOLUTIONS
AT 19.5° C. (SCHIFF)

Bé.	Sp. gr.	Per cent K ₂ CrO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
16.5	1.1287	15	169.3	10.57	1.413
17.6	1.1380	16	182.1	11.37	1.519
18.6	1.1474	17	195.1	12.18	1.628
19.7	1.1570	18	208.3	13.00	1.738
20.7	1.1667	19	221.7	13.84	1.850
21.8	1.1765	20	235.3	14.69	1.964
22.8	1.1864	21	249.1	15.55	2.079
23.8	1.1964	22	263.2	16.43	2.197
24.8	1.2066	23	277.5	17.32	2.316
25.8	1.2169	24	292.1	18.23	2.437
26.9	1.2274	25	306.9	19.16	2.561
27.9	1.2379	26	321.9	20.09	2.686
28.9	1.2485	27	337.1	21.04	2.813
29.8	1.2592	28	352.6	22.01	2.942
30.8	1.2700	29	368.3	22.99	3.074
31.8	1.2808	30	384.2	23.99	3.207
32.8	1.2921	31	400.6	25.01	3.343
33.8	1.3035	32	417.1	26.04	3.481
34.7	1.3151	33	434.0	27.09	3.622
35.7	1.3268	34	451.1	28.16	3.765
36.7	1.3386	35	468.5	29.25	3.910
37.6	1.3505	36	486.2	30.35	4.057
38.6	1.3625	37	504.1	31.47	4.207
39.5	1.3746	38	522.3	32.61	4.359
40.4	1.3868	39	540.9	33.76	4.514
41.4	1.3991	40	559.6	34.94	4.670

POTASSIUM DICHROMATE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM DICHROMATE
SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent K ₂ Cr ₂ O ₇	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0052	1	10.05	0.6275	0.0839
1.7	1.0122	2	20.24	1.264	0.1689
3.7	1.0264	4	41.06	2.563	0.3426
5.7	1.0408	6	62.45	3.898	0.5211
7.6	1.0554	8	84.43	5.271	0.7046
9.5	1.0703	10	107.0	6.682	0.8932

POTASSIUM HYDROXIDE
SPECIFIC GRAVITY OF AQUEOUS POTASSIUM HYDROXIDE
SOLUTIONS AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent KOH	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0083	1	10.08	0.6295	0.0841
2.5	1.0175	2	20.35	1.270	0.1698
3.8	1.0267	3	30.80	1.923	0.2570
5.0	1.0359	4	41.44	2.587	0.3458
6.3	1.0452	5	52.26	3.262	0.4361
7.5	1.0544	6	63.26	3.949	0.5280
8.7	1.0637	7	74.46	4.648	0.6214
9.9	1.0730	8	85.84	5.359	0.7164
11.0	1.0824	9	97.42	6.081	0.8130
12.2	1.0918	10	109.2	6.816	0.9111
13.3	1.1013	11	121.1	7.563	1.011
14.5	1.1108	12	133.3	8.321	1.112
15.6	1.1203	13	145.6	9.092	1.215
16.7	1.1299	14	158.2	9.875	1.320
17.8	1.1396	15	170.9	10.67	1.427
18.8	1.1493	16	183.9	11.48	1.535
19.9	1.1590	17	197.0	12.30	1.644
20.9	1.1688	18	210.4	13.13	1.756
22.0	1.1786	19	223.9	13.98	1.869
23.0	1.1884	20	237.7	14.84	1.983
24.0	1.1984	21	251.7	15.71	2.100
25.0	1.2083	22	265.8	16.59	2.218
26.0	1.2184	23	280.2	17.49	2.339
27.0	1.2285	24	294.8	18.41	2.461
27.9	1.2387	25	309.7	19.33	2.584
28.9	1.2489	26	324.7	20.27	2.710
29.8	1.2592	27	340.0	21.22	2.837
30.8	1.2695	28	355.5	22.19	2.966
31.7	1.2800	29	371.2	23.17	3.098
32.6	1.2905	30	387.2	24.17	3.231
33.6	1.3010	31	403.3	25.18	3.366
34.5	1.3117	32	419.7	26.20	3.503
35.4	1.3224	33	436.4	27.24	3.642
36.2	1.3331	34	453.3	28.30	3.783
37.1	1.3440	35	470.4	29.37	3.926
38.0	1.3549	36	487.8	30.45	4.070
38.8	1.3659	37	505.4	31.55	4.218
39.7	1.3769	38	523.2	32.66	4.366
40.5	1.3879	39	541.3	33.79	4.517
41.4	1.3991	40	559.6	34.94	4.670
42.2	1.4103	41	578.2	36.10	4.825
43.0	1.4215	42	597.0	37.27	4.982
43.8	1.4329	43	616.1	38.46	5.142
44.6	1.4443	44	635.5	39.67	5.303
45.4	1.4558	45	655.1	40.90	5.467
46.2	1.4673	46	675.0	42.14	5.633
47.0	1.4790	47	695.1	43.39	5.801
47.7	1.4907	48	715.5	44.67	5.971
48.5	1.5025	49	736.2	45.96	6.144
49.2	1.5143	50	757.2	47.27	6.319
50.0	1.5262	51	778.4	48.59	6.496
50.7	1.5382	52	799.9	49.93	6.675

POTASSIUM IODIDE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM IODIDE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent KI	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0055	1	10.06	0.6277	0.0839
1.9	1.0130	2	20.26	1.265	0.1691
4.0	1.0281	4	41.12	2.567	0.3432
6.1	1.0437	6	62.62	3.909	0.5226
8.2	1.0597	8	84.78	5.292	0.7075
10.3	1.0761	10	107.6	6.718	0.8980
12.3	1.0930	12	131.2	8.188	1.095
14.4	1.1104	14	155.5	9.705	1.297
16.5	1.1284	16	180.5	11.27	1.507
18.6	1.1469	18	206.4	12.89	1.723
20.6	1.1660	20	233.2	14.56	1.946
23.7	1.1857	22	260.9	16.28	2.177
24.8	1.2060	24	289.4	18.07	2.415
26.8	1.2270	26	319.0	19.92	2.662
28.9	1.2487	28	349.6	21.83	2.918
30.9	1.2712	30	381.4	23.81	3.183
36.0	1.3308	35	465.8	29.08	3.887
41.1	1.3959	40	558.4	34.86	4.660
46.2	1.4672	45	660.2	41.22	5.510
51.2	1.5458	50	772.9	48.25	6.450
56.2	1.6327	55	898.0	56.06	7.494

POTASSIUM NITRATE
SPECIFIC GRAVITY OF AQUEOUS POTASSIUM NITRATE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent KNO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0045	1	10.05	0.6271	0.0838
1.5	1.0108	2	20.22	1.262	0.1687
3.3	1.0234	4	40.94	2.556	0.3416
5.1	1.0363	6	62.18	3.882	0.5189
6.8	1.0494	8	83.95	5.241	0.7006
8.6	1.0627	10	106.3	6.634	0.8868
10.3	1.0762	12	129.1	8.062	1.078
12.0	1.0899	14	152.6	9.525	1.273
13.7	1.1039	16	176.6	11.03	1.474
15.3	1.1181	18	201.3	12.56	1.680
17.0	1.1326	20	226.5	14.14	1.890
18.6	1.1473	22	252.4	15.76	2.106
20.2	1.1623	24	279.0	17.41	2.328

POTASSIUM SULFATE
SPECIFIC GRAVITY OF AQUEOUS POTASSIUM SULFATE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent K ₂ SO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0063	1	10.06	0.6282	0.0840
2.1	1.0145	2	20.29	1.267	0.1693
4.4	1.0310	4	41.24	2.574	0.3442
6.6	1.0477	6	62.86	3.924	0.5246
8.8	1.0646	8	85.17	5.317	0.7107
11.0	1.0817	10	108.17	6.753	0.9027

POTASSIUM TARTRATE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM TARTRATE SOLU-

TIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $K_2C_4H_4O_6$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0048	1	10.05	0.6273	0.0839
1.6	1.0114	2	20.23	1.263	0.1688
3.5	1.0248	4	40.99	2.559	0.3421
5.4	1.0383	6	62.30	3.889	0.5199
7.2	1.0519	8	84.15	5.253	0.7023
8.9	1.0657	10	106.6	6.653	0.8894
10.7	1.0798	12	129.6	8.089	1.081
12.5	1.0941	14	153.2	9.562	1.278
14.2	1.1087	16	177.4	11.07	1.480
16.0	1.1236	18	202.3	12.63	1.688
17.7	1.1387	20	227.7	14.22	1.901
19.4	1.1540	22	253.9	15.85	2.119
21.0	1.1696	24	280.7	17.52	2.343
22.7	1.1855	26	308.2	19.24	2.572
24.3	1.2017	28	336.5	21.01	2.808
26.0	1.2181	30	365.4	22.81	3.050
30.0	1.2606	35	441.2	27.54	3.682
33.9	1.3051	40	522.0	32.59	4.357
37.7	1.3516	45	608.2	37.97	5.076
41.4	1.4001	50	700.1	43.70	5.842

Bé.	Sp. gr.	Per cent $K_2C_4H_4O_6$ + $\frac{1}{2}H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0048	1.040	10.45	0.6522	0.0872
1.6	1.0114	2.080	21.03	1.313	0.1755
3.5	1.0248	4.159	42.62	2.661	0.3557
5.4	1.0383	6.239	64.78	4.044	0.5406
7.2	1.0519	8.319	87.50	5.462	0.7302
8.9	1.0657	10.40	110.8	6.918	0.9247
10.7	1.0798	12.48	134.7	8.411	1.124
12.5	1.0941	14.56	159.3	9.943	1.329
14.2	1.1087	16.64	184.5	11.52	1.539
16.0	1.1236	18.72	210.3	13.13	1.755
17.7	1.1387	20.80	236.8	14.78	1.976
19.4	1.1540	22.88	264.0	16.48	2.203
21.0	1.1696	24.96	291.9	18.22	2.436
22.7	1.1855	27.03	320.5	20.01	2.675
24.3	1.2017	29.12	349.9	21.84	2.920
26.0	1.2181	31.19	380.0	23.72	3.171
30.0	1.2606	36.39	458.8	28.64	3.829
33.9	1.3051	41.59	542.8	33.89	4.530
37.7	1.3516	46.79	632.4	39.48	5.278
41.4	1.4001	51.99	727.9	45.44	6.075

SODIUM ARSENATE

SPECIFIC GRAVITY OF AQUEOUS DI-SODIUM ARSENATE SOLUTIONS AT $\frac{14^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na_2HAsO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0083	1	10.08	0.6295	0.0841
2.5	1.0175	2	20.35	1.270	0.1698
5.1	1.0365	4	41.46	2.588	0.3460
7.7	1.0563	6	63.38	3.957	0.5289
10.3	1.0768	8	86.14	5.378	0.7189
12.9	1.0980	10	109.8	6.854	0.9163
15.5	1.1197	12	134.4	8.388	1.121
18.0	1.1419	14	159.9	9.980	1.334
20.5	1.1645	16	186.3	11.63	1.555

Bé.	Sp. gr.	Per cent Na_2HAsO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0083	2.163	21.80	1.361	0.1819
2.5	1.0175	4.325	44.01	2.747	0.3672
5.1	1.0365	8.650	89.66	5.597	0.7482
7.7	1.0563	12.98	137.1	8.556	1.144
10.3	1.0768	17.30	186.3	11.63	1.555
12.9	1.0980	21.63	237.4	14.82	1.982
15.5	1.1197	25.95	290.6	18.14	2.425
18.0	1.1419	30.28	345.7	21.58	2.885
20.5	1.1645	34.60	402.9	25.15	3.363

SODIUM ARSENATE

SPECIFIC GRAVITY OF AQUEOUS DI-SODIUM ARSENATE SOLUTIONS AT 14° C. (SCHIFF)

Bé.	Sp. gr.	Per cent Na_2HAsO_4 $+12\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0042	1	10.04	0.6269	0.0838
1.2	1.0084	2	20.17	1.259	0.1683
1.8	1.0126	3	30.38	1.896	0.2535
2.4	1.0168	4	40.67	2.539	0.3394
3.0	1.0212	5	51.06	3.188	0.4261
3.6	1.0256	6	61.54	3.842	0.5135
4.2	1.0300	7	72.10	4.501	0.6017
4.8	1.0344	8	82.75	5.166	0.6906
5.4	1.0389	9	93.50	5.837	0.7803
6.0	1.0434	10	104.3	6.514	0.8707
6.6	1.0479	11	115.3	7.196	0.9619
7.2	1.0525	12	126.3	7.885	1.054
7.8	1.0571	13	137.4	8.579	1.147
8.4	1.0618	14	148.7	9.280	1.241
9.0	1.0665	15	160.0	9.987	1.335
9.6	1.0712	16	171.4	10.70	1.430
10.2	1.0759	17	182.9	11.42	1.526
10.8	1.0807	18	194.5	12.14	1.623
11.4	1.0855	19	206.2	12.88	1.721
12.0	1.0904	20	218.1	13.61	1.820
12.6	1.0953	21	230.0	14.36	1.920
13.2	1.1002	22	242.0	15.11	2.020
13.8	1.1052	23	254.2	15.87	2.121
14.4	1.1102	24	266.4	16.63	2.224
15.0	1.1153	25	278.8	17.41	2.327
15.6	1.1204	26	291.3	18.19	2.431
16.2	1.1255	27	303.9	18.97	2.536
16.8	1.1306	28	316.6	19.76	2.642
17.3	1.1358	29	329.4	20.56	2.749
17.9	1.1410	30	342.3	21.37	2.857
18.5	1.1463	31	355.4	22.18	2.965
19.1	1.1516	32	368.5	23.01	3.075
19.7	1.1569	33	381.8	23.83	3.186
20.2	1.1623	34	395.2	24.67	3.298
20.8	1.1677	35	408.7	25.51	3.411
21.4	1.1731	36	422.3	26.36	3.524
22.0	1.1786	37	436.1	27.22	3.639
22.5	1.1838	38	449.1	28.03	3.748
23.1	1.1896	39	464.0	28.96	3.872
23.7	1.1952	40	478.1	29.85	3.990

SODIUM ARSENATE

SPECIFIC GRAVITY OF AQUEOUS TRI-SODIUM ARSENATE SOLUTIONS AT $\frac{17^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na_3AsO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.4	1.0097	1	10.10	0.6303	0.0843
2.9	1.0207	2	20.41	1.274	0.1704
6.0	1.0431	4	41.72	2.605	0.3482
9.0	1.0659	6	63.95	3.992	0.5337
11.9	1.0892	8	87.14	5.440	0.7272
14.7	1.1130	10	111.3	6.948	0.9288
17.5	1.1373	12	136.5	8.520	1.1389

Bé	Sp. gr.	Per cent Na_3AsO_4 + $12\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.4	1.0097	2.040	20.59	1.286	0.1719
2.9	1.0207	4.079	41.64	2.599	0.3475
6.0	1.0431	8.158	85.10	5.313	0.7102
9.0	1.0659	12.237	130.4	8.143	1.089
11.9	1.0892	16.317	177.7	11.09	1.483
14.7	1.1130	20.396	227.0	14.17	1.894
17.5	1.1373	24.4752	278.4	17.38	2.323

SPECIFIC GRAVITY OF AQUEOUS TRI-SODIUM ARSENATE SOLUTIONS AT 17° C. (SCHIFF)

Bé.	Sp. gr.	Per cent Na_3AsO_4 + $12\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0053	1	10.05	0.6276	0.0839
1.5	1.0107	2	20.21	1.262	0.1687
2.3	1.0161	3	30.48	1.903	0.2544
3.1	1.0215	4	40.86	2.551	0.3410
3.8	1.0270	5	51.35	3.206	0.4285
4.6	1.0325	6	61.95	3.867	0.5170
5.3	1.0380	7	72.66	4.536	0.6064

SODIUM ARSENATE (Continued)

SPECIFIC GRAVITY OF AQUEOUS TRI-SODIUM ARSENATE SOLUTIONS AT 17° C. (SCHIFF)

Bé.	Sp. gr.	Per cent Na_3AsO_4 + $12\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
6.0	1.0435	8	83.48	5.211	0.6967
6.8	1.0491	9	94.42	5.894	0.7880
7.5	1.0547	10	105.5	6.584	0.8802
8.3	1.0603	11	116.6	7.281	0.9733
9.0	1.0659	12	127.9	7.985	1.067
9.7	1.0716	13	139.3	8.697	1.163
10.4	1.0773	14	150.8	9.415	1.259
11.1	1.0830	15	162.5	10.14	1.356
11.8	1.0887	16	174.2	10.87	1.454
12.5	1.0945	17	186.1	11.62	1.553
13.2	1.1003	18	198.1	12.36	1.653
13.9	1.1061	19	210.2	13.12	1.754
14.6	1.1120	20	222.4	13.88	1.856
15.3	1.1179	21	234.8	14.66	1.959
16.0	1.1238	22	247.2	15.43	2.063

SODIUM BROMIDE

SPECIFIC GRAVITY OF AQUEOUS SODIUM BROMIDE SOLUTIONS
AT $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent NaBr	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0060	1	10.06	0.6280	0.0840
2.0	1.0139	2	20.28	1.266	0.1692
4.2	1.0298	4	41.19	2.571	0.3438
6.4	1.0462	6	62.77	3.919	0.5238
8.6	1.0631	8	85.05	5.309	0.7097
10.8	1.0803	10	108.0	6.744	0.9015
13.0	1.0981	12	131.8	8.226	1.100
15.1	1.1164	14	156.3	9.757	1.304
17.3	1.1352	16	181.6	11.34	1.516
19.4	1.1546	18	207.8	12.97	1.734
21.5	1.1745	20	234.9	14.66	1.960
23.7	1.1951	22	262.9	16.41	2.194
25.8	1.2163	24	291.9	18.22	2.436
27.9	1.2382	26	321.9	20.10	2.687
30.0	1.2608	28	353.0	22.04	2.946
32.1	1.2841	30	385.2	24.05	3.215
37.3	1.3462	35	471.2	29.41	3.932
42.4	1.4138	40	565.5	35.30	4.719

SODIUM CARBONATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM CARBONATE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na ₂ CO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0086	1	10.09	0.6296	0.0842
2.7	1.0190	2	20.38	1.272	0.1701
5.6	1.0398	4	41.59	2.596	0.3471
8.3	1.0606	6	63.64	3.973	0.5311
10.9	1.0816	8	86.53	5.402	0.7221
13.5	1.1029	10	110.3	6.885	0.9204
16.0	1.1244	12	134.9	8.423	1.126
18.5	1.1463	14	160.5	10.02	1.339

Bé.	Sp. gr.	Per cent Na ₂ CO ₃ +10H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0086	2.70	27.23	1.700	0.2272
2.7	1.0190	5.40	55.02	3.435	0.4592
5.6	1.0398	10.80	112.3	7.010	0.9370
8.3	1.0606	16.20	171.8	10.72	1.434
10.9	1.0816	21.60	233.6	14.58	1.949
13.5	1.1029	27.00	297.7	18.59	2.485
16.0	1.1244	32.40	364.3	22.74	3.040
18.5	1.1463	37.80	433.3	27.05	3.616

SODIUM CHLORIDE

SPECIFIC GRAVITY OF AQUEOUS SODIUM CHLORIDE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NaCl	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0053	1	10.05	0.6276	0.0839
1.8	1.0125	2	20.25	1.264	0.1690
3.8	1.0268	4	41.07	2.564	0.3428
5.8	1.0413	6	62.48	3.900	0.5214
7.7	1.0559	8	84.47	5.273	0.7049
9.6	1.0707	10	107.1	6.684	0.8935
11.5	1.0857	12	130.3	8.133	1.087
13.3	1.1009	14	154.1	9.622	1.286
15.1	1.1162	16	178.6	11.15	1.490
16.9	1.1319	18	203.7	12.72	1.700
18.7	1.1478	20	229.6	14.33	1.916
20.4	1.1640	22	256.1	15.99	2.137
22.2	1.1804	24	283.3	17.69	2.364
23.9	1.1972	26	311.3	19.43	2.598

SODIUM CHROMATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM CHROMATE SOLUTIONS

AT $\frac{18^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na ₂ CrO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0074	1	10.07	0.6289	0.0841
2.3	1.0163	2	20.33	1.269	0.1696
4.8	1.0344	4	41.38	2.583	0.3453
7.3	1.0529	6	63.17	3.944	0.5272
9.7	1.0718	8	85.74	5.353	0.7156
12.1	1.0912	10	109.1	6.812	0.9106
14.5	1.1110	12	133.3	8.323	1.113
16.8	1.1312	14	158.4	9.886	1.322
19.1	1.1518	16	184.3	11.50	1.538
21.4	1.1728	18	211.1	13.18	1.762
23.6	1.1942	20	238.8	14.91	1.993
25.8	1.2160	22	267.5	16.70	2.233
27.9	1.2383	24	297.2	18.55	2.480
30.0	1.2611	26	327.9	20.47	2.736

SODIUM DICHROMATE
SPECIFIC GRAVITY OF AQUEOUS SODIUM DICHROMATE SOLUTIONS AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $\text{Na}_2\text{Cr}_2\text{O}_7$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	1	10.06	0.6280	0.0840
1.9	1.013	2	20.26	1.265	0.1691
3.8	1.027	4	41.08	2.565	0.3428
5.7	1.041	6	62.46	3.899	0.5212
7.7	1.056	8	84.48	5.274	0.7050
9.5	1.070	10	107.0	6.680	0.8929
11.2	1.084	12	130.1	8.121	1.086
12.9	1.098	14	153.7	9.596	1.283
14.6	1.112	16	177.9	11.11	1.485
16.2	1.126	18	202.7	12.65	1.691
17.8	1.140	20	228.0	14.23	1.903
19.2	1.153	22	253.7	15.84	2.117
20.6	1.166	24	279.8	17.47	2.335
22.0	1.179	26	306.5	19.14	2.558
23.5	1.193	28	334.0	20.85	2.788
24.9	1.207	30	362.1	22.60	3.022
28.4	1.244	35	435.4	27.18	3.634
31.6	1.279	40	511.6	31.94	4.269
34.5	1.312	45	590.4	36.86	4.927
37.0	1.342	50	671.0	41.89	5.600

SODIUM HYDROXIDE
SPECIFIC GRAVITY OF AQUEOUS SODIUM HYDROXIDE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NaOH	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.4	1.0095	1	10.10	0.6302	0.0842
2.9	1.0207	2	20.41	1.274	0.1704
4.5	1.0318	3	30.95	1.932	0.2583
6.0	1.0428	4	41.71	2.604	0.3481
7.4	1.0538	5	52.69	3.289	0.4397
8.8	1.0648	6	63.89	3.988	0.5332
10.2	1.0758	7	75.31	4.701	0.6284
11.6	1.0869	8	86.95	5.428	0.7256
12.9	1.0979	9	98.81	6.168	0.8246
14.2	1.1089	10	110.9	6.923	0.9254
16.8	1.1309	12	135.7	8.472	1.133
19.2	1.1530	14	161.4	10.08	1.347
21.6	1.1751	16	188.0	11.74	1.569
23.9	1.1972	18	215.5	13.45	1.798
26.1	1.2191	20	243.8	15.22	2.035
28.2	1.2411	22	273.0	17.05	2.279
30.2	1.2629	24	303.1	18.92	2.529
32.1	1.2848	26	334.0	20.85	2.788
34.0	1.3064	28	365.8	22.84	3.053
35.8	1.3279	30	398.4	24.87	3.324
37.5	1.3490	32	431.7	26.95	3.602
39.1	1.3696	34	465.7	29.07	3.886
40.7	1.3900	36	500.4	31.24	4.176
42.2	1.4101	38	535.8	33.45	4.472
43.6	1.4300	40	572.0	35.71	4.773
45.0	1.4494	42	608.7	38.00	5.080
46.3	1.4685	44	646.1	40.34	5.392
47.5	1.4873	46	684.2	42.71	5.709
48.8	1.5065	48	723.1	45.14	6.035
49.9	1.5253	50	762.7	47.61	6.364

SODIUM NITRATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM NITRATE SOLUTIONS
AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NaNO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0049	1	10.05	0.6273	0.0839
1.7	1.0117	2	20.23	1.263	0.1689
3.6	1.0254	4	41.02	2.561	0.3423
5.5	1.0392	6	62.35	3.892	0.5203
7.3	1.0532	8	84.26	5.260	0.7031
9.2	1.0674	10	106.7	6.663	0.8908
11.0	1.0819	12	129.8	8.105	1.083
12.8	1.0967	14	153.5	9.585	1.281
14.6	1.1118	16	177.9	11.11	1.485
16.4	1.1272	18	202.9	12.67	1.693
18.1	1.1429	20	228.6	14.27	1.908
19.9	1.1589	22	255.0	15.92	2.128
21.6	1.1752	24	282.0	17.61	2.354
23.3	1.1917	26	309.8	19.34	2.586
25.0	1.2085	28	338.4	21.12	2.824
26.7	1.2256	30	367.7	22.95	3.068
30.8	1.2701	35	444.5	27.75	3.710
34.9	1.3175	40	527.0	32.90	4.398
39.0	1.3683	45	615.7	38.44	5.138

SODIUM NITRITE

SPECIFIC GRAVITY OF AQUEOUS SODIUM NITRITE SOLUTIONS
AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NaNO ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0058	1	10.06	0.6279	0.0839
1.8	1.0125	2	20.25	1.264	0.1690
3.7	1.0260	4	41.04	2.562	0.3425
5.5	1.0397	6	62.38	3.894	0.5206
7.4	1.0535	8	84.28	5.261	0.7033
9.2	1.0675	10	106.8	6.664	0.8909
10.9	1.0816	12	129.8	8.103	1.083
12.7	1.0959	14	153.4	9.578	1.280
14.4	1.1103	16	177.6	11.09	1.483
16.1	1.1248	18	202.5	12.64	1.690
17.7	1.1394	20	227.9	14.23	1.902

SODIUM POTASSIUM TARTRATE
SPECIFIC GRAVITY OF AQUEOUS SODIUM POTASSIUM TARTRATE
(ROCHELLE SALT) SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent NaKC ₄ H ₄ O ₆	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0049	1	10.05	0.6273	0.0839
1.7	1.0116	2	20.23	1.263	0.1688
3.6	1.0252	4	41.01	2.560	0.3422
5.4	1.0390	6	62.34	3.892	0.5202
7.3	1.0530	8	84.24	5.259	0.7030
9.1	1.0673	10	106.7	6.663	0.8907
11.0	1.0818	12	129.8	8.104	1.083
12.8	1.0965	14	153.5	9.583	1.281
14.5	1.1114	16	177.8	11.10	1.484
16.3	1.1265	18	202.8	12.66	1.692
18.0	1.1419	20	228.4	14.26	1.906
19.7	1.1576	22	254.7	15.90	2.125
21.4	1.1735	24	281.6	17.58	2.350
23.1	1.1896	26	309.3	19.31	2.581
24.8	1.2059	28	337.7	21.08	2.818
26.4	1.2225	30	366.8	22.90	3.061
28.0	1.2394	32	396.6	24.76	3.310
29.6	1.2566	34	427.2	26.67	3.565
31.2	1.2742	36	458.7	28.64	3.828

Bé.	Sp. gr.	Per cent NaKC ₄ H ₄ O ₆ + 4H ₂ O	G. per liter	Lbs. per cu. ft.	Lb. per gal.
0.7	1.0049	1.343	13.50	0.8425	0.1127
1.7	1.0116	2.686	27.17	1.696	0.2267
3.6	1.0252	5.372	55.07	3.438	0.4596
5.4	1.0390	8.058	83.72	5.227	0.6986
7.3	1.0530	10.74	113.1	7.063	0.9441
9.1	1.0673	13.43	143.3	8.948	1.196
11.0	1.0818	16.12	174.3	10.88	1.455
12.8	1.0965	18.80	206.2	12.87	1.721
14.5	1.1114	21.49	238.8	14.91	1.993
16.3	1.1265	24.17	272.3	17.00	2.273
18.0	1.1419	26.86	306.7	19.15	2.560
19.7	1.1576	29.55	342.0	21.35	2.854
21.4	1.1735	32.23	378.2	23.61	3.157
23.1	1.1896	34.92	415.4	25.93	3.466
24.8	1.2059	37.60	453.5	28.31	3.784
26.4	1.2225	40.29	492.5	30.75	4.110
28.0	1.2394	42.98	532.6	33.25	4.445
29.6	1.2566	45.66	573.8	35.82	4.788
31.2	1.2742	48.35	616.1	38.46	5.141

SODIUM SILICATE
SPECIFIC GRAVITY OF AQUEOUS SODIUM SILICATE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na ₂ O + 3.9SiO ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	1	10.06	0.6280	0.0840
2.0	1.014	2	20.28	1.266	0.1692
4.2	1.030	4	41.20	2.572	0.3438
6.4	1.046	6	62.76	3.918	0.5237
8.6	1.063	8	85.04	5.309	0.7097
10.7	1.080	10	108.0	6.742	0.9013
12.9	1.098	12	131.8	8.225	1.100
14.6	1.116	14	156.2	9.754	1.304
17.1	1.134	16	181.4	11.33	1.514
19.2	1.153	18	207.5	12.96	1.732
21.3	1.172	20	234.4	14.63	1.956
23.3	1.191	22	262.0	16.36	2.187
25.3	1.211	24	290.6	18.14	2.425
27.3	1.232	26	320.3	20.00	2.673
29.3	1.253	28	350.8	21.90	2.928
31.3	1.275	30	382.5	23.88	3.192
33.3	1.298	32	415.4	25.93	3.466

Bé.	Sp. gr.	Per cent Na ₂ O + 3.36SiO ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	1	10.06	0.6280	0.0840
2.0	1.014	2	20.28	1.266	0.1692
4.2	1.030	4	41.20	2.572	0.3438
6.5	1.047	6	62.82	3.922	0.5243
8.9	1.065	8	85.20	5.319	0.7110
11.1	1.083	10	108.3	6.761	0.9038
13.3	1.101	12	132.1	8.248	1.103
15.5	1.120	14	156.8	9.789	1.309
17.7	1.139	16	182.2	11.38	1.521
19.9	1.159	18	208.6	13.02	1.741
22.0	1.179	20	235.8	14.72	1.968
24.2	1.200	22	264.0	16.48	2.203
26.3	1.222	24	293.3	18.31	2.447
28.4	1.244	26	323.4	20.19	2.699
30.6	1.267	28	354.8	22.15	2.961
32.6	1.290	30	387.0	24.16	3.230
34.7	1.314	32	420.5	26.25	3.509
36.7	1.339	34	455.3	28.42	3.799
38.8	1.365	36	491.4	30.68	4.101
40.9	1.393	38	529.3	33.05	4.417

SODIUM SILICATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM SILICATE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na ₂ O + 2.40SiO ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.3	1.016	2	20.32	1.269	0.1696
4.8	1.034	4	41.36	2.582	0.3452
7.2	1.052	6	63.12	3.940	0.5268
9.6	1.071	8	85.68	5.349	0.7150
12.0	1.090	10	109.0	6.805	0.9096
14.4	1.110	12	133.2	8.315	1.112
16.7	1.130	14	158.2	9.876	1.320
19.0	1.151	16	184.2	11.50	1.537

Bé.	Sp. gr.	Per cent Na ₂ O + 2.44SiO ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
32.2	1.285	28	359.8	22.46	3.003
34.2	1.309	30	392.7	24.52	3.277
36.3	1.334	32	426.9	26.65	3.562
38.4	1.360	34	462.4	28.87	3.859
40.5	1.387	36	499.3	31.17	4.167
42.5	1.415	38	537.7	33.57	4.487
44.7	1.445	40	578.0	36.08	4.824

Bé.	Sp. gr.	Per cent Na ₂ O + 2.06SiO ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.3	1.016	2	20.32	1.269	0.1696
4.9	1.035	4	41.40	2.584	0.3455
7.4	1.054	6	63.24	3.948	0.5278
9.9	1.073	8	85.84	5.359	0.7164
12.3	1.093	10	109.3	6.823	0.9121
14.7	1.113	12	133.6	8.338	1.115
17.1	1.134	14	158.8	9.911	1.325
19.6	1.156	16	185.0	11.55	1.544
21.9	1.178	18	212.0	13.24	1.770
24.2	1.200	20	240.0	14.98	2.003

SODIUM SILICATE (Continued)
 SPECIFIC GRAVITY OF AQUEOUS SODIUM SILICATE SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na ₂ O + 2.06SiO ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
26.4	1.223	22	269.1	16.80	2.245
28.7	1.247	24	299.3	18.68	2.498
30.9	1.271	26	330.5	20.63	2.758
33.1	1.296	28	362.9	22.65	3.028
35.2	1.321	30	396.3	24.74	3.307
37.3	1.346	32	430.7	26.89	3.594
39.2	1.371	34	466.1	29.10	3.890
41.2	1.397	36	502.9	31.40	4.197
43.1	1.423	38	540.7	33.76	4.513
45.0	1.450	40	580.0	36.21	4.840
49.6	1.520	45	684.0	42.70	5.708
54.0	1.594	50	797.0	49.75	6.651
58.3	1.673	55	920.2	57.44	7.679

Bé.	Sp. gr.	Per cent Na ₂ O + 1.69SiO ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.4	1.017	2	20.34	1.270	0.1697
5.0	1.036	4	41.44	2.587	0.3458
7.7	1.056	6	63.36	3.955	0.5288
10.4	1.077	8	86.16	5.379	0.7190
12.9	1.098	10	109.8	6.854	0.9163
15.4	1.119	12	134.3	8.383	1.121
17.9	1.141	14	159.7	9.972	1.333
20.3	1.163	16	186.1	11.62	1.553
22.7	1.186	18	213.5	13.33	1.782
25.2	1.210	20	242.0	15.11	2.020
27.5	1.234	22	271.5	16.95	2.266
29.8	1.259	24	302.2	18.86	2.522
32.1	1.284	26	333.8	20.84	2.786
34.3	1.310	28	366.8	22.90	3.061
36.6	1.337	30	401.1	25.04	3.347
38.8	1.365	32	436.8	27.27	3.645
41.0	1.394	34	474.0	29.59	3.955
43.2	1.424	36	512.6	32.00	4.278
45.4	1.456	38	553.3	34.54	4.617

SODIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM SULFATE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na ₂ SO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0073	1	10.07	0.6288	0.0841
2.3	1.0164	2	20.33	1.269	0.1696
4.9	1.0348	4	41.39	2.584	0.3454
7.4	1.0535	6	63.21	3.946	0.5275
9.8	1.0724	8	85.79	5.356	0.7160
12.2	1.0915	10	109.2	6.814	0.9109
14.5	1.1109	12	133.3	8.322	1.112
16.8	1.1306	14	158.3	9.881	1.321
19.0	1.1506	16	184.1	11.49	1.536
21.2	1.1709	18	210.8	13.16	1.759
23.3	1.1915	20	238.3	14.88	1.989
25.4	1.2124	22	266.7	16.65	2.226
27.5	1.2336	24	296.1	18.48	2.471

Bé.	Sp. gr.	Per cent Na ₂ SO ₄ + 10H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0073	2.268	22.85	1.426	0.1907
2.3	1.0164	4.536	46.11	2.878	0.3848
4.9	1.0348	9.073	93.88	5.861	0.7835
7.4	1.0535	13.61	143.4	8.950	1.197
9.8	1.0724	18.15	194.6	12.15	1.624
12.2	1.0915	22.68	247.6	15.46	2.066
14.5	1.1109	27.22	302.4	18.88	2.523
16.8	1.1306	31.75	359.0	22.41	2.996
19.0	1.1506	36.29	417.6	26.07	3.485
21.2	1.1709	40.83	478.1	29.84	3.989
23.3	1.1915	45.36	540.5	33.74	4.511
25.4	1.2124	49.90	605.0	37.77	5.049
27.5	1.2336	54.44	671.5	41.92	5.604

SODIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM SULFATE SOLUTIONS
AT 15° C. (GERLACH)

Bé.	Sp. gr.	Per cent Na_2SO_4 + $10\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.004	1	10.04	0.6268	0.0838
1.2	1.008	2	20.16	1.259	0.1682
1.9	1.013	3	30.39	1.897	0.2536
2.3	1.016	4	40.64	2.537	0.3392
2.8	1.020	5	51.00	3.184	0.4256
3.4	1.024	6	61.44	3.836	0.5127
4.0	1.028	7	71.96	4.492	0.6005
4.5	1.032	8	82.56	5.154	0.6890
5.0	1.036	9	93.24	5.821	0.7781
5.6	1.040	10	104.0	6.492	0.8679
6.1	1.044	11	114.8	7.169	0.9584
6.5	1.047	12	125.6	7.843	1.048
7.2	1.052	13	136.8	8.538	1.141
7.7	1.056	14	147.8	9.229	1.234
8.2	1.060	15	159.0	9.926	1.327
8.7	1.064	16	170.2	10.63	1.421
9.4	1.069	17	181.7	11.34	1.517
9.9	1.073	18	193.1	12.06	1.612
10.4	1.077	19	204.6	12.77	1.708
11.0	1.082	20	216.4	13.51	1.806
11.5	1.086	21	228.1	14.24	1.903
12.0	1.090	22	239.8	14.97	2.001
12.5	1.094	23	251.6	15.71	2.100
12.9	1.098	24	263.5	16.45	2.199
13.5	1.103	25	275.8	17.21	2.301
14.0	1.107	26	287.8	17.97	2.402
14.5	1.111	27	300.0	18.73	2.503
15.1	1.116	28	312.5	19.51	2.608
15.5	1.120	29	324.8	20.28	2.711
16.1	1.125	30	337.5	21.07	2.817

SODIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM SULFATE SOLUTIONS
AT 15° C. (GERLACH)

Bé.	Sp. gr.	Per cent Na ₂ SO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.004	0.44	4.440	0.2772	0.0371
1.2	1.008	0.88	8.916	0.5566	0.0744
1.9	1.013	1.33	13.44	0.8390	0.1122
2.3	1.016	1.77	17.97	1.122	0.1500
2.8	1.020	2.21	22.55	1.408	0.1882
3.4	1.024	2.65	27.17	1.696	0.2268
4.0	1.028	3.10	31.82	1.987	0.2656
4.5	1.032	3.54	36.51	2.279	0.3047
5.0	1.036	3.98	41.24	2.574	0.3441
5.6	1.040	4.42	45.99	2.871	0.3838
6.1	1.044	4.86	50.79	3.171	0.4238
6.5	1.047	5.31	55.56	3.469	0.4637
7.2	1.052	5.75	60.48	3.776	0.5047
7.7	1.056	6.19	65.38	4.082	0.5456
8.2	1.060	6.63	70.32	4.390	0.5868
8.7	1.064	7.08	75.29	4.700	0.6283
9.4	1.069	7.52	80.37	5.017	0.6707
9.9	1.073	7.96	85.42	5.332	0.7128
10.4	1.077	8.40	90.50	5.650	0.7552
11.0	1.082	8.85	95.70	5.974	0.7987
11.5	1.086	9.29	100.9	6.296	0.8417
12.0	1.090	9.73	106.1	6.620	0.8850
12.5	1.094	10.2	111.3	6.947	0.9287
12.9	1.098	10.6	116.5	7.275	0.9726
13.5	1.103	11.1	122.0	7.613	1.018
14.0	1.107	11.5	127.3	7.946	1.062
14.5	1.111	11.9	132.7	8.282	1.107
15.1	1.116	12.4	138.2	8.627	1.153
15.5	1.120	12.8	143.6	8.967	1.199
16.1	1.125	13.3	149.3	9.318	1.246

SODIUM SULFIDE
SPECIFIC GRAVITY OF AQUEOUS SODIUM SULFIDE SOLUTIONS
 AT $\frac{18^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na ₂ S	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.4	1.0098	1	10.10	0.6304	0.0843
3.0	1.0211	2	20.42	1.275	0.1704
6.1	1.0440	4	41.76	2.607	0.3485
9.1	1.0672	6	64.03	3.997	0.5344
12.1	1.0907	8	87.26	5.447	0.7282
14.9	1.1146	10	111.5	6.958	0.9302
17.7	1.1388	12	136.7	8.531	1.140
20.4	1.1634	14	162.9	10.17	1.359
23.0	1.1885	16	190.2	11.87	1.587
25.6	1.2140	18	218.5	13.64	1.824

SODIUM SULFITE
SPECIFIC GRAVITY OF AQUEOUS SODIUM SULFITE SOLUTIONS
 AT $\frac{19^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Na ₂ SO ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0078	1	10.08	0.6291	0.0841
2.5	1.0172	2	20.34	1.270	0.1698
5.1	1.0363	4	41.45	2.588	0.3459
7.6	1.0556	6	63.34	3.954	0.5286
10.1	1.0751	8	86.01	5.369	0.7178
12.6	1.0948	10	109.5	6.835	0.9136
14.9	1.1146	12	133.8	8.350	1.116
17.2	1.1346	14	158.8	9.916	1.326
19.4	1.1549	16	184.8	11.54	1.542
21.7	1.1755	18	211.6	13.21	1.766

SODIUM SULFITE, ACID (BISULFITE)

SPECIFIC GRAVITY OF AQUEOUS SODIUM BISULFITE AND

PROPORTION OF NaHSO_3 AT $\frac{15.6^\circ}{15.6^\circ}$ C.

Bé.	Sp. gr.	Per cent NaHSO_3	Grams per liter	Lbs. per cu. ft.	Lbs. per gal.
0	1.0000	0.00	0.00	0.0000	0.0000
1	1.0069	1.02	10.27	0.6411	0.0857
2	1.0140	2.04	20.69	1.291	0.1726
3	1.0211	3.06	31.25	1.951	0.2607
4	1.0284	4.08	41.96	2.619	0.3502
5	1.0357	5.11	52.92	3.304	0.4417
6	1.0432	6.15	64.16	4.005	0.5354
7	1.0507	7.19	75.55	4.716	0.6304
8	1.0584	8.24	87.21	5.444	0.7278
9	1.0662	9.30	99.16	6.190	0.8275
10	1.0741	10.36	111.3	6.947	0.9286
11	1.0821	11.42	123.6	7.714	1.031
12	1.0902	12.48	136.1	8.493	1.135
13	1.0985	13.56	149.0	9.299	1.243
14	1.1069	14.65	162.2	10.12	1.353
15	1.1154	15.75	175.7	10.97	1.466
16	1.1240	16.85	189.4	11.82	1.581
17	1.1328	17.96	203.5	12.70	1.698
18	1.1417	19.08	217.8	13.60	1.818
19	1.1508	20.20	232.5	14.51	1.940
20	1.1600	21.32	247.3	15.44	2.064
21	1.1694	22.44	262.4	16.38	2.190
22	1.1789	23.57	277.9	17.35	2.319
23	1.1885	24.71	293.7	18.33	2.451
24	1.1983	25.85	309.8	19.34	2.585
25	1.2083	26.99	326.1	20.36	2.722
26	1.2185	28.13	342.8	21.40	2.860
27	1.2288	29.27	359.7	22.45	3.001
28	1.2393	30.43	377.1	23.54	3.147
29	1.2500	31.57	394.6	24.63	3.293
30	1.2609	32.71	412.4	25.75	3.442
31	1.2719	33.86	430.7	26.88	3.594
32	1.2832	35.01	449.2	28.04	3.749
33	1.2946	36.25	469.3	29.30	3.916
34	1.3063	37.51	490.0	30.59	4.089
35	1.3182	38.78	511.2	31.91	4.266
36	1.3303	40.06	532.9	33.27	4.447
37	1.3426	41.30	554.5	34.61	4.627
38	1.3551	42.52	576.2	35.97	4.808
39	1.3680	43.72	598.1	37.34	4.991

SODIUM SULFITE, ACID (BISULFITE) (Continued)

SPECIFIC GRAVITY OF AQUEOUS SODIUM BISULFITE AND

PROPORTION OF SO₂ AT $\frac{15.6^{\circ}}{15.6^{\circ}}$ C.

Bé.	Sp. gr.	Per cent SO ₂	Grams per liter	Lbs. per cu. ft.	Lbs. per gal.
0	1.0000	0.00	0.000	0.0000	0.0000
1	1.0069	0.63	6.323	0.3947	0.0528
2	1.0140	1.26	12.78	0.7976	0.1066
3	1.0211	1.88	19.20	1.198	0.1602
4	1.0284	2.51	25.81	1.611	0.2154
5	1.0357	3.15	32.62	2.037	0.2723
6	1.0432	3.79	39.54	2.468	0.3299
7	1.0507	4.43	46.55	2.906	0.3884
8	1.0584	5.07	53.66	3.350	0.4478
9	1.0662	5.72	60.99	3.807	0.5089
10	1.0741	6.38	68.53	4.278	0.5719
11	1.0821	7.03	76.07	4.749	0.6348
12	1.0902	7.68	83.73	5.227	0.6987
13	1.0985	8.35	91.72	5.726	0.7655
14	1.1069	9.02	99.84	6.233	0.8332
15	1.1154	9.70	108.2	6.754	0.9029
16	1.1240	10.37	116.6	7.276	0.9727
17	1.1328	11.06	125.3	7.821	1.046
18	1.1417	11.75	134.1	8.374	1.119
19	1.1508	12.43	143.0	8.930	1.194
20	1.1600	13.12	152.2	9.501	1.270
21	1.1694	13.81	161.5	10.08	1.348
22	1.1789	14.51	171.1	10.68	1.428
23	1.1885	15.21	180.8	11.28	1.509
24	1.1983	15.91	190.6	11.90	1.591
25	1.2083	16.61	200.7	12.53	1.675
26	1.2185	17.32	211.0	13.17	1.761
27	1.2288	18.02	221.4	13.82	1.848
28	1.2393	18.73	232.1	14.49	1.937
29	1.2500	19.43	242.9	15.16	2.027
30	1.2609	20.14	253.9	15.85	2.119
31	1.2719	20.84	265.1	16.55	2.212
32	1.2832	21.55	276.5	17.26	2.308
33	1.2946	22.31	288.8	18.03	2.410
34	1.3063	23.09	301.6	18.83	2.517
35	1.3182	23.87	314.7	19.64	2.626
36	1.3303	24.66	328.1	20.48	2.738
37	1.3426	25.42	341.3	21.31	2.848
38	1.3551	26.17	354.6	22.14	2.959
39	1.3680	26.91	368.1	22.98	3.072

SODIUM TARTRATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM TARTRATE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent $\text{Na}_2\text{C}_4\text{H}_4\text{O}_6$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0052	1	10.05	0.6275	0.0839
1.8	1.0123	2	20.25	1.264	0.1690
3.8	1.0266	4	41.06	2.564	0.3427
5.7	1.0410	6	62.46	3.899	0.5212
7.6	1.0555	8	84.44	5.271	0.7047
9.5	1.0702	10	107.0	6.681	0.8931
11.4	1.0851	12	130.2	8.129	1.087
13.2	1.1002	14	154.0	9.616	1.285
15.0	1.1156	16	178.5	11.14	1.490
16.8	1.1313	18	203.6	12.71	1.699
18.6	1.1471	20	229.4	14.32	1.915
20.4	1.1633	22	255.9	15.98	2.136
22.1	1.1797	24	283.1	17.67	2.363
23.8	1.1963	26	311.0	19.42	2.596
25.5	1.2132	28	339.7	21.21	2.835

Bé.	Sp. gr.	Per cent $\text{Na}_2\text{C}_4\text{H}_4\text{O}_6$ + $2\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0052	1.186	11.92	0.7441	0.0995
1.8	1.0123	2.371	24.01	1.499	0.2003
3.8	1.0266	4.743	48.69	3.040	0.4063
5.7	1.0410	7.114	74.06	5.623	0.6180
7.6	1.0555	9.486	100.1	6.250	0.8355
9.5	1.0702	11.86	126.9	7.922	1.059
11.4	1.0851	14.23	154.4	9.638	1.288
13.2	1.1002	16.60	182.6	11.40	1.524
15.0	1.1156	18.97	211.6	13.21	1.766
16.8	1.1313	21.34	241.4	15.07	2.015
18.6	1.1471	23.71	272.0	16.98	2.270
20.4	1.1633	26.09	303.5	18.94	2.532
22.2	1.1797	28.46	335.7	20.96	2.802
23.8	1.1963	30.83	368.8	23.02	3.078
25.5	1.2132	33.20	402.8	25.14	3.361

SODIUM THIOSULFATE
SPECIFIC GRAVITY OF AQUEOUS SODIUM THIOSULFATE (HYPO)
 SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé	Sp. gr.	Per cent $\text{Na}_2\text{S}_2\text{O}_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0065	1	10.07	0.6283	0.0840
2.1	1.0148	2	20.30	1.267	0.1694
4.4	1.0315	4	41.26	2.576	0.3443
6.7	1.0483	6	62.90	3.927	0.5249
8.9	1.0654	8	85.23	5.321	0.7113
11.1	1.0827	10	108.3	6.759	0.9035
13.2	1.1003	12	132.0	8.243	1.102
15.3	1.1182	14	156.5	9.773	1.306
17.4	1.1365	16	181.8	11.35	1.517
19.5	1.1551	18	207.9	12.98	1.735
21.5	1.1740	20	234.8	14.66	1.959
23.5	1.1932	22	262.5	16.39	2.191
25.4	1.2128	24	291.1	18.17	2.429
27.4	1.2328	26	320.5	20.01	2.675
29.3	1.2532	28	350.9	21.91	2.928
31.2	1.2739	30	382.2	23.86	3.189
35.8	1.3273	35	464.6	29.00	3.877
40.1	1.3827	40	553.1	34.53	4.616

Bé.	Sp. gr.	Per cent $\text{Na}_2\text{S}_2\text{O}_3$ + $5\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0065	1.570	15.80	0.9863	0.1318
2.1	1.0148	3.139	31.86	1.989	0.2659
4.4	1.0315	6.279	64.77	4.043	0.5405
6.7	1.0483	9.418	98.73	6.164	0.8239
8.9	1.0654	12.56	133.8	8.352	1.117
11.1	1.0827	15.70	170.0	10.61	1.418
13.2	1.1003	18.84	207.3	12.94	1.730
15.3	1.1182	21.98	245.7	15.34	2.051
17.4	1.1365	25.12	285.4	17.82	2.382
19.5	1.1551	28.25	326.4	20.37	2.724
21.5	1.1740	31.39	368.6	23.01	3.076
23.5	1.1932	34.53	412.1	25.72	3.439
25.4	1.2128	37.67	456.9	28.52	3.813
27.4	1.2328	40.81	503.1	31.41	4.199
29.3	1.2532	43.95	550.8	34.38	4.597
31.2	1.2739	47.09	599.9	37.45	5.006
35.8	1.3273	54.94	729.2	45.52	6.085
40.1	1.3827	62.79	868.2	54.20	7.245

SODIUM THIOSULFATE

SPECIFIC GRAVITY OF AQUEOUS SODIUM THIOSULFATE (HYPO)
SOLUTIONS AT 19° C. (SCHIFF)

Bé.	Sp. gr.	Per cent Na ₂ S ₂ O ₃	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0052	0.637	6.404	0.3998	0.0534
1.5	1.0105	1.27	12.88	0.8038	0.1075
2.3	1.0158	1.91	19.41	1.212	0.1620
3.0	1.0211	2.55	26.02	1.624	0.2172
3.7	1.0264	3.19	32.69	2.041	0.2728
4.5	1.0317	3.82	39.44	2.462	0.3291
5.2	1.0370	4.46	46.24	2.887	0.3859
5.9	1.0423	5.10	53.12	3.316	0.4433
6.6	1.0476	5.73	60.07	3.750	0.5013
7.3	1.0529	6.37	67.08	4.187	0.5598
8.0	1.0584	7.01	74.17	4.630	0.6190
8.7	1.0639	7.65	81.33	5.077	0.6787
9.4	1.0695	8.28	88.58	5.529	0.7392
10.1	1.0751	8.92	95.89	5.986	0.8002
10.8	1.0807	9.56	103.3	6.447	0.8618
11.5	1.0863	10.2	110.7	6.912	0.9240
12.2	1.0919	10.8	118.3	7.382	0.9869
12.9	1.0975	11.5	125.9	7.857	1.050
13.6	1.1031	12.1	133.5	8.335	1.114
14.2	1.1087	12.7	141.3	8.819	1.179
14.9	1.1145	13.4	149.1	9.308	1.244
15.6	1.1204	14.0	157.0	9.803	1.310
16.3	1.1263	14.7	165.0	10.30	1.377
16.9	1.1322	15.3	173.1	10.81	1.445
17.6	1.1381	15.9	181.3	11.32	1.513
18.3	1.1440	16.6	189.5	11.83	1.581
18.9	1.1499	17.2	197.8	12.35	1.651
19.5	1.1558	17.8	206.2	12.87	1.721
20.2	1.1617	18.5	214.6	13.40	1.791
20.8	1.1676	19.1	223.2	13.93	1.862
21.5	1.1738	19.7	231.8	14.47	1.935
22.1	1.1800	20.4	240.6	15.02	2.008
22.8	1.1862	21.0	249.4	15.57	2.081
23.4	1.1924	21.7	258.3	16.12	2.155
24.0	1.1986	22.3	267.3	16.68	2.230
24.7	1.2048	22.9	276.3	17.25	2.306
25.3	1.2110	23.6	285.5	17.82	2.382
25.9	1.2172	24.2	294.7	18.40	2.459
26.5	1.2234	24.8	304.0	18.98	2.537
27.1	1.2297	25.5	313.4	19.56	2.615
27.7	1.2362	26.1	322.9	20.16	2.695
28.3	1.2427	26.8	332.5	20.76	2.775
28.9	1.2492	27.4	342.2	21.36	2.856
29.5	1.2558	28.0	352.0	21.98	2.938
30.1	1.2624	28.7	361.9	22.59	3.020
30.7	1.2690	29.3	371.9	23.22	3.103
31.3	1.2756	29.9	381.9	23.84	3.187
31.9	1.2822	30.6	392.1	24.48	3.272
32.5	1.2888	31.2	402.3	25.12	3.357
33.1	1.2954	31.9	412.6	25.76	3.443

SODIUM THIOSULFATE
SPECIFIC GRAVITY OF AQUEOUS SODIUM THIOSULFATE SOLUTIONS AT 19° C. (SCHIFF)

Bé.	Sp. gr.	Per cent $\text{Na}_2\text{S}_2\text{O}_3$ + $5\text{H}_2\text{O}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0052	1	10.05	0.6275	0.0839
1.5	1.0105	2	20.21	1.262	0.1687
2.3	1.0158	3	30.47	1.902	0.2543
3.0	1.0211	4	40.84	2.550	0.3409
3.7	1.0264	5	51.32	3.204	0.4283
4.5	1.0317	6	61.90	3.864	0.5166
5.2	1.0370	7	72.59	4.532	0.6058
5.9	1.0423	8	83.38	5.205	0.6959
6.6	1.0476	9	94.28	5.886	0.7868
7.3	1.0529	10	105.3	6.573	0.8787
8.0	1.0584	11	116.4	7.268	0.9716
8.7	1.0639	12	127.7	7.970	1.065
9.4	1.0695	13	139.0	8.680	1.160
10.1	1.0751	14	150.5	9.396	1.256
10.8	1.0807	15	162.1	10.12	1.353
11.5	1.0863	16	173.8	10.85	1.450
12.2	1.0919	17	185.6	11.59	1.549
12.9	1.0975	18	197.6	12.33	1.649
13.6	1.1031	19	209.6	13.08	1.749
14.2	1.1087	20	221.7	13.84	1.850
14.9	1.1145	21	234.0	14.61	1.953
15.6	1.1204	22	246.5	15.39	2.057
16.3	1.1263	23	259.0	16.17	2.162
16.9	1.1322	24	271.7	16.96	2.268
17.6	1.1381	25	284.5	17.76	2.374
18.3	1.1440	26	297.4	18.57	2.482
18.9	1.1499	27	310.4	19.38	2.591
19.5	1.1558	28	323.6	20.20	2.701
20.2	1.1617	29	336.9	21.03	2.811
20.8	1.1676	30	350.3	21.87	2.923
21.5	1.1738	31	363.9	22.72	3.037
22.1	1.1800	32	377.6	23.57	3.151
22.8	1.1862	33	391.4	24.44	3.267
23.4	1.1924	34	405.4	25.31	3.383
24.0	1.1986	35	419.5	26.19	3.501
24.7	1.2048	36	433.7	27.08	3.620
25.3	1.2110	37	448.1	27.97	3.739
25.9	1.2172	38	462.5	28.87	3.860
26.5	1.2234	39	477.1	29.79	3.982
27.1	1.2297	40	491.9	30.71	4.105
27.7	1.2362	41	506.8	31.64	4.230
28.3	1.2427	42	521.9	32.58	4.356
28.9	1.2492	43	537.2	33.53	4.483
29.5	1.2558	44	552.6	34.49	4.611
30.1	1.2624	45	568.1	35.46	4.741
30.7	1.2690	46	583.7	36.44	4.871
31.3	1.2756	47	599.5	37.43	5.003
31.9	1.2822	48	615.5	38.42	5.136
32.5	1.2888	49	631.5	39.42	5.270
33.1	1.2954	50	647.7	40.43	5.405

STANNIC CHLORIDE

SPECIFIC GRAVITY OF AQUEOUS STANNIC CHLORIDE SOLUTIONS

AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent SnCl ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.1	1.015	2	20.30	1.267	0.1694
4.4	1.031	4	41.24	2.574	0.3442
6.6	1.047	6	62.82	3.922	0.5243
8.7	1.064	8	85.12	5.314	0.7103
10.9	1.081	10	108.1	6.748	0.9021
13.1	1.099	12	131.9	8.233	1.101
15.2	1.117	14	156.4	9.762	1.305
17.2	1.135	16	181.6	11.34	1.515
19.4	1.154	18	207.7	12.97	1.733
21.4	1.173	20	234.6	14.65	1.958
23.4	1.192	22	262.2	16.37	2.188
25.4	1.212	24	290.9	18.16	2.427
27.4	1.233	26	320.6	20.01	2.675
29.5	1.255	28	351.4	21.94	2.933
31.5	1.278	30	383.4	23.93	3.200
36.6	1.337	35	468.0	29.21	3.905
41.7	1.403	40	561.2	35.03	4.682
46.7	1.475	45	663.8	41.44	5.539
51.8	1.555	50	777.5	48.54	6.488
56.8	1.644	55	904.2	56.45	7.546
61.8	1.742	60	1045	65.25	8.722
66.7	1.851	65	1203	75.11	10.04
71.4	1.971	70	1380	86.13	11.51

Bé.	Sp. gr.	Per cent SnCl ₄ + 5H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1.35	13.55	0.8460	0.1131
2.1	1.015	2.69	27.32	1.705	0.2280
4.4	1.031	5.38	55.50	3.465	0.4632
6.6	1.047	8.07	84.54	5.278	0.7055
8.7	1.064	10.8	114.5	7.151	0.9560
10.9	1.081	13.5	145.5	9.082	1.214
13.1	1.099	16.1	177.5	11.08	1.481
15.2	1.117	18.8	210.4	13.14	1.756
17.2	1.135	21.5	244.4	15.26	2.039
19.4	1.154	24.2	279.5	17.45	2.333
21.4	1.173	26.9	315.8	19.71	2.635
23.4	1.192	29.6	352.9	22.03	2.945
25.4	1.212	32.3	391.5	24.44	3.267
27.4	1.233	35.0	431.4	26.93	3.600
29.5	1.255	37.7	472.9	29.52	3.946
31.5	1.278	40.4	516.0	32.21	4.306
36.6	1.337	47.1	629.7	39.31	5.255
41.7	1.403	53.8	755.2	47.15	6.303
46.7	1.475	60.6	893.2	55.78	7.454
51.8	1.555	67.3	1046	65.32	8.732
56.8	1.644	74.0	1217	75.96	10.15
61.8	1.742	80.7	1407	87.81	11.74
66.7	1.851	87.5	1619	101.1	13.51
71.4	1.971	94.2	1857	115.9	15.49

STANNOUS CHLORIDE
SPECIFIC GRAVITY OF AQUEOUS STANNOUS CHLORIDE SOLUTIONS AT $\frac{15^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent SnCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.0068	1	10.07	0.6285	0.0840
2.1	1.0146	2	20.29	1.267	0.1693
4.3	1.0306	4	41.22	2.573	0.3440
6.5	1.0470	6	62.82	3.922	0.5243
8.7	1.0638	8	85.10	5.313	0.7102
10.9	1.0810	10	108.1	6.748	0.9021
13.0	1.0986	12	131.8	8.230	1.100
15.2	1.1167	14	156.3	9.760	1.305
17.3	1.1353	16	181.6	11.34	1.516
19.4	1.1545	18	207.8	12.97	1.734
21.5	1.1743	20	234.9	14.66	1.960
23.6	1.1948	22	262.9	16.41	2.194
25.8	1.2159	24	291.8	18.22	2.435
27.8	1.2377	26	321.8	20.09	2.686
29.9	1.2603	28	352.9	22.03	2.945
32.0	1.2837	30	385.1	24.04	3.214
37.3	1.3461	35	471.1	29.41	3.932
42.5	1.4145	40	565.8	35.32	4.722
47.7	1.4897	45	670.4	41.85	5.594
52.8	1.5729	50	786.5	49.10	6.563
57.9	1.6656	55	916.1	57.19	7.645
63.1	1.7695	60	1062	66.28	8.860
68.1	1.8865	65	1226	76.55	10.23

Bé.	Sp. gr.	Per cent SnCl ₂ + 2H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.0068	1.19	11.98	0.7480	0.1000
2.1	1.0146	2.38	24.15	1.508	0.2015
4.3	1.0306	4.76	49.06	3.063	0.4094
6.5	1.0470	7.14	74.76	4.667	0.6239
8.7	1.0638	9.52	101.3	6.322	0.8452
10.9	1.0810	11.9	128.6	8.031	1.074
13.0	1.0986	14.3	156.9	9.794	1.309
15.2	1.1167	16.7	186.0	11.61	1.553
17.3	1.1353	19.0	216.2	13.49	1.804
19.4	1.1545	21.4	247.3	15.44	2.064
21.5	1.1743	23.8	279.5	17.45	2.332
23.6	1.1948	26.2	312.8	19.53	2.610
25.8	1.2159	28.6	347.3	21.68	2.898
27.8	1.2377	30.9	383.0	23.91	3.196
29.9	1.2603	33.3	419.9	26.22	3.505
32.0	1.2837	35.7	458.3	28.61	3.825
37.3	1.3461	41.7	560.7	35.00	4.679
42.5	1.4145	47.6	673.3	42.03	5.619
47.7	1.4897	53.6	797.8	49.80	6.657
52.8	1.5729	59.5	935.9	58.43	7.810
57.9	1.6656	65.5	1090	68.06	9.098
63.1	1.7695	71.4	1263	78.87	10.54
68.1	1.8865	77.4	1459	91.10	12.18

SUCROSE (CANE SUGAR)

SPECIFIC GRAVITY OF AQUEOUS SUGAR SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}} \text{ C.}$

Bé.	Sp. gr.	Per cent $\text{C}_{12}\text{H}_{22}\text{O}_{11}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
...	0.9982	0	...	...	...
0.3	1.0021	1	10.02	0.6256	0.0836
0.9	1.0060	2	20.12	1.256	0.1679
1.4	1.0099	3	30.30	1.891	0.2528
2.0	1.0139	4	40.56	2.532	0.3384
2.5	1.0179	5	50.89	3.177	0.4247
3.1	1.0219	6	61.31	3.827	0.5117
3.6	1.0259	7	71.81	4.483	0.5993
4.1	1.0299	8	82.40	5.144	0.6876
4.7	1.0340	9	93.06	5.810	0.7766
5.3	1.0381	10	103.8	6.481	0.8664
5.8	1.0423	11	114.7	7.157	0.9568
6.4	1.0465	12	125.6	7.839	1.048
7.0	1.0507	13	136.6	8.527	1.140
7.5	1.0549	14	147.7	9.220	1.232
8.1	1.0592	15	158.9	9.918	1.326
8.7	1.0635	16	170.2	10.62	1.420
9.2	1.0678	17	181.5	11.33	1.515
9.8	1.0721	18	193.0	12.05	1.611
10.3	1.0765	19	204.5	12.77	1.707
10.8	1.0810	20	216.2	13.50	1.804
11.4	1.0854	21	227.9	14.23	1.902
12.0	1.0899	22	239.8	14.97	2.001
12.5	1.0944	23	251.7	15.71	2.101
13.1	1.0990	24	263.8	16.47	2.201
13.6	1.1036	25	275.9	17.22	2.302
14.2	1.1082	26	288.1	17.99	2.404
14.7	1.1128	27	300.5	18.76	2.507
15.3	1.1175	28	312.9	19.53	2.611
15.8	1.1222	29	325.4	20.32	2.716
16.3	1.1270	30	338.1	21.11	2.821
16.9	1.1318	31	350.8	21.90	2.928
17.5	1.1366	32	363.7	22.71	3.035
18.0	1.1415	33	376.7	23.51	3.143
18.6	1.1463	34	389.8	24.33	3.253
19.1	1.1513	35	402.9	25.15	3.363
19.6	1.1562	36	416.2	25.98	3.474
20.1	1.1612	37	429.7	26.82	3.586
20.7	1.1663	38	443.2	27.67	3.698
21.2	1.1713	39	456.8	28.52	3.812
21.7	1.1764	40	470.6	29.38	3.927
22.3	1.1816	41	484.5	30.24	4.043
22.8	1.1868	42	498.4	31.12	4.160
23.3	1.1920	43	512.6	32.00	4.277
23.9	1.1972	44	526.8	32.89	4.396
24.4	1.2025	45	541.1	33.78	4.516
25.0	1.2079	46	555.6	34.69	4.637
25.5	1.2132	47	570.2	35.60	4.759
26.0	1.2186	48	584.9	36.52	4.882
26.5	1.2241	49	599.8	37.44	5.005
27.1	1.2296	50	614.8	38.38	5.131
27.6	1.2351	51	629.9	39.32	5.257
28.1	1.2406	52	645.1	40.27	5.384
28.7	1.2462	53	660.5	41.23	5.512
29.2	1.2519	54	676.0	42.20	5.641
29.7	1.2575	55	691.6	43.18	5.772
30.3	1.2632	56	707.4	44.16	5.904

SUCROSE (CANE SUGAR) (Continued)

SPECIFIC GRAVITY OF AQUEOUS SUGAR SOLUTIONS AT $\frac{20^{\circ}}{4^{\circ}}$ C.

Bé.	Sp. gr.	Per cent $C_{12}H_{22}O_{11}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
30.8	1.2690	57	723.3	45.15	6.036
31.3	1.2748	58	739.4	46.16	6.170
31.8	1.2806	59	755.6	47.17	6.305
32.3	1.2865	60	771.9	48.19	6.441
32.8	1.2924	61	788.3	49.21	6.579
33.4	1.2983	62	804.9	50.25	6.717
33.9	1.3043	63	821.7	51.30	6.857
34.4	1.3103	64	838.6	52.35	6.998
34.8	1.3163	65	855.6	53.41	7.140
35.4	1.3224	66	872.8	54.49	7.284
35.9	1.3286	67	890.1	55.57	7.428
36.4	1.3347	68	907.6	56.66	7.574
36.9	1.3409	69	925.2	57.76	7.721
37.4	1.3472	70	943.0	58.87	7.870
37.9	1.3535	71	961.0	59.99	8.019
38.4	1.3598	72	979.0	61.12	8.170
38.9	1.3661	73	997.3	62.26	8.323
39.4	1.3725	74	1016.	63.41	8.476
39.9	1.3790	75	1034.	64.56	8.631
40.4	1.3854	76	1053.	65.73	8.787
40.9	1.3920	77	1072.	66.91	8.944
41.4	1.3985	78	1091.	68.10	9.103
41.8	1.4051	79	1110.	69.29	9.263
42.2	1.4117	80	1129.	70.50	9.425
42.7	1.4184	81	1149.	71.72	9.588
43.2	1.4251	82	1169.	72.95	9.752
43.7	1.4318	83	1188.	74.19	9.917
44.2	1.4386	84	1208.	75.44	10.08
44.7	1.4454	85	1229.	76.70	10.25
45.2	1.4522	86	1249.	77.97	10.42
45.6	1.4591	87	1269.	79.25	10.59
46.1	1.4660	88	1290.	80.54	10.77
46.6	1.4730	89	1311.	81.85	10.94

SULFURIC ACID
SPECIFIC GRAVITY OF AQUEOUS SULFURIC ACID SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent H ₂ SO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0051	1	10.05	0.6275	0.0839
1.7	1.0118	2	20.24	1.263	0.1689
2.6	1.0184	3	30.55	1.907	0.2550
3.5	1.0250	4	41.00	2.560	0.3422
4.5	1.0317	5	51.59	3.220	0.4305
5.4	1.0385	6	62.31	3.890	0.5200
6.3	1.0453	7	73.17	4.568	0.6106
7.2	1.0522	8	84.18	5.255	0.7025
8.1	1.0591	9	95.32	5.950	0.7955
9.0	1.0661	10	106.6	6.655	0.8897
9.9	1.0731	11	118.0	7.369	0.9851
10.8	1.0802	12	129.6	8.092	1.082
11.7	1.0874	13	141.4	8.825	1.180
12.5	1.0947	14	153.3	9.567	1.279
13.4	1.1020	15	165.3	10.32	1.379
14.3	1.1094	16	177.5	11.08	1.481
15.2	1.1168	17	189.9	11.85	1.584
16.0	1.1243	18	202.4	12.63	1.689
16.9	1.1318	19	215.0	13.42	1.795
17.7	1.1394	20	227.9	14.23	1.902
18.6	1.1471	21	240.9	15.04	2.010
19.4	1.1548	22	254.1	15.86	2.120
20.3	1.1626	23	267.4	16.69	2.231
21.1	1.1704	24	280.9	17.54	2.344
21.9	1.1783	25	294.6	18.39	2.458
22.8	1.1862	26	308.4	19.25	2.574
23.6	1.1942	27	322.4	20.13	2.691
24.4	1.2023	28	336.6	21.02	2.809
25.2	1.2104	29	351.0	21.91	2.929
26.0	1.2185	30	365.6	22.82	3.051
26.8	1.2267	31	380.3	23.74	3.173
27.6	1.2349	32	395.2	24.67	3.298
28.4	1.2432	33	410.3	25.61	3.424
29.1	1.2515	34	425.5	26.56	3.551
29.9	1.2599	35	441.0	27.53	3.680
30.7	1.2684	36	456.6	28.51	3.811
31.4	1.2769	37	472.5	29.49	3.943
32.2	1.2855	38	488.5	30.49	4.077
33.0	1.2941	39	504.7	31.51	4.212
33.7	1.3028	40	521.1	32.53	4.349
34.5	1.3116	41	537.8	33.57	4.488
35.2	1.3205	42	554.6	34.62	4.628
35.9	1.3294	43	571.6	35.69	4.770
36.7	1.3384	44	588.9	36.76	4.914
37.4	1.3476	45	606.4	37.86	5.061
38.1	1.3569	46	624.2	38.97	5.209
38.9	1.3663	47	642.2	40.09	5.359
39.6	1.3758	48	660.4	41.23	5.511
40.3	1.3854	49	678.8	42.38	5.665
41.1	1.3951	50	697.6	43.55	5.821
41.8	1.4049	51	716.5	44.73	5.979
42.5	1.4148	52	735.7	45.93	6.140
43.2	1.4248	53	755.1	47.14	6.302
44.0	1.4350	54	774.9	48.37	6.467

SULFURIC ACID (Continued)
SPECIFIC GRAVITY OF AQUEOUS SULFURIC ACID SOLUTIONS
 AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent H ₂ SO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
44.7	1.4453	55	794.9	49.62	6.634
45.4	1.4557	56	815.2	50.89	6.803
46.1	1.4662	57	835.7	52.17	6.974
46.8	1.4768	58	856.5	53.47	7.148
47.5	1.4875	59	877.6	54.79	7.324
48.2	1.4983	60	899.0	56.12	7.502
48.9	1.5091	61	920.6	57.47	7.682
49.6	1.5200	62	942.4	58.83	7.865
50.3	1.5310	63	964.5	60.21	8.049
51.0	1.5421	64	986.9	61.61	8.236
51.7	1.5533	65	1010	63.03	8.426
52.3	1.5646	66	1033	64.46	8.618
53.0	1.5760	67	1056	65.92	8.812
53.7	1.5874	68	1079	67.39	9.008
54.3	1.5989	69	1103	68.87	9.207
55.0	1.6105	70	1127	70.38	9.408
55.6	1.6221	71	1152	71.90	9.611
56.3	1.6338	72	1176	73.44	9.817
56.9	1.6456	73	1201	74.99	10.02
57.5	1.6574	74	1226	76.57	10.24
58.1	1.6692	75	1252	78.15	10.45
58.7	1.6810	76	1278	79.75	10.66
59.3	1.6927	77	1303	81.37	10.88
59.9	1.7043	78	1329	82.99	11.09
60.5	1.7158	79	1355	84.62	11.31
61.1	1.7272	80	1382	86.26	11.53
61.6	1.7383	81	1408	87.90	11.75
62.1	1.7491	82	1434	89.54	11.97
62.6	1.7594	83	1460	91.16	12.19
63.0	1.7693	84	1486	92.78	12.40
63.5	1.7786	85	1512	94.38	12.62
64.2	1.7872	86	1537	95.95	12.83
64.2	1.7951	87	1562	97.49	13.03
64.5	1.8022	88	1586	99.01	13.23
64.8	1.8087	89	1610	100.5	13.43
65.1	1.8144	90	1633	101.9	13.63
65.3	1.8195	91	1656	103.4	13.82
65.5	1.8240	92	1678	104.8	14.00
65.7	1.8279	93	1700	106.1	14.19
65.8	1.8312	94	1721	107.5	14.36
65.9	1.8337	95	1742	108.7	14.54
66.0	1.8355	96	1762	110.0	14.70
66.0	1.8364	97	1781	111.2	14.87
66.0	1.8361	98	1799	112.3	15.02
65.9	1.8342	99	1816	113.4	15.15
65.8	1.8305	100	1831	114.3	15.28

TABLES OF THE MANUFACTURING CHEMISTS' ASSOCIATION

SULFURIC ACID

Authorities—W. C. FERGUSON; H. P. TALBOT

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States. Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should always be printed on the scale.

$$66^\circ \text{ Baumé} = \text{Sp. Gr. } 1.8354.$$

1 cu. ft. water at 60° F. weighs 62.37 lbs. av.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

H₂SO₄ = 100 per cent.

	H ₂ SO ₄	O. V.	60°
O. V.	93.19	100.00	119.98
60°	77.67	83.35	100.00
50°	62.18	66.72	80.06

Acids stronger than 66° Bé. should have their percentage compositions determined by chemical analysis.

Bé.°	Sp. gr.	Tw.°	Per cent H ₂ SO ₄	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu. ft.	* Freezing (melting) point.
0	1.0000	0.0	0.00	62.37	0.00	0.00	32.0° F.
1	1.0069	1.4	1.02	62.80	1.09	.68	31.2 "
2	1.0140	2.8	2.08	63.24	2.23	1.41	30.5 "
3	1.0211	4.2	3.13	63.69	3.36	2.14	29.8 "
4	1.0284	5.7	4.21	64.14	4.52	2.90	28.9 "
5	1.0357	7.1	5.28	64.60	5.67	3.66	28.1 "
6	1.0432	8.6	6.37	65.06	6.84	4.45	27.2 "
7	1.0507	10.1	7.45	65.53	7.99	5.24	26.3 "
8	1.0584	11.7	8.55	66.01	9.17	6.06	25.1 "
9	1.0662	13.2	9.66	66.50	10.37	6.89	24.0 "
10	1.0741	14.8	10.77	66.99	11.56	7.74	22.8 "
11	1.0821	16.4	11.89	67.49	12.76	8.61	21.5 "
12	1.0902	18.0	13.01	68.00	13.96	9.49	20.0 "
13	1.0985	19.7	14.13	68.51	15.16	10.39	18.3 "
14	1.1069	21.4	15.25	69.04	16.36	11.30	16.6 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

SULFURIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent H ₂ SO ₄	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu.ft.	* Freezing (melting) point.
15	1.1154	23.1	16.38	69.57	17.58	12.23	14.7 F.
16	1.1240	24.8	17.53	70.10	18.81	13.19	12.6 "
17	1.1328	26.6	18.71	70.65	20.08	14.18	10.2 "
18	1.1417	28.3	19.89	71.21	21.34	15.20	7.7 "
19	1.1508	30.2	21.07	71.78	22.61	16.23	4.8 "
20	1.1600	32.0	22.25	72.35	23.87	17.27	+ 1.6 "
21	1.1694	33.9	23.43	72.94	25.14	18.34	- 1.8 "
22	1.1789	35.8	24.61	73.53	26.41	19.42	- 6.0 "
23	1.1885	37.7	25.81	74.13	27.69	20.53	-11 "
24	1.1983	39.7	27.03	74.74	29.00	21.68	-16 "
25	1.2083	41.7	28.28	75.36	30.34	22.87	-23 "
26	1.2185	43.7	29.53	76.00	31.69	24.08	-30 "
27	1.2288	45.8	30.79	76.64	33.04	25.32	-39 "
28	1.2393	47.9	32.05	77.30	34.39	26.58	-49 "
29	1.2500	50.0	33.33	77.96	35.76	27.88	-61 "
30	1.2609	52.2	34.63	78.64	37.16	29.22	-74 "
31	1.2719	54.4	35.93	79.33	38.55	30.58	-82 "
32	1.2832	56.6	37.26	80.03	39.98	32.00	-96 "
33	1.2946	58.9	38.58	80.74	41.40	33.42	-97 "
34	1.3063	61.3	39.92	81.47	42.83	34.90	-91 "
35	1.3182	63.6	41.27	82.22	44.28	36.41	-81 "
36	1.3303	66.1	42.63	82.97	45.74	37.95	-70 "
37	1.3426	68.5	43.99	83.74	47.20	39.53	-60 "
38	1.3551	71.0	45.35	84.52	48.66	41.13	-53 "
39	1.3679	73.6	46.72	85.32	50.13	42.77	-47 "
40	1.3810	76.2	48.10	86.13	51.61	44.45	-41 "
41	1.3942	78.8	49.47	86.96	53.08	46.16	-35 "
42	1.4078	81.6	50.87	87.80	54.58	47.92	-31 "
43	1.4216	84.3	52.26	88.67	56.07	49.72	-27 "
44	1.4356	87.1	53.66	89.54	57.58	51.56	-23 "
45	1.4500	90.0	55.07	90.44	59.09	53.44	-20 "
46	1.4646	92.9	56.48	91.35	60.60	55.36	-14 "
47	1.4796	95.9	57.90	92.28	62.13	57.33	-15 "
48	1.4948	99.0	59.32	93.23	63.65	59.34	-18 "
49	1.5104	102.1	60.75	94.20	65.18	61.40	-22 "

* Calculated from Pickering's results. Journal of London Chemical Society, vol. 57, p. 383.

SULFURIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent H ₂ SO ₄	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu.ft.	*Freezing (melting) point.
50	1.5263	105.3	62.18	95.20	66.72	63.52	-27 F.
51	1.5426	108.5	63.66	96.21	68.31	65.72	-33 "
52	1.5591	111.8	65.13	97.24	69.89	67.96	-39 "
53	1.5761	115.2	66.63	98.30	71.50	70.28	-49 "
54	1.5934	118.7	68.13	99.38	73.11	72.66	-59 "
55	1.6111	122.2	69.65	100.48	74.74	75.10	} Below -40
56	1.6292	125.8	71.17	101.61	76.37	77.60	
57	1.6477	129.5	72.75	102.77	78.07	80.23	
58	1.6667	133.3	74.36	103.95	79.79	82.95	
59	1.6860	137.2	75.99	105.16	81.54	85.75	
60	1.7059	141.2	77.67	106.40	83.35	88.68	+12.6 F.
61	1.7262	145.2	79.43	107.66	85.23	91.76	27.3 "
62	1.7470	149.4	81.30	108.96	87.24	95.06	39.1 "
63	1.7683	153.7	83.34	110.29	89.43	98.63	46.1 "
64	1.7901	158.0	85.66	111.65	91.92	102.63	46.4 "
64 $\frac{1}{4}$	1.7957	159.1	86.33	112.00	92.64	103.75	43.6 "
64 $\frac{1}{2}$	1.8012	160.2	87.04	112.34	93.40	104.93	41.1 "
64 $\frac{3}{4}$	1.8068	161.4	87.81	112.69	94.23	106.19	37.9 "
65	1.8125	162.5	88.65	113.05	95.13	107.54	33.1 "
65 $\frac{1}{4}$	1.8182	163.6	89.55	113.40	96.10	108.97	24.6 "
65 $\frac{1}{2}$	1.8239	164.8	90.60	113.76	97.22	110.60	13.4 "
65 $\frac{3}{4}$	1.8297	165.9	91.80	114.12	98.51	112.42	-1 "
66	1.8354	167.1	93.19	114.47	100.0	114.47	-29 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

APPROXIMATE BOIL- ING POINTS			Per cent 60°	Pounds 60° in 1 cu. ft.	Per cent 50°	Pounds 50° in 1 cu. ft.
50°	Bé.	295 F.	61.93	53.34	77.36	66.63
60°	"	386 "	63.69	55.39	79.56	69.19
61°	"	400 "	65.50	57.50	81.81	71.83
62°	"	415 "	67.28	59.66	84.05	74.53
63°	"	432 "	69.09	61.86	86.30	77.27
64°	"	451 "	70.90	64.12	88.56	80.10
65°	"	485 "	72.72	66.43	90.83	82.98
66°	"	538 "	74.55	68.79	93.12	85.93
			76.37	71.20	95.40	88.94
			78.22	73.68	97.70	92.03

SULFURIC ACID (Continued)

FIXED POINTS

Sp. gr.	Per cent H ₂ SO ₄	Sp. gr.	Per cent H ₂ SO ₄	Per cent 60°	Pounds 60° in 1 cu. ft.	Per cent 50°	Pounds 50° in 1 cu. ft.
1.0000	.00	1.5281	62.34	80.06	76.21	100.00	95.20
1.0048	.71	1.5440	63.79	81.96	78.85	102.38	98.50
1.0347	5.14	1.5748	66.51				
1.0649	9.48	1.6272	71.00	83.86	81.54	104.74	101.85
1.0992	14.22	1.6679	74.46	85.79	84.33	107.15	105.33
1.1353	19.04	1.7044	77.54	87.72	87.17	109.57	108.89
1.1736	23.94	1.7258	79.40				
1.2105	28.55	1.7472	81.32	89.67	90.10	112.01	112.55
1.2513	33.49	1.7700	83.47	91.63	93.11	114.46	116.30
1.2951	38.64	1.7959	86.36	93.67	96.26	117.00	120.24
1.3441	44.15	1.8117	88.53	95.74	99.52	119.59	124.31
1.3947	49.52	1.8194	89.75	97.84	102.89	122.21	128.52
1.4307	53.17	1.8275	91.32				
1.4667	56.68	1.8354	93.19	100.00	106.40	124.91	132.91
1.4822	58.14			102.27	110.10	127.74	137.52
				104.67	114.05	130.75	142.47
				107.30	118.34	134.03	147.82
				110.29	123.14	137.76	153.81
ALLOWANCE FOR TEMPERATURE							
At 10° Bé. .029° Bé. or .00023 Sp. Gr.				111.15	124.49	138.84	155.50
= 1° F.				112.06	125.89	139.98	157.25
At 20° Bé. .036° Bé. or .00034 Sp. Gr.				113.05	127.40	141.22	159.14
= 1° F.							
At 30° Bé. .035° Bé. or .00039 Sp. Gr.				114.14	129.03	142.57	161.17
= 1° F.				115.30	130.75	144.02	163.32
At 40° Bé. .031° Bé. or .00041 Sp. Gr.							
= 1° F.							
At 50° Bé. .028° Bé. or .00045 Sp. Gr.				116.65	132.70	145.71	165.76
= 1° F.				118.19	134.88	147.63	168.48
At 60° Bé. .026° Bé. or .00053 Sp. Gr.				119.98	137.34	149.87	171.56
= 1° F.							
At 63° Bé. .026° Bé. or .00057 Sp. Gr.							
= 1° F.							
At 66° Bé. .0235° Bé. or .00054 Sp. Gr.							
= 1° F.							

SULFURIC ACID, SO₃
SPECIFIC GRAVITY OF AQUEOUS SULFURIC ACID SOLUTIONS AT
 $\frac{20^{\circ}}{4^{\circ}}$ C. GIVING SO₃ CONTENT

Bé.	Sp. gr.	Per cent SO ₃	G. per liter SO ₃	Lbs. per cu. ft. SO ₃	Lbs. per gal. SO ₃
0.7	1.0051	.8163	8.204	.5122	0.0685
1.7	1.0118	1.633	16.52	1.030	.1379
2.6	1.0184	2.449	24.94	1.557	.2082
3.5	1.0250	3.265	33.47	2.090	.2793
4.5	1.0317	4.082	42.11	2.628	.3514
5.4	1.0385	4.898	50.86	3.175	.4245
6.3	1.0453	5.714	59.73	3.729	.4984
7.2	1.0522	6.531	68.72	4.290	.5735
8.1	1.0591	7.347	77.81	4.857	.6494
9.0	1.0661	8.163	87.02	5.433	.7263
9.9	1.0731	8.979	96.32	6.015	.8042
10.8	1.0802	9.796	105.8	6.606	.8833
11.7	1.0874	10.612	115.4	7.204	.9633
12.5	1.0947	11.43	125.1	7.810	1.044
13.4	1.1020	12.24	134.9	8.424	1.126
14.3	1.1094	13.06	144.9	9.045	1.209
15.2	1.1168	13.88	155.0	9.673	1.293
16.0	1.1243	14.69	165.2	10.31	1.379
16.9	1.1318	15.51	175.5	10.95	1.465
17.7	1.1394	16.33	186.0	11.62	1.553
18.6	1.1471	17.14	196.6	12.28	1.641
19.4	1.1548	17.96	207.4	12.95	1.731
20.3	1.1626	18.78	218.3	13.62	1.821
21.1	1.1704	19.59	229.3	14.32	1.913
21.9	1.1783	20.41	240.5	15.01	2.007
22.8	1.1862	21.22	251.8	15.71	2.101
23.6	1.1942	22.04	263.2	16.43	2.197
24.4	1.2023	22.86	274.8	17.16	2.293
25.2	1.2104	23.67	286.5	17.89	2.391
26.0	1.2185	24.49	298.4	18.63	2.491
26.8	1.2267	25.31	310.4	19.38	2.590
27.6	1.2349	26.12	322.6	20.14	2.692
28.4	1.2432	26.94	334.9	20.91	2.795
29.1	1.2515	27.75	347.3	21.68	2.899
29.9	1.2599	28.57	360.0	22.47	3.003
30.7	1.2684	29.39	372.7	23.27	3.111
31.4	1.2769	30.20	385.7	24.07	3.219
32.2	1.2855	31.02	398.8	24.89	3.328
33.0	1.2941	31.84	412.0	25.72	3.438
33.7	1.3028	32.65	425.4	26.45	3.550
34.5	1.3116	33.47	439.0	27.40	3.664
35.2	1.3205	34.29	452.7	28.26	3.778
35.9	1.3294	35.10	466.6	29.13	3.894
36.7	1.3384	35.92	480.7	30.01	4.011
37.4	1.3476	36.73	495.0	30.91	4.131
38.1	1.3569	37.55	509.5	31.81	4.252
38.9	1.3663	38.37	524.2	32.73	4.375
39.6	1.3758	39.18	539.1	33.66	4.499
40.3	1.3854	40.00	554.1	34.50	4.624
41.1	1.3951	40.82	569.5	35.55	4.752
41.8	1.4049	41.63	584.9	36.51	4.881
42.5	1.4148	42.45	600.6	37.49	5.012
43.2	1.4248	43.26	616.4	38.48	5.144
44.0	1.4350	44.08	632.6	39.49	5.279
44.7	1.4453	44.90	648.9	40.51	5.415
45.4	1.4557	45.71	665.5	41.54	5.553

SULFURIC ACID SO₃ (Continued)
SPECIFIC GRAVITY OF AQUEOUS SULFURIC ACID SOLUTIONS AT
 $\frac{20^{\circ}}{4^{\circ}}$ C. GIVING SO₃ CONTENT

Bé.	Sp. gr.	Per cent SO ₃	G. per liter SO ₃	Lbs. per cu. ft. SO ₃	Lbs. per gal. SO ₃
46.1	1.4662	46.53	682.2	42.59	5.693
46.8	1.4768	47.35	699.2	43.65	5.835
47.5	1.4875	48.16	716.4	44.73	5.979
48.2	1.4983	48.98	733.9	45.81	6.124
48.9	1.5091	49.80	751.5	46.91	6.271
49.6	1.5200	50.61	769.3	48.02	6.420
50.3	1.5310	51.43	787.3	49.15	6.571
51.0	1.5421	52.24	805.6	50.29	6.723
51.7	1.5533	53.06	824.5	51.45	6.878
52.3	1.5646	53.88	843.3	52.62	7.035
53.0	1.5760	54.69	862.0	53.81	7.193
53.7	1.5874	55.51	880.8	55.01	7.353
54.3	1.5989	56.33	900.4	56.22	7.516
55.0	1.6105	57.14	920.0	57.45	7.680
55.6	1.6221	57.96	940.4	58.69	7.846
56.3	1.6338	58.77	960.0	59.95	8.014
56.9	1.6456	59.59	980.4	61.22	8.180
57.5	1.6574	60.41	1001	62.51	8.359
58.1	1.6692	61.22	1022	63.80	8.530
58.7	1.6810	62.04	1043	65.10	8.702
59.3	1.6927	62.86	1064	66.42	8.882
59.9	1.7043	63.67	1085	67.75	9.053
60.5	1.7158	64.49	1106	69.08	9.233
61.1	1.7272	65.31	1128	70.42	9.412
61.6	1.7383	66.12	1149	71.75	9.592
62.1	1.7491	66.94	1171	73.09	9.771
62.6	1.7594	67.75	1192	74.42	9.951
63.0	1.7693	68.57	1213	75.74	10.12
63.5	1.7786	69.39	1234	77.04	10.30
63.9	1.7872	70.20	1255	78.33	10.47
64.2	1.7951	71.02	1275	79.58	10.64
64.5	1.8022	71.84	1295	80.82	10.80
64.8	1.8087	72.65	1314	82.04	10.96
65.1	1.8144	73.47	1333	83.18	11.13
65.3	1.8195	74.28	1352	84.41	11.28
65.5	1.8240	75.10	1370	85.55	11.43
65.7	1.8279	75.92	1388	86.61	11.58
65.8	1.8312	76.73	1405	87.75	11.72
65.9	1.8337	77.55	1422	88.73	11.87
66.0	1.8355	78.37	1438	89.79	12.00
66.0	1.8364	79.18	1454	90.77	12.14
66.0	1.8361	80.00	1468	91.67	12.26
65.9	1.8342	80.82	1482	92.57	12.37
65.8	1.8305	81.63	1495	93.31	12.47

TANNIC ACID
SPECIFIC GRAVITY OF AQUEOUS TANNIC ACID SOLUTIONS AT
15° C. (TRAMMER)

Bé.	Sp. gr.	Per cent $C_{14}H_{10}O_9$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0040	1.0	10.04	0.6268	0.0838
0.6	1.0044	1.0	11.05	0.6897	0.0922
0.7	1.0048	1.2	12.06	0.7527	0.1006
0.8	1.0052	1.3	13.07	0.8158	0.1091
0.8	1.0056	1.4	14.08	0.8789	0.1175
0.9	1.0060	1.5	15.09	0.9420	0.1259
0.9	1.0064	1.6	16.10	1.005	0.1344
1.0	1.0068	1.7	17.12	1.068	0.1428
1.0	1.0072	1.8	18.13	1.132	0.1513
1.1	1.0076	1.9	19.14	1.195	0.1598
1.2	1.0080	2.0	20.16	1.259	0.1682
1.2	1.0084	2.1	21.18	1.322	0.1767
1.3	1.0088	2.2	22.19	1.385	0.1852
1.3	1.0092	2.3	23.21	1.449	0.1937
1.4	1.0096	2.4	24.23	1.513	0.2022
1.4	1.0100	2.5	25.25	1.576	0.2107
1.5	1.0104	2.6	26.27	1.640	0.2192
1.5	1.0108	2.7	27.29	1.704	0.2278
1.6	1.0112	2.8	28.31	1.768	0.2363
1.7	1.0116	2.9	29.34	1.831	0.2448
1.7	1.0120	3.0	30.36	1.895	0.2534
1.8	1.0124	3.1	31.38	1.959	0.2619
1.8	1.0128	3.2	32.41	2.023	0.2705
1.9	1.0132	3.3	33.44	2.087	0.2790
1.9	1.0136	3.4	34.46	2.151	0.2876
2.0	1.0140	3.5	35.49	2.216	0.2962
2.1	1.0144	3.6	36.52	2.280	0.3048
2.1	1.0148	3.7	37.55	2.344	0.3133
2.2	1.0152	3.8	38.58	2.408	0.3219
2.2	1.0156	3.9	39.61	2.473	0.3305
2.3	1.0160	4.0	40.64	2.537	0.3392
2.3	1.0164	4.1	41.67	2.601	0.3478
2.4	1.0168	4.2	42.71	2.666	0.3564
2.5	1.0172	4.3	43.74	2.731	0.3650
2.5	1.0176	4.4	44.77	2.795	0.3737
2.6	1.0180	4.5	45.81	2.860	0.3823
2.6	1.0184	4.6	46.85	2.924	0.3909
2.7	1.0188	4.7	47.88	2.989	0.3996
2.7	1.0192	4.8	48.92	3.054	0.4083
2.8	1.0196	4.9	49.96	3.119	0.4169
2.8	1.0200	5.0	51.00	3.184	0.4256
5.6	1.0401	10.0	104.0	6.493	0.8680

TARTARIC ACID
SPECIFIC GRAVITY OF AQUEOUS TARTARIC ACID (D) SOLUTIONS
AT 15° C. (GERLACH)

Bé.	Sp. gr.	Per cent $\text{H}_2\text{C}_4\text{H}_4\text{O}_6$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0045	1	10.05	0.6271	0.0838
1.3	1.0090	2	20.18	1.260	0.1684
2.6	1.0179	4	40.72	2.542	0.3398
3.9	1.0273	6	61.64	3.848	0.5144
5.2	1.0371	8	82.97	5.179	0.6924
6.5	1.0469	10	104.7	6.535	0.8737
7.8	1.0565	12	126.8	7.915	1.058
9.0	1.0661	14	149.3	9.317	1.246
10.3	1.0761	16	172.2	10.75	1.437
11.5	1.0865	18	195.6	12.21	1.632
12.8	1.0969	20	219.4	13.70	1.831
14.0	1.1072	22	243.6	15.21	2.033
15.2	1.1175	24	268.2	16.74	2.238
16.5	1.1282	26	293.3	18.31	2.448
17.7	1.1393	28	319.0	19.91	2.662
19.0	1.1505	30	345.2	21.55	2.880
20.2	1.1615	32	371.7	23.20	3.102
21.3	1.1726	34	398.7	24.89	3.327
22.5	1.1840	36	426.2	26.61	3.557
23.8	1.1959	38	454.4	28.37	3.792
25.0	1.2078	40	483.1	30.16	4.032
26.1	1.2198	42	512.3	31.98	4.275
27.3	1.2317	44	541.9	33.83	4.523
28.5	1.2441	46	572.3	35.73	4.776
29.6	1.2568	48	603.3	37.66	5.034
30.8	1.2696	50	634.8	39.63	5.298
32.0	1.2828	52	667.1	41.64	5.567
33.1	1.2961	54	699.9	43.69	5.841
34.3	1.3093	56	733.2	45.77	6.119

ZINC CHLORIDE

SPECIFIC GRAVITY OF AQUEOUS ZINC CHLORIDE SOLUTIONS

AT $\frac{20^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent ZnCl ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.4	1.0167	2	20.33	1.269	0.1697
4.9	1.0350	4	41.40	2.584	0.3455
7.3	1.0532	6	63.19	3.945	0.5274
9.7	1.0715	8	85.72	5.351	0.7154
11.0	1.0819	10	108.2	6.754	0.9029
14.2	1.1085	12	133.0	8.304	1.110
16.4	1.1275	14	157.9	9.854	1.317
18.6	1.1468	16	183.5	11.45	1.531
20.7	1.1665	18	210.0	13.11	1.752
22.8	1.1866	20	237.3	14.82	1.980
27.9	1.2380	25	309.5	19.32	2.583
32.8	1.2928	30	387.8	24.21	3.237
37.8	1.3522	35	473.3	29.54	3.950
42.7	1.4173	40	566.9	35.39	4.731
47.6	1.4890	45	670.1	41.83	5.592
52.5	1.5681	50	784.1	48.95	6.543
57.4	1.655	55	910.3	56.82	7.596
62.1	1.749	60	1049	65.51	8.757
66.7	1.851	65	1203	75.11	10.05
71.1	1.962	70	1373	85.74	11.46

ZINC CHLORIDE

SPECIFIC GRAVITY OF AQUEOUS ZINC CHLORIDE SOLUTIONS AT

$\frac{60^\circ}{60^\circ}$ F. (WHITNEY, HARTLE, SAKRYD)

BA.	Sp. gr.	Per cent ZnCl ₂	Weight of 1 cu. ft. in lbs.	Lbs. ZnCl ₂ in 1 cu. ft.	Per cent 50 per cent ZnCl ₂	Lbs. 50 per cent ZnCl ₂ in 1 cu. ft.
0	1.0000	0	62.37	0	0	0
1	1.0069	.76	62.80	.4773	1.52	.9546
2	1.0140	1.53	63.24	.9676	3.06	1.9352
3	1.0211	2.29	63.69	1.4585	4.58	2.9170
4	1.0284	3.05	64.14	1.9563	6.10	3.9126
5	1.0357	3.81	64.60	2.4613	7.62	4.9226
6	1.0432	4.63	65.06	3.0123	9.26	6.0246
7	1.0507	5.45	65.53	3.5714	10.90	7.1428
8	1.0584	6.27	66.01	4.1388	12.54	8.2776
9	1.0662	7.09	66.50	4.7149	14.18	9.4298
10	1.0741	7.91	66.99	5.2980	15.82	10.5978
11	1.0821	8.78	67.49	5.9256	17.56	11.8512
12	1.0902	9.65	68.00	6.5620	19.30	13.1240
13	1.0985	10.52	68.51	7.2073	21.04	14.4146
14	1.1069	11.39	69.04	7.8637	22.78	15.7274
15	1.1154	12.26	69.57	8.5293	24.52	17.0586
16	1.1240	13.21	70.10	9.2602	26.42	18.5204
17	1.1328	14.15	70.65	9.9970	28.30	19.9940
18	1.1417	15.10	71.21	10.7527	30.20	21.5054
19	1.1508	16.04	71.78	11.5135	32.08	23.0270
20	1.1600	16.98	72.35	12.2850	33.96	24.5700
21	1.1694	17.96	72.94	13.1000	35.92	26.2000
22	1.1789	18.94	73.53	13.9266	37.88	27.8532
23	1.1885	19.92	74.13	14.7667	39.84	29.5334
24	1.1983	20.90	74.74	15.6207	41.80	31.2414
25	1.2083	21.88	75.36	16.4888	43.76	32.9776
26	1.2185	22.88	76.00	17.3888	45.76	34.7776
27	1.2288	23.88	76.64	18.3016	47.76	36.6032
28	1.2393	24.89	77.30	19.2400	49.78	38.4800
29	1.2500	25.89	77.96	20.1838	51.78	40.3676
30	1.2609	26.90	78.64	21.1542	53.80	42.3084
31	1.2719	27.91	79.33	22.1410	55.82	44.2820
32	1.2832	28.91	80.03	23.1367	57.82	46.2734
33	1.2946	29.92	80.74	24.1574	59.84	48.3148
34	1.3063	30.93	81.47	25.1987	61.86	50.3974
35	1.3182	31.93	82.22	26.2528	63.86	52.5056
36	1.3303	32.94	82.97	27.3303	65.88	54.6606
37	1.3426	33.95	83.74	28.4297	67.90	56.8594
38	1.3551	34.96	84.52	29.5482	69.92	59.0964
39	1.3679	35.97	85.32	30.6896	71.94	61.3792
40	1.3810	36.98	86.13	31.8509	73.96	63.7018
41	1.3942	38.02	86.96	33.0622	76.04	66.1244
42	1.4078	39.05	87.80	34.2859	78.10	68.5718
43	1.4216	40.09	88.67	35.5478	80.18	71.0956
44	1.4356	41.12	89.54	36.8188	82.24	73.6376
45	1.4500	42.16	90.44	38.1295	84.32	76.2590
46	1.4646	43.21	91.35	39.4723	86.42	78.9446
47	1.4796	44.26	92.28	40.8431	88.52	81.6862
48	1.4948	45.32	93.23	42.2518	90.64	84.5036
49	1.5104	46.37	94.20	43.6805	92.74	87.3610
50	1.5263	47.43	95.20	45.1534	94.86	90.3068
51	1.5426	48.48	96.21	46.6426	96.96	93.2852
52	1.5591	49.54	97.24	48.1727	99.08	96.3454

ZINC CHLORIDE (Continued)

SPECIFIC GRAVITY OF AQUEOUS ZINC CHLORIDE SOLUTIONS AT
60° F. (WHITNEY, HARTLE, SAKRYD)

Bé.	Sp. gr.	Per cent ZnCl ₂	Weight of 1 cu. ft. in lbs.	Lbs. ZnCl ₂ in 1 cu. ft.	Per cent 50 per cent ZnCl ₂	Lbs. 50 per cent ZnCl ₂ in 1 cu. ft.
53	1.5761	50.60	98.30	49.7398	101.20	99.4796
54	1.5934	51.66	99.38	51.3397	103.32	102.6794
55	1.6111	52.72	100.48	52.9731	105.44	105.9462
56	1.6292	53.80	101.61	54.6662	107.60	109.3324
57	1.6477	54.88	102.77	56.4002	109.76	112.8004
58	1.6667	55.97	103.95	58.1808	111.94	116.3616
59	1.6860	57.06	105.16	60.0043	114.12	120.0086
60	1.7059	58.15	106.40	61.8716	116.30	123.7432
61	1.7262	59.23	107.66	63.7670	118.46	127.5340
62	1.7470	60.30	108.96	65.7029	120.60	131.4058
63	1.7683	61.37	110.29	67.6850	122.74	135.3700
64	1.7901	62.44	111.65	69.7143	124.88	139.4286
65	1.8125	63.52	113.05	71.8094	127.04	143.6188
66	1.8354	64.68	114.47	74.0392	129.36	148.0784
67	1.8590	65.85	115.95	76.3531	131.70	152.7062
68	1.8831	67.02	117.45	78.7150	134.04	157.4300
69	1.9079	68.19	119.90	81.1461	136.38	162.2922
70	1.9333	69.36	120.58	83.6343	138.72	167.2696

FIXED POINTS*

Bé.	Sp. gr.	Per cent ZnCl ₂
5.08	1.0363	3.88
10.16	1.0754	8.05
15.35	1.1184	12.59
20.35	1.1633	17.32
25.14	1.1707	22.02
30.00	1.2609	26.90
35.07	1.3190	32.00
40.15	1.3829	37.14
44.99	1.4499	42.15
50.14	1.5285	47.58
55.05	1.6120	52.77
60.13	1.7085	58.29
65.11	1.8150	63.65
70.05	1.9345	69.42

APPROXIMATE ALLOWANCE FOR TEMPERATURE

At 5° Bé.	= 0.024° Bé.
" 10° "	= 0.029° "
" 15° "	= 0.029° "
" 20° "	= 0.033° "
" 25° "	= 0.033° "
" 30° "	= 0.033° "
" 35° "	= 0.033° "
" 40° "	= 0.033° "
" 45° "	= 0.033° "
" 50° "	= 0.030° "
" 55° "	= 0.028° "
" 60° "	= 0.027° "
" 65° "	= 0.027° "
" 70° "	= 0.024° "

For each 1° Fahrenheit

* The percentage composition on all fixed points were determined by actual chemical analysis, both Zinc and Chlorine being determined.

ZINC NITRATE
SPECIFIC GRAVITY OF AQUEOUS ZINC NITRATE SOLUTIONS AT
 $\frac{18^{\circ}}{4^{\circ}}$ C.*

Bé.	Sp. gr.	Per cent Zn(NO ₃) ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.2	1.0154	2	20.31	1.268	0.1695
4.5	1.0322	4	41.29	2.577	0.3446
6.9	1.0496	6	62.98	3.931	0.5256
9.2	1.0675	8	85.40	5.331	0.7127
11.5	1.0859	10	108.6	6.779	0.9062
13.8	1.1048	12	132.6	8.276	1.106
16.0	1.1244	14	157.4	9.827	1.314
18.3	1.1445	16	183.1	11.43	1.528
20.6	1.1652	18	209.7	13.09	1.750
22.8	1.1865	20	237.3	14.81	1.980
28.3	1.2427	25	310.7	19.39	2.593
33.7	1.3029	30	390.9	24.40	3.262
39.0	1.3678	35	478.7	29.89	3.995
44.2	1.4378	40	575.1	35.90	4.799
49.2	1.5134	45	681.0	42.51	5.683
54.1	1.5944	50	797.2	49.77	6.653

ZINC NITRATE

SPECIFIC GRAVITY OF AQUEOUS ZINC NITRATE SOLUTIONS AT
17.5° (FRANZ)

Bé.	Sp. gr.	Per cent Zn(NO ₃) ₂	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.4	1.0099	1	10.10	0.6305	0.0843
2.8	1.0198	2	20.40	1.273	0.1702
4.2	1.0297	3	30.89	1.928	0.2578
5.5	1.0396	4	41.58	2.596	0.3470
6.9	1.0496	5	52.48	3.276	0.4380
8.1	1.0590	6	63.54	3.967	0.5303
9.3	1.0684	7	74.79	4.669	0.6241
10.5	1.0778	8	86.22	5.383	0.7196
11.6	1.0872	9	97.85	6.108	0.8166
12.8	1.0968	10	109.7	6.847	0.9153
14.0	1.1070	11	121.8	7.602	1.016
15.2	1.1172	12	134.1	8.369	1.119
16.4	1.1274	13	146.6	9.149	1.223
17.5	1.1376	14	159.3	9.942	1.329
18.6	1.1476	15	172.1	10.75	1.437
19.9	1.1586	16	185.4	11.57	1.547
21.0	1.1696	17	198.8	12.41	1.659
22.2	1.1806	18	212.5	13.27	1.773
23.3	1.1916	19	226.4	14.13	1.889
24.4	1.2024	20	240.5	15.01	2.007
25.6	1.2147	21	255.1	15.92	2.129
26.8	1.2270	22	269.9	16.85	2.253
28.0	1.2393	23	285.0	17.79	2.379
29.1	1.2516	24	300.4	18.75	2.507
30.3	1.2640	25	316.0	19.73	2.637
31.4	1.2766	26	331.9	20.72	2.770
32.5	1.2892	27	348.1	21.73	2.905
33.6	1.3018	28	364.5	22.75	3.042
34.7	1.3144	29	381.2	23.80	3.181
35.7	1.3268	30	398.0	24.85	3.322
36.8	1.3396	31	415.3	25.92	3.466
37.8	1.3524	32	432.8	27.02	3.612
38.8	1.3652	33	450.5	28.12	3.760
39.8	1.3780	34	468.5	29.25	3.910
40.7	1.3906	35	486.7	30.38	4.062
41.7	1.4039	36	505.4	31.55	4.218
42.7	1.4172	37	524.4	32.73	4.376
43.6	1.4305	38	543.6	33.93	4.536
44.6	1.4438	39	563.1	35.15	4.699
45.5	1.4572	40	582.9	36.39	4.864
46.4	1.4707	41	603.0	37.64	5.032
47.3	1.4844	42	623.4	38.92	5.203
48.2	1.4981	43	644.2	40.21	5.376
49.1	1.5118	44	665.2	41.53	5.551
50.0	1.5258	45	686.6	42.86	5.730
50.9	1.5403	46	708.5	44.23	5.913
51.7	1.5548	47	730.8	45.62	6.098
52.6	1.5693	48	753.3	47.02	6.286
53.4	1.5838	49	776.1	48.45	6.476
54.3	1.5984	50	799.2	49.89	6.669

ZINC SULFATE
SPECIFIC GRAVITY OF AQUEOUS ZINC SULFATE SOLUTIONS AT
 $\frac{20^{\circ}}{4^{\circ}} \text{ C.}^*$

Bé.	Sp. gr.	Per cent ZnSO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.7	1.0190	2	20.38	1.272	0.1701
5.6	1.0403	4	41.61	2.598	0.3473
8.5	1.0620	6	63.72	3.978	0.5318
11.3	1.0842	8	86.74	5.415	0.7238
14.0	1.1071	10	110.7	6.911	0.9239
16.8	1.1308	12	135.7	8.471	1.132
19.5	1.1553	14	161.7	10.10	1.350
22.2	1.1806	16	188.9	11.79	1.576

Bé.	Sp. gr.	Per cent ZnSO ₄ + 7H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.7	1.0190	3.562	36.30	2.266	0.3030
5.6	1.0403	7.125	74.12	4.627	0.6185
8.5	1.0620	10.69	113.5	7.085	0.9472
11.3	1.0842	14.25	154.5	9.645	1.289
14.0	1.1071	17.81	197.2	12.31	1.646
16.8	1.1308	21.37	241.7	15.09	2.017
19.5	1.1533	24.94	288.1	17.99	2.404
22.2	1.1806	28.50	336.5	21.00	2.808

ZINC SULFATE

SPECIFIC GRAVITY OF AQUEOUS ZINC SULFATE SOLUTIONS AT
15° C. (GERLACH)

Bé.	Sp. gr.	Per cent ZnSO ₄ + 7H ₂ O	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	1	10.06	0.6280	0.0840
1.9	1.013	2	20.26	1.265	0.1691
2.7	1.019	3	30.57	1.908	0.2551
3.4	1.024	4	40.96	2.557	0.3418
4.1	1.029	5	51.45	3.212	0.4294
4.9	1.035	6	62.10	3.877	0.5182
5.7	1.041	7	72.87	4.549	0.6081
6.5	1.047	8	83.76	5.229	0.6990
7.3	1.053	9	94.77	5.916	0.7909
8.1	1.059	10	105.9	6.611	0.8838
9.0	1.066	11	117.3	7.320	0.9786
9.9	1.073	12	128.8	8.038	1.075
10.6	1.079	13	140.3	8.757	1.171
11.4	1.085	14	151.9	9.483	1.268
12.1	1.091	15	163.7	10.22	1.366
12.8	1.097	16	175.5	10.96	1.465
13.5	1.103	17	187.5	11.71	1.565
14.4	1.110	18	199.8	12.47	1.667
15.1	1.116	19	212.0	13.24	1.770
16.0	1.124	20	224.8	14.03	1.876
16.7	1.130	21	237.3	14.81	1.980
17.5	1.137	22	250.1	15.62	2.087
18.1	1.143	23	262.9	16.41	2.194
18.9	1.150	24	276.0	17.23	2.303
19.7	1.157	25	289.3	18.06	2.414
20.4	1.164	26	302.6	18.89	2.526
21.2	1.171	27	316.2	19.74	2.639
22.0	1.179	28	330.1	20.61	2.755
22.6	1.185	29	343.7	21.45	2.868
23.5	1.193	30	357.9	22.34	2.987
24.2	1.200	31	372.0	23.22	3.104
25.1	1.209	32	386.9	24.15	3.229
25.8	1.216	33	401.3	25.05	3.349
26.5	1.224	34	416.2	25.98	3.473
27.2	1.231	35	430.9	26.90	3.560
28.1	1.240	36	446.4	27.87	3.725
28.6	1.246	37	461.0	28.78	3.847
29.5	1.255	38	476.9	29.77	3.980
30.2	1.263	39	492.6	30.75	4.111
30.9	1.271	40	508.4	31.74	4.243
31.7	1.280	41	524.8	32.76	4.380
32.4	1.288	42	541.0	33.77	4.514
33.0	1.295	43	556.9	34.76	4.647
33.8	1.304	44	573.8	35.82	4.788
34.3	1.310	45	589.5	36.80	4.920
35.2	1.320	46	607.2	37.91	5.067
36.0	1.330	47	625.1	39.02	5.217
36.6	1.337	48	641.8	40.06	5.356
37.3	1.346	49	659.5	41.17	5.504
37.8	1.353	50	676.5	42.23	5.646
38.5	1.362	51	694.6	43.36	5.797
39.2	1.370	52	712.4	44.47	5.945
39.9	1.380	53	731.4	45.66	6.104
40.7	1.390	54	750.6	46.86	6.264
41.4	1.399	55	769.5	48.03	6.421
41.9	1.406	56	787.4	49.15	6.571
42.6	1.416	57	807.1	50.39	6.736
43.2	1.425	58	826.5	51.60	6.897
44.0	1.435	59	846.7	52.85	7.065
44.7	1.445	60	867.0	54.12	7.235

ZINC SULFATE (Continued)
SPECIFIC GRAVITY OF AQUEOUS ZINC SULFATE SOLUTIONS AT
15° C. (GERLACH)

Bé.	Sp. gr.	Per cent ZnSO ₄	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	0.56	5.648	0.3526	0.0471
1.9	1.013	1.12	11.37	0.7101	0.0949
2.7	1.019	1.68	17.16	1.071	0.1432
3.4	1.024	2.25	23.00	1.436	0.1919
4.1	1.029	2.81	28.89	1.803	0.2411
4.9	1.035	3.37	34.86	2.177	0.2910
5.7	1.041	3.93	40.91	2.554	0.3414
6.5	1.047	4.49	47.03	2.936	0.3924
7.3	1.053	5.05	53.21	3.322	0.4440
8.1	1.059	5.61	59.46	3.712	0.4962
9.0	1.066	6.18	65.83	4.110	0.5494
9.9	1.073	6.74	72.29	4.513	0.6033
10.6	1.079	7.30	78.75	4.916	0.6572
11.4	1.085	7.86	85.28	5.324	0.7117
12.0	1.091	8.42	91.88	5.736	0.7667
12.8	1.097	8.98	98.54	6.152	0.8224
13.5	1.103	9.54	105.3	6.572	0.8786
14.4	1.110	10.1	112.2	7.003	0.9361
15.1	1.116	10.7	119.0	7.432	0.9935
16.0	1.124	11.2	126.2	7.879	1.053
16.7	1.130	11.8	133.2	8.317	1.112
17.5	1.137	12.4	140.4	8.767	1.172
18.1	1.143	12.9	147.6	9.214	1.232
18.9	1.150	13.5	155.0	9.673	1.293
19.7	1.157	14.0	162.4	10.14	1.355
20.4	1.164	14.6	169.9	10.61	1.418
21.2	1.171	15.2	177.5	11.08	1.481
22.0	1.179	15.7	185.3	11.57	1.547
22.6	1.185	16.3	192.9	12.04	1.610
23.5	1.193	16.8	200.9	12.54	1.677
24.2	1.200	17.4	208.9	13.04	1.743
25.1	1.209	18.0	217.2	13.56	1.813
25.8	1.216	18.5	225.3	14.06	1.880
26.5	1.224	19.1	233.6	14.59	1.950
27.2	1.231	19.7	241.9	15.10	2.019
28.1	1.240	20.2	250.6	15.65	2.092
28.6	1.246	20.8	258.8	16.16	2.160
29.5	1.255	21.3	267.7	16.71	2.234
30.2	1.263	21.9	276.5	17.26	2.308
30.9	1.271	22.5	285.4	17.82	2.382
31.7	1.280	23.0	294.6	18.39	2.459
32.4	1.288	23.6	303.7	18.96	2.535
33.0	1.295	24.1	312.6	19.52	2.609
33.8	1.304	24.7	322.1	20.11	2.688
34.3	1.310	25.3	331.0	20.66	2.762
35.2	1.320	25.8	340.9	21.23	2.845
36.0	1.330	26.4	350.9	21.91	2.929
36.6	1.337	26.9	360.3	22.49	3.007
37.3	1.346	27.5	370.3	23.12	3.090
37.8	1.353	28.1	379.8	23.71	3.170
38.5	1.362	28.6	390.0	24.35	3.254
39.2	1.370	29.2	400.0	24.97	3.338
39.9	1.380	29.8	410.6	25.63	3.427
40.7	1.390	30.3	421.4	26.31	3.517
41.4	1.399	30.9	432.0	26.97	3.605
41.9	1.406	31.4	442.0	27.60	3.689
42.6	1.416	32.0	453.1	28.29	3.782
43.2	1.425	32.6	464.0	28.97	3.872
44.0	1.435	33.1	475.3	29.67	3.967
44.7	1.445	33.7	486.8	30.39	4.062

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

THE SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS EXPRESSED IN GRAMS OF THE SUBSTANCE SHOWN BY THE FORMULA PER 100 GRAMS OF THE AQUEOUS SOLUTION

Per cent by weight	AgNO_3 20°C. $\frac{4^\circ}{4}$	$\text{Al}(\text{NO}_3)_3$ 18°C. $\frac{4^\circ}{4}$	AuCl_3 15°C. $\frac{4^\circ}{4}$	$\text{Ba}(\text{C}_2\text{H}_3\text{O}_2)_2$ 18°C. $\frac{4^\circ}{4}$	BaBr_2 20°C. $\frac{4^\circ}{4}$
1	1.0070	1.0065	1.0060	1.0059	1.0156
2	1.0154	1.0144	1.0132	1.0133	1.0156
3	1.0237	1.0230	1.0218	1.0219	1.0156
4	1.0327	1.0305	1.0281	1.0282	1.0335
5	1.0416	1.0394	1.0354	1.0355	1.0419
6	1.0506	1.0469	1.0434	1.0433	1.0519
7	1.0596	1.0549	1.0501	1.0507	1.0619
8	1.0690	1.0638	1.0591	1.0587	1.0710
9	1.0782	1.0711	1.0680	1.0675	1.0807
10	1.0882	1.0811	1.0750	1.0745	1.0907
11	1.0982	1.0989	1.0839	1.0834	1.1007
12	1.1080	1.0989	1.0939	1.0908	1.1111
13	1.1178	1.1089	1.1039	1.1008	1.1211
14	1.1284	1.1171	1.1139	1.1075	1.1323
15	1.1395	1.1257	1.1209	1.1166	1.1434
16	1.1495	1.1357	1.1309	1.1246	1.1543
17	1.1596	1.1457	1.1409	1.1326	1.1654
18	1.1715	1.1549	1.1501	1.1421	1.1770
19	1.1834	1.1649	1.1601	1.1521	1.1887
20	1.1942	1.1745	1.1701	1.1599	1.2006
21	1.2050	1.1845	1.1801	1.1699	1.2125
22	1.2158	1.1946	1.1901	1.1782	1.2244
23	1.2266	1.2046	1.2001	1.1864	1.2363
24	1.2374	1.2153	1.2101	1.1970	1.2482
25	1.2545	1.2265	1.2201	1.2161	1.2601
26	1.2653	1.2365	1.2301	1.2261	1.2720
27	1.2761	1.2465	1.2401	1.2356	1.2839
28	1.2869	1.2582	1.2501	1.2456	1.2958
29	1.2977	1.2682	1.2601	1.2554	1.3077
30	1.3205	1.2805	1.2701	1.2654	1.3196
31	1.3313	1.2905	1.2801	1.2754	1.3315
32	1.3421	1.3036	1.2901	1.2854	1.3434
33	1.3529	1.3136	1.3001	1.2954	1.3553
34	1.3637	1.3236	1.3101	1.3054	1.3672
35	1.3931	1.3336	1.3201	1.3069	1.4087
36	1.4039	1.3436	1.3301	1.3169	1.4206
37	1.4147	1.3536	1.3401	1.3269	1.4325
38	1.4255	1.3636	1.3501	1.3369	1.4444
39	1.4363	1.3736	1.3601	1.3469	1.4563
40	1.4743	1.3836	1.3701	1.3608	1.4926
42	1.4851	1.3936	1.3801	1.3708	1.5045
44	1.4959	1.4036	1.3901	1.3808	1.5164
45	1.565	1.4136	1.4001	1.3908	1.5283
46	1.5758	1.4236	1.4101	1.4008	1.5402
48	1.5866	1.4336	1.4201	1.4108	1.5521
50	1.668	1.4436	1.4301	1.4208	1.5640
55	1.786	1.4536	1.4401	1.4308	1.5759
60	1.916	1.4636	1.4501	1.4408	1.5878
65	2.046	1.4736	1.4601	1.4508	1.5997
70	2.2333	1.4836	1.4701	1.4608	1.6116
75	2.420	1.4936	1.4801	1.4708	1.6235
80	2.607	1.5036	1.4901	1.4808	1.6354

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

(Continued)

Per cent by weight	BaI ₂ 20° C. 4°	Ba(NO ₃) ₂ 18° C. 4°	C ₁₂ H ₂₂ O ₁₁ Sucrose 20° C. 4°	CaBr ₂ 20° C. 4°	Ca(C ₂ H ₃ O ₂) ₂ 18° C. 4°
1			1.0021		1.0043
2	1.0154	1.0151	1.0060	1.0152	1.0100
3			1.0099		
4	1.0331	1.0320	1.0139	1.0326	1.0215
5			1.0179		
6	1.0513	1.0494	1.0219	1.0504	1.0331
7			1.0259		
8	1.0701	1.0674	1.0299	1.0688	1.0447
9			1.0340		
10	1.0896		1.0381	1.0877	1.0563
11			1.0423		
12	1.1099		1.0465	1.1071	1.0679
13			1.0507		
14	1.1308		1.0549	1.1272	1.0795
15			1.0592		
16	1.1525		1.0635	1.1480	1.0912
17			1.0678		
18	1.1750		1.0722	1.1696	1.1029
19			1.0765		
20	1.1984		1.0810	1.1919	1.1146
21			1.0854		
22			1.0899		1.1263
23			1.0944		
24			1.0990		
25	1.2610		1.1036	1.2499	
26			1.1082		
27			1.1128		
28			1.1175		
29			1.1222		
30	1.3289		1.1270	1.3125	
31			1.1317		
32			1.1366		
33			1.1415		
34			1.1464		
35	1.404		1.1513	1.381	
36			1.1563		
37			1.1612		
38			1.1663		
39			1.1713		
40	1.490		1.1765	1.457	
42			1.1868		
44			1.1973		
45	1.587		1.2025	1.541	
46			1.2079		
48			1.2186		
50	1.698		1.2296	1.635	
55	1.825		1.2575		
60	1.970		1.2865		
65			1.3163		
70			1.3472		
75			1.3790		
80			1.4117		

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS (Continued)

Per cent by weight	CaI_2 $\frac{20^\circ \text{C}}{4^\circ}$	$\text{Ca}(\text{NO}_3)_2$ $\frac{18^\circ \text{C}}{4^\circ}$	CdBr_2 $\frac{20^\circ \text{C}}{4^\circ}$	CdCl_2 $\frac{20^\circ \text{C}}{4^\circ}$	CdI_2 $\frac{20^\circ \text{C}}{4^\circ}$
1					
2	1.0150	1.0137	1.0158	1.0159	1.0153
3					
4	1.0323	1.0291	1.0339	1.0339	1.0328
5					
6	1.0500	1.0448	1.0524	1.0524	1.0507
7					
8	1.0683	1.0608	1.0714	1.0715	1.0690
9					
10	1.0873	1.0771	1.0910	1.0912	1.0879
11					
12	1.1069	1.0937	1.1112	1.1115	1.1075
13					
14	1.1273	1.1106	1.1322	1.1324	1.1278
15					
16	1.1485	1.1279	1.1540	1.1540	1.1489
17					
18	1.1703	1.1455	1.1766	1.1762	1.1709
19					
20	1.1928	1.1636	1.2000	1.1992	1.1937
21					
22					
23					
24					
25	1.2530	1.2106	1.2605	1.2604	1.2546
26					
27					
28					
29					
30	1.3195	1.260	1.3286	1.3273	1.3219
31					
32					
33					
34					
35	1.3928	1.311	1.4049	1.4010	1.3967
36					
37					
38					
39					
40	1.4734	1.365	1.4902	1.4833	1.4801
42					
44					
45		1.422		1.5748	1.5726
46					
48					
50				1.6762	
55					
60					
65					
70					
75					
80					

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	CdSO_4 $\frac{18^\circ}{4^\circ} \text{C.}$	CoCl_2 $\frac{20^\circ}{4^\circ} \text{C.}$	$\text{Co}(\text{NO}_3)_2$ $\frac{20^\circ}{4^\circ} \text{C.}$	HBr $\frac{20^\circ}{4^\circ} \text{C.}$	HClO_4 $\frac{15^\circ}{4^\circ} \text{C.}$
1	1.0086	1.0073	1.0064	1.0053	1.0050
2	1.0182	1.0165	1.0145	1.0124	1.0109
3					
4	1.0383	1.0350	1.0315	1.0269	1.0228
5					
6	1.0590	1.0538	1.0485	1.0417	1.0348
7					
8	1.0803	1.0735	1.0660	1.0568	1.0471
9					
10	1.1023	1.0940	1.084	1.0723	1.0597
11					
12	1.1250	1.1150	1.103	1.0883	1.0726
13					
14	1.1485	1.1365	1.122	1.1048	1.0859
15					
16	1.1729	1.1585	1.142	1.1219	1.0995
17					
18	1.1982	1.1815	1.163	1.1396	1.1135
19					
20	1.2243	1.2050	1.184	1.1579	1.1279
21					
22				1.1767	1.1428
23					
24				1.1961	1.1581
25	1.2940		1.239		
26				1.2161	1.1738
27					
28				1.2367	1.1900
29					
30	1.3714		1.299	1.2580	1.2067
31					
32					1.2239
33					
34					1.2418
35	1.4551			1.3150	
36					1.2603
37					
38					1.2794
39					
40	1.5470			1.3772	1.2991
42					
44					
45				1.4446	1.3521
46					
48					
50				1.5173	1.4103
55				1.5953	1.4733
60				1.6787	1.5389
65				1.7675	1.6059
70					1.6736
75					
80					

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS (Continued)

Per cent by weight	HF 20° C. 4°	HI 20° C. 4°	HIO ₃ 18° C. 4°	HIO ₄ 17° C. 4°	H ₂ O ₂ 18° C. 4°
1		1.0054	1.0071	1.0076	1.0022
2		1.0127	1.0157	1.0165	1.0058
3					
4		1.0277	1.0334	1.0349	1.0131
5	1.017				
6		1.0431	1.0517	1.0539	1.0204
7					
8		1.0589	1.0706	1.0737	1.0277
9					
10	1.035	1.0751	1.0900	1.0944	1.0351
11					
12		1.0918	1.1100	1.1161	1.0425
13					
14		1.1091	1.1306	1.1388	1.0499
15	1.053				
16		1.1270	1.1519	1.1623	1.0574
17					
18		1.1456	1.1740	1.1865	1.0649
19					
20	1.070	1.1649	1.1969	1.2116	1.0725
21					
22		1.1850	1.2206	1.2376	1.0802
23					
24		1.2059	1.2450	1.2647	1.0880
25	1.086				
26		1.2277	1.2700	1.2931	1.0959
27					
28		1.2503	1.2956	1.3230	1.1040
29					
30	1.101	1.2737	1.3218	1.3545	1.1122
31					
32				1.3875	
33					
34					
35	1.116	1.3357	1.3900		1.1327
36					
37					
38					
39					
40	1.130	1.4029	1.4640		1.1536
42					
44					
45	1.143	1.4755			1.1749
46					
48					
50	1.155				1.1966
55					1.2188
60					1.2416
65					1.2652
70					1.2897
75					1.3149
80					1.3406

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS (Continued)

Per cent by weight	H_2SeO_4 20°C. $\frac{4^\circ}{4}$	HgCl_2 20°C. $\frac{4^\circ}{4}$	$\text{KC}_2\text{H}_3\text{O}_2$ 18°C. $\frac{4^\circ}{4}$	KBrO_3 20°C. $\frac{4^\circ}{4}$	KClO_3 20°C. $\frac{4^\circ}{4}$
1	1.0059	1.0065	1.0038	1.0056	1.0045
2	1.0136	1.0150	1.0089	1.0131	1.0109
3	1.0211	1.0236	1.0131	1.0206	1.0174
4	1.0291	1.0323	1.0191	1.0282	1.0241
5	1.0366	1.0411	1.0249	1.0359	1.0316
6	1.0447	1.0477	1.0293	1.0431	1.0389
7	1.0523	1.0553	1.0336	1.0503	1.0462
8	1.0605	1.0635	1.0395	1.0575	1.0524
9	1.0681	1.0711	1.0453	1.0647	1.0586
10	1.0766	1.0796	1.0497	1.0719	1.0648
11	1.0841	1.0871	1.0559	1.0791	1.0710
12	1.0931	1.0961	1.0599	1.0863	1.0772
13	1.1006	1.1036	1.0670	1.0935	1.0834
14	1.1101	1.1131	1.0703	1.1007	1.0896
15	1.1176	1.1206	1.0765	1.1079	1.0958
16	1.1276	1.1306	1.0808	1.1151	1.1020
17	1.1351	1.1381	1.0860	1.1223	1.1082
18	1.1455	1.1485	1.0914	1.1295	1.1144
19	1.1530	1.1560	1.0976	1.1367	1.1206
20	1.1639	1.1669	1.1022	1.1439	1.1268
21	1.1714	1.1744	1.1084	1.1511	1.1330
22	1.1829	1.1859	1.1131	1.1583	1.1392
23	1.1904	1.1934	1.1193	1.1655	1.1454
24	1.2026	1.2056	1.1241	1.1727	1.1516
25	1.2101	1.2131	1.1303	1.1799	1.1578
26	1.2229	1.2259	1.1353	1.1871	1.1640
27	1.2304	1.2334	1.1415	1.1943	1.1702
28	1.2438	1.2468	1.1466	1.2015	1.1764
29	1.2513	1.2543	1.1528	1.2087	1.1826
30	1.2653	1.2683	1.1579	1.2159	1.1888
31	1.2728	1.2758	1.1641	1.2231	1.1950
32	1.2874	1.2904	1.1693	1.2303	1.2012
33	1.2949	1.2979	1.1755	1.2375	1.2074
34	1.3101	1.3131	1.1817	1.2447	1.2136
35	1.3176	1.3206	1.1868	1.2519	1.2198
36	1.3334	1.3364	1.1920	1.2591	1.2260
37	1.3409	1.3439	1.1982	1.2663	1.2322
38	1.3573	1.3603	1.2044	1.2735	1.2384
39	1.3648	1.3678	1.2106	1.2807	1.2446
40	1.3819	1.3849	1.2162	1.2879	1.2508
42	1.3965	1.3995	1.2246	1.2983	1.2602
44	1.4073	1.4103	1.2318	1.3055	1.2664
45	1.4336	1.4366	1.2460	1.3127	1.2726
46	1.4609	1.4639	1.2544	1.3200	1.2788
48	1.4892	1.4922	1.2628	1.3272	1.2850
50	1.5186	1.5216	1.2761	1.3344	1.2912
55	1.5639	1.5669	1.3065	1.3416	1.2974
60	1.6850	1.6880	1.3372	1.3488	1.3036
65	1.7303	1.7333	1.3444	1.3560	1.3098
70	1.8870	1.8900	1.3516	1.3632	1.3160
75	1.9323	1.9353	1.3578	1.3704	1.3222
80	2.1220	2.1250	1.3640	1.3776	1.3284

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

(Continued)

Per cent by weight	KF 18° C. 4°	KHSO ₄ 20° C. 4°	K ₃ Fe(CN) ₆ 20° C. 4°	K ₄ Fe(CN) ₆ 20° C. 4°	KIO ₃ 20° C. 4°
1	1.0072	1.0051	1.0034	1.0051	1.0068
2	1.0159	1.0120	1.0090	1.0119	1.0155
3	.....	.....	.....	.....	1.0243
4	1.0334	1.0260	1.0201	1.0256	.....
5	.....	.....	.....	.....	.....
6	1.0512	1.0403	1.0314	1.0395	.....
7	.....	.....	.....	.....	.....
8	1.0693	1.0549	1.0427	1.0536	.....
9	.....	.....	.....	.....	.....
10	1.0877	1.0698	1.0542	1.0678	.....
11	.....	.....	.....	.....	.....
12	1.1064	1.0850	1.0656	1.0823	.....
13	.....	.....	.....	.....	.....
14	1.1254	1.1004	1.0774	1.0971	.....
15	.....	.....	.....	.....	.....
16	1.1448	1.1161	1.0890	1.1120	.....
17
18	1.1646	1.1010
19
20	1.1847	1.1130
21
22	1.2052
23
24	1.2260
25
26	1.2471
27
28
29
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SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	LiBr 20° C. 4°	LiCl 20° C. 4°	LiI 20° C. 4°	Li ₂ SO ₄ 20° C. 4°	MgBr ₂ 20° C. 4°
1	1.0055	1.0041	1.0056	1.0068	
2	1.0128	1.0099	1.0131	1.0155	1.0151
3					
4	1.0277	1.0215	1.0284	1.0329	1.0324
5					
6	1.0429	1.0330	1.0442	1.0505	1.0501
7					
8	1.0585	1.0444	1.0604	1.0684	1.0683
9					
10	1.0746	1.0559	1.0771	1.0863	1.0871
11					
12	1.0910	1.0675	1.0943	1.1044	1.1065
13					
14	1.1079	1.0792	1.1120	1.1228	1.1265
15					
16	1.1253	1.0910	1.1303	1.1411	1.1471
17					
18	1.1432	1.1029	1.1492	1.1599	1.1683
19					
20	1.1616	1.1150	1.1688	1.1789	1.1903
21					
22	1.1806	1.1274	1.1890	1.1984	
23					
24	1.2002	1.1399	1.2099	1.2182	
25					1.2482
26	1.2205	1.1527	1.2315		
27					
28	1.2414	1.1658	1.2540		
29					
30	1.2629	1.1791	1.2772		1.3110
31					
32					
33					
34					
35	1.3204		1.3393		1.3790
36					
37					
38					
39					
40	1.3836		1.4078		1.452
42					
44					
45	1.4535		1.4840		1.5320
46					
48					
50			1.5692		
55			1.6654		
60			1.7748		
65					
70					
75					
80					

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	MgI_2 $\frac{20^\circ}{4^\circ} \text{C.}$	$\text{Mg}(\text{NO}_3)_2$ $\frac{20^\circ}{4^\circ} \text{C.}$	MnBr_2 $\frac{18^\circ}{4^\circ} \text{C.}$	MnCl_2 $\frac{18^\circ}{4^\circ} \text{C.}$
1			1.0071	1.0069
2	1.0149	1.0132	1.0157	1.0153
3				
4	1.0321	1.0285	1.0332	1.0324
5				
6	1.0498	1.0441	1.0511	1.0498
7				
8	1.0680	1.0600	1.0695	1.0676
9				
10	1.0869	1.0762	1.0886	1.0859
11				
12	1.1065	1.0928	1.1083	1.1046
13				
14	1.1268	1.1098	1.1287	1.1238
15				
16	1.1478	1.1272	1.1498	1.1435
17				
18	1.1695	1.1449	1.1716	1.1638
19				
20	1.1920	1.1630	1.1942	1.1846
21				
22		1.1815	1.2176	1.2061
23				
24		1.2004	1.2419	1.2283
25	1.2519			
26			1.2672	1.2511
27				
28			1.2934	1.2746
29				
30	1.3180		1.3206	1.2988
31				
32			1.3489	
33				
34				
35	1.3914			
36				
37				
38				
39				
40	1.4730			
42				
44				
45				
46				
48				
50				
55				
60				
65				
70				
75				
80				

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS (Continued)

Per cent by weight	$\text{Mn}(\text{NO}_3)_2$ 18° C. 4°	MnSO_4 20° C. 4°	NH_4Br 25° C. 4°	$\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ 25° C. 4°
1	1.0063	1.0080	1.0027	0.9992
2	1.0140	1.0178	1.0084	1.0013
3				
4	1.0298	1.0378	1.0198	1.0055
5				
6	1.0459	1.0583	1.0314	1.0096
7				
8	1.0624	1.0794	1.0432	1.0136
9				
10	1.0794	1.1012	1.0552	1.0176
11				
12	1.0969	1.1236	1.0674	1.0216
13				
14	1.1149	1.1467	1.0799	1.0255
15				
16	1.1333	1.1705	1.0927	1.0294
17				
18	1.1522	1.1950	1.1058	1.0331
19				
20	1.1717	.....	1.1191	1.0368
21				
22	1.1918	.....	1.1327	1.0404
23				
24	1.2125	.....	1.1466	1.0439
25				
26	1.2338	.....	1.1608	1.0473
27				
28	1.2557	.....	1.1753	1.0507
29				
30	1.2781	.....	1.1901	1.0540
31				
32	.....		1.2053	.....
33				
34	.....		1.2209	.....
35	1.3367	.....	.....	1.0618
36			1.2369	.....
37				
38			1.2533	.....
39				
40	1.3993	.....	1.2702	1.0691
42				
44				
45	1.4662	.....	.....	1.0760
46				
48				
50	1.5378	.....	.....	.....
55	1.6146	.....	.....	.....
60			.....	.....
65			.....	.....
70			.....	.....
75			.....	.....
80	.....	.....	.....	.....

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

(Continued)

Per cent by weight	NH_4I $\frac{18^\circ}{4^\circ} \text{C.}$	N_2H_4 $\frac{15^\circ}{4^\circ} \text{C.}$	NH_2OH $\frac{20^\circ}{4^\circ} \text{C.}$	NaBrO_3 $\frac{18^\circ}{4^\circ} \text{C.}$
1	1.0050	1.0002	1.0002	1.0064
2	1.0114	1.0013	1.0023	1.0143
3	1.0178	1.0024	1.0043	1.0222
4	1.0244	1.0034	1.0065	1.0305
5	1.0309	1.0045	1.0086	1.0387
6	1.0377	1.0056	1.0107	1.0471
7	1.0443	1.0067	1.0128	1.0554
8	1.0513	1.0077	1.0149	1.0641
9	1.0582	1.0088	1.0170	1.0728
10	1.0652	1.0099	1.0192	1.0816
11	1.0722	1.0110	1.0213	1.0904
12	1.0795	1.0121	1.0235	1.0996
13	1.0867	1.0132	1.0256	1.1087
14	1.0942	1.0143	1.0278	1.1182
15	1.1016	1.0154	1.0299	1.1277
16	1.1093	1.0164	1.0322	1.1373
17	1.1168	1.0175	1.0343	1.1468
18	1.1248	1.0186	1.0366	1.1569
19	1.1324	1.0197	1.0387	1.1669
20	1.1407	1.0207	1.0410	1.1771
21	1.1487	1.0218	1.0431	1.1871
22	1.1570	1.0228	1.0454	1.1979
23	1.1652	1.0239	1.0475	1.2087
24	1.1737	1.0248	1.0499	1.2193
25	1.1818	1.0259	1.0519	1.2300
26	1.1908	1.0267	1.0545	1.2407
27	1.1994	1.0278	1.0569	1.2514
28	1.2084	1.0286	1.0591	1.2622
29	1.2172	1.0297	1.0613	1.2730
30	1.2265	1.0305	1.0637	1.2837
31	1.2352	1.0316	1.0659	1.2945
32	1.2442	1.0327	1.0681	1.3053
33	1.2532	1.0338	1.0703	1.3161
34	1.2624	1.0349	1.0725	1.3270
35	1.2745	1.0350	1.0755	1.3379
36	1.2852	1.0361	1.0777	1.3487
37	1.2964	1.0372	1.0799	1.3596
38	1.3072	1.0383	1.0821	1.3704
39	1.3184	1.0394	1.0843	1.3812
40	1.3264	1.0380	1.0875	1.3920
42	1.3408	1.0401	1.0919	1.4037
44	1.3552	1.0422	1.0963	1.4154
45	1.3823	1.0420	1.0997	1.4271
46	1.4094	1.0440	1.1122	1.4388
48	1.4365	1.0460	1.1249	1.4505
50	1.4636	1.0470	1.1376	1.4622
55	1.5157	1.0470	1.1503	1.4739
60	1.5678	1.0460	1.1630	1.4856
65	1.6199	1.0430	1.1757	1.4973
70	1.6720	1.0400	1.1884	1.5090
75	1.7241	1.0370	1.2011	1.5207
80	1.7762	1.0340	1.2138	1.5324

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

(Continued)

Per cent by weight	$\text{NaC}_2\text{H}_3\text{O}_2$ $20^\circ \frac{\text{C.}}{4^\circ}$	NaClO_4 $18^\circ \frac{\text{C.}}{4^\circ}$	$\text{Ni}(\text{NO}_3)_2$ $18^\circ \frac{\text{C.}}{4^\circ}$	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$ $18^\circ \frac{\text{C.}}{4^\circ}$
1	1.0033	1.0051	1.0070	1.0061
2	1.0084	1.0116	1.0155	1.0137
3				
4	1.0186	1.0247	1.0330	1.0290
5				
6	1.0289	1.0381	1.0508	1.0446
7				
8	1.0392	1.0517	1.0693	1.0605
9				
10	1.0495	1.0656	1.0882	1.0768
11				
12	1.0598	1.0798	1.1076	1.0936
13				
14	1.0702	1.0943	1.1277	1.1109
15				
16	1.0807	1.1090	1.1484	1.1283
17				
18	1.0913	1.1241	1.1696	1.1473
19				
20	1.1021	1.1396	1.1914	1.1663
21				
22	1.1130	1.1554	.....	1.1860
23				
24	1.1240	1.1717	.....	1.2063
25			1.2493	
26	1.1351	1.1883	.....	1.2273
27				
28	1.1462	1.2053	.....	1.2489
29				
30	.....	1.2227	1.3114	1.2711
31				
32	.....	1.2407	.....	.....
33				
34	.....	1.2591	.....	.....
35			1.3777	1.3304
36	.....	1.2779	.....	.....
37				
38	.....	1.2969	.....	.....
39				
40	.....	.....	.....	1.3994
42				
44	.....	.....	.....	.....
45				
46	.....	.....	.....	.....
48				
50	.....	.....	.....	.....
55				
60	.....	.....	.....	.....
65				
70	.....	.....	.....	.....
75				
80	.....	.....	.....	.....

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

(Continued)

Per cent by weight	$\text{Pb}(\text{NO}_3)_2$ 18°C. $\frac{18^\circ}{4^\circ}$	SO_3 15.5°C. $\frac{15.5^\circ}{4^\circ}$	SrBr_2 20°C. $\frac{20^\circ}{4^\circ}$	SrCl_2 20°C. $\frac{20^\circ}{4^\circ}$
1	1.0074	1.0040		
2	1.0163	1.0091	1.0157	1.0161
3				
4	1.0344	1.0191	1.0337	1.0344
5				
6	1.0529	1.0292	1.0522	1.0532
7				
8	1.0720	1.0393	1.0712	1.0726
9				
10	1.0918	1.0493	1.0907	1.0925
11				
12	1.1123	.....	1.1109	1.1130
13				
14	1.1336	.....	1.1317	1.1341
15				
16	1.1557	.....	1.1532	1.1558
17				
18	1.1789	.....	1.1757	1.1781
19				
20	1.2030	.....	1.1992	1.2010
21				
22	1.2277	.....	.....	.....
23				
24	1.2529	.....	.....	.....
25			1.2620	1.2600
26	1.2783	.....	.....	.....
27				.....
28	1.3037	.....	.....	.....
29				
30	1.3289	.....	1.3300	1.3250
31	.....	.....	.....	.....
32	.....	.....	.....	.....
33	.....	.....	.....	.....
34	.....	.....	.....	.....
35	.....	.....	1.4050	1.3960
36	.....	.....	.....	.....
37	.....	.....	.....	.....
38	.....	.....	.....	.....
39	.....	.....	.....	.....
40	.....	.....	1.4890	.....
42	.....	.....	.....	.....
44	.....	.....	.....	.....
45	.....	.....	1.5830	.....
46	.....	.....	.....	.....
48	.....	.....	.....	.....
50	.....	.....	1.6860	.....
55	.....	.....	.....	.....
60	.....	.....	.....	.....
65	.....	.....	.....	.....
70	.....	.....	.....	.....
75	.....	.....	.....	.....
80	.....	.....	.....	.....

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	SrI_2 $20^\circ \frac{\text{C.}}{4^\circ}$	$\text{Sr}(\text{NO}_3)_2$ $20^\circ \frac{\text{C.}}{4^\circ}$	ZnBr_2 $20^\circ \frac{\text{C.}}{4^\circ}$	ZnI_2 $20^\circ \frac{\text{C.}}{4^\circ}$
1				
2	1.0154	1.0150	1.0167	1.016
3				
4	1.0331	1.0310	1.0354	1.034
5				
6	1.0513	1.0480	1.0544	1.053
7				
8	1.0701	1.0650	1.0738	1.072
9				
10	1.0896	1.0830	1.0935	1.091
11				
12	1.1099	1.1010	1.1135	1.111
13				
14	1.1308	1.1190	1.1338	1.131
15				
16	1.1526	1.1380	1.1544	1.152
17				
18	1.1753	1.1580	1.1753	1.174
19				
20	1.1990	1.179	1.1965	1.197
21	.....	.....	.....	.....
22	.....	.....	.....	.....
23	.....	.....	.....	.....
24	.....	.....	.....	.....
25	1.2608	1.233	1.2543	1.258
26	.....	.....	.....	.....
27	.....	.....	.....	.....
28	.....	.....	.....	.....
29	.....	.....	.....	.....
30	1.3295	1.290	1.3170	1.325
31	.....	.....	.....	.....
32	.....	.....	.....	.....
33	.....	.....	.....	.....
34	.....	.....	.....	.....
35	1.4058	1.352	1.3859	1.398
36	.....	.....	.....	.....
37	.....	.....	.....	.....
38	.....	.....	.....	.....
39	.....	.....	.....	.....
40	1.4904	1.419	1.4620	1.478
42	.....	.....	.....	.....
44	.....	.....	.....	.....
45	1.5844	.....	1.5470	1.566
46	.....	.....	.....	.....
48	.....	.....	.....	.....
50	.....	.....	1.6430	1.663
55	.....	.....	1.7500	1.770
60	.....	.....	1.8690	1.893
65	.....	.....	2.0020	2.036
70	.....	.....	.....	2.202
75	.....	.....	.....	2.393
80	.....	.....	.....	.....

ETHYL ALCOHOL

SPECIFIC GRAVITY OF MIXTURES OF ETHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Giving the specific gravity of 15.56° C. referred to water at the same temperature. To reduce to specific gravity referred to water at 4° C. multiply by 0.99908.

(U. S. Department of Agriculture.)

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
1.00000	0.00	0.00	0.00	0.99431	3.90	3.12	3.10
0.99984	0.10	0.08	0.08	0.99417	4.00	3.20	3.18
0.99968	0.20	0.16	0.16	0.99403	4.10	3.28	3.26
0.99953	0.30	0.24	0.24	0.99390	4.20	3.36	3.34
0.99937	0.40	0.32	0.32	0.99376	4.30	3.44	3.42
0.99923	0.50	0.40	0.40	0.99363	4.40	3.52	3.50
0.99907	0.60	0.48	0.48	0.99349	4.50	3.60	3.58
0.99892	0.70	0.56	0.56	0.99335	4.60	3.68	3.66
0.99877	0.80	0.64	0.64	0.99322	4.70	3.76	3.74
0.99861	0.90	0.71	0.71	0.99308	4.80	3.84	3.81
0.99849	1.00	0.79	0.79	0.99295	4.90	3.92	3.89
0.99834	1.10	0.87	0.87	0.99281	5.00	4.00	3.97
0.99819	1.20	0.95	0.95	0.99268	5.10	4.08	4.05
0.99805	1.30	1.03	1.03	0.99255	5.20	4.16	4.13
0.99790	1.40	1.11	1.11	0.99241	5.30	4.24	4.21
0.99775	1.50	1.19	1.19	0.99228	5.40	4.32	4.29
0.99760	1.60	1.27	1.27	0.99215	5.50	4.40	4.37
0.99745	1.70	1.35	1.35	0.99202	5.60	4.48	4.44
0.99731	1.80	1.43	1.43	0.99189	5.70	4.56	4.52
0.99716	1.90	1.51	1.51	0.99175	5.80	4.64	4.60
0.99701	2.00	1.59	1.59	0.99162	5.90	4.72	4.68
0.99687	2.10	1.67	1.66	0.99149	6.00	4.80	4.76
0.99672	2.20	1.75	1.74	0.99136	6.10	4.88	4.84
0.99658	2.30	1.83	1.82	0.99123	6.20	4.96	4.92
0.99643	2.40	1.91	1.90	0.99111	6.30	5.05	5.00
0.99629	2.50	1.99	1.98	0.99098	6.40	5.13	5.08
0.99615	2.60	2.07	2.06	0.99085	6.50	5.21	5.16
0.99600	2.70	2.15	2.14	0.99072	6.60	5.29	5.24
0.99586	2.80	2.23	2.22	0.99059	6.70	5.37	5.32
0.99571	2.90	2.31	2.30	0.99047	6.80	5.45	5.40
0.99557	3.00	2.39	2.38	0.99034	6.90	5.53	5.48
0.99543	3.10	2.47	2.46	0.99021	7.00	5.61	5.56
0.99529	3.20	2.55	2.54	0.99009	7.10	5.69	5.64
0.99515	3.30	2.64	2.62	0.98996	7.20	5.77	5.72
0.99501	3.40	2.72	2.70	0.98984	7.30	5.86	5.80
0.99487	3.50	2.80	2.78	0.98971	7.40	5.94	5.88
0.99473	3.60	2.88	2.86	0.98959	7.50	6.02	5.96
0.99459	3.70	2.96	2.94	0.98947	7.60	6.10	6.04
0.99445	3.80	3.04	3.02	0.98934	7.70	6.18	6.11

ETHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF ETHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.98922	7.80	6.26	6.19	0.98435	12.00	9.67	9.52
0.98909	7.90	6.34	6.27	0.98424	12.10	9.75	9.60
0.98897	8.00	6.42	6.35	0.98413	12.20	9.83	9.68
0.98885	8.10	6.50	6.43	0.98402	12.30	9.92	9.76
0.98873	8.20	6.58	6.51	0.98391	12.40	10.00	9.84
0.98861	8.30	6.67	6.59	0.98381	12.50	10.08	9.92
0.98849	8.40	6.75	6.67	0.98370	12.60	10.16	10.00
0.98837	8.50	6.83	6.75	0.98359	12.70	10.24	10.07
0.98825	8.60	6.91	6.83	0.98348	12.80	10.33	10.15
0.98813	8.70	6.99	6.91	0.98337	12.90	10.41	10.23
0.98801	8.80	7.07	6.99	0.98326	13.00	10.49	10.31
0.98789	8.90	7.15	7.07	0.98315	13.10	10.57	10.39
0.98777	9.00	7.23	7.14	0.98305	13.20	10.65	10.47
0.98765	9.10	7.31	7.22	0.98294	13.30	10.74	10.55
0.98754	9.20	7.39	7.30	0.98283	13.40	10.82	10.63
0.98742	9.30	7.48	7.38	0.98273	13.50	10.90	10.71
0.98730	9.40	7.56	7.46	0.98262	13.60	10.98	10.79
0.98719	9.50	7.64	7.54	0.98251	13.70	11.06	10.87
0.98707	9.60	7.72	7.62	0.98240	13.80	11.15	10.95
0.98695	9.70	7.80	7.70	0.98230	13.90	11.23	11.03
0.98683	9.80	7.88	7.78	0.98219	14.00	11.31	11.11
0.98672	9.90	7.96	7.85	0.98209	14.10	11.39	11.19
0.98660	10.00	8.04	7.93	0.98198	14.20	11.47	11.27
0.98649	10.10	8.12	8.01	0.98188	14.30	11.56	11.35
0.98637	10.20	8.20	8.09	0.98177	14.40	11.64	11.43
0.98626	10.30	8.29	8.17	0.98167	14.50	11.72	11.51
0.98614	10.40	8.37	8.25	0.98156	14.60	11.80	11.59
0.98603	10.50	8.45	8.33	0.98146	14.70	11.88	11.67
0.98592	10.60	8.53	8.41	0.98135	14.80	11.97	11.75
0.98580	10.70	8.61	8.49	0.98125	14.90	12.05	11.82
0.98569	10.80	8.70	8.57	0.98114	15.00	12.13	11.90
0.98557	10.90	8.78	8.65	0.98104	15.10	12.21	11.98
0.98546	11.00	8.86	8.73	0.98093	15.20	12.29	12.06
0.98535	11.10	8.94	8.81	0.98083	15.30	12.38	12.14
0.98524	11.20	9.02	8.89	0.98073	15.40	12.46	12.22
0.98513	11.30	9.11	8.97	0.98063	15.50	12.54	12.30
0.98502	11.40	9.19	9.05	0.98052	15.60	12.62	12.37
0.98491	11.50	9.27	9.13	0.98042	15.70	12.70	12.45
0.98479	11.60	9.35	9.21	0.98032	15.80	12.79	12.53
0.98468	11.70	9.43	9.29	0.98021	15.90	12.87	12.61
0.98457	11.80	9.51	9.36	0.98011	16.00	12.95	12.69
0.98446	11.90	9.59	9.44	0.98001	16.10	13.03	12.77

ETHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF ETHYL ALCOHOL AND
WATER BY VOLUME AND BY WEIGHT

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.97991	16.20	13.12	12.85	0.97568	20.40	16.59	16.18
0.97980	16.30	13.20	12.93	0.97558	20.50	16.67	16.26
0.97970	16.40	13.29	13.01	0.97547	20.60	16.75	16.34
0.97960	16.50	13.37	13.09	0.97537	20.70	16.84	16.42
0.97950	16.60	13.45	13.17	0.97527	20.80	16.92	16.50
0.97940	16.70	13.53	13.25	0.97517	20.90	17.01	16.58
0.97929	16.80	13.62	13.33	0.97507	21.00	17.09	16.66
0.97917	16.90	13.70	13.41	0.97497	21.10	17.17	16.74
0.97909	17.00	13.78	13.49	0.97487	21.20	17.26	16.82
0.97899	17.10	13.86	13.57	0.97477	21.30	17.34	16.90
0.97889	17.20	13.94	13.65	0.97467	21.40	17.43	16.98
0.97879	17.30	14.03	13.73	0.97457	21.50	17.51	17.06
0.97869	17.40	14.11	13.81	0.97446	21.60	17.59	17.14
0.97859	17.50	14.19	13.89	0.97436	21.70	17.67	17.22
0.97848	17.60	14.27	13.96	0.97426	21.80	17.76	17.30
0.97838	17.70	14.35	14.04	0.97416	21.90	17.84	17.38
0.97828	17.80	14.44	14.12	0.97406	22.00	17.92	17.46
0.97818	17.90	14.52	14.20	0.97396	22.10	18.00	17.54
0.97808	18.00	14.60	14.28	0.97386	22.20	18.09	17.62
0.97798	18.10	14.68	14.36	0.97375	22.30	18.17	17.70
0.97788	18.20	14.77	14.44	0.97365	22.40	18.26	17.78
0.97778	18.30	14.85	14.52	0.97355	22.50	18.34	17.86
0.97768	18.40	14.94	14.60	0.97345	22.60	18.42	17.94
0.97758	18.50	15.02	14.68	0.97335	22.70	18.51	18.02
0.97748	18.60	15.10	14.76	0.97324	22.80	18.59	18.10
0.97738	18.70	15.18	14.84	0.97314	22.90	18.68	18.18
0.97728	18.80	15.27	14.92	0.97304	23.00	18.76	18.26
0.97718	18.90	15.38	15.00	0.97294	23.10	18.84	18.33
0.97708	19.00	15.43	15.08	0.97283	23.20	18.92	18.41
0.97698	19.10	15.51	15.15	0.97273	23.30	19.01	18.49
0.97688	19.20	15.59	15.23	0.97263	23.40	19.09	18.57
0.97678	19.30	15.68	15.31	0.97253	23.50	19.17	18.65
0.97668	19.40	15.76	15.39	0.97242	23.60	19.25	18.73
0.97658	19.50	15.84	15.47	0.97232	23.70	19.34	18.81
0.97648	19.60	15.93	15.55	0.97222	23.80	19.42	18.88
0.97638	19.70	16.01	15.63	0.97211	23.90	19.51	18.96
0.97628	19.80	16.09	15.71	0.97201	24.00	19.59	19.04
0.97618	19.90	16.18	15.79	0.97191	24.10	19.67	19.12
0.97608	20.00	16.26	15.87	0.97180	24.20	19.76	19.20
0.97598	20.10	16.34	15.95	0.97170	24.30	19.84	19.28
0.97588	20.20	16.42	16.03	0.97159	24.40	19.93	19.36
0.97578	20.30	16.51	16.10	0.97149	24.50	20.01	19.44

ETHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF ETHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.97139	24.60	20.09	19.52	0.96681	28.80	23.64	22.85
0.97128	24.70	20.18	19.60	0.96669	28.90	23.72	22.93
0.97118	24.80	20.26	19.68	0.96658	29.00	23.81	23.01
0.97107	24.90	20.35	19.76	0.96646	29.10	23.89	23.09
0.97097	25.00	20.43	19.84	0.96635	29.20	23.98	23.17
0.97086	25.10	20.51	19.92	0.96623	29.30	24.06	23.25
0.97076	25.20	20.60	20.00	0.96611	29.40	24.15	23.33
0.97065	25.30	20.68	20.08	0.96600	29.50	24.23	23.41
0.97055	25.40	20.77	20.16	0.96587	29.60	24.32	23.49
0.97044	25.50	20.85	20.24	0.96576	29.70	24.40	23.57
0.97033	25.60	20.93	20.32	0.96564	29.80	24.49	23.65
0.97023	25.70	21.02	20.40	0.96553	29.90	24.57	23.73
0.97012	25.80	21.10	20.47	0.96541	30.00	24.66	23.81
0.97001	25.90	21.19	20.55	0.96529	30.10	24.74	23.89
0.96991	26.00	21.27	20.63	0.96517	30.20	24.83	23.97
0.96980	26.10	21.35	20.71	0.96505	30.30	24.91	24.04
0.96969	26.20	21.44	20.79	0.96493	30.40	25.00	24.12
0.96959	26.30	21.52	20.87	0.96481	30.50	25.08	24.20
0.96949	26.40	21.61	20.95	0.96469	30.60	25.17	24.28
0.96937	26.50	21.69	21.03	0.96457	30.70	25.25	24.36
0.96926	26.60	21.77	21.11	0.96445	30.80	25.34	24.44
0.96915	26.70	21.86	21.19	0.96433	30.90	25.42	24.52
0.96905	26.80	21.94	21.27	0.96421	31.00	25.51	24.60
0.96894	26.90	22.03	21.35	0.96409	31.10	25.60	24.68
0.96883	27.00	22.11	21.43	0.96396	31.20	25.68	24.76
0.96872	27.10	22.20	21.51	0.96384	31.30	25.77	24.84
0.96861	27.20	22.28	21.59	0.96372	31.40	25.85	24.92
0.96850	27.30	22.37	21.67	0.96360	31.50	25.94	25.00
0.96839	27.40	22.45	21.75	0.96347	31.60	26.03	25.08
0.96828	27.50	22.54	21.83	0.96335	31.70	26.11	25.16
0.96816	27.60	22.62	21.90	0.96323	31.80	26.20	25.24
0.96805	27.70	22.71	21.98	0.96310	31.90	26.28	25.32
0.96794	27.80	22.79	22.06	0.96298	32.00	26.37	25.40
0.96783	27.90	22.88	22.14	0.96285	32.10	26.46	25.48
0.96772	28.00	22.96	22.22	0.96273	32.20	26.54	25.56
0.96761	28.10	23.04	22.30	0.96260	32.30	26.63	25.64
0.96749	28.20	23.13	22.38	0.96248	32.40	26.71	25.71
0.96738	28.30	23.21	22.45	0.96235	32.50	26.80	25.79
0.96726	28.40	23.30	22.53	0.96222	32.60	26.89	25.87
0.96715	28.50	23.38	22.61	0.96210	32.70	26.97	25.95
0.96704	28.60	23.47	22.69	0.96197	32.80	27.06	26.03
0.96692	28.70	23.55	22.77	0.96185	32.90	27.14	26.11

ETHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF ETHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Specific gravity.	Per cent alcohol by volume.	Percent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.96172	33.00	27.23	26.19	0.95603	37.20	30.88	29.52
0.96159	33.10	27.32	26.27	0.95589	37.30	30.96	29.60
0.96146	33.20	27.40	26.35	0.95574	37.40	31.05	29.68
0.96133	33.30	27.49	26.43	0.95560	37.50	31.14	29.76
0.96120	33.40	27.57	26.51	0.95545	37.60	31.23	29.84
0.96108	33.50	27.66	26.59	0.95531	37.70	31.32	29.92
0.96095	33.60	27.75	26.67	0.95516	37.80	31.40	30.00
0.96082	33.70	27.83	26.75	0.95502	37.90	31.49	30.08
0.96069	33.80	27.92	26.82	0.95487	38.00	31.58	30.16
0.96056	33.90	28.00	26.90	0.95472	38.10	31.67	30.24
0.96043	34.00	28.09	26.98	0.95457	38.20	31.76	30.32
0.96030	34.10	28.18	27.06	0.95442	38.30	31.85	30.40
0.96016	34.20	28.26	27.14	0.95427	38.40	31.94	30.48
0.96003	34.30	28.35	27.22	0.95413	38.50	32.03	30.56
0.95990	34.40	28.43	27.30	0.95398	38.60	32.12	30.64
0.95977	34.50	28.52	27.38	0.95383	38.70	32.20	30.72
0.95963	34.60	28.61	27.46	0.95368	38.80	32.29	30.79
0.95950	34.70	28.70	27.54	0.95353	38.90	32.37	30.87
0.95937	34.80	28.78	27.62	0.95338	39.00	32.46	30.95
0.95923	34.90	28.87	27.70	0.95323	39.10	32.55	31.03
0.95910	35.00	28.96	27.78	0.95307	39.20	32.64	31.11
0.95896	35.10	29.05	27.86	0.95292	39.30	32.72	31.18
0.95883	35.20	29.13	27.94	0.95277	39.40	32.81	31.26
0.95869	35.30	29.22	28.02	0.95262	39.50	32.90	31.34
0.95855	35.40	29.30	28.09	0.95246	39.60	32.99	31.42
0.95842	35.50	29.38	28.17	0.95231	39.70	33.08	31.50
0.95828	35.60	29.48	28.25	0.95216	39.80	33.17	31.58
0.95814	35.70	29.57	28.33	0.95200	39.90	33.27	31.66
0.95800	35.80	29.65	28.41	0.95185	40.00	33.35	31.74
0.95787	35.90	29.74	28.49	0.95169	40.10	33.44	31.82
0.95773	36.00	29.83	28.57	0.95154	40.20	33.53	31.90
0.95759	36.10	29.92	28.65	0.95138	40.30	33.61	31.98
0.95745	36.20	30.00	28.73	0.95122	40.40	33.70	32.06
0.95731	36.30	30.09	28.81	0.95107	40.50	33.79	32.14
0.95717	36.40	30.17	28.88	0.95091	40.60	33.88	32.22
0.95703	36.50	30.26	28.96	0.95075	40.70	33.97	32.30
0.95688	36.60	30.35	29.04	0.95059	40.80	34.06	32.38
0.95674	36.70	30.44	29.12	0.95044	40.90	34.15	32.46
0.95660	36.80	30.52	29.20	0.95028	41.00	34.24	32.54
0.95646	36.90	30.61	29.29	0.95012	41.10	34.33	32.62
0.95632	37.00	30.70	29.36	0.94996	41.20	34.42	32.70
0.95618	37.10	30.79	29.44	0.94980	41.30	34.50	32.78

ETHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF ETHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Specific gravity.	Per cent alcohol by volume.	Percent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Percent alcohol by weight.	Grams alcohol per 100 c.c.
0.94964	41.40	34.59	32.86	0.94258	45.60	38.39	36.19
0.94948	41.50	34.68	32.93	0.94241	45.70	38.48	36.26
0.94932	41.60	34.77	33.01	0.94223	45.80	38.57	36.34
0.94916	41.70	34.86	33.09	0.94206	45.90	38.66	36.42
0.94900	41.80	34.95	33.17	0.94188	46.00	38.75	36.50
0.94884	41.90	35.04	33.25	0.94170	46.10	38.84	36.58
0.94868	42.00	35.13	33.33	0.94152	46.20	38.93	36.66
0.94852	42.10	35.22	33.41	0.94134	46.30	39.03	36.74
0.94835	42.20	35.31	33.49	0.94116	46.40	39.12	36.82
0.94810	42.30	35.40	33.57	0.94098	46.50	39.21	36.90
0.94802	42.40	35.49	33.65	0.94080	46.60	39.30	36.98
0.94786	42.50	35.58	33.73	0.94062	46.70	39.39	37.06
0.94770	42.60	35.67	33.81	0.94044	46.80	39.49	37.13
0.94753	42.70	35.76	33.89	0.94026	46.90	39.58	37.21
0.94737	42.80	35.85	33.97	0.94008	47.00	39.67	37.29
0.94720	42.90	35.94	34.04	0.93990	47.10	39.76	37.37
0.94704	43.00	36.03	34.12	0.93971	47.20	39.85	37.45
0.94687	43.10	36.12	34.20	0.93953	47.30	39.95	37.53
0.94670	43.20	36.21	34.28	0.93934	47.40	40.04	37.61
0.94654	43.30	36.30	34.36	0.93916	47.50	40.13	37.69
0.94637	43.40	36.39	34.44	0.93898	47.60	40.22	37.77
0.94620	43.50	36.48	34.52	0.93879	47.70	40.32	37.85
0.94603	43.60	36.57	34.60	0.93861	47.80	40.41	37.93
0.94586	43.70	36.66	34.68	0.93842	47.90	40.51	38.01
0.94570	43.80	36.75	34.76	0.93824	48.00	40.60	38.09
0.94553	43.90	36.84	34.84	0.93805	48.10	40.69	38.17
0.94536	44.00	36.93	34.91	0.93786	48.20	40.78	38.25
0.94519	44.10	37.02	34.99	0.93768	48.30	40.88	38.33
0.94502	44.20	37.11	35.07	0.93749	48.40	40.97	38.41
0.94484	44.30	37.21	35.15	0.93730	48.50	41.06	38.49
0.94467	44.40	37.30	35.23	0.93711	48.60	41.15	38.57
0.94450	44.50	37.39	35.31	0.93692	48.70	41.24	38.65
0.94433	44.60	37.48	35.39	0.93679	48.80	41.34	38.72
0.94416	44.70	37.57	35.47	0.93655	48.90	41.43	38.80
0.94398	44.80	37.66	35.55	0.93636	49.00	41.52	38.88
0.94381	44.90	37.76	35.63	0.93617	49.10	41.61	38.96
0.94364	45.00	37.84	35.71	0.93598	49.20	41.71	39.04
0.94346	45.10	37.93	35.79	0.93578	49.30	41.80	39.12
0.94329	45.20	38.02	35.87	0.93559	49.40	41.90	39.20
0.94311	45.30	38.12	35.95	0.93540	49.50	41.99	39.28
0.94294	45.40	38.21	36.03	0.93521	49.60	42.08	39.36
0.94276	45.50	38.30	36.11	0.93502	49.70	42.18	39.44

ETHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF ETHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.93482	49.80	42.27	39.52	0.8773	75.00	.....	.....
0.93463	49.90	42.37	39.60	0.8747	76.00	.....	.....
0.9344	50.00	....*	.....	0.8721	77.00	.....	.....
0.9325	51.00	.....	.....	0.8694	78.00	.....	.....
0.9305	52.00	.....	.....	0.8667	79.00	.....	.....
0.9285	53.00	.....	.....	0.8639	80.00	.....	.....
0.9264	54.00	.....	.....	0.8611	81.00	.....	.....
0.9244	55.00	.....	.....	0.8583	82.00	.....	.....
0.9222	56.00	....	.....	0.8554	83.00	.....	.....
0.9201	57.00	.....	.....	0.8525	84.00	.....	.....
0.9180	58.00	.....	.....	0.8496	85.00	.....	.....
0.9158	59.00	.....	.....	0.8465	86.00	.....	.....
0.9136	60.00	.....	.....	0.8435	87.00	.....	.....
0.9113	61.00	.....	.....	0.8404	88.00	.....	.....
0.9091	62.00	.....	.....	0.8372	89.00	.....	.....
0.9068	63.00	.....	.....	0.8339	90.00	.....	.....
0.9044	64.00	.....	.....	0.8306	91.00	.....	.....
0.9021	65.00	.....	.....	0.8272	92.00	.....	.....
0.8997	66.00	.....	.....	0.8236	93.00	.....	.....
0.8974	67.00	.....	.....	0.8199	94.00	.....	.....
0.8949	68.00	.....	.....	0.8161	95.00	.....	.....
0.8925	69.00	.....	.....	0.8121	96.00	.....	.....
0.8900	70.00	.....	.....	0.8079	97.00	.....	.....
0.8876	71.00	.....	.....	0.8035	98.00	.....	.....
0.8850	72.00	.....	.....	0.7989	99.00	.....	.....
0.8825	73.00	.....	.....	0.7939	100.00	.....	.....
0.8799	74.00	.....	.....	.....	.....	.....	.....

■ For specific gravity of mixtures by weight see following table.

ETHYL ALCOHOL

SPECIFIC GRAVITY OF MIXTURES OF ETHYL ALCOHOL AND WATER BY WEIGHT

The table gives the specific gravity at the temperature indicated referred to water at 4° C.

(U. S. Bureau of Standards.)

Per cent alcohol by weight.	15° C.	20° C.	25° C.	Per cent alcohol by weight.	15° C.	20° C.	25° C.
0	0.99913	0.99824	0.99708	51	0.91566	0.91164	0.90758
1	0.99725	0.99636	0.99521	52	0.91344	0.90940	0.90533
2	0.99543	0.99453	0.99338	53	0.91120	0.90715	0.90307
3	0.99366	0.99274	0.99159	54	0.90895	0.90488	0.90079
4	0.99197	0.99102	0.98984	55	0.90670	0.90262	0.89851
5	0.99033	0.98936	0.98815	56	0.90443	0.90034	0.89622
6	0.98877	0.98776	0.98651	57	0.90215	0.89805	0.89392
7	0.98726	0.98620	0.98491	58	0.89987	0.89576	0.89162
8	0.98581	0.98470	0.98336	59	0.89758	0.89346	0.88931
9	0.98442	0.98325	0.98185	60	0.89528	0.89115	0.88700
10	0.98307	0.98185	0.98038	61	0.89297	0.88883	0.88467
11	0.98176	0.98047	0.97893	62	0.89066	0.88651	0.88234
12	0.98049	0.97913	0.97752	63	0.88834	0.88418	0.88000
13	0.97925	0.97781	0.97612	64	0.88601	0.88185	0.87766
14	0.97803	0.97651	0.97474	65	0.88368	0.87950	0.87530
15	0.97683	0.97522	0.97336	66	0.88134	0.87716	0.87295
16	0.97563	0.97393	0.97199	67	0.87899	0.87480	0.87058
17	0.97444	0.97264	0.97061	68	0.87664	0.87244	0.86821
18	0.97324	0.97134	0.96922	69	0.87428	0.87008	0.86583
19	0.97203	0.97003	0.96782	70	0.87192	0.86770	0.86344
20	0.97080	0.96870	0.96640	71	0.86954	0.86532	0.86105
21	0.96956	0.96736	0.96497	72	0.86716	0.86292	0.85864
22	0.96829	0.96599	0.96352	73	0.86477	0.86052	0.85622
23	0.96699	0.96459	0.96203	74	0.86237	0.85812	0.85380
24	0.96566	0.96317	0.96052	75	0.85997	0.85570	0.85137
25	0.96430	0.96171	0.95897	76	0.85755	0.85328	0.84893
26	0.96289	0.96021	0.95739	77	0.85513	0.85084	0.84648
27	0.96145	0.95868	0.95577	78	0.85270	0.84840	0.84403
28	0.95997	0.95711	0.95412	79	0.85026	0.84595	0.84157
29	0.95845	0.95550	0.95244	80	0.84781	0.84349	0.83909
30	0.95688	0.95385	0.95071	81	0.84534	0.84101	0.83660
31	0.95526	0.95215	0.94894	82	0.84286	0.83852	0.83410
32	0.95360	0.95042	0.94713	83	0.84037	0.83602	0.83159
33	0.95191	0.94865	0.94529	84	0.83786	0.83350	0.82906
34	0.95017	0.94684	0.94342	85	0.83534	0.83097	0.82652
35	0.94839	0.94499	0.94152	86	0.83279	0.82842	0.82396
36	0.94657	0.94311	0.93957	87	0.83022	0.82583	0.82137
37	0.94471	0.94119	0.93760	88	0.82767	0.82323	0.81876
38	0.94282	0.93924	0.93560	89	0.82500	0.82060	0.81613
39	0.94089	0.93725	0.93356	90	0.82235	0.81795	0.81348
40	0.93893	0.93524	0.93151	91	0.81966	0.81527	0.81080
41	0.93694	0.93320	0.92943	92	0.81694	0.81255	0.80809
42	0.93491	0.93113	0.92732	93	0.81418	0.80979	0.80534
43	0.93286	0.92904	0.92519	94	0.81138	0.80700	0.80256
44	0.93078	0.92693	0.92305	95	0.80854	0.80417	0.79974
45	0.92868	0.92480	0.92088	96	0.80564	0.80129	0.79689
46	0.92655	0.92264	0.91870	97	0.80271	0.79838	0.79400
47	0.92441	0.92047	0.91650	98	0.79972	0.79541	0.79106
48	0.92225	0.91828	0.91429	99	0.79668	0.79240	0.78809
49	0.92006	0.91608	0.91207	100	0.79358	0.78933	0.78507
50	0.91787	0.91386	0.90983	.....	.....	.....	.....

ETHYL ALCOHOL

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS REFERRED TO
WATER AT THE SAME TEMPERATURE

Per cent alcohol	Sp. gr. 15° 15° C.	Sp. gr. 20° 20° C.	Sp. gr. 25° 25° C.	Per cent alcohol	Sp. gr. 15° 15° C.	Sp. gr. 20° 20° C.	Sp. gr. 25° 25° C.
0	1.00000	1.00000	1.00000	51	0.91635	0.91322	0.91026
1	0.99812	0.99813	0.99811	52	0.91412	0.91097	0.90799
2	0.99629	0.99629	0.99627	53	0.91189	0.90872	0.90571
3	0.99451	0.99451	0.99447	54	0.90964	0.90645	0.90343
4	0.99281	0.99279	0.99274	55	0.90738	0.90418	0.90113
5	0.99118	0.99113	0.99106	56	0.90512	0.90191	0.89883
6	0.98963	0.98955	0.98945	57	0.90285	0.89962	0.89654
7	0.98815	0.98802	0.98788	58	0.90058	0.89733	0.89423
8	0.98670	0.98653	0.98634	59	0.89830	0.89502	0.89191
9	0.98528	0.98505	0.98481	60	0.89601	0.89271	0.88959
10	0.98390	0.98361	0.98330	61	0.89371	0.89040	0.88725
11	0.98256	0.98221	0.98184	62	0.89139	0.88807	0.88491
12	0.98126	0.98084	0.98039	63	0.88907	0.88574	0.88256
13	0.97999	0.97948	0.97897	64	0.88674	0.88339	0.88020
14	0.97875	0.97816	0.97757	65	0.88441	0.88104	0.87783
15	0.97754	0.97687	0.97619	66	0.88207	0.87869	0.87547
16	0.97637	0.97560	0.97484	67	0.87971	0.87632	0.87309
17	0.97518	0.97431	0.97346	68	0.87736	0.87396	0.87071
18	0.97398	0.97301	0.97207	69	0.87500	0.87158	0.86833
19	0.97276	0.97169	0.97065	70	0.87263	0.86920	0.86593
20	0.97152	0.97036	0.96922	71	0.87025	0.86680	0.86352
21	0.97028	0.96901	0.96778	72	0.86785	0.86440	0.86110
22	0.96902	0.96763	0.96630	73	0.86545	0.86200	0.85869
23	0.96773	0.96624	0.96481	74	0.86304	0.85958	0.85626
24	0.96642	0.96483	0.96329	75	0.86063	0.85716	0.85383
25	0.96508	0.96339	0.96176	76	0.85822	0.85473	0.85140
26	0.96371	0.96190	0.96018	77	0.85579	0.85230	0.84895
27	0.96228	0.96037	0.95856	78	0.85336	0.84985	0.84650
28	0.96080	0.95880	0.95689	79	0.85092	0.84740	0.84404
29	0.95927	0.95717	0.95520	80	0.84846	0.84494	0.84157
30	0.95769	0.95551	0.95345	81	0.84599	0.84245	0.83909
31	0.95607	0.95381	0.95168	82	0.84350	0.83997	0.83659
32	0.95440	0.95207	0.94986	83	0.84101	0.83747	0.83408
33	0.95269	0.95028	0.94802	84	0.83850	0.83496	0.83156
34	0.95094	0.94847	0.94613	85	0.83598	0.83242	0.82902
35	0.94915	0.94662	0.94422	86	0.83343	0.82987	0.82646
36	0.94732	0.94473	0.94227	87	0.83086	0.82729	0.82389
37	0.94546	0.94281	0.94031	88	0.82826	0.82469	0.82128
38	0.94355	0.94086	0.93830	89	0.82564	0.82207	0.81865
39	0.94161	0.93886	0.93626	90	0.82299	0.81942	0.81600
40	0.93964	0.93684	0.93421	91	0.82030	0.81674	0.81331
41	0.93764	0.93479	0.93212	92	0.81759	0.81401	0.81060
42	0.93559	0.93272	0.93001	93	0.81484	0.81127	0.80785
43	0.93352	0.93062	0.92787	94	0.81205	0.80848	0.80507
44	0.93143	0.92849	0.92571	95	0.80922	0.80567	0.80225
45	0.92933	0.92636	0.92355	96	0.80636	0.80280	0.79939
46	0.92721	0.92421	0.92137	97	0.80344	0.79988	0.79648
47	0.92506	0.92204	0.91917	98	0.80045	0.79688	0.79349
48	0.92291	0.91986	0.91697	99	0.79739	0.79383	0.79045
49	0.92075	0.91766	0.91475	100	0.79429	0.79074	0.78736
50	0.91856	0.91546	0.91251	.....	.....	.....	.....

ETHYL ALCOHOL

Density of aqueous solutions at 20°C in g/ml. The concentration is expressed as per cent by weight.

Per cent		.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0	0.99	823	804	785	766	748	729	710	692	673	655
1		636	618	599	581	562	544	525	507	489	471
2		453	435	417	399	381	363	345	327	310	292
3		275	257	240	222	205	188	171	154	137	120
4		103	087	070	053	037	020	003	*987	*971	*954
5	0.98	938	922	906	890	874	859	843	827	811	796
6		780	765	749	734	718	703	688	673	658	642
7		627	612	597	582	567	553	538	523	508	493
8		478	463	449	434	419	404	389	374	360	345
9		331	316	301	287	273	258	244	229	215	201
10		187	172	158	144	130	117	103	089	075	061
11		047	033	019	006	*992	*978	*964	*951	*937	*923
12	0.97	910	896	883	869	855	842	828	815	801	788
13		775	761	748	735	722	709	696	683	670	657
14		643	630	617	604	591	578	565	552	539	526
15		514	501	488	475	462	450	438	425	412	400
16		387	374	361	349	336	323	310	297	284	272
17		259	246	233	220	207	194	181	168	155	142
18		129	116	103	089	076	063	050	037	024	010
19	0.96	997	984	971	957	944	931	917	904	891	877
20		864	850	837	823	810	796	783	769	756	742
21		729	716	702	688	675	661	647	634	620	606
22		592	578	564	551	537	523	509	495	481	467
23		453	439	425	411	396	382	368	354	340	326
24		312	297	283	269	254	240	225	211	196	182
25		168	153	139	124	109	094	080	065	050	035
26		020	005	*990	*975	*959	*944	*929	*914	*898	*883
27	0.95	867	851	836	820	805	789	773	757	742	726
28		710	694	678	662	646	630	613	597	581	565
29		548	532	516	499	483	466	450	433	416	400
30		382	365	349	332	315	298	281	264	247	230
31		212	195	178	161	143	126	108	091	074	056
32		038	020	003	*985	*967	*950	*932	*914	*896	*878
33	0.94	860	842	824	806	788	770	752	734	715	697
34		679	660	642	624	605	587	568	550	531	512
35		494	475	456	438	419	400	382	363	344	325
36		306	287	268	249	230	211	192	172	153	134
37		114	095	075	056	036	017	*997	*978	*958	*939
38	0.93	919	899	879	859	840	820	800	780	760	740
39		720	700	680	660	640	620	599	579	559	539
40		518	498	478	453	437	417	396	376	356	335
41		314	294	273	253	232	212	191	170	149	129
42		107	086	065	044	023	002	*981	*960	*939	*918
43	0.92	897	876	855	834	812	791	770	749	728	707
44		685	664	642	621	600	579	557	536	515	493
45		472	450	429	408	386	365	343	322	300	279
46		257	236	214	193	171	150	128	106	085	063
47		041	019	*997	*976	*954	*932	*910	*889	*867	*845
48	0.91	823	801	780	758	736	714	692	670	648	626
49		604	582	560	538	516	494	472	450	428	406
50		384	361	339	317	295	272	250	228	206	183

ETHYL ALCOHOL (Continued)

Per cent		.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
50	0.91	384	361	339	317	295	272	250	228	206	183
51		160	138	116	093	071	049	026	004	*981	*959
52	0.90	936	914	891	869	846	824	801	779	756	734
53		711	689	666	644	621	598	576	553	531	508
54		485	463	440	417	395	372	349	327	304	281
55		258	236	213	190	167	145	122	099	076	054
56		031	008	*985	*962	*939	*917	*894	*871	*848	*825
57	0.89	803	780	757	734	711	688	665	643	620	597
58		574	551	528	505	482	459	436	413	390	367
59		344	321	298	275	252	229	206	183	160	137
60		113	090	067	044	021	*998	*975	*951	*928	*905
61	0.88	882	859	836	812	789	766	743	720	696	673
62		650	626	603	580	557	533	510	487	463	440
63		417	393	370	347	323	300	277	253	230	206
64		183	160	136	113	089	066	042	019	*995	*972
65	0.87	948	925	901	878	854	831	807	784	760	737
66		713	689	666	642	619	595	572	548	524	501
67		477	454	430	406	383	359	336	312	288	265
68		241	218	194	170	147	123	099	075	052	028
69		004	*981	*957	*933	*909	*885	*862	*838	*814	*790
70	0.86	766	742	718	694	671	647	623	599	575	551
71		527	503	479	455	431	407	383	359	335	311
72		287	263	239	215	191	167	143	119	095	071
73		047	022	*998	*974	*950	*926	*902	*878	*854	*830
74	0.85	806	781	757	733	709	685	661	636	612	588
75		564	540	515	491	467	443	419	394	370	346
76		322	297	273	249	225	200	176	152	128	103
77		079	055	031	006	*982	*958	*933	*909	*884	*860
78	0.84	835	811	787	762	738	713	689	664	640	615
79		590	566	541	517	492	467	443	418	393	369
80		344	319	294	270	245	220	196	171	146	121
81		096	072	047	022	*997	*972	*947	*923	*898	*873
82	0.83	848	823	798	773	748	723	698	674	649	624
83		599	574	549	523	498	473	448	423	398	373
84		348	323	297	272	247	222	196	171	146	120
85		095	070	044	019	*994	*968	*943	*917	*892	*866
86	0.82	840	815	789	763	738	712	686	660	635	609
87		583	557	531	505	479	453	427	401	375	349
88		323	297	271	245	219	193	167	140	114	088
89		062	035	009	*983	*956	*930	*903	*877	*850	*824
90	0.81	797	770	744	717	690	664	637	610	583	556
91		529	502	475	448	421	394	366	339	312	285
92		257	230	203	175	148	120	093	066	038	010
93	0.80	983	955	928	900	872	844	817	789	761	733
94		705	677	649	621	593	565	537	509	480	452
95		424	395	367	338	310	281	253	224	195	166
96		138	109	080	051	022	*993	*963	*934	*905	*875
97	0.79	846	816	787	757	727	698	668	638	608	578
98		547	517	487	456	426	396	365	335	305	274
99		243	213	182	151	120	089	059	028	*997	*966
100	0.78	934									

METHYL ALCOHOL

SPECIFIC GRAVITY OF MIXTURES OF METHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Giving the specific gravity at 15°C referred to water at 4°C.

(Calculated from values by Doroshevski and Rozhdestvenski, Dittmar and Fawsitt.)

Per cent alcohol by weight	Per cent alcohol by volume	Specific gravity	Per cent alcohol by weight	Per cent alcohol by volume	Specific gravity
1	1.25	0.99727	51	58.74	0.91653
2	2.50	0.99543	52	59.76	0.91451
3	3.75	0.99370	53	60.77	0.91248
4	4.99	0.99198	54	61.78	0.91044
5	6.22	0.99029	55	62.78	0.90839
6	7.45	0.98864	56	63.78	0.90631
7	8.68	0.98701	57	64.77	0.90421
8	9.91	0.98547	58	65.75	0.90210
9	11.13	0.98394	59	66.73	0.89996
10	12.35	0.98241	60	67.69	0.89781
11	13.56	0.98093	61	68.65	0.89563
12	14.77	0.97945	62	69.61	0.89341
13	15.98	0.97802	63	70.55	0.89117
14	17.18	0.97660	64	71.49	0.88890
15	18.38	0.97518	65	72.42	0.88662
16	19.58	0.97377	66	73.34	0.88433
17	20.77	0.97237	67	74.26	0.88203
18	21.96	0.97096	68	75.17	0.87971
19	23.15	0.96955	69	76.08	0.87739
20	24.33	0.96814	70	76.98	0.87507
21	25.51	0.96673	71	77.86	0.87271
22	26.69	0.96533	72	78.75	0.87033
23	27.86	0.96392	73	79.62	0.86792
24	29.03	0.96251	74	80.48	0.86546
25	30.19	0.96108	75	81.34	0.86300
26	31.35	0.95963	76	82.18	0.86051
27	32.51	0.95817	77	83.02	0.85801
28	33.66	0.95668	78	83.86	0.85551
29	34.81	0.95518	79	84.68	0.85300
30	35.95	0.95366	80	85.50	0.85048
31	37.09	0.95213	81	86.31	0.84794
32	38.22	0.95056	82	87.11	0.84536
33	39.35	0.94896	83	87.90	0.84274
34	40.48	0.94734	84	88.68	0.84009
35	41.59	0.94570	85	89.45	0.83742
36	42.71	0.94404	86	90.21	0.83475
37	43.82	0.94237	87	90.97	0.83207
38	44.92	0.94067	88	91.72	0.82937
39	46.02	0.93894	89	92.46	0.82667
40	47.11	0.93720	90	93.19	0.82396
41	48.20	0.93543	91	93.92	0.82124
42	49.28	0.93365	92	94.63	0.81849
43	50.35	0.93185	93	95.33	0.81568
44	51.42	0.93001	94	96.02	0.81285
45	52.49	0.92815	95	96.70	0.80999
46	53.54	0.92627	96	97.37	0.80713
47	54.60	0.92436	97	98.04	0.80428
48	55.64	0.92242	98	98.70	0.80143
49	56.68	0.92048	99	99.35	0.79859
50	57.71	0.91852	100	100.00	0.79577

METHYL ALCOHOL

SPECIFIC GRAVITY OF MIXTURES OF METHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Giving the specific gravity at 15.6° C. referred to water at the same temperature. To reduce to specific gravity of water at 4°C. multiply by 0.99908.
(Techn. Hogskolan, Stockholm.)

Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.
1.0000	0.00	0.00	0.9950	2.72	3.48	0.9900	5.72	7.13
0.9999	0.06	0.07	0.9949	2.78	3.55	0.9899	5.78	7.21
0.9998	0.11	0.13	0.9948	2.84	3.62	0.9898	5.85	7.28
0.9997	0.17	0.20	0.9947	2.89	3.70	0.9897	5.91	7.36
0.9996	0.22	0.27	0.9946	2.95	3.77	0.9896	5.97	7.44
0.9995	0.28	0.33	0.9945	3.01	3.84	0.9895	6.04	7.52
0.9994	0.33	0.40	0.9944	3.07	3.91	0.9894	6.10	7.59
0.9993	0.39	0.47	0.9943	3.13	3.98	0.9893	6.16	7.67
0.9992	0.44	0.53	0.9942	3.18	4.06	0.9892	6.23	7.75
0.9991	0.50	0.60	0.9941	3.24	4.13	0.9891	6.29	7.82
0.9990	0.55	0.67	0.9940	3.30	4.20	0.9890	6.36	7.90
0.9989	0.61	0.73	0.9939	3.36	4.27	0.9889	6.42	7.98
0.9988	0.66	0.80	0.9938	3.42	4.35	0.9888	6.48	8.05
0.9987	0.72	0.86	0.9937	3.48	4.42	0.9887	6.55	8.13
0.9986	0.77	0.93	0.9936	3.53	4.49	0.9886	6.61	8.21
0.9985	0.83	1.00	0.9935	3.59	4.57	0.9885	6.67	8.29
0.9984	0.88	1.06	0.9934	3.65	4.64	0.9884	6.74	8.36
0.9983	0.94	1.13	0.9933	3.71	4.71	0.9883	6.80	8.44
0.9982	0.99	1.20	0.9932	3.77	4.79	0.9882	6.86	8.52
0.9981	1.05	1.26	0.9931	3.83	4.89	0.9881	6.93	8.56
0.9980	1.10	1.33	0.9930	3.89	4.94	0.9880	6.99	8.67
0.9979	1.15	1.40	0.9929	3.94	5.01	0.9879	7.06	8.75
0.9978	1.20	1.47	0.9928	4.00	5.08	0.9878	7.12	8.83
0.9977	1.26	1.54	0.9927	4.06	5.16	0.9877	7.19	8.90
0.9976	1.31	1.62	0.9926	4.12	5.23	0.9876	7.25	8.98
0.9975	1.36	1.69	0.9925	4.18	5.30	0.9875	7.32	9.06
0.9974	1.41	1.76	0.9924	4.24	5.38	0.9874	7.38	9.14
0.9973	1.46	1.83	0.9923	4.29	5.45	0.9873	7.45	9.22
0.9972	1.52	1.90	0.9922	4.35	5.52	0.9872	7.51	9.29
0.9971	1.57	1.97	0.9921	4.41	5.60	0.9871	7.58	9.37
0.9970	1.62	2.05	0.9920	4.47	5.67	0.9870	7.64	9.45
0.9969	1.67	2.12	0.9919	4.53	5.74	0.9869	7.71	9.53
0.9968	1.72	2.19	0.9918	4.60	5.82	0.9868	7.77	9.61
0.9967	1.78	2.26	0.9917	4.66	5.89	0.9867	7.84	9.68
0.9966	1.83	2.33	0.9916	4.72	5.96	0.9866	7.90	9.76
0.9965	1.88	2.40	0.9915	4.78	6.04	0.9865	7.97	9.84
0.9964	1.93	2.47	0.9914	4.85	6.11	0.9864	8.03	9.92
0.9963	1.98	2.55	0.9913	4.91	6.18	0.9863	8.10	10.00
0.9962	2.04	2.62	0.9912	4.97	6.25	0.9862	8.16	10.07
0.9961	2.09	2.69	0.9911	5.03	6.33	0.9861	8.23	10.15
0.9960	2.14	2.76	0.9910	5.10	6.40	0.9860	8.29	10.23
0.9959	2.20	2.83	0.9909	5.16	6.47	0.9859	8.35	10.31
0.9958	2.26	2.90	0.9908	5.22	6.55	0.9858	8.42	10.38
0.9957	2.31	2.98	0.9907	5.28	6.62	0.9857	8.48	10.47
0.9956	2.37	3.05	0.9906	5.35	6.69	0.9856	8.55	10.55
0.9955	2.43	3.12	0.9905	5.41	6.77	0.9855	8.61	10.63
0.9954	2.49	3.19	0.9904	5.47	6.84	0.9854	8.68	10.71
0.9953	2.55	3.26	0.9903	5.53	6.91	0.9853	8.74	10.79
0.9952	2.60	3.34	0.9902	5.60	6.98	0.9852	8.81	10.87
0.9951	2.66	3.41	0.9901	5.66	7.06	0.9851	8.87	10.95

METHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF METHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.
0.9850	8.94	11.03	0.9796	12.55	15.46	0.9742	16.43	20.09
0.9849	9.00	11.10	0.9795	12.62	15.55	0.9741	16.51	20.17
0.9848	9.06	11.18	0.9794	12.69	15.63	0.9740	16.58	20.26
0.9847	9.13	11.26	0.9793	12.76	15.72	0.9739	16.65	20.35
0.9846	9.19	11.34	0.9792	12.83	15.80	0.9738	16.72	20.43
0.9845	9.26	11.42	0.9791	12.90	15.89	0.9737	16.79	20.52
0.9844	9.32	11.50	0.9790	12.97	15.97	0.9736	16.86	20.60
0.9843	9.39	11.58	0.9789	13.04	16.06	0.9735	16.93	20.69
0.9842	9.45	11.66	0.9788	13.11	16.14	0.9734	17.00	20.77
0.9841	9.52	11.74	0.9787	13.18	16.23	0.9733	17.07	20.86
0.9840	9.58	11.82	0.9786	13.25	16.31	0.9732	17.14	20.94
0.9839	9.65	11.90	0.9785	13.32	16.40	0.9731	17.21	21.03
0.9838	9.72	11.98	0.9784	13.39	16.48	0.9730	17.28	21.11
0.9837	9.78	12.06	0.9783	13.46	16.57	0.9729	17.35	21.20
0.9836	9.85	12.14	0.9782	13.53	16.65	0.9728	17.42	21.28
0.9835	9.92	12.23	0.9781	13.60	16.74	0.9727	17.49	21.37
0.9834	9.99	12.31	0.9780	13.67	16.82	0.9726	17.56	21.45
0.9833	10.06	12.39	0.9779	13.74	16.91	0.9725	17.63	21.54
0.9832	10.12	12.47	0.9778	13.82	16.99	0.9724	17.70	21.62
0.9831	10.19	12.55	0.9777	13.89	17.08	0.9723	17.77	21.71
0.9830	10.26	12.63	0.9776	13.96	17.16	0.9722	17.84	21.79
0.9829	10.33	12.71	0.9775	14.03	17.25	0.9721	17.91	21.88
0.9828	10.40	12.79	0.9774	14.11	17.33	0.9720	17.98	21.96
0.9827	10.46	12.87	0.9773	14.18	17.42	0.9719	18.05	22.05
0.9826	10.53	12.95	0.9772	14.25	17.50	0.9718	18.12	22.13
0.9825	10.60	13.04	0.9771	14.32	17.59	0.9717	18.19	22.22
0.9824	10.67	13.12	0.9770	14.40	17.68	0.9716	18.26	22.30
0.9823	10.74	13.20	0.9769	14.47	17.76	0.9715	18.33	22.39
0.9822	10.80	13.28	0.9768	14.54	17.85	0.9714	18.40	22.47
0.9821	10.87	13.36	0.9767	14.61	17.93	0.9713	18.47	22.56
0.9820	10.94	13.44	0.9766	14.69	18.02	0.9712	18.54	22.64
0.9819	11.01	13.52	0.9765	14.76	18.10	0.9711	18.61	22.73
0.9818	11.07	13.61	0.9764	14.83	18.19	0.9710	18.68	22.82
0.9817	11.14	13.69	0.9763	14.90	18.27	0.9709	18.75	22.90
0.9816	11.21	13.78	0.9762	14.98	18.36	0.9708	18.82	22.99
0.9815	11.27	13.86	0.9761	15.05	18.44	0.9707	18.89	23.07
0.9814	11.34	13.94	0.9760	15.12	18.53	0.9706	18.96	23.16
0.9813	11.41	14.03	0.9759	15.19	18.62	0.9705	19.03	23.24
0.9812	11.47	14.11	0.9758	15.27	18.70	0.9704	19.10	23.33
0.9811	11.54	14.20	0.9757	15.34	18.79	0.9703	19.17	23.41
0.9810	11.61	14.28	0.9756	15.41	18.88	0.9702	19.24	23.50
0.9809	11.67	14.36	0.9755	15.49	18.96	0.9701	19.31	23.58
0.9808	11.74	14.45	0.9754	15.56	19.05	0.9700	19.38	23.67
0.9807	11.80	14.53	0.9753	15.63	19.14	0.9699	19.45	23.75
0.9806	11.87	14.62	0.9752	15.70	19.22	0.9698	19.52	23.84
0.9805	11.94	14.70	0.9751	15.78	19.31	0.9697	19.59	23.92
0.9804	12.00	14.78	0.9750	15.85	19.40	0.9696	19.66	24.00
0.9803	12.07	14.87	0.9749	15.92	19.48	0.9695	19.73	24.09
0.9802	12.14	14.95	0.9748	16.00	19.56	0.9694	19.80	24.17
0.9801	12.20	15.04	0.9747	16.07	19.65	0.9693	19.87	24.25
0.9800	12.27	15.12	0.9746	16.14	19.74	0.9692	19.94	24.34
0.9799	12.34	15.21	0.9745	16.22	19.83	0.9691	20.01	24.42
0.9798	12.41	15.29	0.9744	16.29	19.91	0.9690	20.09	24.51
0.9797	12.48	15.38	0.9743	16.36	20.00	0.9689	20.16	24.59

METHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF METHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.
0.9688	20.23	24.67	0.9668	21.63	26.35	0.9648	23.03	27.99
0.9687	20.30	24.76	0.9667	21.70	26.43	0.9647	23.10	28.07
0.9686	20.37	24.84	0.9666	21.77	26.52	0.9646	23.17	28.18
0.9685	20.44	24.92	0.9665	21.84	26.60	0.9645	23.24	28.24
0.9684	20.51	25.01	0.9664	21.91	26.68	0.9644	23.31	28.32
0.9683	20.58	25.09	0.9663	21.98	26.77	0.9643	23.38	28.40
0.9682	20.65	25.17	0.9662	22.05	26.85	0.9642	23.45	28.48
0.9681	20.72	25.26	0.9661	22.12	26.94	0.9641	23.52	28.56
0.9680	20.79	25.34	0.9660	22.19	27.02	0.9640	23.59	28.64
0.9679	20.86	25.42	0.9659	22.26	27.10	0.9639	23.66	28.72
0.9678	20.93	25.51	0.9658	22.33	27.18	0.9638	23.75	28.80
0.9677	21.00	25.59	0.9657	22.40	27.26	0.9637	23.80	28.88
0.9676	21.07	25.68	0.9656	22.47	27.34	0.9636	23.88	28.96
0.9675	21.14	25.76	0.9655	22.54	27.43	0.9635	23.95	29.04
0.9674	21.21	25.84	0.9654	22.61	27.51	0.9634	24.02	29.11
0.9673	21.28	25.95	0.9653	22.68	27.59	0.9633	24.09	29.19
0.9672	21.33	26.01	0.9652	22.75	27.67	0.9632	24.16	29.27
0.9671	21.42	26.10	0.9651	22.82	27.75	0.9631	24.23	29.36
0.9670	21.49	26.18	0.9650	22.89	27.83	0.9630	24.31	29.43
0.9669	21.56	26.26	0.9649	22.96	27.91	0.9629	24.38	29.51

IMMERSION REFRACTOMETER READINGS OF METHYL AND ETHYL ALCOHOLS AT 20°C

By Leach and Lythgoe. Jour. Am. Chem. Soc. 27, 964 (1905)

% Alcohol by Weight	Methyl Alcohol	Ethyl Alcohol	% Alcohol by Weight	Methyl Alcohol	Ethyl Alcohol	% Alcohol by Weight	Methyl Alcohol	Ethyl Alcohol
0	14.5	14.5	35	35.8	75.8	70	33.0	100.0
1	14.8	16.0	36	36.3	76.9	71	32.3	100.2
2	15.4	17.6	37	36.8	78.0	72	31.7	100.4
3	16.0	19.1	38	37.3	79.1	73	31.1	100.6
4	16.6	20.7	39	37.7	80.2	74	30.4	100.8
5	17.2	22.3	40	38.1	81.3	75	29.7	101.0
6	17.8	24.1	41	38.4	82.3	76	29.0	101.0
7	18.4	25.9	42	38.8	83.3	77	28.3	100.9
8	19.0	27.8	43	39.2	84.2	78	27.6	100.9
9	19.6	29.6	44	39.3	85.2	79	26.8	100.8
10	20.2	31.4	45	39.4	86.2	80	26.0	100.7
11	20.8	33.2	46	39.5	87.0	81	25.1	100.6
12	21.4	35.0	47	39.6	87.8	82	24.3	100.5
13	22.0	36.9	48	39.7	88.7	83	23.6	100.4
14	22.6	38.7	49	39.8	89.5	84	22.8	100.3
15	23.2	40.5	50	39.8	90.3	85	21.8	100.1
16	23.9	42.5	51	39.7	91.1	86	20.8	99.8
17	24.5	44.5	52	39.6	91.8	87	19.7	99.5
18	25.2	46.5	53	39.6	92.4	88	18.6	99.2
19	25.8	48.5	54	39.5	93.0	89	17.3	98.9
20	26.5	50.5	55	39.4	93.6	90	16.1	98.6
21	27.1	52.4	56	39.2	94.1	91	14.9	98.3
22	27.8	54.3	57	39.0	94.7	92	13.7	97.8
23	28.4	56.3	58	38.6	95.2	93	12.4	97.2
24	29.1	58.2	59	38.3	95.7	94	11.0	96.4
25	29.7	60.1	60	37.9	96.2	95	9.6	95.7
26	30.3	61.9	61	37.5	96.7	96	8.2	94.9
27	30.9	63.7	62	37.0	97.1	97	6.7	94.0
28	31.6	65.5	63	36.5	97.5	98	5.1	93.0
29	32.2	67.2	64	36.0	98.0	99	3.5	92.0
30	32.8	69.0	65	35.5	98.3	100	2.0	91.0
31	33.5	70.4	66	35.0	98.7			
32	34.1	71.7	67	34.5	99.1			
33	34.7	73.1	68	34.0	99.4			
34	35.2	74.4	69	33.5	99.7			

Calculation of the percentage of ethyl and methyl alcohols in a mixture with water, assuming a distillate to have a sp. gr. of 0.97917 $\frac{15.56^\circ}{15.56^\circ}$ and a refraction of 30.0 at 20° on the immersion refractometer. — From the tables of sp. gr. for these alcohols the density is found to correspond to 13.70% and 12.83% by weight of ethyl and methyl alcohol respectively: from the table above, the refractometer readings corresponding to 13.70% ethyl and methyl alcohol are 38.16 and 22.42 respectively. Then $(38.16 - 30.0) / (38.16 - 22.42) \times 100 = 51.8\%$, or 51.8% of the alcohol in the distillate is methyl alcohol.

$(12.83 \times 0.518) + 13.70 \times (1 - 0.518) = 13.25$ which is the % by weight of the mixed alcohols in the distillate, of which 13.25×0.518 or 6.86% is methyl alcohol and $13.25 \times (1 - 0.518)$ or 6.39% is ethyl alcohol

DENSITY AND SPECIFIC GRAVITY OF GASES AND VAPORS

Name	Formula	Density g/10°C 760 mm	Density lbs./ft. ³ 32°F, 1 atm.	Specific gravity Air = 1	Specific gravity O ₂ = 1
Acetylene.....	C ₂ H ₂	1.173	0.07323	0.9073	0.8208
Air.....		1.2929	.08071	1.0000	0.9047
Ammonia.....	NH ₃	0.7710	.04813	0.5963	0.5395
Argon.....	A	1.7837	.11135	1.3796	1.2482
Arsenic fluoride.....	AsF ₅	7.71*	.481*	5.96*	5.40*
Arsenic hydride.....	AsH ₃	3.484*	.2175*	2.695*	2.438*
Boron fluoride.....	BF ₃	2.99*	.187*	2.31*	2.09*
Butane (n).....	C ₄ H ₁₀	2.5190†	.15725†	2.0854†	1.8868†
Butane, iso.....	C ₄ H ₁₀	2.673	.1669	2.067	1.870
Carbon dioxide.....	CO ₂	1.9769	.12341	1.5290	1.3834
Carbon monoxide.....	CO	1.2504	.07806	0.9671	0.8750
Carbon oxy sulfide.....	COS	2.72	.170	2.10	1.90
Chlorine.....	Cl ₂	3.214	.2006	2.486	2.249
Chlorine dioxide.....	ClO ₂	3.09 ¹¹	.193 ¹¹	2.39 ¹¹	2.16 ¹¹
Chlorine monoxide.....	Cl ₂ O	3.89	.243	3.01	2.72
Cyanogen.....	C ₂ N ₂	2.335*	.1458*	1.806*	1.634*
Dimethylamine.....	(CH ₃) ₂ NH	1.966 ¹⁷	.1227 ¹⁷	1.521 ¹⁷	1.376 ¹⁷
Ethane.....	C ₂ H ₆	1.3566	.08469	1.0493	0.9493
Ethylene.....	C ₂ H ₄	1.2604	.07868	0.9749	0.8820
Fluorine.....	F ₂	1.696	.1059	1.312	1.187
Germanium hydride (di- germane).....	Ge ₂ H ₆	6.74 ²⁰	.421 ²⁰	5.21 ²⁰	4.72 ²⁰
Germanium tetrahydride	GeH ₄	3.420	.2135	2.645	2.393
Helium.....	He	0.17847	.01114	0.13804	0.12489
Hydrogen.....	H ₂	0.08988	.005611	0.06952	0.06290
Hydrogen bromide.....	HBr	3.6445	.2275	2.8189	2.5503
Hydrogen chloride.....	HCl	1.6392	.10233	1.2678	1.1471
Hydrogen iodide.....	HI	5.7891	.3614	4.4776	4.0510
Hydrogen selenide.....	H ₂ Se	3.670	.229	2.839	2.568
Hydrogen sulfide.....	H ₂ S	1.539	.09608	1.190	1.077
Hydrogen telluride.....	H ₂ Te	5.81	.363	4.49	4.07
Krypton.....	Kr	3.708	.2315	2.868	2.595
Methane.....	CH ₄	0.7168	.04475	0.5544	0.5016
Methylamine.....	CH ₃ NH ₂	1.396	.08715	1.080	0.9769
Methyl chloride.....	CH ₃ Cl	2.3076	.1441	1.7848	1.6148
Methyl ether.....	(CH ₃) ₂ O	2.1098	.1317	1.6318	1.4764
Methyl fluoride.....	CH ₃ F	1.5452	.09646	1.1951	1.0813
Neon.....	Ne	0.90035	.05621	0.69638	0.63004
Nitric oxide.....	NO	1.3402	.08367	1.0366	0.9378
Nitrogen.....	N ₂	1.25055	.07807	0.96724	0.87510
Nitrogen (atm.).....		1.2568	.07846	0.9721	0.8795
Nitrosyl chloride.....	NOCl	2.992	.1868	2.314	2.094
Nitrosyl fluoride.....	NOF	2.176*	.1358*	1.683*	1.523*
Nitrous oxide.....	N ₂ O	1.9778	.1235	1.5297	1.3840
Nitroxyl chloride.....	NO ₂ Cl	2.57*	.160*	1.99*	1.798*
Nitroxyl fluoride.....	NO ₂ F	2.90	.181	2.24	2.03
Oxygen.....	O ₂	1.42904	.08921	1.10527	1.0000
Ozone.....	O ₃	2.144	.1338	1.658	1.500
Phosphine.....	PH ₃	1.5294	.09548	1.1829	1.0702
Phosphorus fluoride.....	PF ₃	3.907*	.2439*	3.022*	2.734*
Phosphorus oxyfluoride.....	POF ₃	4.8	.30	3.7	3.4
Phosphorus pentafluoride	PF ₅	5.81	.363	4.494	4.066
Propane.....	C ₃ H ₈	2.020	.1261	1.562	1.414

* Temperature not stated, probably 20°C.

† Both butane and air at 710 mm.

DENSITY AND SPECIFIC GRAVITY OF GASES AND VAPORS (Continued)

Name	Formula	Density g 10°C 760 mm	Density lbs. ft. ³ 32°F, 1 atm.	Specific gravity Air = 1	Specific gravity O ₂ = 1
Radon.....	Ra	9.73	.607	7.526	6.809
Silicane, chloro.....	SiH ₂ Cl	3.03	.189	2.34	2.12
Silicane, chloromethyl.....	SiH ₂ ClCH ₃	3.64	.227	2.82	2.55
Silicane, dichloromethyl.....	SiHCl ₂ CH ₃	5.3	.33	4.1	3.7
Silicane, dimethyl.....	SiH ₂ (CH ₃) ₂	2.73	.170	2.11	1.91
Silicane, methyl.....	SiH ₃ CH ₃	2.08	.130	1.61	1.46
Silicane, trifluoro.....	SiHF ₃	3.86	.241	2.99	2.70
Silicon fluoride.....	SiF ₄	4.684	.2924	3.623	3.278
Silicon hexahydride.....	Si ₂ H ₆	2.85	.178	2.204	1.994
Silicon tetrahydride.....	SiH ₄	1.44	.0899	1.114	1.008
Subine (15°C, 754 mm).....	SbH ₃	5.30	.331	4.10	3.71
Sulfur dioxide.....	SO ₂	2.9269	.1827	2.2638	2.0482
Sulfur fluoride.....	SF ₂	6.50*	.406*	5.03*	4.55*
Sulfuric oxyfluoride.....	SO ₂ F ₂	3.72*	.232*	2.88*	2.60*
Trimethylamine.....	(CH ₃) ₃ N	2.580	.1611	1.996	1.805
Trimethyl boron.....	(CH ₃) ₃ B	2.52	.157	1.95	1.76
Tungsten fluoride.....	WF ₆	12.9	.805	9.98	9.03
Xenon.....	Xe	5.851	.3653	4.525	4.094

* Temperature not stated, probably 20°C.

DENSITY OF ELEMENTS

The density is given in grams per cubic centimeter and pounds per cubic foot at the temperature stated. Where no temperature is given ordinary atmospheric temperature is understood.

Element	Temp. °C.	Density gm./c.c.	Lbs. per cu. ft.	Observer
Aluminum, hard drawn.....	20	2.699	168.5	Edwards, 1925
liquid.....	659	2.382	148.7	Moorman, 1921
Antimony, vacuo-distilled.....	20	6.618	413.1	Kahlbaum, 1902
compressed.....	20	6.691	417.7	Kahlbaum, 1902
amorphous.....	.....	6.22	388.3	Herard
Argon, liquid.....	-183	1.3845	86.4	Baly-Donnan
.....	-189	1.4233	88.9	Baly-Donnan
Arsenic, metallic.....	15	5.73	357.7	Lashchenko, 1922
amorphous, brown-black.....	.....	3.70	231.0	Guenther [1908
yellow.....	18	2.0	124.9	Erdmann & Reppert,
Barium.....	.....	3.78	236.0	Guntz
.....	25	3.5	218.5	Biltz & Hüttig, 1920
Bismuth, electrolytic.....	.....	9.747	608.5	Classen, 1890 [1912
.....	20	9.80	611.8	Johnston & Adams,
vacuo-distilled.....	20	9.781	610.6	Kahlbaum, 1902
liquid.....	271	10.00	624.3	Vincentini-Omodei
.....	271	10.24	639.25	Plüss, 1915
solid.....	271	9.67	603.7	Vincentini-Omodei
Boron, crystal.....	.....	2.535	158.3	Wigand
amorphous.....	.....	2.45	152.9	Moissan
Bromine, liquid.....	.....	3.12	194.8	Richards-Stull
Cadmium, cast.....	20	8.648	539.9	Egerton & Lee, 1923
wrought.....	.....	8.67	541.2	.....
vacuo-distilled.....	20	8.648	539.9	Kahlbaum, 1902
solid.....	318	8.37	522.5	Vincentini-Omodei
liquid.....	318	7.99	498.8	Vincentini-Omodei
.....	349	7.94	495.7	Arpi, 1914
Caesium.....	20	1.873	116.9	Richards-Brink
Calcium.....	.....	1.54	96.1	Brink
Carbon, crystal.....	.....	3.52	219.7	Wigand
graphite.....	.....	2.25	140.5	Wigand
Cerium, electrolytic.....	.....	6.79	423.9	Muthmann-Weiss
pure.....	.....	6.9	430.7	Muthmann-Weiss
Chlorine, liquid.....	-33.6	1.507	94.1	Drugman-Ramsay
Chromium.....	.....	6.52-73	407.0-420.1	.....
pure.....	20	6.92	432.0	Moissan
.....	.....	7.1	443.2	Richards, 1907
Cobalt.....	21	8.71	543.7	Tilden [1915
.....	.....	8.9	555.6	Kalmus & Harper.
Columbium.....	15	8.4	524.4	Muthmann-Weiss
Copper, cast.....	.....	8.30-95	518.1-558.7	.....
annealed.....	20	8.89	555.0	Dellinger, 1911
wrought.....	.....	8.85-95	552.5-558.7	.....
hard-drawn.....	20	8.89	555.0	Dellinger, 1911
vacuo-distilled.....	20	8.9326	557.6	Kahlbaum, 1902
compressed.....	20	8.9376	558.0	Kahlbaum, 1902

DENSITY OF ELEMENTS (Continued)

Element	Temp. °C.	Density gm./c.c.	Lbs. per cu. ft.	Observer
liquid.....	.....	8.217	513.0	Roberts-Wrightson
Erbium.....	.....	4.77(?)	298.0	St. Meyer
Fluorine, liquid.....	-200	1.14	71.2	Moissan-Dewar
Gallium.....	25	5.903	369.1	Bur. of Stand., 1934
Germanium.....	20	5.46	340.9	Winkler [1913]
Glucinum (Beryllium).....	20	1.84	114.9	Fichter & Jableczynski,
Gold, cast.....	.....	19.3	1204.8	
cold rolled.....	20	19.296	1204.6	Rose, 1912
wrought.....	.....	19.33	1206.7	[1905]
drawn annealed.....	20	19.26	1202.3	Kahlbaum & Sturm,
vacuo-distilled.....	20	18.88	1178.6	Kahlbaum, 1902
compressed.....	20	19.27	1203.0	Kahlbaum, 1902
Helium, liquid.....	-269	0.15	9.4	Onnes
Hydrogen, liquid.....	-252	0.07	4.4	Dewar, 1904
Indium.....	.....	7.28	454.5	Richards
Iridium.....	17	22.42	1399.6	Deville-Debray
Iodine.....	20	4.94	308.4	Richards-Stull
Iron, pure.....	.....	7.85-88	490.1-491.9	[1924]
electrolytic, rolled.....	20	7.90	493.2	Tritton & Hanson,
gray cast.....	.....	7.03-13	438.9-445.1	
white cast.....	.....	7.58-73	473.2-482.6	
wrought.....	.....	7.80-90	486.9-493.2	
liquid.....	.....	6.88	429.5	
steel.....	.....	7.60-80	474.4-486.9	Roberts-Austen
Krypton, liquid.....	-146	2.16	134.8	Ramsay-Travers
Lanthanum.....	.....	6.15	383.9	Muthmann-Weiss
Lead, vacuo-distilled.....	20	11.342	708.0	Kahlbaum, 1902
compressed.....	20	11.347	708.4	Kahlbaum, 1902
solid.....	325	11.005	687.0	Vincentini-Omodei
liquid.....	325	10.645	664.5	Vincentini-Omodei
.....	400	10.597	661.5	Day, Sosman, 1914
.....	850	10.078	629.1	Day, Sosman, 1914
Lithium.....	20	0.534	33.3	Richards-Brink, 1907
Magnesium.....	.....	1.741	108.7	Voigt
Manganese.....	.....	7.42	463.2	Prelinger
Mercury, liquid.....	0	13.596	848.8	Regnault, Volkmann
.....	20	13.546	845.6	
.....	-38.8	13.690	854.6	
solid.....	-38.8	14.193	886.0	Vincentini-Omodei
.....	-188	14.383	897.9	Vincentini-Omodei
Molybdenum.....	.....	9.01	562.5	Dewar, 1902
.....	.....	10.2	636.8	Moissan
Neodymium.....	.....	6.96	434.5	Fink, 1910
Nickel.....	.....	8.60-90	536.9-555.6	Muthmann-Weiss
Nitrogen, liquid.....	-195	0.81	50.6	Baly-Donnan, 1902
.....	-205	0.854	53.3	Baly-Donnan, 1902
Osmium.....	.....	22.5	1404.6	Deville-Debray
Oxygen, liquid.....	-184	1.14	71.2	
Palladium.....	.....	12.16	759.1	Richards-Stull
Phosphorus, white.....	.....	1.83	114.2	
red.....	.....	2.20	137.3	
metallic.....	15	2.34	146.1	Hittorf
Platinum.....	20	21.37	1334.1	Richards-Stull
Potassium.....	20	0.87	54.3	Richards-Brink, 1907
solid.....	62.1	0.851	53.1	Vincentini-Omodei
liquid.....	62.1	0.83	51.8	Vincentini-Omodei
Praesodymium.....	.....	6.475	404.2	Muthmann-Weiss
Rhodium.....	.....	12.44	776.6	Holborn-Henning
Rubidium.....	20	1.532	95.6	Richards-Brink, 1907
Ruthenium.....	0	12.06	752.9	Toby
Samarium.....	.....	7.7-8	480.7-486.9	Muthmann-Weiss

DENSITY OF ELEMENTS (Continued)

Element	Temp. °C.	Density gm./c.c.	Lbs. per cu. ft.	Observer
Selenium.....	.....	4.3-8	268.4-299.6	
Silicon, crystal.....	20	2.42	151.1	Richards-Stull-Brink
amorphous.....	15	2.35	146.7	Vigorous
Silver, cast.....	.....	10.42-53	650.5-657.4	
wrought.....	.....	10.6	661.7	
vacuo-distilled.....	20	10.492	655.0	Kahlbaum, 1902
compressed.....	20	10.503	655.7	Kahlbaum, 1902
liquid.....	.....	9.51	593.7	Wrightson
Sodium.....	20	0.9712	60.6	Richards-Brink, 1907
solid.....	97.6	0.9519	59.4	Vincentini-Omodei
liquid.....	97.6	0.9287	58.0	Vincentini-Omodei
solid.....	-188	1.0066	62.8	Dewar
Strontium.....	.....	2.50-58	156.1-161.1	Matthiessen
Sulfur.....	.....	2.0-1	124.9-131.1	
liquid.....	.....	1.811	112.1	Vincentini-Omodei
Tantalum.....	.....	16.6	1036.3	
Tellurium, crystal.....	.....	6.25	390.2	
amorphous.....	20	6.02	375.8	Beljankin
Thallium.....	.....	11.86	740.4	Richards-Stull [1925]
Thorium.....	.....	11.3-11.7	705.4-730.4	Rentschler, Marden,
Tin, white cast.....	.....	7.29	455.1	Matthiessen
wrought.....	.....	7.30	455.7	
crystallized.....	.....	6.97-7.18	435.1-448.2	
solid.....	226	7.184	448.5	Vincentini-Omodei
liquid.....	226	6.99	436.4	Vincentini-Omodei
gray.....	.....	5.8	362.1	
Titanium.....	18	4.5	280.9	Mixter
Tungsten.....	.....	18.6-19.1	1161.1-1192.4	
Uranium.....	13	18.7	1167.4	Zimmermann
Vanadium.....	.....	5.69	355.3	Ruff-Martin
	20	5.96	372.1	Hull, 1922
Xenon, liquid.....	-109	3.52	219.7	Ramsay-Travers
Yttrium.....	.....	3.80	237.2	St. Meyer
Zinc, cast.....	.....	7.04-16	439.5-447.0	
wrought.....	.....	7.19	448.9	
vacuo-distilled.....	20	6.92	432.0	Kahlbaum, 1902
compressed.....	20	7.13	445.1	Kahlbaum, 1902
liquid.....	.....	6.48	404.5	Roberts-Wrightson
Zirconium.....	.....	6.44	402.0	

DENSITY OF ALLOYS

The density is given in grams per cubic centimeter at ordinary atmospheric temperatures.

Alloy.	Composition.	g./cm. ³	Pounds per cu. ft.
Aluminum and copper	10 Al, 90 Cu	7.69	480.06
	5 Al, 95 Cu	8.37	522.51
	3 Al, 97 Cu	8.69	542.49
Aluminum and zinc..	91 Al, 9 Zn	2.80	174.80
Bell metal.....	78 Cu, 22 Sn	8.70	543.11
Bismuth, lead and tin	53 Bi, 40 Pb, 7 Sn	10.56	659.23

DENSITY OF ALLOYS (Continued)

Alloy.	Composition.	g/cm. ³	Pounds per cu. ft.
Brass, yellow. . . .	70 Cu, 30 Zn cast	8.44	526.88
	rolled	8.56	534.38
	drawn	8.70	543.11
red.	90 Cu, 10 Zn.	8.60	536.87
white.	50 Cu, 50 Zn.	8.20	511.01
Bronze.	90 Cu, 10 Sn (gun metal)	8.78	548.11
	85 Cu, 15 Sn	8.89	554.98
	80 Cu, 20 Sn	8.74	545.61
	75 Cu, 25 Sn	8.83	551.23
Cadmium and tin	32 Cd, 68 Sn	7.70	480.69
Constantan.	60 Cu, 40 Ni	8.88	554.35
German silver. . . .	26.3 Cu, 36.6 Zn, 36.8 Ni	8.30	518.14
	52 Cu, 26 Zn, 22 Ni	8.45	527.51
	59 Cu, 30 Zn, 11 Ni	8.34	520.64
	63 Cu, 30 Zn, 6 Ni	8.30	518.14
Gold and copper	98 Au, 2 Cu	18.84	1176.12
	96 Au, 4 Cu	18.36	1146.16
	94 Au, 6 Cu	17.95	1120.56
	92 Au, 8 Cu	17.52	1093.72
	90 Au, 10 Cu	17.16	1071.25
	88 Au, 12 Cu	16.81	1049.40
	86 Au, 14 Cu	16.47	1028.17
	63.8 Fe, 36 Ni, 0.2 C	8.00	499.42
Lead and tin.	87.5 Pb, 12.5 Sn	10.60	661.73
	84 Pb, 16 Sn	10.33	644.87
	77.8 Pb, 22.2 Sn	10.05	627.39
	63.7 Pb, 36.3 Sn	9.43	588.69
	46.7 Pb, 53.3 Sn	8.73	544.99
	30.5 Pb, 69.5 Sn	8.24	514.40
Magnalium.	90 Al, 10 Mg	2.50	156.07
	70 Al, 30 Mg	2.00	124.85
Manganese bronze	95 Cu, 5 Mn	8.80	549.36
Manganin.	84 Cu, 12 Mn, 4 Ni	8.50	530.63
Monel metal.	71 Ni, 27 Cu, 2 Fe	8.90	555.60
Nickelin. . . . .	.....	8.77	547.48
Phosphor bronze	79.7 Cu, 10 Sn, 9.5 Sb, 0.8 P	8.80	549.36
Platinum and iridium.	90 Pt, 10 Ir	21.62	1349.67
	85 Pt, 15 Ir	21.62	1349.67
	66.67 Pt, 33.33 Ir	21.87	1365.28
	5 Pt, 95 Ir	22.38	1397.12
Speculum metal. .	67 Cu, 33 Sn	8.60	536.87
Steel.	99 Fe, 1 C	7.83	488.80
	86 Fe, 13 Mn, 1 C	7.81	487.55
Wood's metal. . . .	50 Bi, 25 Pb, 12.5 Cd, 12.5 Sn	9.70	659.23

DENSITY OF VARIOUS SOLIDS

The approximate density of various solids at ordinary atmospheric temperature.

In the case of substances with voids such as paper or leather the bulk density is indicated rather than the density of the solid portion.

(Selected principally from the Smithsonian Tables.)

Substance	Grams per cu. cm	Pounds per cu. ft.	Substance	Grams per cu. cm	Pounds per cu. ft.
Agate.....	2.5-2.7	156-168	Garnet.....	3.15-4.3	197-268
Alabaster, carbon- ate.....	2.69-2.78	168-173	Gas carbon.....	1.88	117
sulfate.....	2.26-2.32	141-145	Gelatin.....	1.27	79
Albite.....	2.62-2.65	163-165	Glass, common.....	2.4-2.8	150-175
Amber.....	1.06-1.11	66-69	flint.....	2.9-5.9	180-370
Amphiboles.....	2.9-3.2	180-200	Glue.....	1.27	79
Anorthite.....	2.74-2.76	171-172	Granite.....	2.64-2.76	165-172
Asbestos.....	2.0-2.8	125-175	Graphite.....	2.30-2.72	144-170
Asbestos slate.....	1.8	112	Gum arabic.....	1.3-1.4	81-87
Asphalt.....	1.1-1.5	69-94	Gypsum.....	2.31-2.33	144-145
Basalt.....	2.4-3.1	150-190	Hematite.....	4.9-5.3	306-330
Beeswax.....	0.96-0.97	60-61	Hornblende.....	3.0	187
Beryl.....	2.69-2.7	168-169	Ice.....	0.917	57.2
Biotite.....	2.7-3.1	170-190	Ivory.....	1.83-1.92	114-120
Bone.....	1.7-2.0	106-125	Leather, dry.....	0.86	54
Brick.....	1.4-2.2	87-137	Lime, slaked.....	1.3-1.4	81-87
Butter.....	0.86-0.87	53-54	Limestone.....	2.68-2.76	167-171
Calamine.....	4.1-4.5	255-280	Linoleum.....	1.18	74
Calc spar.....	2.6-2.8	162-175	Magnetite.....	4.9-5.2	306-324
Camphor.....	0.99	62	Malachite.....	3.7-4.1	231-256
Caoutchouc.....	0.92-0.99	57-62	Marble.....	2.6-2.84	160-177
Cardboard.....	0.69	43	Meerschaum.....	0.99-1.28	62-80
Celluloid.....	1.4	87	Mica.....	2.6-3.2	165-200
Cement, set.....	2.7-3.0	170-190	Muscovite.....	2.76-3.00	172-187
Chalk.....	1.9-2.8	118-175	Ochre.....	3.5	218
Charcoal, oak.....	0.57	35	Opal.....	2.2	137
pine.....	0.28-0.44	18-28	Paper.....	0.7-1.15	44-72
Cinnabar.....	8.12	507	Paraffin.....	0.87-0.91	54-57
Clay.....	1.8-2.6	112-162	Peat blocks.....	0.84	52
Coal, anthracite.....	1.4-1.8	87-112	Pitch.....	1.07	67
bituminous.....	1.2-1.5	75-94	Porcelain.....	2.3-2.5	143-156
Cocoa butter.....	0.89-0.91	56-57	Porphyry.....	2.6-2.9	162-181
Coke.....	1.0-1.7	62-105	Pressed wood pulp board.....	0.19	12
Copal.....	1.04-1.14	65-71	Pyrite.....	4.95-5.1	309-318
Cork.....	0.22-0.26	14-16	Quartz.....	2.65	165
Cork linoleum.....	0.54	34	Resin.....	1.07	67
Corundum.....	3.9-4.0	245-250	Rock salt.....	2.18	136
Diamond.....	3.01-3.52	188-220	Rubber, hard.....	1.19	74
Dolomite.....	2.84	177	Rubber, soft commercial.....	1.1	69
Ebonite.....	1.15	72	pure gum.....	0.91-0.93	57-58
Emery.....	4.0	250	Sandstone.....	2.14-2.36	134-147
Epidote.....	3.25-3.50	203-218	Serpentine.....	2.50-2.65	156-165
Feldspar.....	2.55-2.75	159-172	Silica, fused trans- parent.....	2.21	138
Flint.....	2.63	164	translucent.....	2.07	129
Fluorite.....	3.18	198	Slag.....	2.0-3.9	125-240
Galena.....	7.3-7.6	460-470			
Gamboge.....	1.2	75			

DENSITY OF VARIOUS SOLIDS (Continued)

Substance	Grams per cu. cm	Pounds per cu. ft.	Substance	Grams per cu. cm	Pounds per cu. ft.
Slate.....	2.6-3.3	162-205	elm.....	0.54-0.60	34-37
Soapstone.....	2.6-2.8	162-175	hickory.....	0.60-0.93	37-58
Spermaceti.....	0.95	59	holly.....	0.76	47
Starch.....	1.53	95	juniper.....	0.56	35
Sugar.....	1.59	99	larch.....	0.50-0.56	31-35
Talc.....	2.7-2.8	168-174	lignum vitae...	1.17-1.33	73-83
Tallow, beef.....	0.94	59	locust.....	0.67-0.71	42-44
mutton.....	0.94	59	logwood.....	0.91	57
Tar.....	1.02	66	mahogany		
Topaz.....	3.5-3.6	219-223	Honduras...	0.66	41
Tourmaline.....	3.0-3.2	190-200	Spanish.....	0.85	53
Wax, sealing.....	1.8	112	maple.....	0.62-0.75	39-47
Wood (seasoned)			oak.....	0.60-0.90	37-56
alder.....	0.42-0.68	26-42	pear.....	0.61-0.73	38-45
apple.....	0.66-0.84	41-52	pine, pitch.....	0.83-0.85	52-53
ash.....	0.65-0.85	40-53	white.....	0.35-0.50	22-31
balsa.....	0.11-0.14	7-9	yellow.....	0.37-0.60	23-37
bamboo.....	0.31-0.40	19-25	plum.....	0.66-0.78	41-49
basswood.....	0.32-0.59	20-37	poplar.....	0.35-0.5	22-31
beech.....	0.70-0.90	43-56	satinwood.....	0.95	59
birch.....	0.51-0.77	32-48	spruce.....	0.48-0.70	30-44
blue gum.....	1.00	62	sycamore.....	0.40-0.60	24-37
box.....	0.95-1.16	59-72	teak, Indian.....	0.66-0.88	41-55
butternut.....	0.38	24	African.....	0.98	61
cedar.....	0.49-0.57	30-35	walnut.....	0.64-0.70	40-43
cherry.....	0.70-0.90	43-56	water gum.....	1.00	62
dogwood.....	0.76	47	willow.....	0.40-0.60	24-37
ebony.....	1.11-1.33	69-83			

For the specific gravity of other substances the reader is referred to the following tables:

Physical Constants of Inorganic and Metal-Organic Compounds

Physical Constants of Organic Compounds

Constants of Vegetable and Animal Oils, Fats and Waxes

Physical and Chemical Constants of Resins, Oleo-Resins and Gum-Resins

Physical Constants of Minerals

Composition and Physical Properties of Alloys

Properties of Commercial Plastics

Physical Properties of Common Woods

DENSITY OF WATER

The temperature of maximum density for pure water, free from air = **3.98°C.**

The density at this temperature = **0.999973 g/cm³.**

The density of water at 3.98° C is 1.000000 g/ml.

(International Bureau of Weights and Measures, 1910.)

DENSITY OF VARIOUS LIQUIDS

(Selected from Smithsonian Tables.)

Liquid	Grams per cu. cm	Pounds per cu. ft.	Temp. ° C
Acetone.....	0.792	49.4	20°
Alcohol, ethyl.....	0.791	49.4	20
methyl.....	0.810	50.5	0
Benzene.....	0.899	56.1	0
Carbolic acid.....	0.950-0.965	59.2-60.2	15
Carbon disulfide.....	1.293	80.7	0
tetrachloride.....	1.595	99.6	20
Chloroform.....	1.489	93.0	20
Ether.....	0.736	45.9	0
Gasoline.....	0.66-0.69	41.0-43.0	..
Glycerin.....	1.260	78.6	0
Kerosene.....	0.82	51.2	..
Mercury.....	13.6	849.0	..
Milk.....	1.028-1.035	64.2-64.6	..
Naphtha, petroleum ether.....	0.665	41.5	15
wood.....	0.848-0.810	52.9-50.5	0
Oils:			
castor.....	0.969	60.5	15
cocoanut.....	0.925	57.7	15
cotton seed.....	0.926	57.8	16
creosote.....	1.040-1.100	64.9-68.6	15
linseed, boiled.....	0.942	58.8	15
olive.....	0.918	57.3	15
Sea water.....	1.025	63.99	15
Turpentine (spirits).....	0.87	54.3	..
Water.....	1.00	62.43	4

DENSITY OF ALCOHOL

DENSITY OF ETHYL ALCOHOL IN GRAMS PER CUBIC CENTIMETER,
COMPUTED FROM MENDELEEFF'S FORMULA

(Selected from Smithsonian Tables.)

Temp. ° C	0	1	2	3	4
0	.80625	.80541	.80457	.80374	.80290
10	.79788	.79704	.79620	.79535	.79451
20	.78945	.78860	.78775	.78691	.78606
30	.78097	.78012	.77927	.77841	.77756
Temp. ° C	5	6	7	8	9
0	.80207	.80123	.80039	.79956	.79872
10	.79367	.79283	.79198	.79114	.79029
20	.78522	.78437	.78352	.78267	.78182
30	.77671	.77585	.77500	.77414	.77329

HYDROMETERS AND DENSITY UNITS

Alcoholometer. — For testing alcoholic solutions; the scale shows the per cent of alcohol by volume; 0°–100° is the per cent.

Ammoniameter. — For testing ammonia solutions; scale 0°–40°; to convert to sp. gr. multiply by 3 and deduct from 1000.

Barkrometer or Barkometer. — For testing tanning liquor; scale 0°–80° Bk; the number to the right of the decimal point of the sp. gr. is the degree Bk; thus, 1.025 sp. gr. is 25° Bk.

Baumé. — There are two kinds in use; heavy Bé, for liquids heavier than water and light Bé for liquids lighter than water. In the former, 0° corresponds to a sp. gr. 1.000 (water at 4°C.) and 66° corresponds to a sp. gr. 1.842; in the lighter than water scale, 0° Bé is equivalent to the gravity of a 10% solution of sodium chloride and 60° Bé corresponds to a sp. gr. of 0.745. For Baumé degrees on the scale of densities greater than unity, the following equation gives the means of conversion:

$$\text{Sp. gr.} = \frac{m}{m - d} \quad \text{where } m = 145 \text{ (in the United States)}$$

$$m = 144 \text{ (old scale used in Holland)}$$

$$m = 146.78 \text{ (New scale or Gerlach scale)}$$

$$d = \text{Baumé reading}$$

Beck's Hydrometer has 0° corresponding to sp. gr. 1.000 and 30° to sp. gr. 0.850; equal divisions on the scale are continued as far as required in both directions.

Brix Saccharometer or Balling Saccharometer shows directly the per cent of sugar (sucrose) by weight at the temperature indicated on the instrument, usually 17.5°C.; i.e., degrees Brix is the per cent sugar.

Cartier's Hydrometer floats in water at the 10° scale division and at 30° corresponds to 32° Bé.

Oleometer. — For vegetable and sperm oils; scale 50°–0° corresponds to sp. gr. 0.870–0.970.

Soxhlet's Lactometer, for determining the density of milk, has a scale from 25° (sp. gr. 1.025) to 35° (sp. gr. 1.035) divided into suitable scale divisions.

Twaddell Hydrometers have the scale so arranged that the reading multiplied by 5 and added to 1000 gives the sp. gr. with reference to water as 1000; it is always used for densities greater than water.

HYDROMETER CONVERSION TABLES

SHOWING THE RELATION BETWEEN DENSITY (C. G. S.) AND DEGREES BAUMÉ FOR DENSITIES LESS THAN UNITY.

Density.	Degrees Baumé.				
	.00	.01	.02	.03	.04
0.60	103.33	99.51	95.81	92.22	88.75
.70	70.00	67.18	64.44	61.78	59.19
.80	45.00	42.84	40.73	38.68	36.67
.90	25.56	23.85	22.17	20.54	18.94
1.00	10.00	.....	.....	.....	.....

Density.	Degrees Baumé.				
	.05	.06	.07	.08	.09
0.60	85.38	82.12	78.95	75.88	72.90
.70	56.67	54.21	51.82	49.49	47.22
.80	34.71	32.79	30.92	29.09	27.30
.90	17.37	15.83	14.33	12.86	11.41
1.00	.....	.....	.....	.....	.....

HYDROMETER CONVERSION TABLES

(Continued)

SHOWING THE RELATION BETWEEN DENSITY (C. G. S.) AND THE
BAUMÉ AND TWADDELL SCALES FOR DENSITIES ABOVE UNITY.

Density.	Degrees Baumé.	Degrees Twaddell.	Density.	Degrees Baumé.	Degrees Twaddell.
1.00	0.00	0	1.41	42.16	82
1.01	1.44	2	1.42	42.89	84
1.02	2.84	4	1.43	43.60	86
1.03	4.22	6	1.44	44.31	88
1.04	5.58	8	1.45	45.00	90
1.05	6.91	10	1.46	45.68	92
1.06	8.21	12	1.47	46.36	94
1.07	9.49	14	1.48	47.03	96
1.08	10.74	16	1.49	47.68	98
1.09	11.97	18	1.50	48.33	100
1.10	13.18	20	1.51	48.97	102
1.11	14.37	22	1.52	49.60	104
1.12	15.54	24	1.53	50.23	106
1.13	16.68	26	1.54	50.84	108
1.14	17.81	28	1.55	51.45	110
1.15	18.91	30	1.56	52.05	112
1.16	20.00	32	1.57	52.64	114
1.17	21.07	34	1.58	53.23	116
1.18	22.12	36	1.59	53.80	118
1.19	23.15	38	1.60	54.38	120
1.20	24.17	40	1.61	54.94	122
1.21	25.16	42	1.62	55.49	124
1.22	26.15	44	1.63	56.04	126
1.23	27.11	46	1.64	56.58	128
1.24	28.06	48	1.65	57.12	130
1.25	29.00	50	1.66	57.65	132
1.26	29.92	52	1.67	58.17	134
1.27	30.83	54	1.68	58.69	136
1.28	31.72	56	1.69	59.20	138
1.29	32.60	58	1.70	59.71	140
1.30	33.46	60	1.71	60.20	142
1.31	34.31	62	1.72	60.70	144
1.32	35.15	64	1.73	61.18	146
1.33	35.98	66	1.74	61.67	148
1.34	36.79	68	1.75	62.14	150
1.35	37.59	70	1.76	62.61	152
1.36	38.38	72	1.77	63.08	154
1.37	39.16	74	1.78	63.54	156
1.38	39.93	76	1.79	63.99	158
1.39	40.68	78	1.80	64.44	160
1.40	41.43	80	....	.....	...

ABSOLUTE DENSITY OF WATER

DENSITY IN GRAMS PER CUBIC CENTIMETER, COMPUTED FROM THE RELATIVE VALUES BY THIESEN, SCHEEL AND DISSELHORST (1900), AND THE ABSOLUTE VALUE AT 3.98° C. BY THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES (1910).

Degrees	0	1	2	3	4	5	6	7	8	9
0	0.999841	847	854	860	866	872	878	884	889	895
1	900	905	909	914	918	923	927	930	934	938
2	941	944	947	950	953	955	958	960	962	964
3	965	967	968	969	970	971	972	972	973	973
4	973	973	973	972	972	972	970	969	968	966
5	965	963	961	959	957	955	952	950	947	944
6	941	938	935	931	927	924	920	916	911	907
7	902	898	893	888	883	877	872	866	861	855
8	849	843	837	830	824	817	810	803	796	789
9	781	774	766	758	751	742	734	726	717	709
10	700	691	682	673	664	654	645	635	625	615
11	605	595	585	574	564	553	542	531	520	509
12	498	486	475	463	451	439	427	415	402	390
13	377	364	352	339	326	312	299	285	272	258
14	244	230	216	202	188	173	159	144	129	114
15	099	084	069	054	038	023	007	*991	*975	*959
16	0.998943	926	910	893	877	860	843	826	809	792
17	774	757	739	722	704	686	668	650	632	613
18	595	576	558	539	520	501	482	463	444	424
19	405	385	365	345	325	305	285	265	244	224
20	203	183	162	141	120	099	078	056	035	013
21	0.997992	970	948	926	904	882	860	837	815	792
22	770	747	724	701	678	655	632	608	585	561
23	538	514	490	466	442	418	394	369	345	320
24	296	271	246	221	196	171	146	120	095	069
25	044	018	*992	*967	*941	*914	*888	*862	*836	*809
26	0.996783	756	729	703	676	649	621	594	567	540
27	512	485	457	429	401	373	345	317	289	261
28	232	204	175	147	118	089	060	031	002	*973
29	0.995944	914	885	855	826	796	766	736	706	676
30	646	616	586	555	525	494	464	433	402	371

RELATIVE DENSITY AND VOLUME OF WATER

The mass of one cubic centimeter of water at 4° C is taken as unity.
The values given are numerically equal to the absolute density in grams per milliliter.

(Smithsonian Tables, compiled from Various Authors.)

Temp. ° C.	Density.	Volume.	Temp. ° C.	Density.	Volume
-10	0.99815	1.00186	+35	0.99406	1.00598
-9	843	157	36	371	633
-8	869	131	37	336	669
-7	892	108	38	299	706
-6	912	088	39	262	743
-5	0.99930	1.00070	40	0.99224	1.00782
-4	945	055	41	186	821
-3	958	042	42	147	861
-2	970	031	43	107	901
-1	979	021	44	066	943
+0	0.99987	1.00013	45	0.99025	1.00985
1	993	007	46	0.98982	1.01028
2	997	003	47	940	072
3	999	001	48	896	116
4	1.00000	1.00000	49	852	162
5	0.99999	1.00001	50	0.98807	1.01207
6	997	003	51	762	254
7	993	007	52	715	301
8	988	012	53	669	349
9	981	019	54	621	398
10	0.99973	1.00027	55	0.98573	1.01448
11	963	037	60	324	705
12	952	048	65	059	979
13	940	060	70	0.97781	1.02270
14	927	073	75	489	576
15	0.99913	1.00087	80	0.97183	1.02899
16	897	103	85	0.96865	1.03237
17	880	120	90	534	590
18	862	138	95	192	959
19	843	157	100	0.95838	1.04343
20	0.99823	1.00177	110	0.9510	1.0515
21	802	198	120	0.9434	1.0601
22	780	221	130	0.9352	1.0693
23	756	244	140	0.9264	1.0794
24	732	268	150	0.9173	1.0902
25	0.99707	1.00294	160	0.9075	1.1019
26	681	320	170	0.8973	1.1145
27	654	347	180	0.8866	1.1279
28	626	375	190	0.8750	1.1429
29	597	405	200	0.8628	1.1590
30	0.99567	1.00435	210	0.850	1.177
31	537	466	220	0.837	1.195
32	505	497	230	0.823	1.215
33	473	530	240	0.809	1.236
34	440	563	250	0.794	1.259

DENSITY AND VOLUME OF MERCURY

BASED ON THE DENSITY OF MERCURY AT 0° C. BY THIESEN AND SCHEEL
(1898)

(Selected from Smithsonian Tables.)

Temp. ° C.	Mass in gr. per cu.cm.	Vol. of 1 gr. in cu.cms.	Temp. ° C.	Mass in gr. per cu.cm.	Vol. in 1 gr. in cu.cms.
-10	13.6202	0.0734205	30°	13.5217	0.0739552
-9	6177	4338	31	5193	9686
-8	6152	4472	32	5168	9820
-7	6128	4606	33	5144	9953
-6	6103	4739	34	5119	40087
-5	13.6078	0.0734873	35	13.5095	0.0740221
-4	6053	5006	36	5070	0354
-3	6029	5140	37	5046	0488
-2	6004	5273	38	5021	0622
-1	5979	5407	39	4997	0756
0	13.5955	0.0735540	40	13.4973	0.0740891
1	5930	5674	50	4729	2229
2	5906	5808	60	4486	3569
3	5881	5941	70	4244	4910
4	5856	6075	80	4003	6252
5	13.5832	0.0736209	90	13.3762	0.0747594
6	5807	6342	100	3522	8939
7	5782	6476	110	3283	50285
8	5758	6610	120	3044	1633
9	5733	6744	130	2805	2982
10	13.5708	0.0736877	140	13.2567	0.0754334
11	5684	7011	150	2330	5688
12	5659	7145	160	2093	7044
13	5634	7278	170	1856	8402
14	5610	7412	180	1620	9764
15	13.5585	0.0737546	190	13.1384	0.0761128
16	5561	7680	200	1148	2495
17	5536	7813	210	0913	3865
18	5512	7947	220	0678	5239
19	5487	8081	230	0443	6616
20	13.5462	0.0738215	240	13.0209	0.0767996
21	5438	8348	250	12.9975	9381
22	5413	8482	260	9741	70769
23	5389	8616	270	9507	2161
24	5364	8750	280	9273	3558
25	13.5340	0.0738883	290	12.9039	0.0774958
26	5315	9017	300	8806	6364
27	5291	9151	310	8572	7774
28	5266	9285	320	8339	9189
29	5242	9419	330	8105	80609
30	13.5217	0.0739552	340	12.7872	0.0782033
			350	7638	3464
			360	7405	4900

DENSITY OF MOIST AIR

The density of dry air may be determined by computation from the general relation $D = D_0(T_0/T)(P/P_0)$ where D_0 represents a known density at absolute temperature T_0 and pressure P_0 and D , the density at absolute temperature T and pressure P .

The density of **moist** air may be determined by a similar relation:

$D = 1.2929 (273.13/T) [(B - 0.3783e)/760]$ where T is the absolute temperature; B , the barometric pressure in mm, and e the vapor pressure of the moisture in the air in mm. The density will then be the product of two terms, each of which may be found by use of the tables which follow.

The **first factor**, $1.2929 (273.13/T)$, may be found directly in Table I for various temperatures. For convenience, temperatures are given in the table in °C although the values of the factor have been computed with absolute temperatures. The tabular values actually represent the density of dry air at various temperatures and 760 mm pressure.

The **second factor**, $[(B - 0.3783e)/760]$, must be obtained in two steps: **First**—the numerator of the expression is obtained by subtracting 0.3783e from the barometric pressure. The quantity 0.3783e may be found directly from the dew point in Table II. If the wet and dry bulb thermometer readings are known e may be found in the table Reduction of Psychrometric Observations given in the section Hygrometric and Barometric Tables. 0.3783e may then be found by calculation or read from the table. **Second**—the value of the whole factor for any value of $B - 0.3783e$ may be obtained from Table III.

The product of the above two factors will give the required density in g/l.

To facilitate obtaining **approximate values** of the density for ordinary pressures and temperatures, a table of products is given which may be entered with the temperature in °C and the corrected (for moisture) value of the barometric pressure in mm to obtain density.

As an illustration of the use of the tables, let it be desired to find the density of air for a barometric pressure of 750 mm, a dew point of 10° C, and air temperature of 20° C.

From the dew point, the value of 0.3783e is found in Table II to be 3.48 mm. $750 - 3.48 = 746.52$, the corrected pressure. The pressure factor for this value found in Table III by interpolation is 0.98226.

The temperature factor from Table I is 1.2047.

$$1.2047 \times 0.98224 = 1.1833 \text{ g/l.}$$

To obtain the value directly from Table IV, enter it for 20° C and 746.5 mm which gives by interpolation 1.183 g/l.

TABLE I

(1.2929 × 273.13/T)

(Besides being a necessary part of the determination of the density of moist air, the values in this table are actually the density of dry air in g/l at 760 mm pressure for various temperatures.)

Temp. °C	0	1	2	3	4	5	6	7	8	9
-50	1.5 826	897	969	*042	*115	*189	*264	*339	*415	*491
-40	1.5 147	213	278	345	412	479	547	616	686	756
-30	1.4 524	584	645	706	767	829	892	955	*019	*083
-20	1.3 951	*006	*062	*118	*175	*232	*289	*347	*406	*465
-10	1.3 420	472	523	575	628	680	734	787	841	896
- 0	1.2 929	977	*024	*073	*121	*170	*219	*269	*319	*370
+ 0	1.2 929	882	835	789	742	697	651	606	561	517
10	1.2 472	428	385	342	299	256	214	171	130	088
20	1.2 047	006	*965	*925	*885	*845	*805	*766	*727	*688
30	1.1 649	611	573	535	498	460	423	387	350	314
40	1.1 277	242	206	170	135	100	065	031	*996	*962
50	1.0 928	895	861	828	795	762	729	697	664	632
60	1.0 600	569	537	506	475	444	413	382	352	322

DENSITY OF MOIST AIR (Continued)

TABLE II

Vapor Pressure—Value of 0.3783*e*

Dew point °C	Vap. press. <i>e</i> mm (ice)	0.3783 <i>e</i>	Dew point °C	Vap. press. <i>e</i> mm (water)	0.3783 <i>e</i>	Dew point °C	Vap. press. <i>e</i> mm (water)	0.3783 <i>e</i>
-50	0.029	0.01	0	4.58	1.73	30	31.86	12.05
-45	.054	.02	1	4.92	1.86	31	33.74	12.76
-40	.096	.04	2	5.29	2.00	32	35.70	13.51
-35	.169	.06	3	5.68	2.15	33	37.78	14.29
-30	.288	.11	4	6.10	2.31	34	39.95	15.11
-25	0.480	0.18	5	6.54	2.47	35	42.23	15.98
-24	.530	.20	6	7.01	2.65	36	44.62	16.88
-23	.585	.22	7	7.51	2.84	37	47.13	17.83
-22	.646	.24	8	8.04	3.04	38	49.76	18.82
-21	.712	.27	9	8.61	3.26	39	52.51	19.86
-20	0.783	0.30	10	9.21	3.48	40	55.40	20.96
-19	.862	.33	11	9.85	3.73	41	58.42	22.10
-18	.947	.36	12	10.52	3.98	42	61.58	23.30
-17	1.041	.39	13	11.24	4.25	43	64.89	24.55
-16	1.142	.43	14	11.99	4.54	44	68.35	25.86
-15	1.252	0.47	15	12.79	4.84	45	71.97	27.23
-14	1.373	.52	16	13.64	5.16	46	75.75	28.66
-13	1.503	.57	17	14.54	5.50	47	79.70	30.15
-12	1.644	.62	18	15.49	5.86	48	83.83	31.71
-11	1.798	.68	19	16.49	6.24	49	88.14	33.34
-10	1.964	0.74	20	17.55	6.64	50	92.6	35.03
-9	2.144	.81	21	18.66	7.06	51	97.3	36.81
-8	2.340	.89	22	19.84	7.51	52	102.2	38.66
-7	2.550	.96	23	21.09	7.98	53	107.3	40.59
-6	2.778	1.05	24	22.40	8.47	54	112.7	42.63
-5	3.025	1.14	25	23.78	9.00	55	118.2	44.72
-4	3.291	1.24	26	25.24	9.55	56	124.0	46.91
-3	3.578	1.35	27	26.77	10.13	57	130.0	49.18
-2	3.887	1.47	28	28.38	10.74	58	136.3	51.56
-1	4.220	1.60	29	30.08	11.38	59	142.8	54.02
0	4.580	1.73	30	31.86	12.05	60	149.6	56.59

DENSITY OF MOIST AIR (Continued)

TABLE III

Pressure Factor.— $[(B - 0.3783e)/760]$

The figures in the body of the table give values of the whole term $(B - 0.3783e)/760$ for various values of the numerator $(B - 0.3783e)$ expressed at the left and top.

Press. mm. corr.	0	1	2	3	4	5	6	7	8	9
80	.10526	.10658	.10789	.10921	.11053	.11184	.11316	.11447	.11579	.11711
90	.11842	.11974	.12105	.12237	.12368	.12500	.12632	.12763	.12895	.13026
100	.13158	.13289	.13421	.13553	.13684	.13816	.13947	.14079	.14211	.14342
110	.14474	.14605	.14737	.14868	.15000	.15132	.15263	.15395	.15526	.15658
120	.15789	.15921	.16053	.16184	.16316	.16447	.16579	.16711	.16842	.16974
130	.17105	.17237	.17368	.17500	.17632	.17763	.17895	.18026	.18158	.18289
140	.18421	.18553	.18684	.18816	.18947	.19079	.19211	.19342	.19474	.19605
150	.19737	.19868	.20000	.20132	.20263	.20395	.20526	.20658	.20789	.20921
160	.21053	.21184	.21316	.21447	.21579	.21711	.21842	.21974	.22105	.22237
170	.22368	.22500	.22632	.22763	.22895	.23026	.23158	.23289	.23421	.23553
180	.23684	.23816	.23947	.24079	.24211	.24342	.24474	.24605	.24737	.24868
190	.25000	.25132	.25263	.25395	.25526	.25658	.25789	.25921	.26053	.26184
200	.26316	.26447	.26579	.26711	.26842	.26974	.27105	.27237	.27368	.27500
210	.27632	.27763	.27895	.28026	.28158	.28289	.28421	.28553	.28684	.28816
220	.28947	.29079	.29211	.29342	.29474	.29605	.29737	.29868	.30000	.30132
230	.30263	.30395	.30526	.30658	.30789	.30921	.31053	.31184	.31316	.31447
240	.31579	.31711	.31842	.31974	.32105	.32237	.32368	.32500	.32632	.32763
250	.32895	.33026	.33158	.33289	.33421	.33553	.33684	.33816	.33947	.34079
260	.34211	.34342	.34474	.34605	.34737	.34868	.35000	.35132	.35263	.35395
270	.35526	.35658	.35789	.35921	.36053	.36184	.36316	.36447	.36579	.36711
280	.36842	.36974	.37105	.37237	.37368	.37500	.37632	.37763	.37895	.38026
290	.38158	.38289	.38421	.38553	.38684	.38816	.38947	.39079	.39211	.39342
300	.39474	.39605	.39737	.39868	.40000	.40132	.40263	.40395	.40526	.40658
310	.40789	.40921	.41053	.41184	.41316	.41447	.41579	.41711	.41842	.41974
320	.42105	.42237	.42368	.42500	.42632	.42763	.42895	.43026	.43158	.43289
330	.43421	.43553	.43684	.43816	.43947	.44079	.44211	.44342	.44474	.44605
340	.44737	.44868	.45000	.45132	.45263	.45395	.45526	.45658	.45789	.45921
350	.46053	.46184	.46316	.46447	.46579	.46711	.46842	.46974	.47105	.47237
360	.47368	.47500	.47632	.47763	.47895	.48026	.48158	.48289	.48421	.48553
370	.48684	.48816	.48947	.49079	.49211	.49342	.49474	.49605	.49737	.49868
380	.50000	.50132	.50263	.50395	.50526	.50658	.50789	.50921	.51053	.51184
390	.51316	.51447	.51579	.51711	.51842	.51974	.52105	.52237	.52368	.52500
400	.52632	.52763	.52895	.53026	.53158	.53289	.53421	.53553	.53684	.53816
410	.53947	.54079	.54211	.54342	.54474	.54605	.54737	.54868	.55000	.55132
420	.55263	.55395	.55526	.55658	.55789	.55921	.56053	.56184	.56316	.56447
430	.56579	.56711	.56842	.56974	.57105	.57237	.57368	.57500	.57632	.57763
440	.57895	.58026	.58158	.58289	.58421	.58553	.58684	.58816	.58947	.59079
450	.59211	.59342	.59474	.59605	.59737	.59868	.60000	.60132	.60263	.60395
460	.60526	.60658	.60789	.60921	.61053	.61184	.61316	.61447	.61579	.61711
470	.61842	.61974	.62105	.62237	.62368	.62500	.62632	.62763	.62895	.63026
480	.63158	.63289	.63421	.63553	.63684	.63816	.63947	.64079	.64211	.64342
490	.64474	.64605	.64737	.64868	.65000	.65132	.65263	.65395	.65526	.65658
500	.65790	.65921	.66053	.66184	.66316	.66447	.66579	.66711	.66842	.66974
510	.67105	.67237	.67368	.67500	.67632	.67763	.67895	.68026	.68158	.68290
520	.68421	.68553	.68684	.68816	.68947	.69079	.69211	.69342	.69474	.69605
530	.69737	.69868	.70000	.70132	.70263	.70395	.70526	.70658	.70790	.70921
540	.71053	.71184	.71316	.71447	.71579	.71711	.71842	.71974	.72105	.72237

DENSITY OF MOIST AIR (Continued)

TABLE III (Continued)

Press. mm corr.	0	1	2	3	4	5	6	7	8	9
550	.72368	.72500	.72632	.72763	.72895	.73026	.73158	.73290	.73421	.73553
560	.73684	.73816	.73947	.74079	.74211	.74342	.74474	.74605	.74737	.74868
570	.75000	.75132	.75263	.75395	.75526	.75658	.75790	.75921	.76053	.76184
580	.76316	.76447	.76579	.76711	.76842	.76974	.77105	.77237	.77368	.77500
590	.77632	.77763	.77895	.78026	.78158	.78290	.78421	.78553	.78684	.78816
600	.78947	.79079	.79211	.79342	.79474	.79605	.79737	.79868	.80000	.80132
610	.80263	.80395	.80526	.80658	.80790	.80921	.81053	.81184	.81316	.81447
620	.81579	.81711	.81842	.81974	.82105	.82237	.82368	.82500	.82632	.82763
630	.82895	.83026	.83158	.83290	.83421	.83553	.83684	.83816	.83947	.84079
640	.84211	.84342	.84474	.84605	.84737	.84868	.85000	.85132	.85263	.85395
650	.85526	.85658	.85790	.85921	.86053	.86184	.86316	.86447	.86579	.86711
660	.86842	.86974	.87105	.87237	.87368	.87500	.87632	.87763	.87895	.88026
670	.88158	.88290	.88421	.88553	.88684	.88816	.88947	.89079	.89211	.89342
680	.89474	.89605	.89737	.89868	.90000	.90132	.90263	.90395	.90526	.90658
690	.90790	.90921	.91053	.91184	.91316	.91447	.91579	.91711	.91842	.91974
700	.92105	.92237	.92368	.92500	.92632	.92763	.92895	.93026	.93158	.93290
710	.93421	.93553	.93684	.93816	.93947	.94079	.94211	.94342	.94474	.94605
720	.94737	.94868	.95000	.95132	.95263	.95395	.95526	.95658	.95790	.95921
730	.96053	.96184	.96316	.96447	.96579	.96711	.96842	.96974	.97105	.97237
740	.97368	.97500	.97632	.97763	.97895	.98026	.98158	.98290	.98421	.98553
750	.98684	.98816	.98947	.99079	.99211	.99342	.99474	.99605	.99737	.99868
760	1.0000	1.0013	1.0026	1.0039	1.0053	1.0066	1.0079	1.0092	1.0105	1.0118
770	1.0132	1.0145	1.0158	1.0171	1.0184	1.0197	1.0211	1.0224	1.0237	1.0250
780	1.0263	1.0276	1.0289	1.0303	1.0316	1.0329	1.0342	1.0355	1.0368	1.0382
790	1.0395	1.0408	1.0421	1.0434	1.0447	1.0461	1.0474	1.0487	1.0500	1.0513

TABLE IV

Density of Moist Air

Values in the body of the table give the density of moist air in g/l for a limited range of temperatures and corrected pressure values ($B - 0.3783e$). The latter may be obtained by use of Table II.

°C	600	610	620	630	640	650	660	670	680	690
5	1.0024	1.0191	1.0358	1.0525	1.0692	1.0859	1.1026	1.1193	1.1361	1.1528
6	.99876	1.0154	1.0321	1.0487	1.0654	1.0820	1.0986	1.1153	1.1319	1.1486
7	.99521	1.0118	1.0284	1.0450	1.0616	1.0781	1.0947	1.1113	1.1279	1.1445
8	.99165	1.0082	1.0247	1.0412	1.0578	1.0743	1.0908	1.1074	1.1239	1.1404
9	.98818	1.0047	1.0211	1.0376	1.0541	1.0705	1.0870	1.1035	1.1199	1.1364
10	.98463	1.0010	1.0175	1.0339	1.0503	1.0667	1.0831	1.0995	1.1159	1.1323
11	.98115	.99751	1.0139	1.0302	1.0466	1.0629	1.0793	1.0956	1.1120	1.1283
12	.97776	.99406	1.0104	1.0267	1.0430	1.0592	1.0755	1.0918	1.1081	1.1244
13	.97436	.99061	1.0068	1.0231	1.0393	1.0556	1.0718	1.0880	1.1043	1.1205
14	.97097	.98715	1.0033	1.0195	1.0357	1.0519	1.0681	1.0843	1.1004	1.1166
15	.96757	.98370	.99983	1.0160	1.0321	1.0482	1.0643	1.0805	1.0966	1.1127
16	.96426	.98033	.99641	1.0125	1.0286	1.0446	1.0607	1.0768	1.0928	1.1089
17	.96086	.97688	.99290	1.0089	1.0249	1.0409	1.0570	1.0730	1.0890	1.1050
18	.95763	.97359	.98955	1.0055	1.0215	1.0374	1.0534	1.0694	1.0853	1.1013
19	.95431	.97022	.98613	1.0020	1.0179	1.0338	1.0497	1.0656	1.0816	1.0975

DENSITY OF MOIST AIR (Continued)

TABLE IV (Continued)

°C	600	610	620	630	640	650	660	670	680	690
20	.95107	.96693	.98278	.99864	1.0145	1.0303	1.0462	1.0620	1.0779	1.0937
21	.94784	.96364	.97944	.99524	1.0110	1.0294	1.0426	1.0584	1.0742	1.0900
22	.94460	.96035	.97609	.99184	1.0076	1.0233	1.0391	1.0548	1.0706	1.0863
23	.94144	.95714	.97283	.98852	1.0042	1.0199	1.0356	1.0513	1.0670	1.0827
24	.93829	.95393	.96957	.98521	1.0008	1.0165	1.0321	1.0478	1.0634	1.0790
25	.93513	.95072	.96630	.98189	.99748	1.0131	1.0286	1.0442	1.0598	1.0754
26	.93197	.94750	.96304	.97858	.99411	1.0096	1.0252	1.0407	1.0562	1.0718
27	.92889	.94437	.95986	.97534	.99083	1.0063	1.0218	1.0373	1.0528	1.0682
28	.92581	.94124	.95668	.97211	.98754	1.0030	1.0184	1.0338	1.0493	1.0647
29	.92273	.93811	.95350	.96888	.98426	.99963	1.0150	1.0304	1.0458	1.0612
30	.91965	.93498	.95031	.96564	.98097	.99629	1.0116	1.0270	1.0423	1.0576
31	.91665	.93193	.94721	.96249	.97777	.99304	1.0083	1.0236	1.0389	1.0542
32	.91365	.92888	.94411	.95934	.97457	.98979	1.0050	1.0203	1.0355	1.0507
33	.91065	.92586	.94101	.95619	.97137	.98654	1.0017	1.0169	1.0321	1.0473
34	.90773	.92283	.93800	.95313	.96826	.98338	.99851	1.0136	1.0288	1.0439
35	.90473	.91981	.93490	.94998	.96506	.98013	.99521	1.0103	1.0254	1.0405

°C	700	710	720	730	740	750	760	770	780	790
5	1.1695	1.1862	1.2029	1.2196	1.2363	1.2530	1.2697	1.2864	1.3031	1.3198
6	1.1652	1.1819	1.1985	1.2152	1.2318	1.2485	1.2651	1.2817	1.2984	1.3150
7	1.1611	1.1777	1.1943	1.2108	1.2274	1.2440	1.2606	1.2772	1.2938	1.3104
8	1.1569	1.1735	1.1900	1.2065	1.2230	1.2396	1.2561	1.2726	1.2892	1.3057
9	1.1529	1.1694	1.1858	1.2023	1.2188	1.2352	1.2517	1.2682	1.2846	1.3011
10	1.1487	1.1651	1.1816	1.1980	1.2144	1.2308	1.2472	1.2636	1.2800	1.2964
11	1.1447	1.1610	1.1774	1.1937	1.2101	1.2264	1.2428	1.2592	1.2755	1.2919
12	1.1407	1.1570	1.1733	1.1896	1.2059	1.2222	1.2385	1.2548	1.2711	1.2874
13	1.1368	1.1530	1.1692	1.1855	1.2017	1.2180	1.2342	1.2504	1.2667	1.2829
14	1.1328	1.1490	1.1652	1.1814	1.1975	1.2137	1.2299	1.2461	1.2623	1.2784
15	1.1288	1.1450	1.1611	1.1772	1.1933	1.2095	1.2256	1.2417	1.2579	1.2740
16	1.1250	1.1410	1.1571	1.1732	1.1893	1.2053	1.2214	1.2375	1.2535	1.2696
17	1.1210	1.1370	1.1530	1.1691	1.1851	1.2011	1.2171	1.2331	1.2491	1.2651
18	1.1172	1.1332	1.1492	1.1651	1.1811	1.1970	1.2130	1.2290	1.2449	1.2609
19	1.1134	1.1293	1.1452	1.1611	1.1770	1.1929	1.2088	1.2247	1.2406	1.2565
20	1.1096	1.1254	1.1413	1.1572	1.1730	1.1888	1.2047	1.2206	1.2364	1.2522
21	1.1058	1.1216	1.1374	1.1532	1.1690	1.1848	1.2006	1.2164	1.2322	1.2480
22	1.1020	1.1178	1.1335	1.1493	1.1650	1.1808	1.1965	1.2122	1.2280	1.2437
23	1.0984	1.1140	1.1297	1.1454	1.1611	1.1768	1.1925	1.2082	1.2239	1.2396
24	1.0947	1.1103	1.1259	1.1416	1.1572	1.1729	1.1885	1.2041	1.2198	1.2354
25	1.0910	1.1066	1.1222	1.1377	1.1533	1.1689	1.1845	1.2001	1.2157	1.2313
26	1.0873	1.1028	1.1184	1.1339	1.1494	1.1650	1.1805	1.1960	1.2116	1.2271
27	1.0837	1.0992	1.1147	1.1302	1.1456	1.1611	1.1766	1.1921	1.2076	1.2230
28	1.0801	1.0955	1.1110	1.1264	1.1418	1.1573	1.1727	1.1881	1.2036	1.2190
29	1.0765	1.0919	1.1073	1.1227	1.1380	1.1534	1.1688	1.1842	1.1996	1.2149
30	1.0729	1.0883	1.1036	1.1189	1.1342	1.1496	1.1649	1.1802	1.1956	1.2109
31	1.0694	1.0847	1.1000	1.1153	1.1305	1.1458	1.1611	1.1764	1.1917	1.2069
32	1.0659	1.0812	1.0964	1.1116	1.1268	1.1421	1.1573	1.1725	1.1878	1.2030
33	1.0624	1.0776	1.0928	1.1080	1.1231	1.1383	1.1535	1.1687	1.1839	1.1990
34	1.0590	1.0742	1.0893	1.1044	1.1195	1.1347	1.1498	1.1649	1.1801	1.1952
35	1.0555	1.0706	1.0857	1.1008	1.1158	1.1309	1.1460	1.1611	1.1762	1.1912

DENSITY OF DRY AIR

AT THE TEMPERATURE t , AND UNDER THE PRESSURE H CM OF MERCURY
THE DENSITY OF AIR

$$= \frac{0.001293}{1 + 0.00367 t} \frac{H}{76}$$

(From Miller's Laboratory Physics, Ginn & Co, publishers, by permission.)

t	Pressure H in Centimeters						Proportional Parts	
	72.0	73.0	74.0	75.0	76.0	77.0		
°							17	
10	0.001182	0.001198	0.001215	0.001231	0.001247	0.001264	cm	
11	178	193	210	227	243	259	0.1	2
12	173	190	206	222	239	255	0.2	3
13	169	186	202	218	234	251	0.3	5
14	165	181	198	214	230	246	0.4	7
							0.5	8
							0.6	10
							0.7	12
							0.8	14
15	0.001161	0.001177	0.001193	0.001210	0.001226	0.001242	0.9	15
16	157	173	189	205	221	238		
17	153	169	185	201	217	233	16	
18	149	165	181	197	213	229	cm	
19	145	161	177	193	209	225	0.1	2
							0.2	3
							0.3	5
							0.4	6
20	0.001141	0.001157	0.001173	0.001189	0.001205	0.001221	0.5	8
21	137	153	169	185	201	216	0.6	10
22	134	149	165	181	197	212	0.7	11
23	130	145	161	177	193	208	0.8	13
24	126	142	157	173	189	204	0.9	14
							15	
							cm	
25	0.001122	0.001138	0.001153	0.001169	0.001185	0.001200	0.1	1
26	118	134	149	165	181	196	0.2	3
27	115	130	146	161	177	192	0.3	4
28	111	126	142	157	173	188	0.4	6
29	107	123	138	153	169	184	0.5	7
							0.6	9
							0.7	10
							0.8	12
30	0.001104	0.001119	0.001134	0.001150	0.001165	0.001180	0.9	13

DENSITY OF SATURATED VAPORS AT THE TEMPERATURE OF NORMAL EBULLITION

Vapor	Temp. ° C	Density
Acetic acid	118.5	0.00315
Benzene	80.2	0.00275
Chloroform	61.2	0.00443
Ether	34.6	0.00311
Ethyl alcohol	78.3	0.00164
Methyl alcohol	64.7	0.00121
Water	100.0	0.000596

DENSITY OF GASES IN LIQUID AND SOLID FORM

Temperatures marked * are the temperatures of normal ebullition

Gas	Liquid		Solid		Observer
	Temp. °C	D g/cm ³	Temp. °C	D g/cm ³	
Acetylene.....	- 23.5	0.52	.....	.....	Mathias, 1909
	+ 30.3	0.40	.....	.....	.....
Air (20.9 % oxygen)	-147	0.92	.....	.....	.....
Ammonia.....	- 10.7	0.65	.....	.....	Andreeff, 1859
	+ 16.3	0.61	.....	.....	Andreeff, 1859
Argon.....	-187*	1.41	-233	1.65	Baly & Donnan, 1902
Carbon dioxide....	- 60	1.19	- 79	1.53	Behn, 1910
	+ 20	0.77	.....	.....	Amagat
Carbon monoxide..	-190*	0.79	.....	.....	.....
	- 68	0.86	.....	.....	Baly & Donnan
Chlorine.....	- 33.6*	1.56	.....	1.9	Knietsch, 1890
Chlorine.....	+ 20	1.41	.....	.....	Knietsch, 1890
Ethane.....	- 88	0.546	.....	.....	.....
Ethylene.....	-102	0.566	.....	.....	.....
Ethylene.....	- 21	0.41	.....	.....	Cailletet & Mathias, 1886
Ethylene.....	+ 10	0.21	.....	.....	.....
Fluorine.....	-187*	1.11	.....	1.3	.....
Helium.....	-269*	0.122	.....	.....	Kamerling-Onnes & Perrier, 1910
Hydrogen.....	-253*	0.07	-260	0.076	Dewar, 1904
Hydrogen chloride.	- 85.8	1.194	.....	.....	.....
Hydrogen fluoride..	+ 13.6	0.988	.....	.....	.....
Hydrogen phos- phide (phosphine)	- 90	0.746	.....	.....	.....
Hydrogen sulfide..	- 61	0.86	.....	.....	.....
Krypton.....	-146	2.6	.....	2. (?)	.....
Methane.....	-164	0.415	.....	.....	.....
Methyl chloride....	+ 18	0.920	.....	.....	.....
Neon.....	-245.9*	1.204	.....	1.0	.....
Nitrogen.....	-196*	0.804	-253	1.03	Dewar, 1904
Nitrous oxide.....	- 20	1.0	.....	.....	Cailletet & Mathias
Nitrous oxide.....	+ 17	0.80	.....	.....	Villard, 1897
Oxygen.....	-123	0.89	.....	.....	Cailletet & Haute- feuille, 1881
	-182.7*	1.14	-253	-1.41	Kamerling-Onnes & Perrier, 1910
	-205	1.25	.....	.....	Baly & Donnan
Ozone, O ₃	-183	1.71	.....	.....	.....
Sulfur dioxide.....	- 10*	1.46	.....	.....	Pierre
	+ 20	1.38	.....	.....	Cailletet & Mathias
Xenon.....	-109.1*	3.06	.....	2.7(?)	.....

ELASTIC CONSTANTS FOR SOLIDS

The following table gives values for the yield point (or elastic limit, indicated by e.), ultimate tensile strength Young's modulus and the modulus of rigidity in kg/mm². The Brinell hardness number is also given, representing the ratio of load in kilograms on a sphere used to indent material to the spherical area of the indentation in square millimeters.

YIELD POINT, TENSILE STRENGTH, BRINELL HARDNESS

Material	Yield point		Ultimate tensile strength		Brinell hardness number
	Kg/mm ²	Lbs./in. ²	Kg/mm ²	Lbs./in. ²	
Aluminum 99.97, annealed..	.....	×10 ³	5.96	×10 ³	16
99.5, cast.....	.....	.....	7.95	.....	.....
hot rolled.....	10.2	14.51	11.34	16.13	.....
cold ".....	13.2	18.77	14.71	20.92	.....
99.3, rolled.....	.....	.....	19.7-24.6	28 02-34.99	39

ELASTIC CONSTANTS FOR SOLIDS (Continued)

YIELD POINT, TENSILE STRENGTH, BRINELL HARDNESS (Continued)

Material	Yield point		Ultimate tensile strength		Brinell hardness number
	Kg/mm ²	Lbs./in. ²	Kg/mm ²	Lbs./in. ²	
Aluminum-copper		×10 ³		×10 ³	
Cu .93, cold rolled.....	18.1	25.74	20.4	29.01	.....
Cu 1.9 " drawn.....	22.1	31.43	23.62	33.59	.....
Cu 4.97 cast.....	8.2	11.66	10.6	15.08	.....
cold drawn.....	25	35.6	27.9	39.68	.....
Cu 8.08, cast.....	10.2	14.51	11.65	16.57	.....
cold drawn.....	24.3	34.56	25.9	36.84	.....
Aluminum-iron Fe 11, rolled			12.6	17.92	44
Aluminum-magnesium					
Mg 6, rolled.....			28.4	40.39	69
Aluminum-manganese					
Mn 8, rolled.....			15	21.33	50
Aluminum-nickel					
Ni 10, rolled.....			16.5	23.47	53
Aluminum-zinc					
Zn 11%, hard drawn...	14.3	20.34	15.4	21.90	.....
20.15% " ".....	24.8	35.27	40.4	57.46	.....
26.05% " ".....	34.7	49.35	42.2	60.02	.....
Aluminum-zinc-copper					
Zn 23.48, Cu 2.67.....	31.7	45.09	46.6	66.28	.....
Ambrac Ni 20, Zn 5.....	53 e.	75.4 e.	60	85.3	160
"30%" Ni 30, Zn 5.....	67 e.	95.3 e.	74	105.3	190
Antimony (wire).....			1.1	1.56	.....
Arsenic.....					147
Brass, see Cu-Zn					
Bronze, see Cu-Sn					
Cadmium, cast.....			8.5	12.09	21-24
Calcium, cast.....			6	8.5	42
Cerium.....					28
Chromel A, rolled hot Ni					
82.5, Cr 15, Fe 1.....	42-56	59.7- 79.7	74-88	105.3-125.2	175-210
Chromel B, rolled hot Ni					
77.5, Cr 20, Fe 1.....	49-63	69.7- 89.6	77-91	109.5-129.4	180-220
Chromel C, Ni 61, Cr 12, Fe					
25, cast.....	28-42	39.8- 59.7	35-49	49.8- 69.7	130-180
rolled hot.....	35-49	49.8- 69.7	63-77	89.6-109.5	180-200
Chromium.....					91
Cobalt, annealed.....			26.0	37	48
cast.....			24	34.1	124
drawn.....			68	96.7	.....
electrolytic.....					270-311
Constantan, Ni 55, Cu 43.9,					
Mn 1, C .1, annealed..	14-21 e	19.9- 29.9e.	42-49	59.7- 69.7	100-120
cold rolled.....	21-88 e.	29.9-125.2e.	49-99	69.7-140.8	120-300
Copper, rolled			22.77	32.39	.....
99.5 sheet "hard".....			28.1	39.97	.....
wire, hard drawn.....			34.5-47.1	49-67	.....
" annealed.....			22.5-24.6	32-35	.....
Copper-aluminum					
(aluminum bronze)					
Al 1.06, hard rolled.....	10.9	15.50	25	35.6	.....
Al 4.05 " ".....	17.8	25.32	37.5	53.34	.....
Al 9.9 " ".....	23.3	33.14	50.0	85.34	210
quenched.....	65.9	93.73	85.4	121.46	.....
Al 11.73, hard rolled....	19.9	28.30	53.3	75.81	269

ELASTIC CONSTANTS FOR SOLIDS (Continued)

YIELD POINT, TENSILE STRENGTH, BRINELL HARDNESS (Continued)

Material	Yield point		Ultimate tensile strength		Brinell hardness number
	Kg/mm ²	Lbs./in. ²	Kg/mm ²	Lbs./in. ²	
Copper-aluminum-nickel					
Al 5.34, Ni 7.34, cold rolled	81.1	$\times 10^3$ 115.35	84.1	$\times 10^3$ 119.62	180
Al 6.93, Ni 5.62, cold rolled	87.2	124.02	89.0	126.58	.....
Copper-nickel (nickel-silver)					
Ni 10, Zn 25, hard			63	89.6	.....
Ni 15, Zn 28 "			67	95.3	.....
Ni 25, Zn 20 "			77	109.5	208
Copper-tin					
Sn 4, cast and annealed			22.9	32.57	.....
Sn 10 " " "			30.4	43.24	.....
Sn 19 " " "			38.7	55.04	.....
Sn 25 " " "			17.7	25.17	.....
Copper-zinc (brass)					
Zn 10, rolled hard			39	55.5	120
Zn 20 " " "			47	66.8	145
Zn 30 " " "	47	66.8	47	66.8	145
Zn 40 " " "	39	55.5	47	66.8	150
Zn 50 " " "			16	22.8	95
Cupro-nickel Ni 15, hard			49	69.7	.....
soft			32	45.5	.....
Ni 25 " " "	13 e.	18 5 e.	37	52.6	.....
Delta metal	14.1 e.	20 e.	36.6	52	.....
Duralumin, cold rolled					
Al + Cu 3.5-5.5, Mn .5-.8, Mg .5	54	76.8	62.0	88.18	125
Gold, cast			17.6	25	.....
pure, hard drawn			25	35.6	.....
Au 90, Cu 10			45.8	65.1	.....
Gun metal			17.6-35.2	25-50	.....
Indium					1
Iridium, cast					172
Iron, cast	3.5-4.2e.	5-6 e.	10.5-12.7	15-18	.....
electrolytic, annealed	143	203.4	29.5	41.96	77
drawn	78	110.9	80.0	113.78	.....
wrought	14.8-18.3e.	21-26e.	29.5-36.6	42-52	.....
Lanthanum					37
Lead, cast			1.25	1.78	4.2
rolled			2.1	3.0	.....
Lead-antimony Sb 4.5			4.50	6.4	.....
Sb 9.9			5.39	7.67	.....
Lead-tin Sn 33.3			7.63	10.85	.....
Sn 50 (soft solder)			7.1	10.1	18
Magnesium, cast			10.7-14	15.22-19.9	.....
drawn, annealed	8-13	11.4-18.5	18-22	25.6-31.3	29.4
Magnesium-aluminum					
Al 8 Dowmetal A, cast			21.8	31.01	60
Magnesium-Al-Cu-Cd					
Al 8.3, Cu 2, Cd 1, Zn .5, Mn .2, Dowmetal D			15.5	22.05	58
Al 8, Cu 1, Cd 1, Dowmetal R			16.5	23.47	54
Magnesium-cadmium					
Cd 5.5, drawn	12.4	17.64	20.6	29.30	51.9
Magnesium-copper					
Cu 12.7, drawn	21.9	31.2	24.6	34.99	.....

ELASTIC CONSTANTS FOR SOLIDS (Continued)

YIELD POINT, TENSILE STRENGTH, BRINELL HARDNESS (Continued)

Material	Yield point		Ultimate tensile strength		Brinell hardness number
	Kg/mm ²	Lbs./in. ²	Kg/mm ²	Lbs./in. ²	
Magnesium-silicon		×10 ³		×10 ³	
Si 1.2, drawn	22.2	31.58	29	41.3	
Magnesium-zinc-Al					
Zn 3, Al 5, cold drawn			32	45.5	
Manganese-bronze	21.1e.	30e	45.7-59.8	65-85	
Molybdenum, drawn			180-222	256.0-315.8	147
Monel metal, Ni 68.4, Cu 29, Fe 2, Mn 3. C 2, Si .1, cast	21-28e.	29.9-39.8e.	46-56	65.4-79.6	110-130
cold drawn or rolled	28-105e.	39.8-149.3e.	53-120	75.4-170.7	130-300
Nickel 99%, cast	14-21	19.9-29.9	35-49	49.8-69.7	90-110
rolled cold	25-105	35.6-149.3	53-120	75.4-170.7	110-300
Nickel-iron C<.01					
Ni 1			42.1	59.88	
Ni 5			51	72.5	
Ni 10			62.8	89.32	
Ni 18			127.7	181.63	
Ni 25			73.3	104.25	
Ni 50			76.3	108.52	
Nickel-manganese Mn 3			52.1	74.10	
Mn 9.24			58.9	83.77	
Palladium, drawn			38	54.0	49
Phosphor-bronze					
Cu + Sn 3.77, P .16, drawn	41.7	59.31	56	79.6	
Platinum, annealed			24.6	35	
pure, drawn			34	48.4	64
Platinum-iridium, hard-worked					
Ir 10					220
Ir 20			100	142.2	330
Ir 30			140	199.1	400
Platinum-rhodium Rh 10					90
Potassium					.037
Praseodymium					25
Rhodium, cast					139
Ruthenium, cast					220
Silver, cast			28.1	40	
hard drawn			31-36	44.1-51.2	
Silver-copper					
Cu 7.5 (sterling silver) cast	12.8	18.21	22.2	31.58	60
hard drawn			43	61.2	
Ag 75, Cu 25, hard drawn			91.4	130	
Sodium					.07
Steel, castings	25.3-27.4e.	36-39e.	50.6-54.8	72-78	
forgings	26.0-31.6e.	37-45e.	52.7-63.3	75-90	
hard	24.6-28.1e.	35-40e.	49.2-56.2	70-80	
medium	21.1-24.6e.	30-35e.	42.2-49.2	60-70	
mild	17.6-21.1e.	25-30e.	35.2-42.2	50-60	16.0
spring, tempered	77.3-119.5e.	110-170e.	91.4-146.6	130-200	
" untempered	35.2-47.1e.	50-67e.	71.0-94.9	101-135	
Steel-C					
C .08, annealed			32.5	46.22	120
quenched			49.0	69.69	
.38, annealed	28.1	39.97	50.6	71.97	
.49			49	69.7	
.71			78.4	111.51	217
quenched			129	183.5	

ELASTIC CONSTANTS FOR SOLIDS (Continued)

YIELD POINT, TENSILE STRENGTH, BRINELL HARDNESS (Continued)

Material	Yield point		Ultimate tensile strength		Brinell hardness number
	Kg/mm ²	Lbs./in. ²	Kg/mm ²	Lbs./in. ²	
Steel-C (Continued)		×10 ³		×10 ³	
C 1.00 quenched			150	213.3	402
1.40, annealed			68.6	97.57	202
quenched			131.9	187.60	460
Steel-Cr, quenched					
Cr 2, C .5, Mn .24			176.6	251.18	454
Steel-Cr-U, quenched, Cr .78, U .17, C .36, Mn .53, Si .25	143.4	203.96	170	241.8	
—Cr-V, quenched Cr 1.45, V .19, C .46, Mn .45, Si .18	140.9	200.40	169	240.4	444
—Cu, cold drawn, Cu .3, C .72, Mn .83, Si .03			207.6	295.27	
—Mn, forged Mn 8.68, C 1.27, Si .19			123.4	175.51	
—Ni, Ni 1.76, C .26, cast			67.5	96.01	
Ni 2.73, C .37, cast and forged			66.3	94.30	
Ni 3.59, C .20, quenched			133	196.2	354
—Ni-Cr, quenched, Ni 3.7-4.1, Cr .9, C .38, Mn .7, Si .15	106.5	151.47	194	275.9	
—Ni-Cr-U, quenched, Ni 1.63, Cr .61, U .20, C .36, Mn .78, Si .47	150	213.3	175	248.9	
—Ni-Cu, quenched, Ni 2.55, Cu .6, C .46, Mn .82, Si 1.3	196	278.8	230.5	327.84	555
—Ni-U, quenched, Ni 3.15, U .40, C .57, Mn .62, Si .58	183	260.3	209	297.3	
—Ni-V, quenched, Ni 3.15, V .32, C .6, Mn .79, Si 1.3	194.2	276.21	241.3	343.20	627
—Ti, low carbon, quenched, Ti 2.57, C .135, Mn .31, P .01, S .017, Si .14	45.2	64.29	66.2	94.16	143
—Ti, high carbon, quenched, Ti 8.71, C .65, Mn .45, P .016, S .011, Si .163	80.3	114.21	132.5	188.45	477
—U, quenched, U 2.20, C .25, Mn .65, Si .30	145	206.2	160.6	228.42	
—U, quenched, tempered, U .29, C .54, Mn .61	181	257.4	197	280.2	
—U, quenched, U .53, C .72, Mn .54, Si .75	197	280.2	233	331.4	
—V, rolled, V .8, C 1.04, Mn .05, Si .1	92.6	131.70	132.2	188.03	
Tantalum			93	132.3	
Thorium			56.3	80.08	
Tin, hard drawn			7.0	10	
rolled			2.5	3.56	
Tin-antimony-copper bearing alloy					
Sb 11, Cu 11			11.5	16.36	37
Tobin bronze	35.9-39.4e.	51-56e.	46.4-56.2	66-80	
Tungsten, drawn			420	597.4	
Zinc, rolled	9	12.8	12-30	17.1-42.7	

ELASTIC CONSTANTS FOR SOLIDS (Continued)

YOUNG'S MODULUS AND MODULUS OF RIGIDITY (TORSIONAL)

Material	Young's modulus		Modulus of rigidity	
	Dynes/cm ²	Lbs./in. ²	Dynes/cm ²	Lbs./in. ²
	$\times 10^{11}$	$\times 10^6$	$\times 10^{11}$	$\times 10^6$
Aluminum, cast.....	5.6-7.7	8-11		
rolled.....	6.82-7.0	9.7-10		
99.3, rolled.....	6.96	10.10	2.37	3.44
Aluminum-bronze, forged				
Cu 90, Al 10.....	11.81	16.8		
Aluminum-iron Fe 11, rolled.....	6.67	9.67		
Aluminum-magnesium				
Mg 6, rolled.....	6.18	8.96		
Aluminum-manganese				
Mn 8, rolled.....	6.47	9.39		
Aluminum-nickel Ni 10, rolled.....	6.47	9.39		
Ambrac (Ni 20).....	13.14	19.06		
Antimony (wire).....	7.80	11.31	1.98	2.87
Brass, cold rolled.....	9.02	13.09	3.53	5.12
Cadmium, cast.....	6.93	10.06	2.40	3.48
Constantan.....	14.51-15.89	21.05-23.04		
Copper, rolled.....	12.06-12.85	17.49-18.63	4.24	6.14
wire, hard drawn.....	10.19-12.0	14.5-17		
Cupro-nickel.....	8.24	11.95		
Delta metal.....	7.73	11		
Duralumin, cold rolled				
Al + Cu 3.5-5.5, Mn .5-.8, Mg .5.....	6.89	10.00	2.75	3.98
Gold, pure, hard drawn.....	7.85	11.38		
Gun metal.....	7.0	10		
Iridium, cast.....	5.17 (d)	7.50 (d)		
Iron, cast.....	8.4-9.8	12-14		
electrolytic.....	20.6	29.9		
wrought.....	18.3-20.4	26-29		
Iron-cobalt Fe 70, Co 30.....	21.33	30.94		
Lead, rolled.....	1.47-1.67	2.13-2.42	0.54	0.78
Magnesium, drawn, annealed.....	4.18	6.06	1.67	2.42
Magnesium-aluminum				
Al 8 Dowmetal A, cast.....	4.18	6.06		
Monel metal.....	16.48-17.95	23.89-26.03	6.18-6.86	8.96-9.96
Nickel.....	20.01-21.38	29.01-31.01	7.06-7.55	10.24-10.95
Nickel-iron C<.01				
Ni 5.....	21.28	30.86		
Ni 18.....	17.36 (19% Ni)	25.17		
Ni 25.....	18.14 (26% Ni)	26.31		
Palladium, drawn.....	11.77	17.07	4.41	6.40
Platinum, pure, drawn.....	16.67	24.18	6.42	9.32
Platinum-rhodium Rh 10.....			6.47	9.39
Rhodium, cast.....	29.42 (d)	42.67 (d)		
Silver, hard drawn.....	7.75	11.24	2.60	3.77
Steel-C				
C .08 annealed.....			7.79	11.31
drawn.....	19.22	27.88		
.38 annealed.....	20.01	29.01	8.11	11.76
.67 ".....	19.61	28.45	8.04	11.66
Tantalum.....	18.6	27.0		
Tin, rolled.....	3.92-5.39	5.69-7.82	1.67	2.42
Tobin bronze.....	10.	14.5		
Tungsten, drawn.....	35.5	51.49	14.81	21.48
Zinc, rolled.....	7.8-10.20	11.4-14.79	2.9-3.73	4.3-5.40

COMPRESSIBILITY OF LIQUIDS

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Acetone.....	0.	1-500	82×10^{-6}	Amagat, 1893
	0.	500-1000	59.	"
	0.	1000-1500	47.	"
	99.5	8.94-36.5	276.	"
Amyl alcohol..	17.7	8	90.5	Röntgen, 1891
Benzene C ₆ H ₆ .	12.9	0.4-18	87.	Suchodski, 1910
	34.9	2-18	100.	"
	99.9	4.5-19	190.	"
Butyl alcohol..	17.4	8	90.	Röntgen
Carbon disul- phide.....	0.	1-500	66.	Amagat, 1893
	49.2	1000-1500	51.	"
Carbon tetra- chloride.....	20.	100-200	90.7	Richards, 1907
Chlorobenzene	13.	0.4-18	67.	Suchodski, 1910
	35.	0.4-18	77.	"
	100.	0.4-18	127.	"
Chloroform....	0.	.....	101.	Grimaldi, 1887
	20.	.....	128.	"
	40.	.....	162.	"
	60.	.....	204.	"
	100.	8-9	211.	Amagat
	100.	19-34	206.	"
	20.	1-98	94.	Richards&Stall, 1904
	20.	98.7-197.4	89.	Richards&Stall, 1904
	20.	197.4-296.1	80.	Richards&Stall, 1904
Ether.....	12.2	0.4-17.5	163.	Suchodski, 1910
	34.8	2-19	207.	"
	63.	8.6-34.3	293.	Amagat, 1893
	78.5	8.6-34.3	363.	"
	99.	8.6-36.5	523.	"
Ethyl acetate..	13.3	8.1-37.4	104.	"
Ethyl alcohol..	28.	150-400	81.	Barus, 1890
	65.	150-400	100.	"
	100.	150-400	132.	"
	185.	150-400	245.	"
	310.	150-400	1530.	"
	28.	150-200	86.	"
	100.	150-200	168.	"
	310.	150-200	4200.	"

COMPRESSIBILITY OF LIQUIDS (Continued)

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Ethyl alcohol:	0.	1-50	$96. \times 10^{-6}$	Amagat, 1893
	20.	1-50	112.	"
	40.	1-50	125.	"
	0.	100-200	85.	"
	0.	300-400	73.	"
	0.	500-600	64.	"
	0.	900-1000	52.	"
	0.	900-1000	52.	"
Ethyl bromide.	10.1	1-500	89.6	Amagat
	10.1	500-1000	63.4	"
	13.7	0.4-18.5	113.	Suchodski, 1910
	35.	2-19	138.	"
Ethyl chloride.	0.	1-500	103.	Amagat, 1893
	0.	500-1000	69.2	"
	11.	8.5-34.2	128.	"
	62.	12.7-32.8	255.	"
	99.	12.8-34.5	495.	"
Ethyl iodide...	10.6	1-500	73.8	Amagat
		500-1000	56.2	"
Fluor-benzene.	13.9	0.4-18	88.	Suchodski, 1910
	35.3	0.4-18	103.	"
	99.7	4.3-18.5	190.	"
Glycerine.....	14.9	1-10	22.	De Metz, 1890
Mercury.....	0.	.....	3.92	Amagat
	15.	100-200	3.76	Richards, 1907
Methyl acetate	14.3	8.1-37.5	97.	Amagat
	99.	8.3-37	250.	"
Methyl alcohol	0.	1-500	79.4	"
	0.	500-1000	58.3	"
	14.7	8.5-371	104.	"
	100.	8.7-37.3	221.	"
Nitric acid....	20.3	1-32	338.	.....
Palmitic acid..	65.	20-100	88.	Barus, 1890
	100.	20-100	99.	"
Paraffine.....	64.	20-100	84.	"
	100.	20-100	107.	"
Oil, almond...	17.	.....	55.	Quinke
	olive.....	20.5	63.	"
	turpentine...	19.7	79.	"
Toluene.....	10.	1-5.25	79.	DeHeen, 1885
	100.	1-5.25	150.	" "
Xylene.....	10.	1-5.25	74.	" "
	100.	1-5.25	132.	" "

COMPRESSIBILITY OF LIQUIDS (Continued)

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Water.....	0.	1-25	52.5×10^{-6}	Amagat, 1893
	10.	1-25	50.0	"
	20.	1-25	49.1	"
	0.	25-50	51.6	"
	10.	25-50	49.2	"
	20.	25-50	47.6	"
	0.	100-200	49.2	"
	10.	100-200	46.1	"
	20.	100-200	44.2	"
	50.	100-200	42.5	"
	100.	100-200	46.8	"
	0.	500-1000	41.6	"
	0.	1000-1500	35.8	"
	0.	1500-2000	32.4	"
	0.	2000-2500	29.2	"
	0.	2500-3000	26.1	"

ELASTIC CONSTANTS FOR GASES

For short ranges of pressure, at a constant temperature, the volume of a gas is inversely proportional to the pressure or pressure \times volume = a constant. (Boyle's Law.)

For high pressures, the table below shows the relative volumes at various temperatures. The volume at 0° C. and 76 cm. pressure (1 atmosphere) being taken as 1,000,000.

(From Smithsonian Tables.)

Atm.	Oxygen.			Air.		
	0°	99°.5	199°.5	0°	99°.4	200°.4
100	9265	.....	.....	9730		
200	4570	7000	9095	5050	7360	9430
300	3208	4843	6283	3658	5170	6622
400	2629	3830	4900	3036	4170	5240
500	2312	3244	4100	2680	3565	4422
600	2115	2867	3570	2450	3180	3883
700	1979	2610	3202	2288	2904	3502
800	1879	2417	2929	2168	2699	3219
900	1800	2268	2718	2070	2544	3000
1000	1735	2151	.....	1992	2415	2828

Atm.	Nitrogen.			Hydrogen.		
	0°	99°.5	199°.6	0°	99°.3	200°.5
100	9910					
200	5195	7445	9532	5690	7567	9420
300	3786	5301	6715	4030	5286	6520
400	3142	4265	5331	3207	4147	5075
500	2780	3655	4515	2713	3462	4210
600	2543	3258	3973	2387	3006	3627
700	2374	2980	3589	2149	2680	3212
800	2240	2775	3300	1972	2444	2900
900	2149	2616	3085	1832	2244	2657
1000	2068	.....	.....	1720	2093	

COEFFICIENT OF FRICTION

(From Rankine's Compilation, 1858; Smithsonian Tables.)

Materials.	Coefficient of friction.	Angle of repose in degrees.
Wood on wood, dry .....	.25-.50	14.0-26.5
Wood on wood, soapy .....	.20	11.5
Metals on oak, dry .....	.50-.60	26.5-31.0
Metals on oak, wet .....	.24-.26	13.5-14.5
Metals on oak, soapy .....	.20	11.5
Metals on elm, dry .....	.20-.25	11.5-14.0
Hemp on oak, dry .....	.53	28.0
Hemp on oak, wet .....	.33	18.5
Leather on oak .....	.27-.38	15.0-19.5
Leather on metals, dry .....	.56	29.5
Leather on metals, wet .....	.36	20.0
Leather on metals, greasy .....	.23	13.0
Leather on metals, oily .....	.15	8.5
Metals on metals, dry .....	.15-.20	8.5-11.5
Metals on metals, wet .....	.3	16.5
Smooth surfaces occasionally greased ..	.07-.08	4.0-4.5
Smooth surfaces continually greased ..	.05	3.0
Smooth surfaces, best results .....	.03-.036	1.75-2.0
Steel on agate, dry .....	.20	11.5
Steel on agate, oiled .....	.107	6.1
Iron on stone .....	.30-.70	16.7-35.0
Wood on stone	about .40	22.0
Masonry and brick work, dry .....	.60-.70	33.0-35.0
Masonry and brick work, damp mortar ..	.74	36.5
Masonry on dry clay .....	.51	27.0
Masonry on moist clay .....	.33	18.25
Earth on earth .....	.25-1.00	14.0-45.0
Earth on earth, dry sand, clay and mixed earth .....	.38-.75	21.0-37.0
Earth on earth, damp clay	1.00	45.0
Earth on earth, wet clay .....	.31	17.0
Earth on earth, shingle and gravel .....	.81-1.11	39.0-48.0

RESISTANCE TO CRUSHING FOR VARIOUS MATERIALS

Approximate values in pounds per square inch.

Material.	Resistance to crushing in lbs. per sq. in.	Material.	Resistance to crushing in lbs. per sq.in.
Brick:		Granite.....	9700-34000
soft burned ..	3000-6000	Limestone ..	6000-25000
hard burned ..	4500-6500	Marble.....	7600-20700
vitrified	8500-25000	Sandstone ..	2400-29300
Brownstone....	7300-23600	Tufa.....	7700-11600
Concrete	800-3800		

TENSILE STRENGTH OF METALS

(Selected from Smithsonian Tables.)

Given in pounds per square inch. The values can be considered **only as** approximations.

Metal.	Tensile Strength in lbs. per sq. in.
Aluminum wire.....	30000-40000
Brass wire.....	50000-150000
Bronze wire, phosphor, hard drawn.....	110000-140000
Bronze wire, silicon, hard drawn.....	95000-115000
Bronze.....	60000-75000
Cobalt, cast.....	33000
Copper wire, hard drawn.....	60000-70000
German silver.....	40000-50000
Gold wire.....	20000
Iron, cast.....	13000-33000
Iron wire, hard drawn.....	80000-120000
Iron wire, annealed.....	50000-60000
Lead, cast or drawn.....	2600-3300
Magnesium, hard drawn.....	33000
Monel metal, cold drawn.....	80000-100000
Nickel, hard drawn.....	155000
Palladium.....	39000
Platinum wire.....	50000
Silver wire.....	42000
Steel.....	40000-330000
Steel wire, maximum.....	460000
Steel, specially treated nickel steel.....	250000
Steel, piano wire, 0.033 in. diam.....	357000-390000
Steel, piano wire, 0.051 in. diam.....	325000-337000
Tantalum.....	130000
Tin, cast or drawn.....	4000-5000
Tungsten, hard drawn.....	590000
Zinc, cast.....	7000-13000
Zinc, drawn.....	22000-30000

HARDNESS

MOHS' SCALE OF HARDNESS

1 Talc	4 Fluorite	8 Topaz
2 Rock salt or gypsum	5 Apatite	9 Corundum
3 Calcite	6 Feldspar	10 Diamond
	7 Quartz	

HARDNESS OF MATERIALS

Agate.....	6-7	Indium.....	1.2
Alabaster.....	1.7	Iridium.....	6-6.5
Alum.....	2-2.5	Iridosmium.....	7
Aluminum.....	2-2.9	Iron.....	4-5
Alundum.....	9+	Kaolinite.....	2.0-2.5
Amber.....	2-2.5	Lead.....	1.5
Andalusite.....	7.5	Lithium.....	0.6
Anthracite.....	2.2	Loess (0°).....	0.3
Antimony.....	3.0-3.3	Magnesium.....	2.0
Apatite.....	5	Magnetite.....	6
Aragonite.....	3.5	Manganese.....	5.0
Arsenic.....	3.5	Marble.....	3-4
Asbestos.....	5	Meerschaum.....	2-3
Asphalt.....	1-2	Mica.....	2.8
Augite.....	6	Opal.....	4-6
Barite.....	3.3	Orthoclase.....	6
Bell-metal.....	4	Osmium.....	7.0
Beryl.....	7.8	Palladium.....	4.8
Bismuth.....	2.5	Phosphorus.....	0.5
Boric acid.....	3	Phosphorbronze.....	4
Boron.....	9.5	Platinum.....	4.3
Brass.....	3-4	Plat-iridium.....	6.5
Cadmium.....	2.0	Potassium.....	0.5
Calamine.....	5	Pumice.....	6
Calcite.....	3	Pyrite.....	6.3
Calcium.....	1.5	Quartz.....	7
Carbon.....	10.0	Rock salt (halite).....	2
Carborundum.....	9-10	Ross' metal.....	2.5-3.0
Cesium.....	0.2	Rubidium.....	0.3
Chromium.....	9.0	Ruthenium.....	6.5
Copper.....	2.5-3	Selenium.....	2.0
Corundum.....	9	Serpentine.....	3-4
Diamond.....	10	Silicon.....	7.0
Diatomaceous earth.....	1-1.5	Silver.....	2.5-7
Dolomite.....	3.5-4	Silver chloride.....	1.3
Emery.....	7-9	Sodium.....	0.4
Feldspar.....	6	Steel.....	5-8.5
Flint.....	7	Stibnite.....	2
Fluorite.....	4	Strontium.....	1.8
Galena.....	2.5	Sulfur.....	1.5-2.5
Gallium.....	1.5	Talc.....	1
Garnet.....	6.5-7	Tellurium.....	2.3
Glass.....	4.5-6.5	Tin.....	1.5-1.8
Gold.....	2.5-3	Topaz.....	8
Graphite.....	0.5-1	Tourmaline.....	7.3
Gypsum.....	1.6-2	Wax (0°).....	0.2
Hematite.....	6	Wood's metal.....	3
Hornblende.....	5.5	Zinc.....	2.5

SURFACE TENSION

Compiled by T. Fraser Young and William D. Harkins

MEANING OF SYMBOLS

γ = the surface tension in dynes per centimeter.

$\Delta\gamma$ = the surface tension of a solution minus the surface tension of the pure solvent.

-- air, means that the liquid was in contact with air (saturated with its own vapor).

-- vapor, means that the liquid was in contact with its own vapor.

-- N_2 and -- H_2 have corresponding meanings.

-- also designates the surface between a pair of liquids at which the interfacial tension was determined.

% = weight % of the solute (i. e. the organic substance).

f = gram formula weights per 1000 grams of solvent (i. e. water).

$^{\circ}C$ = degrees Centigrade.

$^{\circ}K$ = degrees Kelvin or Absolute. Temperature in $^{\circ}C$ = Temperature in $^{\circ}K - 273.1$.

M.P., at the melting point.

k_E = the Eötvös Constant, in $\text{erg mole}^{-\frac{2}{3}} \text{degree}^{-1}$.

$$-k_E = \frac{d \Gamma}{d t} = \frac{d (M/d)^{\frac{2}{3}} \gamma}{d t}$$

where $\Gamma = \gamma (M/d)^{\frac{2}{3}}$

M = mass of one gram formula weight of the substance

d = density of the substance.

SURFACE TENSION (Continued)

LIQUIDS AGAINST AIR

Substance	°C	Surface tension, γ	°C	Surface tension, γ	k_E
Acetic acid.....	20	27.6	50	24.7	.....
Acetone.....	20	23.7	60	18.6	1.9
Benzene.....	20	28.88	50	25.0	2.22
Benzophenone.....	20	45.1	50	41.8	2.9
n-Butyric acid.....	20	26.8	50	24.0	.....
Carbon tetrachloride...	20	26.8	50	23.1	2.21
Chlorobenzene.....	20	33.2	50	29.6	2.2
Chloroform.....	20	27.1	60	21.7	2.1
Cyclohexane.....	20	25.3	.....	.....	.....
Ethyl acetate.....	20	23.9	50	20.2	2.3
Ethyl alcohol.....	20	22.3	50	19.8	.....
Ethyl ether.....	20	17.0	.....	.....	2.25
n-Hexane.....	20	18.4	40	16.3	.....
Methyl alcohol.....	20	22.6	50	20.1	.....
n-Octane.....	20	21.8	60	17.9	2.3
n-Octyl alcohol.....	20	27.5	.....	.....	.....
Phenol.....	20	40.9	50	37.7	1.85
n-Propylamine.....	20	22.4	45	19.4	1.9
Toluene.....	20	28.43	50	25.0	2.2
Triphenyl-phosphine...	45.7	42.0	95.9	36.9	3.3
Tristearin.....	60	29.6	130	24.7	5.5

Water.—See special table below.

LIQUIDS AGAINST THEIR VAPORS

Formula	°C	γ	°C	γ	k_E
Cl ₂ -vapor	20.	18.	50.	13.	.....
CO ₂ -vapor	-25.	9.1	20.	1.2	.....
N ₂ O ₄ -vapor	1.6	31.	19.8	28.	2.2
NH ₃ -vapor	11.1	23.	59.0	13.	1.3
PCl ₃ -vapor	20.	29.1	50.	25.2	2.2
Substance	°K	γ	°K	γ	k_E
Hydrogen..-vapor	14.68	2.882	20.40	1.912	1.36
Neon.....-vapor	24	5.90	28	4.45	2.0
Nitrogen...-vapor	70.0	10.5	90.0	6.2	2.0
Oxygen....-vapor	70.0	18.3	90.0	13.2	1.9

SURFACE TENSION (Continued)

AQUEOUS SOLUTIONS AGAINST AIR

INORGANIC

(f = gram formula weights per 1000 grams of solvent.)

For the following aqueous solutions the values of $\Delta\gamma$ are given. $\Delta\gamma$ is the difference between the surface tension of the solution and that of the solvent at the same temperature. Positive values of $\Delta\gamma$ mean that the surface tension of the solution is greater than that of the solvent. Negative values, the reverse. For convenience in computing the surface tension, the current accepted value for the surface tension of water at the stated temperature is given in the second column.

Formula	°C (γ_{H_2O})	$\Delta\gamma$ for concentrations indicated									
		f	$\Delta\gamma$	.1 .35	.5 1.5	1.0 3.2	2.0 6.9	3.0 11.0	5.0 18.4	11.2 35.	
CaCl ₂	25 (71.97)										
HCl	20 (72.75)	f	$\Delta\gamma$	.5 -2	1.0 -3	2.0 -5	3.0 -9	4.0 -1.3	6.0 -7.8	9.0 -2.2	17.7 -7.
NH ₄ OH	18 (73.05)	f	$\Delta\gamma$	.5 -1.4	1.0 -2.4	1.5 -3.1	3.0 -5.2	6.0 -7.8	15.0 -12.0	34.0 -16.0	
HNO ₃	20 (72.75)	f	$\Delta\gamma$	.7 -6	1.5 -1.1	2.8 -1.8				8.5 -4.	
KCl	20 (72.75)	f	$\Delta\gamma$	.1 .16	.5 .70	1.0 1.4	2.0 2.8	3.0 4.2	4.0 5.5	4.4 6.0	

SURFACE TENSION (Continued)

Formula	°C ($\gamma_{\text{H}_2\text{O}}$)		$\Delta\gamma$ for concentrations indicated							
			f	$\Delta\gamma$	.5	1.0	2.0	3.8	5.0	12.2
KOH	18 (73.05)	f			.9	1.8	3.5	6.7		11.3
MgCl ₂	20 (72.75)	f			.5	1.0	2.0	3.0	3.65	
		$\Delta\gamma$		.32	1.52	3.0	6.4	10.2	13.0	
MgSO ₄	20 (72.75)	f			.5	1.0	2.0	2.7		
		$\Delta\gamma$		.26	1.03	2.1	4.6	6.5		
NaBr	20 (72.75)	f			.5	1.0	1.5	2.9		
		$\Delta\gamma$			.7	1.3	2.0	3.8		
NaCl	20 (72.75)	f			.5	1.0	2.0	3.0	5.0	6.0
		$\Delta\gamma$		.17	.82	1.64	3.3	4.9	8.2	9.8
Na ₂ CO ₃	20 (72.75)	f			.5	1.0	1.5			
		$\Delta\gamma$		.25	1.3	2.7	4.0			
NaNO ₃	20 (72.75)	f			.5	1.0	2.0	3.0	5.0	7.0
		$\Delta\gamma$		.12	.60	1.2	2.4	3.5	5.6	7.5
NaOH	18 (73.05)	f			.7	1.5			5.0	11.0
		$\Delta\gamma$			1.3	2.8			10.0	23.
Na ₂ SO ₄	20 (72.75)	f			.5	1.0				14.0
		$\Delta\gamma$		.5	1.4	2.7				28.

**AQUEOUS SOLUTIONS AGAINST AIR
ORGANIC**

SURFACE TENSION (Continued)

Substance	°C		Surface tension for concentrations indicated									
			1.000	2.475	5.001	10.01	30.09	49.96	69.91	100.00		
Acetic acid.....	30	% γ	68.0	64.4	60.1	54.6	43.6	38.4	34.3	26.6		
Acetone.....	25	% γ	5.00	10.00	20.00	25.00	50.00	75.0	95.0	100.00		
			55.5	48.9	41.1	38.3	30.4	26.8	24.2	23.0		
n-Butyric acid.....	25	% γ	.14	.31	1.05	3.83	8.6	25.	79.	100.		
			69.	65.	56.	42.	33.	28.	27.	26.		
Ethyl alcohol.....	30	% γ	.979	2.143	4.994	10.39	25.00	50.00	75.06	100.00		
			66.1	61.6	54.2	45.9	34.1	27.5	24.7	21.5		
Glycerol.....	18	% γ	5.0	10.0	15.0	20.0	30.0	50.0	85.0	100.0		
			72.9	72.9	72.7	72.4	72.	70.	66.	63.		
Methyl alcohol.....	30	% γ	1.011	2.500	4.997	9.994	25.00	50.00	75.00	100.00		
			68.4	65.3	61.0	54.6	43.0	32.9	27.1	21.8		
Phenol.....	20	% γ	.024	.047	.118	.471	.941	1.881	3.76	5.62		
			72.6	72.2	71.3	66.5	61.1	54.0	46.0	42.3		
Propionic acid.....	25	% γ	.988	1.91	5.84	9.8	21.7	49.8	73.9	100.0		
			64.	60.	49.	44.	36.	32.	30.	26.		
Sucrose.....	25	% γ	10.0	20.0	30.0	40.0	55.0					
			72.5	73.0	73.4	74.1	75.7					

SURFACE TENSION (Continued)

WATER AGAINST AIR

Temperature °C	Surface tension dynes/cm.	Temperature °C	Surface tension dynes/cm.	Temperature °C	Surface tension dynes/cm.
-8	77.0	15	73.49	40	69.56
-5	76.4	18	73.05	50	67.91
0	75.6	20	72.75	60	66.18
5	74.9	25	71.97	70	64.4
10	74.22	30	71.18	80	62.6
				100	58.9

INTERFACIAL TENSION

Surface Tension at the Interface Between Two Liquids
(Each liquid saturated with the other)

Liquids	Tem- pera- ture °C	γ	Liquids	Tem- pera- ture °C	γ
Benzene- -Mercury...	20	357	Water- -Heptylic acid	20	7.0
Ethyl ether- -Mercury	20	379	Water- -n-Hexane....	20	51.1
Water- -Benzene.....	20	35.00	Water- -Mercury.....	20	375.
Water- -Carbon tetra- chloride	20	45.	Water- -n-Octane.....	20	50.8
Water- -Ethyl ether..	20	10.7	Water- -n-Octyl alcohol	20	8.5

SURFACE TENSION OF METALS

Substance		Gas	Tempera- ture °C	Surface tension	Refer- ences
Name	Symbol				
Aluminum.....	Al.....	- -air	700	840	CR(2)
Antimony.....	Sb.....	- -H ₂	750	368	ZA(4)
".....	Sb.....	- -H ₂	640	350	PM(1)
Bismuth.....	Bi.....	- -H ₂	300	388	PM(1)
".....	Bi.....	- -H ₂	583	354	ZA(1)
".....	Bi.....	- -CO	700-800	346	AdP(2)
Cadmium.....	Cd.....	- -H ₂	320	630	AC(1)
Columbium.....	Cb.....	- -H ₂	1131	1103	ZA(4)
Gallium.....	Ga.....	- -CO ₂	30	358	AC(4)
Gold.....	Au.....	- -air	1070	580-1000	AdP(1)
Lead.....	Pb.....	- -H ₂	350	454	PM(1)
".....	Pb.....	- -H ₂	750	423	ZA(4)
Mercury.....	Hg.....	- -vac.	0	480.3	AC(2)
".....	Hg.....	- -air	15	487	AC(3)
".....	Hg.....	- -H ₂	19	470	PM(1)
".....	Hg.....	- -vac.	60	467.1	AC(2)
Platinum.....	Pt.....	- -air	2000	1819	AdP(3)
Potassium.....	K.....	- -CO ₂	62	1411	AdP(4)
Silver.....	Ag.....	- -air	970	800	AdP(5)
Sodium.....	Na.....	- -CO ₂	90	294	AdP(4)
".....	Na.....	- -vac.	100	206.4	PR(1)
".....	Na.....	- -vac.	250	199.5	PR(1)
Tin.....	Sn.....	- -H ₂	253	526	PM(1)
".....	Sn.....	- -H ₂	878	508	ZA(4)
Zinc.....	Zn.....	- -H ₂	477	753	AC(1)
".....	Zn.....	- -air	590	708	JI(1)

SURFACE TENSION OF FUSED SALTS

Substance		Gas	Temperature °C	Surface tension γ	References
Name	Formula				
Barium chloride.....	BaCl ₂	--air	M.P.	171	ZA(2)
Bismuth tribromide.....	BiBr ₃	--nitrogen	442	46.2	ZA(1)
"	BiBr ₃	--nitrogen	250	66.5	ZA(1)
" trichloride.....	BiCl ₃	--nitrogen	382	52.0	ZA(1)
"	BiCl ₃	--nitrogen	271	66.2	ZA(1)
Calcium chloride.....	CaCl ₂	--air	M.P.	152	ZA(2)
Cesium bromide.....	CsBr.....	--nitrogen	658	81.8	ZA(1)
" chloride.....	CsCl.....	--nitrogen	664	89.2	ZA(1)
" fluoride.....	CsF.....	--nitrogen	723	104.5	ZA(1)
" iodide.....	CsI.....	--nitrogen	654	73.1	ZA(1)
" nitrate.....	CsNO ₃	--nitrogen	426	91.8	ZA(1)
" sulfate.....	Cs ₂ SO ₄	--nitrogen	1036	111.3	ZA(1)
Lead chloride.....	PbCl ₂	--air	490	138	BD(1)
"	PbCl ₂	--air	539	131	BD(1)
Lithium chloride.....	LiCl.....	--nitrogen	614	137.8	ZA(1)
"	LiCl.....	--nitrogen	1075	104.8	ZA(1)
" fluoride.....	LiF.....	--nitrogen	868.5	249.5	ZA(1)
"	LiF.....	--nitrogen	1270	200.1	ZA(1)
" nitrate.....	LiNO ₃	--nitrogen	359	111.5	ZA(1)
"	LiNO ₃	--nitrogen	609	96.2	ZA(1)
" sulfate.....	LiSO ₄	--nitrogen	860	223.8	ZA(1)
"	LiSO ₄	--nitrogen	1214	200.3	ZA(1)
Potassium metaborate.....	KBr.....	--nitrogen	992	123.5	ZA(1)
" bromide.....	KBr.....	--nitrogen	775	85.7	ZA(1)
"	KBr.....	--air	M.P.	83.5	ZA(1)
"	KBr.....	--nitrogen	887	77.8	ZA(1)
" chloride.....	KCl.....	--nitrogen	909	88.0	ZA(1)
"	KCl.....	--nitrogen	1054	77.2	ZA(1)
"	KCl.....	--nitrogen	1167	69.6	ZA(1)
"	KCl.....	--air	M.P.	98.4	ZA(1)
" cyanide.....	KCN.....	--air	M.P.	96.1	ZA(2)
" dichromate.....	K ₂ Cr ₂ O ₇	--nitrogen	420	140.1	ZA(1)
"	K ₂ Cr ₂ O ₇	--nitrogen	535	135.0	ZA(1)
" fluoride.....	KF.....	--nitrogen	913	138.4	ZA(1)
"	KF.....	--nitrogen	1310	104.9	ZA(1)
" molybdate.....	K ₂ MoO ₄	--nitrogen	931	150.5	ZA(1)
"	K ₂ MoO ₄	--nitrogen	1522	112.5	ZA(1)
" nitrate.....	KNO ₃	--nitrogen	380	110.4	ZA(1)
"	KNO ₃	--air	414	100.7	ZA(1)
" metaphosphate.....	KPO ₃	--nitrogen	897	155.5	ZA(1)
"	KPO ₃	--nitrogen	1205	133.5	ZA(1)
"	KPO ₃	--nitrogen	1536	100.3	ZA(1)
" sulfate.....	K ₂ SO ₄	--nitrogen	1070	143.7	ZA(1)
"	K ₂ SO ₄	--nitrogen	1306	128.8	ZA(1)
"	K ₂ SO ₄	--nitrogen	1656	106.8	ZA(1)
" tungstate.....	K ₂ WO ₄	--nitrogen	925	161.0	ZA(1)
"	K ₂ WO ₄	--nitrogen	1520	105.6	ZA(1)
Rubidium bromide.....	RbBr.....	--nitrogen	729	87.7	ZA(1)
" chloride.....	RbCl.....	--nitrogen	750	95.7	ZA(1)
"	RbCl.....	--nitrogen	933	79.9	ZA(1)
"	RbCl.....	--nitrogen	1150	61.4	ZA(1)
" fluoride.....	RbF.....	--nitrogen	803	127.2	ZA(1)
" iodide.....	RbI.....	--nitrogen	673	79.4	ZA(1)
" nitrate.....	RbNO ₃	--nitrogen	327	107.5	ZA(1)
" sulfate.....	Rb ₂ SO ₄	--nitrogen	1086	132.5	ZA(1)
Silver bromide.....	AgBr.....	--air	M.P.	121.4	AdP(5)
" chloride.....	AgCl.....	--air	452	125.5	ZA(3)
"	AgCl.....	--air	494	121.6	ZA(3)
Sodium bromide.....	NaBr.....	--nitrogen	985	90.0	ZA(1)
"	NaBr.....	--air	M.P.	102.8	ZA(1)
" tetraborane deriv.....	NaBO ₂	--nitrogen	1016	193.7	ZA(1)
" chloride.....	NaCl.....	--nitrogen	803	113.8	ZA(1)
"	NaCl.....	--nitrogen	908	106.4	ZA(1)

SURFACE TENSION OF FUSED SALTS (Continued)

Substance		Gas	Temperature °C	Surface tension γ	References
Name	Formula				
Sodium chloride.....	NaCl.....	--nitrogen	996	99.7	ZA(1)
" ".....	NaCl.....	--nitrogen	1080	94.0	ZA(1)
" ".....	NaCl.....	--nitrogen	1172	88.0	ZA(1)
" fluoride.....	NaF.....	--nitrogen	1010	199.5	ZA(1)
" ".....	NaF.....	--nitrogen	1263	173.1	ZA(1)
" ".....	NaF.....	--nitrogen	1546	143.5	ZA(1)
" iodide.....	NaI.....	--air	M.P.	93.9	ZA(1)
" ".....	NaI.....	--nitrogen	861	77.6	ZA(1)
" molybdate.....	NaMoO ₄	--nitrogen	699	214.0	ZA(1)
" nitrate.....	NaNO ₃	--nitrogen	322	119.7	ZA(1)
" ".....	NaNO ₃	--nitrogen	602	103.4	ZA(1)
" ".....	NaNO ₃	--nitrogen	738	93.7	ZA(1)
" ".....	NaNO ₃	--nitrogen	513	108.9	ZA(1)
" metaphosphate.....	NaPO ₃	--nitrogen	827	197.5	ZA(1)
" ".....	NaPO ₃	--nitrogen	1517	147.5	ZA(1)
" sulfate.....	NaSO ₄	--nitrogen	900	194.8	ZA(1)
" ".....	NaSO ₄	--nitrogen	1077	184.7	ZA(1)
" tungstate.....	NaWO ₄	--nitrogen	710	203.3	ZA(1)
Sulfur.....	S.....	--air	445	38.97	JS(1)
Tin chloride.....	SnCl ₂	nitrogen	307	97.0	ZA(1)
" ".....	SnCl ₂	nitrogen	405	89.0	ZA(1)
" ".....	SnCl ₂	nitrogen	480	81.6	ZA(1)

SURFACE TENSION OF VARIOUS LIQUIDS

Substance		In contact with	Temperature °C	Surface tension dynes/ cm.	References
Name	Formula				
Acetaldehyde.....	C ₂ H ₄ O.....	--vapor	20	21.2	AC(5)
Acetaldoxime.....	C ₂ H ₅ NO.....	--vapor	35	30.1	JP(1)
Acetamide.....	C ₂ H ₅ NO.....	--vapor	85	39.3	JS(3)
Acetanilide.....	C ₈ H ₉ NO.....	--vapor	120	35.6	JS(3)
Acetic acid.....	C ₂ H ₄ O ₂	--vapor	10	23.8	ZC(1)
" ".....	C ₂ H ₄ O ₂	--vapor	20	27.8	ZC(1)
" ".....	C ₂ H ₄ O ₂	--vapor	50	24.8	AC(1)
" anhydride.....	C ₄ H ₆ O ₂	--vapor	20	32.7	AC(6); GC(1)
Acetone.....	C ₃ H ₆ O.....	--air or vapor	0	26.21	
" ".....	C ₃ H ₆ O.....	--air or vapor	20	23.70	
" ".....	C ₃ H ₆ O.....	--air or vapor	40	21.16	
Acetonitrile.....	C ₂ H ₃ N.....	--vapor	20	29.30	BF(1)
Acetophenone.....	C ₈ H ₈ O.....	--vapor	20	39.8	
Acetyl chloride.....	C ₂ H ₃ ClO.....	--vapor	14.8	26.7	JS(4)
Acetylene.....	C ₂ H ₂	--vapor	-70.5	16.4	JS(2)
Acetylsalicylic acid.....	C ₉ H ₈ O ₄	--vapor	25.9	60.06	GC(2)
Allyl alcohol.....	C ₃ H ₆ O.....	--air or vapor	20	25.8	
" isothiocyanate.....	C ₄ H ₅ NS.....	--air or vapor	20	34.5	AC(7); GC(1)
Ammonia.....	NH ₃	--vapor	11.1	23.4	JP(6a)
" ".....	NH ₃	--vapor	34.1	18.1	JP(6a)
Aniline.....	C ₆ H ₇ N.....	--vapor	20	42.9	
" ".....	C ₆ H ₇ N.....	--air	10	44.10	
" ".....	C ₆ H ₇ N.....	--air	50	39.4	
Argon.....	A.....	--vapor	-188	13.2	JS(2)
Azoxybenzene.....	C ₁₂ H ₁₀ N ₂ O.....	--vapor	51	43.34	JS(5)
Benzaldehyde.....	C ₇ H ₆ O.....	--air	20	40.04	AC(8), (9)
Benzene.....	C ₆ H ₆	--air	10	30.22	
" ".....	C ₆ H ₆	--air	20	28.88	
" ".....	C ₆ H ₆	--air saturated with vapor	20	28.89	PM(2)

SURFACE TENSION OF VARIOUS LIQUIDS (Continued)

Substance		In contact with	Temperature °C	Surface tension dynes/cm.	References
Name	Formula				
Benzene.....	C_6H_6	--vapor	30	27.56	
Benzonitrile.....	C_7H_5N	--air or vapor	20	39.05	
Benzophenone.....	$C_{13}H_{10}O$	--air or vapor	20	45.1	
Benzylamine.....	C_7H_9N	--vapor	20	39.5	JS(3)
Benzyl alcohol.....	C_7H_8O	--air or vapor	20	39.0	
Bromine.....	Br_2	--vapor	20	41.5	
Bromoform.....	$CHBr_3$	--vapor	20	41.53	JP(2); AC(10)
<i>p</i> -Bromophenol.....	C_6H_5BrO	--vapor	74.4	42.36	JS(6)
<i>d</i> -sec-Butyl alcohol.....	$C_4H_{10}O$	--vapor	10	23.5	JS(7)
<i>n</i> -Butyl alcohol.....	$C_4H_{10}O$	--air or vapor	0	26.2	
" " ".....	$C_4H_{10}O$	--air or vapor	20	24.6	
" " ".....	$C_4H_{10}O$	--air or vapor	50	22.1	
<i>tert</i> -Butyl alcohol.....	$C_4H_{10}O$	--air or vapor	20	20.7	JS(8); AC(11)
<i>n</i> -Butylamine.....	$C_4H_{11}N$	--nitrogen	41	19.7	ZA(1)
<i>n</i> -Butyric acid.....	$C_4H_8O_2$	--air	20	26.8	
Carbon bisulfide.....	CS_2	--vapor	20	32.33	AC(7)
" dioxide.....	CO_2	--vapor	20	1.16	VK(1); (2)
" ".....	CO_2	--vapor	-25	9.13	VK(1); (2)
" tetrachloride.....	CCl_4	--vapor	20	26.95	PRS(1)
" ".....	CCl_4	--vapor	100	17.26	PRS(1)
" ".....	CCl_4	--vapor	200	6.53	PRS(1)
" monoxide.....	CO	--vapor	-193	9.8	JS(2)
" ".....	CO	--vapor	-203	12.1	JS(2)
Chloroacetic acid.....	$C_2H_3ClO_2$	--nitrogen	80.2	33.3	ZA(1)
Chloral.....	C_2HCl_3O	--vapor	19.4	25.34	JS(4)
Chlorine.....	Cl_2	--vapor	20	18.4	JP(3)
".....	Cl_2	--vapor	30	25.4	ZE(1)
".....	Cl_2	--vapor	-40	27.3	ZE(1)
".....	Cl_2	--vapor	-50	29.2	ZE(1)
".....	Cl_2	--vapor	-60	31.2	ZE(1)
Chloroform.....	$CHCl_3$	--air	20	27.14	AC(8)
Dichloroacetic acid.....	$C_2H_2Cl_2O_2$	--nitrogen	25.7	35.4	ZA(1)
Diethylamine.....	$C_4H_{11}N$	--air	56	16.4	GC(1)
Diethylaniline.....	$C_{10}H_{15}N$	--vapor	20	34.2	
Diethyl carbonate.....	$C_5H_{10}O_3$	--air	20	26.31	AC(12); JS(5)
" oxalate.....	$C_6H_{10}O_4$	--vapor	20	32.0	AC(13); GC(1)
" phthalate.....	$C_{12}H_{14}O_4$	--vapor	20	37.5	
" sulfate.....	$C_4H_{10}O_4S$	--air	13	34.61	JS(5)
Dimethylamine.....	C_2H_7N	--nitrogen	0	18.1	JR(4)
".....	C_2H_7N	--nitrogen	5	17.7	ZA(1)
Dimethylaniline.....	$C_8H_{11}N$	--air or vapor	20	36.6	
1,5-Dimethyl-2-phenyl-3-pyrazolone.....	$C_{11}H_{12}N_2O$	--vapor	25.9	63.63	GC(2)
Dimethyl sulfate.....	$C_2H_6O_4S$	--air	18	40.12	JS(5)
Diphenylamine.....	$C_{12}H_{11}N$	--air or vapor	80	37.7	
Ethyl acetate.....	$C_4H_8O_2$	--air	0	26.5	
" ".....	$C_4H_8O_2$	--air	20	23.9	
" ".....	$C_4H_8O_2$	--air	50	20.2	
" acetoacetate.....	$C_6H_{10}O_3$	--air or vapor	20	32.51	
" alcohol.....	C_2H_6O	--air	0	24.05	
" ".....	C_2H_6O	--vapor	10	23.61	
" ".....	C_2H_6O	--vapor	20	22.75	
" ".....	C_2H_6O	--vapor	30	21.89	
Ethylamine.....	$C_2H_5NH_2$	--nitrogen	0	21.3	JP(4)
".....	C_2H_7N	--nitrogen	9.9	20.4	ZA(1)
Ethylbenzene.....	C_8H_{10}	--vapor	20	29.20	
" benzoate.....	$C_9H_{10}O_2$	--vapor	20	35.5	

SURFACE TENSION OF VARIOUS LIQUIDS (Continued)

Substance		In contact with	Temperature °C	Surface tension dynes/cm.	References
Name	Formula				
Ethyl bromide.....	C_2H_5Br	--vapor	20	24.15	AC(8)
" cinnamate.....	$C_{11}H_{12}O_2$	--air	20	38.37	
Ethylene bromide.....	$C_2H_4Br_2$	--vapor	20	38.75	JP(2)
" chloride.....	$C_2H_4Cl_2$	--air	20	32.2	AC(7a)
" oxide.....	C_2H_4O	--vapor	-10	29.2	
"	C_2H_4O	--vapor	20	24.3	
Ethyl ether.....	$C_4H_{10}O$	--vapor	20	17.01	
"	$C_4H_{10}O$	--vapor	50	13.47	
" formate.....	$C_3H_6O_2$	--air or vapor	20	23.6	
" iodide.....	C_2H_5I	--vapor	20	29.4	PRS(1)
" nitrate.....	$C_2H_5NO_3$	--air or vapor	20	28.7	AC(14); GC(1)
dL-Ethyl lactate.....	$C_5H_{10}O_3$	--air	20	29.9	
Ethyl mercaptan.....	C_2H_5S	--air or vapor	20	22.5	
Ethyl salicylate.....	$C_9H_{10}O_3$	--vapor	20.5	38.33	JS(6)
Formamide.....	CH_3NO	--vapor	20	58.2	AC(14)
Formic acid.....	CH_2O_2	--air	20	16.2	WN(1)
Furfural.....	$C_5H_4O_2$	--air or vapor	20	43.5	AC(14); GC(1)
Gelatin solution (1%).....	.....	--water	2.85	8.3	ZK(1)
Glycerol.....	$C_3H_8O_3$	--air	20	63.4	
"	$C_3H_8O_3$	--air	90	58.6	
"	$C_3H_8O_3$	--air	150	51.9	
Glycol.....	$C_2H_6O_2$	--air or vapor	20	47.7	AC(15); JS(4)
Helium.....	He.....	--vapor	-269	.12	AS(1)
"	He.....	--vapor	-270	.239	AS(1)
"	He.....	--vapor	-271.5	.353	AS(1)
n-Hexane.....	C_6H_{14}	--air	20	18.43	
Hydrazine.....	N_2H_4	--vapor	25	91.5	AC(19)
Hydrogen.....	H_2	--vapor	-255.1	2.31	JB(1)
" cyanide.....	HCN.....	--vapor	17	18.2	ZE(1)
" peroxide.....	H_2O_2	--vapor	18.2	76.1	AC(16)
Isobutyl alcohol.....	$C_4H_{10}O$	--vapor	20	23.0	
" amine.....	$C_4H_{11}N$	--air	68	17.6	GC(1)
" chloride.....	C_4H_9Cl	--air	20	21.94	AC(8); GC(1)
Isobutyric acid.....	$C_4H_8O_2$	--air or vapor	20	25.2	
Isopropyl alcohol.....	C_3H_8O	--air or vapor	20	21.7	JS(4); AdP(6)
Mercury.....	Hg.....	--vapor	20	484	FS(1)
"	Hg.....	--air	25	473	AC(16)
"	Hg.....	--in vacuo	90	490	PM(3)
Methyl acetate.....	$C_3H_6O_2$	--air or vapor	20	24.6	
" alcohol.....	CH_4O	--air	0	24.49	AC(17)
"	CH_4O	--air	20	22.61	AC(17)
"	CH_4O	--vapor	50	20.14	AC(17)
Methylamine.....	CH_3NH_2	--nitrogen	-12	22.2	JP(4)
"	CH_5N	--vapor	-20	23.0	ZA(1)
"	CH_3NH_2	--nitrogen	-70	29.2	JP(4)
N-Methylaniline.....	C_7H_7N	--air or vapor	20	39.6	
Methyl benzoate.....	$C_8H_8O_2$	--air or vapor	20	37.6	JP(5); GC(1)
" ether.....	C_2H_6O	--vapor	-10	16.4	ZC(3)
"	C_2H_6O	--vapor	-40	21	ZC(3)
Methylene chloride.....	CH_2Cl_2	--air	20	50.76	AC(10)
Methyl ethyl ketone.....	C_4H_8O	--air or vapor	20	24.6	AS(1); AC(9)
Methyl formate.....	$C_2H_4O_2$	--vapor	20	25.08	AC(17)
" iodide.....	CH_3I	--air	43.5	25.8	GC(1)
" propionate.....	$C_4H_8O_2$	--air or vapor	20	24.9	
" salicylate.....	$C_8H_8O_3$	--nitrogen	94	31.8	ZA(1)
" sulfide.....	C_2H_6S	--vapor	11.1	26.50	JP(6)

FACE TENSION OF VARIOUS LIQUIDS (Continued)

Substance		In contact with	Temperature °C	Surface tension dynes/cm.	References
Name	Formula				
Acetone	$\text{C}_3\text{H}_6\text{O}$	--vapor	-248	5.50	JP(2)
Nitrobenzene	$\text{C}_6\text{H}_5\text{NO}_2$	--air or vapor	20	43.9	
Nitroethane	$\text{C}_2\text{H}_5\text{NO}_2$	--air or vapor	20	32.2	JS(4)
Nitrogen	N_2	--vapor	-183	6.16	JS(2)
"	N_2	--vapor	-193	8.27	JS(2)
"	N_2	--vapor	-203	10.53	JS(2)
" tetra oxide	N_2O_4	--vapor	19.8	27.5	JS(4)
Nitromethane	CH_3NO_2	--vapor	20	36.82	AC(8)
Nitrous oxide	N_2O	--vapor	20	1.75	VK(1)
n-Octane	C_8H_{18}	--vapor	20	21.80	
n-Octyl alcohol	$\text{C}_8\text{H}_{17}\text{O}$	--air	20	27.53	AC(12)
Oleic acid	$\text{C}_{18}\text{H}_{34}\text{O}_2$	--air	20	32.50	PRS(1); AC(12)
Oxygen	O_2	--vapor	-183	13.2	JS(2)
" (65 %)	O_2	--air	-190.5	12.2	BF(1)
"	O_2	--vapor	-193.0	15.7	JS(2)
"	O_2	--vapor	-203	18.3	JS(2)
Paraldehyde	$\text{C}_6\text{H}_{12}\text{O}_3$	--air	20	25.9	AC(15); AdP(6)
Phenetole	$\text{C}_8\text{H}_{10}\text{O}$	--vapor	20	32.74	
Phenol	$\text{C}_6\text{H}_5\text{O}$	--air or vapor	20	40.9	
"	$\text{C}_6\text{H}_5\text{O}$	--air or vapor	3	39.88	
Phenylhydrazine	$\text{C}_6\text{H}_5\text{N}_2$	--vapor	20	46.1	JS(3)
Phosphorus tribromide	PBr_3	--air	24	45.8	JS(5)
" trichloride	PCl_3	--vapor	20	29.1	
" triiodide	PI_3	--vapor	75.3	56.5	ZA(1)
Propionic acid	$\text{C}_3\text{H}_6\text{O}_2$	--vapor	20	26.7	
n-Propyl alcohol	$\text{C}_3\text{H}_7\text{O}$	--vapor	20	23.78	PM(2)
n-Propylamine	$\text{C}_3\text{H}_7\text{N}$	--air	20	22.4	GC(1); JS(3)
n-Propyl bromide	$\text{C}_3\text{H}_7\text{Br}$	--vapor	71	19.65	GC(1)
n-Propyl chloride	$\text{C}_3\text{H}_7\text{Cl}$	--air	47	18.3	AdC(6)
n-Propyl formate	$\text{C}_4\text{H}_8\text{O}_2$	--vapor	20	24.5	
Pyridine	$\text{C}_5\text{H}_5\text{N}$	--air	20	38.0	
Quinoline	$\text{C}_9\text{H}_7\text{N}$	--air	20	45.0	
Ricinoleic acid	$\text{C}_{18}\text{H}_{34}\text{O}_3$	--air	16	35.81	PRS(1)
Selenium	Se	--air	217	92.4	AdP(4)
Styrene	C_8H_8	--air	19	32.14	PRS(1)
Tetrabromoethane 1,1,2,2-	$\text{C}_2\text{H}_2\text{Br}_4$	--air	20	49.67	AC(8); GC(2)
Tetrachloroethane 1,1,2,2-	$\text{C}_2\text{H}_2\text{Cl}_4$	--air	22.5	36.03	ZC(2)
Tetrachloroethylene	C_2Cl_4	--vapor	20	31.74	AC(10)
Toluene	C_7H_8	--vapor	10	27.7	
"	C_7H_8	--vapor	20	28.5	
"	C_7H_8	--vapor	30	27.4	
m-Toluidine	$\text{C}_7\text{H}_9\text{N}$	--vapor	20	36.9	AC(10)
o-Toluidine	$\text{C}_7\text{H}_9\text{N}$	--air or vapor	20	40.0	
Trichloroacetic acid	$\text{C}_2\text{HCl}_3\text{O}_2$	--nitrogen	80.2	27.8	
Trichloroethane 1,1,2-	$\text{C}_2\text{H}_3\text{Cl}_3$	--air	114	22.0	GC(1)
Triethyl phosphate	$\text{C}_6\text{H}_{15}\text{O}_4\text{P}$	--air	15.5	30.61	JS(5)
Trimethylamine	$\text{C}_3\text{H}_9\text{N}$	--nitrogen	-4	17.3	ZA(1)
Triphenyl carbinol	$\text{C}_{18}\text{H}_{15}\text{O}$	--vapor	165.8	30.38	JS(6)
Vinyl acetate	$\text{CH}_3\text{CHOCO-CH}_3$	--vapor	20	23.95	
"	$\text{CH}_3\text{CHOCO-CH}_3$	--vapor	25	23.16	
"	$\text{CH}_3\text{CHOCO-CH}_3$	--vapor	30	22.54	
Water	H_2O	--air	18	74.31	AdP(7)
"	H_2O	--air	18	73.9	AdP(7)
"	H_2O	--air	25.9	71.6	GC(2)
m-Xylene	C_8H_{10}	--vapor	20	28.9	
o-Xylene	C_8H_{10}	--air	20	30.10	
p-Xylene	C_8H_{10}	--vapor	20	28.37	

SURFACE TENSION (Continued)

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VISCOSITY

The **viscosity** of a substance is defined as the tangential force per unit area of either of two horizontal planes at unit distance apart, one of which is fixed, while the other moves with unit velocity, the space being filled with the substance.

In the case of a liquid flowing slowly through a long tube of small diameter, the volume V of liquid which escapes in a time t is given by the equation,

$$V = \frac{\pi p r^4}{8l\eta} t$$

where p is the difference in pressure between the two ends of the tube; r , its radius; l , its length, and η , the viscosity. (Law of Poiseuille.)

A more complete equation is now generally used:

$$\eta = \frac{\pi d g r^4 t}{8Q(l + \lambda)} \left(h - \frac{mv^2}{g} \right)$$

where η is the viscosity; d , the density in g/cm³; r , the radius, and l , the length, of the tube in cm; Q , the volume in cm³ discharged in t sec.; λ , a correction to the length of the tube; h , the average head in cm; m , the coefficient of the kinetic energy correction, mv^2/g ; g , the acceleration due to gravity in cm/sec.²; v , the mean velocity in cm/sec. See Technologic Papers of the Bureau of Standards 100 and 112, 1917 and 1918, for a full discussion.

Viscosity is expressed in dyne-seconds per cm² or poises. The centipoise (cp) is 0.01 poise.

Specific viscosity is the ratio of the viscosity of any substance to that of water at 0° C or other specified temperature. Since the viscosity of water at 20° C is 1.0050 centipoises, the viscosity of any substance expressed in centipoises is approximately equal to its specific viscosity referred to water at 20° C.

Kinematic viscosity is the ratio of the viscosity to the density.

Fluidity is the reciprocal of viscosity.

VISCOSITY OF WATER BELOW 0° C

White-Twining, 1914

Temperature	Viscosity centipoises	Temperature	Viscosity centipoises
0° C	1.798	-7.23	2.341
-2.10	1.930	-8.48	2.458
-4.70	2.121	-9.30	2.549
-6.20	2.250		

VISCOSITY AND FLUIDITY OF WATER 0-100° C

Bingham and Jackson, Bull. Bur. Stds. **14**, 75 (1918)

Temp. °C	Fluidity 1/poises	Viscosity centi- poises	Specific viscosity (0° C)	Temp. °C	Fluidity 1/poises	Viscosity centi- poises	Specific viscosity (0° C)
0	55.80	1.7921	1.0000	50	182.00	0.5494	0.3066
1	57.76	1.7313	.9661	51	185.05	.5404	.3015
2	59.78	1.6728	.9334	52	188.14	.5315	.2966
3	61.76	1.6191	.9035	53	191.23	.5229	.2918
4	63.80	1.5674	.8746	54	194.34	.5146	.2871
5	65.84	1.5188	.8475	55	197.45	.5064	.2826
6	67.90	1.4728	.8218	56	200.62	.4985	.2782
7	70.01	1.4284	.7971	57	203.78	.4907	.2738
8	72.15	1.3860	.7734	58	206.95	.4832	.2696
9	74.28	1.3462	.7512	59	210.13	.4759	.2656
10	76.47	1.3077	.7297	60	213.33	.4688	.2616
11	78.66	1.2713	.7094	61	216.54	.4618	.2577
12	80.89	1.2363	.6899	62	219.80	.4550	.2539
13	83.14	1.2028	.6712	63	223.07	.4483	.2502
14	85.40	1.1709	.6534	64	226.34	.4418	.2465
15	87.69	1.1404	.6363	65	229.64	.4355	.2430
16	90.00	1.1111	.6200	66	232.94	.4293	.2396
17	92.35	1.0828	.6042	67	236.25	.4233	.2362
18	94.71	1.0559	.5892	68	239.57	.4174	.2329
19	97.10	1.0299	.5747	69	242.91	.4117	.2297
20*	99.50	1.0050	.5608	70	246.26	.4061	.2266
21	101.94	.9810	.5474	71	249.63	.4006	.2235
22	104.40	.9579	.5345	72	253.02	.3952	.2205
23	106.86	.9358	.5222	73	256.42	.3900	.2176
24	109.38	.9142	.5101	74	259.82	.3849	.2148
25	111.91	.8937	.4987	75	263.25	.3799	.2120
26	114.45	.8737	.4875	76	266.67	.3750	.2093
27	117.03	.8545	.4768	77	270.12	.3702	.2066
28	119.62	.8360	.4665	78	273.57	.3655	.2040
29	122.25	.8180	.4564	79	277.04	.3610	.2014
30	124.89	.8007	.4468	80	280.53	.3565	.1989
31	127.54	.7840	.4375	81	284.03	.3521	.1965
32	130.22	.7679	.4285	82	287.53	.3478	.1941
33	132.93	.7523	.4198	83	291.03	.3436	.1917
34	135.66	.7371	.4113	84	294.54	.3395	.1894
35	138.40	.7225	.4032	85	298.06	.3355	.1872
36	141.15	.7085	.3953	86	301.63	.3315	.1850
37	143.95	.6947	.3876	87	305.21	.3276	.1828
38	146.76	.6814	.3802	88	308.78	.3239	.1807
39	149.60	.6685	.3730	89	312.35	.3202	.1787
40	152.45	.6560	.3661	90	315.92	.3165	.1766
41	155.30	.6439	.3593	91	319.53	.3130	.1747
42	158.20	.6321	.3527	92	323.13	.3095	.1727
43	161.11	.6207	.3464	93	326.74	.3060	.1707
44	164.02	.6097	.3402	94	330.38	.3027	.1689
45	167.00	.5988	.3341	95	334.01	.2994	.1671
46	169.97	.5883	.3283	96	337.65	.2962	.1653
47	172.95	.5782	.3226	97	341.30	.2930	.1635
48	175.95	.5683	.3171	98	344.96	.2899	.1618
49	178.95	.5588	.3118	99	348.63	.2868	.1600
50	182.00	.5494	.3066	100	352.30	.2838	.1584

* The viscosity of water at 20.20° C is 1.0000 centipoise.

VISCOSITY OF WATER Above 100° C

Pressure is that of the saturated vapor at the temperature indicated.

T °C	Viscosity cp	T °C	Viscosity cp	T °C	Viscosity cp
101	0.282	106	.267	120	.232
102	.279	107	.264	130	.212
103	.276	108	.262	140	.196
104	.273	109	.259	150	.184
105	.270	110	.256	160	.174

VISCOSITY OF LIQUIDS

Viscosity of liquids in centipoises (cp) including elements, inorganic and organic compounds and mixtures.

Liquid	Temp. °C	Viscosity cp	Ref.	Liquid	Temp. °C	Viscosity cp	Ref.
Acetaldehyde...	0	.2797	16	Allyl alcohol...	0	2.145	11
	10	.2557	16		15	1.49	99
	20	.22	26		20	1.363	11
Acetanilide.....	120	2.22	2		30	1.07	99
	130	1.90	11		40	.914	11
Acetic acid.....	15	1.31	79		70	.553	11
	18	1.30	22	Allylamine.....	130	.506	26
	25.2	1.155	63	Allyl chloride...	15	.347	99
	30	1.04	79		30	.300	99
	41	1.00	22	Ammonia.....	-69	.475	76
	59	.70	22		-50	.317	85
	70	.60	22		-40	.276	85
	100	.43	22		-33.5	.255	85
anhydride.....	0	1.24	22	n-Amyl acetate.	11	1.58	35
	15	.971	79		45	.805	27
	18	.90	22	alcohol.....	15	4.65	99
	30	.783	79		30	2.99	99
	100	.49	22	ether.....	15	1.188	72
Acetone.....	-92.5	2.148	62	Aniline.....	-6	13.8	55
	-80.0	1.487	62		0	10.2	55
	-59.6	.932	62		5	8.06	55
	-42.5	.695	62		10	6.50	55
	-30.0	.575	62		15	5.31	55
	-20.9	.510	62		20	4.40	55
	-13.0	.470	22		25	3.71	55
	-10.0	.450	22		30	3.16	55
	0	.399	62		35	2.71	55
	15	.337	72		40	2.37	55
	25	.316	60		50	1.85	55
	30	.295	72		60	1.51	55
	41	.280	22		70	1.27	55
Acetonitrile....	0	.442	16		80	1.09	55
	15	.375	79		90	.935	55
	25	.345	31		100	.825	55
Acetophenone...	11.9	2.28	39	Anisol	0	1.78	86
	23.5	1.59	96		20	1.32	86
	25.0	1.617	48		40	1.12	86
	50.0	1.246	48	Antimony, liq...	645	1.55	105
	80.0	.734	19		700	1.26	105
Air, liq.....	-192.3	.172	40		800	1.08	105
Alcohol. See					850	1.05	105
Ethyl, Methyl,				Benzaldehyde...	25	1.39	89
etc.				Benzene.....	0	.912	45

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.	Liquid	Temp. °C	Viscosity cp	Ref.
Benzene	10	.758	45	Butyric acid. . .	20	1.540	11
	20	.652	45		40	1.120	11
	30	.564	45		50	.975	11
	40	.503	45		70	.760	11
	50	.442	45		100	.551	11
	60	.392	45	Cadmium, liq. . .	349	1.44	32
	70	.358	45		506	1.18	32
	80	.329	45		603	1.10	32
Benzonitrile. . . .	25	1.24	69	Carbolic acid			
Benzophenone. . .	55	4.79	77	See Phenol.			
	120	1.38	77	Carbon dioxide,	0	.099	8
Benzyl alcohol. . .	20	5.8	53	liq., pres-	10	.085	8
Benzylamine. . . .	25	1.59	26	sure that of	20	.071	8
Benzylaniline. . .	33	2.18	14	saturated	30	.053	8
	130	1.20	26	vapor			
Benzyl ether. . . .	0	10.5	91	disulfide.	-13	.514	22
	20	5.33	91		-10	.495	22
	40	3.21	91		0	.436	72
Bismuth.	285	1.61	38		5	.380	72
	304	1.662	57		20	.363	72
	365	1.46	38		40	.330	11
	451	1.280	57	Carbon tetra-	0	1.329	59
	600	.998	57	chloride	15	1.038	59
Bromine, liq. . . .	-4.3	1.31	52		20	.969	65
	0	1.241	52		30	.843	65
	12.6	1.07	52		40	.739	65
	16	1.0	11		50	.651	65
	19.5	.995	52		60	.585	65
	28.9	.911	52		70	.524	65
o-Bromoaniline. .	40	3.19	102		80	.468	65
m-Bromoaniline. .	20	6.81	102		90	.426	65
	40	3.70	102		100	.384	65
	80	1.70	102	Cetyl alcohol. . .	50	13.4	82
p-Bromoaniline. .	80	1.81	102	Chlorine, liq. . .	-76.5	.729	52
Bromobenzene. . .	15	1.196	59		-70.5	.680	52
	30	.985	59		-60.2	.616	52
Bromoform.	15	2.152	72		-52.4	.566	52
	25	1.89	94		-35.4	.494	52
	30	1.741	72		0	.385	52
Butyl acetate. . .	0	1.004	90	Chlorobenzene. .	15	.900	95
	20	.732	90		20	.799	65
	40	.563	90		40	.631	65
n-Butyl alcohol. .	-50.9	36.1	88		80	.431	65
	-30.1	14.7	88		100	.367	65
	-22.4	11.1	88	Chloroform. . . .	-13	.855	22
	-14.1	8.38	88		0	.700	36
	0	5.186	11		8.1	.643	49
	15	3.379	72		15	.596	59
	20	2.948	11		20	.58	50
	30	2.30	80		25	.542	51
	40	1.782	11		30	.514	59
	50	1.411	11		39	.500	22
	70	.930	11	o-Chlorophenol. .	25	4.11	30
	100	.540	11		50	2.015	30
sec-Butyl alcohol	15	4.21	72	m-Chlorophenol. .	25	11.55	30
n-Butyl bromide	15	.626	54	p-Chlorophenol. .	50	4.99	30
n-Butyl chloride	15	.469	79	Copper, liq. . . .	1,085	3.36	105
Butyl chloride,					1,100	3.33	105
tertiary.	15	.543	108		1,150	3.22	105
n-Butyl formate	0	.940	90		1,200	3.12	105
	20	.689	90	o-Cresol.	40	4.49	86
Butyric acid. . . .	0	2.286	11	m-Cresol.	10	43.9	86
	15	1.81	99		20	20.8	86

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.	Liquid	Temp. °C	Viscosity cp	Ref.
<i>m</i> -Cresol.....	40	6.18	86	Ethyl alcohol...	10	1.466	1
<i>p</i> -Cresol.....	40	7.00	86		20	1.200	1
Creosote.....	20	12.0	53		30	1.003	1
Cycloheptane...	13.5	1.64	84		40	.834	1
Cyclohexane....	17	1.02	95		50	.702	1
Cyclohexanol...	20	68	83		60	.592	1
Cyclohexene....	13.5	.696	84		70	.504	1
	20	.66	53	alcohol, anh...	-148	8,470	58
Cyclooctane....	13.5	2.35	84		-146	5,990	58
Cyclopentane...	13.5	.493	84		-130	467	58
<i>n</i> -Decane.....	20	.92	75	aniline.....	25	2.04	26
Diethylamine...	25	.346	24	Ethylbenzene...	17	.691	95
	25	.367	26	benzoate.....	20	2.24	43
Diethylaniline...	.5	3.84	42	bromide.....	-120	5.6	56
	20.0	2.18	42		-100	2.89	56
	25.0	1.95	26		-80	1.81	56
Diethylcarbinol.	15.0	7.34	99		0	.487	11
Diethylketone...	15	.493	99		10	.441	11
Dimethylaniline.	10	1.69	42		15	.418	59
	20	1.41	42		20	.402	11
	25	1.285	26		30	.348	59
	30	1.17	74	<i>n</i> -Ethyl butyrate	15	.711	99
	40	1.04	42	Ethyl carbonate	15	.868	79
	50	.91	42	Ethylene bromide	0	2.438	11
Dimethyl- α -naphthylamine	130	.868	26		17	1.95	95
Dimethyl- β -naphthylamine	130	.952	26		20	1.721	11
Diphenyl.....	70	1.49	75		40	1.286	11
	100	.97	75		67.3	.922	17
Diphenylamine..	130	1.04	26		70	.903	11
Dodecane.....	25	1.35	87		82.2	.750	17
Ether (diethyl-).	-100	1.69	1	chloride.....	99.0	.648	17
	-80	.958	1		0	1.077	22
	-60	.637	1		15	.887	72
	-40	.461	1		19.4	.800	22
	-20	.362	1		40	.652	11
	0	.2842	1		50	.565	22
	17	.240	95		70	.479	11
	20	.2332	1	glycol.....	20	19.9	75
	25	.222	51		40	9.13	75
	40	.197	1		60	4.95	75
	60	.166	1		80	3.02	75
	80	.140	1		100	1.99	75
	100	.118	1	oxide.....	-49.8	.577	46
Ethyl acetate...	0	.582	11		-38.2	.488	46
	8.96	.516	49		-21.0	.394	46
	10	.512	11		0	.320	46
	15	.473	79	Ethyl formate...	20	.402	
	20	.455	11	iodide.....	0	.727	11
	25	.441	48		15	.617	72
	30	.400	79		20	.592	11
	50	.345	48		40	.495	11
	75	.283	48		70	.391	11
alcohol.....	-98.11	44.0	73	malate.....	24.7	3.016	27
	-89.8	28.4	73	oxalate.....	15	2.31	79
	-71.5	13.2	73	propionate...	15	.564	79
	-59.42	8.41	73	Eugenol.....	0	29.9	91
	-52.58	6.87	73		20	9.22	91
	-32.01	3.84	73		40	4.22	91
	-17.59	2.65	73	Fluorobenzene	20	.598	65
	-1.30	1.80	73		40	.478	65
	0	1.773	1		60	.389	65
					80	.329	65
					100	.275	65

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.	Liquid	Temp. °C	Viscosity cp	Ref.
Formamide.....	0	7.55	39	Isobutyric acid..	15	1.44	108
	25	3.30	33		30	1.13	108
Formic acid.....	7.59	2.3868	5	Isoeugenol.....	25	26.72	21
	10	2.262	5	Isoheptane.....	0	.481	11
	20	1.804	5		20	.384	11
	30	1.465	5		40	.315	11
	40	1.219	11	Isohexane.....	0	.376	11
	70	.780	11		20	.306	11
	100	.549	11		40	.254	11
Furfurol.....	0	2.48	16	Isopentane.....	0	.273	11
	25	1.49	31		20	.223	11
Glucose.....	22	9.1 × 10 ¹⁵	107	Isopropyl alcohol	15	2.86	108
	30	6.6 × 10 ¹³	107		30	1.77	108
	40	2.8 × 10 ¹¹	107	Isoquinoline....	25	3.57	26
	60	9.3 × 10 ⁷	107	Isosafrol.....	25	3.981	21
	80	6.6 × 10 ⁵	107	Lead, liq.....	350	2.58	105
	100	2.5 × 10 ⁴	107		400	2.33	105
Glycerin.....	-42	6.71 × 10 ⁶	58		441	2.116	61
	-36	2.05 × 10 ⁶	58		500	1.84	105
	-25	2.62 × 10 ⁵	58		551	1.70	61
	-20	1.34 × 10 ⁵	58		600	1.38	105
	-15.4	6.65 × 10 ⁴	58		703	1.349	61
	-10.8	3.55 × 10 ⁴	58		844	1.185	61
	-4.2	1.49 × 10 ⁴	58	Menthol, liq....	55.6	6.29	17
	0	12,110	68		74.6	2.47	17
	6	6,260	68		99.0	1.04	17
	15	2,330	68	Mercury.....	-20	1.855	66
	20	1,490	68		-10	1.764	66
	25	954	68		0	1.685	66
	30	629	68		10	1.615	66
Glycerin tri- nitrate	10	69.2	78		19.02	1.56	98
	20	36.0	78		20	1.554	66
	30	21.0	78		20.2	1.55	98
	40	13.6	78		30	1.499	66
	60	6.8	78		40	1.450	66
Heptane.....	0	.524	11		40.8	1.45	98
	17	.461	95		41.86	1.44	98
	20	.409	71		50	1.407	66
	25	.386	87		60	1.367	66
	40	.341	11		70	1.331	66
	70	.262	11		80	1.298	66
n-Heptyl alcohol	15	8.53	81		90	1.268	66
Hexadecane....	20	3.34	28		100	1.240	66
Hexane.....	0	.401	11		150	1.130	66
	17	.374	95		200	1.052	66
	20	.326	11		250	.995	66
	25	.294	87		300	.950	66
	40	.271	11		340	.921	66
	50	.248	11	Methyl acetate..	0	.484	11
Hydrazin.....	1	1.29	101		20	.381	65
	10	1.12	101		40	.320	11
	20	.97	101	Methyl alcohol..	-98.30	13.9	100
		.011	40	(Methanol)	-84.23	6.8	100
Hydrogen, liq.....					-72.55	4.36	100
Iodine, liq.....	116	2.27	52		-44.53	1.98	100
Iodobenzene....	15	1.74	99		-22.29	1.22	100
Iron, 2.5% car- bon, liq.....	1,400	2.25	64		0	.82	100
Isoamyl acetate.	8.97	1.030	49		15	.623	79
	19.91	.872	49		20	.597	18
alcohol.....	10	6.20	19		25	.547	1
amine.....	25	.724	26		30	.510	79
Isobutyl alcohol	15	4.703	72		40	.456	11
amine.....	25	.553	26		50	.403	11

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.	Liquid	Temp. °C	Viscosity cp	Ref.
Methyl amine ..	0	.236	23	Oil, rape.....	10	385	3
aniline.....	25	2.02	26		20	163	3
	30	1.55	74		30	96	3
chloride.....	20	.1834	10	soya bean....	20	69.3	53
Methylene bro-	15	.109	99		30	40.6	29
midide	30	.092	99		50	20.6	29
chloride.....	15	.449	99		90	7.8	29
	30	.393	99	sperm.....	15.6	42.0	20
Methyl iodide...	0	.606	11		37.8	18.5	20
	15	.518	108		100.0	4.6	20
	20	.500	11	Oleic acid.....	30	25.6	80
	30	.460	108	Pentadecane....	22	2.81	9
	40	.424	11	Pentane.....	0	.289	11
Naphthalene....	80	.967	77		20	.240	11
	100	.776	77	o-Phenetidine...	0	16.5	102
Nitric acid.....	0	2.275			20	6.08	102
	10	1.770			30	4.22	102
Nitrobenzene...	2.95	2.91	103	m-Phenetidine..	30	12.9	102
	5.69	2.71	93	p-Phenetidine...	20	12.9	102
	5.94	2.71	103		30	8.3	102
	9.92	2.48	103	Phenol.....	18.3	12.7	13
	14.94	2.24	103		50	3.49	92
	20.00	2.03	103		60	2.61	92
Nitromethane...	0	.853	97		70	2.03	92
	25	.620	97		90	1.26	13
o-Nitrotoluene..	0	3.83	102	Phenylcyanide..	.28	1.96	42
	20	2.37	102		20.0	1.33	42
	40	1.63	102	Phosphorus, liq.	21.5	2.34	104
	60	1.21	102		31.2	2.01	104
m-Nitrotoluene..	20	2.33	102		43.2	1.73	104
	40	1.60	102		50.5	1.60	104
	60	1.18	102		60.2	1.45	104
p-Nitrotoluene..	60	1.20	102		69.7	1.32	104
n-Nonane.....	20	.711	75		79.9	1.21	104
n-Octane.....	0	.706	11	Potassium bro-	745	1.48	25
	16	.574	95	midide, liq.	775	1.34	25
	20	.542	11		805	1.19	25
	40	.433	11	nitrate, liq. ...	334	2.1	25
Octadecane.....	40	2.86	28		358	1.7	25
n-Octylalcohol..	15	10.6	81		333	2.97	25
Oil, castor.....	10	2,420	41		418	2.00	25
	20	986	41	Propionic acid. .	10	1.289	11
	30	451	41		15	1.18	79
	40	231	41		20	1.102	11
	100	16.9	41		40	.845	11
cottonseed....	20	70.4	53	Propyl acetate..	10	.66	7
cylinder, fil-	37.8	240.6	20		20	.59	7
tered	100	18.7	20		40	.44	7
cylinder, dark	37.8	422.4	20	n-Propyl alcohol	0	3.883	11
	100	24.0	20		15	2.52	108
linseed.....	30	33.1	29		20	2.256	11
	50	17.6	29		30	1.72	108
	90	7.1	29		40	1.405	11
machine, light	15.6	113.8	20		50	1.130	11
	37.8	34.2	20		70	.760	11
	100	4.9	20	Propyl aldehyde	10	.47	11
machine,	15.6	660.6	20		20	.41	11
heavy	37.8	127.4	20		40	.33	11
olive.....	10	138.0	34	bromide.....	0	.651	11
	20	84.0	34		20	.524	11
	40	36.3	34		40	.433	11
	70	12.4	34	chloride.....	0	.436	11
rape.....	0	2,530	3		20	.352	11

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.	Liquid	Temp. °C	Viscosity cp	Ref.
Propyl chloride...	40	.291	11	Tetradecane....	20	2.18	28
<i>n</i> -Propyl ether...	15	.448	79	Tin, liq.....	240	2.12	105
Pyridine.....	20	.974	47		280	1.678	4
Salicylic acid...	10	3.20	6		300	1.73	105
	20	2.71	6		301	1.680	57
	40	1.81	6		400	1.43	105
Salol.....	45	.746	77		450	1.270	57
Sodium bromide	762	1.42	25		500	1.20	105
	780	1.28	25		600	1.08	105
chloride, liq...	841	1.30	25		604	1.045	57
	896	1.01	25		750	.905	57
	924	.97	25	Toluene.....	0	.772	11
nitrate, liq....	308	2.919	25		17	.61	95
	348	2.439	25		20	.590	11
	398	1.977	25		30	.526	74
	418	1.828	25		40	.471	11
Stearic acid.....	70	11.6	75		70	.354	11
Sucrose (cane	109	2.8×10^6	12	<i>o</i> -Toluidine....	20	4.39	42
sugar)	124.6	1.9×10^6	12	<i>m</i> -Toluidine....	20	3.81	91
Sulfur (gas free)	123.0	10.94	44	<i>p</i> -Toluidine....	50	1.80	30
	135.5	8.66	44	Triacetin.....	17	28.0	95
	149.5	7.09	44	Tributyrin....	20	11.6	53
	156.3	7.19	44	Trichlorethane..	20	1.2	70
	158.2	7.59	44	Tridecane.....	23.3	1.55	9
	159.2	9.48	44	Triethylcarbinol	20	6.75	90
	159.5	14.45	44	Tripalmitin....	70	16.8	67
	160.0	22.83	44	Tristearin.....	75	18.5	67
	160.3	77.32	44	Turpentine.....	0	2.248	11
	165.0	500.0	44		10	1.783	11
	171.0	4,500.0	44		20	1.487	11
	184.0	16,000.00	44		30	1.272	11
	190.5	19,700.0	44		40	1.071	11
	197.5	21,300.0	44		70	.728	11
	200.0	21,500.0	44	Turpentine,			
	210.0	20,500.0	44	Venice.....	17.3	1.3×10^6	15
	217.0	19,100.0	44	<i>n</i> -Undecane....	20	1.17	75
	220.0	18,600.0	44	<i>o</i> -Xylene (xylol)	0	1.105	11
Sulfur dioxide,	-33.5	.5508	23		16	.876	95
liq.	-10.5	.4285	23		20	.810	11
	0.1	.3936	23		40	.627	11
Sulfuric acid....	0	48.4	1	<i>m</i> -Xylene (xylol)	0	.806	11
	15	32.8	106		15	.650	79
	20	25.4	106		20	.620	11
	30	15.7	106		40	.497	11
	40	11.5	106	<i>p</i> -Xylene (xylol)	16	.696	95
	50	8.82	106		20	.648	11
	60	7.22	106		40	.513	11
	70	6.09	106	Zinc, liq.....	280	1.68	38
	80	5.19	106		357	1.42	38
Tetrachloro-					389	1.31	38
ethane.....	15	1.844	59				

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VISCOSITY OF GASES

Gas or vapor	Temp. °C	Vis- cosity micro- poises	Ref.	Gas or vapor	Temp. °C	Vis- cosity micro- poises	Ref.
Acetic acid, vap.	119.1	107.0	3	Air	18	182.7	32
Acetone, vap.	100	93.1	8		40	195.8	32
	119.0	99.1	34		54	195.8	32
	190.4	118.6	34		74	210.2	32
	247.7	133.4	34		229	263.8	32
	306.4	148.1	34		334	312.3	32
Acetylene	0	93.5	12		357	317.5	32
Air	-194.2	55.1	30		409	341.3	32
	-183.1	62.7	30		466	350.1	32
	-104.0	113.0	30		481	358.3	32
	-69.4	133.3	30		537	368.6	32
	-31.6	153.9	30		565	375.0	32
	0	170.8	30		620	391.6	32

VISCOSITY OF GASES (Continued)

Gas or vapor	Temp. °C	Vis- cosity micro- poises	Ref.	Gas or vapor	Temp. °C	Vis- cosity micro- poises	Ref.
Air	638	401.4	32	Carbon dioxide . . .	13	136.1	30
	750	426.3	32		15	145.7	7
	810	441.9	32		19	149.9	32
	923	464.3	32		20	148.0	10
	1034	490.6	32		30	153	10
	1134	520.6	32		32	155	10
Alcohol. See <i>Ethyl</i> , <i>Methyl</i> , etc.					35	156	10
Ammonia	-78.5	67.2	12, 16		40	157	10
	0	91.8			99.1	186.1	7
	20	98.2	27		104	188.9	32
	50	109.2	27		182.4	222.1	7
	100	127.9	27		235	241.5	32
	132.9	139.9	27		302.0	268.2	7
	150	146.3	27		490	330.0	32
	200	164.6	27		685	380.0	32
	250	181.4	27		850	435.8	32
	300	198.7	27		1052	478.6	32
Argon	0	209.6	1	disulfide, vap.	0	91.1	18
	20	221.7	21		14.2	96.4	18
	100	269.5	21		114.3	130.3	34
	200	322.3	21		190.2	156.1	34
	302	368.5	23		309.8	196.6	34
	401	411.5	23	monoxide	-191.5	56.1	12, 17
	493	448.4	23		-78.5	127	
	584	481.5	23		0	166	
	714	525.7	23		15	172	
	827	563.2	23		21.7	175.3	22
Arsenic hydride (Ar- sine)	0	145.8	16		126.7	218.3	22
	15	114.0	16		227.0	254.8	22
	100	198.1	16		276.9	271.4	22
Benzene, vap	14.2	73.8	8, 18	tetrachloride, vap..	76.7	195.0	4
	131.2	103.1	34		127.9	133.4	34
	194.6	119.8	34		200.2	156.2	34
	252.5	134.3	34	Chlorine	314.9	190.2	34
	312.8	148.4	34		12.7	129.7	9
Bromine, vap.	12.8	151	9		20	132.7	38
	65.7	170	9		50	146.9	38
	99.7	188	9		100	167.9	38
	139.7	208	9		150	187.5	38
	179.7	227	9		200	208.5	38
	220.3	248	9		250	227.6	38
Bromoform, vap. . . .	151.2	253.0	4	Chloroform, vap. . . .	0	93.6	1
Bucyl alcohol, <i>n</i> , vap	116.9	143	4		14.2	98.9	1
<i>tert</i> , vap.	82.9	160	4		100	129	1
chloride, <i>n</i> , vap. . . .	78	149.5	4		121.3	135.7	34
iodide, vap	130	202	4		189.1	157.9	34
β -Butylene	18.8	74.4	37		250.0	177.6	34
	100.4	94.5	37	Cyanogen	307.5	194.7	34
	200	119.2	37		0	92.8	16
Butyric acid, vap. . . .	161.7	130.0	3		17	98.7	16
Carbon dioxide	-97.8	89.6	30	Ethane	100	127.1	16
	-78.2	97.2	30		-78.5	63.4	12
	-60.0	106.1	30		0	84.8	12
	-40.2	115.5	30		17.2	90.1	25
	-21	129.4	7		50.8	100.1	25
	-19.4	126.0	30		100.4	114.3	25
	0	139.0	7		200.3	140.9	25
	0	142	14	Ether (diethyl), vap.	0	67.8	1
					14.2	71.6	1
					100	95.5	1

VISCOSITY OF GASES (Continued)

Gas or vapor	Temp. °C	Vis- cosity micro- poises	Ref.	Gas or vapor	Temp. °C	Vis- cosity micro- poises	Ref.
Ether (diethyl), vap.	121.8	98.3	34	Hydrogen.....	129.4	108.6	24
	159.4	107.9	34		229.1	126.0	24
	189.9	115.2	34		299	138.1	23
	251.0	130.0	34		412	155.4	23
	277.8	135.8	34		490	167.2	23
Ethyl acetate, vap...	0	68.4	1		601	182.9	23
	100	94.3	1		713	198.2	23
	128.1	101.8	34		825	213.7	23
	158.6	109.8	34	bromide.....	18.7	181.9	15
	192.9	119.5	34		100.2	234.4	15
	212.5	126	1	chloride.....	12.5	138.5	15
alcohol, vap.....	100	108	8		16.5	140.7	20
	130.2	117.3	34		18	142.6	20
	170.7	129.3	34		100.3	182.2	15
	191.8	135.5	34	iodide.....	20	165.5	38
	212.5	140	8		50	201.8	38
	251.7	151.9	34		100	231.6	38
	308.7	167.0	34		150	262.7	38
bromide, vap.....	38.4	186.5	4		200	292.4	38
butyrate, vap.....	119.8	160.0	3		250	318.9	38
chloride, vap.....	0	93.7	12	phosphide.....	0	106.1	16
Ethylene.....	-75.7	69.9	11		15	112.0	16
	-44.1	76.9	11		100	143.8	16
	-38.6	78.5	11	sulfide.....	0	116.6	16
	0	90.7	11		17	124.1	16
	13.8	95.4	11		100	158.7	16
	20	100.8	27	Iodine, vap.....	124.0	184	9
	50	110.3	27		170.0	204	9
	100	125.7	27		205.4	220	9
	150	140.3	27		247.1	240	9
	200	154.1	27	Isobutyl acetate, vap.	16.1	76.4	6
	250	166.6	27		116.4	155.0	6
bromide, vap.....	131.6	221.0	4	alcohol, vap.....	108.4	144.5	4
chloride, vap.....	83.5	168.0	4	bromide, vap.....	92.3	179.5	4
Ethyl formate, vap..	99.8	92	15	butyrate, vap.....	156.9	167.0	3
iodide, vap.....	72.3	216.0	4	chloride, vap.....	68.5	150.0	4
Helium.....	-257.4	27.0	19	iodide, vap.....	120	204.7	4
	-252.6	35.0	19	Isopentane, vap.....	25	69.5	31
	-191.6	87.1	19		100	86.0	31
	0	186.0	19	Isopropyl alcohol,			
	20	194.1	21	vap.....	99.8	109	13
	100	228.1	21		120.3	103.1	34
	200	267.2	21		198.4	124.8	34
	250	285.3	21		293.1	148.8	34
	282	299.2	23	bromide, vap.....	60	176.0	4
	407	343.6	23	chloride, vap.....	37.0	148.5	4
	486	370.6	23	iodide, vap.....	89.3	201.5	4
	606	408.7	23	Krypton.....	0	232.7	9
	676	430.3	23		15	246	9
	817	471.3	23	Mercury, vap.....	273	494	5
Hydrogen.....	-257.7	5.7	19		313	551	5
	-252.5	8.5	19		369	641	24
	-198.4	33.6	30		380	654	24
	-183.4	38.8	30	Methane.....	-181.6	34.8	12, 16
	-113.5	57.2	30		-78.5	76.0	
	-97.5	61.5	30		0	102.6	
	-31.6	76.7	30		20	108.7	25
	0	83.5	30		100.0	133.1	25
	20.7	87.6	30		200.5	160.5	25
	28.1	89.2	24		284	181.3	23

VISCOSITY OF GASES (Continued)

Gas or vapor	Temp. °C	Vis- cosity micro- poises	Ref.	Gas or vapor	Temp. °C	Vis- cosity micro- poises	Ref.
Methane.....	380	202.6	23	Oxygen.....	227.0	301.7	22
	499	226.4	23		283	323.3	23
Methyl acetate, vap.	99.8	98	8, 13		402	369.3	23
	100	100			496	401.3	23
	143.3	113.9	34		608	437.0	23
	218.5	134.8	34		690	461.2	23
alcohol, vap.....	66.8	135.0	4		829	501.2	23
	111.3	125.9	34	n-Pentane, vap.....	25	67.6	31
	217.5	162.0	34		100	84.1	31
	311.5	192.1	34	Propane.....	17.9	79.5	25
chloride.....	-15.3	92	7, 12		100.4	100.9	25
	0	96.9			199.3	125.1	25
	15.0	104		n-Propyl alcohol, vap.	99.9	93	13
	99.1	137			121.7	102.5	34
	182.4	168			209.7	126.7	34
	302.0	211			273.0	143.4	34
iodide, vap.....	44	232	4	bromide, vap.....	99.8	119	13
Neon.....	0	297.3	9	Propylene.....	16.7	83.4	37
	20	311.1	21		49.9	93.5	37
	100	364.6	21		100.1	107.6	37
	200	424.8	21		199.4	133.8	37
	250	453.2	21	Propyl iodide, vap...	102	210.0	4
	285	470.8	23	Sulfur dioxide.....	-75.0	85.8	29
	429	545.4	23		-20.0	107.8	29
	502	580.2	23		0	115.8	29
	594	623.0	23		0	117	12, 17
	686	662.6	23		18	124.2	
	827	721.0	23		20.5	125.4	29
Nitric oxide (NO)...	0	178	12		100.4	161.2	26
	20	187.6	36		199.4	203.8	26
	100	227.2	36		293	244.7	23
	200	268.2	36		490	311.5	23
Nitrogen.....	-21.5	156.3	2	Trimethylbutane.			
	10.9	170.7	2	(2,2,3-), vap.....	70.3	73.4	33
	27.4	178.1	22		132.2	82.7	33
	127.2	219.1	22		262.1	104.8	33
	226.7	255.9	22	Trimethylethylene,			
	299	279.7	23	vap.....	25	70.1	31
	490	337.4	23		100	86.9	31
	825	419.2	23	Water, vap.....	100	125.5	35
Nitrosyl chloride....	15	113.9	36		150	144.5	35
	100	150.4	36		200	163.5	35
	200	192.0	36		250	182.7	35
Nitrous oxide (N ₂ O).	0	135	12		300	202.4	35
	26.9	148.8	24		350	221.8	35
	126.9	194.3	24		400	241.2	35
n-Nonane, vap.....	100.3	63.3	28	Xenon.....	0	210.1	9
	202.1	78.1	28		16.5	223.5	27
n-Octane, vap.....	100.4	67.5	28		20	226.0	27
	202.2	84.8	28		127	300.9	27
Oxygen.....	0	189	14		177	335.1	27
	19.1	201.8	22		227	365.2	27
	127.7	256.8	22		277	395.4	27

VISCOSITY OF GASES (Continued)

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VISCOSITY OF SOLIDS

Substance	Temp. °C	Viscosity poises	Observer
Glass, soda.....	575	11 $\times 10^{12}$	Trouton and Andrews, 1904
Ice, glacier.....	...	12 $\times 10^{13}$	Deelev, 1908
Menthol.....	14.9	2 $\times 10^{12}$	Heydweiller, 1897
Pitch.....	0	51 $\times 10^{10}$	Trouton and Andrews, 1904
	15	1.3 $\times 10^{10}$	Trouton and Andrews, 1904
Wax, shoe makers'....	8	4.7 $\times 10^6$	Trouton and Andrews, 1904

VISCOSITY OF ALCOHOL-WATER MIXTURES

Bingham and Jackson, Bull. Bur. Stds. **14**, 59 (1918-1919)

Giving the viscosity in centipoises of mixtures of ethyl alcohol and water. For densities see table Ethyl Alcohol—Density of aqueous solutions at 20° C.

% by wt. % by vol.	10	20	30	40	50	60	70	80	90	100
	12.36	24.09	35.23	45.83	55.93	65.56	74.80	83.59	92.01	100
Temp. °C										
0	3.311	5.319	6.94	7.14	6.58	5.75	4.762	3.690	2.732	1.773
5	2.577	4.065	5.29	5.59	5.26	4.63	3.906	3.125	2.309	1.623
10	2.179	3.165	4.05	4.39	4.18	3.77	3.268	2.710	2.101	1.466
15	1.792	2.618	3.26	3.53	3.44	3.14	2.770	2.309	1.802	1.332
20	1.538	2.183	2.71	2.91	2.87	2.67	2.370	2.008	1.610	1.200
25	1.323	1.815	2.18	2.35	2.40	2.24	2.037	1.748	1.424	1.096
30	1.160	1.553	1.87	2.02	2.02	1.93	1.767	1.531	1.279	1.003
35	1.006	1.332	1.58	1.72	1.72	1.66	1.529	1.355	1.147	.914
40	.907	1.160	1.368	1.482	1.499	1.447	1.344	1.203	1.035	.834
45	.812	1.015	1.189	1.289	1.294	1.271	1.189	1.081	.939	.764
50	.734	.907	1.050	1.132	1.155	1.127	1.062	.968	.848	.702
55	.663	.814	.929	.998	1.020	.997	.943	.867	.764	.644
60	.609	.736	.834	.893	.913	.902	.856	.789	.704	.592
65	.554	.666	.752	.802	.818	.806	.766	.711	.641	.551
70	.514	.608	.683	.727	.740	.729	.695	.650	.589	.504
75	.476	.559	.624	.663	.672	.663	.636	.600	.546	.471
80	.430	.505	.567	.601	.612	.604				

VISCOSITY OF AQUEOUS SUCROSE SOLUTIONS

Bingham and Jackson, Bull. Bur. Stds. **14**, 59 (1918-19)

Giving the viscosity in centipoises for 20, 40 and 60 % by weight sucrose solutions for each 5° C from 0 to 100° C. For densities see table Sucrose—Specific gravity of aqueous sugar solutions.

Temp. °C	Viscosity, cp			Temp. °C	Viscosity, cp		
	20 %	40 %	60 %		20 %	40 %	60 %
0	3.804	14.77	238	55	0.884	2.219	11.67
5	3.154	11.56	156	60	.808	1.982	9.83
10	2.652	9.794	109.8	65	.742	1.778	8.34
15	2.267	7.468	74.6	70	.685	1.608	7.15
20	1.960	6.200	56.5	75	.635	1.462	6.20
25	1.704	5.187	43.86	80	.590	1.334	5.40
30	1.504	4.382	33.78	85	.550	1.221	4.73
35	1.331	3.762	26.52	90	.....	1.123	4.15
40	1.193	3.249	21.28	95	.....	1.037	3.72
45	1.070	2.847	17.18	100	.....	.960	3.34
50	.970	2.497	14.01				

VISCOSITY OF AQUEOUS GLYCEROL SOLUTIONS FOR CALIBRATION

From the data of M. L. Sheely, Indust. and Eng. Chem., 24, 1060, (1932)

Sp. gr. 25°/25°C	% Glyc- erol	Viscosity			Sp. gr. 25°/25°C	% Glyc- erol	Viscosity		
		20°	25°	30°			20°	25°	30°
1.00000	0	1.005	0.893	0.800	1.12720	50	6.050	5.041	4.247
1.00235	1	1.029	0.912	0.817	1.12995	51	6.396	5.319	4.467
1.00475	2	1.055	0.935	0.836	1.13265	52	6.764	5.697	4.709
1.00710	3	1.083	0.959	0.856	1.13540	53	7.158	5.910	4.957
1.00950	4	1.112	0.984	0.877	1.13815	54	7.562	6.230	5.210
1.01185	5	1.143	1.010	0.900	1.14090	55	7.997	6.582	5.494
1.01425	6	1.175	1.037	0.924	1.14365	56	8.482	6.963	5.816
1.01660	7	1.207	1.064	0.948	1.14640	57	9.018	7.394	6.148
1.01900	8	1.239	1.092	0.972	1.14915	58	9.586	7.830	6.495
1.02135	9	1.274	1.121	0.997	1.15185	59	10.25	8.312	6.870
1.02370	10	1.311	1.153	1.024	1.15460	60	10.96	8.823	7.312
1.02620	11	1.350	1.186	1.052	1.15735	61	11.71	9.428	7.740
1.02865	12	1.390	1.221	1.082	1.16010	62	12.52	10.11	8.260
1.03110	13	1.431	1.256	1.112	1.16285	63	13.43	10.83	8.812
1.03360	14	1.473	1.292	1.143	1.16560	64	14.42	11.57	9.386
1.03605	15	1.517	1.331	1.174	1.16835	65	15.54	12.36	10.02
1.03850	16	1.565	1.370	1.207	1.17110	66	16.73	13.22	10.68
1.04100	17	1.614	1.411	1.244	1.17385	67	17.96	14.18	11.45
1.04345	18	1.664	1.453	1.281	1.17660	68	19.40	15.33	12.33
1.04590	19	1.715	1.495	1.320	1.17935	69	21.07	16.62	13.27
1.04840	20	1.769	1.542	1.360	1.18210	70	22.94	17.96	14.32
1.05095	21	1.829	1.592	1.403	1.18480	71	25.17	19.53	15.56
1.05350	22	1.892	1.644	1.447	1.18755	72	27.56	21.29	16.88
1.05605	23	1.957	1.699	1.494	1.19025	73	30.21	23.28	18.34
1.05860	24	2.025	1.754	1.541	1.19295	74	33.04	25.46	19.93
1.06115	25	2.095	1.810	1.590	1.19565	75	36.46	27.73	21.68
1.06370	26	2.167	1.870	1.641	1.19840	76	40.19	30.56	23.60
1.06625	27	2.242	1.934	1.695	1.20110	77	44.53	33.58	25.90
1.06880	28	2.324	2.008	1.752	1.20380	78	49.57	37.18	28.68
1.07135	29	2.410	2.082	1.812	1.20655	79	55.47	41.16	31.62
1.07395	30	2.501	2.157	1.876	1.20925	80	62.0	45.86	34.92
1.07660	31	2.597	2.235	1.942	1.21190	81	69.3	51.02	38.56
1.07925	32	2.700	2.318	2.012	1.21455	82	77.9	56.90	42.92
1.08190	33	2.809	2.407	2.088	1.21720	83	87.9	64.2	47.90
1.08455	34	2.921	2.502	2.167	1.21990	84	99.6	72.2	53.63
1.08715	35	3.040	2.600	2.249	1.22255	85	112.9	81.5	60.05
1.08980	36	3.169	2.706	2.335	1.22520	86	129.6	92.6	68.1
1.09245	37	3.300	2.817	2.427	1.22790	87	150.4	106.1	77.5
1.09510	38	3.440	2.932	2.523	1.23055	88	174.5	122.6	88.8
1.09775	39	3.593	3.052	2.624	1.23320	89	201.4	141.8	101.1
1.10040	40	3.750	3.181	2.731	1.23585	90	234.6	163.6	115.3
1.10310	41	3.917	3.319	2.845	1.23850	91	278.4	189.3	134.4
1.10575	42	4.106	3.466	2.966	1.24115	92	328.4	221.8	156.5
1.10845	43	4.307	3.624	3.094	1.24380	93	387.7	262.9	182.8
1.11115	44	4.509	3.787	3.231	1.24645	94	457.7	308.7	212.0
1.11380	45	4.715	3.967	3.380	1.24910	95	545	366.0	248.8
1.11650	46	4.952	4.165	3.540	1.25165	96	661	435.0	296.7
1.11915	47	5.206	4.367	3.706	1.25425	97	805	522.9	354.0
1.12185	48	5.465	4.571	3.873	1.25685	98	974	629	424.0
1.12450	49	5.730	4.787	4.051	1.25945	99	1197	775	511.0
1.12720	50	6.050	5.041	4.247	1.26201	100	1499	945	624

DIFFUSION

GASES INTO AIR

Gas or vapor	Temp. ° C	Coefficient of diffusion, sq. cm/sec	Observer
Alcohol, vapor.....	40.4	0.137	Winkelmann
Carbon dioxide.....	0.0	0.139	Mean of various
Carbon disulfide.....	19.9	0.102	Winkelmann
Ether, vapor.....	19.9	0.089	Winkelmann
Hydrogen.....	0.0	0.634	Obermayer
Oxygen.....	0.0	0.178	Obermayer
Water, vapor.....	8.0	0.239	Guglielmo

AQUEOUS SOLUTIONS INTO PURE WATER Concentration in gram-molecules per liter.

Substance	Concen- tration	Temp. ° C	Diffusion sq. cm/day	Observer
Acetic acid.....	0.2	13.5	0.77	Scheffer
	1.0	12	0.74	Arrhenius
	2.0	12	0.69	Arrhenius
	3.0	12	0.68	
	4.0	12	0.66	Arrhenius
Ammonia.....	1.0	15.23	1.54	Abegg
Barium chloride.....	0.2	8	0.66	Scheffer
Bromine.....	0.1	12	0.8	Euler
Cadmium sulfate.....	2.0	19.04	0.246	Seitz
Calcium chloride.....	2.0	10	0.68	Schuhmeister
Chlorine.....	0.1	12	1.22	Euler
Copper sulfate.....	0.1	17	0.39	Thovort
Formic acid.....	1.0	12	0.97	Abegg
Glycerine.....	0.1	10.14	0.357	Heimbrodt
	0.2	10.1	3.55	Heimbrodt
	1.0	10.14	0.339	Heimbrodt
Hydrochloric acid.....	0.1	19.2	2.21	Thovort
	1.0	12	2.09	Arrhenius
	2.0	12	2.21	Arrhenius
Iodine.....	0.1	12	(0.5)	Euler
Magnesium sulfate.....	1.0	7	0.30	Scheffer
Nitric acid.....	0.1	19.5	2.07	Thovort
Potassium bromide.....	1.0	10	1.13	Schuhmeister
carbonate.....	3.0	10	0.60	Schuhmeister
chloride.....	0.1	17.5	1.38	Thovort
chloride.....	4.0	10	1.27	Schuhmeister
hydrate.....	0.1	13.5	1.72	Thovort
	1.0	12	1.72	Arrhenius
	3.0	12	1.89	Arrhenius
Silver nitrate.....	0.1	12	0.985	Thovort
Sodium acetate.....	0.2	12	0.67	Kawalki
chloride.....	0.1	15	0.94	Thovort
	0.2	15	0.94	Thovort
	1.0	15	0.94	Thovort
	1.0	14.3	0.964	Heimbrodt
hydrate.....	1.0	12	1.11	Thovort
iodide.....	1.0	10	0.80	Schuhmeister
	2.0	10	0.90	Schuhmeister
Sugar.....	1.0	12	0.254	Arrhenius
Sulfuric acid.....	1.0	12	1.12	Arrhenius
	2.0	12	1.16	Arrhenius
Urea.....	0.1	14.8	0.97	Heimbrodt
	0.2	14.8	0.969	Heimbrodt
Zinc acetate.....	2.0	18.05	0.210	Seitz
	2.0	0.04	0.120	Seitz
sulfate.....	1.0	14.8	0.236	Seitz

OSMOTIC PRESSURE OF AQUEOUS SOLUTIONS

FOR A MEMBRANE OF FERROCYANIDE OF COPPER

Dissolved Substance.	Gms. substance in 1 cm. ³ sol.	Temp. ° C.	Pressure, cm. Hg.	Observer.
Glycerine.....	.00199	0	36.7	
Gum arabic.....	0.0099	15.5	7.0	Pfeffer
Gum arabic.....	0.164	15.6	119.3	Pfeffer
Phenol (carbolic acid)	.00127	0	23.3	Naccari
	Gm.-mol. sub- stance per gm. sol.		Pressure in atm.	
Glucose.....	.0001	10.2	2.39	Morse, 1911
	.0005	10.2	11.55	Morse, 1911
	.0010	10.0	23.80	Morse, 1911
Saccharose (cane sugar).....	.0001	10.0	2.50	Morse, 1911
	.0005	10.0	12.30	Morse, 1911
	.0010	10.0	25.69	Morse, 1911
	Gm.-mol. sub- stance in 1 ccm. ³ sol.			
Potassium carbonate	.00005	15	1.17	Adie, 1891
ferrocyanide.....	.00005	15	3.44	Adie, 1891
nitrate.....	.00005	15	1.56	Adie, 1891
Sodium citrate (acid)	.00005	15	4.32	Adie, 1891

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COEFFICIENT OF THERMAL EXPANSION

LINEAR

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade.

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Aluminum.....	-191 to +16	18.35	Henning, 1907
	20	25.5	Voigt, 1893
	40	23.13	Fizeau, 1869
	600	31.50	Chatelier
99.95 %.....	20-100	23.8	Hidnert, 1925
	20-300	25.7	"
	20-600	28.7	"
commercial.....	20-100	24.0	"
	20-300	26.7	"
	20-600	28.7	"
Aluminum-bronze.....	20	17.0	National Physical Laboratory
Aluminum-beryllium alloy			
10 % Be.....	20-100	21.4	Hidnert & Sweeney, 1927
	20-300	23.3	" "
	20-500	25.4	" "
32.7 % Be.....	20-100	17.9	" "
	20-300	20.6	" "
	20-500	22.3	" "
Aluminum-copper alloy			
10 % Cu.....	20-100	22.4	} Hidnert, 1925
	20-300	28.3	
	20-500	27.7	
Aluminum-silicon alloy 10 % Si....	20-100	21.1	} Hidnert, 1925
	20-300	22.9	
	20-500	24.9	
Aluminum-zinc alloy 12 % Zn....	20-100	24.9	} Hidnert, 1925
	20-300	28.1	
	20-500	27.5	
97 % Zn.....	20-100	27.5	} Hidnert, 1925
	20-200	29.6	
	20-300	28.1	
Antimony.....	-180 to +13	10.23	Gruneisen, 1910
	20	12.	Fizeau, 1869
	15-101	10.88	Gruneisen, 1910
parallel to axis.....	10-90	17.30	Fizeau, 1869
perpendicular to axis.....	10-90	8.28	"
Arsenic.....	10-90	3.86	"
*Bakelite-dilecto.....	20-60	22.	Souder & Hidnert, 1919
micarta 32X.....	25-50	33.	" "
Beryllium 98.9 %.....	20-100	12.3	Hidnert, 1925
	20-300	14.0	"
	20-700	16.8	"
Bismuth.....	-180 to +15	12.98	} Hidnert, 1925
	19-101	13.45	
	10-90	15.37	
parallel to axis.....	10-90	15.37	} Hidnert, 1925
perpendicular to axis.....	10-90	10.84	
	10-90	10.84	
Brass			
cast.....	0-100	18.75	Smeaton
wire.....	0-100	19.30	"
66Cu, 34Zn.....	20	18.9	National Physical Laboratory

* See Scientific Paper of Bureau of Standards No. 352.

COEFFICIENT OF THERMAL EXPANSION (Continued)

LINEAR

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Primer gilding 97Cu, 2.97Zn....	25-100	16.9	
.01Pb, .02Fe, cold rolled	25-300	17.7	
cast.....	25-100	17.2	
commercial bronze 90.26Cu....	25-100	17.5	
9.7Zn, .01Pb, .03Fe	25-300	18.1	
cold rolled			
cast.....	25-100	17.4	
Low brass 80.02Cu.....	25-100	18.0	
19.89Zn, .05Pb, .03Fe	25-300	19.1	
cold rolled			
cast.....	25-100	17.9	
Spring brass, 72.02Cu.....	25-100	18.5	
27.95Zn, .01Pb, .02Fe	25-300	19.8	Hidnert, 1921
cold rolled			Scientific Paper No. 410
cast.....	25-100	18.3	Bureau of Standards
Commercial brass, 64.81Cu....	25-100	19.0	
34.92Zn, .24Pb, .03Fe	25-300	20.2	
cold rolled			
cast.....	25-100	18.9	
Leaded bronze 88.3Cu.....	25-100	17.5	
10. Zn, 1.68Pb, .02Fe	25-300	18.3	
cold rolled			
cast.....	25-100	17.6	
Free turning rod 62.33Cu.....	25-100	19.1	
35.04Zn, 2.57Pb, .06Fe	25-300	20.4	
cold rolled			
cast.....	25-100	19.0	
Brick.....		9.5	National Physical Laboratory
Bronze			
3Cu, 1Sn.....	16.6-100	18.44	Daniell
	16.6-350	21.16	"
	16.6-957	17.37	"
93.5Cu, 6.5Sn.....	16-100	17.5	Bein, 1912
90Cu, 10Sn.....	0-900	22.0	Le Chatelier, 1889
80Cu, 20Sn.....	0-800	27.0	" "
70Cu, 30Sn.....	0-700	29.5	" "
phosphor			
97, 6Cu, 2Sn, 0.2P.....	0-85	16.8	Mean
Cadmium.....	-183 to +14	44.6	Gruneisen, 1901
	20	28.8	Matthiessen, 1866
	0-100	31.59	"
	13-90	29.39	Fizeau
	315	31.6	Vicentini & Omodie
Calcite, parallel to axis.....	0-85	25.14	Benoit, 1888
perpendicular to axis.....	0-85	5.58	"
Caoutchouc.....		65.7-68.6	Various
	17-25	77.0	Kohlrausch
Carbon			
diamond.....	40	1.18	Fizeau, 1869
gas carbon.....	40	5.40	"
graphite.....	40	7.86	"
Celluloid.....	20-70	109	Souder & Hidnert, 1919
Cement and concrete.....		10-14	Fizeau
Chromium.....	20-100	6.8	Hidnert, 1931
Cobalt.....	40	12.36	Fizeau
*Condesite (No. 100).....	16-79	44.0	Souder & Hidnert, 1919
(No. 128).....	18-56	20.0	" "
Constantan.....	4-29	15.23	
60Cu, 40Ni.....	20	17.0	National Physical Laboratory

* See Scientific Paper Bureau of Standards No. 352.

COEFFICIENT OF THERMAL EXPANSION (Continued)

LINEAR

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Constantan.....	-191 to +16	12.02	Henning, 1907
	0-38	14.48	Guillaume, 1896
	0-500	14.81	Holborn & Day, 1900
Copper.....	-191 to +16	14.09	Henning, 1907
electrolytic.....	25-100	16.8	Hidnert, 1921
	25-300	17.8	"
	0-625	16.07	Dittenberger, 1902
Diamond, <i>see Carbon</i>			
Duralumin, cast.....	20-100	23.6	Hidnert, 1925
	20-300	26.0	"
	20-500	27.3	"
cold rolled.....	20-100	23.7	"
	20-300	26.4	"
	20-500	27.3	"
Ebonite.....	25-35	84.2	Kohlrausch
Emerald, parallel to axis.....	0-85	-1.35	Benoit
perpendicular to axis.....	0-85	1.00	
Fluor spar, CaF_2	0-100	19.5	Pfaff
Formica.....	20-60	30.0	Souder & Hidnert, 1919
Galena.....		19.9	
German silver.....	0-100	18.36	Pfaff
60Cu, 15Ni, 25Zn			
Glass			
tube.....	0-100	8.33	Fizeau
soft.....		8.5	Schott
hard.....		9.7	"
plate.....	0-100	8.91	Lavoisier & Laplace
crown.....	0-100	8.97	"
flint.....	50-60	7.88	Pulfrich
Jena thermometer			
16III normal.....	0-100	8.1	Schott
59III.....	0-100	5.8	"
59III.....	-191 to +16	4.24	Henning, 1907
Gold.....	-183 to +16	13.2	Gruneisen, 1910
	16-100	14.3	"
Gold-copper.....	0-100	15.52	Matthiessen
2Au, 1Cu			
Gold-platinum.....	0-100	15.23	"
2Au, 1Pt.			
Granite.....		8.3	
Gun Metal.....		18.3	National Physical Laboratory
Gutta percha.....		198.3	Russner, 1882
Hard Rubber.....	20-60	80.	Souder & Hidnert, 1919
Ice.....	-20 to -1	51.0	
	-10 to 0	50.7	Vincent, 1902
Indium.....	40	41.7	Fizeau, 1869
Invar, <i>see Nickel steel</i>			
Iodine.....	-188 to 16	83.7	Dewar, 1902
Iridium.....	-183 to +19	5.71	Gruneisen, 1910
	-190 to +17	9.07	Henning, 1907
Iron.....			
soft.....	40	12.10	Fizeau, 1869
cast.....	40	10.61	"
cast.....	-190 to +16	8.50	Henning, 1907
wrought.....	-18 to +100	11.40	Andrews
steel.....	40	13.22	Fizeau, 1869
steel, annealed.....	40	10.95	"
steel, 1.2% C.....	0-100	10.5	Le Chatelier, 1899
	100-200	11.5	"
	200-300	13.	"

COEFFICIENT OF THERMAL EXPANSION (Continued)

LINEAR

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Iron, steel	300-400	15.	Le Chatelier, 1899
"	400-500	14.	"
"	500-600	16.	"
"	600-700	16.	"
"	above 900	29.	"
Lead	-183 to +14	27.08	Gruneisen, 1910
	18-100	29.40	"
Lead-tin	0-100	25.08	Smeaton
2Pb, 1Sn			
Magnesium	-183 to +15	21.40	Gruneisen, 1910
	18-100	26.08	"
	20-100	26.0	Hidnert & Sweeney, 1928
	20-200	27.9	"
	20-500	29.8	"
cast	20-100	26.96	C. D. H., 1917
wrought	20-100	26.73	"
Magnalium	0-13	22.	Guillaume, 1902
96Al, 4Mg			
86Al, 14Mg	12-39	23.8	Stadhagen, 1901
Marble	15-100	11.7	Frohlich
" Rutland blue (Vt)			
heated in air	25-100	15.	Souder & Hidnert, 1919
	100-200	23.	"
	200-300	28.	"
cooled	300-200	15.	"
	200-100	9.	"
	100-25	4.	"
* Silver gray (Ga.)			
cooled	25-0	13.	"
	0 to -60	10.	"
heated in air	20-65	1.0	"
cooled	65-20	.5	"
Masonry		4.-7.	
Mercury	-183 to -39	30.	Dewar, 1902
	-78 to -38	41.	Grunmach, 1901
Molybdenum	25-100	4.9	Hidnert & Gero, 1924
	25-500	5.5	"
Monel metal	25-100	13.7-14.5	Souder & Hidnert
	25-300	14.9-15.2	"
	25-600	15.9-16.7	"
Nickel	-191 to +16	10.12	Henning, 1907
	40	12.79	Fizeau
	16-250	13.97	Holborn & Day, 1901
	375-1000	13.46	Holborn & Day, 1901
commercial	25-100	12.9	Souder & Hidnert, 1921
		13.5	
Nickel steel			
10% Ni	20	13.0	Nat. Phys. Lab.
20	20	19.5	"
30	20	12.	"
36 (Invar)	20	.9	"
40	20	6.0	"
50	20	9.7	"
80	20	12.5	"
Osmium	40	6.57	Fizeau
Palladium	40	11.76	"
	0-100	11.74	Matthiessen
Paraffine	0-16	106.6	Rodwell
	16-38	130.3	"
	38-49	477.1	"
Phosphorus	0-44	124.	Ladue, 1891

* For full details and data on other samples see Scientific Paper 352 Bureau of Standards.

COEFFICIENT OF THERMAL EXPANSION (Continued)

LINEAR

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Phosphor bronze, <i>see Bronze</i>			
Platinum.....	40	8.99	Fizeau
Platinum iridium.....	40	8.84	"
10 Pt. 1Ir			
Platinum silver.....	0-100	15.23	Matthiessen
33Pt, 67Ag			
Porcelain.....	20-790	4.13	Braun
Berlin.....	0-100	3.1	Holborn & Gruneisen
Bayeux.....	0	2.5	Tutton, 1902
	1000-1400	5.53	Deville & Troost
Clay .50, flint .15			
beryl .35.....	20-200	1.6	Souder & Hidnert, 1919
	400-540	3.6	" "
clay .80, feldspar.....	20-200	2.9	" "
.85, whiting .015.....	200-400	4.0	" "
clay .70, feldspar.....	20-300	3.3	" "
.19, flint .095, whiting 1.5	200-400		
		4.0	" "
clay .50, feldspar.....	20-200	4.7	" "
.16, flint .34.....	200-400	4.6	" "
Quartz (crystal).....	-190 to +16	5.21	Scheel
parallel to axis.....	0-80	7.97	Benoit, 1888
perpendicular to axis.....	0-80	13.37	"
fused.....	-191 to +16	.256	Henning, 1907
	0-30	.42	Chappius, 1903
	0-100	.50	Scheel, 1907
	0-800	.546	Randall, 1910
	0-1200	.585	"
Rhodium.....	40	8.5	Fizeau
Rock salt.....	40	40.40	"
Rubidium.....	2-17	86.2	Elsa Deuss, 1911
Ruthenium.....	40	9.63	Fizeau
Sandstone.....	20	7.-12	
Selenium.....	-180 to 0	37.2	Dorsey, 1908
	40	36.80	Fizeau
Silicon.....	40	7.63	"
Silver.....	-191 to +16	17.04	Henning, 1907
	20	18.8	Voigt, 1893
	20	6.-10.	
Slate.....			
Solder, <i>see Lead-tin</i>			
Speculum metal.....	20	19.3	Smeaton
68Cu, 32Sn			
Sodium.....	-188 to +17	62.2	Dewar, 1902
Stainless steel			
hardened.....	20-100	9.6	Souder & Hidnert, 1921
	20-200	9.8	" "
	20-600	11.2	" "
annealed.....	20-100	10.3	" "
	20-200	10.7	" "
	20-600	12.1	" "
Stellite, soft.....	20-100	14.1	Souder & Hidnert, 1921
80Co, 20Cr	20-300	15.2	" "
	20-600	16.1	" "
hard, 55Co, 40Cr.....	20-100	13.4	" "
3W, 2C	20-300	15.0	" "
	20-600	16.5	" "
"No. 2" 55Co, 35Cr.....	20-100	11.0	" "
10W	20-300	12.4	" "
Sulphur, crystal.....	40	64.13	Fizeau, 1869
Tantalum, annealed.....	20-100	0.7	Hidnert, 1927
Tellurium.....	40	16.75	Fizeau, 1869

COEFFICIENT OF THERMAL EXPANSION (Continued)

LINEAR

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Thallium.....	40	30.21	Fizeau, 1869
Thorium.....	0-100	12.3	Rentschler, Marden, 1925
Tin.....	-183 to +16	22.57	Gruneisen, 1910
	18-100	26.92	"
Topaz, axis a.....	0-100	8.32	Pfaff
" b.....	0-100	8.36	"
" c.....	0-100	4.72	"
Tourmaline			
parallel to axis.....	0-100	9.37	"
perpendicular to axis.....	0-100	7.73	"
Tungsten 99.978%.....	-100-0	4.2	Hidnert & Sweeney, 1925
	0-100	4.3	"
	0-300	4.5	"
	0-500	4.6	"
filament.....	1000-2600	6.1	Worthen, 1916
Type metal.....	17-254	19.52	Daniell
Vulcanite.....	0-18	63.60	Mayer
Wood			
parallel to fiber			
ash.....	0-100	9.51	Glatzel
beech.....	2-34	2.57	Villari
chestnut.....	2-34	6.49	"
elm.....	2-34	5.65	"
mahogany.....	2-34	3.61	"
maple.....	2-34	6.38	"
oak.....	2-34	4.92	"
pine.....	2-34	5.41	"
walnut.....	2-34	6.58	"
across fiber			
beech.....	2-34	61.4	"
chestnut.....	2-34	32.5	"
elm.....	2-34	44.3	"
mahogany.....	2-34	40.4	"
maple.....	2-34	48.4	"
oak.....	2-34	54.4	"
pine.....	2-34	34.1	"
walnut.....	2-34	48.4	"
Zinc.....	-180 to 0	26.4	Dorsey, 1908
	10-100	26.28	Thiesen, 1895
Alundum, Al ₂ O ₃	25-900	8.7	Boeck, 1912
Bauxite brick.....	25-100	4.4	Wilkes
Caoutchouc.....	16.7-25.3	77.0	Kohlrausch
Carborundum, SiC.....	25-100	6.58	Boeck, 1912
	100-900° C.	4.74	
Corundum.....		6.76	Pfaff
Fire clay brick.....	25-100	8.1 ± 3	
Flint, SiO ₂	15-1000	17.4	Houldsworth & Cobb, 1924
Limestone, Oolitic, (Ind.).....	25-100	9	Souder & Hidnert, 1919
Magnesium oxide.....	25-100	9.7-11.4	
Rubber, "Red Antimony" tubing..	10-100	111	Napier & Prettyman, 1932

THERMAL EXPANSION OF GLASSES

The following table gives the mean coefficient of linear expansion for various types of glass as determined by Peters and Cragoe of the Bureau of Standards. 1920.

Glass sample	Temp. interval	Coeffi- cient	Temp. interval	Coeffi- cient
		$\times 10^{-4}$		$\times 10^{-4}$
1 Barium flint.....	22-494	0.088	519-550	0.331
4 Plate, American.....	20-508	.108	540-560	.401
6 German.....	21-496	.099	564-589	.477
7 French.....	21-513	.094	597-613	.424
8 Light crown.....	24-422	.104	494-507	.548
10 Borosilicate crown.....	22-498	.090	539-562	.393
11 Barium crown.....	23-499	.090	589-610	.649
12 Medium flint.....	23-402	.097	452-478	.396
13 Light flint.....	22-451	.088	494-512	.347
16 Commercial glass.....	23-445	.107	510-534	.309
20 McBeth-Evans flask.....	22-449	.069	567-586	.454
21 Pyrex.....	21-471	.036	552-571	.151
22 Schott-Genossen flask.....	19-414	.056	540-562	.404
23 Soda tubing.....	21-372	.120	506-525	.234
24 Lead tubing.....	21-338	.091	464-483	.236
26 Fluorite tubing.....	22-364	.098	510-551	.284
29 Fusing in glass, German.....	23-383	.090	456-481	.283
30 Fusing in glass, Corning.....	22-376	.083	460-485	.258
Chemical glassware*				
Glasbake.....	20-300	.037		
Kimble.....	20-300	.049		
Pyrex.....	20-300	.033		
Vycor.....	20-300	.008		

More complete data, including the composition of the samples named above, will be found in Scientific Paper No. 393, Bureau of Standards.

* Wichers, Finn, Clabaugh, Jour. Res. N.B.S. 26, 539, 1941.

EQUATION FOR THE LINEAR EXPANSION OF SOLIDS

If l_0 is the length at 0°C the length at $t^\circ \text{C}$ is $l_t = l_0 (1 + \alpha t + \beta t^2)$.

The table gives the values of these coefficients.

Substance	Temp. limits $^\circ \text{C}$	α	β	Observer
Aluminum.....	10-90	$.2221 \times 10^{-4}$	$.114 \times 10^{-7}$	Fizeau
Brass.....	10-90	.1781	.098	Fizeau
Copper.....	10-90	.1596	.102	Fizeau
Gold.....	10-90	.1410	.042	Fizeau
Iron, pure.....	0-38	.1145	.071	Guillaume
Lead.....	10-90	.2829	.120	Fizeau
Nickel.....	0-38	.1255	.057	Guillaume
Platinum.....	0-1000	.0868	.013	Holborn and Valentine
Silver.....	10-90	.1862	.074	Fizeau
Tin.....	10-90	.2094	.175	Fizeau
Zinc.....	10-90	.2969	-.0635	Fizeau

CUBICAL EXPANSION OF SOLIDS

The coefficient of cubical expansion for a solid is approximately three times the linear coefficient.

The experimental values for various solids are given in the following table. The coefficient is the increase in volume per unit volume per degree Centigrade.

Substance	Temp. ° C	Coefficient	Observer
Antimony.....	0-100	0.3167×10^{-4}	Matthiessen
Asphalt.....		5-7	.....
Beryl.....	0-100	0.3167	Pfaff
Bismuth.....		0.4000	Kopp
Diamond.....	40	0.0354	Fizeau
Emerald.....	40	0.0168	Fizeau
Fiber, vulcanized.....		0.27	.....
Fluor spar.....	14-47	0.6235	Kopp
Galena.....	0-100	0.558	Pfaff
Glass, white tube.....	0-100	0.2648	Regnault
green tube.....	0-100	0.2299	Regnault
Jena.....	0-100	0.2533	Reichsanstalt
Ice.....	-20 to -1	1.1250	Brunner
Iceland spar.....	50-60	0.1447	Pulfrich
Iron.....	0-100	0.3550	Dulong and Petit
Marble.....		0.3-0.6	.....
Paraffin.....	20	5.88	Russner
Platinum.....	0-100	0.265	.....
Porcelain.....	0-100	0.1080	Deville and Troost
Quartz.....	50-60	0.3530	Pulfrich
Rock salt.....	50-60	1.2120	Pulfrich
Silver.....	0-100	0.5831	Matthiessen
Slate.....		0.15-0.3	.....
Sulfur.....	13.2-50.3	2.23	Kopp
Tar.....		6.-8.	.....
Tin.....	0-100	0.6889	Matthiessen
Zinc.....	0-100	0.8928	Matthiessen

CUBICAL EXPANSION OF LIQUIDS

(From Smithsonian Tables)

The table gives the values of the coefficients α , β and γ in the equation $V_t = V_0(1 + \alpha t + \beta t^2 + \gamma t^3)$ and also the true coefficient at 20°C.

Liquid	Temp. Range °C	$\alpha \times 10^3$	$\beta \times 10^6$	$\gamma \times 10^8$	True coeff. at 20°C $\times 10^3$
Acetic acid.....	16-107	1.0630	0.12636	1.0876	1.071
Acetone.....	0-54	1.3240	3.8090	-0.87983	1.487
Alcohol:					
Amyl.....	-15-80	0.9001	0.6573	1.18458	0.902
Ethyl, 30% by vol.....	18-39	0.2928	10.790	-11.87	.....
" 50% ".....	0-39	0.7450	1.85	0.730	.....
" 99.3% ".....	27-46	1.012	2.20	.....	1.12
" 500 atmos. press.....	0-40	0.866	.....	.....	.....
" 3000 ".....	0-40	0.524	.....	.....	.....
Methyl.....	0-61	1.1342	1.3635	0.8741	1.199
Benzene.....	11-81	1.17626	1.27776	0.80648	1.237
Bromine.....	0-59	1.06218	1.87714	-0.30854	1.132
Calcium chloride:					
5.8% solution.....	18-25	0.07878	4.2742	.....	0.250
40.9% ".....	17-24	0.42383	0.8571	.....	0.458
Carbon disulphide.....	-34-60	1.13980	1.37065	1.91225	1.218
500 atmos. pressure.....	0-50	0.940	.....	.....	.....
3000 ".....	0-50	0.581	.....	.....	.....
Carbon tetrachloride.....	0-76	1.18384	0.89881	1.35135	1.236
Chloroform.....	0-63	1.10715	4.66473	-1.74328	1.273
Ether.....	-15-38	1.51324	2.35918	4.00512	1.656
Glycerine.....		0.4853	0.4895	.....	0.505
Hydrochloric acid:					
33.2% solution.....	0-33	0.4460	0.215	.....	0.455
Mercury.....	0-100	0.18182	0.0078	.....	0.18186
Olive oil.....		0.6821	1.1405	-0.539	0.721
Pentane.....	0-33	1.4646	3.09319	1.6084	1.608
Potassium chloride:					
24.3% solution.....	16-25	0.2695	2.080	.....	0.353
Phenol.....	36-157	0.8340	0.10732	0.4446	1.090
Petroleum:					
Density 0.8467.....	24-120	0.8994	1.396	.....	0.955
Sodium chloride:					
20.6% solution.....	0-29	0.3640	1.237	.....	0.414
Sodium sulphate:					
24% solution.....	11-40	0.3599	1.258	.....	0.410
Sulphuric acid:					
10.9% solution.....	0-30	0.2835	2.580	.....	0.387
100.0% ".....	0-30	0.5758	-0.432	.....	0.558
Turpentine.....	-9-106	0.9003	1.9595	-0.44998	0.973
Water.....	0-33	-0.06427	8.5053	-6.7900	0.207

COEFFICIENTS OF EXPANSION OF GASES AT CONSTANT PRESSURE

Change in volume per unit volume per degree Centigrade.

(From Smithsonian Tables.)

Gas.	Temp. ° C.	Pressure in cm. of mercury	Coeffi- cient.	Observer.
Acetylene.....	0	76.	.003772	Leduc, 1912
Acetylene.....	0-100	76.	3739	Leduc, 1912
Air.....	0-100	76.	3670	Regnault, 1842
Air.....	0-100	100.1	36728	Chappuis, 1903
Ammonia.....	0	76.	3860	Leduc, 1912
Ammonia.....	0-100	76.	3800	Leduc, 1912
Carbon dioxide.....	0	76.	3751	Leduc, 1912
Carbon dioxide.....	0-100	76.	3723	Leduc, 1912
Carbon dioxide.....	0-20	51.8	37128	Chappuis, 1903
Carbon dioxide.....	0-40	51.8	37100	Chappuis, 1903
Carbon dioxide.....	0-100	51.8	37073	Chappuis, 1903
Carbon dioxide.....	0-20	99.8	37602	Chappuis, 1903
Carbon dioxide.....	0-100	99.8	37410	Chappuis, 1903
Carbon dioxide.....	0-20	137.7	37972	Chappuis, 1903
Carbon dioxide.....	0-100	137.7	37703	Chappuis, 1903
Carbon dioxide.....	0-7.5	2621.	1097	Baly-Ramsay, 1894
Carbon dioxide.....	64-100	2621.	6574	Baly-Ramsay, 1894
Carbon monoxide.....	0-100	76.	3669	Regnault, 1842
Chlorine.....	0	76.	3900	Leduc, 1912
Chlorine.....	0-100	76.	3830	Leduc, 1912
Cyanogen.....	0	76.	396	Leduc, 1912
Cyanogen.....	0-100	76.	387	Leduc, 1912
Hydrochloric acid.....	0	76.	3770	Leduc, 1912
Hydrochloric acid.....	0-100	76.	3734	Leduc, 1912
Hydrogen.....	0-100	100.0	36600	Chappuis, 1903
Hydrogen.....	0-100	200. atm	332	Amagat, 1890
Hydrogen.....	0-100	400. atm	295	Amagat, 1890
Hydrogen.....	0-100	600. atm	261	Amagat, 1890
Hydrogen.....	0-100	800. atm	242	Amagat, 1890
Nitrogen.....	0	76.	3673	Leduc, 1912
Nitrogen.....	0-100	76.	3671	Leduc, 1912
Nitrous oxide.....	0-100	76.	3719	Regnault, 1842
Oxygen.....	0-100	100. atm	486	Amagat
Oxygen.....	0-100	200. atm	534	Amagat
Oxygen.....	0-100	400. atm	459	Amagat
Oxygen.....	0-100	600. atm	357	Amagat
Oxygen.....	0-100	800. atm	288	Amagat
Oxygen.....	0-100	1000. atm	241	Amagat
Sulphur dioxide.....	0-100	76.	3903	Regnault, 1842
Sulphur dioxide.....	.....	98.	3980	Regnault, 1842
Water vapor.....	0-119	76.	4187	Hirn, 1862
Water vapor.....	0-141	76.	4189	Hirn, 1862
Water vapor.....	0-162	76.	4071	Hirn, 1862
Water vapor.....	0-203	76.	3938	Hirn, 1862
Water vapor.....	0-247	76.	3799	Hirn, 1862

COEFFICIENT OF EXPANSION OF GASES AT CONSTANT VOLUME

Change in pressure per unit pressure per degree Centigrade.

(From Smithsonian Tables.)

Gas.	Temp. ° C.	Pressure cm. of Hg.	Coeffi- cient.	Observer.
Acetylene.....	0	76.	.003741	Leduc, 1912
Acetylene.....	0-100	76.	3726	Leduc, 1912
Air.....	.....	6	37666	Meleander, 1890-92
Air.....	.....	1.3	37127	Meleander, 1890-92
Air.....	.....	10.0	36630	Meleander, 1890-92
Air.....	.....	25.4	36580	Meleander, 1890-92
Air.....	.....	75.2	36660	Meleander, 1890-92
Air.....	0-100	100.1	36744	Chappuis, 1903
Air.....	.....	76.0	36650	Regnault, 1842
Air.....	.....	200.0	36903	Regnault, 1842
Air.....	.....	2000.	38866	Regnault, 1842
Air.....	.....	10000.	4100	Regnault, 1842
Ammonia.....	0	76.	3800	Leduc, 1912
Ammonia.....	0-100	76.	3770	Leduc, 1912
Argon.....	.....	51.7	3668	Keunen-Randall, 1896
Carbon dioxide.....	0-20	51.8	36985	Chappuis, 1903
Carbon dioxide.....	0-40	51.8	36972	Chappuis, 1903
Carbon dioxide.....	0-100	51.8	36981	Chappuis, 1903
Carbon dioxide.....	0-20	99.8	37335	Chappuis, 1903
Carbon dioxide.....	0-100	99.8	37262	Chappuis, 1903
Carbon dioxide.....	0-100	100.0	37248	Chappuis, 1892
Carbon dioxide.....	0	76	3724	Leduc, 1912
Carbon dioxide.....	0-100	76	3714	Leduc, 1912
Carbon monoxide.....	.....	76.	36667	Regnault, 1842
Cyanogen.....	0	76.	3870	Leduc, 1912
Cyanogen.....	0-100	76.	3830	Leduc, 1912
Ethane.....	0	76	3780	Leduc, 1912
Ethane.....	0-100	76.	3750	Leduc, 1912
Helium.....	.....	56.7	3665	Keunen-Randall, 1896
Hydrochloric acid.....	.....	76.	3740	Leduc, 1912
Hydrochloric acid.....	0-100	76	3721	Leduc, 1912
Hydrogen.....	0	76.	3663	Leduc, 1912
Hydrogen.....	0-100	76.	3664	Leduc, 1912
Hydrogen.....	16-132	.0077	3328	Baly-Ramsay, 1894
Hydrogen.....	15-132	.025	3623	Baly-Ramsay, 1894
Hydrogen.....	12-105	.47	3656	Baly-Ramsay, 1894
Hydrogen.....	0-100	100.0	36626	Chappuis, 1903
Methane.....	0	76.	3680	Leduc, 1912
Methane.....	0-100	76.	3678	Leduc, 1912
Nitrogen.....	0	76.	3672	Leduc, 1912
Nitrogen.....	0-100	76.	3672	Leduc, 1912
Nitrogen.....	13-132	.06	3021	Baly-Ramsay, 1894
Nitrogen.....	9-133	.53	3290	Baly-Ramsay, 1894
Nitrogen.....	0-20	100.2	36754	Chappuis, 1903
Nitrogen.....	0-100	100.2	36744	Chappuis, 1903
Oxygen.....	0	76.	3673	Leduc, 1912
Oxygen.....	0-100	76.	3672	Leduc, 1912
Oxygen.....	11-132	.007	4161	Baly-Ramsay, 1894
Oxygen.....	9-132	.25	3984	Baly-Ramsay, 1894
Oxygen.....	11-132	.51	3831	Baly-Ramsay, 1894
Oxygen.....	.....	1.9	36683	Meleander, 1891
Oxygen.....	.....	18.5	36690	Meleander, 1891
Nitrous oxide.....	.....	76.	3676	Regnault, 1842
Sulphur dioxide, SO ₂.....	.....	76.	3845	Regnault, 1842

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS

Factors and their logarithms for reducing a gas volume to normal conditions, 0° C., 760 mm pressure.

The volume of *dry* gas measured at any temperature 10–35° C. inclusive and pressure 690–784 mm of Hg may be reduced to the volume at 0° C. (273.18° K.) and 760 mm of Hg pressure by multiplying by the factor found in the table.

In case the volume of gas is measured in the presence of water vapor the pressure of the aqueous vapor must be subtracted from the value of the total or barometric pressure before entering the table. In the case of atmospheric air the vapor pressure may be found by determining the dew point or temperature of saturation. The pressure of water vapor may then be read from the small table below. If gas volumes are measured over water, the vapor pressure will be that of saturated aqueous vapor at the temperature used. A table giving the pressure of saturated aqueous vapor over water is given below.

Pressure of Saturated Water Vapor

°C.	mm	°C.	mm	°C.	mm
9	8.6	18	15.5	27	26.7
10	9.2	19	16.5	28	28.3
11	9.8	20	17.5	29	30.0
12	10.5	21	18.7	30	31.8
13	11.2	22	19.8	31	33.7
14	12.0	23	21.1	32	35.7
15	12.8	24	22.4	33	37.7
16	13.6	25	23.8	34	39.9
17	14.5	26	25.2	35	42.2

Factors and Logarithms

T°C.	690		692		694		696		697		698	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.8758	.9424	.8783	.9437	.8809	.9449	.8834	.9462	.8847	.9468	.8860	.9474
11	.8727	.9409	.8752	.9421	.8778	.9434	.8803	.9446	.8816	.9453	.8828	.9459
12	.8696	.9393	.8722	.9406	.8747	.9419	.8772	.9431	.8785	.9437	.8797	.9443
13	.8666	.9378	.8691	.9391	.8716	.9403	.8741	.9416	.8754	.9422	.8767	.9428
14	.8636	.9363	.8661	.9376	.8686	.9388	.8711	.9401	.8723	.9407	.8736	.9413
15	.8606	.9348	.8631	.9361	.8656	.9373	.8681	.9386	.8693	.9392	.8706	.9398
16	.8576	.9333	.8601	.9345	.8626	.9358	.8651	.9370	.8663	.9377	.8675	.9383
17	.8546	.9318	.8571	.9330	.8596	.9343	.8621	.9355	.8633	.9362	.8646	.9368
18	.8517	.9303	.8542	.9315	.8566	.9328	.8591	.9341	.8603	.9347	.8616	.9353
19	.8488	.9288	.8512	.9301	.8537	.9313	.8562	.9326	.8574	.9332	.8586	.9338
20	.8459	.9273	.8483	.9286	.8508	.9298	.8532	.9311	.8545	.9317	.8557	.9323
21	.8430	.9258	.8455	.9271	.8479	.9283	.8503	.9296	.8516	.9302	.8528	.9308
22	.8402	.9244	.8426	.9256	.8450	.9269	.8475	.9281	.8487	.9287	.8499	.9294
23	.8373	.9229	.8397	.9241	.8422	.9254	.8446	.9266	.8458	.9273	.8470	.9279
24	.8345	.9214	.8369	.9227	.8393	.9239	.8417	.9252	.8430	.9258	.8442	.9264
25	.8317	.9200	.8341	.9212	.8365	.9225	.8389	.9237	.8401	.9243	.8413	.9250
26	.8289	.9185	.8313	.9198	.8337	.9210	.8361	.9223	.8373	.9229	.8385	.9235
27	.8261	.9171	.8285	.9183	.8309	.9196	.8333	.9208	.8345	.9214	.8357	.9221
28	.8234	.9156	.8258	.9169	.8282	.9181	.8306	.9194	.8318	.9200	.8329	.9206
29	.8207	.9142	.8230	.9154	.8254	.9167	.8278	.9179	.8290	.9186	.8302	.9192
30	.8180	.9127	.8203	.9140	.8227	.9152	.8251	.9165	.8263	.9171	.8274	.9177
31	.8153	.9113	.8176	.9126	.8200	.9138	.8224	.9151	.8235	.9157	.8247	.9163
32	.8126	.9099	.8149	.9111	.8173	.9124	.8197	.9136	.8208	.9143	.8220	.9149
33	.8099	.9085	.8123	.9097	.8146	.9110	.8170	.9122	.8182	.9128	.8193	.9135
34	.8073	.9070	.8096	.9083	.8120	.9095	.8143	.9108	.8155	.9114	.8167	.9120
35	.8047	.9056	.8070	.9069	.8093	.9081	.8117	.9094	.8128	.9100	.8140	.9106

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	699		700		701		702		703		704	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.8872	.9480	.8885	.9487	.8898	.9493	.8910	.9499	.8923	.9505	.8936	.9511
11	.8841	.9465	.8854	.9471	.8866	.9477	.8879	.9484	.8892	.9490	.8904	.9496
12	.8810	.9450	.8823	.9456	.8835	.9462	.8848	.9468	.8860	.9474	.8873	.9481
13	.8779	.9434	.8792	.9441	.8804	.9447	.8817	.9453	.8829	.9459	.8842	.9465
14	.8748	.9419	.8761	.9426	.8774	.9432	.8786	.9438	.8799	.9444	.8811	.9450
15	.8718	.9404	.8731	.9410	.8743	.9417	.8756	.9423	.8768	.9429	.8780	.9435
16	.8688	.9389	.8700	.9395	.8713	.9402	.8725	.9408	.8738	.9414	.8750	.9420
17	.8658	.9374	.8670	.9380	.8683	.9387	.8695	.9393	.8707	.9399	.8720	.9405
18	.8628	.9359	.8641	.9365	.8653	.9372	.8665	.9378	.8678	.9384	.8690	.9390
19	.8599	.9344	.8611	.9350	.8623	.9357	.8636	.9363	.8648	.9369	.8660	.9375
20	.8569	.9329	.8582	.9336	.8594	.9342	.8606	.9348	.8618	.9354	.8631	.9360
21	.8540	.9315	.8552	.9321	.8565	.9327	.8577	.9333	.8589	.9339	.8601	.9346
22	.8511	.9300	.8523	.9306	.8535	.9312	.8548	.9318	.8560	.9325	.8572	.9331
23	.8482	.9285	.8494	.9291	.8507	.9298	.8519	.9304	.8531	.9310	.8543	.9316
24	.8454	.9271	.8466	.9277	.8478	.9283	.8490	.9289	.8502	.9295	.8514	.9301
25	.8425	.9256	.8437	.9262	.8449	.9268	.8462	.9275	.8474	.9281	.8486	.9287
26	.8397	.9241	.8409	.9248	.8421	.9254	.8433	.9260	.8445	.9266	.8457	.9272
27	.8369	.9227	.8381	.9233	.8393	.9239	.8405	.9245	.8417	.9252	.8429	.9258
28	.8341	.9212	.8353	.9219	.8365	.9225	.8377	.9231	.8389	.9237	.8401	.9243
29	.8314	.9198	.8326	.9204	.8338	.9210	.8349	.9217	.8361	.9223	.8373	.9229
30	.8286	.9184	.8298	.9190	.8310	.9196	.8322	.9202	.8334	.9208	.8346	.9215
31	.8259	.9169	.8271	.9175	.8283	.9182	.8294	.9188	.8306	.9194	.8318	.9200
32	.8232	.9155	.8244	.9161	.8255	.9167	.8267	.9174	.8279	.9180	.8291	.9186
33	.8205	.9141	.8217	.9147	.8228	.9153	.8240	.9159	.8252	.9165	.8264	.9172
34	.8178	.9127	.8190	.9133	.8202	.9139	.8213	.9145	.8225	.9151	.8237	.9158
35	.8152	.9112	.8163	.9119	.8175	.9125	.8187	.9131	.8198	.9137	.8210	.9143

T°C.	705		706		707		708		709		710	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.8948	.9517	.8961	.9524	.8974	.9530	.8986	.9536	.8999	.9542	.9012	.9548
11	.8917	.9502	.8929	.9508	.8942	.9514	.8955	.9521	.8967	.9527	.8980	.9533
12	.8886	.9487	.8898	.9493	.8911	.9499	.8923	.9505	.8936	.9511	.8949	.9518
13	.8854	.9472	.8867	.9478	.8880	.9484	.8892	.9490	.8905	.9496	.8917	.9502
14	.8824	.9456	.8836	.9463	.8849	.9469	.8861	.9475	.8874	.9481	.8886	.9487
15	.8793	.9441	.8805	.9447	.8818	.9454	.8830	.9460	.8843	.9466	.8855	.9472
16	.8762	.9426	.8775	.9432	.8787	.9439	.8800	.9445	.8812	.9451	.8825	.9457
17	.8732	.9411	.8745	.9417	.8757	.9424	.8769	.9430	.8782	.9436	.8794	.9442
18	.8702	.9396	.8715	.9402	.8727	.9409	.8739	.9415	.8752	.9421	.8764	.9427
19	.8672	.9381	.8685	.9388	.8697	.9394	.8709	.9400	.8722	.9406	.8734	.9412
20	.8643	.9367	.8655	.9373	.8667	.9379	.8680	.9385	.8692	.9391	.8704	.9397
21	.8613	.9352	.8626	.9358	.8638	.9364	.8650	.9370	.8662	.9376	.8674	.9382
22	.8584	.9337	.8596	.9343	.8609	.9349	.8621	.9355	.8633	.9362	.8645	.9368
23	.8555	.9322	.8567	.9328	.8579	.9335	.8592	.9341	.8604	.9347	.8616	.9353
24	.8526	.9308	.8538	.9314	.8551	.9320	.8563	.9326	.8575	.9332	.8587	.9338
25	.8498	.9293	.8510	.9299	.8522	.9305	.8534	.9311	.8546	.9318	.8558	.9324
26	.8469	.9278	.8481	.9285	.8493	.9291	.8505	.9297	.8517	.9303	.8529	.9309
27	.8441	.9264	.8453	.9270	.8465	.9276	.8477	.9282	.8489	.9289	.8501	.9295
28	.8413	.9249	.8425	.9256	.8437	.9262	.8449	.9268	.8461	.9274	.8473	.9280
29	.8385	.9235	.8397	.9241	.8409	.9247	.8421	.9254	.8433	.9260	.8445	.9266
30	.8357	.9221	.8369	.9227	.8381	.9233	.8393	.9239	.8405	.9245	.8417	.9251
31	.8330	.9206	.8342	.9213	.8354	.9219	.8365	.9225	.8377	.9231	.8389	.9237
32	.8303	.9192	.8314	.9198	.8326	.9204	.8338	.9211	.8350	.9217	.8361	.9223
33	.8275	.9178	.8287	.9184	.8299	.9190	.8311	.9196	.8322	.9202	.8334	.9209
34	.8248	.9164	.8260	.9170	.8272	.9176	.8284	.9182	.8295	.9188	.8307	.9194
35	.8222	.9150	.8233	.9156	.8245	.9162	.8257	.9168	.8268	.9174	.8280	.9180

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	711		712		713		714		715		716	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9025	.9554	.9037	.9560	.9050	.9566	.9063	.9573	.9075	.9579	.9088	.9585
11	.8993	.9539	.9005	.9545	.9018	.9551	.9031	.9557	.9043	.9563	.9056	.9569
12	.8961	.9524	.8974	.9530	.8986	.9536	.8999	.9542	.9012	.9548	.9024	.9554
13	.8930	.9508	.8942	.9515	.8955	.9521	.8967	.9527	.8980	.9533	.8993	.9539
14	.8899	.9493	.8911	.9499	.8924	.9505	.8936	.9512	.8949	.9518	.8961	.9524
15	.8868	.9478	.8880	.9484	.8893	.9490	.8905	.9496	.8918	.9503	.8930	.9509
16	.8837	.9463	.8849	.9469	.8862	.9475	.8874	.9481	.8887	.9487	.8899	.9494
17	.8807	.9448	.8819	.9454	.8831	.9460	.8844	.9466	.8856	.9472	.8869	.9479
18	.8776	.9433	.8789	.9439	.8801	.9445	.8813	.9451	.8826	.9457	.8838	.9464
19	.8746	.9418	.8759	.9424	.8771	.9430	.8783	.9436	.8795	.9443	.8808	.9449
20	.8716	.9403	.8729	.9409	.8741	.9416	.8753	.9422	.8765	.9428	.8778	.9434
21	.8687	.9389	.8699	.9395	.8711	.9401	.8723	.9407	.8736	.9413	.8748	.9419
22	.8657	.9374	.8669	.9380	.8682	.9386	.8694	.9392	.8706	.9398	.8718	.9404
23	.8628	.9359	.8640	.9365	.8652	.9371	.8664	.9377	.8677	.9383	.8689	.9390
24	.8599	.9344	.8611	.9351	.8623	.9357	.8635	.9363	.8647	.9369	.8659	.9375
25	.8570	.9330	.8582	.9336	.8594	.9342	.8606	.9348	.8618	.9354	.8630	.9360
26	.8541	.9315	.8553	.9321	.8565	.9327	.8577	.9334	.8589	.9340	.8601	.9346
27	.8513	.9301	.8525	.9307	.8537	.9313	.8549	.9319	.8561	.9325	.8573	.9331
28	.8485	.9286	.8497	.9292	.8508	.9299	.8520	.9305	.8532	.9311	.8544	.9317
29	.8456	.9272	.8468	.9278	.8480	.9284	.8492	.9290	.8504	.9296	.8516	.9302
30	.8429	.9258	.8440	.9264	.8452	.9270	.8464	.9276	.8476	.9282	.8488	.9288
31	.8401	.9243	.8413	.9249	.8424	.9255	.8436	.9261	.8448	.9268	.8460	.9274
32	.8373	.9229	.8385	.9235	.8397	.9241	.8409	.9247	.8420	.9253	.8432	.9259
33	.8346	.9215	.8358	.9221	.8369	.9227	.8381	.9233	.8393	.9239	.8405	.9245
34	.8319	.9201	.8330	.9207	.8342	.9213	.8354	.9219	.8365	.9225	.8377	.9231
35	.8292	.9186	.8303	.9193	.8315	.9199	.8327	.9205	.8338	.9211	.8350	.9217

T°C.	717		718		719		720		721		722	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9101	.9591	.9113	.9597	.9126	.9603	.9139	.9609	.9151	.9615	.9164	.9621
11	.9069	.9575	.9081	.9581	.9094	.9588	.9107	.9594	.9119	.9600	.9132	.9606
12	.9037	.9560	.9049	.9566	.9062	.9572	.9075	.9578	.9087	.9584	.9100	.9590
13	.9005	.9545	.9018	.9551	.9030	.9557	.9043	.9563	.9055	.9569	.9068	.9575
14	.8974	.9530	.8986	.9536	.8999	.9542	.9011	.9548	.9024	.9554	.9036	.9560
15	.8943	.9515	.8955	.9521	.8968	.9527	.8980	.9533	.8992	.9539	.9005	.9545
16	.8912	.9500	.8924	.9506	.8936	.9512	.8949	.9518	.8961	.9524	.8974	.9530
17	.8881	.9485	.8893	.9491	.8906	.9497	.8918	.9503	.8930	.9509	.8943	.9515
18	.8850	.9470	.8863	.9476	.8875	.9482	.8887	.9488	.8900	.9494	.8912	.9500
19	.8820	.9455	.8832	.9461	.8845	.9467	.8857	.9473	.8869	.9479	.8882	.9485
20	.8790	.9440	.8802	.9446	.8814	.9452	.8827	.9458	.8839	.9464	.8851	.9470
21	.8760	.9425	.8772	.9431	.8784	.9437	.8797	.9443	.8809	.9449	.8821	.9455
22	.8730	.9410	.8742	.9416	.8755	.9422	.8767	.9428	.8779	.9434	.8791	.9440
23	.8701	.9396	.8713	.9402	.8725	.9408	.8737	.9414	.8749	.9420	.8761	.9426
24	.8671	.9381	.8684	.9387	.8696	.9393	.8708	.9399	.8720	.9405	.8732	.9411
25	.8642	.9366	.8654	.9372	.8666	.9378	.8679	.9384	.8691	.9390	.8703	.9397
26	.8613	.9352	.8625	.9358	.8637	.9364	.8649	.9370	.8661	.9376	.8674	.9382
27	.8585	.9337	.8597	.9343	.8609	.9349	.8621	.9355	.8633	.9361	.8645	.9367
28	.8556	.9323	.8568	.9329	.8580	.9335	.8592	.9341	.8604	.9347	.8616	.9353
29	.8528	.9308	.8540	.9314	.8552	.9320	.8564	.9327	.8575	.9333	.8587	.9339
30	.8500	.9294	.8512	.9300	.8523	.9306	.8535	.9312	.8547	.9318	.8559	.9324
31	.8472	.9280	.8484	.9286	.8495	.9292	.8507	.9298	.8519	.9304	.8531	.9310
32	.8444	.9265	.8456	.9271	.8467	.9278	.8479	.9284	.8491	.9290	.8503	.9296
33	.8416	.9251	.8428	.9257	.8440	.9263	.8452	.9269	.8463	.9275	.8475	.9281
34	.8389	.9237	.8401	.9243	.8412	.9249	.8424	.9255	.8436	.9261	.8447	.9267
35	.8362	.9223	.8373	.9229	.8385	.9235	.8397	.9241	.8408	.9247	.8420	.9253

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	723		724		725		726		727		728	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9177	.9627	.9190	.9633	.9202	.9639	.9215	.9645	.9228	.9651	.9240	.9657
11	.9144	.9612	.9157	.9618	.9170	.9624	.9182	.9630	.9195	.9636	.9208	.9642
12	.9112	.9596	.9125	.9602	.9138	.9608	.9150	.9614	.9163	.9620	.9175	.9626
13	.9081	.9581	.9093	.9587	.9106	.9593	.9118	.9599	.9131	.9605	.9143	.9611
14	.9049	.9566	.9061	.9572	.9074	.9578	.9086	.9584	.9099	.9590	.9111	.9596
15	.9017	.9551	.9030	.9557	.9042	.9563	.9055	.9569	.9067	.9575	.9080	.9581
16	.8986	.9536	.8999	.9542	.9011	.9548	.9023	.9554	.9036	.9560	.9048	.9566
17	.8955	.9521	.8968	.9527	.8980	.9533	.8992	.9539	.9005	.9545	.9017	.9551
18	.8924	.9506	.8937	.9512	.8949	.9518	.8961	.9524	.8974	.9530	.8986	.9536
19	.8894	.9491	.8906	.9497	.8918	.9503	.8931	.9509	.8943	.9515	.8955	.9521
20	.8863	.9476	.8876	.9482	.8888	.9488	.8900	.9494	.8913	.9500	.8925	.9506
21	.8833	.9461	.8846	.9467	.8858	.9473	.8870	.9479	.8882	.9485	.8894	.9491
22	.8803	.9446	.8816	.9452	.8828	.9458	.8840	.9464	.8852	.9470	.8864	.9476
23	.8774	.9432	.8786	.9438	.8798	.9444	.8810	.9450	.8822	.9456	.8834	.9462
24	.8744	.9417	.8756	.9423	.8768	.9429	.8780	.9435	.8792	.9441	.8805	.9447
25	.8715	.9403	.8727	.9409	.8739	.9415	.8751	.9420	.8763	.9426	.8775	.9432
26	.8686	.9388	.8698	.9394	.8710	.9400	.8722	.9406	.8734	.9412	.8746	.9418
27	.8657	.9373	.8669	.9379	.8680	.9385	.8692	.9391	.8704	.9397	.8716	.9403
28	.8628	.9359	.8640	.9365	.8652	.9371	.8664	.9377	.8676	.9383	.8687	.9398
29	.8599	.9345	.8611	.9351	.8623	.9357	.8635	.9363	.8647	.9369	.8659	.9375
30	.8571	.9330	.8583	.9336	.8595	.9342	.8606	.9348	.8618	.9354	.8630	.9360
31	.8543	.9316	.8554	.9322	.8566	.9328	.8578	.9334	.8590	.9340	.8602	.9346
32	.8515	.9302	.8526	.9308	.8538	.9314	.8550	.9320	.8562	.9326	.8573	.9332
33	.8487	.9287	.8498	.9293	.8510	.9299	.8522	.9305	.8534	.9311	.8545	.9317
34	.8459	.9273	.8471	.9279	.8482	.9285	.8494	.9291	.8506	.9297	.8518	.9303
35	.8432	.9259	.8443	.9265	.8455	.9271	.8467	.9277	.8478	.9283	.8490	.9289

T°C.	729		730		731		732		733		734	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9253	.9663	.9266	.9669	.9278	.9675	.9291	.9681	.9304	.9687	.9316	.9693
11	.9220	.9647	.9233	.9653	.9246	.9659	.9258	.9665	.9271	.9671	.9284	.9677
12	.9188	.9632	.9201	.9638	.9213	.9644	.9226	.9650	.9238	.9656	.9251	.9662
13	.9156	.9617	.9168	.9623	.9181	.9629	.9194	.9635	.9206	.9641	.9219	.9647
14	.9124	.9602	.9136	.9608	.9149	.9614	.9162	.9620	.9174	.9626	.9187	.9632
15	.9092	.9587	.9105	.9593	.9117	.9599	.9130	.9605	.9142	.9610	.9155	.9616
16	.9061	.9572	.9073	.9578	.9086	.9584	.9098	.9589	.9110	.9595	.9123	.9601
17	.9030	.9557	.9042	.9563	.9054	.9569	.9067	.9574	.9079	.9580	.9091	.9586
18	.8998	.9542	.9011	.9548	.9023	.9554	.9036	.9560	.9048	.9565	.9060	.9571
19	.8968	.9527	.8980	.9533	.8992	.9539	.9005	.9545	.9017	.9551	.9029	.9556
20	.8937	.9512	.8949	.9518	.8962	.9524	.8974	.9530	.8986	.9536	.8998	.9542
21	.8907	.9497	.8919	.9503	.8931	.9509	.8943	.9515	.8955	.9521	.8968	.9527
22	.8876	.9482	.8889	.9488	.8901	.9494	.8913	.9500	.8925	.9506	.8937	.9512
23	.8846	.9468	.8859	.9474	.8871	.9480	.8883	.9486	.8895	.9491	.8907	.9497
24	.8817	.9453	.8829	.9459	.8841	.9465	.8853	.9471	.8865	.9477	.8877	.9483
25	.8787	.9438	.8799	.9444	.8811	.9450	.8823	.9456	.8835	.9462	.8847	.9468
26	.8758	.9424	.8770	.9430	.8782	.9436	.8794	.9442	.8806	.9448	.8818	.9454
27	.8728	.9409	.8740	.9415	.8752	.9421	.8764	.9427	.8776	.9433	.8788	.9439
28	.8699	.9395	.8711	.9401	.8723	.9407	.8735	.9413	.8747	.9419	.8759	.9425
29	.8671	.9380	.8682	.9386	.8694	.9392	.8706	.9398	.8718	.9404	.8730	.9410
30	.8642	.9366	.8654	.9372	.8666	.9378	.8677	.9384	.8689	.9390	.8701	.9396
31	.8613	.9352	.8625	.9358	.8637	.9364	.8649	.9370	.8661	.9376	.8673	.9381
32	.8585	.9338	.8597	.9343	.8609	.9349	.8621	.9355	.8632	.9361	.8644	.9367
33	.8557	.9323	.8569	.9329	.8581	.9335	.8592	.9341	.8604	.9347	.8616	.9353
34	.8529	.9309	.8541	.9315	.8553	.9321	.8564	.9327	.8576	.9333	.8588	.9339
35	.8502	.9295	.8513	.9301	.8525	.9307	.8537	.9313	.8548	.9319	.8560	.9325

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	735		736		737		738		739		740	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9329	.9698	.9342	.9704	.9355	.9710	.9367	.9716	.9380	.9722	.9393	.9728
11	.9296	.9683	.9309	.9689	.9322	.9695	.9334	.9701	.9347	.9707	.9360	.9713
12	.9264	.9668	.9276	.9674	.9289	.9680	.9301	.9686	.9314	.9691	.9327	.9697
13	.9231	.9653	.9244	.9659	.9256	.9664	.9269	.9670	.9281	.9676	.9294	.9682
14	.9199	.9637	.9212	.9643	.9224	.9649	.9237	.9655	.9249	.9661	.9262	.9667
15	.9167	.9622	.9180	.9628	.9192	.9634	.9205	.9640	.9217	.9646	.9229	.9652
16	.9135	.9607	.9148	.9613	.9160	.9619	.9173	.9625	.9185	.9631	.9198	.9637
17	.9104	.9592	.9116	.9598	.9129	.9604	.9141	.9610	.9153	.9616	.9166	.9622
18	.9073	.9577	.9085	.9583	.9097	.9589	.9110	.9595	.9122	.9601	.9134	.9607
19	.9041	.9562	.9054	.9568	.9066	.9574	.9078	.9580	.9091	.9586	.9103	.9592
20	.9011	.9548	.9023	.9553	.9035	.9559	.9047	.9565	.9060	.9571	.9072	.9577
21	.8980	.9533	.8992	.9539	.9004	.9545	.9017	.9550	.9029	.9556	.9041	.9562
22	.8949	.9518	.8962	.9524	.8974	.9530	.8986	.9536	.8998	.9542	.9010	.9547
23	.8919	.9503	.8931	.9509	.8943	.9515	.8956	.9521	.8968	.9527	.8980	.9533
24	.8889	.9489	.8901	.9495	.8913	.9500	.8925	.9506	.8938	.9512	.8950	.9518
25	.8859	.9474	.8871	.9480	.8883	.9486	.8895	.9492	.8908	.9498	.8920	.9503
26	.8830	.9459	.8842	.9465	.8854	.9471	.8866	.9477	.8878	.9483	.8890	.9489
27	.8800	.9445	.8812	.9451	.8824	.9457	.8836	.9463	.8848	.9469	.8860	.9474
28	.8771	.9430	.8783	.9436	.8795	.9442	.8807	.9448	.8819	.9454	.8831	.9460
29	.8742	.9416	.8754	.9422	.8766	.9428	.8778	.9434	.8789	.9440	.8801	.9446
30	.8713	.9402	.8725	.9408	.8737	.9414	.8749	.9419	.8760	.9425	.8772	.9431
31	.8684	.9387	.8696	.9393	.8708	.9399	.8720	.9405	.8732	.9411	.8743	.9417
32	.8656	.9373	.8668	.9379	.8679	.9385	.8691	.9391	.8703	.9397	.8715	.9403
33	.8628	.9359	.8639	.9365	.8651	.9371	.8663	.9377	.8675	.9382	.8686	.9388
34	.8599	.9345	.8611	.9351	.8623	.9357	.8635	.9362	.8646	.9368	.8658	.9374
35	.8572	.9331	.8583	.9336	.8595	.9342	.8607	.9348	.8618	.9354	.8630	.9360

T°C.	741		742		743		744		745		746	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9405	.9734	.9418	.9740	.9431	.9745	.9443	.9751	.9456	.9757	.9469	.9763
11	.9372	.9718	.9385	.9724	.9397	.9730	.9410	.9736	.9423	.9742	.9435	.9748
12	.9339	.9703	.9352	.9709	.9364	.9715	.9377	.9721	.9390	.9727	.9402	.9732
13	.9307	.9688	.9319	.9694	.9332	.9700	.9344	.9705	.9357	.9711	.9369	.9717
14	.9274	.9673	.9287	.9679	.9299	.9684	.9312	.9690	.9324	.9696	.9337	.9702
15	.9242	.9658	.9254	.9663	.9267	.9669	.9279	.9675	.9292	.9681	.9304	.9687
16	.9210	.9643	.9222	.9648	.9235	.9654	.9247	.9660	.9260	.9666	.9272	.9672
17	.9178	.9628	.9191	.9633	.9203	.9639	.9215	.9645	.9228	.9651	.9240	.9657
18	.9147	.9613	.9159	.9618	.9171	.9624	.9184	.9630	.9196	.9636	.9208	.9642
19	.9115	.9598	.9128	.9604	.9140	.9609	.9152	.9615	.9164	.9621	.9177	.9627
20	.9084	.9583	.9096	.9589	.9109	.9595	.9121	.9600	.9133	.9606	.9145	.9612
21	.9053	.9568	.9065	.9574	.9078	.9580	.9090	.9586	.9102	.9591	.9114	.9597
22	.9023	.9553	.9035	.9559	.9047	.9565	.9059	.9571	.9071	.9577	.9083	.9582
23	.8992	.9539	.9004	.9544	.9016	.9550	.9028	.9556	.9041	.9562	.9053	.9568
24	.8962	.9524	.8974	.9530	.8986	.9536	.8998	.9541	.9010	.9547	.9022	.9553
25	.8932	.9509	.8944	.9515	.8956	.9521	.8968	.9527	.8980	.9533	.8992	.9539
26	.8902	.9495	.8914	.9501	.8926	.9506	.8938	.9512	.8950	.9518	.8962	.9524
27	.8872	.9480	.8884	.9486	.8896	.9492	.8908	.9498	.8920	.9504	.8932	.9509
28	.8843	.9466	.8855	.9472	.8866	.9477	.8878	.9483	.8890	.9489	.8902	.9495
29	.8813	.9451	.8825	.9457	.8837	.9463	.8849	.9469	.8861	.9475	.8873	.9481
30	.8784	.9437	.8796	.9443	.8808	.9449	.8820	.9455	.8832	.9460	.8843	.9466
31	.8755	.9423	.8767	.9429	.8779	.9434	.8791	.9440	.8803	.9446	.8814	.9452
32	.8727	.9408	.8738	.9414	.8750	.9420	.8762	.9426	.8774	.9432	.8785	.9438
33	.8698	.9394	.8710	.9400	.8721	.9406	.8733	.9412	.8745	.9418	.8757	.9423
34	.8670	.9380	.8681	.9386	.8693	.9392	.8705	.9398	.8716	.9403	.8728	.9409
35	.8642	.9366	.8653	.9372	.8665	.9378	.8676	.9383	.8688	.9389	.8700	.9395

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	747		748		749		750		751		752	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9481	.9769	.9494	.9775	.9507	.9780	.9520	.9786	.9532	.9792	.9545	.9798
11	.9448	.9753	.9461	.9759	.9473	.9765	.9486	.9771	.9499	.9777	.9511	.9782
12	.9415	.9738	.9427	.9744	.9440	.9750	.9453	.9756	.9465	.9761	.9478	.9767
13	.9382	.9723	.9395	.9729	.9407	.9735	.9420	.9740	.9432	.9746	.9445	.9752
14	.9349	.9708	.9362	.9714	.9374	.9719	.9387	.9725	.9399	.9731	.9412	.9737
15	.9317	.9693	.9329	.9698	.9342	.9704	.9354	.9710	.9367	.9716	.9379	.9722
16	.9285	.9678	.9297	.9683	.9309	.9689	.9322	.9695	.9334	.9701	.9347	.9707
17	.9252	.9663	.9265	.9668	.9277	.9674	.9290	.9680	.9302	.9686	.9314	.9692
18	.9221	.9648	.9233	.9653	.9245	.9659	.9258	.9665	.9270	.9671	.9282	.9677
19	.9189	.9633	.9201	.9639	.9214	.9644	.9226	.9650	.9238	.9656	.9251	.9662
20	.9158	.9618	.9170	.9624	.9182	.9629	.9194	.9635	.9207	.9641	.9219	.9647
21	.9127	.9603	.9139	.9609	.9151	.9615	.9163	.9620	.9175	.9626	.9188	.9632
22	.9096	.9588	.9108	.9594	.9120	.9600	.9132	.9606	.9144	.9611	.9156	.9617
23	.9065	.9574	.9077	.9579	.9089	.9585	.9101	.9591	.9113	.9597	.9126	.9603
24	.9034	.9559	.9046	.9565	.9058	.9571	.9071	.9576	.9083	.9582	.9095	.9588
25	.9004	.9544	.9016	.9550	.9028	.9556	.9040	.9562	.9052	.9568	.9064	.9573
26	.8974	.9530	.8986	.9536	.8998	.9541	.9010	.9547	.9022	.9553	.9034	.9559
27	.8944	.9515	.8956	.9521	.8968	.9527	.8980	.9533	.8992	.9538	.9004	.9544
28	.8914	.9501	.8926	.9507	.8938	.9512	.8950	.9518	.8962	.9524	.8974	.9530
29	.8885	.9486	.8897	.9492	.8908	.9498	.8920	.9504	.8932	.9510	.8944	.9515
30	.8855	.9472	.8867	.9478	.8879	.9484	.8891	.9489	.8903	.9495	.8915	.9501
31	.8826	.9458	.8838	.9464	.8850	.9469	.8862	.9475	.8873	.9481	.8885	.9487
32	.8797	.9443	.8809	.9449	.8821	.9455	.8833	.9461	.8844	.9467	.8856	.9472
33	.8768	.9429	.8780	.9435	.8792	.9441	.8804	.9447	.8815	.9452	.8827	.9458
34	.8740	.9415	.8752	.9421	.8763	.9427	.8775	.9432	.8787	.9438	.8798	.9444
35	.8711	.9401	.8723	.9407	.8735	.9413	.8746	.9418	.8758	.9424	.8770	.9430

T°C.	753		754		755		756		757		758	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9558	.9803	.9570	.9809	.9583	.9815	.9596	.9821	.9608	.9827	.9621	.9832
11	.9524	.9788	.9537	.9794	.9549	.9800	.9562	.9805	.9575	.9811	.9587	.9817
12	.9491	.9773	.9503	.9779	.9516	.9784	.9528	.9790	.9541	.9796	.9554	.9802
13	.9457	.9758	.9470	.9763	.9482	.9769	.9495	.9775	.9508	.9781	.9520	.9786
14	.9424	.9743	.9437	.9748	.9449	.9754	.9462	.9760	.9474	.9766	.9487	.9771
15	.9392	.9727	.9404	.9733	.9417	.9739	.9429	.9745	.9441	.9750	.9454	.9756
16	.9359	.9712	.9372	.9718	.9384	.9724	.9396	.9730	.9409	.9735	.9421	.9741
17	.9327	.9697	.9339	.9703	.9352	.9709	.9364	.9715	.9376	.9720	.9389	.9726
18	.9295	.9682	.9307	.9688	.9319	.9694	.9332	.9700	.9344	.9705	.9356	.9711
19	.9263	.9667	.9275	.9673	.9287	.9679	.9300	.9685	.9312	.9690	.9324	.9696
20	.9231	.9653	.9244	.9658	.9256	.9664	.9268	.9670	.9280	.9676	.9293	.9681
21	.9200	.9638	.9212	.9644	.9224	.9649	.9236	.9655	.9249	.9661	.9261	.9667
22	.9167	.9623	.9181	.9629	.9193	.9635	.9205	.9640	.9217	.9646	.9230	.9652
23	.9138	.9608	.9150	.9614	.9162	.9620	.9174	.9626	.9186	.9631	.9198	.9637
24	.9107	.9594	.9119	.9599	.9131	.9605	.9143	.9611	.9155	.9617	.9167	.9622
25	.9076	.9579	.9088	.9585	.9100	.9591	.9112	.9596	.9124	.9602	.9137	.9608
26	.9046	.9565	.9058	.9570	.9070	.9576	.9082	.9582	.9094	.9588	.9106	.9593
27	.9016	.9550	.9028	.9556	.9040	.9562	.9052	.9567	.9064	.9573	.9076	.9579
28	.8986	.9536	.8998	.9541	.9010	.9547	.9022	.9553	.9034	.9559	.9045	.9564
29	.8956	.9521	.8968	.9527	.8980	.9533	.8992	.9538	.9004	.9544	.9015	.9550
30	.8926	.9507	.8938	.9513	.8950	.9518	.8962	.9524	.8974	.9530	.8986	.9536
31	.8897	.9492	.8909	.9498	.8921	.9504	.8933	.9510	.8944	.9515	.8956	.9521
32	.8868	.9478	.8880	.9484	.8891	.9490	.8903	.9495	.8915	.9501	.8927	.9507
33	.8839	.9464	.8851	.9470	.8862	.9475	.8874	.9481	.8886	.9487	.8898	.9493
34	.8810	.9450	.8822	.9456	.8833	.9461	.8845	.9467	.8857	.9473	.8869	.9479
35	.8781	.9436	.8793	.9441	.8805	.9447	.8816	.9453	.8828	.9459	.8840	.9464

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	759		760		761		762		763		764	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9634	.9838	.9646	.9844	.9659	.9849	.9672	.9855	.9685	.9861	.9697	.9866
11	.9600	.9823	.9612	.9828	.9625	.9834	.9638	.9840	.9650	.9845	.9663	.9851
12	.9566	.9807	.9579	.9813	.9591	.9819	.9604	.9824	.9617	.9830	.9629	.9836
13	.9533	.9792	.9545	.9798	.9558	.9804	.9570	.9809	.9583	.9815	.9595	.9821
14	.9499	.9777	.9512	.9783	.9524	.9788	.9537	.9794	.9549	.9800	.9562	.9805
15	.9466	.9762	.9479	.9768	.9491	.9773	.9504	.9779	.9516	.9785	.9529	.9790
16	.9434	.9747	.9446	.9753	.9459	.9758	.9471	.9764	.9483	.9770	.9496	.9775
17	.9401	.9732	.9413	.9738	.9426	.9743	.9438	.9749	.9451	.9755	.9463	.9760
18	.9369	.9717	.9381	.9723	.9393	.9728	.9406	.9734	.9418	.9740	.9431	.9745
19	.9337	.9702	.9349	.9708	.9361	.9713	.9374	.9719	.9386	.9725	.9398	.9730
20	.9305	.9687	.9317	.9693	.9329	.9698	.9342	.9704	.9354	.9710	.9366	.9716
21	.9273	.9672	.9285	.9678	.9298	.9684	.9310	.9689	.9322	.9695	.9334	.9701
22	.9242	.9658	.9254	.9663	.9266	.9669	.9278	.9675	.9290	.9680	.9303	.9686
23	.9210	.9643	.9223	.9649	.9235	.9654	.9247	.9660	.9259	.9666	.9271	.9671
24	.9179	.9628	.9192	.9634	.9204	.9640	.9216	.9645	.9228	.9651	.9240	.9657
25	.9149	.9614	.9161	.9619	.9173	.9625	.9185	.9631	.9197	.9636	.9209	.9642
26	.9118	.9599	.9130	.9605	.9142	.9610	.9154	.9616	.9166	.9622	.9178	.9628
27	.9088	.9584	.9100	.9590	.9112	.9596	.9123	.9602	.9135	.9607	.9147	.9613
28	.9057	.9570	.9069	.9576	.9081	.9581	.9093	.9587	.9105	.9593	.9117	.9599
29	.9027	.9556	.9039	.9561	.9051	.9567	.9063	.9573	.9075	.9578	.9087	.9584
30	.8998	.9541	.9009	.9547	.9021	.9553	.9033	.9558	.9045	.9564	.9057	.9570
31	.8968	.9527	.8980	.9533	.8992	.9538	.9003	.9544	.9015	.9550	.9027	.9555
32	.8939	.9513	.8950	.9518	.8962	.9524	.8974	.9530	.8986	.9535	.8997	.9541
33	.8909	.9498	.8921	.9504	.8933	.9510	.8945	.9516	.8956	.9521	.8968	.9527
34	.8880	.9484	.8892	.9490	.8904	.9496	.8915	.9501	.8927	.9507	.8939	.9513
35	.8851	.9470	.8863	.9476	.8875	.9482	.8886	.9487	.8898	.9493	.8910	.9499

T°C.	765		766		767		768		769		770	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9710	.9872	.9723	.9878	.9735	.9883	.9748	.9889	.9761	.9895	.9773	.9900
11	.9676	.9857	.9688	.9863	.9701	.9868	.9714	.9874	.9726	.9879	.9739	.9885
12	.9642	.9842	.9654	.9847	.9667	.9853	.9680	.9859	.9692	.9864	.9705	.9870
13	.9608	.9826	.9621	.9832	.9633	.9838	.9646	.9843	.9658	.9849	.9671	.9855
14	.9575	.9811	.9587	.9817	.9600	.9823	.9612	.9828	.9625	.9834	.9637	.9839
15	.9541	.9796	.9554	.9802	.9566	.9807	.9579	.9813	.9591	.9819	.9604	.9824
16	.9508	.9781	.9521	.9787	.9533	.9792	.9546	.9798	.9558	.9804	.9570	.9809
17	.9475	.9766	.9488	.9772	.9500	.9777	.9513	.9783	.9525	.9789	.9537	.9794
18	.9443	.9751	.9455	.9757	.9468	.9762	.9480	.9768	.9492	.9774	.9505	.9779
19	.9410	.9736	.9423	.9742	.9435	.9747	.9447	.9753	.9460	.9759	.9472	.9764
20	.9378	.9721	.9391	.9727	.9403	.9733	.9415	.9738	.9427	.9744	.9440	.9750
21	.9346	.9706	.9359	.9712	.9371	.9718	.9383	.9723	.9395	.9729	.9408	.9735
22	.9315	.9692	.9327	.9697	.9339	.9703	.9351	.9709	.9363	.9714	.9376	.9720
23	.9283	.9677	.9295	.9683	.9308	.9688	.9320	.9694	.9332	.9700	.9344	.9705
24	.9252	.9662	.9264	.9668	.9276	.9674	.9288	.9679	.9300	.9685	.9312	.9691
25	.9221	.9648	.9233	.9653	.9245	.9659	.9257	.9665	.9269	.9670	.9281	.9676
26	.9190	.9633	.9202	.9639	.9214	.9645	.9226	.9650	.9238	.9656	.9250	.9661
27	.9159	.9619	.9171	.9624	.9183	.9630	.9195	.9636	.9207	.9641	.9219	.9647
28	.9129	.9604	.9141	.9610	.9153	.9616	.9165	.9621	.9177	.9627	.9189	.9633
29	.9099	.9590	.9111	.9595	.9123	.9601	.9134	.9607	.9146	.9612	.9158	.9618
30	.9069	.9575	.9081	.9581	.9092	.9587	.9104	.9592	.9116	.9598	.9128	.9604
31	.9039	.9561	.9051	.9567	.9062	.9572	.9074	.9578	.9086	.9584	.9098	.9589
32	.9009	.9547	.9021	.9553	.9033	.9558	.9045	.9564	.9056	.9570	.9068	.9575
33	.8980	.9533	.8991	.9538	.9003	.9544	.9015	.9550	.9027	.9555	.9038	.9561
34	.8950	.9518	.8962	.9524	.8974	.9530	.8986	.9535	.8997	.9541	.9009	.9547
35	.8921	.9504	.8933	.9510	.8945	.9516	.8956	.9521	.8968	.9527	.8980	.9533

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	771		772		773		774		775		776	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9786	.9906	.9799	.9912	.9811	.9917	.9824	.9923	.9837	.9929	.9850	.9934
11	.9752	.9891	.9764	.9896	.9777	.9902	.9790	.9908	.9802	.9913	.9815	.9919
12	.9717	.9875	.9730	.9881	.9743	.9887	.9755	.9892	.9768	.9898	.9780	.9904
13	.9683	.9860	.9696	.9866	.9708	.9872	.9721	.9877	.9734	.9883	.9746	.9888
14	.9650	.9845	.9662	.9851	.9675	.9856	.9687	.9862	.9700	.9868	.9712	.9873
15	.9616	.9830	.9629	.9836	.9641	.9841	.9654	.9847	.9666	.9852	.9678	.9858
16	.9583	.9815	.9595	.9821	.9608	.9826	.9620	.9832	.9633	.9837	.9645	.9843
17	.9550	.9800	.9562	.9806	.9575	.9811	.9587	.9817	.9599	.9822	.9612	.9828
18	.9517	.9785	.9529	.9791	.9542	.9796	.9554	.9802	.9566	.9807	.9579	.9813
19	.9484	.9770	.9497	.9776	.9509	.9781	.9521	.9787	.9534	.9793	.9546	.9798
20	.9452	.9755	.9464	.9761	.9476	.9766	.9489	.9772	.9501	.9778	.9513	.9783
21	.9420	.9740	.9432	.9746	.9444	.9752	.9456	.9757	.9469	.9763	.9481	.9768
22	.9388	.9726	.9400	.9731	.9412	.9737	.9424	.9742	.9437	.9748	.9449	.9754
23	.9356	.9711	.9368	.9717	.9380	.9722	.9392	.9728	.9405	.9733	.9417	.9739
24	.9325	.9696	.9337	.9702	.9349	.9708	.9361	.9713	.9373	.9719	.9385	.9724
25	.9293	.9682	.9305	.9687	.9317	.9693	.9329	.9699	.9341	.9704	.9354	.9710
26	.9262	.9667	.9274	.9673	.9286	.9678	.9298	.9684	.9310	.9690	.9322	.9695
27	.9231	.9653	.9243	.9658	.9255	.9664	.9267	.9669	.9279	.9675	.9291	.9681
28	.9201	.9638	.9213	.9644	.9224	.9649	.9236	.9655	.9248	.9661	.9260	.9666
29	.9170	.9624	.9182	.9629	.9194	.9635	.9206	.9641	.9218	.9646	.9230	.9652
30	.9140	.9609	.9152	.9615	.9164	.9621	.9175	.9626	.9187	.9632	.9199	.9637
31	.9110	.9595	.9122	.9601	.9133	.9606	.9145	.9612	.9157	.9618	.9169	.9623
32	.9080	.9581	.9092	.9586	.9103	.9592	.9115	.9598	.9127	.9603	.9139	.9609
33	.9050	.9567	.9062	.9572	.9074	.9578	.9085	.9583	.9097	.9589	.9109	.9595
34	.9021	.9552	.9032	.9558	.9044	.9564	.9056	.9569	.9067	.9575	.9079	.9580
35	.8991	.9538	.9003	.9544	.9015	.9550	.9026	.9555	.9038	.9561	.9050	.9566

T°C.	777		778		779		780		782		784	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	.9862	.9940	.9875	.9945	.9888	.9951	.9900	.9956	.9926	.9968	.9951	.9979
11	.9827	.9924	.9840	.9930	.9853	.9936	.9865	.9941	.9891	.9952	.9916	.9963
12	.9793	.9909	.9806	.9915	.9818	.9920	.9831	.9926	.9856	.9937	.9881	.9948
13	.9759	.9894	.9771	.9900	.9784	.9905	.9796	.9911	.9822	.9922	.9847	.9933
14	.9725	.9879	.9737	.9884	.9750	.9890	.9762	.9896	.9787	.9907	.9812	.9918
15	.9691	.9864	.9703	.9869	.9716	.9875	.9728	.9880	.9753	.9892	.9778	.9903
16	.9657	.9849	.9670	.9854	.9682	.9860	.9695	.9865	.9720	.9876	.9744	.9888
17	.9624	.9834	.9636	.9839	.9649	.9845	.9661	.9850	.9686	.9861	.9711	.9873
18	.9591	.9819	.9603	.9824	.9616	.9830	.9628	.9835	.9653	.9846	.9677	.9858
19	.9558	.9804	.9570	.9809	.9583	.9815	.9595	.9820	.9620	.9832	.9644	.9843
20	.9525	.9789	.9538	.9794	.9550	.9800	.9562	.9806	.9587	.9817	.9611	.9828
21	.9493	.9774	.9505	.9780	.9517	.9785	.9530	.9791	.9554	.9802	.9579	.9813
22	.9461	.9759	.9473	.9765	.9485	.9770	.9497	.9776	.9522	.9787	.9546	.9798
23	.9429	.9745	.9441	.9750	.9453	.9756	.9465	.9761	.9490	.9772	.9514	.9784
24	.9397	.9730	.9409	.9736	.9421	.9741	.9433	.9747	.9458	.9758	.9482	.9769
25	.9366	.9715	.9378	.9721	.9390	.9727	.9402	.9732	.9426	.9743	.9450	.9754
26	.9334	.9701	.9346	.9706	.9358	.9712	.9370	.9718	.9394	.9729	.9418	.9740
27	.9303	.9686	.9315	.9692	.9327	.9697	.9339	.9703	.9363	.9714	.9387	.9725
28	.9272	.9672	.9284	.9677	.9296	.9683	.9308	.9689	.9332	.9700	.9356	.9711
29	.9241	.9657	.9253	.9663	.9265	.9669	.9277	.9674	.9301	.9685	.9325	.9696
30	.9211	.9643	.9223	.9649	.9235	.9654	.9247	.9660	.9270	.9671	.9294	.9682
31	.9181	.9629	.9192	.9634	.9204	.9640	.9216	.9645	.9240	.9657	.9263	.9668
32	.9151	.9614	.9162	.9620	.9174	.9626	.9186	.9631	.9209	.9642	.9233	.9653
33	.9121	.9600	.9132	.9606	.9144	.9611	.9156	.9617	.9179	.9628	.9203	.9639
34	.9091	.9586	.9103	.9592	.9114	.9597	.9126	.9603	.9149	.9614	.9173	.9625
35	.9061	.9572	.9073	.9578	.9085	.9583	.9096	.9589	.9120	.9600	.9143	.9611

REDUCTION OF GAS VOLUME

VALUES OF $(1 + \alpha t)$ FOR TEMPERATURES FROM 0 TO 120° C.

T	0	1	2	3	4	5	6	7	8	9
00	1.0000	1.0037	1.0073	1.0110	1.0147	1.0183	1.0220	1.0257	1.0294	1.0330
10	1.0367	1.0404	1.0440	1.0477	1.0514	1.0550	1.0587	1.0624	1.0661	1.0697
20	1.0734	1.0771	1.0807	1.0844	1.0881	1.0917	1.0954	1.0991	1.1028	1.1064
30	1.1101	1.1138	1.1174	1.1211	1.1248	1.1284	1.1321	1.1358	1.1395	1.1431
40	1.1468	1.1505	1.1541	1.1578	1.1615	1.1651	1.1688	1.1725	1.1762	1.1798
50	1.1835	1.1872	1.1908	1.1945	1.1982	1.2018	1.2055	1.2092	1.2129	1.2165
60	1.2202	1.2239	1.2275	1.2312	1.2349	1.2385	1.2422	1.2459	1.2496	1.2532
70	1.2569	1.2606	1.2642	1.2679	1.2716	1.2752	1.2789	1.2826	1.2863	1.2899
80	1.2936	1.2973	1.3009	1.3046	1.3083	1.3119	1.3156	1.3193	1.3230	1.3266
90	1.3303	1.3340	1.3376	1.3413	1.3450	1.3486	1.3523	1.3560	1.3597	1.3633
100	1.3670	1.3707	1.3743	1.3780	1.3817	1.3853	1.3890	1.3927	1.3964	1.4000
110	1.4037	1.4074	1.4110	1.4147	1.4184	1.4220	1.4257	1.4294	1.4331	1.4367
120	1.4404									

VALUES OF $H/760$ FOR PRESSURES FROM 700 TO 780 MM OF MERCURY

H	0	1	2	3	4	5	6	7	8	9
700	0.9211	0.9224	0.9237	0.9250	0.9263	0.9276	0.9289	0.9303	0.9316	0.9329
710	0.9342	0.9355	0.9368	0.9382	0.9395	0.9408	0.9421	0.9434	0.9447	0.9461
720	0.9474	0.9487	0.9500	0.9513	0.9526	0.9539	0.9553	0.9566	0.9579	0.9592
730	0.9605	0.9618	0.9632	0.9645	0.9658	0.9671	0.9684	0.9697	0.9711	0.9724
740	0.9737	0.9750	0.9763	0.9776	0.9789	0.9803	0.9816	0.9829	0.9842	0.9855
750	0.9868	0.9882	0.9895	0.9908	0.9921	0.9934	0.9947	0.9961	0.9974	0.9987
760	1.0000	1.0013	1.0026	1.0039	1.0053	1.0066	1.0079	1.0092	1.0105	1.0118
770	1.0132	1.0145	1.0158	1.0171	1.0184	1.0197	1.0211	1.0224	1.0237	1.0250
780	1.0263									

MECHANICAL EQUIVALENT OF HEAT

Observer.	Ergs per calorie (15°).	Observer.	Ergs per calorie (15°).
Joule, 1878.....	4.177×10^7	Callendar and Barnes, 1900	4.186×10^7
Rowland, 1879.....	4.188	Dieterici, 1905.....	4.1879
Griffiths, 1893.....	4.196	Blousfield, 1912.....	4.1791
Schuster and Gannon, 1898	4.196	Jaeger and Steinwehr, 1921	4.184

ACCEPTED VALUES

- 1 gram calorie (20°C) = 4.181 joules
- 1 gram calorie (15°C) = 4.185 joules
- 1 gram calorie (mean) = 4.186 joules
- 1 British thermal unit (39°F) = 1060.4 joules
- 1 British thermal unit (60°F) = 1054.6 joules
- 1 British thermal unit (mean) = 1054.8 joules

SPECIFIC HEAT OF WATER

Ice

Temp. °C	Specific heat	Observer	Temp. °C	Specific heat	Observer
-252 to -188	.146	Dieterici, 1903	-31.8	.4454	Dickinson-Osborne, 1915
-250	.0361		-23.7	.4599	Dickinson-Osborne, 1915
-200	.162	Mean	-24.5	.4605	Dickinson-Osborne, 1915
-188 to -78	.285	Dieterici, 1903	-20.8	.4668	Dickinson-Osborne, 1915
-180	.199	Nernst, 1910	-14.8	.4782	Dickinson-Osborne, 1915
-160	.230	Nernst, 1910	-14.6	.4779	Dickinson-Osborne, 1915
-150	.246		-11.0	.4861	Dickinson-Osborne, 1915
-140	.262	Nernst, 1910	-8.1	.4896	Dickinson-Osborne, 1915
-100	.329	Mean	-4.3	.4989	Dickinson-Osborne, 1915
-78 to -18	.463	Dieterici, 1903	-4.5	.4984	Dickinson-Osborne, 1915
-60	.392		-4.9	.4932	Dickinson-Osborne, 1915
-38.3	.4346	Dickinson-Osborne, 1915	-2.6	.5003	Dickinson-Osborne, 1915
-34.3	.4411	Dickinson-Osborne, 1915	-2.2	.5018	Dickinson-Osborne, 1915
-30.6	.4488	Dickinson-Osborne, 1915			
Water Below 0°C					
-6	1.0119	Martinetti, 1890	-3	1.0102	Martinetti, 1890
-5	1.0155	Barnes, 1902	-2	1.0097	Martinetti, 1890
-5	1.0113	Martinetti, 1890	-1	1.0092	Martinetti, 1890
-4	1.0105	Martinetti, 1890			

Heat Capacity of Air-free Water 0°-100°C at 1 Atmosphere Pressure

The heat capacity of air-free water is given in international steam table calories per gram and in absolute joules per gram. (1 absolute joule—0.238846 I.T. Cal.).

The enthalpy or heat content is given for air-free water in I.T. Cal. per gram and in absolute joules per gram.

From Osborne, Stimson and Ginnings; B. of S. Jour. Res. 23, 238, 1939.

Temp. °C	Thermal Capacity		Enthalpy	
	Cal./g/°C	Joules/g/°C	Cal./g	Joules/g
0	1.00738	4.2177	0.0245	0.1026
1	1.00652	4.2141	1.0314	4.3184
2	1.00571	4.2107	2.0376	8.5308
3	1.00499	4.2077	3.0429	12.7400
4	1.00430	4.2048	4.0475	16.9462
5	1.00368	4.2022	5.0515	21.1498
6	1.00313	4.1999	6.0549	25.3503
7	1.00260	4.1977	7.0578	29.5496
8	1.00213	4.1957	8.0602	33.7463
9	1.00170	4.1939	9.0621	37.9410
10	1.00129	4.1922	10.0636	42.1341
11	1.00093	4.1907	11.0647	46.3255
12	1.00060	4.1893	12.0654	50.5155
13	1.00029	4.1880	13.0659	54.7041
14	1.00002	4.1869	14.0660	58.8916

SPECIFIC HEAT OF WATER (Continued)
Heat Capacity of Air-free Water 0°–100°C at 1 Atmosphere Pressure
(Continued)

Temp. °C	Thermal Capacity		Enthalpy	
	Cal./g/°C	Joules/g/°C	Cal./g	Joules/g
15	.99976	4.1858	15.0659	63.0779
16	.99955	4.1849	16.0655	67.2632
17	.99933	4.1840	17.0650	71.4476
18	.99914	4.1832	18.0642	75.6312
19	.99897	4.1825	19.0633	79.8141
20	.99883	4.1819	20.0622	83.9963
21	.99869	4.1813	21.0609	88.1778
22	.99857	4.1808	22.0596	92.3589
23	.99847	4.1804	23.0581	96.5395
24	.99838	4.1800	24.0565	100.7196
25	.99828	4.1796	25.0548	104.8994
26	.99821	4.1793	26.0530	109.0788
27	.99814	4.1790	27.0512	113.2580
28	.99809	4.1788	28.0493	117.4369
29	.99804	4.1786	29.0474	121.6157
30	.99802	4.1785	30.0455	125.7943
31	.99799	4.1784	31.0435	129.9727
32	.99797	4.1783	32.0414	134.1510
33	.99797	4.1783	33.0394	138.3293
34	.99795	4.1782	34.0374	142.5076
35	.99795	4.1782	35.0353	146.6858
36	.99797	4.1783	36.0333	150.8641
37	.99797	4.1783	37.0312	155.0423
38	.99799	4.1784	38.0292	159.2207
39	.99802	4.1785	39.0272	163.3991
40	.99804	4.1786	40.0253	167.5777
41	.99807	4.1787	41.0233	171.7563
42	.99811	4.1789	42.0214	175.9351
43	.99816	4.1791	43.0195	180.1141
44	.99819	4.1792	44.0177	184.2933
45	.99826	4.1795	45.0159	188.4726
46	.99830	4.1797	46.0142	192.6522
47	.99835	4.1799	47.0125	196.8320
48	.99842	4.1802	48.0109	201.0120
49	.99847	4.1804	49.0094	205.1923
50	.99854	4.1807	50.0079	209.3729
51	.99862	4.1810	51.0065	213.5538
52	.99871	4.1814	52.0051	217.7350
53	.99878	4.1817	53.0039	221.9166
54	.99885	4.1820	54.0027	226.0984

SPECIFIC HEAT OF WATER (Continued)

Heat Capacity of Air-free Water 0°–100°C at 1 Atmosphere Pressure
(Continued)

Temp. °C	Thermal Capacity		Enthalpy	
	Cal/g/°C	Joules/g/°C	Cal/g	Joules/g
55	.99895	4.1824	55.0016	230.2806
56	.99905	4.1828	56.0006	234.4632
57	.99914	4.1832	56.9997	238.6462
58	.99924	4.1836	57.9989	242.8296
59	.99933	4.1840	58.9982	247.0134
60	.99943	4.1844	59.9975	251.1976
61	.99955	4.1849	60.9970	255.3822
62	.99964	4.1853	61.9966	259.5673
63	.99976	4.1858	62.9963	263.7529
64	.99988	4.1863	63.9962	267.9390
65	1.00000	4.1868	64.9961	272.1256
66	1.00014	4.1874	65.9962	276.3127
67	1.00026	4.1879	66.9964	280.5003
68	1.00041	4.1885	67.9967	284.6885
69	1.00053	4.1890	68.9972	288.8772
70	1.00067	4.1896	69.9977	293.0665
71	1.00081	4.1902	70.9985	297.2564
72	1.00096	4.1908	71.9994	301.4469
73	1.00112	4.1915	73.0004	305.6381
74	1.00127	4.1921	74.0016	309.8299
75	1.00143	4.1928	75.0030	314.0224
76	1.00160	4.1935	76.0045	318.2155
77	1.00177	4.1942	77.0062	322.4094
78	1.00194	4.1949	78.0080	326.6039
79	1.00213	4.1957	79.0101	330.7992
80	1.00229	4.1964	80.0123	334.9952
81	1.00248	4.1972	81.0147	339.1920
82	1.00268	4.1980	82.0172	343.3897
83	1.00287	4.1988	83.0200	347.5881
84	1.00308	4.1997	84.0230	351.7873
85	1.00327	4.2005	85.0262	355.9874
86	1.00349	4.2014	86.0295	360.1883
87	1.00370	4.2023	87.0331	364.3902
88	1.00392	4.2032	88.0369	368.5929
89	1.00416	4.2042	89.0410	372.7966
90	1.00437	4.2051	90.0452	377.0012
91	1.00461	4.2061	91.0497	381.2068
92	1.00485	4.2071	92.0545	385.4135
93	1.00509	4.2081	93.0594	389.6211
94	1.00535	4.2092	94.0647	393.8297

SPECIFIC HEAT OF WATER (Continued)
Heat Capacity of Air-free Water 0°–100°C at 1 Atmosphere Pressure
(Continued)

Temp. °C	Thermal Capacity		Enthalpy	
	Cal/g/°C	Joules/g/°C	Cal/g	Joules/g
95	1.00561	4.2103	95.0701	398.0395
96	1.00588	4.2114	96.0759	402.2503
97	1.00614	4.2125	97.0819	406.4622
98	1.00640	4.2136	98.0882	410.6753
99	1.00669	4.2148	99.0947	414.8895
100	1.00697	4.2160	100.1015	419.1049

Enthalpy of Air-saturated Water
1 Atmosphere Pressure 0–100°C

Temp. °C	Enthalpy		Temp. °C	Enthalpy	
	Cal/g	Joules/g		Cal/g	Joules/g
0	0	0	75	74.9907	313.9712
5	5.0276	21.0496	80	80.0019	334.9519
10	10.0402	42.0363	85	85.0180	355.9532
15	15.0431	62.9826	90	90.0395	376.9773
20	20.0400	83.9034	95	95.0671	398.0270
25	25.0332	104.8089	100	100.1016	419.1053
30	30.0244	125.7063			
35	35.0149	146.6003			
40	40.0055	167.4949			
45	44.9968	188.3928			
50	49.9896	209.2964			
55	54.9842	230.2077			
60	59.9811	251.1289			
65	64.9808	272.0619			
70	69.9839	293.0087			

SPECIFIC HEAT OF WATER (Continued)

Specific Heat of Water Above 100°C

* Mean specific heat of water in 15°C calories between 0°C and the temperature stated.

Heat content (Enthalpy) in joules per gram between 0°C and the temperature stated.

From data by Osborne, Stimson and Flock, B of S Jour. Res. 5, 411, 1930.

Temp. °C	Specific heat mean 0-t°C	Heat content 0-t joules/g	Temp. °C	Specific heat mean 0-t°C	Heat content 0-t joules/g
100	1.0008	418.75	190	1.0153	807.15
110	1.0015	460.97	200	1.0181	852.02
120	1.0025	503.36	210	1.0212	897.35
130	1.0037	545.93	220	1.0247	943.24
140	1.0050	588.71	230	1.0285	989.75
150	1.0067	631.75	240	1.0326	1036.97
160	1.0083	675.06	250	1.0376	1084.97
170	1.0103	718.66	260	1.0423	1133.87
180	1.0127	762.72	270	1.0483	1184.32

Specific Heat of Super-heated Steam

Specific heat of steam under constant pressure given in atmospheres and at temperatures above saturation.

Temp. °C	Pressure in atmospheres						
	1	2	4	6	8	10	12
110	0.481						
120	0.477	0.498					
130	0.475	0.494					
140	0.473	0.489					
150	0.472	0.486	0.519				
160	0.471	0.483	0.512	0.549			
170	0.470	0.481	0.507	0.538			
180	0.469	0.479	0.502	0.528	0.561	0.602	
190	0.469	0.478	0.498	0.522	0.549	0.583	0.625
200	0.469	0.478	0.495	0.515	0.539	0.567	0.601
210	0.470	0.477	0.493	0.510	0.531	0.555	0.584
220	0.470	0.477	0.491	0.506	0.524	0.545	0.569
230	0.471	0.477	0.489	0.504	0.519	0.537	0.557
240	0.472	0.477	0.488	0.501	0.515	0.530	0.548
250	0.473	0.477	0.488	0.499	0.512	0.525	0.540
260	0.474	0.478	0.487	0.498	0.509	0.521	0.534
270	0.474	0.478	0.487	0.497	0.507	0.518	0.529
280	0.475	0.479	0.487	0.496	0.505	0.515	0.525
290	0.476	0.480	0.487	0.495	0.504	0.513	0.523
300	0.477	0.481	0.488	0.495	0.503	0.511	0.519

SPECIFIC HEAT OF WATER (Continued)

Specific Heat of Super-heated Steam (Continued)

Temp. °C	Pressure in atmospheres						
	1	2	4	6	8	10	12
310	0.478	0.482	0.488	0.495	0.502	0.510	0.518
320	0.480	0.483	0.489	0.496	0.502	0.509	0.516
330	0.482	0.484	0.490	0.496	0.502	0.508	0.515
340	0.483	0.485	0.491	0.496	0.502	0.507	0.513
350	0.484	0.486	0.492	0.497	0.502	0.507	0.512
360	0.485	0.487	0.492	0.497	0.502	0.507	0.511
370	0.486	0.488	0.493	0.498	0.503	0.507	0.511
380	0.488	0.490	0.494	0.498	0.503	0.507	0.511
390	0.489	0.491	0.495	0.499	0.503		
400	0.490	0.492	0.496	0.500	0.504		
410	0.492	0.494	0.497	0.501	0.505		
420	0.494	0.496	0.498	0.502	0.506		
430	0.495	0.497	0.500	0.504	0.507		
440	0.497	0.499	0.501	0.505	0.508		
450	0.498	0.500	0.503	0.506	0.509		
460	0.500	0.501	0.505	0.507	0.510		
470	0.502	0.503	0.506	0.508	0.512		
480	0.504	0.505	0.507	0.509	0.513		
490	0.505	0.506	0.509	0.511	0.514		
500	0.506	0.508	0.510	0.512	0.515		

SPECIFIC HEAT AND ATOMIC HEAT OF MERCURY

The specific heat is given in relation to water at 15°C. The atomic heat is the thermal capacity of one gram atom.

Values between -75.6° and -36.7°C. are from Carpenter and Stoodley, *Phil. Mag.* **10**, 249, 1930; from 0-80°C., Barnes-Cooke; from 90-140°C., mean of Winklemann, Naccari and Milthaler; above 140°C., mean of Naccari and Milthaler.

Temp. °C	Specific heat	Atomic heat	Temp. °C	Specific heat	Atomic heat
	Solid			Liquid	
-75.6	.0319	6.3995	30	.03316	6.6522
-72.9	.0324	6.4998	35	.03312	6.6442
-65.4	.0324	6.4998	40	.03308	6.6362
-59.5	.0324	6.4998	50	.03300	6.6201
-44.9	.0336	6.7405	60	.03294	6.6081
-42.2	.0336	6.7405	70	.03289	6.5981
-40.0	.0337	6.7606	80	.03284	6.5880
			90	.03277	6.5740
	Liquid		100	.03269	6.5579
-36.7	.0339	6.8007	110	.03262	6.5439
			120	.03255	6.5299
	Liquid		130	.03248	6.5158
0	.03346	6.7124	140	.03241	6.5018
5	.03340	6.7004	150	.03240	6.4998
10	.03335	6.6903	170	.03220	6.4596
15	.03330	6.6803	190	.03200	6.4195
20	.03325	6.6703	210	.03190	6.3995
25	.03320	6.6603			

SPECIFIC HEAT OF ELEMENTS

Element	Temp. °C	Sp. ht., cal./g	Element	Temp. °C	Sp. ht., cal./g
Aluminum.....	-250	0.0039	Calcium (con- tinued).....	100	0.1625
	-240.6	0.0092		300	0.1832
	-233	0.0165		600	0.188
	-200	0.076	Carbon, charcoal..	0-24	0.165
	-150	0.1367	diamond.....	-233	0.0005
	-100	0.1676		-185	0.0025
	-50	0.1914		-188 to -78	0.019
	0	0.2079		-78 to +18	0.079
	20	0.214		0	0.1044
	100	0.225		20	0.12
	300	0.248		140	0.222
	600	0.277		223	0.264
liquid.....	660	0.25		247	0.303
Antimony.....	-207.1	0.0322		606	0.441
	-150	0.0412		823	0.428
	-100	0.0448	carbon, amor....	26-76	0.168
	-50	0.0476	graphite.....	-243	0.005
	0	0.0494		-203	0.0175
	20-100	0.0504		-191 to -79	0.057
	100	0.0513		-66	0.053
	200	0.0520		20	0.17
	300	0.0537		85	0.177
	500	0.054		138	0.254
Argon, solid.....	-223	0.155		642	0.445
liquid.....	-100	0.134		896	0.454
Arsenic.....	-216	0.032	Cerium.....	-253 to -196	0.033
	-117.6	0.0666		0-100	0.0423
	18	0.078		20-100	0.0511
gray, crystal....	0-100	0.0822	Cesium, solid....	20	0.052
blk., amor.....	0-100	0.0861		0-26	0.0482
Barium.....	-185 to +20	0.068	liquid.....	50	0.058
Beryllium.....	-202	0.017	Chlorine.....	-113	0.19
	0-46	0.397	liquid.....	0-24	0.226
	0-100	0.425	Chromium.....	-150	0.0599
	0-300	0.505		-100	0.0797
Bismuth.....	-150	0.0264		-50	0.0941
	-100	0.0273		0	0.1044
	-50	0.0282		20	0.11
	0	0.0291		18-100	0.111
	20	0.0294		100	0.112
	100	0.0304		400	0.133
liquid.....	297	0.0292		500	0.150
	400	0.035		600	0.187
Boron.....	-191 to -78	0.071	Cobalt.....	-150	0.0672
	-76 to 0	0.168		-100	0.0809
	0-100	0.307		-50	0.0914
	100	0.287		0	0.1023
	500	0.472		20	0.1001
	900	0.510		100	0.1067
Bromine, solid....	-253.1	0.0205		200	0.1134
	-173.1	0.0659		300	0.121
	-73.1	0.080		*508	{ 0.145
	-13.1	0.088			{ 0.125
Bromine, liquid...	13-45	0.107		800	0.160
Cadmium.....	-263	0.0019		1000	0.184
	-203.1	0.0415		*1112	{ 0.270
	-103.1	0.0518			{ 0.170
	27.9	0.0552	Copper.....	-253	0.0031
	107.9	0.0569		-189	0.0506
	277	0.060		-150	0.0674
liquid.....	321	0.077		-100	0.0783
Calcium.....	-185 to +20	0.157		-50	0.0862
	0-20	0.145		0	0.0910
	24	0.168			

■ Temperatures of transformation.

SPECIFIC HEAT OF ELEMENTS (Continued)

Element	Temp. °C	Sp. ht., cal./g	Element	Temp. °C	Sp. ht., cal./g
Copper (con- tinued).....	20	0.0921	Lead (con- tinued).....	300	0.0356
	15-100	0.09305	liquid.....	360	0.0375
	100	0.0939		500	0.0370
	200	0.0963	Lithium.....	-183	0.3
	900	0.1259		-100	0.600
	18-100	0.0928		0	0.079
liquid.....	1084	0.101		50	0.96
Gallium.....	-258.1	0.0049		100	1.0407
	-213.1	0.044		190	1.374
	-73.1	0.084	Magnesium.....	-150	0.1767
	12-23	0.079		-100	0.2025
liquid.....	13-110	0.080		-50	0.2228
	119	0.079		0	0.2316
Germanium.....	0-100	0.074		20	0.246
Gold.....	-258.1	0.0018		100	0.257
	-209.5	0.0211		300	0.279
	-150	0.0266	liquid.....	600	0.311
	-100	0.0281		650-775	0.284
	-50	0.0293	Manganese.....	-188 to -79	0.0820
	0	0.0302		-100	0.0979
	18	0.0312		0	0.1072
	0-100	0.0316		20-100	0.1211
	100	0.0314		60	0.1211
liquid.....	1100	0.0327		325	0.1783
Hydrogen, solid...	-260.6	0.57	Mercury, solid....	-263.3	0.00552
liquid.....	-252	0.231		-259.8	0.00783
Indium.....	-186 to -79	0.0263		-245.6	0.0172
	-79 to +18	0.0303		-220.2	0.0255
	0-100	0.057		-163.7	0.0298
Iodine.....	-263.2	0.0037		-81.4	0.0324
	-255.9	0.0118		-43.1	0.0337
	-221.1	0.0353	liquid.....	-33.1	0.0338
	-90 to +17	0.0485		0	0.03346
	20	0.0523		20	0.03325
liquid.....	107-180	0.108		40	0.03308
Iridium.....	-186 to +18	0.0282		60	0.03294
	18-100	0.0323		100	0.03269
	0-900	0.0371		200	0.0323
Iron, cast.....	20-100	0.1189		250	0.0321
wrought.....	15-100	0.1152	Molybdenum.....	-257	0.0004
hard drawn.....	20-100	0.1146		-239.1	0.0034
pure.....	-256.2	0.00067		-181.5	0.0300
	-214.0	0.0194		-152.7	0.0399
	-172.6	0.0512		-34.5	0.0561
	-67.5	0.0939		0	0.0589
	0	0.1043		20-100	0.065
	20	0.107		250	0.0632
α, β, γ	100	0.115		475	0.0750
	500	0.163	Neodymium.....	0-100	0.045
	760	0.320	Nickel.....	-258	0.0008
	1000	0.162		-247.9	0.0024
γ	100	0.127		-201.2	0.0363
	700	0.157		-150	0.0660
	1000	0.162		-100	0.0817
Lanthanum.....	0-100	0.0448		-50	0.0940
Lead.....	-270	0.00001		0	0.1032
	-267	0.00086		20	0.105
	-259	0.0073		100	0.1146
	-150	0.0279		500	0.1270
	-100	0.0283		800	0.1413
	-50	0.0289	liquid.....	1452	0.13
	0	0.0297	Nitrogen, solid....	-212	0.39
	20	0.0306	liquid.....	-200	0.474
	100	0.0320			

SPECIFIC HEAT OF ELEMENTS (Continued)

Element	Temp. °C	Sp. ht., cal./g	Element	Temp. °C	Sp. ht., cal./g
Osmium.....	19-98	0.0311	Silver (con-		
Oxygen, solid.....	-221.8	0.336	tinued).....	500	0.0581
liquid.....	-200	0.394		800	0.076
Palladium.....	-180 to +18	0.0528	liquid.....	900	0.0685
	0	0.0538	Sodium.....	-256.1	0.026
	100	0.0564		-238.5	0.108
	500	0.0653		-155.5	0.215
	900	0.0717		-40	0.279
	1500	0.0766		20	0.295
Phosphorus, yel-			liquid.....	100	0.32
low.....	-136	0.124	Sulfur.....	-188 to +18	0.137
	-40	0.165	rhombic.....	15-96	0.176
	9	0.189	monocl.....	0-52	0.181
red.....	-136	0.107	liquid.....	115-160	0.220
	-40	0.182	Tantalum.....	-201.7	0.0205
	9	0.190		20	0.036
Platinum.....	-255.6	0.00123		380	0.035
	-237.7	0.0073		900	0.036
	-191.7	0.0211		1100	0.043
	-152.1	0.0261		1400	0.044
	-64.8	0.0307	Tellurium.....	-188 to +18	0.047
	0	0.03162	cryst.....	15-100	0.0483
	20	0.0324		15-200	0.0487
	500	0.0349	Thallium.....	-185 to +20	0.038
	750	0.0365		28	0.0311
	1000	0.0381		20-100	0.0326
	1300	0.0400	Thorium.....	-253 to -196	0.0197
Potassium.....	-258.4	0.032		0-100	0.0276
	-255.8	0.045	Tin.....	-186 to -79	0.0486
	-201.3	0.140		-186.7	0.0422
	-53.1	0.172		-150	0.0450
	14	0.18		-100	0.0483
	22-56	0.192		-50	0.0512
liquid.....	63	0.18		0	0.0536
	78-100	0.217		18	0.0542
	90	0.200		100	0.0577
	181	0.196	liquid.....	1100	0.0758
Praseodymium...	0-100	0.046	gray.....	20	0.515
Rhenium.....	0-20	0.035	Titanium.....	-185 to +20	0.082
Rhodium.....	10-97	0.058		0-100	0.1125
Rubidium, solid...	0	0.0802	Tungsten.....	-247.1	0.0012
liquid.....	50	0.0908		-218.4	0.0098
Ruthenium.....	0-100	0.0611		-173.1	0.0205
Selenium.....	-188 to +18	0.068		-73.1	0.0288
	3	0.072		20-100	0.034
	20.5	0.077		100	0.0320
	29.5	0.085		500	0.0344
	32	0.127		1000	0.0367
	38	0.131		1500	0.0390
Silicon.....	-212	0.029	Uranium, α.....	0	0.0275
	-143.3	0.087		100	0.02919
	-86.2	0.126		200	0.03135
	13.9	0.168		400	0.03681
	18.2-99.1	0.181		600	0.04521
	18.0-900.6	0.210		700	0.04262
Silver.....	-238	0.0146	, β.....	800	0.03843
	-150	0.0461	, γ.....	0-100	0.1153
	-100	0.0505	Vanadium.....	-201.3	0.0573
	-50	0.0537	Zinc.....	-100	0.0814
	0	0.0557		0	0.0913
	20	0.0558		20	0.0925
	100	0.0564		100	0.0957
			Zirconium.....	0-100	0.068

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS

Specific heat is given in calories (15°) per gram per degree Centigrade. To change to joules per gram per degree Centigrade multiply by 4.185.

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Aluminum chloride.....	AlCl ₃ (α).....	93	.468
chloride.....	AlCl ₃ (β).....	0	.196
chloride.....	AlCl ₃ ·6H ₂ O.....	35	.313
fluoride.....	AlF ₃	35	.229
fluoride.....	2AlF ₃ ·7H ₂ O.....	35	.342
hydroxide.....	Al(OH) ₃	0	.177
		50	.202
oxide.....	Al ₂ O ₃	0	.174
		50	.198
sulfate.....	Al ₂ (SO ₄) ₃	50	.184
sulfate.....	Al ₂ (SO ₄) ₃ ·18H ₂ O.....	34	.354
Ammonia.....	NH ₃	-103 to -188	.502
Ammonium bromide.....	NH ₄ Br.....	20	.210
chloride.....	NH ₄ Cl.....	-200	.121
		-100	.263
		0	.357
		50	.389
iodide.....	NH ₄ I.....	0	.111
		50	.118
nitrate.....	NH ₄ NO ₃	-100	.306
		0	.397
		100	.428
sulfate.....	(NH ₄) ₂ SO ₄	-100	.283
		0	.337
		50	.345
Antimony trisulfide.....	Sb ₂ S ₃	0	.0829
Arsenous oxide.....	As ₂ O ₃	0	.117
Barium carbonate.....	BaCO ₃	0	.0999
		100	.110
chlorate.....	Ba(ClO ₃) ₂ ·H ₂ O.....	32	.158
chloride.....	BaCl ₂ ·2H ₂ O.....	0	.140
nitrate.....	Ba(NO ₃) ₂	47	.148
sulfate.....	BaSO ₄	0	.111
thiosulfate.....	BaS ₂ O ₃	58	.162
Beryllium oxide.....	BeO.....	50	.260
sulfate.....	BeSO ₄	50	.198
Bismuth sulfide.....	Bi ₂ S ₃	50	.0600
trioxide.....	Bi ₂ O ₃	50	.0569
Cadmium nitrate.....	Cd(NO ₃) ₂ ·4H ₂ O.....	40	.260
sulfate.....	3CdSO ₄ ·8H ₂ O.....	0	.195
		20	.200
sulfide.....	CdS.....	0	.0882
		50	.0922
Calcium carbonate.....	CaCO ₃	0	.203
		100	.214
chloride.....	CaCl ₂	61	.164
chloride.....	CaCl ₂ ·6H ₂ O.....	0	.320
fluoride.....	CaF ₂	0	.204
		40	.212
formate.....	Ca(HCO ₂) ₂	0	.238
hydroxide.....	Ca(OH) ₂	0	.260
		50	.288
molybdate.....	CaMoO ₄	15	.165
oxide.....	CaO.....	0	.177
		100	.197

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Calcium			
sulfate.....	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	36	.265
tungstate.....	CaWO_4	15	.104
Carbon dioxide, solid.....	CO_2	-225	.124
monoxide, solid.....	CO	-220	.417
		-206	.457
Ceric oxide.....	CeO_2	0	.0870
		50	.0946
sulfate.....	$\text{Ce}(\text{SO}_4)_2$	50	.117
sulfate.....	$\text{CeSO}_4 \cdot 5\text{H}_2\text{O}$	50	.201
Chromic oxide.....	Cr_2O_3	0	.168
		50	.189
sulfate.....	$\text{Cr}_2(\text{SO}_4)_3$	50	.172
sulfate.....	$\text{Cr}_2(\text{SO}_4)_3 \cdot 5\text{H}_2\text{O}$	50	.200
Cobaltous nitrate.....	$\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	32	.373
sulfate.....	$\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$	48	.342
Columbium pentoxide.....	Cb_2O_5	50	.101
Copper ammonium sul- fate.....	$\text{CuSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot$ $6\text{H}_2\text{O}$	0	.256
Copper sulfate.....	$\text{CuSO}_4 \cdot \text{H}_2\text{O}$	0	.172
		50	.191
sulfate.....	$\text{CuSO}_4 \cdot 3\text{H}_2\text{O}$	9	.228
sulfate.....	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	0	.253
		50	.287
Cupric carbonate.....	$2\text{CuO} \cdot \text{CO}_2 \cdot \text{H}_2\text{O}$	57	.177
chloride.....	CuCl_2	58	.139
oxide.....	CuO	0	.125
		100	.144
sulfide.....	CuS	0	.129
		100	.151
Cuprous iodide.....	CuI	0	.0658
		50	.0671
oxide.....	Cu_2O	0	.110
		100	.116
selenide.....	Cu_2Se	60	.104
sulfide.....	Cu_2S	0	.148
		50	.166
Erbium oxide.....	Er_2O_3	50	.0650
Ferric oxide.....	Fe_2O_3	0	.148
		100	.182
Ferrosoferric oxide (mag- netite).....	Fe_3O_4	0	.151
		100	.179
Ferrous carbonate.....	FeCO_3	54	.194
sulfate.....	FeSO_4	45	.167
sulfate.....	$\text{FeSO}_4 \cdot 4\text{H}_2\text{O}$	9	.284
sulfate.....	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	0	.325
		10	.337
sulfide.....	FeS	0	.135
Gallium sesqui-oxide.....	Ga_2O_3	50	.105
Gold iodide.....	AuI	0	.0404
		50	.0432
Hydrogen peroxide.....	H_2O_2	-25	.471
Indium sesquioxide.....	In_2O_3	50	.0808
Iron diarsenide.....	FeAs_2	50	.0860
disulfide.....	FeS_2	0	.118
		50	.128
Lanthanum sesquioxide..	La_2O_3	50	.0750

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Lead ammonium chloride.	2PbCl ₂ ·NH ₄ Cl.....	10	.0865
Lead borate.....	PbB ₂ O ₄	57	.0903
Lead bromide.....	PbBr ₂	0	.0502
		50	.0530
carbonate.....	PbCO ₃	32	.0800
chloride.....	PbCl ₂	0	.0649
		100	.0681
chromate.....	PbCrO ₄	35	.0908
dioxide.....	PbO ₂	0	.0619
		50	.0650
iodide.....	PbI ₂	0	.0417
		100	.0437
molybdate.....	PbMoO ₄	15	.100
monoxide.....	PbO.....	0	.0483
		50	.0509
nitrate.....	Pb(NO ₃) ₂	45	.115
pyrophosphate.....	Pb ₂ P ₂ O ₇	55	.0820
silicate.....	PbSiO ₃	60	.0779
sulfate.....	PbSO ₄	45	.0839
sulfide.....	PbS.....	0	.0502
		100	.0511
thiosulfate.....	PbS ₂ O ₃	58	.0918
tungstate.....	PbWO ₄	15	.0769
Lithium chloride.....	LiCl.....	55	.282
fluoride.....	LiF.....	10	.373
hydride.....	LiH.....	0	.980
		50	1.07
hydroxide.....	LiOH.....	0	.327
		50	.356
nitrate.....	LiNO ₃	210	.387
thiosulfate.....	Li ₂ S ₂ O ₃	58	.0920
Magnesium carbonate.....	MgCO ₃	25	.200
chloride.....	MgCl ₂ ·6H ₂ O.....	44	.378
chloride.....	MgCl ₂	48	.194
nitrate.....	Mg(NO ₃) ₂ ·6H ₂ O.....	55	.887
oxide.....	MgO.....	0	.209
		50	.232
sulfate.....	MgSO ₄ ·7H ₂ O.....	12	.361
sulfate.....	MgSO ₄ ·6H ₂ O.....	9	.349
sulfate.....	MgSO ₄ ·H ₂ O.....	9	.239
sulfate.....	MgSO ₄	61	.222
Manganese dioxide.....	MnO ₂	0	.152
		50	.163
nitrate.....	Mn(NO ₃) ₂ ·6H ₂ O.....	47	.373
Manganic oxide.....	Mn ₂ O ₃	58	.162
oxide.....	Mn ₂ O ₃ ·3H ₂ O.....	38	.177
Manganous oxide.....	MnO.....	58	.158
sulfate.....	MnSO ₄ ·5H ₂ O.....	32	.323
sulfate.....	MnSO ₄	61	.182
Mercuric chloride.....	HgCl ₂	0	.0640
		100	.0669
cyanide.....	Hg(CN) ₂	29	.100
iodide.....	HgI ₂ (red).....	0	.0404
		50	.0413
oxide.....	HgO.....	0	.0485
		50	.0521
sulfide.....	HgS.....	0	.0506
		50	.0520

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Mercurous chloride.....	HgCl.....	0	.0499
		50	.0512
sulfate.....	Hg ₂ SO ₄	0	.0616
		50	.0680
Molybdenum trioxide....	MoO ₃	54	.134
Nickel nitrate.....	Ni(NO ₃) ₂ ·6H ₂ O.....	80	.473
sulfate.....	NiSO ₄ ·6H ₂ O.....	35	.313
sulfate.....	NiSO ₄	58	.225
sulfide.....	NiS.....	0	.116
		100	.128
Nitrogen pentoxide.....	N ₂ O ₅	-80 to -5	.239
Potassium acetate.....	KC ₂ H ₃ O ₂	20	.272
	KHSO ₄	35	.244
aluminum sulfate, (alum).....	K ₂ SO ₄ Al ₂ (SO ₄) ₃ ·24H ₂ O	0	.324
		50	.360
Potassium arsenate, acid	KH ₂ AsO ₄	31	.174
Potassium bromide.....	KBr.....	0	.104
		100	.108
	K ₂ CO ₃	47	.210
chlorate.....	KClO ₃	0	.191
		50	.205
chloride.....	KCl.....	0	.162
		100	.168
chloroplatinate.....	K ₂ PtCl ₆	30	.112
chromate.....	K ₂ CrO ₄	46	.186
dichromate.....	K ₂ Cr ₂ O ₇	0	.178
ferricyanide.....	K ₃ Fe(CN) ₆	26	.232
ferrocyanide.....	K ₄ Fe(CN) ₆	0	.210
		50	.225
ferrocyanide.....	K ₄ Fe(CN) ₆ ·3H ₂ O.....	0	.267
		50	.285
fluoride.....	KF.....	0	.199
		50	.204
metaborate.....	K ₂ B ₂ O ₄	57	.225
nitrate.....	KNO ₃	0	.214
		100	.240
perchlorate.....	KClO ₄	30	.189
phosphate, dihydrogen	KH ₂ PO ₄	33	.208
pyrophosphate.....	K ₄ P ₂ O ₇	58	.191
thiosulfate.....	K ₂ S ₂ O ₃	60	.196
Silicon carbide.....	SiC.....	0	.143
		100	.194
Silver bromide.....	AgBr.....	0	.0695
		100	.0734
chloride.....	AgCl.....	0	.0848
		50	.0906
cyanate.....	AgCNO.....	40	.124
iodide.....	AgI.....	0	.0548
		100	.0593
nitrate.....	AgNO ₃	50	.146
selenide.....	Ag ₂ Se.....	37 to 187	.0693
sulfide.....	Ag ₂ S.....	0	.0719
		50	.0748
Sodium acetate.....	NaC ₂ H ₃ O ₂	38	.339
acetate.....	NaC ₂ H ₃ O ₂ ·3H ₂ O.....	0	.344
		40	.602

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Sodium bromide.....	NaBr.....	0	.118
carbonate.....	Na ₂ CO ₃	100	.124
chloride.....	NaCl.....	45	.256
		0	.204
		100	.217
fluoride.....	NaF.....	0	.258
		100	.279
formate.....	NaHCO ₂	46	.306
iodide.....	NaI.....	0	.0829
		50	.0848
metaborate.....	Na ₂ B ₂ O ₄	57	.253
nitrate.....	NaNO ₃	0	.247
		50	.270
phosphate, di.....	Na ₂ HPO ₄ ·12H ₂ O.....	0	.404
		50	.464
phosphate, di.....	Na ₂ HPO ₄ ·7H ₂ O.....	0	.351
		50	.406
pyrophosphate.....	Na ₄ P ₂ O ₇	50	.227
sulfate.....	Na ₂ SO ₄	0	.202
		100	.220
tetraborate.....	Na ₂ B ₄ O ₇	45	.234
tetraborate (borax)...	Na ₂ B ₄ O ₇ ·10H ₂ O.....	35	.385
thiosulfate.....	Na ₂ S ₂ O ₃ ·5H ₂ O.....	21	.346
thiosulfate.....	Na ₂ S ₂ O ₃	9	.220
Stannic oxide.....	SnO ₂	45	.0898
sulfide.....	SnS ₂	54	.119
Stannous chloride.....	SnCl ₂	60	.102
sulfide.....	SnS.....	56	.0839
Strontium molybdate.....	SrMoO ₄	15	.148
nitrate.....	Sr(NO ₃) ₂	32	.182
sulfate.....	SrSO ₄	48	.143
Sulfuric acid.....	H ₂ SO ₄	-30	.239
		0	.270
Sulfur dioxide.....	SO ₂	-185 to -103	.229
Thallium monochloride...	TlCl.....	0	.0520
		100	.0542
Thorium chloride.....	ThCl.....	30	.406
dioxide.....	ThO ₂	0	.0571
		50	.0589
sulfate.....	Th(SO ₄) ₂	50	.0980
Tin see under Stannous and Stannic			
Titanium dioxide.....	TiO ₂	0	.168
Tungsten trioxide.....	WO ₃	0	.0743
		50	.0832
Uranium oxide (ous-ic)...	U ₃ O ₈	0	.0671
		50	.0750
Uranium trichloride.....	UCl ₃	100	.07167
Uranium tetrachloride...	UCl ₄	100	.07923
Water, solid.....	H ₂ O.....	-250	.0361
		-200	.156
		-150	.246
		-100	.332
		-40	.435
		0	.492
Yttrium oxide.....	Y ₂ O ₃	57	.112
Zinc chloride.....	ZnCl ₂	60	.136

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Zinc nitrate.....	$\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	30	.318
oxide.....	ZnO	0	.114
		100	.129
sulfate.....	$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$	0	.322
sulfate.....	$\text{ZnSO}_4 \cdot 6\text{H}_2\text{O}$	9	.299
sulfate.....	$\text{ZnSO}_4 \cdot \text{H}_2\text{O}$	9	.194
sulfate.....	ZnSO_4	50	.174
sulfide.....	ZnS	0	.116
		100	.118
Zirconium dioxide.....	ZrO_2	0	.103

SPECIFIC HEAT OF LIQUID INORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Specific Heat Cal. (15°)/g
Ammonia.....	NH_3	-60	1.047
		0	1.098
		20	1.125
		100	1.48
Calcium chloride.....	$\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$	33-99	.552
Hydrogen peroxide.....	H_2O_2	0	.578
Lead bromide.....	PbBr_2	550	.0779
chloride.....	PbCl_2	540	.121
Lithium nitrate.....	LiNO_3	280	.390
Potassium dichromate ..	$\text{K}_2\text{Cr}_2\text{O}_7$	397	.0335
nitrate.....	KNO_3	380	.0332
Silver bromide.....	AgBr	500	.0760
chloride.....	AgCl	490	.129
nitrate.....	AgNO_3	250	.187
Sodium acetate.....	$\text{NaC}_2\text{H}_3\text{O}_2$	61.8	.846
chlorate.....	NaClO_3	280	.325
nitrate.....	NaNO_3	350	.430
thiosulfate.....	$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$	13-98	.570
Stannic chloride.....	SnCl_4	14-98	.148
Sulfur dioxide.....	SO_2	-20	.313
		0	.318
		20	.327
		100	.418
Sulfuric acid.....	H_2SO_4	10	.339
acid pyro.....	$\text{H}_2\text{S}_2\text{O}_7$	35	.334
Water.....	H_2O See special table		

SPECIFIC HEAT OF SOLID ORGANIC COMPOUNDS

Specific heat is given in calories (15°) per gram per degree Centigrade. To change to joules per gram per degree Centigrade multiply by 4.185.

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Acetic acid.....	$\text{CH}_3\text{CO}_2\text{H}$	0	.487
Acetone.....	$(\text{CH}_3)_2\text{CO}$	-210	.540
o-Aminobenzoic acid.....	$\text{H}_2\text{NC}_6\text{H}_4\text{CO}_2\text{H}$	85	.254
m-Aminobenzoic acid.....	.....	120	.253
p-Aminobenzoic acid.....	.....	128	.287
Aniline.....	$\text{C}_6\text{H}_5\text{NH}_2$.....	?	.741
Anthracene.....	$\text{C}_{14}\text{H}_{10}$	50	.308
		100	.350
Anthraquinone.....	$(\text{C}_6\text{H}_4)_2(\text{CO})_2$	0	.258
Azobenzene.....	$(\text{C}_6\text{H}_5\text{N})_2$	28	.330
Benzene.....	C_6H_6	-250	.0399
		-200	.124
		-100	.227
		-50	.299
Benzoic acid.....	$\text{C}_6\text{H}_5\text{CO}_2\text{H}$	20	.287
Benzophenone.....	$(\text{C}_6\text{H}_5)_2\text{CO}$	-150	.115
		-50	.220
		0	.275
		20	.303
Betol.....	$\text{HOC}_6\text{H}_4\text{CO}_2\text{C}_{10}\text{H}_7$	-150	.129
		-100	.167
o-Bromochlorobenzene.....	$\text{C}_6\text{H}_4\text{BrCl}$	-34	.192
m-Bromochlorobenzene.....	.....	-52	.150
p-Bromochlorobenzene.....	.....	-40	.150
		0	.170
o-Bromiodobenzene.....	$\text{C}_6\text{H}_4\text{BrI}$	-50	.143
m-Bromiodobenzene.....	.....	-75 to -15	.143
p-Bromiodobenzene.....	.....	-40	.116
β-Bromonaphthalene.....	$\text{C}_{10}\text{H}_7\text{Br}$	41	.260
Bromophenol.....	$\text{HOC}_6\text{H}_4\text{Br}$	32	.263
Camphene.....	$\text{C}_{10}\text{H}_{16}$	35	.380
Capric acid.....	$\text{CH}_3(\text{CH}_2)_9\text{CO}_2\text{H}$	8	.695
Caprylic acid.....	$\text{CH}_3(\text{CH}_2)_6\text{CO}_2\text{H}$	-2	.628
Carbon tetrachloride.....	CCl_4	-200	.0812
		-80	.182
		-40	.201
Catechol.....	$\text{C}_6\text{H}_4(\text{OH})_2$	163	.278
Chloral alcoholate.....	$\text{CCl}_3\text{CHO} \cdot \text{C}_2\text{H}_5\text{OH}$	78	.509
hydrate.....	$\text{CCl}_3\text{CHO} \cdot \text{H}_2\text{O}$	32	.213
Chloroacetic acid.....	$\text{CH}_2\text{ClCO}_2\text{H}$	60	.363
p-Chlorobenzoic acid.....	$\text{ClC}_6\text{H}_4\text{CO}_2\text{H}$	80	.228
m-Chlorobenzoic acid.....	.....	94	.232
p-Chlorobenzoic acid.....	.....	180	.242
Crotonic acid.....	$\text{CH}_3\text{CHCHCO}_2\text{H}$	38	.520
Cyameliide.....	$\text{C}_3\text{H}_3\text{O}_3\text{N}_3$	40	.263
Cyanuric acid.....	$(\text{HNCO})_3$	40	.318
Dextrose.....	$\text{C}_6\text{H}_{12}\text{O}_6$	-250	.0155
		0	.277
		20	.275
Dextrin.....	$(\text{C}_6\text{H}_{10}\text{O}_5)_x$	0 to 90	.292
o-Dibromobenzene.....	$\text{C}_6\text{H}_4\text{Br}_2$	-36	.249
m-Dibromobenzene.....	.....	-25	.134
p-Dibromobenzene.....	.....	-50	.139
Dichloroacetic acid.....	$\text{CHCl}_2\text{CO}_2\text{H}$	solid	.406
o-Dichlorobenzene.....	$\text{C}_6\text{H}_4\text{Cl}_2$	-48.5	.185

SPECIFIC HEAT OF SOLID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
m-Dichlorobenzene.....		-52	.186
p-Dichlorobenzene.....		-50	.219
Dicyandiamide.....	$C_2H_4N_4$	0 to 204	.456
Dulcitol.....	$C_6H_8(OH)_6$	20	.282
m-Diiodobenzene.....	$C_6H_4I_2$	-52	.100
p-Diiodobenzene.....		-50	.101
Dibenzyl.....	$(C_6H_5CH_2)_2$	28	.363
Dimethyl oxalate.....	$(CO_2CH_3)_2$	10	.212
Dimethylpyrone.....	$(CH_3)_2C_5H_2O_2$	50	.368
o-Dinitrobenzene.....	$C_6H_4(NO_2)_2$	-160	.252
m-Dinitrobenzene.....		-160	.248
p-Dinitrobenzene.....		119	.259
Diphenyl.....	$(C_6H_5)_2$	40	.385
Diphenylamine.....	$(C_6H_5)_2NH$	26	.337
Ethyl alcohol.....	C_2H_5OH	-190	.232
(crystalline)			
(vitreous).....		-190	.260
Erythritol.....	$(CHOHCH_2OH)_2$	60	.351
Formic acid.....	HCO_2H	-22	.387
		0	.430
Glutaric acid.....	$(CH_2)_3(CO_2H)_2$	20	.299
Glycerol.....	$C_3H_5(OH)_3$	-250	.0471
		-200	.115
		-100	.217
		0	.330
Glycol.....	$(CH_2OH)_2$	40	.528
Hexadecane.....	$C_{16}H_{34}$	19	.495
Iodobenzene.....	C_6H_5I	40	.191
Lactose.....	$C_{12}H_{22}O_{11}$	20	.287
	$C_{12}H_{22}O_{11} \cdot H_2O$	20	.299
Lauric acid.....	$C_{11}H_{23}CO_2H$	-30	.430
Levulose.....	$C_6H_{12}O_6$	20	.275
Malonic acid.....	$CH_2(CO_2H)_2$	20	.275
Maltose.....	$C_{12}H_{22}O_{11}$	20	.320
Mannitol.....	$C_6H_8(OH)_6$	0	.313
Melamine.....	$C_3H_6N_6$	40	.351
Myristic acid.....	$C_{13}H_{27}CO_2H$	0	.381
Naphthalene.....	$C_{10}H_8$	-130	.281
α -Naphthol.....	$C_{10}H_7OH$	50	.240
β -Naphthol.....		61	.252
α -Naphthylamine.....	$C_{10}H_7NH_2$	0	.270
m-Nitroaniline.....	$H_2NC_6H_4NO_2$	-160	.275
o-Nitroaniline.....		-160	.269
p-Nitroaniline.....		-160	.276
Nitrobenzene.....	$C_6H_5NO_2$	20	.349
		100	.356
o-Nitrobenzoic acid.....	$NO_2C_6H_4CO_2H$	-163	.256
m-Nitrobenzoic acid.....		-160	.247
Nitronaphthalene.....	$C_{10}H_7NO_2$	0	.236
Oxalic acid.....	$(CO_2H)_2 \cdot 2H_2O$	0	.338
		50	.385
Palmitic acid.....	$C_{15}H_{31}CO_2H$	-180	.167
		-100	.251
		-50	.306
		0	.382
		20	.430

SPECIFIC HEAT OF SOLID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g./ °C.
Picric acid.....	$\text{HOC}_6\text{H}_2(\text{NO}_2)_3$	-100 0 50	.165 .240 .263
Phthalic acid.....	$\text{C}_6\text{H}_4(\text{CO}_2\text{H})_2$	20	.232
Propionic acid.....	$\text{C}_2\text{H}_5\text{CO}_2\text{H}$	-33	.726
n-Propyl alcohol.....	$\text{C}_3\text{H}_7\text{OH}$	-200 -130	.170 .497
iso-Propyl alcohol.....	$\text{C}_3\text{H}_7\text{OH}$	-200	.0507
Pyrotartaric acid.....	$\text{C}_6\text{H}_5\text{O}_4$	20	.301
Quinhydrone.....	$\text{C}_{12}\text{H}_{10}\text{O}_4$	-250 -200 0	.0165 .0980 .256
Quinol.....	$\text{C}_6\text{H}_4(\text{OH})_2$	-250 -150	.0246 .268
Quinone.....	$\text{C}_6\text{H}_4\text{O}_2$	-250 -200 -150	.0311 .113 .282
Resorcinol.....	$\text{C}_6\text{H}_4(\text{OH})_2$	-160	.269
Salol.....	$\text{HOC}_6\text{H}_4\text{CO}_2\text{C}_6\text{H}_5$	32	.289
Stearic acid.....	$\text{C}_{17}\text{H}_{35}\text{CO}_2\text{H}$	15	.399
Succinic acid.....	$(\text{CH}_2\text{CO}_2\text{H})_2$	0	.248
Sucrose.....	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	20	.299
Tartaric acid.....	$\text{H}_2\text{C}_4\text{H}_4\text{O}$..	36 0 50	.287 .308 .366
Thymol.....	$\text{C}_{10}\text{H}_{14}\text{O}$	0	.315
Trichloroacetic acid.....	$\text{CCl}_3\text{CO}_2\text{H}$	solid	.459
Trimethyl carbinol.....	$(\text{CH}_3)_3\text{COH}$	-4	.559
Trinitrotoluene.....	$\text{CH}_3\text{C}_6\text{H}_2(\text{NO}_2)_3$	-100 0 100	.170 .311 .385
Trinitroxylene.....	$(\text{CH}_3)_2\text{C}_6\text{H}(\text{NO}_2)_3$	20 to 50	.423
Triphenylmethane.....	$(\text{C}_6\text{H}_5)_3\text{CH}$	0	.189
o-Toluic acid.....	$\text{CH}_3\text{C}_6\text{H}_4\text{CO}_2\text{H}$..	54	.277
m-Toluic acid.....	.....	54	.239
p-Toluic acid.....	.....	130	.271
p-Toluidine.....	$\text{CH}_3\text{C}_6\text{H}_4\text{NH}_2$	0 20	.337 .387
Urea.....	$(\text{NH}_2)_2\text{CO}$	20	.320

SPECIFIC HEAT OF HEAVY WATER

% D ₂ O	Temp. °C.	Specific Heat cal./g	Molar Heat cal./mol.	Observer
99.7	-20.5- 0 (solid)	0.408	8.18	Bartholomé and Clusius
97.7	0 (solid)	0.51	10.2	Jacobs
98	4 -26 (liquid)	1.018	20.4	Brown, Barnes, & Maass
98	26 -45 (liquid)	1.003	20.1	" " " "
98	26 -65 (liquid)	1.008	20.2	" " " "

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS

Specific heat is given in calories (15°) per gram per degree Centigrade. To change to joules per gram per degree Centigrade multiply by 4.185.

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g./ °C.
Acetic acid.....	CH ₃ COOH.....	0	.468
Acetone.....	(CH ₃) ₂ CO.....	0	.506
		20	.528
Acetonitrile.....	CH ₃ CN.....	21-76	.541
Acetophenone.....	C ₆ H ₅ COCH ₃	20-193	.474
Acetyl chloride.....	CH ₃ COCl.....	0	.339
Allyl acetate.....	CH ₃ CO ₂ C ₃ H ₅	0	.431
alcohol.....	C ₃ H ₅ OH.....	21-96	.665
benzoate.....	C ₆ H ₅ CO ₂ C ₃ H ₅	20	.388
butyrate.....	C ₃ H ₇ CO ₂ C ₃ H ₅	20	.451
chloride.....	CH ₂ CHCH ₂ Cl.....	0	.313
isobutyrate.....	C ₃ H ₇ CO ₂ C ₃ H ₅	20	.448
propionate.....	C ₂ H ₅ CO ₂ C ₃ H ₅	20	.451
valerate.....	C ₄ H ₉ CO ₂ C ₃ H ₅	20	.451
o-Aminobenzoic acid.....	H ₂ N-C ₆ H ₄ -CO ₂ H.....	145	.435
m-Aminobenzoic acid.....	.....	174	.435
p-Aminobenzoic acid.....	.....	186	.444
iso-Amyl acetate.....	CH ₃ CO ₂ C ₅ H ₁₁	" 20	.459
alcohol.....	C ₅ H ₁₁ OH.....	0	.502
		20	.535
		75.5	.688
d-prim.-Amyl alcohol	C ₅ H ₁₁ OH.....	22-125	.712
tert.-Amyl alcohol.....	.....	20-99	.753
iso-Amyl butyrate.....	C ₃ H ₇ CO ₂ C ₅ H ₁₁	20	.459
formate.....	HCO ₂ C ₅ H ₁₁	20	.459
isobutyrate.....	C ₃ H ₇ CO ₂ C ₅ H ₁₁	20	.459
propionate.....	C ₂ H ₅ CO ₂ C ₅ H ₁₁	20	.459
succinate.....	(CH ₂ CO ₂ C ₅ H ₁₁) ₂	0	.449
valerate.....	C ₄ H ₉ CO ₂ C ₅ H ₁₁	20	.459
iso-Amylamine.....	C ₅ H ₁₁ NH ₂	22-91	.614
Amylene.....	C ₅ H ₁₀	0	.282
Anethol.....	C ₉ H ₉ OCH ₃	22.48	.551
Aniline.....	C ₆ H ₅ -NH ₂	0	.478
		50	.521
		100	.547
Anisol.....	C ₆ H ₅ OCH ₃	20-152	.483
Benzaldehyde.....	C ₆ H ₅ CHO.....	22-172	.428
Benzene.....	C ₆ H ₆	5	.389
		20	.406
		60	.444
		90	.473
Benzoic acid.....	C ₆ H ₅ CO ₂ H.....	0	.424
Benzonitrile.....	C ₆ H ₅ CN.....	22-186	.441
β-Benzophenone.....	(C ₆ H ₅) ₂ CO.....	3-40	.383
Benzyl alcohol.....	C ₆ H ₅ CH ₂ OH.....	20-100	.511
chloride.....	C ₆ H ₅ CH ₂ Cl.....	0	.323
Betol.....	HOC ₆ H ₄ CO ₂ C ₁₀ H ₇	19-63	.356
Bromobenzene.....	C ₆ H ₅ Br.....	20	.231
o-Bromochlorobenzene.....	C ₆ H ₄ BrCl.....	0	.215
m-Bromochlorobenzene.....	.....	0	.212
o-Bromiodobenzene.....	C ₆ H ₄ BrI.....	5-100	.160
m-Bromiodobenzene.....	.....	5-100	.158
Bromophenol.....	HOC ₆ H ₄ Br.....	18-77	.316
n-Butane.....	C ₄ H ₁₀	0	.550
iso-Butane.....	.....	0	.550
iso-Butyl acetate.....	CH ₃ CO ₂ C ₄ H ₉	20	.459

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
n-Butyl alcohol.....	C ₄ H ₉ OH.....	2.3	.526
		19.2	.563
iso-Butyl alcohol.....		21-109	.716
Butyl butyrate.....	C ₈ H ₇ CO ₂ C ₄ H ₉	20	.459
iso-Butyl butyrate.....		20	.459
n-Butyl chloride.....	C ₄ H ₉ Cl.....	20	.451
formate.....	HCO ₂ C ₄ H ₉	20	.459
Butyl propionate.....	C ₂ H ₅ CO ₂ C ₄ H ₉	20	.459
iso-Butyl succinate.....	(CH ₂ CO ₂ C ₄ H ₉) ₂	0	.442
Butyl valerate.....	C ₄ H ₉ CO ₂ C ₄ H ₉	20	.459
n-Butyric acid.....	C ₃ H ₇ CO ₂ H.....	20-100	.515
iso-Butyric acid.....	C ₄ H ₈ O ₂	20	.450
n-Butyronitrile.....	C ₃ H ₇ CN.....	21-113	.547
Caproic acid.....	C ₅ H ₁₁ CO ₂ H.....	29-105	.533
Capronitrile.....	C ₅ H ₁₁ CN.....	18-156	.542
Carbon tetrachloride.....	CCl ₄	0	.198
		20	.201
Carvacrol.....	C ₉ H ₁₃ OH.....	24-233	.577
Catechol.....	C ₆ H ₄ (OH) ₂	0	.462
Chloral.....	CCl ₃ CHO.....	17-53	.250
hydrate.....	CCl ₃ CHO·H ₂ O.....	55-88	.470
Chlorobenzene.....	C ₆ H ₅ Cl.....	20	.309
o-Chlorobenzoic acid.....	ClC ₆ H ₄ CO ₂ H.....	0	.392
m-Chlorobenzoic acid.....		0	.266
p-Chlorobenzoic acid.....		226	.547
Chloroform.....	CHCl ₃	0	.232
		15	.226
		20	.234
o-Chlorophenol.....	HOC ₆ H ₄ Cl.....	0-20	.401
Chlorotoluene.....	CH ₃ C ₆ H ₄ Cl.....	0	.316
o-Cresol.....	CH ₃ C ₆ H ₄ OH.....	0-20	.499
m-Cresol.....		0-20	.479
p-Cresyl methyl ether.....	CH ₃ C ₆ H ₄ OCH ₃	0	.405
Crotonic acid.....	C ₃ H ₅ CO ₂ H.....	71.4	.500
Cyclohexanol.....	C ₆ H ₁₁ OH.....	15-18	.417
Cyclohexanone.....	C ₆ H ₁₀ O.....	15-18	.433
o-Cymene.....	C ₃ H ₇ C ₆ H ₄ CH ₃	0	.400
Decylene-2.....	C ₁₀ H ₂₀	0-50	.469
Diallyl oxalate.....	(CO ₂ C ₃ H ₅) ₂	20	.426
succinate.....	(CH ₂ CO ₂ C ₃ H ₅) ₂	20	.452
Diamylene.....	C ₁₀ H ₂₀	20-130	.545
o-Dibromobenzene.....	C ₆ H ₄ Br ₂	0	.180
m-Dibromobenzene.....		0	.175
Dibutyl oxalate.....	(CO ₂ C ₄ H ₉) ₂	20	.441
Dichloroacetic acid.....	Cl ₂ CHCO ₂ H.....	21-106	.350
o-Dichlorobenzene.....	C ₆ H ₄ Cl ₂	0	.270
m-Dichlorobenzene.....		0	.270
p-Dichlorobenzene.....		53-99	.298
Diethylamine.....	(C ₂ H ₅) ₂ NH.....	22.5	.518
Diethylaniline.....	C ₆ H ₅ N(C ₂ H ₅) ₂	20	.452
Diethyl carbonate.....	CO(OC ₂ H ₅) ₂	20-100	.464
ketone.....	(C ₂ H ₅) ₂ CO.....	20-98.5	.557
malate.....	HOC ₂ H ₃ (CO ₂ C ₂ H ₅) ₂	24-186	.475
malonate.....	CH ₂ (CO ₂ C ₂ H ₅) ₂	20	.433
oxalate.....	(CO ₂ C ₂ H ₅) ₂	20	.433
succinate.....	(CH ₂ CO ₂ C ₂ H ₅) ₂	20	.452
o-Diiodobenzene.....	C ₆ H ₄ I ₂	0	.136

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
m-Diiodobenzene.....		34.2-99.6	.140
Diisooamyl.....	$C_{10}H_{22}$	21.5-155	.590
oxalate.....	$(CO_2C_4H_{11})_2$	20	.449
Diisobutylamine.....	$(C_4H_9)_2NH$	22-130	.571
Dimethylaniline.....	$C_6H_5N(CH_3)_2$	0-20	.418
Dimethyl carbonate.....	$CO(OCH_3)_2$	19.8-88	.452
o-Dinitrobenzene.....	$C_6H_4(NO_2)_2$	0	.349
m-Dinitrobenzene.....		90	.405
p-Dinitrobenzene.....		0	.279
Diphenylamine.....	$(C_6H_5)_2NH$	53	.464
Diphenyl oxide.....	$(C_6H_5)_2O$	30	.399
Dipropylamine.....	$(C_3H_7)_2NH$	22-100	.597
Dipropyl ketone.....	$(C_3H_7)_2CO$	20-140	.552
malonate.....	$CH_2(CO_2C_3H_7)_2$	20	.433
succinate.....	$(CH_2CO_2C_3H_7)_2$	20	.452
Di-n-propyl oxalate.....	$(CO_2C_3H_7)_2$	20	.433
Dodecane.....	$C_{12}H_{26}$	0-50	.500
Dodecylene.....	$C_{12}H_{24}$	0-50	.457
Ether.....	$(C_2H_5)_2O$	-50	.517
		0	.529
		30	.547
		120	.803
		180	1.041
Ethyl acetate.....	$CH_3CO_2C_2H_5$	20	.459
acetoacetate.....	$CH_3COCH_2CO_2C_2H_5$	20-100	.477
alcohol.....	C_2H_5OH	-100	.456
		0	.535
		25	.581
		100	.824
benzene.....	C_6H_6	30	.409
benzoate.....	$C_6H_5CO_2C_2H_5$	20	.389
bromide.....	C_2H_5Br	5-10	.216
		15-20	.215
butyrate.....	$C_3H_7CO_2C_2H_5$	20	.459
chloride.....	C_2H_5Cl	0	.368
chloroacetate.....	$ClCH_2CO_2C_2H_5$	9-138	.418
dichloroacetate.....	$Cl_2CHCO_2C_2H_5$	20	.329
formate.....	$HCO_2C_2H_5$	14-49	.510
iodide.....	C_2H_5I	0	.162
isobutyrate.....	$C_3H_7CO_2C_2H_5$	20	.459
propionate.....	$C_2H_5CO_2C_2H_5$	20	.459
sulfide.....	$(C_2H_5)_2S$	0	.470
		15-20	.477
trichloroacetate.....	$CCl_3CO_2C_2H_5$	10-81	.295
valerate.....	$C_4H_9CO_2C_2H_5$	20	.459
Ethylene bromide.....	$(CH_2Br)_2$	20	.174
chloride.....	$(CH_2Cl)_2$	20	.301
		60	.319
Formamide.....	$HCONH_2$	19	.551
Formic acid.....	HCO_2H	0	.437
		15.5	.511
		20-100	.526
Furfural.....	$(C_4H_3O)CHO$	20-100	.418
Glycerol, (glycerine).....	$HOCH_2CHOH-CH_2OH$	0	.540
		50	.600
		100	.369
		0	.544
Glycol.....	$(CH_2OH)_2$	14.9	.571

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Heptaldehyde.....	$C_6H_{13}CHO$	0	.365
n-Heptane (B. P. 98°) ...	C_7H_{16}	20	.490
iso-Heptane.....		0-50	.501
Heptylene (B. P., 98°)...	C_7H_{14}	0-50	.488
Heptylic acid.....	$C_6H_{13}CO_2H$	9	.558
n-Hexadecane (B.P., 275°)	$C_{16}H_{34}$	0-50	.496
1, 5-Hexadiene.....	C_6H_{10}	0	.407
o-Hexahydrocresol.....	$CH_3C_6H_{10}OH$	15-18	.418
m-Hexahydrocresol.....		15-18	.422
p-Hexahydrocresol.....		15-18	.423
n-Hexane.....	C_6H_{14}	20-100	.600
Hexylene.....	C_6H_{12}	0-50	.506
Lauric acid.....	$C_{11}H_{23}CO_2H$	57	.515
Mesitylene.....	$C_6H_3(CH_3)_3$	0	.393
Mesityl oxide.....	$C_6H_{10}O$	21-121	.521
Methyl acetate.....	$CH_3CO_2CH_3$	15	.468
alcohol.....	CH_3OH	0	.566
		20	.600
Methyl aniline.....	$C_6H_5NHCH_3$	20-197	.513
benzoate.....	$C_6H_5CO_2CH_3$	0	.363
butyl ketone.....	$CH_3COC_4H_9$	21-127	.553
n-butyrate.....	$C_3H_7CO_2CH_3$	20	.459
chloroacetate.....	$ClCH_2CO_2CH_3$	20	.382
dichloroacetate.....	$Cl_2CHCO_2CH_3$	20	.311
ethyl ketone.....	$CH_3COC_2H_5$	20-78	.549
ethyl ketoxime.....	$(CH_3)(C_2H_5)CNOH$	22-152	.650
formate.....	HCO_2CH_3	13-29	.516
hexyl ketone.....	$CH_3COC_6H_{13}$	22-168	.552
isobutyl ketone.....	$CH_3COC_4H_9$	20	.459
isopropyl ketone.....	$CH_3COC_3H_7$	20-91	.525
propionate.....	$C_3H_7CO_2CH_3$	20	.459
trichloroacetate.....	$Cl_3CCO_2CH_3$	20	.267
valerate.....	$C_4H_9CO_2CH_3$	20	.459
o-Methylcyclohexanone..	$C_7H_{12}O$	15-18	.436
m-Methylcyclohexanone..		15-18	.441
p-Methylcyclohexanone..		15-18	.441
Methylene chloride.....	CH_2Cl_2	15-40	.238
Myristic acid.....	$C_{13}H_{27}CO_2H$	56-100	.539
Naphthalene.....	$C_{10}H_8$	0	.313
α -Naphthol.....	$C_{10}H_7OH$	0	.389
β -Naphthol.....		0	.403
α -Naphthylamine.....	$C_{10}H_7NH_2$	53.2	.475
o-Nitraniline.....	$H_2NC_6H_4NO_2$	0	.400
m-Nitraniline.....		0	.392
p-Nitraniline.....		0	.427
Nitrobenzene.....	$C_6H_5NO_2$	30	.339
		120	.394
o-Nitrobenzoic acid.....	$O_2NC_6H_4CO_2H$	0	.314
m-Nitrobenzoic acid.....		0	.405
p-Nitrobenzoic acid.....		238	.449
Nitromethane.....	CH_3NO_2	17	.412
α -Nitronaphthalene.....	$C_{10}H_7NO_2$	58.6	.365
Nonane.....	C_9H_{20}	0-50	.503
Nonylene.....	C_9H_{18}	0-50	.485
n-Octane.....	C_8H_{18}	20-123	.578
Octylene.....	C_8H_{16}	0-50	.486
Olive oil.....		6.6	.471
Palmitic acid.....	$C_{15}H_{31}CO_2H$	65-104	.653

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/ °C.
Paraldehyde.....	(CH ₃ CHO) ₃	0	.436
Pentadecane.....	C ₁₅ H ₃₂	0-50	.497
Pentadecylene.....	C ₁₅ H ₃₀	0-50	.471
iso-Pentane.....	C ₅ H ₁₂	8	.527
Petroleum.....		21-58	.511
Phenetole.....	C ₆ H ₅ OC ₂ H ₅	20	.446
Phenol.....	C ₆ H ₅ OH.....	14-26	.561
Piperidine.....	C ₅ H ₁₁ N.....	20-98	.523
Propane.....	C ₃ H ₈	0	.576
Propionaldehyde.....	C ₂ H ₅ CHO.....	0	.522
Propionic acid.....	C ₂ H ₅ CO ₂ H.....	20-137	.560
Propionitrile.....	C ₂ H ₅ CN.....	19-95	.538
n-Propyl acetate.....	CH ₃ CO ₂ C ₃ H ₇	20	.459
Propyl alcohol.....	C ₃ H ₇ OH.....	-100	.435
		0	.526
		25	.586
benzene.....	C ₆ H ₆ C ₃ H ₇	0	.400
Propyl benzoate.....	C ₆ H ₅ CO ₂ C ₃ H ₇	20	.398
butyrate.....	C ₃ H ₇ CO ₂ C ₃ H ₇	20	.459
chloroacetate.....	CH ₂ ClCO ₂ C ₃ H ₇	20	.414
n-Propyl formate.....	HCO ₂ C ₃ H ₇	20	.459
Propyl isobutyrate.....	C ₃ H ₇ CO ₂ C ₃ H ₇	20	.459
phenyl ether.....	C ₆ H ₅ OC ₆ H ₅	0	.429
propionate.....	C ₂ H ₅ CO ₂ C ₃ H ₇	20	.459
valerate.....	C ₄ H ₉ CO ₂ C ₃ H ₇	20	.459
Pseudocumene.....	C ₆ H ₃ (CH ₃) ₃	20	.414
Pyridine.....	C ₅ H ₅ N.....	21-108	.431
Quinol.....	C ₆ H ₄ (OH) ₂	0	.492
Quinoline.....	C ₉ H ₇ N.....	0-20	.352
Quinone.....	C ₆ H ₄ O ₂	0	.324
Resorcinol.....	C ₆ H ₄ (OH) ₂	0	.452
Salicylaldehyde.....	HOC ₆ H ₄ CHO.....	18	.382
Salol.....	HOC ₆ H ₄ CO ₂ C ₆ H ₅	44.1	.391
Stearic acid.....	C ₁₇ H ₃₅ CO ₂ H.....	74-137	.550
Tetrachloroethylene.....	C ₂ Cl ₄	20	.211
Tetradecane.....	C ₁₄ H ₃₀	0-50	.497
Tetradecylene.....	C ₁₄ H ₂₈	0-50	.453
m-Thymol.....	C ₉ H ₁₃ OH.....	50	.567
Toluene.....	C ₆ H ₅ CH ₃	0	.386
		50	.421
		100	.470
o-Toluic acid.....	CH ₃ C ₆ H ₄ CO ₂ H.....	0	.422
m-Toluic acid.....		0	.503
p-Toluic acid.....		0	.316
o-Toluidine.....	CH ₃ C ₆ H ₄ NH ₂	22-195	.524
p-Toluidine.....		43	.598
Trichloroethylene.....	C ₂ HCl ₃	20	.223
Tridecane.....	C ₁₃ H ₂₈	0-50	.499
Tridecylene.....	C ₁₃ H ₂₆	0-50	.457
Trinitrotoluene (2, 4, 6).....	CH ₃ C ₆ H ₂ (NO ₂) ₃	?	.335
Turpentine, oil.....		0	.411
Undecane.....	C ₁₁ H ₂₄	0-50	.501
Undecylene.....	C ₁₁ H ₂₂	0-50	.482
Valeronitrile.....	C ₄ H ₉ CN.....	23-121	.520
iso-Valeric acid.....	C ₄ H ₉ CO ₂ H.....	23-93	.590
o-Xylene.....	(CH ₃) ₂ C ₆ H ₄	30	.411
m-Xylene.....		16-35	.387
p-Xylene.....		30	.397

SPECIFIC HEAT OF ALLOYS AND VARIOUS SOLIDS

Values given in calories per gram.

Substance.	Temp. ° C.	Sp. heat.	Observer.
Alloys			
aluminum bronze, 88.7 Cu, 11.3 Al	20-100	0.104	Louguinine
antimony bismuth tin, 21.6Sb, 36.7Bi, 41.7Sn	22-99	.046	Regnault
antimony lead, 37.1Sb, 62.9Pb	10-98	.0388	"
bell metal, 80Cu, 20Sn.....	14-98	.0862	"
Bismuth tin, 63.8Bi, 36.2Sn...	20-99	.0400	"
46.9Bi, 53.1Sn.....	20-99	.0450	"
56.9Bi, 43.1Sn.....	17-99	.0450	Person
brass, 60Cu, 40Zn.....	-186--79	.0743	Behn
	-79-+18	.0873	"
	20-100	.0917	Voigt
72Cu, 28Zn.....	14-98	.094	Regnault
bronze, 80Cu, 20Sn.....	15-98	.086	"
88Cu, 12Sn, 0.94P	20-100	.0874	Voigt
constantan.....	0	.098	Jaeger, Diesselhorst
	100	.102	"
German silver.....	0	.094	Tomlinson
	100	.095	"
invar, 64Fe, 36Ni	-182-+15	.095	"
	15-100	.120	"
	15-600	.126	"
lead bismuth, 39.9Pb, 60.1Bi..	16-99	.0317	Person
lead bismuth tin,			
32.5Pb, 49.0Bi, 18.5Sn.....	14-80	.0600n	Person
31.8Pb, 32.0Bi, 36.2Sn.....	11-98	.0448	Regnault
lead tin, 63.7Pb, 36.3Sn.....	12-99	.0407	"
46.7Pb, 53.3Sn.....	10-99	.0451	"
Lipowitz alloy, 24.97Pb.....	5-50	.0345	Mazotto
10.13Cd, 50.66Bi, 14.24Sn			
manganin.....	0	.097	Jaeger, Diesselhorst
	100	.095	"
platinum iridium, 90Pt, 10Ir..	20-100	.0323	Pionchon
Rose alloy, 27.5Pb, 48.9Bi,....	20-89	.0552	Schütz
23.6 Sn			
solder, <i>see</i> lead tin			
steel, ordinary (.004C).....	20	0.107	Regnault
	100	.117	"
Wood's alloy, 25.85Pb, 6.99Cd, 52.43Bi, 14.73Sn	5-50	.0352	Mazotto
Amalgams			
50.8Pb, 49.2Hg.....	23-99	.0383	Regnault
78.3Pb, 37.1Sn, 62.9Hg.....	22-99	.0729	"
54.1Sn, 45.9Hg.....	25-99	.0659	Schütz
Asbestos.....	20-98	.195	Ulrich
Basalt.....	20-100	.20	Mean
Calcspar.....	0-100	.2005	Lindner
Carborundum.....	3-44	.162	
Cellulose, dry.....		.37	Mean
Cement, powder.....	200-10	.20	
Chalk.....	20-99	.214	Regnault
Charcoal.....	10	.16	Weber, 1875
Clay, dry.....	20-100	.22	Mean
Ebonite.....	20-100	.40	Louguinine, 1882
Glass, normal thermometer.....	19-100	.1988	Wachsmuth
crown.....	10-50	.161	H. Meyer
flint.....	10-50	.117	H. Meyer

SPECIFIC HEAT OF ALLOYS AND VARIOUS SOLIDS (Continued)

Values given in calories per gram

Substance.	Temp. ° C.	Sp. heat.	Observer.
Carboloy.....		.052	
Granite.....	12-100	.192	Joly
Ice.....	-200	.168	Nernst, 1910
	-180	.199	" "
	-160	.230	" "
	-140	.262	" "
	-100	.325	" "
	- 60	.392	" "
	- 20	.480	" "
	- 10	.530	" "
India rubber (Para).....	?-100	.481	Gee and Terry
Leather, dry.....		.36	
Marble.....	0-100	.21	
Mica (Mg).....	20-98	.2061	Ulrich
Paraffin.....	0-20	.6939	R. W. Weber
Porcelain.....	15-950	.26	Harker, 1905
Quartz.....	12-100	.188	Joly
Rock-salt.....	13-45	.219	Kopp
Rubber, Synthetic (Government rubber—Styrene Type)	- 253	.02692	Rands, Ferguson,
	- 223	.08075	Prather, 1944
	- 173	.1462	
	- 73	.2685	
	- 53	.4009	
	- 33	.4123	
	- 3	.4319	
	7	.4391	
	17	.4465	
	27	.4539	
	47	.4697	
Sugar.....	20	.274	Hess, 1888
Vulcanite.....	20-100	.3312	A. M. Mayer
Wood.....		.42	

COLOR SCALE OF TEMPERATURE

This table is the result of an effort to interpret in terms of thermometric readings, the common expressions used in describing temperatures. It is obvious that the values are only approximations.

Color.	Temperature, °C.
Incipient red heat.....	500-550
Dark red heat.....	650-750
Bright red heat.....	850-950
Yellowish red heat.....	1050-1150
Incipient white heat.....	1250-1350
White heat.....	1450-1550

SPECIFIC HEAT

Variation with Temperature

The table gives the true specific heat at the temperatures named. From data of Wüst, Meuthen, and Durrer, 1918.

°C	Pb	Zn	Al	Ag	Au	Cu	Ni	Fe	Co	Quartz
0°C	0.0359	0.0878	0.2220	0.0573	0.0317	0.1008	0.1095	0.1055	0.0912	.....
100	0.0336	0.0965	0.2297	0.0583	0.0320	0.1014	0.1200	0.1168	0.0993	0.2372
200	0.0313	0.1052	0.2374	0.0594	0.0322	0.1020	0.1305	0.1282	0.1073	0.2416
300	0.0290	0.1139	0.2451	0.0605	0.0325	0.1026	0.1409	0.1396	0.1154	0.2460
400	0.0266	0.1226	0.2529	0.0616	0.0328	0.1032	0.1294	0.1509	0.1235	0.2504
500	0.0259	0.1173	0.2606	0.0627	0.0330	0.1038	0.1294	0.1623	0.1316	0.2548
600	0.0252	0.1141	0.2683	0.0638	0.0333	0.1045	0.1294	0.1737	0.1396	0.2592
700	0.0246	0.1109	0.2523	0.0649	0.0335	0.1051	0.1295	0.1850	0.1477	0.2636
800	0.0239	0.1076	0.2571	0.0660	0.0338	0.1057	0.1295	0.1592	0.1558	0.2680
900	0.0233	0.1044	0.2619	0.0671	0.0341	0.1063	0.1295	0.1592	0.1639	0.2724
1000	0.0226	0.1012	0.2667	0.0637	0.0343	0.1069	0.1295	0.1448	.....	0.2768
1100	.....	.....	.....	0.0694	0.0329	0.1028	0.1296	0.1448	0.1424	0.2812
1200	.....	.....	.....	0.0750	0.0346	0.1159	0.1296	0.1448	0.1454	0.2856
1300	.....	.....	.....	0.0807	0.0364	0.1291	0.1296	0.1449	0.1483	0.2900
1400	.....	.....	.....	.....	.....	.....	0.1296	0.1449	0.1512	0.2944
1500	.....	.....	.....	.....	.....	.....	0.1338	0.2142	0.1472	0.2988
1600	.....	.....	.....	.....	.....	.....	.....	0.1501	0.1472	.....

SPECIFIC HEAT FOR AQUEOUS SOLUTIONS

Giving the specific heat referred to that of water at the same temperatures.
Concentration of the solutions is stated as the number of molecules of water to each molecule of the solutes (anhydrous.)

Values from Marignac, Thomsen and others.

Substance	Temp. °C.	Concentration		
		25	50	100
Acetic acid.....	21-52	0.957	0.977	0.987
Aluminum sulphate.....	21-53	.....	.....	0.870
Ammonium acetate.....	17.5	0.911	0.951	0.976
chloride.....	18	0.881	0.937	0.966
hydroxide.....	18	.....	0.999	.....
nitrate.....	18	0.880	0.929	0.962
sulphate.....	19-51	0.803	0.879	0.933
Barium chloride.....	22-27	.....	0.780	0.875
Cadmium sulphate.....	12	0.696	0.813	0.893
Calcium acetate.....	22-52	.....	0.896	0.939
chloride.....	21-51	0.754	0.851	0.917
nitrate.....	21-51	0.760	0.846	0.911
Chromic acid.....	21-53	0.825	0.896	0.942
Copper chloride.....	19-51	0.779	0.864	0.920
nitrate.....	18-50	.....	0.826	0.899
sulphate.....	18-23	.....	0.841	0.908
Ferric chloride.....	0-98	0.666	0.750	0.854
Hydrochloric acid.....	18	.....	0.932	0.964
Lactic acid.....	16.5	0.947	0.970	0.982
Lead acetate.....	18-51	0.682	0.794	0.881
nitrate.....	18-51	.....	0.750	0.851
Lithium chloride.....	11	.....	0.941	0.973
hydroxide.....	13	.....	0.958	0.978
Magnesium chloride.....	22-52	0.772	0.866	0.923
nitrate.....	19-51	.....	0.832	0.903
Sulphate.....	18	.....	0.857	0.917
Manganese chloride.....	0-98	0.787	0.861	0.914
nitrate.....	19-51	.....	0.832	0.903
sulphate.....	19-51	.....	0.844	0.912
Nickel chloride.....	24-55	0.735	0.831	0.902
nitrate.....	24-55	0.717	0.823	0.895
sulphate.....	25-56	.....	0.837	0.910
Nitric acid.....	18	.....	0.930	0.963
Oxalic acid.....	20-52	.....	0.942	0.965
Potassium bromide.....	20-51	0.769	0.864	0.925
carbonate.....	21-52	0.760	0.851	0.916
chloride.....	18	0.828	0.904	0.948
chromate.....	20-51	.....	0.810	0.890
hydroxide.....	18	.....	0.916	0.954
iodide.....	20-51	0.715	0.830	0.906
nitrate.....	18-23	0.832	0.900	0.943

SPECIFIC HEAT OF AQUEOUS SOLUTIONS (Continued)

Giving the specific heat referred to that of water at the same temperatures. Concentration of the solutions is stated as the number of molecules of water to each molecule of the solutes (anhydrous).

Values from Marignac, Thomsen and others.

Substance.	Temp. °C.	Concentration.		
		25	50	100
Potassium oxalate.....	21-52	.....	0.839	0.908
sulphate.....	19-52	.....	.....	0.902
Silver nitrate.....	25-52	0.750	0.849	0.913
Sodium acetate.....	18	.....	0.938	0.965
bromide.....	20-52	0.809	0.886	0.939
carbonate.....	21-52	0.865	0.907	0.943
chloride.....	18	0.880	0.931	0.962
chromate.....	21-52	0.781	0.856	0.913
hydroxide.....	18	0.908	0.942	0.968
iodide.....	20-51	0.749	0.850	0.917
nitrate.....	18	0.863	0.918	0.950
sulphate.....	21-52	0.819	0.878	0.960
Strontium chloride.....	21-26	.....	0.814	0.894
nitrate.....	19-51	.....	0.817	0.890
Sulphuric acid.....	21	0.854	0.915	0.956
Zinc chloride.....	19-51	0.796	0.884	0.933
nitrate.....	20-52	0.718	0.823	0.899
sulphate.....	20-52	.....	0.842	0.911

SPECIFIC HEAT OF GASES

The following table gives values of the specific heat at constant pressure in calories per gram and the value of γ , the ratio of the specific heat at constant pressure to that at constant volume. Values are given for pressures of one atmosphere except where otherwise stated.

Gas or vapor	Sp. ht., const. press.			Value of γ		
	Temp. °C	Sp. ht. cal./g	Obs.	Temp. °C	γ	Obs.
Acetaldehyde, C_2H_4O				30	1.14	39
Acetic acid, $C_2H_4O_2$	118-140	1.50	1	136	1.15	30
	140-180	1.27	1			
Acetone, C_3H_6O	26-110	0.3470	23			
	130-230	0.4119	23			
Acetylene, C_2H_2	-71	0.3509	26	-71	1.31	26
	+15	0.3832		+15	1.26	
Air.....	-120 (10 atm.)	0.2719		-118	1.415	3
	(20 atm.)	0.3221		-78	1.408	3
	(40 atm.)	0.4791		+17	1.403	3
	(70 atm.)	0.7771				
	-50 (10 atm.)	0.2440				
	(20 atm.)	0.2521				
	(40 atm.)	0.2741				
	(70 atm.)	0.3121				
(Data for air compiled from various observers: 2, 6, 10, 19, 21)	+50 (20 atm.)	0.2480				
	(100 atm.)	0.2719				
	(220 atm.)	0.2961				
	100 (1 atm.)	0.2404		100	1.401	
	(20 atm.)	0.2471				
	(100 atm.)	0.2600				
	(220 atm.)	0.2841				
	400	0.2430		400	1.393	
	1000	0.2570		1000	1.365	
	1400	0.2609		1400	1.341	
	1800	0.2850		1800	1.316	
Ammonia, NH_3	15	0.5232		15	1.310	27
Amylene, C_6H_{10}	ca. 210	0.631	9			
Argon, A.....	-180	0.133	26	-180	ca. 1.76	26
	+15	0.1253		+15	1.668	
Benzene, C_6H_6	80	0.260	14			
	34-115	0.301	37			
	120-220	0.370	23			
Bromine, Br.....	19-388	0.055	31	20-350 (0.3-1.5 atm.)	1.32	31
Carbon dioxide, CO_2	-75	0.184	26	-75	1.37	26
	+45	0.1989		+15	1.304	
Carbon disulfide, CS_2	80-190	0.157	23			
Carbon monoxide, CO.....	-180	0.259	26	-180	1.41	26
	+15	0.2478		+15	1.404	
Carbon tetrachloride, CCl_4	0	0.140	16	20 (0.1 atm.)	1.13	4, 34
	30	0.132	16			
	70	0.115	16			
Chlorine, Cl_2	15	0.1149		15	1.355	
Chloroform, $CHCl_3$	27-118	0.145	37	100	1.15	30
	120-230	0.157	23			
Cyanogen, CN.....	15	0.4095		15	1.256	
Ethane, C_2H_6	-82	0.3475	26	-82	1.28	26
	+15	0.3861		+15	1.22	
				50	1.21	7
Ethyl acetate, $C_4H_8O_2$	35-189	0.3711	37			
Ethyl alcohol, C_2H_5O	90	0.406	8, 18	90	1.13	8, 18
	100-223	0.454	23			
Ethyl bromide, C_2H_5Br ...	28-116	0.161	37	14 (0.3 atm.)	1.19	4
Ethyl chloride, C_2H_5Cl ...	10-170	0.2750	23	16 (0.3-0.5 atm.)	1.19	4
Ethyl cyanide, C_3H_5N	114-223	0.4260	23			
Ethyl ether, $C_4H_{10}O$	27-189	0.4619	37			
	35	0.4449	14	35	1.08	14

SPECIFIC HEAT OF GASES (Continued)

Gas or vapor	Sp. ht., const. press.			Value of γ		
	Temp. °C	Sp. ht. cal./g	Obs.	Temp. °C	γ	Obs.
Ethylene, C_2H_4	-91	0.3086	26	-91	1.35	26
	+15	0.3592	.....	+15	1.255	.....
	15-100	0.399	23, 37	100	1.18	39
	25-200	0.430	37			
Ethylene chloride, $C_2H_4Cl_2$	111-221	0.23	23			
Helium, He.....	-180	1.25	26	-180	1.660	26
Hydriodic acid, HI.....				+20-100	1.40	31
Hydrobromic acid, HBr....	+11-100	0.082	23			
Hydrochloric acid, HCl....	10-190	0.185	23			
	15	0.1939		15	1.41	.....
				100	1.40	31
Hydrocyanic acid, HCN....				65	1.31	35
Hydrogen, H_2				-185	1.605	3
	-181	2.64	26	-181	1.597	26
				-118	1.480	3
				-78	1.443	3
	-76	3.15	26	-76	1.453	26
				-21	1.420	3
	+15	3.389	.....	+15	1.410	.....
	100	3.429	.....	100	1.404	.....
	200	3.463	.....	200	1.398	.....
(Data for hydrogen com- piled from various observers: 5, 21, 29)	400	3.533	.....	400	1.387	.....
	600	3.602	.....	600	1.377	.....
	800	3.672	.....	800	1.367	.....
	1000	3.741	.....	1000	1.358	.....
	2000	4.088	.....	2000	1.318	.....
Hydrogen sulfide, H_2S	-57	0.292	26	-57	1.29	26
	-45	0.279	26	-45	1.30	26
	+10-190	0.243	33			
	15	0.2533	.....	+15	1.32	.....
				18	1.30	32
Iodine, I.....	206-377	0.034	31	185	1.30	30
Krypton, Kr.....				19	1.68	22
Mercury, Hg.....				360	1.67	13
				(0.5-1 atm.)		
Methane, CH_4	-115	0.4502	15	-115	1.41	15
	-80	0.5038	26	-80	1.34	26
	-74	0.4979	15	-74	1.35	15
	+10-200	0.5931	6, 23			
	15	0.5284	.....	+15	1.31	.....
Methyl alcohol, CH_4O	77	0.390	8	77	1.203	8
	100-223	0.4581	23			
Methyl ether, C_2H_6O				6-30	1.11	17
Neon, Ne.....				19	1.64	22
Nitric oxide, NO.....	-80	0.2445	26	-80	1.38	26
	-45	0.2389	26	-45	1.39	26
	+10-180	0.232	23			
	15	0.2329	.....	+15	1.400	.....
Nitrogen, N_2	-181	0.256	26	-181	1.47	26
	+15	0.2477	.....	+15	1.404	.....
Nitrogen peroxide, NO_2 ...	27-67	1.620	1, 15			
Nitrous oxide N_2O	-70	0.1900	26	-70	1.34	26
	-30	0.1998	26	-30	1.31	26
				0	1.32	39
	+15	0.2004	.....	+15	1.303	.....
	25-100	0.212	23			
Oxygen, O_2	-181	0.2285	26	-181	1.45	26
	-76	0.2143	26	-76	1.415	26
	+15	0.2178	.....	+15	1.401	.....
	100	0.2181	20	100	1.399	20
	200	0.2187	20	200	1.396	20

SPECIFIC HEAT OF GASES (Continued)

Gas or vapor	Sp. ht., const. press.			Value of γ		
	Temp. °C	Sp. ht. cal./g	Obs.	Temp. °C	γ	Obs.
Oxygen, O ₂ (Con't)	400	0.2213	20	400	1.391	20
	600	0.2241	20	600	1.383	20
	800	0.2278	20	800	1.375	20
	1000	0.2325	20	1000	1.365	20
	2000	0.2669	20	2000	1.303	20
				300	1.17	28
Phosphorus, P						
Phosphorus trichloride, PCl ₃	110-250	0.135	23			
Potassium, K				850	1.77	36
				680-1000	1.69	24
Propane, C ₃ H ₈				16	1.13	4
				(0.5 atm.)		
Silicon tetrachloride, SiCl ₄	90-230	0.132	23			
Sodium, Na				750-920	1.68	24
Stannic chloride, SnCl ₄	149-273	0.094	23			
Sulfur dioxide, SO ₂	10-190	0.134	23			
	15	0.1516		15	1.29	
				20	1.27	27
Water, H ₂ O	100	0.4820		100	1.324	
	120	0.4769				
	140	0.4741				
	160	0.4719				
(Data for water compiled from various observers: 11, 12, 20)	180	0.4710				
	200	0.4710		200	1.310	
	300	0.4769		300	1.304	
	400	0.4901		400	1.301	
	500 (1 atm.)	0.5071		500	1.296	
	(10 atm.)	0.5159				
	(20 atm.)	0.5259				
Xenon, Xe				19	1.66	22

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- | | |
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BOILING POINT OF WATER*

(Hydrogen Scale)

Pressure mm.	Tenths of millimeters									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
700	97.714	718	722	725	729	733	737	741	745	749
701	753	757	761	765	769	773	777	781	785	789
702	792	796	800	804	808	812	816	820	824	828
703	832	836	840	844	847	851	855	859	863	867
704	871	875	879	883	887	891	895	899	902	906
705	97.910	914	918	922	926	930	934	938	942	946
706	949	953	957	961	965	969	973	977	981	985
707	989	993	996	*000	*004	*008	*012	*016	*020	*024
708	98.028	032	036	040	043	047	051	055	059	063
709	067	071	075	079	082	086	090	094	098	102
710	98.106	110	114	118	121	125	129	133	137	141
711	145	149	153	157	160	164	168	172	176	180
712	184	188	192	195	199	203	207	211	215	219
713	223	227	230	234	238	242	246	250	254	258
714	261	265	269	273	277	281	285	289	292	296
715	98.300	304	308	312	316	320	323	327	331	335
716	339	343	347	351	355	358	362	366	370	374
717	378	382	385	389	393	397	401	405	409	412
718	416	420	424	428	432	436	440	443	447	451
719	455	459	463	467	470	474	478	482	486	490
720	98.493	497	501	505	509	513	517	520	524	528
721	532	536	540	544	547	551	555	559	563	567
722	570	574	578	582	586	590	593	597	601	605
723	609	613	617	620	624	628	632	636	640	643
724	647	651	655	659	662	666	670	674	678	682
725	98.686	689	693	697	701	705	709	712	716	720
726	724	728	732	735	739	743	747	751	755	758
727	762	766	770	774	777	781	785	789	793	797
728	800	804	808	812	816	819	823	827	831	835
729	838	842	846	850	854	858	861	865	869	873
730	98.877	880	884	888	892	896	899	903	907	911
731	915	918	922	926	930	934	937	941	945	949
732	953	956	960	964	968	972	975	979	983	987
733	991	994	998	*002	*006	*010	*013	*017	*021	*025
734	99.029	032	036	040	044	048	051	055	059	063
735	99.067	070	074	078	082	085	089	093	097	101
736	104	108	112	116	119	123	127	131	135	138
737	142	146	150	153	157	161	165	169	172	176
738	180	184	187	191	195	199	203	206	210	214
739	218	221	225	229	233	236	240	244	248	252
740	99.255	259	263	267	270	274	278	282	285	289
741	293	297	300	304	308	312	316	319	323	327
742	331	334	338	342	346	349	353	357	361	364
743	368	372	376	379	383	387	391	394	398	402
744	406	409	413	417	421	424	428	432	436	439
745	99.443	447	451	454	458	462	466	469	473	477
746	481	484	488	492	495	499	503	507	510	514
747	518	522	525	529	533	537	540	544	548	551
748	555	559	563	566	570	574	578	581	585	589
749	592	596	600	604	607	611	615	619	622	626

For lower pressures see under Vapor Tension of Water

BOILING POINT OF WATER (Continued)

(Hydrogen Scale)

Pressure mm	Tenths of millimeters									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
750	99.630	633	637	641	645	648	652	656	659	663
751	667	671	674	678	682	686	689	693	697	700
752	704	708	712	715	719	723	726	730	734	738
753	741	745	749	752	756	760	764	767	771	775
754	778	782	786	790	793	797	801	804	808	812
755	99.815	819	823	827	830	834	838	841	845	849
756	852	856	860	863	867	871	875	878	882	886
757	889	893	897	900	904	908	911	915	919	923
758	926	930	934	937	941	945	948	952	956	959
759	963	967	970	974	978	982	985	989	993	996
760	100.000	004	007	011	015	018	022	026	029	033
761	037	040	044	048	052	055	059	063	066	070
762	074	077	081	085	088	092	096	099	103	107
763	110	114	118	121	125	129	132	136	140	143
764	147	151	154	158	162	165	169	173	176	180
765	100.184	187	191	195	198	202	206	209	213	216
766	220	224	227	231	235	238	242	246	249	253
767	257	260	264	268	271	275	279	283	286	290
768	293	297	300	304	308	311	315	319	322	326
769	330	333	337	341	344	348	352	355	359	363
770	100.366	370	373	377	381	384	388	392	395	399
771	403	406	410	414	417	421	424	428	432	435
772	439	442	446	450	453	457	461	464	468	472
773	475	479	483	486	490	493	497	501	504	508
774	511	515	519	522	526	530	533	537	540	544
775	100.548	551	555	559	562	566	569	573	577	580
776	584	588	591	595	598	602	606	609	613	616
777	620	624	627	631	634	638	642	645	649	653
778	656	660	663	667	671	674	678	681	685	689
779	692	696	689	703	707	710	714	718	721	725
780	100.728	732	735	739	743	746	750	753	757	761
781	764	768	772	775	779	782	786	789	793	797
782	800	804	807	811	815	818	822	825	829	833
783	836	840	843	847	851	854	858	861	865	869
784	872	876	879	883	886	890	894	897	901	904
785	100.908	912	915	919	922	926	929	933	937	940
786	944	947	951	954	958	962	965	969	972	976
787	979	983	987	990	994	997	*001	*005	*008	*012
788	101.015	019	022	026	029	033	037	040	044	047
789	051	054	058	062	065	069	072	076	079	083
790	101.087	090	094	097	101	104	108	112	115	119
791	122	126	129	133	136	140	144	147	151	154
792	158	161	165	168	172	176	179	183	186	190
793	193	197	200	204	207	211	215	218	222	225
794	229	232	236	239	243	246	250	254	257	261
795	101.264	268	271	275	278	282	286	289	293	296
796	300	303	307	310	314	317	321	324	328	332
797	335	339	342	346	349	353	356	360	363	367
798	370	374	377	381	385	388	392	395	399	402
799	406	409	413	416	420	423	427	430	434	437
800	101.441	...	...	...	...	...	...	...	...	...

MELTING AND BOILING POINTS OF THE ELEMENTS

MELTING AND BOILING POINTS OF THE ELEMENTS

Element	Melting point, °C	Boiling point, °C	Element	Melting point, °C	Boiling point, °C
Aluminum	659.7	1800	Neon	-248.67	-245.9
Antimony	630.5	1380	Nickel	1455	2900
Argon	-189.2	-185.7	Nitrogen	-209.86	-195.8
Arsenic	814 ^{sublim.}	615 ^(subl.)	Osmium	2700	>5300
Barium	850	1140	Oxygen	-218.4	-183
Beryllium	1350	1500	Ozone	-251.4	-112
Bismuth	271.3	1450	Palladium	1549.4	2200
Boron	2300	2550	Phosphorus (yel.)	44.1	280
Bromine	-7.2	58.78	Platinum	1773.5	4300
Cadmium	320.9	767	Potassium	62.3	760
Calcium	810	1170	Praseodymium	940	.....
Carbon	>3500	4200	Radium	960	1140
Cerium	640	1400	Radon	-110	.....
Cesium	28.5	670	Rhenium	3000	.....
Chlorine	-101.6	-34.6	Rhodium	1985	>2500
Chromium	1615	2200	Rubidium	38.5	700
Cobalt	1495	3000	Ruthenium	2450	>2700
Columbium (niobium)	2500	3300	Samarium	>1300	.....
Copper	1083	4230	Scandium	1200	2400
Erbium	.....	.....	Selenium, gray, trig.	220	688
Fluorine	-223	-187	Silicon	1420	2600
Gallium	29.75	>1600	Silver	960.5	1950
Germanium	958.5	2700	Sodium	97.5	880
Gold	1062.4	2600	Strontium	800	1150
Hafnium	1700	>3200	Sulfur (rhomb.)	112.8	444.6
Helium	-272.2	-268.9	Tantalum	119.0	>4100
Hydrogen	-259.14	-252.7	Tellurium	2996	1390
Indium	155	1450	Thallium	452	1650
Iodine	113.5	184.35	Thorium	303.5	>3000
Iridium	2350	>4800	Tin	1845	2260
Iron	1535	3000	Titanium	231.89	>3000
Krypton	-157 (-169)	-152.9 (-151.8)	Tungsten	3370	5900
Lanthanum	826	1800	Uranium	<1150	.....
Lead	327.4	1620	Vanadium	1710	3000
Lithium	186	>1220	Xenon	-112 (-140)	-107.1 (-109.1)
Magnesium	651	1110	Ytterbium	1800	2500
Manganese	1260	1900	Yttrium	1490	907
Mercury	-38.87	356.9	Zinc	419.47	>2900
Molybdenum	2620	3700	Zirconium	1900	.....
Neodymium	840	.....		

MELTING POINTS OF MIXTURES OF METALS

(*Smithsonian Physical Tables*)

Melting-points, °C.

Metals		Percentage of metal in second column.												
		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		
Pb.	Sn.	326	295	276	262	240	220	190	185	200	216	232		
	Bi.	322	290	...	...	179	145	126	168	205	...	268
	Te.	322	710	790	880	917	760	600	480	410	425	446		
	Ag.	328	460	545	590	620	650	705	775	840	905	959		
	Na.	...	360	420	400	370	330	290	250	200	130	96		
	Cu.	326	870	920	925	945	950	955	985	1005	1020	1084		
	Sb.	326	250	275	330	395	440	490	525	560	600	632		
	Al.	Sb.	650	750	840	925	945	950	970	1000	1040	1010	632	
		Cu.	650	630	600	560	540	580	610	755	930	1055	1084	
		Au.	655	675	740	800	855	915	970	1025	1055	675	1062	
Ag.		650	625	615	600	590	580	575	570	650	750	954		
Sb.	Zn.	654	640	620	600	580	560	530	510	475	425	419		
	Fe.	653	860	1015	1110	1145	1145	1220	1315	1425	1500	1515		
	Sn.	650	645	635	625	620	605	590	570	560	540	232		
	Bi.	Ag.	632	610	590	575	555	540	520	470	405	330	268	
		Ag.	630	595	570	545	520	500	505	545	680	850	959	
		Sn.	622	600	570	525	480	430	395	350	310	255	232	
		Zn.	632	555	510	540	570	565	540	525	510	470	419	
	Ni.	Sn.	1455	1380	1290	1200	1235	1290	1305	1230	1060	800	232	
		Na.	Bi.	96	425	520	590	645	690	720	730	715	570	268
			Cd.	96	125	185	245	285	325	330	340	360	390	322
Cd.	Ag.	322	420	520	610	700	760	805	850	895	940	954		
	Tl.	321	300	285	270	262	258	245	230	210	235	302		
	Zn.	322	280	270	295	313	327	340	355	370	390	419		
Au.	Cu.	1063	910	890	895	905	925	975	1000	1025	1060	1084		
	Ag.	1064	1062	1061	1058	1054	1049	1039	1025	1006	982	963		
	Pt.	1075	1125	1190	1250	1320	1380	1455	1530	1610	1685	1775		
	K.	Na.	62	17.5	-10	-3.5	5	11	26	41	58	77	97.5	
Hg.		...	...	...	...	...	90	110	135	162	265	...
Tl.		62.5	133	165	188	205	215	220	240	280	305	301		
Cu.	Ni.	1080	1180	1240	1290	1320	1355	1380	1410	1430	1440	1455		
	Ag.	1082	1035	990	945	910	870	830	788	814	875	960		
	Sn.	1084	1005	890	755	725	680	630	580	530	440	232		
	Zn.	1084	1040	995	930	900	880	820	780	700	580	419		
Ag.	Zn.	959	850	755	705	690	660	630	610	570	505	419		
	Sn.	959	870	750	630	550	495	450	420	375	300	232		
Na.	Hg.	96.5	90	80	70	60	45	22	55	95	215	...		

* The data in this table are compiled from various sources,—hence the variations in the melting point of the metals as shown in this column.

MELTING AND BOILING TEMPERATURES

Temperature of Fusion for Various Substances for Atmospheric Pressure

For the melting- and boiling-points of the chemical elements and of inorganic compounds see under Physical Constants of the Elements, and Physical Constants of Inorganic Compounds.

Substance.	Temp. of fusion ° C.	Substance.	Temp. of fusion ° C.
Acetylene.....	-81	German silver..	1000.
Alcohol, ethyl..	-130.	Glass.....	1100.
Brass.....	900.	Glycerine.....	17.
Butter.....	31-31.5	Olive oil.....	2-6
Camphor.....	177.7	Paraffin.....	55.
Caoutchouc,		Resin.....	135.
pure gum....	120.	Sea water.....	-2.5
Chloroform....	-63.2	Sugar (cane)...	160.
Ether.....	-117.6		

Boiling-point for Various Substances

Giving the boiling-point at atmospheric pressure and the variation per cm. pressure near 76 cm.

Substance	Temp. ° C.	Variation.
Acetone.....	57.	0.39
Acetylene.....	-72.2	
Alcohol, ethyl.....	78.3	0.34
methyl.....	64.7	0.35
Amyl acetate.....	148.	
Benzene.....	80.	0.43
Camphor.....	205.	0.56
Chloroform.....	61.2	0.41
Ether.....	34.6	0.40
Gasoline.....	70-90.	
Glycerine.....	291.	
Turpentine.....	159.	

MELTING POINT OF ICE—VARIATION WITH PRESSURE

(From Tamann, 1900, by permission.)

Pressure in kg. per sq.cm.	Temp. ° C.	Pressure in kg. per sq.cm.	Temp. ° C.
1	0.0	1410	-12.5
336	- 2.5	1625	-15.0
615	- 5.0	1835	-17.5
890	- 7.5	2042	-20.0
1155	-10.0	2200	-22.1

BOILING POINTS OF WATER-ALCOHOL MIXTURES

(P. N. Evans, Journal of Industrial and Engineering Chemistry.)

Boiling point, °C.	Weight per cent alcohol in		Boiling point, °C.	Weight per cent alcohol in	
	Liquid.	Vapor.		Liquid.	Vapor.
78.2	91	92	86.5	18	71
78.4	85	89	87.0	17	70
78.6	82	88	87.5	16	69
78.8	80	87	88.0	15	68
79.0	78	86	88.5	13	67
79.2	76	85	89.0	12	65
79.4	74	85	89.5	11	63
79.6	72	84	90.0	10	61
79.8	69	84	90.5	10	59
80.0	67	83	91.0	9	57
80.2	64	83	91.5	8	55
80.4	62	82	92.0	8	53
80.6	59	82	92.5	7	51
80.8	56	81	93.0	6	49
81.0	53	81	93.5	6	46
81.2	50	80	94.0	5	44
81.4	47	80	94.5	5	42
81.6	45	80	95.0	4	39
81.8	43	79	95.5	4	36
82.0	41	79	96.0	3	33
82.5	36	78	96.5	3	30
83.0	33	78	97.0	2	27
83.5	30	77	97.5	2	23
84.0	27	76	98.0	1	19
84.5	25	75	98.5	1	15
85.0	23	74	99.0	0	10
85.5	21	73	99.5	0	5
86.0	20	72	100.0	0	0

MOLECULAR ELEVATION OF THE BOILING POINT

(Most values from Hoyt, C.S. and Fink, C.K., Journal of Physical Chemistry, Vol. 41, No. 3., March, 1937.)

Molecular elevation of the boiling point showing the elevation of the boiling point in degrees C due to the addition of one gram molecular weight of the dissolved substance to 1000 grams of any one of the solvents below. The correction in the last column gives the number of degrees to be subtracted for each mm. of difference between the barometric reading and 760 mm.

Solvent	K_B	Barometric Correction per mm.
Acetic acid.....	3.07	0.0008
Acetone.....	1.71	0.0004
Aniline.....	3.52	0.0009
Benzene.....	2.53	0.0007
Bromobenzene.....	6.26	0.0016
Carbon bisulfide.....	2.34	0.0006
Carbon tetrachloride.....	5.03	0.0013
Chloroform.....	3.63	0.0009
Cyclohexane.....	2.79	0.0007
Ethanol (ethyl alcohol).....	1.22	0.0003
Ethyl acetate.....	2.77	0.0007
Ethyl ether.....	2.02	0.0005
n-Hexane.....	2.75	0.0007
Methanol (methyl alcohol).....	0.83	0.0002
Methyl acetate.....	2.15	0.0005
Nitrobenzene.....	5.24	0.0013
n-Octane.....	4.02	0.0010
Phenol.....	3.56	0.0009
Toluene.....	3.33	0.0008
Water.....	0.512	0.0001

MOLECULAR DEPRESSION OF THE FREEZING POINT

Showing the depression of the freezing point due to the addition of one gram molecular weight of dissolved substance, for various solvents.

Solvent	Depression for one gram molecular weight dissolved in 100 gms. °C
Acetic acid.....	39.0
Benzene.....	49.0
Benzophenone.....	98.0
Diphenyl.....	80.0
Diphenylamine.....	86.0
Ethylene dibromide.....	118.0
Formic acid.....	27.7
Naphthalene.....	68-69
Nitrobenzene.....	70.0
Phenol.....	74.0
Stearic acid.....	45.0
Triphenyl methane.....	124.5
Urethane.....	51.4
Water.....	18.5-18.7

LOWERING OF FREEZING POINT FOR AQUEOUS SOLUTIONS

The concentration of the solutions is expressed as the number of gram formula weights per 1,000 grams of water. The table gives the molal lowering of freezing point in °C for the concentration stated.

Solute	Concentration										
	0.001	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1.0	2.0	5.0
AgNO ₃ ...			3.60	3.54	3.42	3.32	3.20	2.96	2.63	2.16	...
AlCl ₃ *...			7.10	6.62	6.02	5.68	5.76	7.06	9.45	...	...
Al(NO ₃) ₃ *...					6.3	6.1	6.5	7.9	10.6	...	...
Al ₂ (SO ₄) ₃ ...							3.92	4.19			
BaCl ₂ ...	5.30	5.120	5.034	4.938	4.796	4.698	4.64		5.20		
Ba(NO ₃) ₂ ...	5.39		5.01	4.87		4.25	3.79				
Br ₂ ...			1.95	1.90	1.875	1.870					
CaCl ₂ ...			5.112		4.886	4.832	4.78	4.98	5.85	7.68	
Ca(NO ₃) ₂ ...					4.7	4.58	4.50		4.59	4.86	
CdBr ₂ ...		4.76	4.47		3.65	3.22					
CdCl ₂ ...		4.79	4.71		4.12	3.84	3.57	3.24			
CdI ₂ ...		4.06	3.86		2.69	2.27	2.1	2.1	2.25		
Cd(NO ₃) ₂ ...		5.28	5.20	5.15		5.08	5.08		5.42	6.2	
CdSO ₄ ...		2.916	2.744		2.3	2.1	1.93		1.79		
Cl ₂ ...			4.0	3.816	3.145						
CoCl ₂ ...		5.208	5.107		4.918	4.882	4.946		6.31	8.51	
Co(NO ₃) ₂ ...						4.6	4.5		5.5		
CoSO ₄ ...							2.02	1.75			
Cr ₂ (SO ₄) ₃ *...					4.6	4.2					
Cu(NO ₃) ₂ ...						5.1	5.0		5.7	6.7	
CuSO ₄ ...		2.871	2.703		2.266	2.085	1.912	1.722	1.715		
FeCl ₃ ...				6.93	6.28	6.01	6.02	6.55	8.18	12.45	
Fe(NO ₃) ₃ ...						6.30	6.48		9.4		
FeSO ₄ ...						2.39	2.10				
HCl...	3.690	3.635	3.601	3.568	3.532	3.523	3.54	3.68	3.94	4.43	
HF...						1.98	1.91		1.93	2.03	
HI...						3.50	3.56		4.09	4.75	7.70
HIO ₃ ...					3.12	2.95	2.71	2.21	1.72	1.16	0.75
HNO ₃ ...		3.67	3.64	3.61	3.55	3.51	3.47		3.58	3.79	
H ₂ O ₂ ...						1.84	1.84	1.86	1.88	1.91	1.96
H ₃ PO ₄ ...		3.1	2.95	2.75		2.36	2.23		2.14	2.41	
H ₂ SO ₃ ...						2.8	2.6		2.35		
H ₂ SO ₄ ...		4.814	4.584		4.112	3.940	3.790		4.04	5.07	
H ₂ S ₂ O ₆ *...					5.06	5.04	5.14				
KBr...					3.500	3.452	3.400	3.330	3.290	3.275	
KC ₂ H ₃ O ₂ ...								3.78	3.92	4.22	
KCN...					3.49	3.41	3.34	3.27	3.25	3.27	3.44
KCNS...						3.44	3.37	3.25			
K ₂ C ₂ O ₄ *...						4.46		4.18			
K ₂ CO ₃ ...			5.20	5.00	4.74	4.56	4.42	4.39	4.51	5.01	
KCl...	3.66	3.648	3.610	3.566	3.503	3.451	3.394	3.314	3.250	3.220	
KClO ₃ ...			3.556	3.513	3.435	3.334					
K ₂ CrO ₄ ...					3.0	3.3	3.6			3.6	
K ₂ Cr ₂ O ₇ ...	7.06										
KF...						3.39	3.35	3.36	3.39		
K ₃ Fe(CN) ₆ ...	7.10	6.53	6.26	5.98	5.60	5.30	5.00	4.55			
K ₄ Fe(CN) ₆ ...					5.72	5.18					
KHCO ₃ ...								3.09	2.91	2.68	
KH ₂ PO ₄ ...				3.59	3.47	3.34	3.19				
KI...						3.54	3.44	3.38	3.37	3.40	3.50
KNO ₃ ...		3.638	3.590	3.537	3.431	3.314	3.154	2.882	2.56		
KOH...		3.66	3.65	3.62	3.50	3.42	3.39	3.44	3.60	3.96	5.77
K ₂ SO ₄ ...	5.280	5.150	5.010		4.559	4.319	4.044				
LiCl...		3.612	3.598	3.582	3.553	3.52	3.50	3.58	3.80	4.41	
MgCl ₂ ...			5.144		4.974	4.938	4.977	5.38	6.35	8.8	

* Concentration stated as gram formula weights per liter.

LOWERING OF FREEZING POINT (Continued)

Solute	Concentration										
	0.001	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1.0	2.0	5.0
Mg(NO ₃) ₂ ..						4.74	4.78	5.08	5.78	7.0	....
MgSO ₄	3.38	3.02	2.85		2.420	2.252	2.090		2.02		....
MnCl ₂						4.86	4.90		6.05		....
Mn(NO ₃) ₂ ..							4.92		6.00	6.64	
MnSO ₄							2.14		2.02	2.5	....
NH ₃									1.94	1.94	2.06
NH ₄ Cl.....		3.617	3.582	3.544	3.489	3.442	3.392	3.34	3.33	3.34	
NH ₄ NO ₃ ...			3.572	3.535	3.470	3.396	3.296	3.11	2.92	2.65	2.17
NaBr.....				3.611	3.551	3.507	3.468	3.456	3.51	3.68	
NaC ₂ H ₃ O ₂ ..						3.59	3.58		3.78	4.14	
Na ₂ CO ₃			5.12	4.93		4.44	4.17				
NaCl.....	3.66		3.604	3.570		3.478	3.424		3.37	3.45	
NaClO ₃	3.682		3.588	3.547		3.433					
Na ₂ CrO ₄ ...						4.49	4.23		3.71		
NaHCO ₃ ...						3.65	3.51				
Na ₂ HPO ₄ ...			4.99	4.85	4.61	4.34					
NaI.....						3.68	3.52		3.66	3.97	
NaNH ₄											
HPO ₄			4.95	4.78	4.51	4.23	3.87				
NaNO ₃			3.55	3.53		3.406	3.327		3.02	2.79	
NaOH.....			3.55	3.51	3.46	3.42	3.41	3.40	3.44	3.58	
Na ₃ PO ₄ ...			7.15	6.85	6.11	5.69					
Na ₂ S*						7.12	7.06		6.87		
Na ₂ SiO ₃ ...			6.6	6.42		5.32	4.71	4.02			
Na ₂ SO ₃							4.36				
Na ₂ SO ₄		5.2	5.04	4.874		4.344	4.057				
NiCl ₂				5.58	5.41	5.38	5.43	5.69	6.22	8.67	
Ni(NO ₃) ₂ ..						4.91	4.91		5.86		
NiSO ₄		3.036	2.832	2.63	2.37	2.20	2.05		1.94		
Pb(C ₂ H ₃ O ₂) ₂					3.63	2.85	2.37				
Pb(NO ₃) ₂ ..	5.368	5.090	4.898	4.657	4.276	3.955	3.560	2.940	2.435		
SrCl ₂			5.3	5.10		4.82	4.80		5.83	7.54	
Sr(NO ₃) ₂ ..			5.7	5.35		4.63	4.40		3.90		
UO ₂ (NO ₃) ₂					5.16	5.00	4.92		6.15		
Zn(C ₂ H ₃ O ₂) ₂						4.74	4.37				
ZnCl ₂		5.28	5.15	5.04		4.94	4.96		5.21	5.49	
Zn(NO ₃) ₂ ..						4.89	4.89		5.83	7.12	
ZnSO ₄			2.80	2.65		2.29	2.12		1.87		

ORGANIC COMPOUNDS

Solute	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1.0	2.0	5.0	10.0
Acetic acid..					1.90			1.79		1.6	1.4
Acetone.....			1.86		1.85			1.79			
Aniline.....	1.85			1.82	1.79	1.73					
Citric acid..	2.26	2.14	2.08	2.03			1.93	1.94	2.00		
Dextrose.....			1.86	1.86	1.87			1.92			
Ethyl acetate					1.85	1.83	1.82				
Ethylalcohol			1.83		1.83			1.83	1.84		2.2
Ethyl ether..	1.67	1.67	1.70	1.72	1.70						
Glycerol.....	1.86					1.87	1.89	1.92		2.1	
Methyl alcohol.....		1.82			1.81	1.81			1.86		2.00
Oxalic acid..			3.40	3.04	2.84	2.64					
Phenol.....					1.81	1.83	1.63				
Picric acid..	3.82	3.63	3.28								
n-Propyl alcohol.....		1.86		1.84	1.83			1.79	1.79	1.76	
Sucrose.....	1.86			1.87	1.88	1.90	1.96	2.06	2.3		
d-Tartaric acid.....		2.34		2.12	2.05	1.98	1.94			2.35	

CORRECTION OF BOILING POINTS TO STANDARD PRESSURE

By H. B. HASS AND R. F. NEWTON

This correction may be made by using the equation:

$$\Delta t = \frac{(273.1 + t)(2.8808 - \log p)}{\phi + .15(2.8808 - \log p)} \quad (1)$$

where Δt = degrees C to be added to the observed boiling point.

t = the observed boiling point.

$\log p$ = the logarithm of the observed pressure in millimeters of mercury.

ϕ = the entropy of vaporization at 760 mm.

The value of ϕ may be estimated from the graph and the table. Substances not included in the table may be classified by grouping them with compounds which bear a close physical or structural resemblance to them.

Example 1. Benzene boils at 20°C. at 75 mm pressure. What is its normal boiling point? We do not find benzene in the table but we find hydrocarbons in group 2, and a group 2 compound with a boiling point of 20° has a ϕ of 4.6.

Substituting in the equation:

$$\Delta t = \frac{(273.1 + 20)(2.8808 - 1.8751)}{4.60 + .15(2.8808 - 1.8751)} = 62^\circ$$

Adding this to 20° gives 82° as a first approximation.

The graph shows that the ϕ for a compound of group 2 boiling at 82° is 4.72 instead of 4.60 which we originally used. Since ϕ is in the denominator,

this increase will lower our Δt by the ratio, $\frac{4.60}{4.72}$, or the corrected Δt is $62 \times \frac{4.60}{4.72} = 60.4$. Adding Δt to t , gives 80.4° as a second approximation.

The formula can best be used in a slightly different form when the reverse calculation is desired, i.e., when one calculates the vapor pressure at a given temperature, lower than the normal boiling point.

$$2.8808 - \log p = \frac{\phi \Delta t}{273.1 + t - .15 \Delta t} \quad (2)$$

Example 2 Alcohol boils at 78.4°C. What is its vapor pressure at 20°C.?

Substituting in equation 2:

$$2.8808 - \log p = \frac{6.06 \times 58.4}{293.1 - (.15 \times 58.4)} = 1.245$$

$$\log p = 2.8808 - 1.245 = 1.6358$$

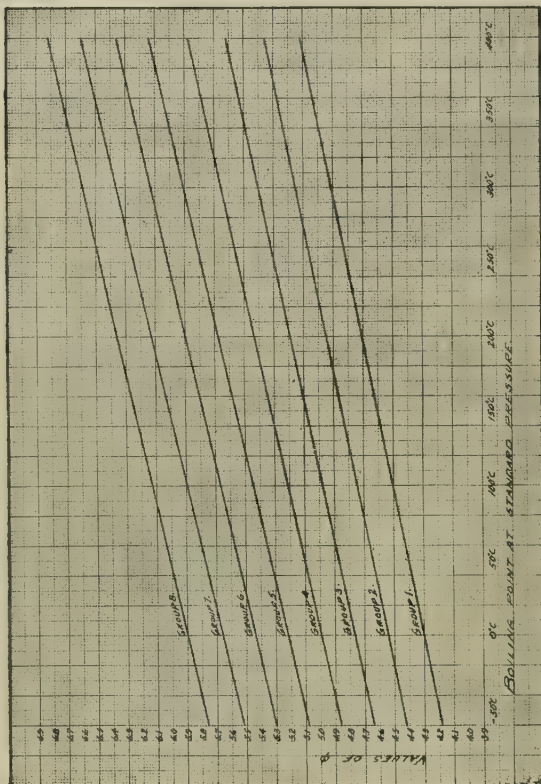
$$p = 43.2 \text{ mm.}$$

Here no second approximation is necessary, since the correct value of ϕ was taken immediately, the normal boiling point having been known.

Compound	Group	Compound	Group
Acetaldehyde.....	3	Carbon sulfoselenide....	2
Acetic acid.....	4	<i>m.p.</i> Chloroanilines....	3
Acetic anhydride.....	6	Chlorinated derivatives.	Same group
Acetone.....	3		as though
Acetophenone.....	4		Cl was H
Amines.....	3	<i>o.m.p.</i> Cresols.....	4
<i>n</i> -Amyl alcohol.....	8	Cyanogen.....	4
Anthracene.....	1	Cyanogen chloride.....	3
Anthraquinone.....	1	Dibenzyl ketone.....	2
Benzaldehyde.....	2	Dimethyl amine.....	4
Benzoic acid.....	5	Dimethyl oxalate.....	4
Benzonitrile.....	2	Dimethyl silicane.....	2
Benzophenone.....	2	Esters.....	3
Benzyl alcohol.....	5	Ethanol.....	8
Butylethylene.....	1	Ethers.....	2
Butyric acid.....	7	Ethylamine.....	4
Camphor.....	2	Ethylene glycol.....	7
Carbon monoxide.....	1	Ethylene oxide.....	3
Carbon oxysulfide.....	2	Formic acid.....	3
Carbon suboxide.....	2	Glycol diacetate.....	4

CORRECTION OF BOILING POINTS (Continued)

Compound	Group	Compound	Group
Halogen derivatives....	Same group as though halogen were hydrogen.	Methyl formate.....	4
Heptylic acid.....	7	Methyl salicylate.....	2
Hydrocarbons.....	2	Methyl silicane.....	1
Hydrogen cyanide.....	3	α, β Naphthols.....	3
Isoamyl alcohol.....	7	Nitrobenzene.....	3
Isobutyl alcohol.....	8	Nitromethane.....	3
Isobutyric acid.....	6	o.m.p. Nitrotoluenes....	2
Isocaproic acid.....	7	o.m.p. Nitrotoluidines..	2
Methane.....	1	Phenanthrene.....	1
Methanol.....	7	Phenol.....	5
Methyl amine.....	5	Phosgene.....	2
Methyl benzoate.....	3	Phthalic anhydride.....	2
Methyl ether.....	3	Propionic acid.....	5
Methyl ethyl ether.....	3	n-Propyl alcohol.....	8
Methyl ethyl ketone....	2	Quinoline.....	2
Methyl fluoride.....	3	Sulfides.....	2
		Tetranitromethane.....	3
		Trichloroethylene.....	1
		Valeric acid.....	7
		Water.....	6



CRITICAL CONSTANTS FOR GASES

Name	Formula	Temp., ° C.	Pressure, atm.	Density gms. per cm. ³
Acetaldehyde.....	CH ₃ CHO	188	.....	.....
Acetic acid.....	CH ₃ CO ₂ H	321.6	57.2	0.351
Acetic anhydride.....	(CH ₃ CO) ₂ O	296	46	.....
Acetone.....	(CH ₃) ₂ CO	235.0	47	0.268
Acetonitrile.....	CH ₃ CN	274.7	47.7	0.240
Acetylene.....	C ₂ H ₂	36	62	0.231
Air.....	.....	-140.7	37.2	0.35;* 0.31†
Allyl alcohol.....	C ₃ H ₅ OH	272	.....	.....
Allyl sulfide.....	(C ₃ H ₅) ₂ S	380	.....	.....
Allylene.....	CH ₂ CCH	128	.....	.....
Ammonia.....	NH ₃	132.4	111.5	0.235
<i>iso</i> -Amyl acetate.....	CH ₃ CO ₂ C ₅ H ₁₁	326	.....	.....
<i>iso</i> -Amyl alcohol.....	C ₅ H ₁₁ OH	307	.....	.....
<i>tert</i> -Amyl alcohol.....	C ₅ H ₁₁ OH	272	.....	.....
<i>iso</i> -Amyl butyrate.....	C ₃ H ₇ CO ₂ C ₅ H ₁₁	346	.....	.....
<i>iso</i> -Amyl formate.....	HCO ₂ C ₅ H ₁₁	303	34	0.282
<i>iso</i> -Amyl mercaptan.....	C ₅ H ₁₁ SH	321	.....	.....
<i>iso</i> -Amyl propionate.....	C ₃ H ₅ CO ₂ C ₅ H ₁₁	338	.....	.....
<i>iso</i> -Amyl sulfide.....	(C ₅ H ₁₁) ₂ S	391	.....	.....
Aniline.....	C ₆ H ₅ NH ₂	426	52.4	.....
Anisole.....	C ₆ H ₅ OCH ₃	369	41.3	.....
Argon.....	A	-122	48	0.531
Benzene.....	C ₆ H ₆	288.5	47.7	0.304
Benzonitrile.....	C ₆ H ₅ CN	426	41.6	.....
Bromine.....	Br ₂	302	.....	.....
Bromobenzene.....	C ₆ H ₅ Br	397	44.6	0.486
<i>n</i> -Butane.....	C ₄ H ₁₀	153	36	.....
<i>iso</i> -Butane.....	C ₄ H ₁₀	134	37	.....
<i>n</i> -Butyl acetate.....	CH ₃ CO ₂ C ₄ H ₉	306	.....	.....
<i>iso</i> -Butyl acetate.....	CH ₃ CO ₂ C ₄ H ₉	288	31	0.281
<i>n</i> -Butyl alcohol.....	C ₄ H ₉ OH	287	48.4	.....
<i>iso</i> -Butyl alcohol.....	C ₄ H ₉ OH	265	48	.....
<i>sec</i> -Butyl alcohol.....	C ₄ H ₉ OH	265	.....	.....
<i>tert</i> -Butyl alcohol.....	C ₄ H ₉ OH	235	.....	.....
<i>iso</i> -Butyl butyrate.....	C ₃ H ₇ CO ₂ C ₄ H ₉	338	.....	.....
<i>iso</i> -Butyl formate.....	HCO ₂ C ₄ H ₉	278	38	0.288
<i>iso</i> -Butyl isobutyrate.....	C ₃ H ₇ CO ₂ C ₄ H ₉	329	.....	.....
<i>iso</i> -Butyl isovalerate.....	C ₄ H ₉ CO ₂ C ₄ H ₉	348	.....	.....
<i>iso</i> -Butyl propionate.....	C ₃ H ₅ CO ₂ C ₄ H ₉	319	.....	.....
<i>n</i> -Butyric acid.....	C ₃ H ₇ CO ₂ H	355	.....	0.302
<i>iso</i> -Butyric acid.....	C ₃ H ₇ CO ₂ H	336	.....	0.304
Butyronitrile.....	C ₃ H ₇ CN	309	37.4	.....
Capronitrile.....	C ₅ H ₁₁ CN	349	32.2	.....
Carbon dioxide.....	CO ₂	31.1	73.0	0.460
Carbon disulfide.....	CS ₂	273	76	.....
Carbon monoxide.....	CO	-139	35	0.311
Carbon oxysulfide.....	COS	105	61	.....
Carbon tetrachloride.....	CCl ₄	283.1	45.0	0.558
Chlorine.....	Cl ₂	144.0	76.1	0.573
Chlorobenzene.....	C ₆ H ₅ Cl	359	44.6	0.365
Chloroform.....	CHCl ₃	263	.....	0.516
<i>m</i> -Cresol.....	C ₇ H ₇ OH	432	45.0	.....
<i>o</i> -Cresol.....	C ₇ H ₇ OH	422	49.4	.....
<i>p</i> -Cresol.....	C ₇ H ₇ OH	426	50.8	.....
Cyanogen.....	C ₂ N ₂	128	59	.....
Cyclohexane.....	C ₆ H ₁₂	281.0	40.4	0.270
Diethyl amine.....	(C ₂ H ₅) ₂ NH	223.5	36.2	0.246

* Plait point. † Critical point of contact.

CRITICAL CONSTANTS FOR GASES (Continued)

Name	Formula	Temp., ° C.	Pressure, atm.	Density gms. per cm. ³
Diisobutyl.....	C ₈ H ₁₈	277	24.5	0.237
Diisopropyl.....	C ₆ H ₁₄	227.4	30.6	0.241
Dimethyl amine.....	(CH ₃) ₂ NH	164.6	51.7	.....
Dimethyl aniline.....	C ₆ H ₅ N(CH ₃) ₂	415	35.8	.....
Dimethyl- <i>o</i> -toluidine.....	C ₇ H ₇ N(CH ₃) ₂	395	30.8	.....
Dipropyl amine.....	(C ₃ H ₇) ₂ NH	277	31	.....
Ethane.....	C ₂ H ₆	32.1	48.8	0.21
Ethyl acetate.....	CH ₃ CO ₂ C ₂ H ₅	250.1	37.8	0.308
Ethyl alcohol.....	C ₂ H ₅ OH	243.1	63.1	0.2755
Ethyl allyl ether.....	C ₂ H ₅ OC ₃ H ₅	245	.....	.....
Ethyl amine.....	C ₂ H ₅ NH ₂	183.2	55.5	.....
Ethyl bromide.....	C ₂ H ₅ Br	231	.....	0.513
Ethyl butyrate.....	C ₃ H ₇ CO ₂ C ₂ H ₅	293	30	0.276
Ethyl caprylate.....	C ₇ H ₁₅ CO ₂ C ₂ H ₅	386	.....	.....
Ethyl chloride.....	C ₂ H ₅ Cl	187.2	52	0.33
Ethyl chloroformate.....	ClCO ₂ C ₂ H ₅	<235	.....	.....
Ethyl crotonate.....	C ₃ H ₅ CO ₂ C ₂ H ₅	326	.....	.....
Ethyl disulfide.....	(C ₂ H ₅) ₂ S ₂	369	.....	.....
Ethyl ether.....	(C ₂ H ₅) ₂ O	193.8	35.5	0.2625
Ethyl formate.....	HCO ₂ C ₂ H ₅	235.3	46.65	0.323
Ethyl isobutyrate.....	C ₃ H ₇ CO ₂ C ₂ H ₅	280	30	0.276
Ethyl isovalerate.....	C ₄ H ₉ CO ₂ C ₂ H ₅	315	.....	.....
Ethyl mercaptan.....	C ₂ H ₅ SH	225.5	54.2	0.301
Ethyl nonylate.....	C ₈ H ₁₇ CO ₂ C ₂ H ₅	400	.....	.....
Ethyl propionate.....	C ₂ H ₅ CO ₂ C ₂ H ₅	272.9	33.0	0.2965
Ethyl propyl ether.....	C ₂ H ₅ OC ₃ H ₇	227.4	32.1	0.258
Ethyl sulfide.....	(C ₂ H ₅) ₂ S	283.8	39.1	0.279
Ethyl valerate.....	C ₄ H ₉ CO ₂ C ₂ H ₅	297	.....	.....
Ethylene.....	C ₂ H ₄	9.7	50.9	0.22
Ethylene oxide.....	(CH ₂) ₂ O	192.0	.....	.....
Fluorobenzene.....	C ₆ H ₅ F	286	44.6	0.354
Germanium tetrachloride	GeCl ₄	277	38	.....
Helium.....	He	-267.9	2.26	0.0693
<i>n</i> -Heptane.....	C ₇ H ₁₆	266.8	26.8	0.234
<i>n</i> -Heptyl alcohol.....	C ₇ H ₁₅ OH	365	.....	.....
<i>n</i> -Hexane.....	C ₆ H ₁₄	234.8	29.5	0.234
Hydrazine.....	N ₂ H ₄	380	145	.....
Hydrogen.....	H ₂	-239.9	12.8	0.0310
Hydrogen bromide.....	HBr	90	84	.....
Hydrogen chloride.....	HCl	51.4	81.6	0.42
Hydrogen cyanide.....	HCN	183.5	50	0.20
Hydrogen iodide.....	HI	151	82	.....
Hydrogen selenide.....	H ₂ Se	138	88	.....
Hydrogen sulfide.....	H ₂ S	100.4	88.9	.....
Iodine.....	I ₂	553	.....	.....
Iodobenzene.....	C ₆ H ₅ I	448	44.6	0.581
Krypton.....	Kr	-63	54	0.78
Mercury.....	Hg	>1550	>200	4-5
Methane.....	CH ₄	-82.5	45.8	0.162
Methyl acetate.....	CH ₃ CO ₂ CH ₃	233.7	46.3	0.325
Methyl alcohol.....	CH ₃ OH	240.0	78.7	0.272
Methyl amine.....	CH ₃ NH ₂	156.9	73.6	.....
Methyl aniline.....	C ₆ H ₅ NHCH ₃	429	51.3	.....
Methyl butyrate.....	C ₃ H ₇ CO ₂ CH ₃	281.3	34.2	0.300
Methyl chloride.....	CH ₃ Cl	143.1	65.8	0.37
Methyl ethyl ether.....	C ₂ H ₅ OCH ₃	164.7	43.4	0.270
Methyl ethyl sulfide.....	CH ₃ SC ₂ H ₅	260	42	.....
Methyl fluoride.....	CH ₃ F	44.9	62.0	.....
Methyl formate.....	HCO ₂ CH ₃	214.0	59.15	0.349
Methyl isobutyrate.....	C ₃ H ₇ CO ₂ CH ₃	267.55	33.7	0.301

CRITICAL CONSTANTS FOR GASES (Continued)

Name	Formula	Temp., ° C.	Pressure, atm.	Density gms. per cm. ³
Methyl mercaptan.....	CH ₃ SH	196.8	71.4	0.323
Methyl oxalate.....	(CO ₂ CH ₃) ₂	260	9.48	.....
Methyl propionate.....	C ₂ H ₅ CO ₂ CH ₃	257.4	39.3	0.312
Methyl sulfide.....	(CH ₃) ₂ S	229.9	54.6	0.306
Methyl valerate.....	C ₄ H ₉ CO ₂ CH ₃	294d	32	0.279
Methylal.....	H ₂ C(OCH ₃) ₂	224	.....	.....
Neon.....	Ne	-228.7	25.9	0.484
Nitric oxide.....	NO	-94	65	0.52
Nitrogen.....	N ₂	-147.1	33.5	0.3110
Nitrogen tetroxide.....	N ₂ O ₄	158	99	.....
Nitrous oxide.....	N ₂ O	36.5	71.7	0.45
<i>n</i> -Octane.....	C ₈ H ₁₈	296	24.6	0.234
Phenetyl alcohol.....	C ₈ H ₁₇ OH	385	.....	.....
<i>sec</i> .-Octyl alcohol.....	C ₈ H ₁₇ OH	364	.....	.....
Oxygen.....	O ₂	-118.8	49.7	0.430
Paraldehyde.....	C ₆ H ₁₂ O ₃	290	.....	.....
<i>n</i> -Pentane.....	C ₅ H ₁₂	197.2	33.0	0.232
<i>iso</i> -Pentane.....	C ₅ H ₁₂	187.8	32.8	0.234
Phenetole.....	C ₆ H ₅ OC ₂ H ₅	374	33.8	.....
Phenol.....	C ₆ H ₅ OH	419	60.5	.....
Phosgene.....	COCl ₂	182	56	0.52
Phosphine.....	PH ₃	51	64	0.30
Phosphonium chloride....	PH ₄ Cl	49	73	.....
Propane.....	C ₃ H ₈	95.6	43	.....
Propionic acid.....	C ₂ H ₅ CO ₂ H	339.5	53.0	0.315
Propionitrile.....	C ₂ H ₅ CN	291.2	41.3	0.241
Propyl acetate.....	CH ₃ CO ₂ C ₃ H ₇	276.2	32.9	0.296
<i>n</i> -Propyl alcohol.....	C ₃ H ₇ OH	263.7	49.95	0.273
<i>iso</i> -Propyl alcohol.....	C ₃ H ₇ OH	235	53	.....
Propyl amine.....	C ₃ H ₇ NH ₂	223.8	46.3	.....
Propyl butyrate.....	C ₃ H ₇ CO ₂ C ₃ H ₇	327	.....	.....
<i>n</i> -Propyl chloride.....	C ₃ H ₇ Cl	230	45.2	.....
Propyl formate.....	HCO ₂ C ₃ H ₇	264.85	40.1	0.309
Propyl isobutyrate.....	C ₃ H ₇ CO ₂ C ₃ H ₇	316	.....	.....
Propyl isovalerate.....	C ₄ H ₉ CO ₂ C ₃ H ₇	336	.....	.....
Propyl propionate.....	C ₂ H ₅ CO ₂ C ₃ H ₇	305	.....	.....
Propylene.....	C ₃ H ₆	92.3	45.0	.....
Pyridine.....	C ₅ H ₅ N	344	60.0	.....
Quinoline.....	C ₉ H ₇ N	>520	.....	.....
Radon.....	Rn	104	62	.....
Silicon tetrafluoride.....	SiF ₄	-1.5	50	.....
Silicon tetrahydride.....	SiH ₄	-3.5	48	.....
Stannic chloride.....	SnCl ₄	318.7	37.0	0.742
Sulfur.....	S	1040	.....	.....
Sulfur dioxide.....	SO ₂	157.2	77.7	0.52
Sulfur trioxide.....	SO ₃	218.3	83.6	0.630
Thiophene.....	C ₄ H ₄ S	317	48	.....
Thymol.....	C ₁₀ H ₁₄ OH	425	.....	.....
Toluene.....	C ₆ H ₅ CH ₃	320.6	41.6	0.292
Tolunitrile.....	C ₇ H ₇ CN	450	.....	.....
Triethyl amine.....	(C ₂ H ₅) ₃ N	262	30	0.251
Trimethyl amine.....	(CH ₃) ₃ N	161	41	.....
<i>n</i> -Valeric acid.....	C ₄ H ₉ CO ₂ H	379	.....	.....
<i>iso</i> -Valeric acid.....	C ₄ H ₉ CO ₂ H	361	.....	.....
Water.....	H ₂ O	374.0	217.72	0.4
Xenon.....	Xe	16.6	58.2	1.155

VAN DER WAALS' CONSTANTS FOR GASES *

Name	Formula	<i>a</i>	<i>b</i>
Acetic acid.....	CH ₃ CO ₂ H	0.03505	0.004767
Acetic anhydride.....	(CH ₃ CO) ₂ O	0.03967	0.005639
Acetone.....	(CH ₃) ₂ CO	0.02774	0.004437
Acetonitrile.....	CH ₃ CN	0.03503	0.005216
Acetylene.....	C ₂ H ₂	0.00875	0.002293
Ammonia.....	NH ₃	0.00831	0.001655
Amyl formate.....	HCO ₂ C ₅ H ₁₁	0.05496	0.007724
Amylene.....	C ₅ H ₁₀	0.03169	0.005390
iso-Amylene.....	C ₅ H ₁₀	0.03604	0.006274
Aniline.....	C ₆ H ₅ NH ₂	0.05282	0.006113
Argon.....	A	0.00268	0.001437
Benzene.....	C ₆ H ₆	0.03588	0.005150
Benzonitrile.....	C ₆ H ₅ CN	0.06655	0.007697
Bromobenzene.....	C ₆ H ₅ Br	0.05692	0.006872
n-Butane.....	C ₄ H ₁₀	0.02884	0.005472
iso-Butane.....	C ₄ H ₁₀	0.02564	0.005098
iso-Butyl acetate.....	CH ₃ CO ₂ C ₄ H ₉	0.05680	0.008185
iso-Butyl alcohol.....	C ₄ H ₉ OH	0.03394	0.005103
iso-Butyl benzene.....	C ₆ H ₅ C ₄ H ₉	0.07692	0.009572
iso-Butyl formate.....	HCO ₂ C ₄ H ₉	0.04492	0.006591
Butyronitrile.....	C ₃ H ₇ CN	0.05125	0.007126
Capronitrile.....	C ₅ H ₁₁ CN	0.06890	0.008858
Carbon dioxide.....	CO ₂	0.00716	0.001905
Carbon disulfide.....	CS ₂	0.02316	0.003431
Carbon monoxide.....	CO	0.00296	0.001779
Carbon oxysulfide.....	COS	0.00784	0.002597
Carbon tetrachloride.....	CCl ₄	0.04064	0.006173
Chlorine.....	Cl ₂	0.01294	0.002510
Chlorobenzene.....	C ₆ H ₅ Cl	0.05068	0.006485
Chloroform.....	CHCl ₃	0.03023	0.004562
m-Cresol.....	C ₇ H ₈ O	0.06254	0.007175
Cyanogen.....	C ₂ N ₂	0.01528	0.003081
Cyclohexane.....	C ₆ H ₁₂	0.04347	0.006359
Cymene.....	C ₁₀ H ₁₄	0.08403	0.010430
Decane.....	C ₁₀ H ₂₂	0.09675	0.012970
Di-isobutyl.....	C ₈ H ₁₈	0.06970	0.010250
Diethylamine.....	(C ₂ H ₅) ₂ NH	0.03816	0.006216
Dimethylamine.....	(CH ₃) ₂ NH	0.02069	0.003826
Dimethyl aniline.....	C ₆ H ₄ N(CH ₃) ₂	0.07473	0.008793
Diphenyl.....	(C ₆ H ₅) ₂	0.10520	0.011070
Diphenyl methane.....	(C ₆ H ₅) ₂ CH ₂	0.07616	0.010000
Dipropylamine.....	(C ₃ H ₇) ₂ NH	0.05524	0.008124
Di-isopropyl.....	C ₆ H ₁₄	0.04610	0.007453
Durene.....	C ₁₀ H ₁₄	0.09032	0.010820
Ethane.....	C ₂ H ₆	0.01074	0.002848
Ethyl acetate.....	CH ₃ CO ₂ C ₂ H ₅	0.04076	0.006303
Ethyl alcohol.....	C ₂ H ₅ OH	0.02395	0.003753
Ethylamine.....	C ₂ H ₅ NH ₂	0.02113	0.003754
Ethyl benzene.....	C ₆ H ₅ C ₂ H ₅	0.05701	0.007443
Ethyl butyrate.....	C ₃ H ₇ CO ₂ C ₂ H ₅	0.05993	0.008567
Ethyl isobutyrate.....	C ₃ H ₇ CO ₂ C ₂ H ₅	0.05754	0.008410
Ethyl chloride.....	C ₂ H ₅ Cl	0.02174	0.003862
Ethyl ether.....	(C ₂ H ₅) ₂ O	0.03464	0.006002
Ethyl formate.....	HCO ₂ C ₂ H ₅	0.02949	0.004714
Ethyl mercaptan.....	C ₂ H ₅ SH	0.02240	0.003615
Ethyl propionate.....	C ₂ H ₅ CO ₂ C ₂ H ₅	0.04861	0.007209
Ethyl sulfide.....	(C ₂ H ₅) ₂ S	0.03737	0.005421
Ethylene.....	C ₂ H ₄	0.00891	0.002551
Ethylene bromide.....	(CH ₂ Br) ₂	0.02787	0.003868
Ethylene chloride.....	(CH ₂ Cl) ₂	0.03370	0.004850
Ethylidene chloride.....	CH ₃ CHCl ₂	0.03090	0.004790
Fluorobenzene.....	C ₆ H ₅ F	0.03972	0.005742
Germanium tetrachloride.....	GeCl ₄	0.04504	0.00663C
Helium.....	He	0.000068	0.001058
n-Heptane.....	C ₇ H ₁₆	0.06280	0.011850

*For pressure in atom.

VAN DER WAALS' CONSTANTS FOR GASES (Continued)

Name	Formula	<i>a</i>	<i>b</i>
<i>n</i> -Hexane.....	C ₆ H ₁₄	0.04861	0.007747
Hydrogen.....	H ₂	0.000487	0.001188
Hydrogen bromide.....	HBr	0.00887	0.001978
Hydrogen chloride.....	HCl	0.00731	0.001822
Hydrogen selenide.....	H ₂ Se	0.01050	0.002070
Hydrogen sulfide.....	H ₂ S	0.00883	0.001914
Iodobenzene.....	C ₆ H ₅ I	0.06592	0.007395
Krypton.....	Kr	0.00462	0.001776
Mercury.....	Hg	0.01613	0.000757
Mesitylene.....	C ₉ H ₁₂	0.06840	0.008835
Methane.....	CH ₄	0.00449	0.001910
Methyl acetate.....	CH ₃ CO ₂ CH ₃	0.03047	0.004870
Methyl alcohol.....	CH ₃ OH	0.01898	0.002992
Methylamine.....	CH ₃ NH ₂	0.01421	0.002675
Methyl butyrate.....	C ₃ H ₇ CO ₂ CH ₃	0.04771	0.007004
Methyl isobutyrate.....	C ₃ H ₇ CO ₂ CH ₃	0.04883	0.007308
Methyl chloride.....	CH ₃ Cl	0.01489	0.002894
Methyl ether.....	(CH ₃) ₂ O	0.01609	0.003235
Methyl ethyl ether.....	CH ₃ OC ₂ H ₅	0.02381	0.004364
Methyl ethyl sulfide.....	CH ₃ SC ₂ H ₅	0.03833	0.005821
Methyl fluoride.....	CH ₃ F	0.00923	0.002350
Methyl formate.....	HCO ₂ CH ₃	0.02160	0.003602
Methyl propionate.....	C ₂ H ₅ CO ₂ CH ₃	0.03968	0.006070
Methyl sulfide.....	(CH ₃) ₂ S	0.02564	0.004113
Methyl valerate.....	C ₄ H ₉ CO ₂ CH ₃	0.05771	0.008237
Naphthalene.....	C ₁₀ H ₈	0.07923	0.008648
Neon.....	Ne	0.00042	0.000763
Nitric oxide.....	NO	0.00267	0.001245
Nitrogen.....	N ₂	0.00277	0.001747
Nitrogen dioxide.....	NO ₂	0.01053	0.001975
Nitrous oxide.....	N ₂ O	0.00754	0.001971
<i>n</i> -Octane.....	C ₈ H ₁₈	0.07440	0.010570
Oxygen.....	O ₂	0.00271	0.001421
<i>n</i> -Pentane.....	C ₅ H ₁₂	0.03788	0.006516
<i>iso</i> -Pentane.....	C ₅ H ₁₂	0.03598	0.006328
Phenetole.....	C ₆ H ₅ OC ₂ H ₅	0.07009	0.008764
Phosphine.....	PH ₃	0.00923	0.002302
Phosphonium chloride.....	PH ₄ Cl	0.00808	0.002029
Phosphorus.....	P	0.10550	0.006990
Propane.....	C ₃ H ₈	0.001727	0.003770
Propionic acid.....	C ₂ H ₅ CO ₂ H	0.04008	0.005297
Propionitrile.....	C ₂ H ₅ CN	0.03277	0.004750
Propyl acetate.....	CH ₃ CO ₂ C ₃ H ₇	0.04908	0.007227
Propyl alcohol.....	C ₃ H ₇ OH	0.02974	0.004548
<i>iso</i> -Propyl alcohol.....	C ₃ H ₇ OH	0.02747	0.004377
Propyl amine.....	C ₃ H ₇ NH ₂	0.02988	0.004865
Propyl benzene.....	C ₃ H ₇ C ₆ H ₅	0.07146	0.009054
<i>iso</i> -Propyl benzene.....	C ₆ H ₅ C ₃ H ₇	0.07105	0.009041
Propyl chloride.....	C ₃ H ₇ Cl	0.03170	0.005098
Propyl formate.....	HCO ₂ C ₃ H ₇	0.03777	0.005724
Propylene.....	C ₃ H ₆	0.01670	0.003693
Pseudo-cumene.....	C ₉ H ₁₂	0.07298	0.009023
Silicon fluoride.....	SiF ₄	0.00836	0.002487
Silicon tetrahydride.....	SiH ₄	0.00861	0.002583
Stannic chloride.....	SnCl ₄	0.05363	0.007332
Sulfur dioxide.....	SO ₂	0.01338	0.002516
Thiophene.....	C ₄ H ₄ S	0.04130	0.005670
Toluene.....	C ₆ H ₅ CH ₃	0.04795	0.006533
Triethylamine.....	(C ₂ H ₅) ₃ N	0.05415	0.008176
Trimethylamine.....	(CH ₃) ₃ N	0.02594	0.004841
Xenon.....	Xe	0.00816	0.002279
<i>m</i> -Xylene.....	C ₆ H ₄ (CH ₃) ₂	0.06051	0.007912
<i>o</i> -Xylene.....	C ₆ H ₄ (CH ₃) ₂	0.05974	0.007836
<i>p</i> -Xylene.....	C ₆ H ₄ (CH ₃) ₂	0.06165	0.008077
Water.....	H ₂ O	0.01089	0.001362

FREEZING MIXTURES

A is the proportion of the substance named in the first column to be added to the proportion of the substance given in column B. The table gives the temperature of the separate ingredients and the temperature attained by the mixture.

(From Smithsonian Tables.)

Substance.	A	B	Initial Temp. ° C.	Temp. ° C. attained by mixt.
NaC ₂ H ₃ O ₂ (cryst.)....	85	H ₂ O 100	10.7	- 4.7
NH ₄ Cl.....	30	H ₂ O 100	13.3	- 5.1
NaNO ₃	75	H ₂ O 100	13.2	- 5.3
Na ₂ S ₂ O ₃ (cryst.).....	110	H ₂ O 100	10.7	- 8.0
KI.....	140	H ₂ O 100	10.8	-11.7
CaCl ₂ (cryst.).....	250	H ₂ O 100	10.8	-12.4
NH ₄ NO ₃	60	H ₂ O 100	13.6	-13.6
CaCl ₂	30	* Snow 100	- 1	-10.9
NH ₄ Cl.....	25	Snow 100	- 1	-15.4
NH ₄ NO ₃	45	Snow 100	- 1	-16.75
NaNO ₃	50	Snow 100	- 1	-17.75
NaCl.....	33	Snow 100	- 1	-21.3
H ₂ SO ₄ +H ₂ O..... (66.1% H ₂ SO ₄).....	1	Snow 1.097	- 1	-37.0
	1	Snow 2.52	- 1	-30.0
	1	Snow 4.32	- 1	-25.0
	1	Snow 7.92	- 1	-20.0
	1	Snow 13.08	- 1	-16.0
	1	Snow .49	0	-19.7
CaCl ₂ +6H ₂ O.....	1	Snow .61	0	-39.0
	1	Snow .70	0	-54.9
	1	Snow .81	0	-40.3
	1	Snow 1.23	0	-21.5
	1	Snow 2.46	0	- 9.0
	1	Snow 4.92	0	- 4.0
Alcohol at 4°.....	77	Snow 73.	0	-30.0
Chloroform.....	..	CO ₂ solid	.....	-72.0
Ether.....	....	CO ₂ solid	.....	-77.0
Liquid SO ₂.....	....	CO ₂ solid	.....	-77.0
NH ₄ NO ₃	1	H ₂ O .94	20	- 4.0
	1	Snow .94	0	- 4.0
	1	H ₂ O 1.20	10	-14.0
	1	Snow 1.20	0	-14.0
	1	H ₂ O 1.31	10	-17.5
	1	Snow 1.31	0	-17.5

* Or finely pulverized ice

PERCENTAGE COMPOSITION OF ANTI-FREEZE SOLUTIONS

ALCOHOL AND WATER SOLUTIONS

% alcohol by weight	Sp. gr. 20°/4° C. (68° F.)	Point of crystallization	
		Deg. C.	Deg. F.
2.5	0.99363	-1.0	30.2
4.8	0.98971	-2.0	28.4
6.8	0.98658	-3.0	26.6
11.3	0.98006	-5.0	23.0
13.8	0.97670	-6.1	21.0
16.4	0.97336	-7.5	18.5
17.5	0.97194	-8.7	16.3
18.8	0.97024	-9.4	15.1
20.3	0.96823	-10.6	12.9
22.1	0.96578	-12.2	10.0
24.2	0.96283	-14.0	6.8
26.7	0.95914	-16.0	3.2
29.9	0.95400	-18.9	-2.0
33.8	0.94715	-23.6	-10.5
39.0	0.93720	-28.7	-19.7
46.3	0.92193	-33.9	-29.0
56.1	0.90008	-41.0	-41.8
71.9	0.86311	-51.3	-60.3

GLYCEROL (GLYCERINE) AND WATER SOLUTIONS*

% glycerol by weight	Sp. gr. 15°/15° C. (59° F.)	Sp. gr. 20°/20° C. (68° F.)	Freezing point	
			Deg. C.	Deg. F.
10	1.02415	1.02395	-1.6	29.1
20	1.04935	1.04880	-4.8	23.4
30	1.07560	1.07470	-9.5	14.9
40	1.10255	1.10135	-15.4	4.3
50	1.12985	1.12845	-23.0	-9.4
60	1.15770	1.15605	-34.7	-30.5
70	1.18540	1.18355	-38.9	-38.0
80	1.21290	1.21090	-20.3	-5.5
90	1.23950	1.23755	-1.6	29.1
100	1.26557	1.26362	17.0	62.6

* Bosart and Snoddy, Jour. Ind. Eng. Chem. 19, 506 (1927); Lane, *ibid.* 17, 924 (1925). The Chemical Division of the Proctor and Gamble Co. suggest that a correction of +2° F. be added to all temperatures below zero degree Fahrenheit.

ETHYLENE GLYCOL (PRESTONE) AND WATER SOLUTIONS

% glycol by volume	Sp. gr. 15.6° C. (60° F.)	Freezing point	
		Deg. C.	Deg. F.
12.5	1.019	-3.9	25
17.0	1.026	-6.7	20
25.0	1.038	-12.2	10
32.5	1.048	-17.8	0
38.5	1.056	-23.3	-10
44.0	1.063	-28.9	-20
49.0	1.069	-34.4	-30
52.5	1.073	-40.0	-40

HEAT OF FUSION ELEMENTS AND INORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g*
Aluminum.....	Al.....	658	76.8
Ammonia.....	NH ₃	-75	108.1
		-77.6	83.9
Antimony bromide.....	SbBr ₃	94	9.76
trichloride.....	SbCl ₃	73.2	13.3
trisulfide.....	Sb ₂ S ₃	540	17.6
Argon.....	A.....	-190	6.71
Arsenous bromide.....	AsBr ₃	31	8.94
Barium chloride.....	BaCl ₂	958.9	27.5
Bismuth.....	Bi.....	268	12.64
Bromine.....	Br.....	-7.32	16.2
Cadmium.....	Cd.....	320.7	13.66
nitrate.....	Cd(NO ₃) ₂ ·4H ₂ O.....	59.5	25.3
Caesium hydroxide.....	CsOH.....	272.3	10.8
Calcium chloride.....	CaCl ₂	773.9	54.3
chloride.....	CaCl ₂ ·6H ₂ O.....	29	40.7
nitrate.....	Ca(NO ₃) ₂ ·4H ₂ O.....	42.1	34.0
Carbon dioxide.....	CO ₂	-56.2	45.3
monoxide.....	CO.....	-206	8.00
Chlorine.....	Cl.....	-103.5	23.0
Cobalt nitrate.....	Co(NO ₃) ₂ ·6H ₂ O.....		30.2
Copper.....	Cu.....	1083	42.
Cupric nitrate.....	Cu(NO ₃) ₂ ·6H ₂ O.....	24.4	29.4
Gold.....	Au.....	1064	15.8
Hydriodic acid.....	HI.....	-53	5.68
Hydrobromic acid.....	HBr.....	-86	7.67
Hydrochloric acid.....	HCl.....	-114	13.9
acid.....	HCl·2H ₂ O.....	-18.5	34.6
Hydrogen.....	H.....		14.0
peroxide.....	H ₂ O ₂	-1.7	74.1
Iodine.....	I.....		11.71
Iron, gray cast.....	Fe.....		5.50
white cast.....			7.89
slag.....			11.9
Lead.....	Pb.....	327	5.86
bromide.....	PbBr ₂	490	12.3
chloride.....	PbCl ₂	485	20.9
iodide.....	PbI ₂	375	11.5
Lithium nitrate.....	LiNO ₃	250	88.5
silicate.....	Li ₂ SiO ₃		80.2
silicate.....	Li ₂ SiO ₃ ·Li ₂ O.....		62.1
Magnesium chloride.....	MgCl ₂ ·6H ₂ O.....	116.7	41.2
nitrate.....	Mg(NO ₃) ₂ ·6H ₂ O.....	90	38.2
Manganese nitrate.....	Mn(NO ₃) ₂ ·6H ₂ O.....	25.8	28.8
Mercuric bromide.....	HgBr ₂	235	12.8
iodide.....	HgI ₂	250	9.80
Mercury.....	Hg.....	-39	2.82
Nickel.....	Ni.....	1435	73.8
nitrate.....	Ni(NO ₃) ₂ ·6H ₂ O.....	56.7	36.4
Nitric acid.....	HNO ₃	-47	9.55
Nitrogen.....	N.....	-210	6.09
dioxide.....	NO.....	-163	18.4
pentoxide.....	N ₂ O ₅	29.5	76.7
tetroxide.....	N ₂ O ₄	-10.14	32.3 to 37.2
Oxygen.....	O.....	-219	3.30
Palladium.....		1545	36.3

* Gram calories (15° C.) per gram.

HEAT OF FUSION (Continued)

ELEMENTS AND INORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g
Platinum.....	Pt.....	1755	27.2
Potassium.....	K.....	62	15.7
chloride.....	KCl.....	772.3	74.1
dichromate.....	K ₂ Cr ₂ O ₇	397	29.7
fluoride.....	KF.....	859.9	108.
hydroxide.....	KOH.....	360.4	28.6
nitrate.....	KNO ₃	308	25.4
Phosphorous acid, hypo..	H ₃ PO ₂	17.4	35.0
Phosphorus.....	P.....	44.2	5.03
oxychloride.....	POCl ₃	2	19.8
Rubidium chloride.....	RbCl.....	.....	38.0
hydroxide.....	RbOH.....	301	15.8
Silicon tetrachloride.....	SiCl ₄	70.3	10.9
Silver.....	Ag.....	961	21.07
bromide.....	AgBr.....	430	12.5
chloride.....	AgCl.....	451	30.7
nitrate.....	AgNO ₃	455	21.3
Sodium.....	Na.....	208	17.7
chlorate.....	NaClO ₃	97	31.7
chloride.....	NaCl.....	255	49.0
chromate.....	Na ₂ CrO ₄ ·10H ₂ O.....	804.3	124.
fluoride.....	NaF.....	23	39.2
hydroxide.....	NaOH.....	992.2	186.
nitrate.....	NaNO ₃	318.4	40.0
phosphate, dibasic.....	Na ₂ HPO ₄ ·12H ₂ O.....	333	45.3
sulfate.....	Na ₂ SO ₄ ·10H ₂ O.....	36.1	66.8
thiosulfate.....	Na ₂ S ₂ O ₃ ·5H ₂ O.....	31	51.3
Stannic bromide.....	SnBr ₄.....	.....	47.8
chloride.....	SnCl ₄	25.5	6.26
Strontium chloride.....	SrCl ₂	-33	8.40
Sulfur.....	S.....	872.3	25.4
trioxide.....	SO ₃	119	13.2
Sulfuric acid.....	H ₂ SO ₄ ·H ₂ O.....	-30	24.0
acid.....	H ₂ SO ₄	8.56	39.1
acid, pyro.....	H ₂ S ₂ O ₇	10.352	24.0
Thallium bromide.....	TlBr.....	35	17.9
monochloride.....	TlCl.....	460	12.7
Tin.....	Sn.....	427	16.6
Titanium tetrachloride...	TiCl ₄	232	14.0
Water.....	H ₂ O.....	-25	11.8
ice from sea water.....	H ₂ O.....	0	79.71
Zinc.....	Zn.....	-8.7	54.0
nitrate.....	Zn(NO ₃) ₂ ·6H ₂ O.....	419	28.13
		36.4	31.1

HEAT OF FUSION (Continued)

ORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g
Acetic acid.....	$\text{CH}_3\text{CO}_2\text{H}$	16.58	44.7
Acetone.....	$(\text{CH}_3)_2\text{CO}$	16.7 -95.5 -94.6	43.2 23.4 19.6
Acrylic acid.....	$\text{C}_2\text{H}_3\text{CO}_2\text{H}$	13	37.0
Allocinnamic acid.....	$\text{C}_6\text{H}_5\text{C}_2\text{H}_2\text{CO}_2\text{H}$	58	27.4
o-Aminobenzoic acid.....	$\text{H}_2\text{NC}_6\text{H}_4\text{CO}_2\text{H}$	145	35.5
m-Aminobenzoic acid.....	.....	180	38.0
p-Aminobenzoic acid.....	.....	188.5	36.5
tert.-Amyl alcohol.....	$\text{C}_5\text{H}_{11}\text{OH}$.....	.....	12.5
Anethole.....	$\text{C}_3\text{H}_5\text{C}_6\text{H}_4\text{OCH}_3$	21.5	25.8
Aniline.....	$\text{C}_6\text{H}_5\text{NH}_2$	-7.03	21.0
Anthracene.....	$\text{C}_{14}\text{H}_{10}$	216.55	38.7
Anthraquinone.....	$(\text{C}_6\text{H}_4)_2(\text{CO})_2$	282	37.5
Azobenzene.....	$(\text{C}_6\text{H}_5\text{N})_2$	69.1 66 68	28.9 28.0 32.4
Azoxybenzene.....	$(\text{C}_6\text{H}_5)_2\text{ON}_2$	34.6	21.6
Benzene.....	C_6H_6	5.42 5.40	30.3 30.2
Benzil.....	$(\text{C}_6\text{H}_5\text{CO})_2$	94.94	22.2
Benzoic acid.....	$\text{C}_6\text{H}_5\text{CO}_2\text{H}$	121.8	33.9
Benzophenone.....	$(\text{C}_6\text{H}_5)_2\text{CO}$	48.25	23.5
Benzylaniline.....	$\text{C}_6\text{H}_5\text{NHC}_7\text{H}_7$	36	21.9
Bromal hydrate.....	$\text{CBr}_3\text{CHO}\cdot\text{H}_2\text{O}$	46	16.9
Bromocamphor.....	$\text{C}_{10}\text{H}_{15}\text{BrO}$.....	.....	41.6
o-Bromochlorobenzene.....	$\text{C}_6\text{H}_4\text{BrCl}$	-12.6	15.4
m-Bromochlorobenzene.....	.....	-21.2	15.3
p-Bromochlorobenzene.....	.....	64.6	23.4
o-Bromiodobenzene.....	$\text{C}_6\text{H}_4\text{BrI}$	21	12.2
m-Bromiodobenzene.....	.....	-9.3	10.3
p-Bromiodobenzene.....	.....	90.1	16.6
p-Bromophenol.....	$\text{HOC}_6\text{H}_4\text{Br}$	64	20.5
p-Bromotoluene.....	$\text{CH}_3\text{C}_6\text{H}_4\text{Br}$	27.6	20.9
n-Butyl alcohol.....	$\text{C}_4\text{H}_9\text{OH}$	-89.2	29.9
tert.-Butyl alcohol.....	$\text{C}_4\text{H}_9\text{OH}$	25.45 25.4	21.0 21.9
n-Butyric acid.....	$\text{C}_3\text{H}_7\text{CO}_2\text{H}$	-5.7	30.1
n-Capric acid.....	$\text{C}_9\text{H}_{19}\text{CO}_2\text{H}$	31.2	38.9
n-Caprylic acid.....	$\text{C}_7\text{H}_{15}\text{CO}_2\text{H}$	16.34	35.4
Carbazole.....	$\text{C}_{12}\text{H}_9\text{N}$	236	42.1
Carbon tetrachloride.....	CCl_4	-24	4.16
Carvoxime (d).....	$\text{C}_{10}\text{H}_{14}\text{NOH}$	71.5	23.3
Carvoxime (l).....	.....	71	23.4
Carvoxime (dl).....	.....	91	24.6
Catechol.....	$\text{C}_6\text{H}_4(\text{OH})_2$	104.3	49.4
Cetyl alcohol.....	$\text{C}_{16}\text{H}_{33}\text{OH}$	47	33.8
Cinnamic acid.....	$\text{C}_6\text{H}_5\text{C}_2\text{H}_2\text{CO}_2\text{H}$	133	36.5
anhydride.....	$(\text{C}_6\text{H}_5\text{C}_2\text{H}_4\text{CO})_2\text{O}$	48	28.1
Chloral alcoholate.....	$\text{CCl}_3\text{CHO}\cdot\text{C}_2\text{H}_5\text{OH}$	9	24.0
hydrate.....	$\text{CCl}_3\text{CHO}\cdot\text{H}_2\text{O}$.....	.....	33.2
Chloroacetic acid (α).....	$\text{ClCH}_2\text{CO}_2\text{H}$	61.2	31.1
acid (β).....	.....	56	35.1
p-Chloroaniline.....	$\text{H}_2\text{NC}_6\text{H}_4\text{Cl}$	69	37.2
o-Chlorobenzoic acid.....	$\text{ClC}_6\text{H}_4\text{CO}_2\text{H}$	140.2	39.3
m-Chlorobenzoic acid.....	.....	154.25	36.4
p-Chlorobenzoic acid.....	.....	239.7	49.2

HEAT OF FUSION (Continued)

ORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g
m-Chloronitrobenzene ...	$\text{ClC}_6\text{H}_4\text{NO}_2$	43.8	29.4
p-Chloronitrobenzene....		44.16	31.5
p-Cresol.....	$\text{CH}_3\text{C}_6\text{H}_4\text{OH}$	82	21.4
Cyanamide.....	H_2NCN	34	26.3
Cyclohexanol.....	$\text{C}_6\text{H}_{11}(\text{OH})$	42.9	49.8
Dibenzyl.....	$(\text{C}_6\text{H}_5\text{CH}_2)_2$	23.2	4.19
o-Dibromobenzene.....	$\text{C}_6\text{H}_4\text{Br}_2$	51	31.0
m-Dibromobenzene.....		18	12.8
p-Dibromobenzene.....		-6.9	13.4
Dibromophenol (2, 4)....	$\text{HO C}_6\text{H}_3\text{Br}_2$	86	20.5
Dichloroacetic acid.....	$\text{Cl}_2\text{CHCO}_2\text{H}$	12	14.0
o-Dichlorobenzene.....	$\text{C}_6\text{H}_4\text{Cl}_2$	10.8	14.2
m-Dichlorobenzene.....		-17.5	21.0
p-Dichlorobenzene.....		-24.4	20.5
o-Diiodobenzene.....		52.7	29.7
m-Diiodobenzene.....	$\text{C}_6\text{H}_4\text{I}_2$	23.4	10.2
p-Diiodobenzene.....		34.2	11.6
Dimethyl tartrate (d)....	$(\text{CHOH})_2(\text{CO}_2\text{CH}_3)_2$	129	16.2
Dimethyl tartrate (dl)...		49	21.5
o-Dinitrobenzene.....	$\text{C}_6\text{H}_4(\text{NO}_2)_2$	87	35.1
m-Dinitrobenzene.....		116.93	32.3
p-Dinitrobenzene.....		90.08	24.7
Dinitrotoluene (2, 4)....		173.5	40.0
Diphenyl.....	$\text{CH}_3\text{C}_6\text{H}_3(\text{NO}_2)_3$	70	26.4
Diphenylamine.....	$(\text{C}_6\text{H}_5)_2$	71	26.1
Diphenylmethane.....	$(\text{C}_6\text{H}_5)_2\text{NH}$	53.4	25.2
Ethyl alcohol.....	$(\text{C}_6\text{H}_5)_2\text{CH}_2$	26.3	25.2
Ethylene dibromide.....	$\text{C}_2\text{H}_5\text{OH}$	-114.4	24.9
Elaidic acid.....	$(\text{CH}_2\text{Br})_2$	9.55	13.5
Formic acid.....	$\text{C}_{17}\text{H}_{33}\text{CO}_2\text{H}$	47	52.1
Glutaric acid.....	HCO_2H	8.0	58.9
Glycerol.....	$(\text{CH}_2)_3(\text{CO}_2\text{H})_2$	99.3	37.4
Glycol.....	$\text{C}_3\text{H}_5(\text{OH})_3$	18	47.5
	$(\text{CH}_2\text{OH})_2$	-11.5	43.3
		-12.3	41.6
Hydrazobenzene.....	$(\text{C}_6\text{H}_5\text{NH})_2$	134	22.9
Hydrocinnamic acid.....	$\text{C}_6\text{H}_5\text{C}_2\text{H}_4\text{CO}_2\text{H}$	48	28.1
p-Iodotoluene.....	$\text{IC}_6\text{H}_4\text{CO}_2\text{H}$	34	18.8
n-Lauric acid.....	$\text{C}_{11}\text{H}_{23}\text{CO}_2\text{H}$	43.85	43.7
Levulinic acid.....	$\text{CH}_3\text{CO}(\text{CH}_2)_2\text{CO}_2\text{H}$	33	19.0
α-Menthol (l).....	$\text{C}_{10}\text{H}_{19}\text{OH}$	42	18.6
Methane.....	CH_4	-182.6	14.5
Methyl alcohol.....	CH_3OH	-97	16.4
		-97.8	22.0
cinnamate.....	$\text{C}_6\text{H}_5\text{C}_2\text{H}_2\text{CO}_2\text{CH}_3$	34.5	26.5
fumarate.....	$(\text{CHCO}_2\text{CH}_3)_2$	102	57.9
oxalate.....	$(\text{CO}_2\text{CH}_3)_2$	49.5	42.7
phenylpropiolate.....	$\text{C}_6\text{H}_5\text{C}_2\text{CO}_2\text{CH}_3$	18	22.9
succinate.....	$(\text{CH}_2\text{CO}_2\text{CH}_3)_2$	18	35.7
Myristic acid.....	$\text{C}_{13}\text{H}_{27}\text{CO}_2\text{H}$.....	.....	47.5
Naphthalene.....	C_{10}H_8	79.9	35.6
α-Naphthol.....	$\text{C}_{10}\text{H}_7\text{OH}$	95	38.9
β-Naphthol.....		120.6	31.3
α-Naphthylamine.....	$\text{C}_{10}\text{H}_7\text{NH}_2$	47.5	22.3
		48.9	22.0
		50.1	24.9
o-Nitroaniline.....	$\text{H}_2\text{NC}_6\text{H}_4\text{NO}_2$	69.3	27.9

HEAT OF FUSION (Continued)

ORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g
m-Nitroaniline.....	H ₂ NC ₆ H ₄ NO ₂	111.8	41.0
p-Nitroaniline.....	.....	147.5	36.5
Nitrobenzene.....	C ₆ H ₅ NO ₂	5.72	22.5
o-Nitrobenzoic acid.....	O ₂ NC ₆ H ₄ CO ₂ H.....	145.8	40.1
m-Nitrobenzoic acid.....	.....	141.1	27.6
p-Nitrobenzoic acid.....	.....	239.2	52.8
α-Nitronaphthalene.....	C ₁₀ H ₇ NO ₂	56	25.4
o-Nitrophenol.....	HOC ₆ H ₄ NO ₂	42.8	26.8
.....	.....	44.51	30.9
Palmitic acid.....	C ₁₅ H ₃₁ CO ₂ H.....	55	39.2
Paraffin.....	.....	52.40	35.10
Paraldehyde.....	(CH ₃ CHO) ₃	12.6	25.0
Phenanthrene.....	C ₁₄ H ₁₀	98.2	24.3
Phenol.....	C ₆ H ₅ OH.....	25.37	29.0
Phenylacetic acid.....	C ₆ H ₅ CH ₂ CO ₂ H.....	74.9	25.4
.....	.....	76.58	30.0
.....	.....	77	32.0
Phenylhydrazine.....	C ₆ H ₅ N ₂ H ₃	22.1	36.3
iso-Propyl alcohol.....	C ₃ H ₇ OH.....	-88.5	21.0
Quinol.....	C ₆ H ₄ (OH) ₂	172.3	58.8
Quinone.....	C ₆ H ₄ O ₂	112.85	40.9
Resorcinol.....	C ₆ H ₄ (OH) ₂	109.65	46.2
Spermaceti.....	.....	43.9	36.98
Stearic acid.....	C ₁₇ H ₃₅ CO ₂ H.....	64	47.6
Stilbene.....	(C ₆ H ₅ CH) ₂	124	39.9
Succinic anhydride.....	(CH ₂ CO) ₂ O.....	119	48.7
Succinonitrile.....	(CH ₂ CN) ₂	54.5	11.7
Thymol.....	C ₁₀ H ₁₃ OH.....	48.5	27.5
Tolane.....	(C ₆ H ₅ C) ₂	60	28.7
o-Toluic acid.....	CH ₃ C ₆ H ₄ CO ₂ H.....	103.7	35.4
m-Toluic acid.....	.....	108.75	27.6
p-Toluic acid.....	.....	179.6	39.9
p-Toluidine.....	CH ₃ C ₆ H ₄ NH ₂	40.01	39.9
Tribromoaniline (2, 4, 6).....	H ₂ NC ₆ H ₂ Br ₃	122	16.8
Tribromophenol (2, 4, 6).....	HOC ₆ H ₂ Br ₃	93	13.4
Trichloroacetic acid.....	CCl ₃ CO ₂ H.....	59.1	8.6
Trinitroglycerol.....	C ₃ H ₅ (NO ₂) ₃	12.3	23.0
metastable form.....	.....	13	33.2
stable form.....	.....	.....	5.21
Trinitrotoluene (T. N. T.) (2, 4, 6).....	CH ₃ C ₆ H ₂ (NO ₂) ₃	79	22.3
Triphenylmethane.....	(C ₆ H ₅) ₃ CH.....	92.3	17.8
Tristearin.....	(C ₁₇ H ₃₅ CO ₂) ₃ C ₃ H ₅	56	45.6
n-Undecylic acid (α).....	C ₁₀ H ₂₁ CO ₂ H.....	28.25	32.2
n-Undecylic acid (β).....	.....	.....	42.9
Urethane.....	H ₂ NCO ₂ C ₂ H ₅	48.7	40.9
Veratrol (1, 2).....	C ₆ H ₄ (OCH ₃) ₂	22.7	27.5
Wax (Bees').....	.....	61.8	42.3
p-Xylene.....	C ₆ H ₄ (CH ₃) ₂	16	39.8

HEAT OF VAPORIZATION

ELEMENTS AND INORGANIC COMPOUNDS

Name	Formula	Temperature, °C	Heat of Vaporization Cal. (15°)/g*
Air.....		.....	50.97
Ammonia.....	NH ₃	-33.4	327.1
		-20	317.6
		-10	309.7
		0	301.6
Ammonium chloride.....	NH ₄ Cl (solid).....	350	78.9
Argon.....	Ar.....	-186	37.6
Boron chloride.....	BCl ₃	10	38.2
Bromine.....	Br.....	63	43.7
Carbon dioxide.....	CO ₂	-60	87.2
		-50	83.4
		-40	79.6
		-30	71.4
		-20	66.9
		-10	61.4
		0	55.0
		10	46.6
		20	35.1
		30	11.9
Carbon monoxide.....	CO.....	-192	50.4
Chlorosulfonic acid.....	ClSO ₃ H.....	151	110.2
Helium.....	He.....	-268.6	6.
Hydriodic acid.....	HI.....	-37.2	33.9
Hydrobromic acid.....	HBr.....	-69.9	48.7
Hydrochloric acid.....	HCl.....	-84.3	98.7
Hydrofluoric acid.....	HF.....	17	360.8
Hydrogen.....	H ₂	-252.8	108.
sulfide.....	H ₂ S.....	-61.4	131.9
Iodine.....		184	23.95
Mercury.....		357	65.
Nitric acid.....	HNO ₃	86.0	114.9
Nitrogen.....	N ₂	-195.55	47.6
tetroxide.....	N ₂ O ₄	18	93.4
Oxygen.....	O ₂	-182.9	50.9
Phosphorus.....	P.....	287	130.
Phosphorus trichloride...	PCl ₃	78	51.4
Silicon tetrachloride.....	SiCl ₄	57	36.1
Stannic chloride.....	SnCl ₄	112	30.3
Sulfur chloride.....	S ₂ Cl ₂	138	49.5
dioxide.....	SO ₂	-10.08	94.9
		0	91.3
		10	87.7
		20	84.1
		30	80.8
		40	71.2
		50	73.8
		60	70.3
		140	61.2
pentoxydichloride.....	S ₂ O ₅ Cl ₂	53	118.5
trioxide.....	SO ₃	326	122.1
Sulfuric acid.....	H ₂ SO ₄	69.1	49.4
oxychloride.....	SO ₂ Cl ₂	82	54.5
Sulfurous oxychloride.....	SOCl ₂	0	595.9
Water.....	H ₂ O.....	10	590.4
		20	584.9
		30	579.5

* Gram calories (15°C) per gram.

HEAT OF VAPORIZATION (Continued)

ELEMENTS AND INORGANIC COMPOUNDS

Name	Formula	Temperature, °C	Heat of Vapori- zation Cal. (15°)/g
Water	H ₂ O	40	574.0
		50	568.5
		60	563.2
		70	557.5
		80	551.7
		90	545.8
		100	539.55
		110	532.9
		120	525.7
		130	518.5
		140	511.1
		150	503.5
		160	495.6
		170	487.2
		180	478.6

HEAT OF VAPORIZATION (Continued)

ORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Heat of Vapori- zation Cal. (15°)/g
Acetaldehyde.....	CH ₃ CHO.....	21	136.
Acetic acid.....	CH ₃ CO ₂ H.....	118.3	96.8
anhydride.....	(CH ₃ CO) ₂ O.....	137	66.2
Acetone.....	(CH ₃) ₂ CO.....	56.1	124.5
Acetonitrile.....	CH ₃ CN.....	80	174.
Acetyl chloride.....	CH ₃ COCl.....	51	78.9
Allyl alcohol.....	C ₃ H ₅ OH.....	96	163.
n-Amyl alcohol.....	C ₆ H ₁₁ OH.....	131	120.2
iso-Amyl alcohol.....	.....	130.2	119.8
n-Amyl bromide.....	C ₆ H ₁₁ Br.....	129	48.3
n-Amyl ether.....	(C ₆ H ₁₁) ₂ O.....	170	69.5
n-Amyl iodide.....	C ₆ H ₁₁ I.....	155	47.6
iso-Amyl isobutyrate.....	C ₃ H ₇ CO ₂ C ₆ H ₁₁	168	57.6
iso-Amyl n-valerate.....	C ₄ H ₉ CO ₂ C ₆ H ₁₁	187	56.2
Amylene.....	C ₆ H ₁₀	12.5	75.0
p-Anethole.....	C ₆ H ₅ OCH ₃	232	71.4
Benzene.....	C ₆ H ₆	80.2	94.3
Butane.....	C ₄ H ₁₀	0	91.5
iso-Butane.....	.....	10	82.4
.....	.....	-10	87.5
n-Butyl alcohol.....	C ₄ H ₉ OH.....	116.8	141.
iso-Butyl alcohol.....	.....	106.9	138.
sec.-Butyl alcohol.....	.....	98.1	134.
tert-Butyl alcohol.....	.....	83	130.5
n-Butyl formate.....	HCO ₂ C ₄ H ₉	105.1	86.8
iso-Butyl formate.....	.....	97.0	78.5
n-Butyl iodide.....	C ₄ H ₉ I.....	129.5	45.9
iso-Butyl n-valerate.....	C ₄ H ₉ CO ₂ C ₄ H ₉	169	57.8
iso-Butyl isovalerate.....	.....	169	60.5
n-Butyric acid.....	C ₃ H ₇ CO ₂ H.....	163.5	114.0
iso-Butyric acid.....	C ₃ H ₇ CO ₂ H.....	154	111.6
n-Butyronitrile.....	C ₃ H ₇ CN.....	117.4	114.9
Carbon disulfide.....	CS ₂	46.25	84.1
tetrachloride.....	CCl ₄	76.75	46.4
Carvacrol.....	C ₁₀ H ₁₃ OH.....	237	68.1
Chloral.....	CCl ₃ CHO.....	.....	54.0
hydrate.....	Cl ₃ CCHO·H ₂ O.....	96	132.
Chloroform.....	CHCl ₃	61.5	59.0
Cyanogen.....	(CN) ₂	0	10.3
chloride.....	ClCN.....	13	135.
p-Cymene.....	C ₁₀ H ₁₄	176	67.6
Dichloroacetic acid.....	Cl ₂ CHCO ₂ H.....	194.4	77.2
n-Decane.....	C ₁₀ H ₂₂	160	60.2
Diethyl carbonate.....	CO(OC ₂ H ₅) ₂	126	73.1
ketone.....	(C ₂ H ₅) ₂ CO.....	101	90.8
Diethylamine.....	(C ₂ H ₅) ₂ NH.....	58	91.0
Dimethyl carbonate.....	CO(OCH ₃) ₂	90	88.2
Ethane.....	C ₂ H ₆	0	75.0
.....	.....	-20	87.0
.....	.....	-40	97.5
.....	.....	-90	127.
Ethyl acetate.....	CH ₃ CO ₂ C ₂ H ₅	0.0	102.0
alcohol.....	C ₂ H ₅ OH.....	78.3	204.
bromide.....	C ₂ H ₅ Br.....	38.4	59.9
caprylate.....	C ₇ H ₁₅ CO ₂ C ₂ H ₅	207	60.5
chloride.....	C ₂ H ₅ Cl.....	4.7	92.95
.....	.....	15.0	92.5
.....	.....	20.0	92.2
.....	.....	25.0	92.0

HEAT OF VAPORIZATION (Continued)

ORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Heat of Vaporization Cal. (15°)/g
Ethyl ether.....	(C ₂ H ₅) ₂ O.....	34.6	83.9
formate.....	HCO ₂ C ₂ H ₅	53.3	97.2
iodide.....	C ₂ H ₅ I.....	71.2	45.6
nonylate.....	C ₈ H ₁₇ CO ₂ C ₂ H ₅	227	58.1
propionate.....	C ₂ H ₅ CO ₂ C ₂ H ₅	97.6	80.1
Ethylene bromide.....	(CH ₂ Br) ₂	130.8	46.2
chloride.....	(CH ₂ Cl) ₂	0.0	85.3
		82.3	77.3
oxide.....	(CH ₂) ₂ O.....	13	139.
Ethylamine.....	C ₂ H ₅ NH ₂	15	14.6
Ethylidene chloride.....	CH ₃ CHCl ₂	0.0	76.7
		60	67.1
Formic acid.....	HCO ₂ H.....	101	120.0
Furane.....	(CH) ₄ O.....	31	95.3
Furfural.....	C ₄ H ₃ OCHO.....	160.5	107.5
Glycol.....	(CH ₂ OH) ₂	197	191.
Hydrocyanic acid.....	HCN.....	20	210.
Methane.....	CH ₄	-159	138.
Methyl acetate.....	CH ₃ CO ₂ CH ₃	0.0	114.0
		56.3	98.1
alcohol.....	CH ₃ OH.....	64.7	262.8
n-butyrate.....	C ₃ H ₇ CO ₂ CH ₃	102.6	79.8
chloride.....	CH ₃ Cl.....	-23.8	102.3
		20.0	95.3
ethyl ketone.....	CH ₃ COC ₂ H ₅	78.2	106.0
ethyl ketoxime.....	C ₄ H ₈ NOH.....	182	115.9
formate.....	HCO ₂ CH ₃	31.3	112.4
iodide.....	CH ₃ I.....	42	45.9
isobutyrate.....	C ₃ H ₇ CO ₂ CH ₃	91.1	78.1
isopropyl ketone.....	C ₄ H ₁₀ CO.....	92	89.8
propionate.....	C ₂ H ₅ CO ₂ CH ₃	79.0	87.6
Methylene chloride.....	CH ₂ Cl ₂	40.5	78.6
Naphthalene.....	C ₁₀ H ₈	218	75.5
Nitromethane.....	CH ₃ NO ₂	99.9	135.
iso-Pentane.....	C ₅ H ₁₂	13	88.7
Piperidine.....	C ₅ H ₁₁ N.....	106	89.4
Propane.....	C ₃ H ₈	20	83.4
		0	89.6
		-20	95.3
		-30	98.0
Propionic acid.....	C ₂ H ₅ CO ₂ H.....	139.3	98.8
Propionitrile.....	C ₂ H ₅ CN.....	97	134.
n-Propyl acetate.....	CH ₃ CO ₂ C ₃ H ₇	100.4	80.3
n-Propyl alcohol.....	C ₃ H ₇ OH.....	97.2	164.
iso-Propyl alcohol.....		82.3	159.
n-Propyl formate.....	HCO ₂ C ₃ H ₇	80.0	88.1
Pyridine.....	C ₅ H ₅ N.....	114.1	107.4
Tetrachloroethane-1, 1, 2, 2.....	(CHCl ₂) ₂	145.0	55.1
Tetrachloroethylene.....	(CCl ₂) ₂	120.7	50.1
Trichloroethylene.....	C ₂ HCl ₃	85.7	57.3
Turpentine.....	C ₁₀ H ₁₆	156	68.6
α-Valeric acid.....	C ₄ H ₉ CO ₂ H.....	184.6	103.2
iso-Valeric acid.....		176.3	101.1
n-Valeronitrile.....	C ₄ H ₉ CN.....	129	96.3

CHANGE IN VOLUME DUE TO FUSION

The table gives the variation in volume expressed in c.cm. for one gram of the substance.

Substance.	Variation, cm.	Observer.
Aluminum.....	+0.019	Toepler, 1894
Bismuth.....	-0.0034	Toepler, 1894
Cadmium.....	+0.0064	Toepler, 1894
Iron.....	-0.0085	Wrightson, Roberts, 1881
Lead.....	+0.0034	Toepler, 1894
Tin.....	+0.0039	Toepler, 1894
Water.....	-0.083*	Toepler, 1894
Zinc...	+0.0105	Toepler, 1894

*For one cubic centimeter.

FIXED TEMPERATURE FOR THERMOMETER CALIBRATION

Corrections for pressure are indicated by equations in which p indicates pressure in millimeters of mercury, and t the boiling point at normal pressure.

Points designated by an asterisk (*) are suggested by E. F. Mueller as base points to be used in defining a Standard Working Scale.

Substance	Point	Temperature thermodynamic scale °C	Condition or correction
Hydrogen.....	Boiling	-252.75	+0.0044 ($p-760$)
Nitrogen.....	Vapor pressure	-195.80	+0.0109 ($p-760$)
Liquid O ₂ *.	Vapor pressure	-183.00	+0.0126 ($p-760$) -0.0000065 ($p-760$) ²
Isopentane.....	Freezing	-159.6	
Methylcyclohexane....	Freezing	-126.3	
Ether.....	Rapid freezing or slow melting	-116.3	
Carbon disulfide.....	Freezing	-111.6	
Toluene.....	Freezing	- 95.1	
Ethyl acetate.....	Freezing	- 83.6	
Solid CO ₂ *.....	Vapor pressure	- 78.51	+0.01595 ($p-760$) -0.000011 ($p-760$) ²
Chloroform.....	Freezing	- 63.5	
Chlorobenzene.....	Freezing	- 45.2	
Mercury*.....	Freezing	- 38.87	
Carbon tetrachloride...	Freezing	- 22.9	
Ice*.....	Melting	0.000	
Sodium sulfate.....	Transition	32.384	
Ethyl alcohol.....	Boiling	78.26	76 cm. variation 0.34° per cm.
Benzene.....	Boiling	80.0	76 cm. variation 0.43° per cm.

FIXED TEMPERATURE FOR THERMOMETER CALIBRATION (Continued)

Substance	Point	Temperature thermo- dynamic scale °C	Condition or correction
Water*	Boiling	100.000	$+0.0367 (p-760) - 0.000023 (p-760)^2$
Chlorobenzene	Boiling	132.	76 cm. variation 0.50° per cm.
Xylene (m.)	Boiling	138.8	76 cm. variation 0.50° per cm.
Aniline	Boiling	184.51	76 cm. variation 0.51° per cm.
Toluidine (o.)	Boiling	199.7	76 cm. variation 0.58° per cm.
Naphthalene	Con- densing	217.96	$+0.2075 (t+273.1) \log_{10} (p/760)$
Tin	Freezing	231.85	
Diphenylamine	Boiling	302.	
Benzophenone	Con- densing	305.9	$+0.194 (t+273.1) \log_{10} (p/760)$
Cadmium	Freezing	320.9	
Lead	Freezing	327.4	
Mercury	Boiling	356.9	
Potassium dichromate	Melting	397.5	
Zinc	Freezing	419.45	
Sulfur*	Con- densing	444.60	$+0.0909 (p-760) - 0.000048 (p-760)^2$
Potassium sulfate	Inver- sion	583.0	
Antimony*	Freezing	630.5	Approx. To be determined with resistance thermom- eter.
30.5 NaCl+69.5 Na ₂ SO ₄	Melting	637.0	
Aluminum (99.85%)	Freezing	658.9	
Potassium chloride	Melting	770.3	
Sodium chloride	Melting	800.4	
Sodium sulfate	Melting	884.7	
Silver*	Freezing	960.5	(reducing atmosphere)
Gold*	Freezing	1063.	
Potassium sulfate	Melting	1069.1	
Copper	Freezing	1083.	(reducing atmosphere)
Lithium metasilicate	Melting	1202.	
Diopside	Melting	1395.	
Nickel	Melting or freezing	1452.	
Palladium	Freezing	1555. ±2	
Anorthite	Melting	1555.	
Platinum	Melting	1755. ±6	
Alumina	Melting	2000.	
Tungsten	Melting	3370. ±30	

PRESSURE OF AQUEOUS VAPOR

VAPOR PRESSURE OF ICE

Pressure of aqueous vapor over ice in mm of Hg for temperatures from -98 to 0°C.

Temp. °C	0	2	4	6	8
-90	.000070	.000048	.000033	.000022	.000015
-80	.00040	.00029	.00020	.00014	.00010
-70	.00194	.00143	.00105	.00077	.00056
-60	.00808	.00614	.00464	.00349	.00261
-50	.02955	.0230	.0178	.0138	.0106
-40	.0966	.0768	.0609	.0481	.0378
-30	.2859	.2318	.1873	.1507	.1209

Temp. °C	0.0	0.2	0.4	0.6	0.8
-29	0.317	0.311	0.304	0.298	0.292
-28	0.351	0.344	0.337	0.330	0.324
-27	0.389	0.381	0.374	0.366	0.359
-26	0.430	0.422	0.414	0.405	0.397
-25	0.476	0.467	0.457	0.448	0.439
-24	0.526	0.515	0.505	0.495	0.486
-23	0.580	0.569	0.558	0.547	0.536
-22	0.640	0.627	0.615	0.603	0.592
-21	0.705	0.691	0.678	0.665	0.652
-20	0.776	0.761	0.747	0.733	0.719
-19	0.854	0.838	0.822	0.806	0.791
-18	0.939	0.921	0.904	0.887	0.870
-17	1.031	1.012	0.993	0.975	0.956
-16	1.132	1.111	1.091	1.070	1.051
-15	1.241	1.219	1.196	1.175	1.153
-14	1.361	1.336	1.312	1.288	1.264
-13	1.490	1.464	1.437	1.411	1.386
-12	1.632	1.602	1.574	1.546	1.518
-11	1.785	1.753	1.722	1.691	1.661
-10	1.950	1.916	1.883	1.849	1.817
-9	2.131	2.093	2.057	2.021	1.985
-8	2.326	2.285	2.246	2.207	2.168
-7	2.537	2.493	2.450	2.408	2.367
-6	2.765	2.718	2.672	2.626	2.581
-5	3.013	2.962	2.912	2.862	2.813
-4	3.280	3.225	3.171	3.117	3.065
-3	3.568	3.509	3.451	3.393	3.336
-2	3.880	3.816	3.753	3.691	3.630
-1	4.217	4.147	4.079	4.012	3.946
-0	4.579	4.504	4.431	4.359	4.287

VAPOR PRESSURE OF WATER BELOW 100°C

Pressure of aqueous vapor over water in mm of Hg for temperatures from -15.8 to 100°C. Values for fractional degrees between 50 and 89 were obtained by interpolation.

Temp. °C	0.0	0.2	0.4	0.6	0.8
-15	1.436	1.414	1.390	1.368	1.345
-14	1.560	1.534	1.511	1.485	1.460
-13	1.691	1.665	1.637	1.611	1.585
-12	1.834	1.804	1.776	1.748	1.720
-11	1.987	1.955	1.924	1.893	1.863
-10	2.149	2.116	2.084	2.050	2.018
-9	2.326	2.289	2.254	2.219	2.184
-8	2.514	2.475	2.437	2.399	2.362
-7	2.715	2.674	2.633	2.593	2.553
-6	2.931	2.887	2.843	2.800	2.757
-5	3.163	3.115	3.069	3.022	2.976
-4	3.410	3.359	3.309	3.259	3.211
-3	3.673	3.620	3.567	3.514	3.461
-2	3.956	3.898	3.841	3.785	3.730
-1	4.258	4.196	4.135	4.075	4.016
-0	4.579	4.513	4.448	4.385	4.320
0	4.579	4.647	4.715	4.785	4.855
1	4.926	4.998	5.070	5.144	5.219
2	5.294	5.370	5.447	5.525	5.605
3	5.685	5.766	5.848	5.931	6.015
4	6.101	6.187	6.274	6.363	6.453
5	6.543	6.635	6.728	6.822	6.917
6	7.013	7.111	7.209	7.309	7.411
7	7.513	7.617	7.722	7.828	7.936
8	8.045	8.155	8.267	8.380	8.494
9	8.609	8.727	8.845	8.965	9.086
10	9.209	9.333	9.458	9.585	9.714
11	9.844	9.976	10.109	10.244	10.380
12	10.518	10.658	10.799	10.941	11.085
13	11.231	11.379	11.528	11.680	11.833
14	11.987	12.144	12.302	12.462	12.624
15	12.788	12.953	13.121	13.290	13.461
16	13.634	13.809	13.987	14.166	14.347
17	14.530	14.715	14.903	15.092	15.284
18	15.477	15.673	15.871	16.071	16.272
19	16.477	16.685	16.894	17.105	17.319

VAPOR PRESSURE OF WATER BELOW 100°C (Continued)

Temp. °C	0.0	0.2	0.4	0.6	0.8
20	17.535	17.753	17.974	18.197	18.422
21	18.650	18.880	19.113	19.349	19.587
22	19.827	20.070	20.316	20.565	20.815
23	21.068	21.324	21.583	21.845	22.110
24	22.377	22.648	22.922	23.198	23.476
25	23.756	24.039	24.326	24.617	24.912
26	25.209	25.509	25.812	26.117	26.426
27	26.739	27.055	27.374	27.696	28.021
28	28.349	28.680	29.015	29.354	29.697
29	30.043	30.392	30.745	31.102	31.461
30	31.824	32.191	32.561	32.934	33.312
31	33.695	34.082	34.471	34.864	35.261
32	35.663	36.068	36.477	36.891	37.308
33	37.729	38.155	38.584	39.018	39.457
34	39.898	40.344	40.796	41.251	41.710
35	42.175	42.644	43.117	43.595	44.078
36	44.563	45.054	45.549	46.050	46.556
37	47.067	47.582	48.102	48.627	49.157
38	49.692	50.231	50.774	51.323	51.879
39	52.442	53.009	53.580	54.156	54.737
40	55.324	55.91	56.51	57.11	57.72
41	58.34	58.96	59.58	60.22	60.86
42	61.50	62.14	62.80	63.46	64.12
43	64.80	65.48	66.16	66.86	67.56
44	68.26	68.97	69.69	70.41	71.14
45	71.88	72.62	73.36	74.12	74.88
46	75.65	76.43	77.21	78.00	78.80
47	79.60	80.41	81.23	82.05	82.87
48	83.71	84.56	85.42	86.28	87.14
49	88.02	88.90	89.79	90.69	91.59
50	92.51	93.5	94.4	95.3	96.3
51	97.20	98.2	99.1	100.1	101.1
52	102.09	103.1	104.1	105.1	106.2
53	107.20	108.2	109.3	110.4	111.4
54	112.51	113.6	114.7	115.8	116.9
55	118.04	119.1	120.3	121.5	122.6
56	123.80	125.0	126.2	127.4	128.6
57	129.82	131.0	132.3	133.5	134.7
58	136.08	137.3	138.5	139.9	141.2
59	142.60	143.9	145.2	146.6	148.0

VAPOR PRESSURE OF WATER BELOW 100°C (Continued)

Temp. °C	0.0	0.2	0.4	0.6	0.8
60	149.38	150.7	152.1	153.5	155.0
61	156.43	157.8	159.3	160.8	162.3
62	163.77	165.2	166.8	168.3	169.8
63	171.38	172.9	174.5	176.1	177.7
64	179.31	180.9	182.5	184.2	185.8
65	187.54	189.2	190.9	192.6	194.3
66	196.09	197.8	199.5	201.3	203.1
67	204.96	206.8	208.6	210.5	212.3
68	214.17	216.0	218.0	219.9	221.8
69	223.73	225.7	227.7	229.7	231.7
70	233.7	235.7	237.7	239.7	241.8
71	243.9	246.0	248.2	250.3	252.4
72	254.6	256.8	259.0	261.2	263.4
73	265.7	268.0	270.2	272.6	274.8
74	277.2	279.4	281.8	284.2	286.6
75	289.1	291.5	294.0	296.4	298.8
76	301.4	303.8	306.4	308.9	311.4
77	314.1	316.6	319.2	322.0	324.6
78	327.3	330.0	332.8	335.6	338.2
79	341.0	343.8	346.6	349.4	352.2
80	355.1	358.0	361.0	363.8	366.8
81	369.7	372.6	375.6	378.8	381.8
82	384.9	388.0	391.2	394.4	397.4
83	400.6	403.8	407.0	410.2	413.6
84	416.8	420.2	423.6	426.8	430.2
85	433.6	437.0	440.4	444.0	447.5
86	450.9	454.4	458.0	461.6	465.2
87	468.7	472.4	476.0	479.8	483.4
88	487.1	491.0	494.7	498.5	502.2
89	506.1	510.0	513.9	517.8	521.8
90	525.76	529.77	533.80	537.86	541.95
91	546.05	550.18	554.35	558.53	562.75
92	566.99	571.26	575.55	579.87	584.22
93	588.60	593.00	597.43	601.89	606.38
94	610.90	615.44	620.01	624.61	629.24
95	633.90	638.59	643.30	648.05	652.82
96	657.62	662.45	667.31	672.20	677.12
97	682.07	687.04	692.05	697.10	702.17
98	707.27	712.40	717.56	722.75	727.98
99	733.24	738.53	743.85	749.20	754.58
100	760.00	765.45	770.93	776.44	782.00
101	787.57	793.18	798.82	804.50	810.21

VAPOR PRESSURE OF WATER ABOVE 100° C.

Based on values given by Keyes in the International Critical Tables.

Temp. °C.	Pressure		Temp. °F.	Temp. °C.	Pressure		Temp. °F.
	mm	Pounds per sq. in.			mm	Pounds per sq. in.	
100	760.	14.696	212.0	145	3116.76	60.268	293.0
101	787.51	15.228	213.8	146	3203.40	61.944	294.8
102	815.86	15.776	215.6	147	3292.32	63.663	296.6
103	845.12	16.342	217.4	148	3382.76	65.412	298.4
104	875.06	16.921	219.2	149	3476.24	67.220	300.2
105	906.07	17.521	221.0	150	3570.48	69.042	302.0
106	937.92	18.136	222.8	151	3667.00	70.908	303.8
107	970.60	18.768	224.6	152	3766.56	72.833	305.6
108	1004.42	19.422	226.4	153	3866.88	74.773	307.4
109	1038.92	20.089	228.2	154	3970.24	76.772	309.2
110	1074.56	20.779	230.0	155	4075.88	78.815	311.0
111	1111.20	21.487	231.8	156	4183.80	80.901	312.8
112	1148.74	22.213	233.6	157	4293.24	83.018	314.6
113	1187.42	22.961	235.4	158	4404.96	85.178	316.4
114	1227.25	23.731	237.2	159	4519.72	87.397	318.2
115	1267.98	24.519	239.0	160	4636.00	89.646	320.0
116	1309.94	25.330	240.8	161	4755.32	91.953	321.8
117	1352.95	26.162	242.6	162	4876.92	94.304	323.6
118	1397.18	27.017	244.4	163	5000.04	96.685	325.4
119	1442.63	27.896	246.2	164	5126.96	99.139	327.2
120	1489.14	28.795	248.0	165	5256.16	101.638	329.0
121	1536.80	29.717	249.8	166	5386.88	104.165	330.8
122	1586.04	30.669	251.6	167	5521.40	106.766	332.6
123	1636.36	31.642	253.4	168	5658.20	109.412	334.4
124	1687.81	32.637	255.2	169	5798.04	112.116	336.2
125	1740.93	33.664	257.0	170	5940.92	114.879	338.0
126	1795.12	34.712	258.8	171	6085.32	117.671	339.8
127	1850.83	35.789	260.6	172	6233.52	120.537	341.6
128	1907.83	36.891	262.4	173	6383.24	123.432	343.4
129	1966.35	38.023	264.2	174	6538.28	126.430	345.2
130	2026.16	39.180	266.0	175	6694.08	129.442	347.0
131	2087.42	40.364	267.8	176	6852.92	132.514	348.8
132	2150.42	41.582	269.6	177	7015.56	135.659	350.6
133	2214.64	42.824	271.4	178	7180.48	138.848	352.4
134	2280.76	44.103	273.2	179	7349.20	142.110	354.2
135	2347.26	45.389	275.0	180	7520.20	145.417	356.0
136	2416.34	46.724	276.8	181	7694.24	148.782	357.8
137	2488.16	48.113	278.6	182	7872.08	152.221	359.6
138	2560.67	49.515	280.4	183	8052.96	155.719	361.4
139	2634.84	50.950	282.2	184	8236.88	159.275	363.2
140	2710.92	52.421	284.0	185	8423.84	162.890	365.0
141	2788.44	53.920	285.8	186	8616.12	166.609	366.8
142	2867.48	55.448	287.6	187	8809.92	170.356	368.6
143	2948.80	57.020	289.4	188	9007.52	174.177	370.4
144	3031.64	58.622	291.2	189	9208.16	178.057	372.2

VAPOR PRESSURE OF WATER ABOVE 100° C. (Continued)

Temp. °C.	Pressure		Temp. °F.	Temp. °C.	Pressure		Temp. °F.
	mm	Pounds per sq. in.			mm	Pounds per sq. in.	
190	9413.36	182.025	374.0	235	22967.96	444.128	455.0
191	9620.08	186.022	375.8	236	23382.92	452.152	456.8
192	9831.36	190.107	377.6	237	23802.44	460.264	458.6
193	10047.20	194.281	379.4	238	24229.56	468.523	460.4
194	10265.32	198.499	381.2	239	24661.24	476.871	462.2
195	10488.76	202.819	383.0	240	25100.52	485.365	464.0
196	10715.24	207.199	384.8	241	25543.60	493.933	465.8
197	10944.76	211.637	386.6	242	25994.28	502.647	467.6
198	11179.60	216.178	388.4	243	26449.52	511.450	469.4
199	11417.48	220.778	390.2	244	26912.36	520.400	471.2
200	11659.16	225.451	392.0	245	27381.28	529.467	473.0
201	11905.40	230.213	393.8	246	27855.52	538.638	474.8
202	12155.44	235.048	395.6	247	28335.84	547.926	476.6
203	12408.52	239.942	397.4	248	28823.76	557.360	478.4
204	12666.16	244.924	399.2	249	29317.00	566.898	480.2
205	12929.12	250.008	401.0	250	29817.84	576.583	482.0
206	13197.40	255.196	402.8	251	30324.00	586.370	483.8
207	13467.96	260.428	404.6	252	30837.76	596.305	485.6
208	13742.32	265.733	406.4	253	31356.84	606.342	487.4
209	14022.76	271.156	408.2	254	31885.04	616.556	489.2
210	14305.48	276.623	410.0	255	32417.80	626.858	491.0
211	14595.04	282.222	411.8	256	32957.40	637.292	492.8
212	14888.40	287.895	413.6	257	33505.36	647.888	494.6
213	15184.80	293.626	415.4	258	34059.40	658.601	496.4
214	15488.04	299.490	417.2	259	34618.76	669.417	498.2
215	15792.80	305.383	419.0	260	35188.00	680.425	500.0
216	16104.40	311.408	420.8	261	35761.80	691.520	501.8
217	16420.56	317.522	422.6	262	36343.20	702.763	503.6
218	16742.04	323.738	424.4	263	36932.20	714.152	505.4
219	17067.32	330.028	426.2	264	37529.56	725.703	507.2
220	17395.64	336.377	428.0	265	38133.00	737.372	509.0
221	17731.56	342.872	429.8	266	38742.52	749.158	510.8
222	18072.80	349.471	431.6	267	39361.92	761.135	512.6
223	18417.84	356.143	433.4	268	39986.64	773.215	514.4
224	18766.68	362.888	435.2	269	40619.72	785.457	516.2
225	19123.12	369.781	437.0	270	41261.16	797.861	518.0
226	19482.60	376.732	438.8	271	41910.20	810.411	519.8
227	19848.92	383.815	440.6	272	42566.08	823.094	521.6
228	20219.80	390.987	442.4	273	43229.56	835.923	523.4
229	20596.76	398.276	444.2	274	43902.16	848.929	525.2
230	20978.28	405.654	446.0	275	44580.84	862.053	527.0
231	21365.12	413.134	447.8	276	45269.40	875.367	528.8
232	21757.28	420.717	449.6	277	45964.04	888.799	530.6
233	22154.00	428.388	451.4	278	46669.32	902.437	532.4
234	22558.32	436.207	453.2	279	47382.20	916.222	534.2

VAPOR PRESSURE OF WATER ABOVE 100° C. (Continued)

Temp. °C	Pressure		Temp. °F	Temp. °C	Pressure		Temp. °F
	mm	Pounds per sq. in.			mm	Pounds per sq. in.	
280	48104.20	930.183	536.0	330	96512.40	1866.245	626.0
281	48833.80	944.291	537.8	331	97758.80	1890.346	627.8
282	49570.24	958.532	539.6	332	99020.40	1914.742	629.6
283	50316.56	972.963	541.4	333	100297.20	1939.431	631.4
284	51072.76	987.586	543.2	334	101581.60	1964.267	633.2
285	51838.08	1002.385	545.0	335	102881.20	1989.398	635.0
286	52611.76	1017.345	546.8	336	104196.00	2014.822	636.8
287	53395.32	1032.497	548.6	337	105526.00	2040.540	638.6
288	54187.24	1047.810	550.4	338	106871.20	2066.552	640.4
289	54989.04	1063.314	552.2	339	108224.00	2092.710	642.2
290	55799.20	1078.980	554.0	340	109592.00	2119.163	644.0
291	56612.40	1094.705	555.8	341	110967.60	2145.763	645.8
292	57448.40	1110.871	557.6	342	112358.40	2172.657	647.6
293	58284.40	1127.036	559.4	343	113749.20	2199.550	649.4
294	59135.60	1143.496	561.2	344	115178.00	2227.179	651.2
295	59994.40	1160.102	563.0	345	116614.40	2254.954	653.0
296	60860.80	1176.856	564.8	346	118073.60	2283.171	654.8
297	61742.40	1193.903	566.6	347	119532.80	2311.387	656.6
298	62624.00	1210.950	568.4	348	121014.80	2340.044	658.4
299	63528.40	1228.439	570.2	349	122504.40	2368.848	660.2
300	64432.80	1245.927	572.0	350	124001.60	2397.799	662.0
301	65352.40	1263.709	573.8	351	125521.60	2427.191	663.8
302	66279.60	1281.638	575.6	352	127049.20	2456.730	665.6
303	67214.40	1299.714	577.4	353	128599.60	2486.710	667.4
304	68156.80	1317.937	579.2	354	130157.60	2516.837	669.2
305	69114.40	1336.454	581.0	355	131730.80	2547.258	671.0
306	70072.00	1354.971	582.8	356	133326.80	2578.119	672.8
307	71052.40	1373.929	584.6	357	134945.60	2609.422	674.6
308	72048.00	1393.181	586.4	358	136579.60	2641.018	676.4
309	73028.40	1412.139	588.2	359	138228.80	2672.908	678.2
310	74024.00	1431.390	590.0	360	139893.20	2705.093	680.0
311	75042.40	1451.083	591.8	361	141572.80	2737.571	681.8
312	76076.00	1471.070	593.6	362	143275.20	2770.490	683.6
313	77117.20	1491.203	595.4	363	144992.80	2803.703	685.4
314	78166.00	1511.484	597.2	364	146733.20	2837.357	687.2
315	79230.00	1532.058	599.0	365	148519.20	2871.892	689.0
316	80294.00	1552.632	600.8	366	150320.40	2906.722	690.8
317	81373.20	1573.501	602.6	367	152129.20	2941.698	692.6
318	82467.60	1594.663	604.4	368	153960.80	2977.116	694.4
319	83569.60	1615.972	606.2	369	155815.20	3012.974	696.2
320	84686.80	1637.575	608.0	370	157692.40	3049.273	698.0
321	85819.20	1659.472	609.8	371	159584.80	3085.866	699.8
322	86959.20	1681.516	611.6	372	161507.60	3123.047	701.6
323	88114.40	1703.854	613.4	373	163468.40	3160.963	703.4
324	89277.20	1726.339	615.2	374	165467.20	3199.613	705.2
325	90447.60	1748.971	617.0				
326	91633.20	1771.897	618.8				
327	92826.40	1794.969	620.6				
328	94042.40	1818.483	622.4				
329	95273.60	1842.291	624.2				

VAPOR PRESSURE OF MERCURY

Vapor pressure of mercury in mm. of Hg for temperatures from -38 to 400°C. Note that the values for the first four lines only, are to be multiplied by 10⁻⁶.

Temp. °C	0	2	4	6	8
	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
-30	4.78	3.59	2.66	1.97	1.45
-20	18.1	14.0	10.8	8.28	6.30
-10	60.6	48.1	38.0	29.8	23.2
-0	185.	149.	119.	95.4	76.2
+ 0	.000185	.000228	.000276	.000335	.000406
+10	.000490	.000588	.000706	.000846	.001009
20	.001201	.001426	.001691	.002000	.002359
30	.002777	.003261	.003823	.004471	.005219
40	.006079	.007067	.008200	.009497	.01098
50	.01267	.01459	.01677	.01925	.02206
60	.02524	.02883	.03287	.03740	.04251
70	.04825	.05469	.06189	.06993	.07889
80	.08880	.1000	.1124	.1261	.1413
90	.1582	.1769	.1976	.2202	.2453
100	.2729	.3032	.3366	.3731	.4132
110	.4572	.5052	.5576	.6150	.6776
120	.7457	.8198	.9004	.9882	1.084
130	1.186	1.298	1.419	1.551	1.692
140	1.845	2.010	2.188	2.379	2.585
150	2.807	3.046	3.303	3.578	3.873
160	4.189	4.528	4.890	5.277	5.689
170	6.128	6.596	7.095	7.626	8.193
180	8.796	9.436	10.116	10.839	11.607
190	12.423	13.287	14.203	15.173	16.200
200	17.287	18.437	19.652	20.936	22.292
210	23.723	25.233	26.826	28.504	30.271
220	32.133	34.092	36.153	38.318	40.595
230	42.989	45.503	48.141	50.909	53.812
240	56.855	60.044	63.384	66.882	70.543
250	74.375	78.381	82.568	86.944	91.518
260	96.296	101.28	106.48	111.91	117.57
270	123.47	129.62	136.02	142.69	149.64
280	156.87	164.39	172.21	180.34	188.79
290	197.57	206.70	216.17	226.00	236.21
300	246.80	257.78	269.17	280.98	293.21
310	305.89	319.02	332.62	346.70	361.26
320	376.33	391.92	408.04	424.71	441.94
330	459.74	478.13	497.12	516.74	537.00
340	557.90	579.45	601.69	624.64	648.30
350	672.69	697.83	723.73	750.43	777.92
360	806.23	835.38	865.36	896.23	928.02
370	960.66	994.34	1028.9	1064.4	1100.9
380	1138.4	1177.0	1216.6	1257.3	1299.1
390	1341.9	1386.1	1431.3	1477.7	1525.2
400	1574.1	.....	.....	.....	.....

VAPOR PRESSURE OF CARBON DIOXIDE

SOLID

From Bureau of Standards Journal of Research

(Mercury column, density = 13.5951 g/cm³, η = 980.665)

Pressure in microns of mercury

°C	0	1	2	3	4	5	6	7	8	9
-180	0.013	0.008	0.006	0.004	0.003	0.0017	0.0011	0.0007	0.0005	0.0003
-170	.37	.27	.20	.14	.10	.074	.052	.037	.026	.018
-160	5.9	4.6	3.6	2.7	2.1	1.58	1.19	.90	.67	.50
-150	60.5	48.8	39.2	31.4	25.1	19.9	15.8	12.4	9.8	7.6
-140	431	359	298	247	204	168	138	113	92	75

Pressure in mm of mercury

-130	2.31	1.97	1.68	1.43	1.22	1.03	0.87	0.73	0.61	0.51
-120	9.81	8.57	7.46	6.49	5.63	4.88	4.22	3.64	3.13	2.69
-110	34.63	30.76	27.27	24.14	21.34	18.83	16.58	14.58	12.80	11.22
-100	104.81	94.40	84.91	76.27	68.43	61.30	54.84	48.99	43.71	38.94
- 90	279.5	254.7	231.8	210.8	191.4	173.6	157.3	142.4	128.7	116.2
- 80	672.2	618.3	568.2	521.7	478.5	438.6	401.6	367.4	335.7	306.5
- 70	1486.1	1377.3	1275.6	1180.5	1091.7	1008.9	931.7	859.7	792.7	730.3
- 60	3073.1	2865.1	2669.7	2486.3	2314.2	2152.8	2001.5	1859.7	1726.9	1602.5
- 50	.....	.....	.....	.....	.....	.....	.....	3780.9	3530.2	3294.6

Liquid

°C	0	1	2	3	4	5	6	7	8	9
-50	5127.8	4922.7	4723.9	4531.1	4344.3	4163.2	3987.9	3818.2*	3653.9*	3495.0*
-40	7545	7271	7005	6746	6494	6250	6012	5781	5557	5339
-30	10718	10363	10017	9679	9350	9029	8716	8412	8115	7826
-20	14781	14331	13891	13461	13040	12630	12229	11838	11455	11082
-10	19872	19312	18764	18228	17703	17189	16686	16194	15712	15241
- 0	26142	25457	24786	24127	23482	22849	22229	21622	21026	20443
0	26142	26840	27552	28277	29017	29771	30539	31323	32121	32934
10	33763	34607	35467	36343	37236	38146	39073	40017	40980	41960
20	42959	43977	45014	46072	47150	48250	49370	50514	51680	52871
30	54086	55327	.....	.....	.....	.....	.....	.....	.....	.....

* Undercooled liquid.

Critical temperature = 31.0°C. Triple point, -56.602 ± 0.005°C; 3885.2 ± 0.4 mm.

VAPOR PRESSURE

Pressure and Density (or Specific Volume) of Saturated Vapor

Pressure of the saturated vapor is given in millimeters of mercury or in atmospheres as indicated; the density of the liquid and saturated vapor in g/cm³, and the specific volume in cm³/g. The temperatures are stated in degrees Centigrade. The normal boiling point is the temperature for which the pressure is 1 atm. or 760 mm. Data refers to the liquid state unless otherwise indicated.

The following abbreviations are used: b.p., boiling point; c.p., critical point; liq., liquid; m.p., melting point; sol., solid; t.p., triple point.

Elements and Inorganic Compounds

°C	Pressure	Density g/cm ³		°C	Pressure	Sp. Vol. cm ³ /g	
		liq.	vap.			liq.	vap.
Aluminum Al				Ammonia NH ₃ (Continued)			
liq. 1800 b.p.	760 mm			-14	2.4328 atm.	1.5215	488.88
Ammonia NH ₃				-12	2.6443	1.5276	452.02
°C	Pressure	Sp. Vol. cm ³ /g		-10	2.8703	1.5338	418.46
		liq.	vap.	-8	3.1112	1.5400	387.87
				-6	3.3677	1.5464	359.95
				-4	3.6405	1.5528	334.42
				-2	3.9303	1.5594	311.04
				0	4.2380	1.5660	289.62
				+ 2	4.5640	1.5727	269.95
				4	4.9090	1.5796	251.88
				6	5.2750	1.5866	235.25
				8	5.6610	1.5936	219.92
				10	6.0685	1.6008	205.79
				12	6.4985	1.6081	192.73
				14	6.9520	1.6156	180.66
				16	7.4290	1.6231	169.49
				18	7.9310	1.6308	159.14
				20	8.4585	1.6386	149.53
				22	9.0125	1.6466	140.61
				24	9.5940	1.6547	132.33
				26	10.2040	1.6630	124.61
				28	10.8430	1.6714	117.43
				30	11.512	1.6800	110.73
				32	12.212	1.6888	104.48
				34	12.943	1.6977	98.640
				36	13.708	1.7069	93.181
				38	14.507	1.7162	88.074
				40	15.339	1.7257	83.290
				42	16.209	1.7354	78.806
				44	17.113	1.7454	74.600
				46	18.056	1.7555	70.650
				48	19.038	1.7659	66.939
				50	20.059	1.7766	63.448
				52	21.121	1.7875	.....
				54	22.224	1.7987	.....
				56	23.372	1.8102	.....
				58	24.562	1.8220	.....
				60	25.797	1.8341	48.8
				62	27.079	1.8465	.....
				64	28.407	1.8593	.....
				66	29.784	1.8725	.....
				68	31.211	1.8860	.....
				70	32.687	1.9000	37.7
				72	34.227	1.9145	.....
				74	35.813	1.9294	.....

VAPOR PRESSURE (Continued)

°C	Pressure	Sp. Vol. cm ³ /g		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Ammonia NH ₃ (Continued)				Antimony trichloride SbCl ₃			
76	37.453 atm.	1.9448		120 liq.	29. mm		
78	39.149	1.9608		130	43.		
80	40.902	1.9774	29.3	140	64.		
82	42.712	1.9946		150	92.		
84	44.582	2.0124		160	127.		
86	46.511	2.0311					
88	48.503	2.0505		Antimony triiodide SbI ₃			
90	50.558	2.0708	22.8	250 liq.	23. mm		
92	52.677	2.0920		280	53.		
94	54.860	2.1143		310	115.		
96	57.111	2.1377					
98	59.429	2.1623		Argon A			
100	61.816	2.1885	17.6	-189.19 t.p.	512.17 mm		
102	64.274	2.2162		-185.66 b.p.	1.0000 atm.		
104	66.804	2.2510		-183.15 liq.		1.37396	0.00801
106	69.406	2.2773		-161.23	7.4332	1.22414	0.03723
108	72.084	2.3112		-150.76		1.13851	0.06785
110	74.837	2.3478		-150.57	13.707		
112	77.668	2.3877		-140.80	22.185		
114	80.578	2.4314		-135.51		0.97385	0.15994
116	83.570	2.4796		-129.83	35.846		
118	86.644	2.5393		-122.44 c.p.	47.996		
120	89.802	2.5948					
122	93.045	2.6656		Arsine AsH ₃			
124	96.376	2.7495		liq.			
126	99.796	2.8523		-55 b.p.	1.00 atm.		
128	103.309	2.9851		-40	2.0		
130	106.913	3.1769		-20	4.3		
132	110.613	3.5315		0	8.4		
132.9 c.p.	112.3	4.2830		+20	15.		
Ammonium chloride NH ₄ Cl				Arsenic As			
				604.3 sol.	760. mm		
Antimony Sb				Barium Ba			
				887 liq.	1. mm		
				1146 b.p.	760.		
Antimony bromide SbBr ₃				Bismuth Bi			
				606.8 liq.	0.001 mm		
				904.	1.		
				1470 b.p.	760.		
Antimony trichloride SbCl ₃				Boron chloride BCl ₃			
				-80 liq.	4.0 mm		
				-60	18.0		
				-30	116.0		
				-15	251.0		
				0	477.0		
Antimony triiodide SbI ₃				Bromine Br			
				-90 sol.	0.0052 mm		
				-80	0.0251		
Antimony							
818 liq.	1 mm						
1327 b.p.	760.						
Antimony bromide							
180 liq.	42 mm						
200	82.						
220	148.						

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Sp. Vol. cm ³ /g	
		liq.	vap.			liq.	vap.
Bromine Br (Continued)				Carbon dioxide CO ₂ (Continued)			
-70	0.102 mm			-34	12.299 atm.	0.9158	
-60	0.357			-32	13.176	0.9226	
-50	1.09			-30	14.099	0.9302	27.19
-40	2.98			-28	15.067	0.9381	25.40
-30	7.45			-26	16.084	0.9452	23.71
-20	17.1			-24	17.150	0.9533	22.11
-10	36.6			-22	18.267	0.9615	20.62
- 7.3 m.p.	44.4			-20	19.437	0.9699	19.22
0 liq.	65.9			-18	20.661	0.9794	17.95
+10	109.			-16	21.940	0.9892	16.78
20	173.			-14	23.277	0.9990	15.70
30	264.			-12	24.673	1.0091	14.73
40	392.			-10	26.129	1.0194	13.83
50.	564.			- 8	27.648	1.0309	13.01
55.78 b.p.	760.			- 6	29.231	1.0428	12.25
Cadmium Cd				- 4	30.879	1.0548	11.54
219.1 sol.	0.001 mm			- 2	32.595	1.0683	10.88
392.2 liq.	1.			0	34.379	1.0811	10.26
454.6	5.			+ 2	36.235	1.0953	9.68
485.3	10.			4	38.163	1.1099	9.13
767 b.p.	760.			6	40.166	1.1261	8.59
Caesium Cs				8	42.247	1.1442	8.06
112.3 liq.	0.001 mm			10	44.406	1.1628	7.57
278.6	1.			12	46.648	1.1834	7.04
669.3 b.p.	760.			14	48.974	1.2063	6.58
Calcium Ca				16	51.388	1.2330	6.14
529 sol.	0.001 mm			18	53.895	1.2626	5.68
917 liq.	1.			20	56.495	1.2953	5.26
1174 b.p.	760.			22	59.197	1.3351	4.83
Carbon C				24	62.006	1.3831	4.39
liq.				26	64.928	1.4430	3.97
3927 b.p.	760. mm			28	67.971	1.5267	3.53
				30	71.143	1.6722	3.00
				31.1 c.p.	72.947	2.1547	2.15
Carbon disulfide CS ₂							
						Density g/cm ³	
°C	Pressure	Sp. Vol. cm ³ /g		°C	Pressure		
		liq.	vap.			liq.	vap.
-70 liq.	5.2485 atm.	0.8496		-70 liq.	1.6 mm		
-54	5.7156	0.8554		-60	3.5		
-52	6.2139	0.8606		-50	7.1		
-50	6.7446	0.8658		-40	14.0		
-48	7.3089	0.8718		-30	26.2		
-46	7.9078	0.8780		-20	46.5		
-44	8.5426	0.8834		-10	78.8		
-42	9.2147	0.8897		0	127.3		
-40	9.9251	0.8961		+10	198.1		
-38	10.675	0.9025		20	297.5		
-36	11.466	0.9091		30	432.7		
				40	616.7		
				46.25 b.p.	1.00 atm.	1.225	

* See special table preceding.

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Carbon disulfide CS ₂ (Continued)				Chlorine Cl (Continued)			
50	1.13 atm.	.....	0.0045	30	8.60 atm.	1.377	0.0300
60	1.54	.....	0.0058	40	11.1	1.344	0.0384
70	2.05	.....	0.0075	50	14.1	1.310	0.0486
80	2.69	.....	0.0075	60	17.6	1.375	0.0600
90	3.47	.....	0.0095	70	21.6	1.240	0.0740
100	4.42	.....	0.012	80	26.2	1.199	0.0910
110	5.55	.....	0.015	90	31.5	1.156	0.1125
120	6.90	.....	0.018	100	37.6	1.109	0.136
130	8.47	.....	0.021	110	44.4	1.059	0.164
140	10.3	.....	0.026	120	52.4	0.998	0.206
150	12.4	.....	0.031	130	61.4	0.920	0.258
160	14.9	.....	0.035	140	71.4	0.750	0.405
170	17.6	.....	0.041	144 c.p.	76.1	0.573	0.573
180	20.8	.....	0.052	Chromium Cr			
190	24.3	.....	0.068	liq.			
200	28.3	.....	0.084	2200 b.p.	760. mm	.....	.....
210	32.8	.....	0.101	Cobalt Co			
220	37.8	.....	0.122	1254 liq.	0.001 mm	.....	.....
230	43.4	.....	0.144	1859	1.	.....	.....
240	49.6	.....	0.178	3168 b.p.	760.	.....	.....
250	56.5	.....	0.212	Copper Cu			
260	64.1	.....	0.247	1320 liq.	0.001 mm	.....	.....
270	72.5	.....	0.301	1707	1.	.....	.....
273 c.p.	75.	.....		2310 b.p.	760.	.....	.....
Carbon monoxide CO				Cupric chloride CuCl ₂			
-220.6 sol.	4. mm	.....		487.6 sol.	223.9 mm	.....	.....
-209.1	50.	.....		470.5	128.8	.....	.....
-205.70	111.33	.....		407.2	22.39	.....	.....
-192.0	1.0 atm.	0.803	0.0044	335.2	5.0	.....	.....
-190	1.2	0.794	0.0054	318.6	3.55	.....	.....
-180	3.2	0.748	0.013	Cupric oxide CuO			
-170	6.7	0.697	0.027	600 sol.	1.34 × 10 ⁻⁷ mm	.....	.....
-160	12.4	0.639	0.046	800	1.15 × 10 ⁻⁴	.....	.....
-150	20.9	0.560	0.088	950	6.8 × 10 ⁻⁴	.....	.....
-140	33.2	0.420	0.190	Cyanogen chloride CNCl			
-139 c.p.	35.	0.303	0.303	-32.69 sol.	58.6 mm	.....	.....
Chlorine Cl				-24.7	101.71	.....	.....
liq.				-11.41	250.67	.....	.....
-103 m.p.	8.9 mm	.....		Ferric chloride FeCl ₃			
-100	11.8	.....		245.0 sol.	19.95 mm	.....	.....
-90	27.8	.....		292.3	316.2	.....	.....
-80	58.7	.....		Gold Au			
-70	115.	.....		1292 liq.	0.001 mm	.....	.....
-60	211.	.....		1768	1.	.....	.....
-50	363.	.....		2611 b.p.	760.	.....	.....
-40	594.	.....				
-34.6 b.p.	760.	.....				
-30	1.23 atm.	1.550					
-20	1.84	1.524					
-10	2.61	1.496					
0	3.65	1.468	0.0128				
+ 10	4.96	1.438	0.0175				
20	6.57	1.408	0.0226				

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Gold chloride AuCl ₃				Hydrochloric acid HCl (Continued)			
100 sol.	7.0 mm			0	25.46 atm.	0.924	0.054
138.5	11.0			+20	41.58	0.831	0.097
181	61.2			40	64.52	0.697	0.180
202	154.5			51.5 c.p.	81.6	0.424	0.424
229	424.2			Hydrocyanic acid HCN			
251	808.7			25.65 liq.	1.00 atm.	0.695	0.0011
Helium He				40	1.67		
-271.9 liq.		0.1459		60	3.15		
-271.7	3. mm			80	5.52		
-271.0		0.1464		100	9.16		
-270.8		0.1466	0.001368	120	14.5		
-269.9	197.			140	22.1		
-269.2		0.1311	0.01176	160	32.7	0.420	0.050
-268.9 b.p.	1.000 atm.			180	47.1	0.290	0.120
-268.9		0.1253	0.01637	183.5 c.p.	50.	0.20	0.20
-268.4		0.1139	0.02699	Hydrogen H ₂			
-268.2	1.749			liq.			
-267.9 c.p.	2.261	0.06930	0.06930	-259.14 t.p.	51.4 mm		
Hydriodic acid HI				-258.46	79.9		
liq.				-258.27		0.07631	0.00020
-35.5 b.p.	1.00 atm.	2.798		-256.61	191.9		
-20	1.86			-254.73	397.6		
0	3.70			-253.24		0.07134	0.00116
+20	6.65	2.230		-252.74 b.p.	1.0000 atm.		
40	11.1			-248.50	2.8937		
60	17.3			-245.73		0.06050	0.00613
80	25.8			-245.68	5.0566		
100	37.0			-240.49	11.752		
120	51.6			-239.91 c.p.	12.80	0.03102	0.03102
140	70.4			Hydrogen sulfide H ₂ S			
150.5 c.p.	82.			-82 liq.	172 mm		
Hydrobromic acid HBr				-78	235.		
liq.				-74	339.		
-67.0 b.p.	1.00 atm.			-70	432.		
-60	1.41			-66	535.		
-40	3.31			-62	660.		
-20	6.72			-59.5 b.p.	1.00 atm.	0.965	
0	12.3			-40	2.50		
+20	20.6	1.589		-20	5.39		
40	32.5			0	10.2		
60	49.0			+20	17.7		
80	71.4			40	28.3		
90 c.p.	85.			60	43.0		
Hydrochloric acid HCl				80	62.6		
-108 liq.	168.5 mm			100.4 c.p.	88.9		
-104	226.2			Iodine I			
-100	329.8			-50 sol.	0.000037 mm		
-96	503.4			-40	0.00019		
-88	640.3			-30	0.00080		
-85.03 b.p.	1.00 atm.	1.191	0.0025	-20	0.0030		
-80	1.32	1.178	0.0032	-10	0.0099		
-60	3.45	1.122	0.0083	0	0.0299		
-40	7.55	1.063	0.017	+10	0.0808		
-20	14.53	0.997	0.032	20	0.202		

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Iodine I (Continued)				Mercurous chloride HgCl			
30	0.471 mm			100 sol.	0.0089 mm		
40	1.03			120	0.016		
50	2.16			140	0.038		
60	4.31			160	0.15		
70	8.22			180	0.45		
80	15.1			310	103.0		
90	26.8			330	189.2		
100	45.5			350	329.9		
110	74.9			370	548.9		
114.15 m.p.	90.1			Mercury Hg (See special table.)			
120 liq.	111.			-76.4 sol.	10 ⁻⁹ mm		
130	157.			-65.7	10 ⁻⁸		
140	217.			-53.6	10 ⁻⁷		
150	294.			-40.4	10 ⁻⁶		
160	394.			Molybdenum Mo			
170	521.			2293 sol.	0.001 mm		
180	679.			Neon Ne			
184.35 b.p.	760.			-257.62 sol.	0.55 mm		
190	869.			-254.92	7.8		
Iron Fe				-253.16	28.2		
1884 liq.	1. mm			-251.24	91.		
3235 b.p.	760.			-250.22	148.		
Krypton Kr				-249.09	250.		
sol.				-248.56	317.		
-169 t.p.	132.5 mm			-248.51 liq.	325.0		
-160.3 liq.	386.4			-247.49	451.6		
-151.8 b.p.	1.000 atm.			-246.66	605.2		
-130	4.315			-245.92 b.p.	1.000 atm.		
-90	24.27			-236.82	7.970		
-62.6 c.p.	54.24			-228.71 c.p.	26.86		
Lead Pb				Nickel Ni			
636.2 liq.	0.001 mm			1851 liq.	1. mm		
985.	1.			3147 b.p.	760.		
Lead chloride PbCl ₂				Nitric oxide NO			
400 sol.	0.00174 mm			liq.			
425	0.0058			-151.0 b.p.	1.0 atm.		
450	0.0178			-140	3.0		
475	0.051			-120	14.3		
Lead sulfide PbS				-100	46.		
850 sol.	2.0 mm			-93 c.p.	65.		
917	4.0			Nitrogen N ₂			
968	10.5			sol.			
995	17.0			-209.86 t.p.	96.4 mm		
Magnesium Mg				-198.26 liq.	561.3		
772. liq.	1. mm			-195.78 b.p.	1.000 atm.		
1070 b.p.	760.			-173.58	7.3705		
Manganese Mn				-152.11	25.889		
liq.				-147.13 c.p.	33.490		
1900 b.p.	760. mm			Nitrogen peroxide N ₂ O ₄			
				liq.			
				21.3 b.p.	1.00 atm.		

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Nitrogen peroxide N ₂ O ₄ (Continued)				Phosphorus pentachloride PCl ₅			
40	2.28 atm.			156.1 sol.	562.3 mm		
60	5.03			136.7	266.1		
80	10.3			101.4	37.58		
100	19.8			Phosphorus trioxide P ₂ O ₃			
120	35.9			30 liq.	3. mm		
140	62.2			50	9.0		
158 c.p.	99.			60	20.		
Nitrous oxide N ₂ O				70	60.		
liq.				80	150.		
-88.49 b.p.	1.000 atm.	1.226	0.0031	90	300.		
-73.18	2.312	1.199	0.0050	Pictet's fluid 64SO ₂ + 44CO ₂ by weight			
-53.18	5.662	1.140	0.0122	-30	585.2 mm		
-33.18	11.730	1.075	0.025	-25	676.4		
-20	18.1	1.001	0.048	-20	744.8		
0	31.3	0.910	0.087	-15	896.8		
+20	50.3	0.784	0.161	-10	1018.4		
36.5	71.7	0.451	0.451	-5	1216.0		
Oxygen O ₂				0	1390.8		
-210.4 liq.		1.2746	0.0000865	+5	1672.0		
-204.52	36.11 mm			10	1938.0		
-195.50	162.15			15	2264.8		
-186.91	493.30			20	2584.0		
-182.95 b.p.	1.000 atm.			25	2979.2		
-154.5		0.9758	0.0385	30	3382.0		
-149.25	12.506			35	3838.0		
-129.9		0.7781	0.1320	40	4347.2		
-125.28	38.571			45	4788.0		
-118.82 c.p.	49.713	0.4299	0.4299	50	5213.6		
Ozone O ₃				Potassium K			
-193.1 liq.	0.015 mm			162.3 liq.	0.001 mm		
-173.1	1.3			344.2	1.		
-153.1	25.4			758 b.p.	760.		
-133.1	182.8			Radon Rn			
-112.4 b.p.	760.			-101 sol.	50 mm		
-5 c.p.	67. atm.			-70.5 t.p.	500.		
Phosphine PH ₃				-61.8 liq.	1.000 atm.		
-129 liq.	43.0 mm			-50	2.065		
-121	85.7			-20	5.260		
-113	158.3			10	11.40		
-101	354.2			70	37.67		
-89	699.5			104.4 c.p.	62.44		
-87.5 b.p.	1.00 atm.	0.746	0.0023	Selenium Se			
-80	1.46	0.738	0.0032	200 sol.	0.0015 mm		
-60	3.47	0.712	0.0073	210	0.0032		
-40	7.1	0.684	0.014	217.4 m.p.	0.0055		
-20	12.9	0.651	0.025	220 liq.	0.0062		
0	21.6	0.613	0.042	230	0.0097		
20	34.2	0.566	0.067	390	3.0		
40	51.9	0.50	0.11	400	4.0		
51 c.p.	64.	0.30	0.30	420	7.0		
Phosphonium chloride PH ₄ Cl				440	11.		
-63.0 sol.	39.81 mm			460	17.		
-26.8	760.0			480 liq.	28.		
0.9	5623.0			500	42.		

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Selenium Se (Continued)				Sulfur S (Continued)			
620	313. mm	.....	.....	190	1.4 mm	.....	.....
640	420.	.....	.....	200	2.1	.....	.....
660	550.	.....	.....	210	3.1	.....	.....
680	700.	.....	.....	220	4.4	.....	.....
688 b.p.	760.	.....	.....	230	6.3	.....	.....
Selenium dioxide SeO ₂				240	8.7	.....	.....
72.0 sol	13.43 mm	.....	.....	250	12.	.....	.....
180.9	39.00	.....	.....	260	16.	.....	.....
236.9	66.07	.....	.....	270	21.	.....	.....
289.2	316.2	.....	.....	280	28.	.....	.....
317.0	760.0	.....	.....	290	37.	.....	.....
Silicon Si				300	48.	.....	.....
719.2 sol	0.001 mm	.....	.....	310	60.	.....	.....
1219	1.	.....	.....	320	76.	.....	.....
Silver Ag				330	95.	.....	.....
837 liq.	0.001 mm	.....	.....	340	118.	.....	.....
1218	1.	.....	.....	350	146.	.....	.....
1948 b.p.	760.	.....	.....	360	179.	.....	.....
Silver oxide Ag ₂ O				370	218.	.....	.....
1316 sol.	0.46 mm	.....	.....	380	263.	.....	.....
1435	3.4	.....	.....	390	325.	.....	.....
Sodium Na				400	376.	.....	.....
238.1 liq.	0.001 mm	.....	.....	410	446.	.....	.....
441.2	1.	.....	.....	420	525.	.....	.....
882. b.p.	760.	.....	.....	430	613.	.....	.....
Stannic chloride SnCl ₄				440	711.	.....	.....
- 10 liq.	2.8 mm	.....	.....	444.60 b.p.	760.0	.....	.....
10	10.3	.....	.....	450	821.	.....	.....
30	31.3	.....	.....	460	948.	.....	.....
60	112.0	.....	.....	470	1093.	.....	.....
90	360.5	.....	.....	480	1257.	.....	.....
114.1 b.p.	1.00 atm.	1.978	0.0085	490	1441.	.....	.....
120	1.18	1.963	0.0099	500	1647.	.....	.....
140	1.96	1.907	0.0162	510	1876.	.....	.....
Strontium Sr				520	2130.	.....	.....
713.4 liq.	0.001 mm	.....	.....	530	2410.	.....	.....
899	1.	.....	.....	540	2718.	.....	.....
1154 b.p.	760.	.....	.....	550	3055.	.....	.....
Sulfur S				560	3423.	.....	.....
50 sol.	0.0002 mm	.....	.....	570	3824.	.....	.....
60	0.0004	.....	.....	Sulfur dioxide SO ₂			
70	0.0010	.....	.....	°C	Pressure	Sp. Vol. cm ³ /g	
80	0.0023	.....	.....			liq.	vap.
90	0.0049	.....	.....	-70 liq.	19.9 mm	.....	.....
100	0.010	.....	.....	-65	30.0	.....	.....
110	0.021	.....	.....	-60	42.8	.....	.....
114.5 m.p.	0.028	.....	.....	-55	61.8	.....	.....
120 liq.	0.040	.....	.....	-50	86.7	0.6423	.....
130	0.074	.....	.....	-45	119.6	0.6472	.....
140	0.13	.....	.....	-40	162.3	0.6523	.....
150	0.22	.....	.....	-35	217.1	0.6575	.....
160	0.37	.....	.....	-30	286.0	0.6627	.....
170	0.59	.....	.....		
180	0.91	.....	.....		

VAPOR PRESSURE (Continued)

°C	Pressure	Sp. Vol. cm ³ /g		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Sulfur dioxide SO ₂ (Continued)				Sulfur trioxide SO ₃			
-25	373.0 mm	0.6680		liq.			
-20	478.0	0.6739		44.6 b.p.	1.00 atm	1.807	0.003
-15	607.0	0.6798		60	2.0	1.732	0.006
-10	761.0	0.6859		80	4.3	1.639	0.013
-5	947.0	0.6916		100	8.0	1.547	0.025
0	1.529 atm.	0.6974		120	13.3	1.465	0.037
+ 2	1.657	0.6998		140	20.6	1.382	0.056
4	1.793	0.7022		160	30.3	1.296	0.086
6	1.938	0.7047		180	43.4	1.196	0.137
8	2.092	0.7072	156.3	200	61.1	1.058	0.233
10	2.256	0.7097	147.1	218.3 c.p.	83.6	0.630	0.630
12	2.429	0.7123	137.0				
14	2.613	0.7153	128.2	Thallium Tl			
16	2.807	0.7179	119.0	412.7 liq.	0.001 mm		
18	3.012	0.7205	111.1	748	1.		
20	3.228	0.7231	103.1	1650 b.p.	760.		
22	3.456	0.7262	97.09	Tin Sn			
24	3.697	0.7289	90.91	1282 liq.	0.001 mm		
26	3.951	0.7315	86.21	1503	1.		
28	4.217	0.7348	81.30	2260 b.p.	760.		
30	4.498	0.7375	75.76	Tungsten W			
32	4.793	0.7407	70.92	3353 sol.	0.001 mm		
34	5.102	0.7440	66.67	Xenon Xe			
36	5.427	0.7474	62.50	liq.			
38	5.768	0.7508	58.14	-109.1 b.p.	1.000 atm.		
40	6.125	0.7536	54.64	-100	1.629		
42	6.499	0.7570	51.02	-60	8.570	2.699	0.079
44	6.890	0.7610	48.08	-20	26.73	2.292	0.238
46	7.300	0.7646	45.25	0.0	41.24	1.987	0.421
48	7.729	0.7680	42.74	16.6 c.p.	58.22	1.154	1.154
50	8.176	0.7722	40.65	Zinc Zn			
60	10.729	0.7918	31.85	296.3 sol.	0.001 mm		
70	13.867	0.8137	25.77	487.7 liq.	1.		
80	17.682	0.8382	20.92	558.9	5.		
90	22.268	0.8658	16.39	594.1	10.		
100	27.714	0.8977	12.94	632.3	20.		
110	34.091	0.9355	10.31				
120	41.432	0.9823	8.078				
130	49.705	1.0449	6.146				
140	58.783	1.1363	4.554				
150	68.405	1.3038	3.256				

Organic Compounds

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Acetic acid C ₂ H ₄ O ₂				Acetic acid C ₂ H ₄ O ₂ (Continued)			
20 liq	11.7 mm			90	293.7 mm		
30	20.6			100	417.1		
40	34.8			110	580.8		
50	56.6			118.5 b.p.	1.000 atm.	0.9380	0.003150
60	88.9			120	1.058	0.9362	0.003271
70	136.0			140	1.884	0.9091	0.005515
80	202.3			160	3.149	0.8829	0.00887

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Acetic acid C ₂ H ₄ O ₂ (Continued)				Acetylene C ₂ H ₂			
180	5.014 atm.	0.8555	0.01370	-84.0 liq.	1.00 atm.		
200	7.682	0.8265	0.02052	-81.5 t.p.	1.20	0.618	0.0021
220	11.39	0.7941	0.03021	-60	3.48	0.585	0.0056
240	16.42	0.7571	0.04327	-40	7.7	0.551	0.012
260	23.07	0.7136	0.06165	-20	14.9	0.512	0.024
280	31.67	0.6629	0.0883	0	26.3	0.464	0.045
300	42.54	0.5950	0.1331	+20	43.1	0.400	0.082
320	56.01	0.4615	0.2417	36.0	61.7	0.230	0.230
321.6 c.p.	57.21	0.3506	0.3506				
Acetone C ₃ H ₆ O				Amyl alcohol C ₅ H ₁₂ O			
-94.8 sol.	0.017 mm			0 liq.	0.6 mm		
-90 liq.	0.021			10	1.3		
-70	0.34			20	2.8		
-50	2.4			40	10.6		
-30	11.2			60	34.1		
-10	38.7			80	95.1		
5	89.1			100	233.3		
+10	115.6			110	350.3		
15	147.1			120	512.3		
20	184.8			130	730.8		
25	229.2						
30	282.7						
35	346.4						
40	421.5						
45	510.5						
50	612.6						
56.1 b.p.	1.000 atm.	0.750	0.002				
60	1.14	0.746	0.003				
70	1.58	0.734	0.003				
80	2.12	0.719	0.004				
90	2.81	0.706	0.005				
100	3.67	0.693	0.007				
110	4.74	0.679	0.009				
120	6.01	0.665	0.011				
130	7.53	0.650	0.013				
140	9.33	0.634	0.016				
150	11.5	0.618	0.020				
160	13.9	0.601	0.024				
170	16.6	0.588	0.030				
180	20.0	0.568	0.039				
190	23.8	0.540	0.050				
200	28.0	0.514	0.065				
210	32.7	0.482	0.085				
220	38.1	0.443	0.110				
230	44.1	0.393	0.152				
235 c.p.	47.0	0.268	0.268				
Acetonitrile C ₂ H ₃ N				iso-Amyl alcohol C ₅ H ₁₂ O			
80 liq.		0.717	0.001	10 liq.	1.0 mm		
100		0.694	0.002	20	2.3		
120		0.670	0.004	40	9.7		
140		0.646	0.007	60	33.3		
160		0.620	0.011	80	95.9		
180		0.590	0.015	100	238.6		
200		0.555	0.022	110	358.6		
220		0.514	0.034	120	523.3		
240		0.467	0.053	130	743.2		
260		0.399	0.091	140	1033.		
274.7 c.p.		0.240	0.240	150	1400.		
				Aniline C ₆ H ₇ N			
				50 liq.	2.4 mm		
				60	5.7		
				70	10.6		
				80	18.0		
				90	29.2		
				100	45.7		
				110	69.2		
				120	96.6		
				130	144.5		
				Benzene. See end of table			
				Benzoic acid C ₇ H ₆ O ₂			
				100 liq.	1.79 mm		
				140	14.6		
				150	23.6		
				160	36.3		
				170	55.8		
				180	81.6		
				190	119.1		
				200	171.3		
				210	239.		
				220	331.5		
				230	451.		

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Benzoic acid C ₇ H ₆ O ₂ (Continued)				n-Butyl alcohol C ₄ H ₁₀ O (Continued)			
240	597. mm			65	77.7 mm		
250	780.			70	112.3		
				75	131.3		
Benzophenone C ₁₃ H ₁₀ O				iso-Butyl alcohol C ₄ H ₁₀ O			
0 sol.	2.03 × 10 ⁻⁵ mm			60 liq.	99.1 mm		
8	6.94 × 10 ⁻⁵			70	158.5		
32	1.418 × 10 ⁻³			80	248.9		
Benzoyl chloride C ₆ H ₅ ClO				90	384.6		
40 liq.	1.1 mm			100	583.5		
50	2.4			110	845.3		
60	4.8			120	1197.		
70	8.2			130	1668.		
80	13.6			iso-Butyl formate C ₆ H ₁₀ O ₂			
90	21.8			40 liq.	84. mm		
100	33.9			60	200.		
110	51.4			80	417.		
120	75.1			95	687.		
130	107.8			97.9 b.p.	1.000 atm.		
140	152.0			100	1.067		
Bromobenzene C ₆ H ₅ Br				120	1.92		
30 liq.	5.67 mm			140	3.25		
40	9.99			160	5.19		
50	16.96			180	7.89		
60	27.61			200	11.5		
70	43.55			220	16.3		
80	66.22			240	22.3		
90	97.72			260	29.8		
100	141.1			278 c.p.	38.		
110	198.7			Butyric acid C ₄ H ₈ O ₂			
120	274.9			20 liq.	0.75 mm		
140	495.8			30	1.5		
156.15 b.p.	760.			40	3.0		
160	846.	1.2994	0.0052	50	5.25		
180	1350.	1.2697	0.0081	60	9.35		
200	2075.	1.2385	0.0121	Camphor C ₁₀ H ₁₆ O			
220	3055.	1.2037	0.0174	180 liq.	380. mm		
240	4360.	1.1689	0.0248	190	490.		
260	6080.	1.1310	0.0343	200	624.		
397 c.p.	33900.	0.4859	0.4859	Caproic acid C ₆ H ₁₂ O ₂			
iso-Butane C ₄ H ₁₀				80 liq.	2.5 mm		
-30 liq.	463. mm			90	5.3		
-25	544.			100	10.6		
-20	646.			110	18.9		
-15	745.			120	31.4		
n-Butyl alcohol C ₄ H ₁₀ O				130	51.0		
20 liq.	4.39 mm			135	62.6		
25	6.44			Carbon tetrachloride CCl ₄			
30	9.52			-20 liq.	9.8 mm		
35	13.1			-15	13.5		
40	18.6			-10	18.5		
45	24.9			-5	24.8		
50	33.7			0	32.9		
55	44.9						
60	59.2						

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Carbon tetrachloride CCl ₄ (Continued)				Chlorobenzene C ₆ H ₅ Cl (Continued)			
+5	43.2 mm			50	41.98 mm		
10	56.0			60	65.54		
15	71.7			70	97.90		
20	91.			80	144.75		
25	114.5			90	208.35		
30	143.0			100	292.75		
35	176.2			110	402.55		
40	215.8			120	542.80		
45	262.5			130	718.95		
50	317.1			132 b.p.	760.		
55	379.3			140	939.5	0.9723	0.0043
60	450.8			160	1535.	0.9480	0.0068
65	530.9			180	2370.	0.9224	0.0102
70	622.3			200	3520.	0.8955	0.0151
76.75 b.p.	760.			220	5055.	0.8672	0.0214
80	838.	1.4765	0.0061	240	7050.	0.8356	0.0300
90	1112.	1.4554	0.0080	260	9650.	0.8016	0.0417
100	1457.	1.4343	0.0103	359.2 c.p.	33900.	0.3654	0.3654
110	1880.	1.4124	0.0131	o-Chlorobenzoic acid C ₇ H ₅ ClO ₂			
120	2390.	1.3902	0.0164	100 sol.	0.1803 mm		
130	3000.	1.3680	0.0204	m-Chlorobenzoic acid C ₇ H ₅ ClO ₂			
140	3725.	1.3450	0.0250	100.63 sol.	0.197 mm		
150	4555.	1.3215	0.0304	p-Chlorobenzoic acid C ₇ H ₅ ClO ₂			
160	5535.	1.2983	0.0365	100 sol.	0.045 mm		
170	6640.	1.2734	0.0437	Chloroform CHCl ₃			
180	7900.	1.2470	0.0525	-60 liq.	0.81 mm		
190	9315.	1.2192	0.0625	-50	2.06		
200	10940.	1.1888	0.0742	-40	4.7		
210	12760.	1.1566	0.0879	-30	10.0		
220	14800.	1.1227	0.1040	-20	19.6		
230	17060.	1.0857	0.1232	-10	34.75		
240	19600.	1.0444	0.1464	0	61.0		
250	22410.	0.9980	0.1754	+10	100.5		
o-Chloroaniline C ₆ H ₄ ClN				20	159.6		
80 liq.	7.7 mm			25	199.1		
100	20.7			30	246.0		
120	48.4			35	301.3		
140	101.9			40	366.4		
160	199.1			45	439.0		
180	358.5			50	526.0		
200	608.2			55	625.2		
m-Chloroaniline C ₆ H ₄ ClN				60	739.6		
100 liq.	9.0 mm			60.9 b.p.	760.0		
120	23.1			70	1019.		
140	52.1			80	1403.		
160	107.2			90	1880.		
180	203.5			100	2430.		
200	363.1			110	3100.		
220	616.6			120	3890.		
Chlorobenzene C ₆ H ₅ Cl				130	4860		
0. liq.	2.52 mm			140	5950		
10	4.86			150	7080		
20	8.76			160	8800.		
30	15.45						
40	26.00						

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
o-Cresol C ₇ H ₈ O				Cymene C ₁₀ H ₁₄ (Continued)			
60 liq.	3.55 mm			80	43.55 mm		
80	11.5			100	87.85		
100	31.6			120	169.25		
120	74.1			140	304.65		
140	158.1			160	519.6		
160	308.3			p-Dibromobenzene C ₆ H ₄ Br ₂			
180	566.9			84.0 sol.	7.586 mm		
m-Cresol C ₇ H ₈ O				52.8	0.6607		
60 liq.	1.76 mm			21.0	0.0158		
80	6.37			Diethylamine C ₄ H ₁₁ N			
100	19.05			54.0 liq.	724. mm		
120	48.6			55.4 b.p.	1.000 atm.	0.668	0.003
140	106.9			60	1.16	0.663	0.003
160	219.3			80	2.13	0.640	0.005
180	411.2			100	3.67	0.616	0.008
p-Cresol C ₇ H ₈ O				120	5.92	0.591	0.014
60 liq.	1.7 mm			140	9.10	0.562	0.022
80	6.17			160	13.4	0.528	0.035
100	18.3			180	18.9	0.489	0.053
120	47.4			200	25.8	0.438	0.080
140	105.0			220	34.4	0.339	0.150
160	216.8			223.5 c.p.	36.2	0.246	0.246
180	407.4			Diethylaniline C ₁₀ H ₁₅ N			
Cyanogen C ₂ N ₂				60 liq.	2.7 mm		
-25 liq.	629.8 mm			80	6.8		
-21.17 b.p.	1.000 atm.			100	16.2		
-20	1.055			120	38.2		
0	2.414			140	80.6		
+20	4.85			160	158.0		
40	8.80			180	291.7		
60	14.8			200	504.0		
80	23.4			220	837.0		
100	35.3			Dimethylamine C ₂ H ₇ N			
120	51.5			6.05 liq.	724. mm		
128.3 c.p.	59.7			7.2 b.p.	1.000 atm.		
Cyclohexane C ₆ H ₁₂				20	1.66		
liq.				40	3.32		
80.75 b.p.	760. mm	0.7199	0.0029	60	6.04		
100	1304.	0.6988	0.0049	80	10.2		
120	2140.	0.6775	0.0080	100	16.0		
140	3355.	0.6553	0.0123	120	23.9		
160	5040.	0.6313	0.0184	140	34.4		
180	7285.	0.6060	0.0265	160	48.0		
200	10130.	0.5773	0.0380	164.6 c.p.	51.7		
220	13690.	0.5443	0.0534	Dinitrophenol-2, 4 C ₆ H ₄ N ₂ O ₆			
240	18140.	0.5058	0.0746	100 sol.	0.228 mm		
260	23590.	0.4537	0.1097	Diphenyl C ₁₂ H ₁₀			
281.0 c.p.	30835.	0.2703	0.2703	210 liq.	243. mm		
Cymene C ₁₀ H ₁₄				220	330.		
0 liq.	4.65 mm			225	376.5		
20	6.3			230	426.6		
40	10.95			235	482.		
60	21.4						

VAPOR PRESSURE (Continued)

°C	Pressure	Density ■ /cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Diphenyl C ₁₂ H ₁₀ (Continued)				Ethyl alcohol C ₂ H ₆ O (Continued)			
240	542.9 mm	.....	.....	+5	17.3 mm	.....	.....
245	609.5	.....	.....	10	23.6	.....	.....
250	681.6	.....	.....	15	32.2	.....	.....
Ethane C ₂ H ₆				20	43.9	.....	.....
-140 liq.	14.1 mm	.....	.....	25	59.0	.....	.....
-130	39.5	.....	.....	30	78.8	.....	.....
-120	94.7	.....	.....	35	103.7	.....	.....
-110	202.8	.....	.....	40	135.3	.....	.....
-100	393.8	.....	.....	45	174.0	.....	.....
-90	705.2	.....	.....	50	222.2	.....	.....
-88.62 b.p.	1.000 atm.	0.546	0.00206	55	280.6	.....	.....
-80	1.556	0.535	0.00311	60	352.7	.....	.....
-60	3.743	0.509	0.00707	65	448.8	.....	.....
-40	7.672	0.482	0.0141	70	542.5	.....	.....
-20	14.02	0.453	0.0260	75	666.1	.....	.....
0	23.56	0.416	0.0463	78.3 b.p.	1.000 atm.	0.7365	0.00165
+20	37.28	0.363	0.085	80	1.069	0.7348	0.00174
32.2 c.p.	48.2	0.220	0.220	90	1.562	0.7251	0.00250
Ethyl acetate C ₄ H ₈ O ₂				100	2.228	0.7157	0.00351
-20 liq.	6.5 mm	.....	.....	110	3.107	0.7057	0.00486
-10	12.9	.....	.....	120	4.243	0.6925	0.00658
0	24.2	.....	.....	130	5.685	0.6789	0.00877
+10	42.8	.....	.....	140	7.486	0.6631	0.01152
20	72.8	.....	.....	150	9.700	0.6489	0.01488
30	118.7	.....	.....	160	12.39	0.6329	0.01916
40	186.3	.....	.....	170	15.61	0.6165	0.02446
50	282.3	.....	.....	180	19.44	0.5984	0.03115
60	415.3	.....	.....	190	23.94	0.5782	0.0397
70	596.3	.....	.....	200	29.20	0.5568	0.0508
77.15 b.p.	1.000 atm.	0.8283	0.003230	210	35.31	0.5291	0.0655
80	1.093	0.8245	0.003495	220	42.38	0.4958	0.0854
100	2.000	0.7972	0.006158	230	50.53	0.4550	0.1135
120	3.404	0.7683	0.01030	240	59.92	0.3825	0.1715
140	5.461	0.7378	0.01650	243.1 c.p.	63.11	0.2755	0.2755
160	8.349	0.7033	0.02577	Ethylamine C ₂ H ₇ N			
180	12.27	0.6653	0.03883	15.45 liq.	724. mm	.....	.....
200	17.45	0.6210	0.05797	16.6 b.p.	1.000 atm.	.....	.....
220	24.15	0.5648	0.08905	20	1.14	.....	.....
240	32.68	0.4778	0.1499	40	2.34	.....	.....
250.1 c.p.	37.80	0.3077	0.3077	60	4.35	.....	.....
Ethyl alcohol C ₂ H ₆ O				80	7.48	.....	.....
-65 liq.	0.021 mm	.....	.....	100	12.1	.....	.....
-60	0.045	.....	.....	120	18.5	.....	.....
-55	0.087	.....	.....	140	27.0	.....	.....
-50	0.12	.....	.....	160	38.4	.....	.....
-45	0.24	.....	.....	180	52.9	.....	.....
-40	0.39	.....	.....	183.2 c.p.	55.5	.....	.....
-35	0.63	.....	.....	Ethyl bromide C ₂ H ₅ Br			
-30	1.04	.....	.....	-20 liq.	59. mm	.....	.....
-25	1.63	.....	.....	-10	101.	.....	.....
-20	2.5	.....	.....	0	165.	.....	.....
-15	3.65	.....	.....	+10	257.	.....	.....
-10	5.6	.....	.....	20	386.	.....	.....
-5	8.3	.....	.....	30	564.	.....	.....
0	12.2	.....	.....	40	802.	.....	.....
				50	1113.	.....	.....
				60	1512.	.....	.....

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Ethyl chloride C ₂ H ₅ Cl				Ethyl ether C ₄ H ₁₀ O (Continued)			
liq.				60	2.275 atm.	0.6658	0.006771
12.2 b.p.	1.00 atm.	0.9060	0.00285	70	3.021	0.6532	0.00892
20	1.33	0.8943	0.00372	80	3.939	0.6402	0.01155
40	2.55	0.8633	0.00692	90	5.054	0.6250	0.01477
60	4.50	0.8306	0.0120	100	6.394	0.6105	0.01867
80	7.41	0.7958	0.0190	110	7.987	0.5942	0.02349
100	11.5	0.7575	0.0294	120	9.861	0.5764	0.02934
120	17.2	0.715	0.043	130	12.05	0.5580	0.03638
140	24.7	0.665	0.064	140	14.58	0.5385	0.04488
160	34.3	0.602	0.099	150	17.48	0.5179	0.05551
180	46.6	0.494	0.178	160	20.80	0.4947	0.06911
187 c.p.	51.6	0.331	0.331	170	24.57	0.4658	0.08731
Ethylene C ₂ H ₄				180	28.81	0.4268	0.1135
liq.				185	31.12	0.4018	0.1320
-103.8 b.p.	1.00 atm.	0.569	0.0022	190	33.57	0.3663	0.1620
-100	1.24	0.564	0.0026	193.8 c.p.	35.52	0.2625	0.2625
-80	3.35	0.534	0.0063	Ethyl formate C ₃ H ₆ O ₂			
-60	7.38	0.500	0.0133	-20 liq.	22.5 mm		
-40	14.2	0.461	0.025	0	72.4		
-20	24.8	0.414	0.046	+20	192.5		
0	40.6	0.345	0.088	40	446.7		
+ 9.6 c.p.	50.6	0.210	0.210	54.35 b.p.	1.000 atm.	0.8767	0.002843
Ethylene bromide C ₂ H ₄ Br ₂				60	1.208	0.8689	0.003370
-28.21 sol.	1.51 mm			80	2.251	0.8409	0.006098
-12.30	2.65			100	3.883	0.8112	0.01032
0.	3.47			120	6.290	0.7796	0.01657
6.54	6.16			140	9.674	0.7448	0.02564
-10 liq	2.5			160	14.26	0.7058	0.03876
9	3.9			180	20.28	0.6610	0.05747
Ethylene oxide C ₂ H ₄ O				200	28.00	0.6066	0.08621
-60 liq.	15.3 mm			220	37.70	0.5290	0.1379
-40	64.1			230	43.39	0.4635	0.1890
-20	196.4			235.3 c.p.	46.65	0.3232	0.3232
-10	316.3			Ethyl iodide C ₂ H ₅ I			
0	493.1			0 liq.	41.5 mm		
+10	738.0			10	68.5		
Ethyl ether C ₄ H ₁₀ O				20	108.5		
-119.8 sol.	0.0027 mm			30	167.5		
-117.3	0.0065			40	251.5		
-100 liq.	0.05			50	364.0		
-80	0.6			60	512.0		
-60	4.1			Ethyl propionate C ₅ H ₁₀ O ₂			
-40	19.0			0 liq.	8.3 mm		
-30	37.6			20	27.75		
-10	112.3			40	77.9		
0	185.3			60	188.0		
+ 5	233.2			80	403.6		
10	291.7			99.0 b.p.	1.000 atm.	0.7964	0.003489
15	360.7			100	1.027	0.7951	0.003580
20	442.2			120	1.828	0.7692	0.00620
25	537.0			140	3.042	0.7413	0.01024
30	647.3			160	4.788	0.7115	0.01615
34.6 b.p.	1.000 atm.	0.6962	0.003162	180	7.206	0.6795	0.02469
40	1.212	0.6894	0.003731	200	10.45	0.6443	0.03676
50	1.680	0.6764	0.005079	220	14.73	0.6027	0.05435
				240	20.28	0.5501	0.08230

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Ethyl propionate C ₅ H ₁₀ O ₂ (Continued)				Heptane C ₇ H ₁₆ (Continued)			
260	27.40 atm.	0.4744	0.1337	100	795.2 mm		
270	31.69	0.4018	0.1957	110	1047.		
272.9 c.p.	33.03	0.2965	0.2965	120	1367.		
Ethyl sulfide C ₄ H ₁₀ S				Hydroquinol C ₆ H ₆ O ₂			
20 liq.	63.8 mm			155.0 sol.	5.9 mm		
40	137.0			164.3	1.0		
60	233.5			150 liq.	4.0		
80	539.5			170	15.2		
90.3 b.p.	1.000 atm.	0.765	0.003	190	37.7		
100	1.32	0.755	0.003	200	55.7		
120	2.26	0.732	0.005	210	79.8		
140	3.66	0.709	0.008	230	158.5		
160	5.68	0.684	0.011	250	291.8		
180	8.36	0.656	0.017	270	509.3		
200	12.0	0.625	0.027	o-Hydroxybenzoic acid C ₇ H ₆ O ₃			
220	16.6	0.590	0.041	100 sol.	0.397 mm		
240	22.3	0.549	0.061	m-Hydroxybenzoic acid C ₇ H ₆ O ₃			
260	29.3	0.494	0.094	101.06 sol.	0.00149 mm		
280	37.6	0.395	0.175	p-Hydroxybenzoic acid C ₇ H ₆ O ₃			
283.8 c.p.	39.1	0.279	0.279	100.91 sol.	0.00030 mm		
Formic acid CH ₂ O ₂				Iodobenzene C ₆ H ₅ I			
2 sol.	9.7 mm			30 liq.	1.48 mm		
4	11.6			40	2.24		
6	14.1			50	4.85		
8	17.4			60	8.30		
10 liq.	18.9			70	13.65		
20	33.1			80	21.78		
30	52.2			90	33.50		
40	82.6			100	50.23		
50	125.9			110	73.88		
60	189.7			120	105.4		
70	279.6			130	148.3		
80	398.1			140	204.9		
90	552.1			150	276.7		
100	753.4			160	367.3		
Glycol C ₂ H ₆ O ₂				170	479.7		
120 liq.	39. mm			180	618.7		
130	62.			188.45 b.p.	760.		
140	96.8			200	991.	1.5470	0.0073
150	147.9			220	1520.	1.5124	0.0108
160	218.8			240	2245.	1.4764	0.0156
170	316.2			260	3220.	1.4384	0.0220
180	445.2			448 c.p.	33900.	0.5814	0.5814
190	615.9			Mesitylene C ₉ H ₁₂			
Heptane C ₇ H ₁₆				0 liq.	15.6 mm		
0 liq.	11.45 mm			20	27.15		
10	20.5			40	48.9		
20	35.5			60	87.35		
30	58.35			80	150.8		
40	92.05			100	247.25		
50	140.9			120	381.1		
60	208.9			140	550.05		
70	302.3			160	740.35		
80	426.6						
90	588.8						

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Methane CH ₄				Methyl n-butyrate C ₅ H ₁₀ O ₂ (Continued)			
-182 liq.	94.0 mm	.....	.....	60	167.5 mm	.....	.....
-178	152.1	.....	.....	80	361.4	.....	.....
-176	190.5	.....	.....	100	700.7	.....	.....
-161.5 b.p.	1.00 atm.	0.4245	0.0018	102.75 b.p.	1.000 atm.	0.8035	0.003595
-160	1.13	0.4222	0.0020	120	1.649	0.7816	0.005708
-140	4.38	0.3916	0.0068	140	2.756	0.7551	0.009294
-120	11.84	0.3547	0.0175	160	4.359	0.7270	0.01459
-100	25.7	0.3050	0.0413	180	6.587	0.6964	0.02215
- 82.1 c.p.	45.8	0.1615	0.1615	200	9.593	0.6633	0.03268
Methyl acetate C ₃ H ₆ O ₂				220	13.55	0.6251	0.04831
-135 sol.	0.00354 mm	.....	.....	240	18.69	0.5773	0.07143
- 20 liq.	19.	.....	.....	260	25.25	0.5166	0.1091
0	62.1	.....	.....	280	33.58	0.3812	0.2201
20	169.8	.....	.....	281.3 c.p.	34.19	0.3002	0.3002
40	400.4	.....	.....	Methyl iso-butyrate C ₅ H ₁₀ O ₂			
57.15 b.p.	1.000 atm.	0.8840	0.002830	0	12.1 mm	.....	.....
60	1.104	0.8800	0.003076	20	38.9	.....	.....
80	2.092	0.8519	0.005618	40	104.7	.....	.....
100	3.659	0.8221	0.009671	60	243.8	.....	.....
120	5.998	0.7893	0.01570	80	505.0	.....	.....
140	9.325	0.7532	0.02454	92.3 b.p.	1.000 atm.	0.8040	0.003617
160	13.88	0.7133	0.03731	100	1.257	0.7945	0.004472
180	19.95	0.6671	0.05682	120	2.193	0.7680	0.007628
200	27.84	0.6100	0.08658	140	3.588	0.7396	0.01224
220	37.92	0.5281	0.1416	160	5.569	0.7095	0.01903
233.7 c.p.	46.31	0.3252	0.3252	180	8.280	0.6767	0.02869
Methyl alcohol CH ₄ O				200	11.89	0.6411	0.04228
liq.				220	16.59	0.5961	0.06289
64.7 b.p.	1.000 atm.	0.7510	0.001222	240	22.64	0.5386	0.09615
80	1.764	0.7355	0.002084	260	30.32	0.4495	0.1623
100	3.452	0.7140	0.003984	267.55 c.p.	33.72	0.3012	0.3012
120	6.255	0.6900	0.007142	Methyl chloride CH ₃ Cl			
140	10.63	0.6640	0.01216	liq.			
160	17.11	0.6340	0.01994	- 24.0 b.p.	1.00 atm.	0.997	0.00255
180	26.35	0.5980	0.03186	- 20	1.18	0.990	0.00297
200	39.08	0.5530	0.05075	0	2.50	0.955	0.00599
220	56.18	0.4900	0.08635	+ 20	4.75	0.918	0.0110
230	66.67	0.4410	0.1187	40	8.33	0.878	0.0139
240.0 c.p.	78.67	0.2722	0.2722	60	13.6	0.832	0.032
Methylamine CH ₅ N				80	21.2	0.783	0.049
liq.				100	31.4	0.725	0.075
- 6.6 b.p.	1.000 atm.	.....	.....	120	45.0	0.647	0.120
0	1.33	.....	.....	140	62.6	0.497	0.238
+ 20	2.92	.....	.....	143.2 c.p.	65.8	0.365	0.365
40	5.93	.....	.....	Methylene bromide CH ₂ Br ₂			
60	10.15	.....	.....	0 liq.	11.5 mm	.....	.....
80	16.7	.....	.....	10	20.4	.....	.....
100	25.9	.....	.....	20	34.7	.....	.....
120	38.5	.....	.....	30	56.4	.....	.....
140	55.1	.....	.....	Methylene chloride CH ₂ Cl ₂			
156.9 c.p.	73.6	.....	.....	0 liq.	147. mm	.....	.....
Methyl n-butyrate C ₅ H ₁₀ O ₂				10	229.7	.....	.....
0 liq.	7.3 mm	.....	.....	20	348.9	.....	.....
20	24.5	.....	.....	30	511.4	.....	.....
40	69.2	.....	.....		

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Methyl ether C ₂ H ₆ O				Methyl formate C ₂ H ₄ O ₂ (Continued)			
liq.				140	17.83 atm.	0.7638	0.04124
- 23.7 b.p.	1.000 atm.	0.7222	0.0024	160	25.64	0.7136	0.06231
- 20	1.17	0.7174	0.0027	180	35.76	0.6521	0.09434
- 10	1.74	0.7040	0.0039	200	48.50	0.5658	0.1524
0	2.54	0.6905	0.0055	214.0 c.p.	59.15	0.3489	0.3489
+ 10	3.59	0.6759	0.0076	Methyl iodide CH ₃ I			
20	4.95	0.6610	0.0104	0 liq.	141.2 mm		
30	6.62	0.6455	0.0142	10	220.2		
40	8.69	0.6292	0.0188	20	331.4		
50	11.25	0.6116	0.0241	30	483.4		
60	14.27	0.5932	0.0306	Methyl propionate C ₄ H ₈ O ₂			
70	17.90	0.5735	0.0385	- 20 liq.	5.6 mm		
80	22.10	0.5517	0.0484	0	21.9		
90	26.9	0.5257	0.0623	+ 20	66.2		
100	32.6	0.4950	0.0810	40	169.3		
110	39.0	0.4575	0.1060	60	380.3		
115	42.5	0.4350	0.1222	79.7 b.p.	1.000 atm.	0.8412	0.003173
120	46.3	0.4040	0.1465	80	1.006	0.8408	0.003199
125	50.3	0.3510	0.1930	100	1.851	0.8137	0.005714
126.9 c.p.	52.0	0.2714	0.2714	120	3.165	0.7852	0.009569
Methyl ethyl ether C ₃ H ₈ O				140	5.096	0.7553	0.01529
liq.				160	7.812	0.7221	0.02356
7.5 b.p.	1.000 atm.	0.716	0.003	180	11.50	0.6856	0.03552
10	1.10	0.713	0.004	200	16.38	0.6445	0.05236
20	1.61	0.700	0.006	220	22.68	0.5938	0.07812
30	2.29	0.687	0.008	240	30.70	0.5220	0.1236
40	3.14	0.672	0.010	Methyl salicylate C ₈ H ₈ O ₂			
50	4.24	0.658	0.013	216 liq.	645.5 mm		
60	5.56	0.644	0.016	218	677.2		
70	7.21	0.628	0.019	220	710.2		
80	9.16	0.612	0.023	222	744.3		
90	11.4	0.596	0.029	224	779.8		
100	14.2	0.579	0.034	225	798.1		
110	17.3	0.560	0.040	Methyl sulfide C ₂ H ₆ S			
120	20.9	0.540	0.050	liq.			
130	25.0	0.516	0.064	35.8 b.p.	1.000 atm.	0.831	0.002
140	29.6	0.487	0.082	40	1.15	0.826	0.003
150	34.7	0.450	0.109	60	2.15	0.803	0.003
160	40.5	0.401	0.153	80	3.68	0.777	0.006
164.7 c.p.	43.4	0.270	0.270	100	5.97	0.750	0.010
Methyl ethyl ketone C ₅ H ₁₀ O				120	9.14	0.721	0.016
20 liq.	77.5 mm			140	13.4	0.689	0.026
30	121.4			160	19.1	0.652	0.040
40	188.4			180	26.2	0.610	0.063
50	300.0			200	35.6	0.559	0.092
Methyl formate C ₂ H ₄ O ₂				220	47.0	0.486	0.146
- 20 liq.	67.7 mm			229.9 c.p.	54.6	0.306	0.306
0	195.0			Naphthalene C ₁₀ H ₈			
+ 20	476.4			85 liq.	9.8 mm		
31.9 b.p.	1.000 atm.	0.9569	0.002468	90	12.5		
40	1.355	0.9447	0.003236	100	18.9		
60	2.608	0.9133	0.006039	110	28.3		
80	4.610	0.8803	0.01049	225	887.		
100	7.614	0.8452	0.01723				
120	11.91	0.8070	0.02688				

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
Naphthalene C ₁₀ H ₈ (Continued)				n-Octane C ₈ H ₁₈ (Continued)			
230	988. mm			+20	10.45 mm		
235	1098.			40	30.85		
240	1218.			60	77.55		
245	1347.			80	174.8		
250	1487.			100	353.6		
α-Naphthol C ₁₀ H ₈ O				120	646.4		
120 liq.	2.8 mm			140	1114.		
140	7.4			iso-Pentane C ₅ H ₁₂			
160	17.9			-20 liq.	100.00 mm		
180	37.5			0	257.35		
200	74.7			+20	572.2		
220	139.0			40	1140.5		
240	243.2			Phosgene CCl ₂ O			
260	403.7			liq.			
280	639.6			7.95 b.p.	1.00 atm.	1.409	0.005
β-Naphthol C ₁₀ H ₈ O				20	1.55	1.381	0.007
140 liq.	5.8 mm			40	2.97	1.332	0.012
160	13.6			60	5.25	1.280	0.020
180	29.5			80	8.68	1.224	0.030
200	59.2			100	13.6	1.165	0.046
220	111.5			120	20.3	1.100	0.072
240	198.5			140	29.1	1.017	0.112
260	336.2			160	40.4	0.903	0.182
280	544.3			180	54.4	0.685	0.359
300	848.7			182 c.p.	56.	0.520	0.520
m-Nitroacetanilide C ₈ H ₈ N ₂ O ₃				Picric acid C ₆ H ₃ N ₃ O ₇			
100 sol.	0.0042 mm			100.4 sol.	0.00249 mm		
p-Nitroacetanilide C ₈ H ₈ N ₂ O ₃				Propane C ₃ H ₈			
100 sol.	0.0021 mm			-38.4 liq.	1050. mm		
p-Nitroaniline C ₆ H ₆ N ₂ O ₂				-30.85	1368.		
100 sol.	0.0136 mm			Propyl acetate C ₅ H ₁₀ O ₂			
Nitrobenzene C ₆ H ₅ NO ₂				0	7.0 mm		
80 liq.	7.5 mm			20	25.0		
90	12.9			40	70.9		
100	20.85			60	171.9		
110	32.5			80	373.0		
p-Nitrobenzoic acid C ₇ H ₅ NO ₄				100	723.8		
100 sol.	0.0096 mm			101.55 b.p.	1.000 atm.	0.7938	0.003495
Nitroglycerol C ₃ H ₇ NO ₅				120	1.703	0.7702	0.005760
20 liq.	0.00025 mm			140	2.851	0.7435	0.009497
30	0.00083			160	4.518	0.7149	0.01489
40	0.0024			180	6.832	0.6835	0.02268
50	0.0073			200	9.947	0.6488	0.03390
60	0.0188			220	14.05	0.6087	0.05025
70	0.043			240	19.36	0.5586	0.07576
80	0.098			260	26.13	0.4908	0.1205
90	0.23			276.2 c.p.	32.91	0.2957	0.2957
n-Octane C ₈ H ₁₈				n-Propyl alcohol C ₃ H ₈ O			
-20 liq.	0.64 mm			0 liq.	3.44 mm		
0	2.94			5	5.04		
				10	7.26		

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm ³		°C	Pressure	Density g/cm ³	
		liq.	vap.			liq.	vap.
n-Propyl alcohol C ₃ H ₈ O (Continued)				Propyl formate C ₄ H ₈ O ₂ (Continued)			
15	10.3			260	37.54 atm.	0.4404	0.1848
20	14.5			264.85 c.p.	40.13	0.3093	0.3093
25	20.1			Quinoline C ₉ H ₇ N			
30	27.6			80 liq.	3.1 mm		
35	37.4			100	8.5		
40	50.2			120	20.7		
45	66.4			140	45.3		
50	87.2			160	91.4		
55	113.6			Turpentine C ₁₀ H ₁₆			
60	147.0			0 liq.	2.1 mm		
65	186.8			10	2.9		
70	239.0			20	4.4		
75	301.0			30	6.9		
80	376.0			40	10.8		
85	466.			50	17.0		
90	574.			60	26.5		
95	697.			70	40.6		
97.4 b.p.	1.000 atm.	0.7351	0.00208	80	61.3		
100	1.100	0.7325	0.00226	90	90.6		
110	1.577	0.7220	0.00320	100	131.1		
120	2.208	0.7110	0.00443	110	186.0		
130	3.022	0.6995	0.00605	120	257.0		
140	4.055	0.6875	0.00805	130	349.0		
150	5.341	0.6740	0.01060	140	464.0		
160	6.915	0.6600	0.01380	155	605.0		
170	8.817	0.6450	0.01770	160	686.0		
180	11.08	0.6285	0.0225	165	775.0		
190	13.75	0.6110	0.0282	Tetrachloroethylene C ₂ Cl ₄			
200	16.86	0.5920	0.0353	40 liq.	41. mm		
210	20.46	0.5715	0.0442	60	104.		
220	24.57	0.5485	0.0556	80	226.		
230	29.26	0.5230	0.0704	100	438.5		
240	34.57	0.4920	0.0904	Toluene C ₇ H ₈			
250	40.55	0.4525	0.1180	30 liq.	36.7 mm		
260	47.27	0.3905	0.1610	40	59.1		
263.7 c.p.	49.95	0.2734	0.2734	50	92.6		
Propylene C ₃ H ₆				60	139.5		
-127.4 liq.	3. mm			70	202.4		
-110.4	15.			80	289.7		
-34.4	1307.			90	404.6		
Propyl formate C ₄ H ₈ O ₂				100	557.2		
0	21.4 mm			p-Toluic acid C ₈ H ₈ O ₂			
20	63.9			100 sol.	0.216 mm		
40	163.6			o-Toluidine C ₇ H ₇ N			
60	364.9			40 liq.	1.1 mm		
80	734.5			60	3.7		
80.9 b.p.	1.000 atm.	0.8330	0.003136	80	10.5		
100	1.769	0.8080	0.005432	100	27.2		
120	3.010	0.7811	0.009033	120	62.3		
140	4.821	0.7523	0.01422	140	129.9		
160	7.343	0.7209	0.02179	160	250.2		
180	10.74	0.6873	0.03236	180	450.2		
200	15.20	0.6487	0.04717	200	762.9		
220	20.94	0.6024	0.06897				
240	28.27	0.5438	0.1045				

VAPOR PRESSURE (Continued)

°C		Pressure		Density g/cm ³	
				liq.	vap.
m-Toluidine C ₇ H ₉ N					
60 liq.	3.4 mm				
80	9.4				
100	23.9				
126	54.8				
140	115.5				
160	224.9				
180	410.6				
200	706.7				
p-Toluidine C ₇ H ₉ N					
40 liq.	1.1 mm				
60	3.7				
80	10.5				
100	26.6				
120	60.6				
140	126.3				
160	244.9				
180	441.3				
200	753.0				
Trichloroethylene C ₂ HCl ₃					
25 liq.	73. mm				
30	94.				
40	149.				
50	224.				
60	324.5				
70	453.0				
80	618.0				
Trinitrotoluene C ₇ H ₅ N ₃ O ₆					
80 liq.	0.042 mm				
85	0.053				
90	0.067				
95	0.085				
100	0.106				
Urethane C ₃ H ₇ NO ₂					
120 liq.	103. mm				
140	203.				
160	392.				
Valeric acid C ₅ H ₁₀ O ₂					
60 liq.	2.07 mm				
80	9.3				
Benzene C ₆ H ₆					
80.2 b.p.	760 mm				
90	1008	0.8041	0.0036		
100	1335	0.7927	0.0047		
110	1740	0.7809	0.0060		
120	2230	0.7692	0.0077		
130	2820	0.7568	0.0096		
140	3520	0.7440	0.0118		
150	4335	0.7310	0.0144		
160	5300	0.7185	0.0173		
Valeric acid C ₅ H ₁₀ O ₂ (Continued)					
100	28.2 mm				
120	70.5				
140	159.6				
160	336.1				
180	660.7				
iso-Valeric acid C ₅ H ₁₀ O ₂					
10 liq.	0.2 mm				
30	0.75				
50	2.9				
70	9.4				
90	27.3				
110	69.8				
130	159.8				
150	338.3				
o-Xylene C ₈ H ₁₀					
0 liq.	4.0 mm				
20	10.05				
40	23.7				
60	52.4				
80	108.9				
100	213.1				
120	393.85				
140	689.9				
m-Xylene C ₈ H ₁₀					
0 liq.	1.75 mm				
20	6.43				
40	19.48				
60	50.59				
80	115.72				
100	238.22				
120	448.85				
140	784.64				
p-Xylene C ₈ H ₁₀					
0 liq.	8.29 mm				
20	16.35				
40	34.00				
60	70.64				
80	142.04				
100	270.46				
120	481.33				
140	794.84				
150					
160					
170	6385	0.7043	0.0209		
180	7620	0.6906	0.0249		
190	9040	0.6758	0.0298		
200	10650	0.6605	0.0355		
220	14520	0.6255	0.0502		
240	19350	0.5851	0.0714		
260	25350	0.5328	0.1038		
280	32800	0.4514	0.1660		
288.5	36400		0.3045		

VAPOR PRESSURE

Variation with Temperature

The following table gives the value of the constants a and b in the following equation:

$$\log_{10} p = -\frac{0.05223a}{T} + b$$

where p is the pressure in mm of mercury of the saturated vapor at the absolute temperature T . ($T = t^{\circ}\text{C} + 273.1$).

Elements and Inorganic Compounds

Compound	Formula	Temp. range $^{\circ}\text{C}$	a	b
Aluminum oxide.....	Al_2O_3	1840 to 2200 liq.	540,000	14.22
Ammonia.....	NH_3	-127 to -78 sc..	31,211	9.9974
Ammonium bromide.....	NH_4Br	250 to 400 sol.	90,208	9.9404
Ammonium chloride.....	NH_4Cl	100 to 400 sol.	83,486	10.0164
Ammonium cyanide.....	NH_4CN	7 to 17 sol.	41,484	9.978
Ammonium iodide.....	NH_4I	300 to 400 sol.	95,730	10.2700
Ammonium sulfhydrate.....	NH_4HS	6 to 40 sol.	46,023	10.7500
Antimony.....	Sb	1070 to 1325 liq.	189,000	9.051
Argon.....	A	-208 to -189 sol.	7,814.5	7.5741
Arsenic.....	As	-189 to -183 liq.	6,826.0	6.9605
Arsenous oxide.....	As_2O_3	800 to 860 liq.	47,100	6.692
Barium.....	Ba	440 to 815 sol.	133,000	10.800
Bismuth.....	Bi	100 to 310 sol.	111,350	12.127
Bismuth trichloride.....	BiCl_3	315 to 490 liq.	52,120	6.513
Cadmium.....	Cd	930 to 1130 liq.	350,000	15.765
		1210 to 1420 liq.	200,000	8.876
		91 to 213 sol.	13,125	2.681
		150 to 320.9 sol.	109,000	8.564
Cadmium iodide.....	CdI_2	500 to 840 liq.	99,900	7.897
Caesium.....	Cs	385 to 450 liq.	122,200	9.269
Caesium chloride.....	CsCl	200 to 350 liq.	73,400	6.949
		986 to 1295 liq.	163,200	8.340

VAPOR PRESSURE (Continued)

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	a	b
Calcium.....	Ca	960 to 1110 liq.	370,000	16,240
Carbon.....	C	3880 to 4430 liq.	540,000*	9,596*
Carbon dioxide.....	CO ₂	-135 to -56.7 sol.	26,179.3	9,9082
Carbon monoxide.....	CO	-290 to -206 liq.	6,354	6,976
Chlorine.....	Cl	-154 to -103 sol.	29,293	9,950
Cobalt.....	Co	2375 liq.	309,000	7,571
Copper.....	Cu	2100 to 2310 liq.	468,000	12,344
Cuprous chloride.....	Cu ₂ Cl ₂	878 to 1369 liq.	80,700	5,454
Cyanogen.....	(CN) ₂	-72 to -28 sol.	32,437	9,6539
		-32 to -6 liq.	23,750	7,808
Ferrous chloride.....	FeCl ₂	700 to 930 sol.	135,200	8,33
Gold.....	Au	2315 to 2500 liq.	385,000	9,853
Hydriodic acid.....	HI	-97 to -51 sol.	24,160	8,259
		-50 to -34 liq.	21,580	7,630
Hydrobromic acid.....	HBr	-114 to -86 sol.	22,420	8,734
		-86 to -66 liq.	17,960	7,427
Hydrochloric acid.....	HCl	-158 to -110 sol.	19,588	8,4430
Hydrocyanic acid.....	HCN	-8 to +27 liq.	27,830	7,7446
Hydrofluoric acid.....	HF	-83 to +48 liq.	25,180	7,370
Hydrogen peroxide.....	H ₂ O ₂	10 to 90 liq.	48,530	8,853
Hydrogen sulfide.....	H ₂ S	-110 to -83 sol.	20,690	7,880
Iron.....	Fe	2220 to 2450 liq.	309,000	7,482
Krypton.....	Kr	-189 to -169 sol.	10,065	7,1770
		-169 to -150 liq.	9,377.0	6,92387
Lead.....	Pb	525 to 1325 liq.	188,500	7,827
Lead bromide.....	PbBr ₂	735 to 918 liq.	118,000	8,064
Lead chloride.....	PbCl ₂	500 to 950 liq.	141,900	8,961
Lithium bromide.....	LiBr	1010 to 1265 liq.	152,700	8,068
Lithium chloride.....	LiCl	1045 to 1325 liq.	155,900	7,939
Lithium fluoride.....	LiF	1398 to 1666 liq.	218,400	8,753
Lithium iodide.....	LiI	940 to 1140 liq.	143,600	8,011
Magnesium.....	Mg	900 to 1070 liq.	260,000	12,993

* Based on boiling point of 3927° C or 4200° absolute.

VAPOR PRESSURE (Continued)

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	a	b
Manganese.....	Mn	1510 to 1900 liq.	267,000	9,300
Mercuric bromide.....	HgBr ₂	111 to 235 sol.	79,800	10,181
		238 to 331 liq.	61,250	8,284
Mercuric chloride.....	HgCl ₂	60 to 130 sol.	85,030	10,888
		130 to 270 sol.	78,850	10,094
Mercuric iodide.....	HgI ₂	275 to 309 liq.	61,020	8,409
		100 to 250 sol.	82,340	10,057
Mercury.....	Hg	266 to 360 liq.	62,770	8,115
		-80 to -38.87 sol.	73,000	10,383
		400 to 1300 liq.	58,700	7,752
Molybdenum.....	Mo	1800 to 2240 sol.	680,000	10,844
Nitrogen.....	N ₂	-215 to -210 sol.	6,881.3	7,665.58
Nitrogen dioxide.....	NO	-200 to -161 sol.	16,423	10,048
		-163.7 to -148 liq.	13,040	8,440
Nitrogen monoxide.....	N ₂ O	-144 to -90 sol.	23,590	9,579
		-90.1 to -88.7 liq.	16,440	7,535
Nitrogen pentoxide.....	N ₂ O ₅	-30 to +30 sol.	57,180	12,647
Nitrogen tetroxide.....	N ₂ O ₄	-100 to -40 sol.	55,160	13,400
		-40 to -10 sol.	45,440	11,214
		-8 to +43.2 liq.	33,430	8,814
		-25 to 0 liq.	39,400	10,30
Nitrogen trioxide.....	N ₂ O ₃	20 to 44.1 sol.	63,123	9,651.1
Phosphorus (white).....	P	380 to 590 sol.	108,510	11,084.2
Phosphorus (violet).....	P	1425 to 1765 sol.	486,000	7,786
Platinum.....	Pt	260 to 760 liq.	84,900	7,183
Potassium.....	K	906 to 1063 liq.	168,100	8,2470
Potassium bromide.....	KBr	1095 to 1375 liq.	163,800	7,936
		906 to 1105 liq.	174,500	8,352.6
Potassium chloride.....	KCl	1116 to 1418 liq.	169,700	8,130
		1278 to 1500 liq.	207,500	9,000
Potassium fluoride.....	KF	1170 to 1327 liq.	136,000	7,330
Potassium hydroxide.....	KOH	843 to 1028 liq.	157,600	8,095.7
Potassium iodide.....	KI	1063 to 1333 liq.	155,700	7,949

VAPOR PRESSURE (Continued)

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	a	b
Rubidium.....	Rb	250 to 370 liq.	76, 000	6.976
Rubidium chloride.....	RbCl	1142 to 1395 liq.	198, 600	9.111
Silicon.....	Si	1200 to 1320 sol.	170, 000	5.950
Silicon dioxide.....	SiO ₂	1860 to 2230 liq.	506, 000	13.43
Silver.....	Ag	1650 to 1950 liq.	250, 000	8.762
Silver chloride.....	AgCl	1255 to 1442 liq.	185, 500	8.179
Sodium.....	Na	180 to 883 liq.	103, 300	7.553
Sodium bromide.....	NaBr	1138 to 1394 liq.	161, 600	7.948
Sodium chloride.....	NaCl	976 to 1155 liq.	180, 300	8.3297
Sodium cyanide.....	NaCN	1156 to 1430 liq.	185, 800	8.548
Sodium fluoride.....	NaF	800 to 1360 liq.	155, 520	7.472
Sodium hydroxide.....	NaOH	1562 to 1701 liq.	218, 200	8.640
Sodium iodide.....	NaI	1010 to 1402 liq.	132, 000	7.030
Stannic chloride.....	SnCl ₄	1063 to 1307 liq.	165, 100	8.371
Strontium.....	Sr	-52 to -38 sol.	46, 740	9.824
Sulfur dioxide.....	SO ₂	940 to 1140 liq.	360, 000	16.056
Sulfur trioxide.....	SO ₃	-95 to -75 sol.	35, 827	10.5916
Thallium.....	Tl	24 to 48 liq.	43, 450	10.022
Thallium chloride.....	TlCl	950 to 1200 liq.	120, 000	6.140
Tin.....	Sn	665 to 807 liq.	105, 200	7.974
Tungsten.....	W	1950 to 2270 liq.	328, 000	9.643
Zinc.....	Zn	2230 to 2770 sol.	897, 000	9.920
		250 to 419.4 sol.	133, 000	9.200
		600 to 985 liq.	118, 000	8.108

Organic Compounds

Acetaldehyde.....	C ₂ H ₄ O	-24.3 to +27.5 liq.	27, 707	7.8206
Acetic acid.....	C ₂ H ₄ O ₂	-35 to 10 sol.	41, 689	8.502
Acetic anhydride.....	C ₄ H ₆ O ₃	100 to 140 liq.	45, 585	8.688

VAPOR PRESSURE (Continued)

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	a	b
Acetylene.....	C_2H_2	-140 to -82 sol.	21,914	8,933
Aniline.....	C_6H_7N	145 to 185 liq.	45,951.6	8,1278
Anthracene.....	$C_{14}H_{10}$	100 to 600 sol.	70,390	8,706
		100 to 160 liq.	72,000	8,91
		223 to 342 liq.	59,219	7,910
Anthraquinone.....	$C_{14}H_8O_2$	224 to 286 sol.	110,040	12,305
Benzene.....	C_6H_6	-58 to -30 sol.	42,904	9,556
		-30 to +5 sol.	44,222	9,846
		0 to 42 liq.	34,172	7,9622
		42 to 100 liq.	32,295	7,6346
Benzoic acid.....	$C_7H_6O_2$	60 to 110 sol.	63,820	9,033
Benzophenone.....	$C_{12}H_{10}O$	260 to 308 liq.	58,221	8,137
Benzoyl chloride.....	C_7H_5ClO	140 to 200 liq.	45,416	7,9245
Benzyl alcohol.....	C_7H_8O	100 to 135 liq.	59,491	9,5152
		135 to 205 liq.	53,118	8,6977
Butane.....	C_4H_{10}	-100 to +12 liq.	23,450	7,395
iso-Butane.....	C_4H_{10}	-115 to -34 liq.	21,273	7,25
n-Butyl alcohol.....	$C_4H_{10}O$	75 to 117.5 liq.	46,774	9,1362
Butyric acid.....	$C_4H_8O_2$	80 to 165 liq.	51,103	9,010
Bromobenzene.....	C_6H_5Br	-26 to -15 liq.	42,500	8,075
p-Bromochlorobenzene.....	C_6H_4BrCl	23 to 63 sol.	69,755	11,629
Camphor.....	$C_{10}H_{16}O$	0 to 180 sol.	53,559	8,799
Carbon tetrachloride.....	CCl_4	-70 to -50 sol.	34,608	8,05
		-19 to +20 liq.	33,914	8,004
		-35 to -15 liq.	42,250	8,594
		-5 to +5 sol.	37,394	8,594
		30 to 50 sol.	72,218	12,480
Chlorobenzene.....	C_6H_5Cl	0 to 30 liq.	31,706	7,909
Cyclohexane.....	C_6H_{12}	0 to 30 liq.	35,598	8,126
p-Dichlorobenzene.....	$C_6H_4Cl_2$	278 to 284 liq.	57,350	8,088
Dichloroethane-1,1.....	$C_2H_4Cl_2$	-30 to +30 liq.	26,319	7,691
Dichloroethane-1,2.....	$C_2H_4Cl_2$	-160 to -104 liq.	14,396	7,330
Diphenylamine.....	$C_{12}H_{11}N$			
Ethyl chloride.....	C_2H_5Cl			
Ethylene.....	C_2H_4			

VAPOR PRESSURE (Continued)

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	a	b
Ethylene bromide.....	$C_2H_4Br_2$	10 to 150 liq.	38, 082	7, 792
Heptane.....	C_7H_{16}	-63 to -40 liq.	37, 358	8, 2585
Hexane.....	C_6H_{14}	-10 to +90 liq.	31, 679	7, 724
Iodobenzene.....	C_6H_5I	-30 to +18 liq.	43, 000	7, 500
Methane.....	CH_4	-194 to -184 sol.	9, 856.2	7, 6509
		-174 to -163 liq.	8, 516.9	6, 8626
Methyl alcohol.....	CH_3O	-62 to -44 liq.	39, 234	8, 9547
		-10 to +80 liq.	38, 324	8, 8017
Methyl chloride.....	CH_3Cl	-47.4 to -10 liq.	21, 988	7, 481
Methyl ether.....	C_2H_6O	-70 to -20 liq.	23, 025	7, 720
Methyl fluoride.....	CH_3F	-102 to -76 liq.	17, 053	7, 445
Methyl salicylate.....	$C_9H_8O_3$	175 to 215 liq.	48, 670	8, 008
Naphthalene.....	$C_{10}H_8$	0 to 80 sol.	71, 401	11, 450
		120 to 200 liq.	47, 382	7, 927
o-Nitroaniline.....	$C_6H_6N_2O_2$	150 to 260 liq.	63, 881	8, 8684
m-Nitroaniline.....	$C_6H_6N_2O_2$	170 to 260 liq.	65, 880	8, 8188
p-Nitroaniline.....	$C_6H_6N_2O_2$	190 to 260 liq.	77, 345	9, 5595
Nitrobenzene.....	$C_6H_5NO_2$	112 to 209 liq.	48, 855	8, 192
Nitromethane.....	CH_3NO_2	47 to 100 liq.	36, 914	8, 033
Oxalic acid.....	$C_2H_2O_4$	55 to 105 sol.	90, 502.6	12, 2229
n-Pentane.....	C_5H_{12}	-20 to +50 liq.	27, 891	7, 558
Phenol.....	C_6H_6O	116 to 180 liq.	49, 644	8, 587
Phthalic anhydride.....	$C_8H_4O_3$	160 to 285 liq.	54, 920	8, 022
Propane.....	C_3H_8	-136 to -40 liq.	19, 037	7, 217
Propionic acid.....	$C_3H_6O_2$	20 to 140 liq.	46, 150	8, 715
n-Propyl alcohol.....	C_3H_8O	-45 to -10 liq.	47, 274	9, 5180
Propyl bromide.....	C_3H_7Br	0 to 30 liq.	32, 430	7, 821
Propyl chloride.....	C_3H_7Cl	0 to 50 liq.	28, 894	7, 593
Propylene.....	C_3H_6	-95 to -48 liq.	19, 693	7, 4463
Quinoline.....	C_9H_7N	180 to 240 liq.	49, 720	7, 969
Tetrachloroethane-1, 1, 1, 2.....	$C_2H_2Cl_4$	105 to 145 liq.	36, 508	7, 605
Tetrachloroethane-1, 1, 2, 2.....	$C_2H_2Cl_4$	26 to 145 liq.	39, 729	7, 846
Toluene.....	C_7H_8	-92 to +15 liq.	39, 198	8, 330

LOWERING OF VAPOR PRESSURE BY SALTS IN AQUEOUS SOLUTIONS

The table gives the reduction of the vapor pressure in millimeters due to the presence of the number of grammolecules of salt per liter of water given at the head of the columns, at the temperature 100° C, at which temperature the vapor pressure of pure water is 760 millimeters.

(From Smithsonian Tables.)

Substance	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
Al ₂ (SO ₄) ₃	12.8	36.5							
AlCl ₃	22.5	61.0	179.0	318.0					
BaSO ₄	6.6	15.4	34.4						
Ba(OH) ₂	12.3	22.5	39.0						
Ba(NO ₃) ₂	13.5	27.0							
Ba(ClO ₃) ₂	15.8	33.3	70.5	108.2					
BaCl ₂	16.4	36.7	77.6						
BaBr ₂	16.8	38.8	91.4	150.0	204.7				
CaSO ₄	9.9	23.0	56.0	106.0					
Ca(NO ₃) ₂	16.4	34.8	74.6	139.3	161.7	205.4			
CaCl ₂	17.0	39.8	95.3	166.6	241.5	319.5			
CaBr ₂	17.7	44.2	105.8	191.0	283.3	368.5			
CdSO ₄	4.1	8.9	18.1						
CdI ₂	7.6	14.8	33.5	52.7					
CdBr ₂	8.6	17.8	36.7	55.7	80.0				
CdCl ₂	9.6	18.8	36.7	57.0	77.3	99.0			
Cd(NO ₃) ₂	15.9	36.1	78.0	122.2					
Cd(ClO ₃) ₂	17.5								
CoSO ₄	5.5	10.7	22.9	45.5					
CoCl ₂	15.0	34.8	83.0	136.0	186.4				
Co(NO ₃) ₂	17.3	39.2	89.0	152.0	218.7	282.0	332.0		
FeSO ₄	5.8	10.7	24.0	42.4					
H ₃ BO ₃	6.0	12.3	25.1	38.0	51.0				
H ₃ PO ₄	6.6	14.0	28.6	45.2	62.0	81.5	103.0	146.9	189.5
H ₃ AsO ₄	7.3	15.0	30.2	46.4	64.9				
H ₂ SO ₄	12.9	26.5	62.8	104.0	148.0	198.4	247.0	343.2	
KH ₂ PO ₄	10.2	19.5	33.3	47.8	60.5	73.1	85.2		
KNO ₃	10.3	21.1	40.1	57.6	74.5	88.2	102.1	126.3	148.0
KClO ₃	10.6	21.6	42.8	62.1	80.0				
KBrO ₃	10.9	22.4	45.0						
KHSO ₄	10.9	21.9	43.3	65.3	85.5	107.8	129.2	170.0	
KNO ₂	11.1	22.8	44.8	67.0	90.0	110.5	130.7	167.0	198.8
KClO ₄	11.5	22.3							
KCl.....	12.2	24.4	48.8	74.1	100.9	128.5	152.2		
KHCO ₃	11.6	23.6	59.0	77.6	104.2	132.0	160.0	210.0	255.0
KI.....	12.5	25.3	52.2	82.6	112.2	141.5	171.8	225.5	278.5
K ₂ C ₂ O ₄	13.9	28.3	59.8	94.2	131.0				
K ₂ WO ₄	13.9	33.0	75.0	123.8	175.4	226.4			
K ₂ CO ₃	14.4	31.0	68.3	105.5	152.0	209.0	258.5	350.0	
KOH.....	15.0	29.5	64.0	99.2	140.0	181.8	223.0	309.5	387.8
K ₂ CrO ₄	16.2	29.5	60.0						
LiNO ₃	12.2	25.9	55.7	88.9	122.2	155.1	188.0	253.4	309.2
LiCl.....	12.1	25.5	57.1	95.0	132.5	175.5	219.5	311.5	393.5
LiBr.....	12.2	26.2	60.0	97.0	140.0	186.3	241.5	341.5	438.0
Li ₂ SO ₄	13.3	28.1	56.8	89.0					
LiHSO ₄	12.8	27.0	57.0	93.0	130.0	168.0			
LiI.....	13.6	28.6	64.7	105.2	154.5	206.0	264.0	357.0	445.0
Li ₂ SiF ₆	15.4	34.0	70.0	106.0					
LiOH.....	15.9	37.4	78.1						
Li ₂ CrO ₄	16.4	32.6	74.0	120.0	171.0				
MgSO ₄	6.5	12.0	24.5	47.5					
MgCl ₂	16.8	39.0	100.5	183.3	277.0	377.0			
Mg(NO ₃) ₂	17.6	42.0	101.0	174.8					

LOWERING OF VAPOR PRESSURE BY SALTS IN AQUEOUS SOLUTIONS (Continued)

Substance	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
MgBr ₂	17.9	44.0	115.8	205.3	298.5				
MgH ₂ (SO ₄) ₂	18.3	46.0	116.0						
MnSO ₄	6.0	10.5	21.0						
MnCl ₂	15.0	34.0	76.0	122.3	167.0	209.0			
NaH ₂ PO ₄	10.5	20.0	36.5	51.7	66.8	82.0	96.5	126.7	157.1
NaHSO ₄	10.9	22.1	47.3	75.0	100.2	126.1	148.5	189.7	231.4
NaNO ₃	10.6	22.5	46.2	68.1	90.3	111.5	131.7	167.8	198.8
NaClO ₃	10.5	23.0	48.4	73.5	98.5	123.3	147.5	196.5	223.5
(NaPO ₃) ₆	11.6								
NaOH.....	11.8	22.8	48.2	77.3	107.5	139.1	172.5	243.3	314.0
NaNO ₂	11.6	24.4	50.0	75.0	98.2	122.5	146.5	189.0	226.2
Na ₂ HPO ₄	12.1	23.5	43.0	60.0	78.7	99.8	122.1		
NaHCO ₃	12.9	24.1	48.2	77.6	102.2	127.8	152.0	198.0	239.4
Na ₂ SO ₄	12.6	25.0	48.9	74.2					
NaCl.....	12.3	25.2	52.1	80.0	111.0	143.0	176.5		
NaBrO ₃	12.1	25.0	54.1	81.3	108.8	136.0			
NaBr.....	12.6	25.9	57.0	89.2	124.2	159.5	197.5	268.0	
NaI.....	12.1	25.6	60.2	99.5	136.7	177.5	221.0	301.5	370.0
Na ₄ P ₂ O ₇	13.2	22.0							
Na ₂ CO ₃	14.3	27.3	53.5	80.2	111.0				
Na ₂ C ₂ O ₄	14.5	30.0	65.8	105.8	146.0				
Na ₂ WO ₄	14.8	33.6	71.6	115.7	162.6				
Na ₃ PO ₄	16.5	30.0	52.5						
(NaPO ₃) ₃	17.1	36.5							
NH ₄ NO ₃	12.8	22.0	42.1	62.7	82.9	103.8	121.0	152.2	180.0
(NH ₄) ₂ SiF ₆	11.5	25.0	44.5						
NH ₄ Cl.....	12.0	23.7	45.1	69.3	94.2	118.5	138.2	179.0	213.8
NH ₄ HSO ₄	11.5	22.0	46.8	71.0	94.5	118.5	139.0	181.2	218.0
(NH ₄) ₂ SO ₄	11.0	24.0	46.5	69.5	93.0	117.0	141.8		
NH ₄ Br.....	11.9	23.9	48.8	74.1	99.4	121.5	145.5	190.2	228.5
NH ₄ I.....	12.9	25.1	49.8	78.5	104.5	132.3	156.0	200.0	243.5
NiSO ₄	5.0	10.2	21.5						
NiCl ₂	16.1	37.0	86.7	147.0	212.8				
Ni(NO ₃) ₂	16.1	37.3	91.3	156.2	235.0				
Pb(NO ₃) ₂	12.3	23.5	45.0	63.0					
Sr(SO ₃) ₂	7.2	20.3	47.0						
Sr(NO ₃) ₂	15.8	31.0	64.0	97.4	131.4				
SrCl ₂	16.8	38.8	91.4	156.8	223.3	281.5			
SrBr ₂	17.8	42.0	101.1	179.0	267.0				
ZnSO ₄	4.9	10.4	21.5	42.1	66.2				
ZnCl ₂	9.2	18.7	46.2	75.0	107.0	153.0	195.0		
Zn(NO ₃) ₂	16.6	39.0	93.5	157.5	223.8				

HEAT CONDUCTIVITY

Giving the quantity of heat in calories which is transmitted per second through a plate one centimeter thick across an area of one square centimeter when the temperature difference is one degree Centigrade.

METALS

Substance	Temp. ° C.	Conduc- tivity	Observer
Aluminum.....	-160	0.514	Lees, 1908
	18	0.480	Jaeger & Diesselhorst, 1900
	18	0.504	Lees, 1908
	100	0.492	Jaeger & Diesselhorst, 1900
	100	0.49	Angell, 1911
	200	0.55	"
	300	0.64	"
	400	0.76	"
Antimony.....	600	1.01	"
	0	0.0442	Lorenz, 1881
	100	0.040	"
Bismuth.....	0-30	0.042	Berget, 1890
	-186	0.025	Macchia, 1907
	0	0.0177	Lorenz
	18	0.0194	Jaeger & Diesselhorst, 1900
Brass (70Cu+30Zn).. (70Cu+30Zn)..... yellow..... red.....	100	0.0161	Jaeger & Diesselhorst, 1900
	-160	0.181	Lees, 1908
	17	0.260	"
	0	0.204	Lorenz
	0	0.246	"
Bronze, aluminum (90Cu, 10Al)	.....	0.18	Van Aubel
Cadmium.....	-160	0.239	Lees, 1908
	0	0.220	Lorenz
	18	0.222	Jaeger & Diesselhorst, 1900
	100	0.216	Jaeger & Diesselhorst, 1900
Constantan..... (60Cu, 40Ni).....	18	0.054	Jaeger & Diesselhorst, 1900
	100	0.064	Jaeger & Diesselhorst, 1900
Copper, pure.....	-160	1.097	Lees, 1908
	13	1.00	Angström, 1863
	18	0.918	Jaeger & Diesselhorst, 1900

HEAT CONDUCTIVITY (Continued)

METALS

Substance	Temp. ° C.	Conduc- tivity	Observer
Copper, pure.....	100	0.908	Jaeger & Diesselhorst, 1900
	100-197	1.043	Hering, 1910
	100-268	0.969	"
	100-370	0.931	"
	100-541	0.902	"
	100-837	0.858	"
German silver.....	0	0.070	Lorenz, 1881
	100	0.089	"
(52Cu, 26Zn, 22Ni)		0.10	Glage, 1905
Gold.....	17	0.705	Barratt, 1914
	18	0.700	Jaeger & Diesselhorst, 1900
	100	0.703	Jaeger & Diesselhorst, 1900
Iridium.....	17	0.141	Barratt, 1914
Iron, pure.....	18	0.161	Jaeger & Diesselhorst
	100	0.151	" "
	100-727	0.202	Hering, 1910
	100-1245	0.191	"
wrought.....	-160	0.152	Lees, 1908
	18	0.144	Jaeger & Diesselhorst
	100	0.143	" "
cast.....	18	0.109	" "
	100	0.108	" "
	54	0.114	Callendar
	102	0.111	"
Steel.....	-160	0.113	Lees, 1908
	18	0.115	" "
	18	0.108	Jaeger & Diesselhorst
	100	0.107	" "
Lead.....	-160	0.092	Lees, 1908
	18	0.083	Jaeger & Diesselhorst
	100	0.082	" "
Magnesium.....	0-100	0.376	Lorenz, 1881
Manganin.....	18	0.0519	Jaeger & Diesselhorst
(84Cu, 4Ni, 12Mn)	100	0.06310	" "
	-160	0.035	Lees, 1908
Mercury.....	0	0.0148	H. F. Weber, 1880
	50	0.0189	" "
	17	0.0197	R. Weber, 1902
Molybdenum.....	17	0.346	Barratt, 1914
Nickel.....	-160	0.129	Lees, 1908

HEAT CONDUCTIVITY (Continued)

METALS

Substance	Temp. °C.	Conduc- tivity	Observer
Nickel	18	0.142	Jaeger & Diesselhorst, 1900
	100	0.138	Jaeger & Diesselhorst, 1900
	300	0.126	Angell, 1911
	600	0.088	"
	800	0.068	"
	1200	0.058	"
Palladium.....	18	0.1683	Jaeger & Diesselhorst, 1900
	100	0.182	
Platinum.....	18	0.1664	Jaeger & Diesselhorst, 1900
	100	0.1733	Jaeger & Diesselhorst, 1900
Platinum-iridium. . .	17	0.074	Barratt, 1914
10 % Ir			
Platinum-rhodium... 10 % Rh	17	0.072	Barratt, 1914
Platinoid.....	18	0.060	Lees, 1908
Rhodium.....	17	0.210	Barratt, 1914
Silver, pure.....	-160	0.998	Lees, 1908
	18	0.974	"
	18	1.006	Jaeger & Diesselhorst, 1900
	100	0.992	Jaeger & Diesselhorst, 1900
Tin.....	-160	0.192	Lees, 1908
	0	0.1528	Lorenz, 1881
	18	0.155	Jaeger & Diesselhorst, 1900
	100	0.145	Jaeger & Diesselhorst, 1900
	100	0.1423	Lorenz, 1881
Tantalum.....	17	0.130	Barratt, 1914
Tungsten.....	17	0.476	"
	18	0.35	Coolidge
Wood's alloy.....		0.0319	H. F. Weber
Zinc.....	-160	0.278	Lees, 1908
	18	0.2653	Jaeger & Diesselhorst
	100	0.2619	" "

HEAT CONDUCTIVITY (Continued)

VARIOUS SOLIDS

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Asbestos fiber, 500° C..	0.00019	Randolph, 1912
paper.....	0.0006	.....
	0.0004	Lees-Chorlton, 1896
Basalt.....	0.0052	Hecht, 1903
Brick, common red....	0.0015	Herschel-L e b o u r & Dunn, 1879
Blotting paper.....	0.00015	Lees-Charlton, 1896
Carbon.....	0.01	
Carborundum.....	0.0005	Lorenz
brick, 150°-1200°...	0.032-0.027	Wologdine
Cardboard.....	0.0005	.....
Cement, Portland.....	0.00071	Lees-Chorlton, 1896
Chalk.....	0.0020	Herschel-L e b o u r & Dunn, 1879
Concrete, cinder.....	0.00081	.....
stone.....	0.0022	Norton
Cork.....	0.00072	G. Forbes, 1875
	0.00013	Lees, 1892-8
Cotton wool.....	0.000043	G. Forbes
felt.....	0.000033	"
Diatomic earth.....	0.00013	Hutton-Blard
Earth's crust, ave.....	0.004	.....
Ebonite.....	0.00042	Lees
	0.00014	Barratt, 1914
Eiderdown, d = .109..	0.000046	Peclet, 1878
Felt.....	0.000087	.....
Fiber, red.....	0.0011	Barratt, 1914
Fire brick.....	0.00028	Hutton-Blard
	0.0011	Barratt, 1914
Flannel.....	0.00023	
Gas carbon, 20°.....	0.0085	Barratt, 1914
100°.....	0.0095	"
Glass		
crown (window)....	0.0025	Lees, 1892-8
flint.....	0.002	"
Jena.....	0.001-0.002	"
soda, 20°.....	0.0017	Barratt, 1914
100°.....	0.0018	"
Granite, 100°.....	0.0045-0.0050	Poole, 1912
500°.....	0.0040	"
Graphite.....	0.012	.....
Graphite brick, 300° to 700°.....	0.24	Wologdine, 1909

HEAT CONDUCTIVITY (Continued)

VARIOUS SOLIDS (Continued)

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Gutta percha.....	0.00048	Péclet, 1878
Gypsum.....	0.0031	R. Weber, 1878
Haircloth, felt.....	0.000042	G. Forbes
Ice.....	0.005	.....
	0.0039	.....
	0.0022	Forbes, 1875
Infusorial earth, 100°..	0.00034	Skinner
300°..	0.00040	"
pressed bricks, 100°..	0.00030	"
Lamp black, 100	0.00007	Randolph, 1912
Leather, cowhide.....	0.00042	Lees-Chorlton, 1896
chamois.....	0.00015	" "
Lime.....	0.00029	Hutton-Blard
Linen.....	0.00021	Lees-Chorlton, 1896
Magnesia, MgO.....	0.00016-0.00045	Hutton-Blard
brick, 50°-1130°....	0.0027-0.0072	Wologdine, 1909
Magnesium carbonate,		
100°.....	0.00023	Skinner
300°.....	0.00025	"
Marble.....	0.0071	Lees, 1892-8
Mica, perpendicular to		
cleavage plane....	0.0018	Lees
Paper.....	0.0003	"
Paraffine.....	0.0006	"
0°.....	0.00023	R. Weber, 1878
Plaster of Paris.....	0.00070	Lees-Chorlton, 1896
Porcelain.....	0.0025	Lees, 1892-8
165°-1055°.....	0.0039-0.0047	Wologdine, 1909
Quartz, parallel to axis.	0.030	Lees, 1892-8
perpendicular to axis.	0.016	"
Rubber, para.....	0.00045	"
Sand, dry.....	0.00093	Herschel-Lebour & Dunn, 1879
Sandstone.....	0.0055	Herschel-Lebour & Dunn, 1879
Sawdust.....	0.00012	G. Forbes, 1875
Silica, fused, 20°.....	0.00237	Barratt, 1914
100°.....	0.00255	"
Silica brick, 100° to		
1000° C.....	0.002-0.003	Wologdine, 1909
Silk.....	0.000095	Lees-Chorlton, 1896
Slate.....	0.004700	Lees, 1892-8

HEAT CONDUCTIVITY (Continued)

VARIOUS SOLIDS (Continued)

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Snow, compact.....	0.00051	Hjeltström
Soil, dry.....	0.00033	Lees-Chorlton, 1896
Wax, bees'.....	0.00009	G. Forbes
Wood, fir || to axis.....	0.00030	.....
perpendicular to axis.	0.00009	.....

LIQUIDS

Acetic acid.....	0.00047	H. F. Weber
Amyl alcohol.....	0.000328	"
Aniline, 12°.....	0.00041	.....
Benzole, 5°.....	0.000333	H. F. Weber
Carbon disulphide, 9° to 15°.....	0.000343	"
Chloroform, 9°-15°...	0.000288	"
Ether, 9°-15°.....	0.000303	"
Ethyl alcohol.....	0.000423	"
Glycerine, 9°-15°.....	0.000637	Graetz
Methyl alcohol.....	0.000495	H. F. Weber
Oils: olive.....	0.000395	Wachsmuth
castor.....	0.000425	"
petroleum, 13°.....	0.000355	Graetz
turpentine.....	0.000325	"
Vaseline, 25°.....	0.00044	Lees
Water, 4°.....	0.00138	H. F. Weber
0°.....	0.00120	"
17°.....	0.00131	R. Weber
20°.....	0.00143	Milner & Chattock

GASES

Air, 0°.....	0.0000568	Winklemann
Argon, 0°.....	0.0000389	Schwarze
Ammonia gas, 0°.....	0.0000458	Winklemann
Carbon dioxide, 0°....	0.0000307	"
monoxide.....	0.0000499	"
Ethylene.....	0.0000395	"
Helium, 0°.....	0.000339	Schwarze
Hydrogen, 0°.....	0.000327	Winklemann
100°.....	0.000369	Graetz
Methane, 7°-8°.....	0.0000647	Winklemann
Nitric oxide, NO, 8°...	0.0000460	"
Nitrogen, 7°-8°.....	0.0000524	"
Nitrous oxide, N ₂ O ...	0.0000350	
Oxygen, 7°-8°.....	0.0000563	

THERMAL CONDUCTIVITY OF MATERIALS

(Bureau of Standards Letter Circular No. 227)

D = Density in pounds per cubic foot.

K = Thermal conductivity in B.T.U. per hour, square foot, and temperature gradient of 1 degree Fahrenheit per inch thickness. The lower the conductivity, the greater the insulating values.

SOFT FLEXIBLE MATERIALS IN SHEET FORM

		D	K
Dry Zero	Kapok between burlap or paper..	1.0	0.24
		2.0	0.25
Cabots Quilt	Eel grass between kraft paper....	3.4	0.25
		4.6	0.26
Hair Felt	Felted cattle hair.....	11.0	0.26
		13.0	0.26
Balsam Wool	Chemically treated wood fibre....	2.2	0.27
Hairinsul	75% hair 25% jute.....	6.3	0.27
	50% hair 50% jute.....	6.1	0.26
Linofelt	Flax fibres between paper.....	4.9	0.28
Thermofelt	Jute and asbestos fibres, felted...	10.0	0.37
	Hair and asbestos fibres, felted...	7.8	0.28

LOOSE MATERIALS

Rock Wool	Fibrous material made from rock,	6.0	0.26
	also made in sheet form, felted and	10.0	0.27
	confined with wire netting.....	14.0	0.28
		18.0	0.29
Glass Wool	Pyrex glass, curled.....	4.0	0.29
		10.0	0.29
Sil-O-Cel	Powdered diatomaceous earth....	10.6	0.31
Regranulated	Fine particles.....	9.4	0.30
Cork	about $\frac{3}{16}$ inch particles.....	8.1	0.31
Thermofill	Gypsum in powdered form.....	26.	0.52
		34.	0.60
Sawdust	Various.....	12.0	0.41
	redwood.....	10.9	0.42
Shavings	Various, from planer.....	8.8	0.41
Charcoal	From maple, beech and birch,		
	coarse.....	13.2	0.36
	6 mesh.....	15.2	0.37
	20 mesh.....	19.2	0.39

SEMI-FLEXIBLE MATERIALS IN SHEET FORM

Flaxlinum	Flax fibre.....	13.0	0.31
Fibrofelt	Flax and rye fibre.....	13.6	0.32

THERMAL CONDUCTIVITY OF MATERIALS (Continued)

SEMI-RIGID MATERIALS IN BOARD FORM

Corkboard	No added binder; very low density	5.4	0.25
Corkboard	No added binder; low density....	7.0	0.27
Corkboard	No added binder; medium density	10.6	0.30
Corkboard	No added binder; high density ..	14.0	0.34
Eureka	Corkboard with asphaltic binder .	14.5	0.32
Rock Cork	Rock wool block with binder.....	14.5	0.326
	Also called "Tucork"		
Lith	Board containing rock wool, flax and straw pulp.....	14.3	0.40

STIFF FIBROUS MATERIALS IN SHEET FORM

Insulite	Wood pulp.....	16.2	0.34
		16.9	0.34
Celotex	Sugar cane fibre.....	13.2	0.34
		14.8	0.34
*Masonite.....	K =	0.33	
*Inso-board.....		0.33	
*Maizewood.....		0.33 to 0.39	
*Cornstalk Pith Board.....		0.24 to 0.30	
*Maftex.....		0.34	

CELLULAR GYPSUM

Insulux or Pyrocell.....	8	0.35
	12	0.44
	18	0.59
	24	0.77
	30	1.00

WOODS (Across Grain)

Balsa.....	7.3	0.33
	8.8	0.38
	20	0.58
Cypress.....	29	0.67
White pine.....	32	0.78
Mahogany.....	34	0.90
Virginia pine.....	34	0.98
Oak.....	38	1.02
Maple.....	44	1.10

MISCELLANEOUS BUILDING MATERIALS

(Data taken from various sources)

	K		K
Cinder concrete....	2 to 3	Limestone.....	4 to 9
Building gypsum....	About 3	Concrete.....	6 to 9
Plaster.....	2 to 5	Sandstone.....	8 to 16
Building brick.....	3 to 6	Marble.....	14 to 20
Glass.....	5 to 6	Granite.....	13 to 28

* From various commercial laboratories and the work of O. R. Sweeney at Iowa State College.

TEMPERATURE OF SATURATED STEAM

The following table gives the temperature of saturated water vapor in degrees Centigrade and degrees Fahrenheit corresponding to gauge pressure in pounds from 0 to 3184. Zero gauge pressure corresponds to an absolute pressure of 14.696 pounds per square inch.

Gauge pressure lbs./in. ²	Temp. °F	Temp. °C	Gauge pressure lbs./in. ²	Temp. °F	Temp. °C	Gauge pressure lbs./in. ²	Temp. °F	Temp. °C
0	212.0	100.0	55	302.5	150.3	110	344.1	173.4
1	215.4	101.9	56	303.6	150.9	111	344.7	173.7
2	218.5	103.6	57	304.5	151.4	112	345.4	174.1
3	221.5	105.3	58	305.4	151.9	113	345.9	174.4
4	224.4	106.9	59	306.3	152.4	114	346.5	174.7
5	227.1	108.4	60	307.4	153.0	115	347.2	175.1
6	229.6	109.8	61	308.3	153.5	116	347.7	175.4
7	232.3	111.3	62	309.2	154.0	117	348.3	175.7
8	234.7	112.6	63	309.9	154.4	118	348.8	176.0
9	237.0	113.9	64	310.8	154.9	119	349.5	176.4
10	239.4	115.2	65	311.7	155.4	120	350.1	176.7
11	241.5	116.4	66	312.6	155.9	121	350.6	177.0
12	243.7	117.6	67	313.5	156.4	122	351.1	177.3
13	245.8	118.8	68	314.2	156.8	123	351.7	177.6
14	247.8	119.9	69	315.1	157.3	124	352.2	177.9
15	249.8	121.0	70	316.0	157.8	125	352.9	178.3
16	251.6	122.0	71	316.8	158.2	126	353.5	178.6
17	253.4	123.0	72	317.7	158.7	127	354.0	178.9
18	255.4	124.1	73	318.4	159.1	128	354.6	179.2
19	257.0	125.0	74	319.3	159.6	129	355.1	179.5
20	258.8	126.0	75	320.0	160.0	130	355.6	179.8
21	260.4	126.9	76	320.9	160.5	131	356.2	180.1
22	262.0	127.8	77	321.6	160.9	132	356.7	180.4
23	263.7	128.7	78	322.3	161.3	133	357.3	180.7
24	265.3	129.6	79	323.1	161.7	134	357.8	181.0
25	266.7	130.4	80	323.8	162.1	135	358.3	181.3
26	268.3	131.3	81	324.7	162.6	136	358.9	181.6
27	269.8	132.1	82	325.4	163.0	137	359.2	181.8
28	271.2	132.9	83	326.1	163.4	138	359.8	182.1
29	272.7	133.7	84	326.8	163.8	139	360.3	182.4
30	274.1	134.5	85	327.6	164.2	140	360.9	182.7
31	275.4	135.2	86	328.3	164.6	141	361.4	183.0
32	276.8	136.0	87	329.0	165.0	142	361.9	183.3
33	278.1	136.7	88	329.7	165.4	143	362.3	183.5
34	279.3	137.4	89	330.4	165.8	144	362.8	183.8
35	280.6	138.1	90	331.2	166.2	145	363.4	184.1
36	281.8	138.8	91	331.9	166.6	146	363.9	184.4
37	283.1	139.5	92	332.6	167.0	147	364.5	184.7
38	284.4	140.2	93	333.1	167.3	148	364.8	184.9
39	285.6	140.9	94	333.9	167.7	149	365.4	185.2
40	286.7	141.5	95	334.6	168.1	150	365.9	185.5
41	288.0	142.2	96	335.1	168.4	151	366.4	185.8
42	289.0	142.8	97	335.8	168.8	152	366.8	186.0
43	290.1	143.4	98	336.6	169.2	153	367.3	186.3
44	291.2	144.0	99	337.3	169.6	154	367.9	186.6
45	292.3	144.6	100	337.8	169.9	155	368.2	186.8
46	293.5	145.3	101	338.5	170.3	156	368.8	187.1
47	294.4	145.8	102	339.1	170.6	157	369.3	187.4
48	295.5	146.4	103	339.8	171.0	158	369.7	187.6
49	296.6	147.0	104	340.5	171.4	159	370.2	187.9
50	297.7	147.6	105	341.1	171.7	160	370.6	188.1
51	298.6	148.1	106	341.6	172.0	161	371.1	188.4
52	299.7	148.7	107	342.3	172.4	162	371.7	188.7
53	300.7	149.3	108	342.9	172.7	163	372.0	188.9
54	301.6	149.8	109	343.6	173.1	164	372.6	189.2

TEMPERATURE OF SATURATED STEAM (Continued)

Gauge pressure lbs./in. ²	Temp. °F	Temp. °C	Gauge pressure lbs./in. ²	Temp. °F	Temp. °C	Gauge pressure lbs./in. ²	Temp. °F	Temp. °C
165	372.9	189.4	225	397.2	202.9	285	417.2	214.0
166	373.5	189.7	226	397.6	203.1	286	417.6	214.2
167	373.8	189.9	227	397.9	203.3	287	417.9	214.4
168	374.4	190.2	228	398.3	203.5	288	418.1	214.5
169	374.7	190.4	229	398.7	203.7	289	418.5	214.7
170	375.3	190.7	230	399.0	203.9	290	418.8	214.9
171	375.8	191.0	231	399.4	204.1	291	419.0	215.0
172	376.2	191.2	232	399.7	204.3	292	419.4	215.2
173	376.5	191.4	233	400.1	204.5	293	419.7	215.4
174	376.9	191.6	234	400.3	204.7	294	419.9	215.5
175	377.4	191.9	235	400.8	204.9	295	420.3	215.7
176	377.8	192.1	236	401.2	205.1	296	420.6	215.9
177	378.3	192.4	237	401.5	205.3	297	420.8	216.0
178	378.7	192.6	238	401.9	205.5	298	421.2	216.2
179	379.2	192.9	239	402.3	205.7	299	421.3	216.3
180	379.6	193.1	240	402.6	205.9	300	421.7	216.5
181	379.9	193.3	241	403.0	206.1	301	422.1	216.7
182	380.5	193.6	242	403.3	206.3	302	422.2	216.8
183	380.8	193.8	243	403.7	206.5	303	422.6	217.0
184	381.4	194.1	244	404.1	206.7	304	423.0	217.2
185	381.7	194.3	245	404.4	206.9	305	423.1	217.3
186	382.1	194.5	246	404.8	207.1	306	423.5	217.5
187	382.6	194.8	247	405.0	207.2	307	423.9	217.7
188	383.0	195.0	248	405.3	207.4	308	424.0	217.8
189	383.4	195.2	249	405.7	207.6	309	424.4	218.0
190	383.7	195.4	250	406.0	207.8	310	424.6	218.1
191	384.1	195.6	251	406.4	208.0	311	424.9	218.3
192	384.6	195.9	252	406.8	208.2	312	425.3	218.5
193	385.0	196.1	253	407.1	208.4	313	425.5	218.6
194	385.3	196.3	254	407.3	208.5	314	425.8	218.8
195	385.9	196.6	255	407.7	208.7	315	426.2	219.0
196	386.2	196.8	256	408.0	208.9	316	426.4	219.1
197	386.6	197.0	257	408.4	209.1	317	426.7	219.3
198	387.0	197.2	258	408.7	209.3	318	426.9	219.4
199	387.5	197.5	259	408.9	209.4	319	427.3	219.6
200	387.9	197.7	260	409.3	209.6	320	427.5	219.7
201	388.2	197.9	261	409.6	209.8	321	427.8	219.9
202	388.6	198.1	262	410.0	210.0	322	428.0	220.0
203	388.9	198.3	263	410.4	210.2	323	428.4	220.2
204	389.3	198.5	264	410.7	210.4	324	428.5	220.3
205	389.8	198.8	265	410.9	210.5	325	428.9	220.5
206	390.2	199.0	266	411.3	210.7	326	429.3	220.7
207	390.6	199.2	267	411.6	210.9	327	429.4	220.8
208	390.9	199.4	268	412.0	211.1	328	429.8	221.0
209	391.3	199.6	269	412.2	211.2	329	430.0	221.1
210	391.6	199.8	270	412.5	211.4	330	430.3	221.3
211	392.2	200.1	271	412.9	211.6	331	430.5	221.4
212	392.5	200.3	272	413.2	211.8	332	430.9	221.6
213	392.9	200.5	273	413.4	211.9	333	431.1	221.7
214	393.3	200.7	274	413.8	212.1	334	431.4	221.9
215	393.6	200.9	275	414.1	212.3	335	431.6	222.0
216	394.0	201.1	276	414.5	212.5	336	432.0	222.2
217	394.3	201.3	277	414.7	212.6	337	432.1	222.3
218	394.7	201.5	278	415.0	212.8	338	432.5	222.5
219	395.1	201.7	279	415.4	213.0	339	432.7	222.6
220	395.4	201.9	280	415.8	213.2	340	433.0	222.8
221	395.8	202.1	281	415.9	213.3	341	433.2	222.9
222	396.1	202.3	282	416.3	213.5	342	433.6	223.1
223	396.5	202.5	283	416.7	213.7	343	433.9	223.3
224	396.9	202.7	284	417.0	213.9	344	434.1	223.4

TEMPERATURE OF SATURATED STEAM (Continued)

Gauge pressure lbs./in. ²	Temp. °F	Temp. °C	Gauge pressure lbs./in. ²	Temp. °F	Temp. °C	Gauge pressure lbs./in. ²	Temp. °F	Temp. °C
343	434.3	223.5	585	486.1	252.3	960	541.6	283.1
346	434.7	223.7	590	487.0	252.8	970	542.8	283.8
347	434.8	223.8	595	487.9	253.3	980	544.1	284.5
348	435.2	224.0	600	488.8	253.8	990	545.2	285.1
349	435.4	224.1	605	489.7	254.3	1000	546.4	285.8
350	435.7	224.3	610	490.6	254.8	1010	547.7	286.5
351	435.9	224.4	615	491.5	255.3	1020	548.8	287.1
352	436.3	224.6	620	492.3	255.7	1030	550.0	287.8
353	436.5	224.7	625	493.2	256.2	1040	551.1	288.4
354	436.6	224.8	630	494.1	256.7	1050	552.4	289.1
355	437.0	225.0	635	495.0	257.2	1060	553.5	289.7
356	437.2	225.1	640	495.7	257.6	1070	554.7	290.4
357	437.5	225.3	645	496.6	258.1	1080	555.8	291.0
358	437.7	225.4	650	497.5	258.6	1090	556.9	291.6
359	438.1	225.6	655	498.2	259.0	1100	558.0	292.2
360	438.3	225.7	660	499.1	259.5	1110	559.0	292.8
365	439.5	226.4	665	499.8	259.9	1120	560.1	293.4
370	440.8	227.1	670	500.7	260.4	1130	561.2	294.0
375	442.0	227.8	675	501.4	260.8	1140	562.5	294.7
380	443.3	228.5	680	502.3	261.3	1150	563.5	295.3
385	444.6	229.2	685	503.1	261.7	1160	564.6	295.9
390	445.8	229.9	690	504.0	262.2	1170	565.5	296.4
395	447.1	230.6	695	504.7	262.6	1180	566.6	297.0
400	448.2	231.2	700	505.6	263.1	1190	567.7	297.6
405	449.4	231.9	705	506.3	263.5	1200	568.8	298.2
410	450.5	232.5	710	507.0	263.9	1210	569.8	298.8
415	451.8	233.2	715	507.7	264.3	1220	570.7	299.3
420	452.8	233.8	720	508.6	264.8	1230	571.8	299.9
425	453.9	234.4	725	509.4	265.2	1240	572.9	300.5
430	455.2	235.1	730	510.1	265.6	1250	573.8	301.0
435	456.3	235.7	735	510.8	266.0	1260	574.9	301.6
440	457.3	236.3	740	511.7	266.5	1270	576.0	302.2
445	458.4	236.9	745	512.4	266.9	1280	576.9	302.7
450	459.5	237.5	750	513.1	267.3	1290	578.0	303.3
455	460.6	238.1	755	513.9	267.7	1300	578.8	303.8
460	461.7	238.7	760	514.6	268.1	1310	579.7	304.3
465	462.7	239.3	765	515.3	268.5	1320	580.8	304.9
470	463.8	239.9	770	516.0	268.9	1330	581.7	305.4
475	464.9	240.5	775	516.7	269.3	1340	582.8	306.0
480	466.0	241.1	780	517.5	269.7	1350	583.7	306.5
485	467.1	241.7	785	518.2	270.1	1360	584.6	307.0
490	468.0	242.2	790	518.9	270.5	1370	585.5	307.5
495	469.0	242.8	795	519.6	270.9	1380	586.6	308.1
500	470.1	243.4	800	520.3	271.3	1390	587.5	308.6
505	471.0	243.9	805	521.1	271.7	1400	588.4	309.1
510	472.1	244.5	810	521.8	272.1	1410	589.3	309.6
515	473.0	245.0	820	523.2	272.9	1420	590.4	310.2
520	474.1	245.6	830	524.7	273.7	1430	591.3	310.7
525	475.0	246.1	840	525.9	274.4	1440	592.2	311.2
530	476.1	246.7	850	527.4	275.2	1450	593.1	311.7
535	477.0	247.2	860	528.6	275.9	1460	594.0	312.2
540	477.9	247.7	870	530.1	276.7	1470	594.9	312.7
545	478.8	248.2	880	531.3	277.4	1480	595.8	313.2
550	479.8	248.8	890	532.6	278.1	1490	596.7	313.7
555	480.7	249.3	900	534.0	278.9	1500	597.6	314.2
560	481.6	249.8	910	535.3	279.6	1510	598.5	314.7
565	482.5	250.3	920	536.5	280.3	1520	599.2	315.1
570	483.4	250.8	930	537.8	281.0	1530	600.1	315.6
575	484.3	251.3	940	539.1	281.7	1540	601.0	316.1
580	485.2	251.8	950	540.3	282.4	1550	601.9	316.6

TEMPERATURE OF SATURATED STEAM (Continued)

Gauge pressure lbs./in. ²	Temp. °F	Temp. °C	Gauge pressure lbs./in. ²	Temp. °F	Temp. °C	Gauge pressure lbs./in. ²	Temp. °F	Temp. °C
1560	602.6	317.0	2110	644.4	340.2	2660	678.4	359.1
1570	603.5	317.5	2120	645.1	340.6	2670	678.9	359.4
1580	604.4	318.0	2130	645.8	341.0	2680	679.5	359.7
1590	605.3	318.5	2140	646.3	341.3	2690	680.0	360.0
1600	606.0	318.9	2150	647.1	341.7	2700	680.5	360.3
1610	606.9	319.4	2160	647.8	342.1	2710	681.1	360.6
1620	607.8	319.9	2170	648.5	342.5	2720	681.6	360.9
1630	608.5	320.3	2180	649.0	342.8	2730	682.2	361.2
1640	609.4	320.8	2190	649.8	343.2	2740	682.7	361.5
1650	610.2	321.2	2200	650.3	343.5	2750	683.2	361.8
1660	611.1	321.7	2210	651.0	343.9	2760	684.0	362.2
1670	612.0	322.2	2220	651.7	344.3	2770	684.5	362.5
1680	612.7	322.6	2230	652.3	344.6	2780	685.0	362.8
1690	613.4	323.0	2240	653.0	345.0	2790	685.6	363.1
1700	614.3	323.5	2250	653.5	345.3	2800	686.1	363.4
1710	615.0	323.9	2260	654.3	345.7	2810	686.5	363.6
1720	615.9	324.4	2270	654.8	346.0	2820	687.0	363.9
1730	616.6	324.8	2280	655.5	346.4	2830	687.6	364.2
1740	617.4	325.2	2290	656.1	346.7	2840	688.1	364.5
1750	618.3	325.7	2300	656.8	347.1	2850	688.6	364.8
1760	619.0	326.1	2310	657.3	347.4	2860	689.2	365.1
1770	619.9	326.6	2320	658.0	347.8	2870	689.7	365.4
1780	620.6	327.0	2330	658.6	348.1	2880	690.3	365.7
1790	621.3	327.4	2340	659.3	348.5	2890	690.8	366.0
1800	622.0	327.8	2350	659.8	348.8	2900	691.3	366.3
1810	622.8	328.2	2360	660.6	349.2	2910	691.7	366.5
1820	623.7	328.7	2370	661.1	349.5	2920	692.2	366.8
1830	624.4	329.1	2380	661.8	349.9	2930	692.8	367.1
1840	625.1	329.5	2390	662.4	350.2	2940	693.3	367.4
1850	625.8	329.9	2400	663.1	350.6	2950	693.9	367.7
1860	626.5	330.3	2410	663.6	350.9	2960	694.2	367.9
1870	627.4	330.8	2420	664.2	351.2	2970	694.8	368.2
1880	628.2	331.2	2430	664.9	351.6	2980	695.3	368.5
1890	628.9	331.6	2440	665.4	351.9	2990	695.8	368.8
1900	629.6	332.0	2450	666.0	352.2	3000	696.4	369.1
1910	630.3	332.4	2460	666.7	352.6	3010	696.7	369.3
1920	631.0	332.8	2470	667.2	352.9	3020	697.3	369.6
1930	631.8	333.2	2480	667.9	353.3	3030	697.8	369.9
1940	632.5	333.6	2490	668.5	353.6	3040	698.4	370.2
1950	633.2	334.0	2500	669.0	353.9	3050	698.7	370.4
1960	633.9	334.4	2510	669.7	354.3	3060	699.3	370.7
1970	634.6	334.8	2520	670.3	354.6	3070	699.8	371.0
1980	635.4	335.2	2530	670.8	354.9	3080	700.3	371.3
1990	636.1	335.6	2540	671.5	355.3	3090	700.7	371.5
2000	636.8	336.0	2550	672.1	355.6	3100	701.2	371.8
2010	637.5	336.4	2560	672.6	355.9	3110	701.8	372.1
2020	638.2	336.8	2570	673.2	356.2	3120	702.1	372.3
2030	639.0	337.2	2580	673.7	356.5	3130	702.7	372.6
2040	639.5	337.5	2590	674.4	356.9	3140	703.2	372.9
2050	640.2	337.9	2600	675.0	357.2	3150	703.6	373.1
2060	640.9	338.3	2610	675.5	357.5	3160	704.1	373.4
2070	641.7	338.7	2620	676.0	357.8	3170	704.5	373.6
2080	642.4	339.1	2630	676.6	358.1	3180	705.0	373.9
2090	642.9	339.4	2640	677.3	358.5	3184	705.2	*374.0
2100	643.6	339.8	2650	677.8	358.8	....	....	....

* Critical point.

PROPERTIES OF SATURATED STEAM

PROPERTIES OF

METRIC AND

The heat units used are the large calorie, 15° to 16° C and the B.T.U., 62° to 63° F. The heat of the liquid, q , is the heat required to raise unit mass of water from 0° C (32° F) to the temperature indicated. The heat of vaporization, r , is the heat required to vaporize unit mass of water at the indicated temperature and pressure. Total heat involved, $H = r + q$.

The heat of vaporization overcomes external pressure and changes the state from liquid to vapor at constant temperature and pressure. If u is the

Temperature, degrees Centigrade. <i>t</i>	Total pressure, (Gauge pressure plus atmospheric pressure)			Heat of the liquid.		Heat of vaporiza- tion.		Heat equiva- lent of inter- nal work.		Temperature, degrees Fahrenheit. <i>t</i>
	Millimeters of mer- cury. <i>p</i>	Kilograms per square centimeter. <i>p</i>	Pounds per square inch. <i>p</i>	Calories per kilogram. <i>q</i>	B.T.U. per pound. <i>q</i>	Calories per kilogram. <i>r</i>	B.T.U. per pound. <i>r</i>	Calories per kilogram. <i>p</i>	B.T.U. per pound. <i>p</i>	
0	4.579	0.00623	0.0886	0.00	0.0	595.4	1071.7	565.3	1017.5	32
1	4.924	0.00670	0.0952	1.01	1.8	594.9	1070.8	564.7	1016.4	33.8
2	5.290	0.00719	0.1023	2.02	3.6	594.4	1069.9	564.0	1015.3	35.6
3	5.681	0.00772	0.1099	3.03	5.5	593.9	1069.0	563.4	1014.2	37.4
4	6.097	0.00829	0.1179	4.03	7.3	593.3	1068.0	562.8	1013.1	39.2
5	6.541	0.00889	0.1265	5.04	9.1	592.8	1067.1	562.2	1011.9	41
6	7.011	0.00953	0.1356	6.04	10.9	592.3	1066.1	561.5	1010.7	42.8
7	7.511	0.01021	0.1453	7.05	12.7	591.8	1065.2	560.9	1009.6	44.6
8	8.042	0.01093	0.1555	8.05	14.5	591.2	1064.2	560.2	1008.5	46.4
9	8.606	0.01170	0.1664	9.05	16.3	590.7	1063.3	559.6	1007.4	48.2
10	9.205	0.01252	0.1780	10.06	18.1	590.2	1062.3	559.0	1006.2	50
11	9.840	0.01338	0.1903	11.06	19.9	589.6	1061.3	558.3	1005.0	51.8
12	10.513	0.01429	0.2033	12.06	21.7	589.1	1060.4	557.7	1003.9	53.6
13	11.226	0.01526	0.2171	13.06	23.5	588.6	1059.4	557.1	1002.7	55.4
14	11.980	0.01629	0.2317	14.06	25.3	588.1	1058.5	556.5	1001.6	57.2
15	12.779	0.01737	0.2471	15.06	27.1	587.6	1057.6	555.9	1000.5	59
16	13.624	0.01852	0.2635	16.06	28.9	587.0	1056.6	555.2	999.4	60.8
17	14.517	0.01974	0.2807	17.06	30.7	586.5	1055.7	554.6	998.3	62.6
18	15.460	0.02102	0.2990	18.06	32.5	585.9	1054.7	553.9	997.1	64.4
19	16.456	0.02237	0.3182	19.06	34.3	585.4	1053.8	553.3	996.0	66.2
20	17.51	0.02381	0.3386	20.06	36.1	584.9	1052.8	552.7	994.8	68
21	18.62	0.02532	0.3601	21.06	37.9	584.4	1051.9	552.1	993.7	69.8
22	19.79	0.02691	0.3827	22.06	39.7	583.9	1051.0	551.5	992.6	71.6
23	21.02	0.02858	0.4065	23.06	41.5	583.3	1050.0	550.8	991.4	73.4
24	22.32	0.03035	0.4316	24.06	43.3	582.8	1049.1	550.2	990.3	75.2
25	23.69	0.03221	0.4581	25.05	45.1	582.3	1048.1	549.5	989.1	77
26	25.13	0.03417	0.4860	26.05	46.9	581.8	1047.2	548.9	988.0	78.8
27	26.65	0.03623	0.5154	27.05	48.7	581.2	1046.2	548.2	986.9	80.6
28	28.25	0.03841	0.5463	28.05	50.5	580.7	1045.2	547.6	985.7	82.4
29	29.94	0.04071	0.5790	29.04	52.3	580.2	1044.3	547.0	984.6	84.2
30	31.71	0.04311	0.6132	30.04	54.1	579.6	1043.3	546.3	983.4	86

SATURATED STEAM

ENGLISH UNITS

change in volume the external work is pu and the corresponding amount of heat is Apu where A is the reciprocal of the mechanical equivalent of heat. The part of the heat of vaporization not used in external work is considered used in changing the state from liquid to vapor. The heat required for this work may be represented by $p = r - Apu$.

(From Peabody, Steam and Entropy Tables, John Wiley and Sons, Inc., publishers, by permission.)

Temperature, degrees Centigrade. <i>t</i>	Heat equivalent of external work.		Entropy of the liquid. θ	Entropy of vaporization. $\frac{r}{T}$	Specific volume.		Density.		Temperature, degrees Fahrenheit. <i>t</i>
	Calories per kilogram. <i>Apu</i>	B.T.U. per pound. <i>Apu</i>			Cubic meters per kilo. <i>s</i>	Cubic feet per pound. <i>s</i>	Kilos per cubic meter. $\frac{1}{s}$	Pounds per cubic foot. $\frac{1}{s}$	
0	30.1	54.2	0.0000	2.1804	206.3	3304	0.00485	0.000303	32
1	30.2	54.4	0.0037	2.1706	192.7	3087	0.00519	0.000324	33.8
2	30.4	54.6	0.0074	2.1609	180.0	2884	0.00556	0.000347	35.6
3	30.5	54.8	0.0110	2.1513	168.2	2694	0.00595	0.000371	37.4
4	30.5	54.9	0.0146	2.1416	157.2	2513	0.00636	0.000397	39.2
5	30.6	55.2	0.0183	2.1320	147.1	2356	0.00680	0.000424	41
6	30.8	55.4	0.0219	2.1225	137.7	2206	0.00726	0.000453	42.8
7	30.9	55.6	0.0256	2.1130	129.0	2067	0.00775	0.000484	44.6
8	31.0	55.7	0.0290	2.1036	120.9	1937	0.00827	0.000516	46.4
9	31.1	55.9	0.0326	2.0943	113.4	1816	0.00882	0.000551	48.2
10	31.2	56.1	0.0361	2.0850	106.3	1703	0.00941	0.000587	50
11	31.3	56.3	0.0397	2.0758	99.8	1599	0.01002	0.000625	51.8
12	31.4	56.5	0.0433	2.0667	93.7	1502	0.01067	0.000666	53.6
13	31.5	56.7	0.0467	2.0576	88.1	1411	0.01135	0.000709	55.4
14	31.6	56.9	0.0502	2.0486	82.9	1327	0.01206	0.000754	57.2
15	31.7	57.1	0.0537	2.0396	77.9	1248	0.01283	0.000801	59
16	31.8	57.3	0.0571	2.0308	73.3	1174	0.01364	0.000852	60.8
17	31.9	57.4	0.0607	2.0220	69.1	1105	0.01447	0.000905	62.6
18	32.0	57.6	0.0641	2.0132	65.1	1041	0.01536	0.000961	64.4
19	32.1	57.8	0.0675	2.0045	61.3	982	0.01631	0.001018	66.2
20	32.2	58.0	0.0709	1.9959	57.8	926	0.01730	0.001080	68
21	32.3	58.2	0.0743	1.9873	54.5	873	0.01835	0.001145	69.8
22	32.4	58.4	0.0776	1.9788	51.5	824	0.01942	0.001214	71.6
23	32.5	58.6	0.0811	1.9703	48.60	778	0.02058	0.001286	73.4
24	32.6	58.8	0.0845	1.9620	45.92	735	0.02178	0.001361	75.2
25	32.8	59.0	0.0878	1.9536	43.40	695	0.02304	0.001439	77
26	32.9	59.2	0.0911	1.9453	41.05	657	0.02436	0.001522	78.8
27	33.0	59.3	0.0945	1.9370	38.83	622	0.02575	0.001608	80.6
28	33.1	59.5	0.0978	1.9288	36.74	589	0.02722	0.001698	82.4
29	33.2	59.7	0.1011	1.9207	34.78	557	0.02875	0.001795	84.2
30	33.3	59.9	0.1044	1.9126	32.95	528	0.03035	0.001894	86

PROPERTIES OF

Temperature, degrees Centigrade.	Total pressure.			Heat of the liquid.		Heat of vaporiza- tion.		Heat equiva- lent of inter- nal work.		Temperature, degrees Fahrenheit
	Millimeters of mer- cury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
<i>t</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>q</i>	<i>q</i>	<i>r</i>	<i>r</i>	<i>p</i>	<i>p</i>	<i>t</i>
31	33.57	0.04564	0.6492	31.04	55.9	579.1	1042.4	545.7	982.2	87.8
32	35.53	0.04830	0.6871	32.04	57.7	578.6	1041.4	545.1	981.0	89.6
33	37.59	0.05111	0.7269	33.04	59.5	578.0	1040.4	544.4	979.9	91.4
34	39.75	0.05404	0.7687	34.03	61.3	577.4	1039.4	543.7	978.7	93.2
35	42.02	0.05713	0.8126	35.03	63.1	576.9	1038.5	543.1	977.6	95
36	44.40	0.06037	0.8586	36.03	64.9	576.4	1037.5	542.5	976.4	96.8
37	46.90	0.06376	0.9068	37.02	66.6	575.8	1036.5	541.8	975.2	98.6
38	49.51	0.06731	0.9574	38.02	68.4	575.3	1035.5	541.2	974.0	100.4
39	52.26	0.07105	1.0105	39.02	70.2	574.7	1034.5	540.5	972.8	102.2
40	55.13	0.07495	1.0661	40.02	72.0	574.2	1033.5	539.9	971.7	104
41	58.14	0.07905	1.1243	41.01	73.8	573.6	1032.5	539.2	970.5	105.8
42	61.30	0.08334	1.1854	42.01	75.6	573.1	1031.5	538.6	969.3	107.6
43	64.59	0.08782	1.2492	43.01	77.4	572.5	1030.5	537.9	968.2	109.4
44	68.05	0.09252	1.3159	44.01	79.2	571.9	1029.4	537.2	966.9	111.2
45	71.66	0.09743	1.3858	45.00	81.0	571.3	1028.4	536.5	965.7	113
46	75.43	0.10256	1.4587	46.00	82.8	570.8	1027.4	535.8	964.5	114.8
47	79.38	0.10792	1.5350	47.00	84.6	570.2	1026.4	535.1	963.3	116.6
48	83.50	0.11353	1.6147	48.00	86.4	569.6	1025.3	534.4	962.0	118.4
49	87.80	0.11937	1.6979	48.99	88.2	569.0	1024.3	533.7	960.8	120.2
50	92.30	0.12549	1.7849	49.99	90.0	568.4	1023.2	533.0	959.6	122
51	96.99	0.13187	1.8756	50.99	91.8	567.8	1022.2	532.3	958.4	123.8
52	101.88	0.13852	1.9701	51.99	93.6	567.3	1021.2	531.7	957.2	125.6
53	106.99	0.14546	2.0689	52.99	95.4	566.8	1020.2	531.1	956.0	127.4
54	112.30	0.15268	2.172	53.98	97.2	566.2	1019.1	530.4	954.7	129.2
55	117.85	0.16023	2.279	54.98	99.0	565.6	1018.1	529.7	953.5	131
56	123.61	0.16806	2.390	55.98	100.8	565.1	1017.1	529.1	952.3	132.8
57	129.63	0.17624	2.506	56.98	102.6	564.5	1016.1	528.4	951.1	134.6
58	135.89	0.18475	2.627	57.98	104.4	563.9	1015.1	527.7	949.9	136.4
59	142.41	0.19362	2.754	58.97	106.2	563.4	1014.1	527.1	948.7	138.2
60	149.19	0.20284	2.885	59.97	108.0	562.8	1013.1	526.4	947.5	140
61	156.24	0.21242	3.021	60.97	109.8	562.2	1012.0	525.7	946.3	141.8
62	163.58	0.2224	3.163	61.97	111.6	561.7	1011.0	525.1	945.1	143.6
63	171.20	0.2328	3.310	62.97	113.4	561.1	1009.9	524.4	943.8	145.4
64	179.13	0.2435	3.464	63.98	115.2	560.5	1008.9	523.7	942.6	147.2
65	187.36	0.2547	3.623	64.98	117.0	559.9	1007.8	523.0	941.3	149
66	195.92	0.2664	3.789	65.98	118.8	559.3	1006.8	522.3	940.1	150.8
67	204.80	0.2784	3.960	66.98	120.6	558.8	1005.8	521.7	938.9	152.6
68	214.02	0.2910	4.139	67.98	122.4	558.2	1004.7	521.0	937.6	154.4
69	223.58	0.3040	4.324	68.98	124.2	557.6	1003.6	520.3	936.3	156.2
70	233.53	0.3175	4.516	69.98	126.0	556.9	1002.5	519.5	935.0	158

SATURATED STEAM (Continued)

Temperature, degrees Centigrade. <i>t</i>	Heat equivalent of external work.		Entropy of the liquid. <i>θ</i>	Entropy of vaporization. $\frac{r}{T}$	Specific volume.		Density.		Temperature, degrees Fahrenheit. <i>t</i>
	Calories per kilogram. <i>A_{pu}</i>	B.T.U. per pound. <i>A_{pu}</i>			Cubic meters per kilo. <i>s</i>	Cubic feet per pound. <i>s</i>	Kilos per cubic meter. $\frac{1}{s}$	Pounds per cubic foot. $\frac{1}{s}$	
31	33.4	60.2	0.1077	1.9046	31.24	501	0.03201	0.001996	87.8
32	33.5	60.4	0.1110	1.8966	29.62	474.7	0.03376	0.002107	89.6
33	33.6	60.5	0.1142	1.8886	28.08	449.7	0.03561	0.002224	91.4
34	33.7	60.7	0.1175	1.8806	26.62	426.5	0.03757	0.002345	93.2
35	33.8	60.9	0.1207	1.8728	25.25	404.7	0.03960	0.002471	95
36	33.9	61.1	0.1239	1.8650	23.98	384.2	0.04170	0.002603	96.8
37	34.0	61.3	0.1272	1.8572	22.78	364.9	0.04390	0.002740	98.6
38	34.1	61.5	0.1304	1.8494	21.65	346.8	0.04619	0.002884	100.4
39	34.2	61.7	0.1336	1.8417	20.58	329.7	0.04859	0.003033	102.2
40	34.3	61.8	0.1368	1.8341	19.57	313.5	0.0511	0.003190	104
41	34.4	62.0	0.1399	1.8265	18.61	298.0	0.0537	0.003356	105.8
42	34.5	62.2	0.1431	1.8189	17.69	283.3	0.0565	0.003530	107.6
43	34.6	62.3	0.1463	1.8113	16.82	269.5	0.0595	0.003711	109.4
44	34.7	62.5	0.1494	1.8038	16.01	256.5	0.0625	0.003899	111.2
45	34.8	62.7	0.1526	1.7963	15.25	244.4	0.0656	0.004092	113
46	35.0	62.9	0.1557	1.7889	14.54	233.0	0.0688	0.004292	114.8
47	35.1	63.1	0.1588	1.7815	13.86	222.1	0.0722	0.004502	116.6
48	35.2	63.3	0.1619	1.7742	13.21	211.7	0.0757	0.004724	118.4
49	35.3	63.5	0.1650	1.7669	12.60	201.9	0.0794	0.00495	120.2
50	35.4	63.6	0.1682	1.7597	12.02	192.6	0.0832	0.00519	122
51	35.5	63.8	0.1713	1.7525	11.47	183.8	0.0872	0.00544	123.8
52	35.6	64.0	0.1743	1.7454	10.96	175.5	0.0912	0.00570	125.6
53	35.7	64.2	0.1774	1.7383	10.47	167.7	0.0955	0.00596	127.4
54	35.8	64.4	0.1804	1.7312	10.00	160.3	0.1000	0.00624	129.2
55	35.9	64.6	0.1835	1.7242	9.56	153.2	0.1046	0.00653	131
56	36.0	64.8	0.1865	1.7173	9.14	146.5	0.1094	0.00683	132.8
57	36.1	65.0	0.1895	1.7104	8.74	140.1	0.1144	0.00713	134.6
58	36.2	65.2	0.1925	1.7035	8.36	134.0	0.1196	0.00746	136.4
59	36.3	65.4	0.1955	1.6967	8.00	128.3	0.1250	0.00779	138.2
60	36.4	65.6	0.1986	1.6899	7.66	122.8	0.1305	0.00814	140
61	36.5	65.7	0.2016	1.6831	7.34	117.6	0.1362	0.00850	141.8
62	36.6	65.9	0.2046	1.6764	7.03	112.7	0.1422	0.00887	143.6
63	36.7	66.1	0.2075	1.6696	6.74	108.0	0.1484	0.00926	145.4
64	36.8	66.3	0.2105	1.6629	6.46	103.5	0.1548	0.00966	147.2
65	36.9	66.5	0.2135	1.6563	6.19	99.2	0.1615	0.01008	149
66	37.0	66.7	0.2164	1.6497	5.94	95.1	0.1684	0.01051	150.8
67	37.1	66.9	0.2194	1.6431	5.70	91.3	0.1754	0.01095	152.6
68	37.2	67.1	0.2223	1.6366	5.47	87.6	0.1828	0.01142	154.4
69	37.3	67.3	0.2253	1.6300	5.25	84.1	0.1905	0.01189	156.2
70	37.4	67.4	0.2282	1.6235	5.04	80.7	0.1984	0.01239	158

PROPERTIES OF

Temperature, degrees Centigrade. <i>t</i>	Total pressure.			Heat of the liquid.		Heat of vaporiza- tion.		Heat equiva- lent of inter- nal work.		Temperature, degrees Fahrenheit. <i>t</i>
	Millimeters of mer- cury. <i>p</i>	Kilograms per square centimeter. <i>p</i>	Pounds per square inch. <i>p</i>	Calories per kilogram. <i>q</i>	B.T.U. per pound. <i>q</i>	Calories per kilogram. <i>r</i>	B.T.U. per pound. <i>r</i>	Calories per kilogram. <i>p</i>	B.T.U. per pound. <i>p</i>	
71	243.8	0.3315	4.715	70.98	127.8	556.4	1001.5	518.8	933.9	159.8
72	254.5	0.3460	4.921	71.99	129.6	555.8	1000.4	518.1	932.6	161.6
73	265.6	0.3611	5.136	72.99	131.4	555.2	999.4	517.4	931.4	163.4
74	277.1	0.3767	5.358	73.99	133.2	554.6	998.3	516.7	930.1	165.2
75	289.0	0.3929	5.589	74.99	135.0	554.0	997.3	516.0	928.8	167
76	301.3	0.4096	5.826	76.00	136.8	553.4	996.2	515.3	927.6	168.8
77	314.0	0.4269	6.072	77.00	138.6	552.9	995.2	514.7	926.4	170.6
78	327.2	0.4449	6.327	78.00	140.4	552.3	994.1	514.0	925.2	172.4
79	340.9	0.4635	6.592	79.01	142.2	551.7	993.0	513.3	923.9	174.2
80	355.1	0.4828	6.867	80.01	144.0	551.1	991.9	512.6	922.6	176
81	369.7	0.5026	7.150	81.02	145.8	550.5	990.8	511.9	921.3	177.8
82	384.9	0.5233	7.443	82.02	147.6	549.9	989.8	511.2	920.1	179.6
83	400.5	0.5445	7.745	83.03	149.4	549.3	988.7	510.5	918.8	181.4
84	416.7	0.5665	8.058	84.03	151.2	548.7	987.6	509.8	917.6	183.2
85	433.5	0.5894	8.383	85.04	153.1	548.1	986.5	509.1	916.3	185
86	450.8	0.6129	8.717	86.04	154.9	547.4	985.4	508.3	915.0	186.8
87	468.6	0.6371	9.062	87.05	156.7	546.8	984.3	507.6	913.7	188.6
88	487.1	0.6623	9.419	88.06	158.5	546.2	983.2	506.9	912.5	190.4
89	506.1	0.6881	9.787	89.06	160.3	545.6	982.1	506.2	911.2	192.2
90	525.8	0.7149	10.167	90.07	162.1	544.9	980.9	505.4	909.9	194
91	546.1	0.7425	10.560	91.08	163.9	544.3	979.8	504.7	908.5	195.8
92	567.1	0.7710	10.966	92.08	165.7	543.7	978.7	504.0	907.2	197.6
93	588.7	0.8004	11.384	93.09	167.5	543.1	977.6	503.3	906.0	199.4
94	611.0	0.8307	11.815	94.10	169.3	542.5	976.5	502.6	904.7	201.2
95	634.0	0.8620	12.260	95.11	171.2	541.9	975.4	501.9	903.4	203
96	657.7	0.8942	12.718	96.12	173.0	541.2	974.2	501.1	902.1	204.8
97	682.1	0.9274	13.190	97.12	174.8	540.6	973.1	500.4	900.8	206.6
98	707.3	0.9616	13.678	98.13	176.6	539.9	971.9	499.6	899.4	208.4
99	733.3	0.9970	14.180	99.14	178.5	539.3	970.8	498.9	898.2	210.2
100	760.0	1.0333	14.697	100.2	180.3	538.7	969.7	498.2	896.9	212
101	787.5	1.0707	15.229	101.2	182.1	538.1	968.5	497.5	895.5	213.8
102	815.9	1.1093	15.778	102.2	183.9	537.4	967.3	496.8	894.1	215.6
103	845.1	1.1490	16.342	103.2	185.7	536.8	966.2	496.1	892.9	217.4
104	875.1	1.1898	16.923	104.2	187.6	536.2	965.1	495.4	891.6	219.2
105	906.1	1.2319	17.522	105.2	189.4	535.6	964.0	494.7	890.3	221
106	937.9	1.2752	18.137	106.2	191.2	534.9	962.8	493.9	889.0	222.8
107	970.6	1.3196	18.769	107.2	193.0	534.2	961.6	493.1	887.6	224.6
108	1004.3	1.3653	19.420	108.2	194.8	533.6	960.5	492.4	886.3	226.4
109	1038.8	1.4123	20.089	109.3	196.7	532.9	959.3	491.6	885.0	228.2
110	1074.5	1.4608	20.777	110.3	198.5	532.3	958.1	490.9	883.6	230

SATURATED STEAM (Continued)

Temperature, degrees Centigrade. <i>t</i>	Heat equivalent of external work.		Entropy of the liquid. θ	Entropy of vaporization. $\frac{r}{T}$	Specific volume.		Density.		Temperature, degrees Fahrenheit <i>t</i>
	Calories per kilogram. <i>Apv</i>	B. T. U. per pound. <i>Apv</i>			Cubic meters per kilo. <i>s</i>	Cubic feet per pound. <i>s</i>	Kilos per cubic meter. $\frac{1}{s}$	Pounds per cubic foot. $\frac{1}{s}$	
71	37.6	67.6	0.2311	1.6171	4.838	77.5	0.2067	0.01290	159.8
72	37.7	67.8	0.2340	1.6107	4.647	74.4	0.2152	0.01344	161.6
73	37.8	68.0	0.2369	1.6044	4.466	71.5	0.2239	0.01398	163.4
74	37.9	68.2	0.2398	1.5981	4.294	68.8	0.2329	0.01453	165.2
75	38.0	68.5	0.2427	1.5918	4.130	66.2	0.2421	0.01510	167
76	38.1	68.6	0.2456	1.5856	3.973	63.7	0.2517	0.01570	168.8
77	38.2	68.8	0.2484	1.5793	3.822	61.2	0.2616	0.01634	170.6
78	38.3	68.9	0.2513	1.5731	3.676	58.8	0.2720	0.01700	172.4
79	38.4	69.1	0.2541	1.5670	3.537	56.6	0.2827	0.01767	174.2
80	38.5	69.3	0.2570	1.5609	3.404	54.5	0.2938	0.01835	176
81	38.6	69.5	0.2598	1.5548	3.277	52.5	0.3052	0.01905	177.8
82	38.7	69.7	0.2626	1.5487	3.156	50.6	0.3168	0.01976	179.6
83	38.8	69.9	0.2654	1.5426	3.040	48.71	0.3289	0.02053	181.4
84	38.9	70.0	0.2682	1.5366	2.929	46.92	0.3414	0.02131	183.2
85	39.0	70.2	0.2711	1.5307	2.824	45.23	0.3541	0.02211	185
86	39.1	70.4	0.2739	1.5247	2.723	43.62	0.3672	0.02293	186.8
87	39.2	70.6	0.2767	1.5187	2.627	42.08	0.3807	0.02376	188.6
88	39.3	70.7	0.2795	1.5128	2.534	40.59	0.3946	0.02463	190.4
89	39.4	70.9	0.2823	1.5069	2.444	39.15	0.4091	0.02554	192.2
90	39.5	71.0	0.2851	1.5010	2.358	37.77	0.4241	0.02648	194
91	39.6	71.3	0.2879	1.4952	2.275	36.45	0.4395	0.02743	195.8
92	39.7	71.5	0.2906	1.4894	2.197	35.19	0.4552	0.02842	197.6
93	39.8	71.6	0.2934	1.4836	2.122	34.00	0.4713	0.02941	199.4
94	39.9	71.8	0.2961	1.4779	2.050	32.86	0.4878	0.03043	201.2
95	40.0	72.0	0.2989	1.4723	1.980	31.75	0.505	0.03149	203
96	40.1	72.1	0.3016	1.4666	1.913	30.67	0.523	0.03260	204.8
97	40.2	72.3	0.3043	1.4609	1.849	29.63	0.541	0.03375	206.6
98	40.3	72.5	0.3070	1.4552	1.787	28.64	0.560	0.03492	208.4
99	40.4	72.6	0.3097	1.4496	1.728	27.69	0.579	0.03611	210.2
100	40.5	72.8	0.3125	1.4441	1.671	26.78	0.598	0.03734	212
101	40.6	73.0	0.3152	1.4386	1.617	25.90	0.618	0.03861	213.8
102	40.6	73.2	0.3179	1.4330	1.564	25.06	0.639	0.03990	215.6
103	40.7	73.3	0.3205	1.4275	1.514	24.25	0.661	0.04124	217.4
104	40.8	73.5	0.3232	1.4220	1.465	23.47	0.683	0.04261	219.2
105	40.9	73.7	0.3259	1.4165	1.419	22.73	0.705	0.04400	221
106	41.0	73.8	0.3286	1.4111	1.374	22.01	0.728	0.04543	222.8
107	41.1	74.0	0.3312	1.4057	1.331	21.31	0.751	0.04692	224.6
108	41.2	74.2	0.3339	1.4003	1.289	20.64	0.776	0.04845	226.4
109	41.3	74.3	0.3365	1.3949	1.248	19.99	0.801	0.05000	228.2
110	41.4	74.5	0.3392	1.3895	1.209	19.37	0.827	0.0516	230

PROPERTIES OF

Temperature, degrees Centigrade. <i>t</i>	Total pressure.			Heat of the liquid.		Heat of vaporiza- tion.		Heat equiva- lent of inter- nal work.		Temperature, degrees Fahrenheit. <i>t</i>
	Millimeters of mer- cury. <i>p</i>	Kilograms per square centimeter. <i>p</i>	Pounds per square inch. <i>p</i>	Calories per kilogram. <i>q</i>	B. T. U. per pound. <i>q</i>	Calories per kilogram. <i>r</i>	B. T. U. per pound. <i>r</i>	Calories per kilogram. <i>ρ</i>	B. T. U. per pound. <i>ρ</i>	
111	1111.1	1.5106	21.486	111.3	200.3	531.6	956.9	490.2	832.3	231.8
112	1148.7	1.5617	22.214	112.3	202.1	530.9	955.7	489.4	830.9	233.6
113	1187.4	1.6144	22.962	113.3	203.9	530.3	954.5	488.7	829.5	235.4
114	1227.1	1.6684	23.729	114.3	205.8	529.6	953.3	487.9	828.2	237.2
115	1267.9	1.7238	24.518	115.3	207.6	528.9	952.1	487.1	826.8	239
116	1309.8	1.7808	25.328	116.4	209.4	528.2	950.8	486.3	825.4	240.8
117	1352.8	1.8393	26.160	117.4	211.2	527.5	949.5	485.5	823.9	242.6
118	1397.0	1.8993	27.015	118.4	213.0	526.9	948.4	484.8	822.6	244.4
119	1442.4	1.9611	27.893	119.4	214.9	526.2	947.2	484.0	821.3	246.2
120	1488.9	2.0243	28.792	120.4	216.7	525.6	946.0	483.4	820.0	248
121	1536.6	2.0891	29.715	121.4	218.5	524.9	944.8	482.6	818.6	249.8
122	1585.7	2.1556	30.664	122.5	220.4	524.2	943.5	481.8	817.1	251.6
123	1636.0	2.2241	31.637	123.5	222.2	523.5	942.3	481.0	815.8	253.4
124	1687.5	2.2943	32.64	124.5	224.1	522.8	941.0	480.2	814.3	255.2
125	1740.5	2.3663	33.66	125.5	225.9	522.1	939.8	479.4	813.0	257
126	1794.7	2.4401	34.71	126.5	227.7	521.4	938.6	478.6	811.6	258.8
127	1850.3	2.5156	35.78	127.5	229.5	520.7	937.3	477.8	810.2	260.6
128	1907.3	2.5931	36.88	128.6	231.4	520.0	936.1	477.0	808.8	262.4
129	1965.8	2.6726	38.01	129.6	233.3	519.3	934.8	476.3	807.4	264.2
130	2025.6	2.7540	39.17	130.6	235.1	518.6	933.6	475.5	806.0	266
131	2086.9	2.8373	40.36	131.6	236.9	517.9	932.3	474.7	804.6	267.8
132	2149.8	2.9227	41.57	132.6	238.7	517.3	931.1	474.0	803.2	269.6
133	2214.0	3.0101	42.81	133.7	240.6	516.6	929.8	473.3	801.8	271.4
134	2280.0	3.0999	44.09	134.7	242.4	515.9	928.5	472.5	800.4	273.2
135	2347.5	3.1916	45.39	135.7	244.2	515.1	927.2	471.6	800.0	275
136	2416.5	3.2854	46.73	136.7	246.0	514.4	925.9	470.8	800.0	276.8
137	2487.3	3.3816	48.10	137.7	247.9	513.7	924.6	470.1	800.0	278.6
138	2559.7	3.4801	49.50	138.8	249.7	513.0	923.3	469.3	800.0	280.4
139	2633.8	3.581	50.93	139.8	251.6	512.3	922.1	468.5	800.0	282.2
140	2709.5	3.684	52.39	140.8	253.4	511.5	920.7	467.6	800.0	284
141	2787.1	3.789	53.89	141.8	255.3	510.7	919.3	466.8	800.0	285.8
142	2866.4	3.897	55.43	142.8	257.1	510.1	918.1	466.1	800.0	287.6
143	2947.7	4.008	57.00	143.9	259.0	509.3	916.7	465.3	800.0	289.4
144	3030.5	4.121	58.60	144.9	260.8	508.6	915.4	464.4	800.0	291.2
145	3115.3	4.236	60.24	145.9	262.7	507.8	914.1	463.6	800.0	293
146	3202.1	4.354	61.92	146.9	264.5	507.1	912.8	462.8	800.0	294.8
147	3290.8	4.474	63.64	148.0	266.4	506.4	911.5	462.0	800.0	296.6
148	3381.3	4.597	65.39	149.0	268.2	505.6	910.1	461.2	800.0	298.4
149	3474.0	4.723	67.18	150.0	270.1	504.9	908.8	460.4	800.0	300.2
150	3568.7	4.852	69.01	151.0	271.9	504.1	907.4	459.5	800.0	302

SATURATED STEAM (Continued)

Temperature, degrees Centigrade. <i>t</i>	Heat equivalent of external work.		Entropy of the liquid. <i>θ</i>	Entropy of vaporization. $\frac{r}{T}$	Specific volume.		Density.		Temperature, degrees Fahrenheit. <i>t</i>
	Calories per kilogram. <i>Apv</i>	B.T.U. per pound. <i>Apv</i>			Cubic meters per kilo. <i>s</i>	Cubic feet per pound. <i>s</i>	Kilos per cubic meter. $\frac{1}{s}$	Pounds per cubic foot. $\frac{1}{s}$	
111	41.4	74.6	0.3418	1.3842	1.172	18.77	0.853	0.0533	231.8
112	41.5	74.8	0.3445	1.3789	1.136	18.20	0.880	0.0550	233.6
113	41.6	75.0	0.3471	1.3736	1.101	17.64	0.908	0.0567	235.4
114	41.7	75.1	0.3498	1.3683	1.068	17.10	0.936	0.0585	237.2
115	41.8	75.3	0.3524	1.3631	1.036	16.59	0.965	0.0603	239
116	41.9	75.4	0.3550	1.3579	1.005	16.09	0.995	0.0622	240.8
117	42.0	75.6	0.3576	1.3527	0.9746	15.61	1.026	0.0641	242.6
118	42.1	75.8	0.3602	1.3475	0.9460	15.16	1.057	0.0659	244.4
119	42.2	75.9	0.3628	1.3423	0.9183	14.72	1.089	0.0679	246.2
120	42.2	76.0	0.3654	1.3372	0.8914	14.28	1.122	0.0700	248
121	42.3	76.2	0.3680	1.3321	0.8653	13.86	1.156	0.0721	249.8
122	42.4	76.4	0.3705	1.3269	0.8401	13.46	1.190	0.0743	251.6
123	42.5	76.5	0.3731	1.3218	0.8158	13.07	1.226	0.0765	253.4
124	42.6	76.7	0.3756	1.3167	0.7924	12.69	1.262	0.0788	255.2
125	42.7	76.8	0.3782	1.3117	0.7698	12.33	1.299	0.0811	257
126	42.8	77.0	0.3807	1.3067	0.7479	11.98	1.337	0.0835	258.8
127	42.9	77.1	0.3833	1.3017	0.7267	11.64	1.376	0.0859	260.6
128	43.0	77.3	0.3858	1.2967	0.7063	11.32	1.416	0.0883	262.4
129	43.0	77.4	0.3884	1.2917	0.6867	11.00	1.456	0.0909	264.2
130	43.1	77.6	0.3909	1.2868	0.6677	10.70	1.498	0.0935	266
131	43.2	77.7	0.3934	1.2818	0.6493	10.40	1.540	0.0961	267.8
132	43.3	77.9	0.3959	1.2769	0.6315	10.12	1.583	0.0988	269.6
133	43.3	78.0	0.3985	1.2720	0.6142	9.839	1.628	0.1016	271.4
134	43.4	78.1	0.4010	1.2672	0.5974	9.569	1.674	0.1045	273.2
135	43.5	78.3	0.4035	1.2623	0.5812	9.309	1.721	0.1074	275
136	43.6	78.4	0.4060	1.2574	0.5656	9.060	1.768	0.1104	276.8
137	43.6	78.5	0.4085	1.2526	0.5506	8.820	1.816	0.1134	278.6
138	43.7	78.7	0.4110	1.2479	0.5361	8.587	1.865	0.1165	280.4
139	43.8	78.8	0.4135	1.2431	0.5219	8.360	1.916	0.1196	282.2
140	43.9	78.9	0.4160	1.2383	0.5081	8.140	1.968	0.1229	284
141	43.9	79.1	0.4185	1.2335	0.4948	7.926	2.021	0.1262	285.8
142	44.0	79.2	0.4209	1.2288	0.4819	7.719	2.075	0.1296	287.6
143	44.0	79.3	0.4234	1.2241	0.4694	7.519	2.130	0.1330	289.4
144	44.2	79.5	0.4259	1.2194	0.4574	7.326	2.186	0.1365	291.2
145	44.2	79.6	0.4283	1.2147	0.4457	7.139	2.244	0.1401	293
146	44.3	79.7	0.4307	1.2100	0.4343	6.957	2.303	0.1437	294.8
147	44.4	79.9	0.4332	1.2054	0.4232	6.780	2.363	0.1475	296.6
148	44.4	80.0	0.4356	1.2008	0.4125	6.609	2.424	0.1513	298.4
149	44.5	80.1	0.4380	1.1962	0.4022	6.443	2.486	0.1552	300.2
150	44.6	80.2	0.4405	1.1916	0.3921	6.282	2.550	0.1592	302

PROPERTIES OF

Temperature, degrees Centigrade.	Total pressure.			Heat of the liquid.		Heat of vaporiza- tion.		Heat equiva- lent of inter- nal work.		Temperature, degrees Fahrenheit.
	Millimeters of mer- cury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
<i>t</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>q</i>	<i>q</i>	<i>r</i>	<i>r</i>	<i>p</i>	<i>p</i>	<i>t</i>
151	3665.3	4.984	70.88	152.1	273.8	503.4	906.1	458.7	825.7	303.8
152	3764.1	5.118	72.79	153.1	275.6	502.6	904.7	457.9	824.2	305.6
153	3864.9	5.255	74.74	154.1	277.4	501.9	903.3	457.1	822.7	307.4
154	3968	5.395	76.73	155.1	279.2	501.1	901.9	456.3	821.2	309.2
155	4073	5.538	78.76	156.2	281.1	500.3	900.5	455.4	819.6	311
156	4181	5.684	80.84	157.2	283.0	499.6	899.2	454.6	818.2	312.8
157	4290	5.833	82.96	158.2	284.8	498.8	897.8	453.8	816.7	314.6
158	4402	5.985	85.12	159.3	286.7	498.1	896.5	453.0	815.3	316.4
159	4517	6.141	87.33	160.3	288.5	497.3	895.1	452.1	813.7	318.2
160	4633	6.300	89.59	161.3	290.4	496.5	893.7	451.2	812.2	320
161	4752	6.462	91.89	162.3	292.2	495.7	892.3	450.4	810.7	321.8
162	4874	6.628	94.25	163.4	294.1	494.9	890.9	449.5	809.2	323.6
163	4998	6.796	96.65	164.4	295.9	494.2	889.5	448.7	807.7	325.4
164	5124	6.967	99.09	165.4	297.7	493.4	888.1	447.9	806.2	327.2
165	5253	7.142	101.58	166.5	299.6	492.6	886.7	447.0	804.7	329
166	5384	7.320	104.11	167.5	301.5	491.9	885.4	446.3	803.3	330.8
167	5518	7.502	106.71	168.5	303.3	491.1	883.9	445.4	801.7	332.6
168	5655	7.688	109.35	169.5	305.1	490.3	882.5	444.6	800.1	334.4
169	5794	7.877	112.04	170.6	307.0	489.5	881.0	443.7	798.5	336.2
170	5937	8.071	114.79	171.6	308.9	488.7	879.6	442.8	797.0	338
171	6081	8.268	117.59	172.6	310.7	487.9	878.3	441.9	795.6	339.8
172	6229	8.469	120.45	173.7	312.6	487.1	876.9	441.1	794.1	341.6
173	6379	8.673	123.36	174.7	314.5	486.3	875.4	440.2	792.5	343.4
174	6533	8.882	126.33	175.7	316.3	485.5	873.9	439.4	790.9	345.2
175	6689	9.094	129.35	176.8	318.2	484.7	872.4	438.5	789.3	347
176	6848	9.310	132.43	177.8	320.0	483.9	871.0	437.7	787.8	348.8
177	7010	9.531	135.56	178.8	321.8	483.1	869.5	436.8	786.2	350.6
178	7175	9.755	138.75	179.9	323.7	482.3	868.1	436.0	784.7	352.4
179	7343	9.983	142.00	180.9	325.6	481.4	866.6	435.0	783.1	354.2
180	7514	10.216	145.30	181.9	327.5	480.6	865.1	434.2	781.5	356
181	7688	10.453	148.67	183.0	329.3	479.8	863.6	433.3	779.9	357.8
182	7866	10.695	152.11	184.0	331.2	479.0	862.2	432.5	778.4	359.6
183	8046	10.940	155.60	185.0	333.0	478.2	860.7	431.6	776.9	361.4
184	8230	11.189	159.15	186.1	334.9	477.4	859.2	430.8	775.3	363.2
185	8417	11.444	162.77	187.1	336.8	476.6	857.7	429.9	773.7	365
186	8608	11.703	166.46	188.1	338.6	475.7	856.3	429.0	772.2	366.8
187	8802	11.967	170.21	189.2	340.5	474.8	854.7	428.0	770.5	368.6
188	8999	12.235	174.02	190.2	342.4	474.0	853.2	427.2	768.9	370.4
189	9200	12.508	177.90	191.2	344.2	473.2	851.7	426.3	767.4	372.2
190	9404	12.786	181.85	192.3	346.1	472.3	850.2	425.4	765.8	374

SATURATED STEAM (Continued)

Temperature, degrees Centigrade. <i>t</i>	Heat equivalent of external work.		Entropy of the liquid. θ	Entropy of vaporization. $\frac{r}{T}$	Specific volume.		Density.		Temperature, degrees Fahrenheit. <i>t</i>
	Calories per kilogram. <i>Ap_u</i>	B. T. U. per pound. <i>Ap_u</i>			Cubic meters per kilo. <i>s</i>	Cubic feet per pound. <i>s</i>	Kilos per cubic meter. $\frac{1}{s}$	Pounds per cubic foot. $\frac{1}{s}$	
151	44.6	80.4	0.4429	1.1870	0.3824	6.126	2.615	0.1632	303.8
152	44.7	80.5	0.4453	1.1824	0.3729	5.974	2.682	0.1674	305.6
153	44.8	80.6	0.4477	1.1778	0.3637	5.826	2.750	0.1716	307.4
154	44.8	80.7	0.4501	1.1733	0.3548	5.683	2.818	0.1759	309.2
155	44.9	80.9	0.4525	1.1688	0.3463	5.546	2.888	0.1803	311
156	45.0	81.0	0.4549	1.1644	0.3380	5.413	2.959	0.1847	312.8
157	45.0	81.1	0.4573	1.1599	0.3298	5.282	3.032	0.1893	314.6
158	45.1	81.2	0.4596	1.1554	0.3218	5.154	3.108	0.1940	316.4
159	45.2	81.4	0.4620	1.1509	0.3140	5.029	3.185	0.1988	318.2
160	45.3	81.5	0.4644	1.1465	0.3063	4.906	3.265	0.2038	320
161	45.3	81.6	0.4668	1.1421	0.2989	4.789	3.345	0.2088	321.8
162	45.4	81.7	0.4692	1.1377	0.2920	4.677	3.425	0.2138	323.6
163	45.5	81.8	0.4715	1.1333	0.2855	4.571	3.503	0.2188	325.4
164	45.5	81.9	0.4739	1.1289	0.2792	4.469	3.582	0.2238	327.2
165	45.6	82.0	0.4763	1.1245	0.2729	4.368	3.664	0.2289	329
166	45.6	82.1	0.4786	1.1202	0.2666	4.268	3.751	0.2343	330.8
167	45.7	82.2	0.4810	1.1159	0.2603	4.168	3.842	0.2399	332.6
168	45.7	82.4	0.4833	1.1115	0.2540	4.070	3.937	0.2457	334.4
169	45.8	82.5	0.4857	1.1072	0.2480	3.975	4.032	0.2516	336.2
170	45.9	82.6	0.4880	1.1029	0.2423	3.883	4.127	0.2575	338
171	46.0	82.7	0.4903	1.0987	0.2368	3.794	4.223	0.2636	339.8
172	46.0	82.8	0.4926	1.0944	0.2314	3.709	4.322	0.2696	341.6
173	46.1	82.9	0.4949	1.0901	0.2262	3.626	4.421	0.2758	343.4
174	46.1	83.0	0.4972	1.0859	0.2212	3.545	4.521	0.2821	345.2
175	46.2	83.1	0.4995	1.0817	0.2164	3.467	4.621	0.2884	347
176	46.2	83.2	0.5018	1.0775	0.2117	3.391	4.724	0.2949	348.8
177	46.3	83.3	0.5041	1.0733	0.2072	3.318	4.826	0.3014	350.6
178	46.3	83.4	0.5064	1.0691	0.2027	3.247	4.933	0.3080	352.4
179	46.4	83.5	0.5087	1.0649	0.1983	3.177	5.04	0.3148	354.2
180	46.4	83.6	0.5110	1.0608	0.1941	3.109	5.15	0.3217	356
181	46.5	83.7	0.5133	1.0567	0.1899	3.041	5.27	0.3288	357.8
182	46.5	83.8	0.5156	1.0525	0.1857	2.974	5.38	0.3362	359.6
183	46.6	83.8	0.5178	1.0484	0.1817	2.911	5.50	0.3435	361.4
184	46.6	83.9	0.5201	1.0443	0.1778	2.849	5.62	0.3510	363.2
185	46.7	84.0	0.5224	1.0403	0.1740	2.787	5.75	0.3588	365
186	46.7	84.1	0.5246	1.0362	0.1702	2.727	5.88	0.3667	366.8
187	46.8	84.2	0.5269	1.0321	0.1666	2.669	6.00	0.3746	368.6
188	46.8	84.3	0.5291	1.0280	0.1632	2.614	6.13	0.3826	370.4
189	46.9	84.3	0.5314	1.0240	0.1598	2.560	6.26	0.3906	372.2
190	46.9	84.4	0.5336	1.0200	0.1565	2.507	6.39	0.3989	374

PROPERTIES OF

Temperature, degrees Centigrade.	Total pressure.			Heat of the liquid.		Heat of vaporiza- tion.		Heat equiva- lent of inter- nal work.		Temperature, degrees Fahrenheit.
<i>t</i>	Millimeters of mer- cury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	<i>l</i>
191	9612	13.068	185.87	193.3	347.9	471.5	848.7	424.5	764.2	375.8
192	9823	13.355	189.96	194.4	349.8	470.6	847.1	423.6	762.5	377.6
193	10038	13.647	194.11	195.4	351.7	469.8	845.6	422.8	761.0	379.4
194	10256	13.944	198.33	196.4	353.5	468.9	844.1	421.9	759.4	381.2
195	10479	14.247	202.64	197.5	355.4	468.1	842.5	421.0	757.7	383
196	10705	14.554	207.01	198.5	357.3	467.2	841.0	420.1	756.1	384.8
197	10934	14.866	211.45	199.5	359.2	466.4	839.5	419.2	754.6	386.6
198	11168	15.184	215.96	200.6	361.1	465.6	838.0	418.4	753.0	388.4
199	11406	15.507	220.56	201.6	362.9	464.7	836.4	417.4	751.3	390.2
200	11647	15.835	225.23	202.7	364.8	463.8	834.8	416.5	749.7	392
201	11893	16.169	229.98	203.7	366.7	462.9	833.3	415.6	748.1	393.8
202	12142	16.508	234.80	204.7	368.5	462.1	831.8	414.8	746.6	395.6
203	12395	16.852	239.71	205.8	370.4	461.2	830.2	413.8	744.9	397.4
204	12653	17.202	244.69	206.8	372.3	460.3	828.6	412.9	743.3	399.2
205	12915	17.558	249.75	207.9	374.1	459.4	827.0	412.0	741.6	401
206	13181	17.921	254.89	208.9	376.0	458.6	825.4	411.1	740.0	402.8
207	13452	18.289	260.13	210.0	377.9	457.7	823.8	410.2	738.3	404.6
208	13727	18.663	265.45	211.0	379.8	456.8	822.2	409.3	736.7	406.4
209	14006	19.042	270.85	212.0	381.6	455.9	820.6	408.4	735.1	408.2
210	14290	19.428	276.34	213.1	383.5	455.0	819.1	407.5	733.6	410
211	14578	19.820	281.91	214.1	385.4	454.1	817.4	406.6	731.9	411.8
212	14871	20.218	287.57	215.2	387.3	453.2	815.8	405.7	730.2	413.6
213	15168	20.622	293.31	216.2	389.2	452.4	814.3	404.9	728.7	415.4
214	15470	21.033	299.16	217.3	391.1	451.5	812.7	404.0	727.1	417.2
215	15778	21.452	305.10	218.3	392.9	450.6	811.0	403.1	725.4	419
216	16090	21.876	311.14	219.3	394.8	449.6	809.3	402.1	723.7	420.8
217	16406	22.306	317.26	220.4	396.7	448.7	807.7	401.2	722.1	422.6
218	16728	22.743	323.48	221.4	398.5	447.8	806.1	400.3	720.5	424.4
219	17055	23.188	329.81	222.5	400.4	446.9	804.5	399.4	718.9	426.2
220	17387	23.639	336.24	223.5	402.3	446.0	802.9	398.5	717.3	428

SATURATED STEAM (Concluded)

Temperature, degrees Centigrade.	Heat equivalent of external work.		Entropy of the liquid.	Entropy of vaporization.	Specific volume.		Density.		Temperature, degrees Fahrenheit.
	Calories per kilogram.	B.T.U. per pound.			Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	
<i>t</i>	<i>Apu</i>	<i>Apu</i>	θ	$\frac{r}{T}$	<i>s</i>	<i>s</i>	$\frac{1}{s}$	$\frac{1}{s}$	<i>t</i>
191	47.0	84.5	0.5358	1.0160	0.1533	2.456	6.52	0.4072	375.8
192	47.0	84.6	0.5381	1.0120	0.1501	2.405	6.66	0.4158	377.6
193	47.0	84.6	0.5403	1.0080	0.1470	2.355	6.80	0.4246	379.4
194	47.0	84.7	0.5426	1.0040	0.1440	2.306	6.94	0.4336	381.2
195	47.1	84.8	0.5448	1.0000	0.1411	2.259	7.09	0.4426	383
196	47.1	84.9	0.5470	0.9961	0.1382	2.214	7.23	0.4516	384.8
197	47.2	84.9	0.5492	0.9922	0.1354	2.169	7.38	0.4610	386.6
198	47.2	85.0	0.5514	0.9882	0.1327	2.126	7.53	0.4704	388.4
199	47.3	85.1	0.5536	0.9843	0.1300	2.083	7.69	0.4801	390.2
200	47.3	85.1	0.5558	0.9804	0.1274	2.041	7.84	0.4900	392
201	47.3	85.2	0.5580	0.9765	0.1249	2.001	8.00	0.4998	393.8
202	47.3	85.2	0.5602	0.9727	0.1225	1.962	8.16	0.510	395.6
203	47.4	85.3	0.5624	0.9688	0.1201	1.923	8.33	0.520	397.4
204	47.4	85.3	0.5646	0.9650	0.1177	1.885	8.50	0.531	399.2
205	47.4	85.4	0.5668	0.9611	0.1153	1.847	8.67	0.541	401
206	47.5	85.4	0.5690	0.9572	0.1130	1.810	8.85	0.552	402.8
207	47.5	85.5	0.5712	0.9534	0.1108	1.774	9.03	0.564	404.6
208	47.5	85.5	0.5733	0.9496	0.1086	1.739	9.21	0.575	406.4
209	47.5	85.5	0.5755	0.9458	0.1065	1.705	9.39	0.587	408.2
210	47.5	85.5	0.5777	0.9420	0.1044	1.673	9.58	0.598	410
211	47.5	85.5	0.5799	0.9382	0.1024	1.640	9.77	0.610	411.8
212	47.5	85.6	0.5820	0.9344	0.1004	1.608	9.96	0.622	413.6
213	47.5	85.6	0.5842	0.9307	0.0984	1.577	10.16	0.634	415.4
214	47.5	85.6	0.5863	0.9269	0.0965	1.546	10.36	0.647	417.2
215	47.5	85.6	0.5885	0.9232	0.0947	1.516	10.56	0.660	419
216	47.5	85.6	0.5906	0.9195	0.0928	1.486	10.78	0.673	420.8
217	47.5	85.6	0.5927	0.9157	0.0910	1.458	10.99	0.686	422.6
218	47.5	85.6	0.5948	0.9120	0.0893	1.430	11.20	0.699	424.4
219	47.5	85.6	0.5969	0.9084	0.0876	1.403	11.41	0.713	426.2
220	47.5	85.6	0.5991	0.9047	0.0860	1.376	11.62	0.727	428

THERMODYNAMIC

Ammonia, NH₃

Temp. °F	Abs. press. sat. vap.		Heat content abv. -40°F BTU/lb.		Ht. of vaporiz. BTU/ lb.	Heat content abv. -40°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
-60	5.55	0.390	-21.2	589.6	610.8	-11.8	327.6	339.3	-51.11
-58	5.93	.417	-19.1	590.4	609.5	-10.6	328.0	338.6	-50.00
-56	6.33	.445	-17.0	591.2	608.2	-9.44	328.4	337.9	-48.89
-54	6.75	.475	-14.8	592.1	606.9	-8.22	328.9	337.2	-47.78
-52	7.20	.506	-12.7	592.9	605.6	-7.06	329.4	336.4	-46.67
-50	7.67	0.539	-10.6	593.7	604.3	-5.89	329.8	335.7	-45.56
-48	8.16	.574	-8.5	594.4	602.9	-4.7	330.2	334.9	-44.44
-46	8.68	.610	-6.4	595.2	601.6	-3.6	330.7	334.2	-43.33
-44	9.23	.649	-4.3	596.0	600.3	-2.4	331.1	333.5	-42.22
-42	9.81	.690	-2.1	596.8	598.9	-1.2	331.6	332.7	-41.11
-40	10.41	0.7319	0.0	597.6	597.6	0.0	332.0	332.0	-40.00
-38	11.04	.7762	+ 2.1	598.3	596.2	+ 1.2	332.4	331.2	-38.89
-36	11.71	.8233	4.3	599.1	594.8	2.4	332.8	330.4	-37.78
-34	12.41	.8725	6.4	599.9	593.5	3.6	333.3	329.7	-36.67
-32	13.14	.9238	8.5	600.6	592.1	4.7	333.7	328.9	-35.56
-30	13.90	0.9773	10.7	601.4	590.7	5.94	334.1	328.2	-34.44
-28	14.71	1.034	12.8	602.1	589.3	7.11	334.5	327.4	-33.33
-26	15.55	1.093	14.9	602.8	587.9	8.28	334.9	326.6	-32.22
-24	16.42	1.154	17.1	603.6	586.5	9.50	335.3	325.8	-31.11
-22	17.34	1.219	19.2	604.3	585.1	10.7	335.7	325.1	-30.00
-20	18.30	1.287	21.4	605.0	583.6	11.9	336.1	324.2	-28.89
-18	19.30	1.357	23.5	605.7	582.2	13.1	336.5	323.4	-27.78
-16	20.34	1.430	25.6	606.4	580.8	14.2	336.9	322.7	-26.67
-14	21.43	1.507	27.8	607.1	579.3	15.4	337.3	321.8	-25.56
-12	22.56	1.586	30.0	607.8	577.8	16.7	337.7	321.0	-24.44
-10	23.74	1.669	32.1	608.5	576.4	17.8	338.1	320.2	-23.33
-8	24.97	1.756	34.3	609.2	574.9	19.1	338.4	319.4	-22.22
-6	26.26	1.846	36.4	609.8	573.4	20.2	338.8	318.6	-21.11
-4	27.59	1.940	38.6	610.5	571.9	21.4	339.2	317.7	-20.00
-2	28.98	2.037	40.7	611.1	570.4	22.6	339.5	316.9	-18.89
0	30.42	2.139	42.9	611.8	568.9	23.8	339.9	316.1	-17.78
2	31.92	2.244	45.1	612.4	567.3	25.1	340.2	315.2	-16.67
4	33.47	2.353	47.2	613.0	565.8	26.2	340.6	314.3	-15.56
6	35.09	2.467	49.4	613.6	564.2	27.4	340.9	313.4	-14.44
8	36.77	2.585	51.6	614.3	562.7	28.7	341.3	312.6	-13.33
10	38.51	2.708	53.8	614.9	561.1	29.9	341.6	311.7	-12.22
12	40.31	2.834	56.0	615.5	559.5	31.1	341.9	310.8	-11.11
14	42.18	2.966	58.2	616.1	557.9	32.3	342.3	309.9	-10.00
16	44.12	3.102	60.3	616.6	556.3	33.5	342.6	309.1	-8.89
18	46.13	3.243	62.5	617.2	554.7	34.7	342.9	308.2	-7.78
20	48.21	3.390	64.7	617.8	553.1	35.9	343.2	307.3	-6.67
22	50.36	3.541	66.9	618.3	551.4	37.2	343.5	306.3	-5.56
24	52.59	3.697	69.1	618.9	549.8	38.4	343.8	305.4	-4.44
26	54.90	3.860	71.3	619.4	548.1	39.6	344.1	304.5	-3.33
28	57.28	4.027	73.5	619.9	546.4	40.8	344.4	303.6	-2.22

PROPERTIES

Ammonia, NH₃

Temp. °F	Spec. vol. sat. vap.		Density sat. vap.		Dens. liq. lb./ft. ³	Entropy from -40°F BTU/lb./°F		Temp. °C
	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³		Liq.	Vap.	
-60	44.73	2.792	0.02235	0.3580	43.91	-0.0517	1.4769	-51.11
-58	42.05	2.625	.02378	.3809		-.0464	1.4713	-50.00
-56	39.56	2.470	.02528	.4049		-.0412	1.4658	-48.89
-54	37.24	2.325	.02685	.4301		-.0360	1.4604	-47.78
-52	35.09	2.191	.02850	.4565		-.0307	1.4551	-46.67
-50	33.08	2.065	0.03023	0.4842	43.49	-0.0256	1.4497	-45.56
-48	31.20	1.948	.03205	.5134		-.0204	1.4445	-44.44
-46	29.45	1.839	.03395	.5438		-.0153	1.4393	-43.33
-44	27.82	1.737	.03595	.5758		-.0102	1.4342	-42.22
-42	26.29	1.641	.03804	.6093		-.0051	1.4292	-41.11
-40	24.86	1.552	0.04022	0.6442	43.08	0.0000	1.4242	-40.00
-38	23.53	1.469	.04251	.6809		.0051	1.4193	-38.89
-36	22.27	1.390	.04489	.7190		.0101	1.4144	-37.78
-34	21.10	1.317	.04739	.7591		.0151	1.4096	-36.67
-32	20.00	1.249	.04999	.8007		.0201	1.4048	-35.56
-30	18.97	1.184	0.05271	0.8443	42.65	0.0250	1.4001	-34.44
-28	18.00	1.124	.05555	.8898		.0300	1.3955	-33.33
-26	17.09	1.067	.05850	.9371		.0350	1.3909	-32.22
-24	16.24	1.014	.06158	.9864		.0399	1.3863	-31.11
-22	15.43	0.9633	.06479	1.038		.0448	1.3818	-30.00
-20	14.68	0.9164	0.06813	1.091	42.22	0.0497	1.3774	-28.89
-18	13.97	.8721	.07161	1.147		.0545	1.3729	-27.78
-16	13.29	.8297	.07522	1.205		.0594	1.3686	-26.67
-14	12.66	.7903	.07898	1.265		.0642	1.3643	-25.56
-12	12.06	.7529	.08289	1.328		.0690	1.3600	-24.44
-10	11.50	0.7179	0.08695	1.393	41.78	0.0738	1.3558	-23.33
-8	10.97	.6848	.09117	1.460		.0786	1.3516	-22.22
-6	10.47	.6536	.09555	1.531		.0833	1.3474	-21.11
-4	9.991	.6237	.1001	1.603		.0880	1.3433	-20.00
-2	9.541	.5956	.1048	1.679		.0928	1.3393	-18.89
■	9.116	0.5691	0.1097	1.757	41.34	0.0975	1.3352	-17.78
2	8.714	.5440	.1148	1.839		.1022	1.3312	-16.67
4	8.333	.5202	.1200	1.922		.1069	1.3273	-15.56
6	7.971	.4976	.1254	2.009		.1115	1.3234	-14.44
8	7.629	.4763	.1311	2.100		.1162	1.3195	-13.33
1■	7.304	0.4560	0.1369	2.193	40.89	0.1208	1.3157	-12.22
12	6.996	.4367	.1429	2.289		.1254	1.3118	-11.11
14	6.703	.4185	.1492	2.390		.1300	1.3081	-10.00
16	6.425	.4011	.1556	2.492		.1346	1.3043	-8.89
18	6.161	.3846	.1623	2.600		.1392	1.3006	-7.78
20	5.910	0.3690	0.1692	2.710	40.43	0.1437	1.2969	-6.67
22	5.671	.3540	.1763	2.824		.1483	1.2933	-5.56
24	5.443	.3398	.1837	2.943		.1528	1.2897	-4.44
26	5.227	.3263	.1913	3.064		.1573	1.2861	-3.33
28	5.021	.3135	.1992	3.191		.1618	1.2825	-2.22

THERMODYNAMIC

Ammonia, NH₃ (Continued)

Temp. °F	Abs. press. sat. vap.		Heat content abv. -40°F BTU/lb.		Ht. of vaporiz. BTU/ lb.	Heat content abv. -40°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
30	59.74	4.200	75.7	620.5	544.8	42.1	344.7	302.7	- 1.11
32	62.29	4.379	77.9	621.0	543.1	43.3	345.0	301.7	0.00
34	64.91	4.564	80.1	621.5	541.4	44.5	345.3	300.8	+ 1.11
36	67.63	4.755	82.3	622.0	539.7	45.7	345.6	299.8	2.22
38	70.43	4.952	84.6	622.5	537.9	47.0	345.8	298.8	3.33
40	73.32	5.155	86.8	623.0	536.2	48.2	346.1	297.9	4.44
42	76.31	5.365	89.0	623.4	534.4	49.4	346.3	296.9	5.56
44	79.38	5.581	91.2	623.9	532.7	50.7	346.6	295.9	6.67
46	82.55	5.804	93.5	624.4	530.9	51.9	346.9	294.9	7.78
48	85.82	6.034	95.7	624.8	529.1	53.2	347.1	293.9	8.89
50	89.19	6.271	97.9	625.2	527.3	54.4	347.3	292.9	10.00
52	92.66	6.515	100.2	625.7	525.5	55.67	347.6	291.9	11.11
54	96.23	6.766	102.4	626.1	523.7	56.89	347.8	290.9	12.22
56	99.91	7.024	104.7	626.5	521.8	58.17	348.1	289.9	13.33
58	103.7	7.291	106.9	626.9	520.0	59.39	348.3	288.9	14.44
60	107.6	7.565	109.2	627.3	518.1	60.67	348.5	287.8	15.56
62	111.6	7.846	111.5	627.7	516.2	61.94	348.7	286.8	16.67
64	115.7	8.135	113.7	628.0	514.3	63.17	348.9	285.7	17.78
66	120.0	8.437	116.0	628.4	512.4	64.44	349.1	284.7	18.89
68	124.3	8.739	118.3	628.8	510.5	65.72	349.3	283.6	20.00
70	128.8	9.056	120.5	629.1	508.6	66.94	349.5	282.6	21.11
72	133.4	9.379	122.8	629.4	506.6	68.22	349.7	281.4	22.22
74	138.1	9.709	125.1	629.8	504.7	69.50	349.9	280.4	23.33
76	143.0	10.05	127.4	630.1	502.7	70.78	350.1	279.3	24.44
78	147.9	10.40	129.7	630.4	500.7	72.06	350.2	278.2	25.56
80	153.0	10.76	132.0	630.7	498.7	73.33	350.4	277.1	26.67
82	158.3	11.13	134.3	631.0	496.7	74.61	350.6	275.9	27.78
84	163.7	11.51	136.6	631.3	494.7	75.89	350.7	274.8	28.89
86	169.2	11.90	138.9	631.5	492.6	77.17	350.8	273.7	30.00
88	174.8	12.29	141.2	631.8	490.6	78.44	351.0	272.6	31.11
90	180.6	12.70	143.5	632.0	488.5	79.72	351.1	271.4	32.22
92	186.6	13.12	145.8	632.2	486.4	81.00	351.2	270.2	33.33
94	192.7	13.55	148.2	632.5	484.3	82.33	351.4	269.1	34.44
96	198.9	13.98	150.5	632.6	482.1	83.61	351.4	267.8	35.56
98	205.3	14.43	152.9	632.9	480.0	84.94	351.6	266.7	36.67
100	211.9	14.90	155.2	633.0	477.8	86.22	351.7	265.4	37.78
102	218.6	15.37	157.6	633.2	475.6	87.56	351.8	264.2	38.89
104	225.4	15.85	159.9	633.4	473.5	88.83	351.9	263.1	40.00
106	232.5	16.35	162.3	633.5	471.2	90.17	351.9	261.8	41.11
108	239.7	16.85	164.6	633.6	469.0	91.44	352.0	260.6	42.22
110	247.0	17.37	167.0	633.7	466.7	92.78	352.1	259.3	43.33
112	254.5	17.89	169.4	633.8	464.4	94.11	352.1	258.0	44.44
114	262.2	18.43	171.8	633.9	462.1	95.44	352.2	256.7	45.56
116	270.1	18.99	174.2	634.0	459.8	96.78	352.2	255.4	46.67
118	278.2	19.56	176.6	634.0	457.4	98.11	352.2	254.1	47.78
120	286.4	20.14	179.0	634.0	455.0	99.45	352.2	252.8	48.89
122	294.8	20.73	181.4	634.0	452.6	100.8	352.2	251.4	50.00
124	303.4	21.33	183.9	634.0	450.1	102.2	352.2	250.1	51.11

PROPERTIES (Continued)

Ammonia, NH₃ (Continued)

Temp. °F	Spec. vol. sat. vap.		Density sat. vap.		Dens. liq. lb./ft. ³	Entropy from -40°F BTU/lb./°F		Temp. °C
	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³		Liq.	Vap.	
30	4.825	0.3012	0.2073	3.321	39.96	0.1663	1.2790	- 1.11
32	4.637	.2895	.2156	3.453		.1708	1.2755	0.00
34	4.459	.2784	.2243	3.593		.1753	1.2721	+ 1.11
36	4.289	.2678	.2332	3.735		.1797	1.2686	2.22
38	4.126	.2576	.2423	3.881		.1841	1.2652	3.33
40	3.971	0.2479	0.2518	4.033	39.49	0.1885	1.2618	4.44
42	3.823	.2387	.2616	4.190		.1930	1.2585	5.56
44	3.682	.2299	.2716	4.350		.1974	1.2552	6.67
46	3.547	.2214	.2819	4.515		.2018	1.2519	7.78
48	3.418	.2134	.2926	4.687		.2062	1.2486	8.89
50	3.294	0.2056	0.3036	4.863	39.00	0.2105	1.2453	10.00
52	3.176	.1983	.3149	5.044		.2149	1.2421	11.11
54	3.063	.1912	.3265	5.230		.2192	1.2389	12.22
56	2.954	.1844	.3385	5.422		.2236	1.2357	13.33
58	2.851	.1780	.3508	5.619		.2279	1.2325	14.44
60	2.751	0.1717	0.3635	5.823	38.50	0.2322	1.2294	15.56
62	2.656	.1658	.3765	6.031		.2365	1.2262	16.67
64	2.565	.1601	.3899	6.245		.2408	1.2231	17.78
66	2.477	.1546	.4037	6.466		.2451	1.2201	18.89
68	2.393	.1494	.4179	6.694		.2494	1.2170	20.00
70	2.312	0.1443	0.4325	6.928	38.00	0.2537	1.2140	21.11
72	2.235	.1395	.4474	7.166		.2579	1.2110	22.22
74	2.161	.1349	.4628	7.413		.2622	1.2080	23.33
76	2.089	.1304	.4786	7.666		.2664	1.2050	24.44
78	2.021	.1262	.4949	7.927		.2706	1.2020	25.56
80	1.955	0.1220	0.5115	8.193	37.48	0.2749	1.1991	26.67
82	1.892	.1181	.5287	8.469		.2791	1.1962	27.78
84	1.831	.1143	.5462	8.749		.2833	1.1933	28.89
86	1.772	.1106	.5643	9.039		.2875	1.1904	30.00
88	1.716	.1071	.5828	9.335		.2917	1.1875	31.11
90	1.661	0.1037	0.6019	9.641	36.95	0.2958	1.1846	32.22
92	1.609	.1004	.6214	9.954		.3000	1.1818	33.33
94	1.559	.09733	.6415	10.28		.3041	1.1789	34.44
96	1.510	.09427	.6620	10.60		.3083	1.1761	35.56
98	1.464	.09140	.6832	10.94		.3125	1.1733	36.67
100	1.419	0.08859	0.7048	11.29	36.40	0.3166	1.1705	37.78
102	1.375	.08584	.7270	11.65		.3207	1.1677	38.89
104	1.334	.08328	.7498	12.01		.3248	1.1649	40.00
106	1.293	.08072	.7732	12.39		.3289	1.1621	41.11
108	1.254	.07829	.7972	12.77		.3330	1.1593	42.22
110	1.217	0.07598	0.8219	13.17	35.84	0.3372	1.1566	43.33
112	1.180	.07367	.8471	13.57		.3413	1.1538	44.44
114	1.145	.07148	.8730	13.98		.3453	1.1510	45.56
116	1.112	.06942	.8996	14.41		.3495	1.1483	46.67
118	1.079	.06736	.9269	14.85		.3535	1.1455	47.78
120	1.047	0.06536	0.9549	15.30	35.26	0.3576	1.1427	48.89
122	1.017	.06349	.9837	15.76		.3618	1.1400	50.00
124	0.987	.0616	1.0132	16.229		.3659	1.1372	51.11

THERMODYNAMIC

Carbon Dioxide, CO₂

Temp. °F	Abs. press. sat. vap.		Heat content abv. 32°F BTU/lb.		Heat of vaporiz. BTU/ lb.	Heat content abv. 0°C g-cal./g		Heat of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
-20	220.6	15.51	-23.96	102.0	126.0	-13.31	56.67	70.00	-28.89
-18	228.4	16.06	-23.13	102.1	125.2	-12.85	56.72	69.56	-27.78
-16	236.4	16.62	-22.30	102.2	124.5	-12.39	56.78	69.17	-26.67
-14	244.6	17.20	-21.46	102.2	123.7	-11.92	56.78	68.72	-25.56
-12	253.0	17.79	-20.61	102.3	122.9	-11.45	56.83	68.28	-24.44
-10	261.7	18.40	-19.76	102.3	122.0	-10.98	56.83	67.78	-23.33
-8	270.6	19.03	-18.90	102.3	121.2	-10.50	56.83	67.33	-22.22
-6	279.7	19.66	-18.04	102.3	120.3	-10.02	56.83	66.83	-21.11
-4	289.1	20.33	-17.17	102.3	119.5	-9.539	56.83	66.39	-20.00
-2	298.7	21.00	-16.29	102.3	118.6	-9.050	56.83	65.89	-18.89
0	308.6	21.70	-15.41	102.2	117.7	-8.561	56.78	65.39	-17.78
2	318.7	22.41	-14.51	102.2	116.7	-8.061	56.78	64.83	-16.67
4	329.1	23.14	-13.61	102.1	115.8	-7.561	56.72	64.33	-15.56
6	339.8	23.89	-12.71	102.1	114.8	-7.061	56.72	63.78	-14.44
8	350.7	24.66	-11.79	102.0	113.8	-6.550	56.67	63.22	-13.33
10	361.8	25.44	-10.87	101.9	112.8	-6.039	56.61	62.67	-12.22
12	373.3	26.25	-9.934	101.8	111.7	-5.519	56.56	62.06	-11.11
14	385.0	27.07	-8.992	101.7	110.7	-4.996	56.50	61.50	-10.00
16	397.1	27.92	-8.038	101.5	109.6	-4.466	56.39	60.89	-8.89
18	409.4	28.78	-7.076	101.4	108.5	-3.931	56.33	60.28	-7.78
20	422.0	29.67	-6.102	101.2	107.3	-3.390	56.22	59.61	-6.67
22	434.9	30.58	-5.117	101.0	106.1	-2.843	56.11	58.94	-5.56
24	448.1	31.50	-4.121	100.8	104.9	-2.289	56.00	58.28	-4.44
25	454.8	31.98	-3.618	100.7	104.3	-2.010	55.94	57.94	-3.89
27	468.5	32.94	-2.601	100.5	103.1	-1.445	55.83	57.28	-2.78
29	482.5	33.92	-1.570	100.2	101.8	-0.8722	55.67	56.56	-1.67
31	496.8	34.93	-0.525	99.98	100.5	-0.292	55.54	55.83	-0.56
33	511.4	35.95	+0.531	99.69	99.16	+0.295	55.38	55.09	+0.56
35	526.4	37.01	1.604	99.38	97.77	0.8911	55.21	54.32	1.67
37	541.7	38.09	2.697	99.05	96.35	1.498	55.03	53.53	2.78
39	557.4	39.19	3.806	98.69	94.88	2.114	54.83	52.71	3.89
41	573.4	40.31	4.932	98.31	93.37	2.740	54.62	51.87	5.00
43	589.8	41.47	6.080	97.90	91.82	3.378	54.39	51.01	6.11
45	606.5	42.64	7.251	97.46	90.21	4.028	54.14	50.12	7.22
47	623.6	43.84	8.443	96.99	88.55	4.691	53.88	49.19	8.33
49	641.1	45.07	9.664	96.50	86.83	5.369	53.61	48.24	9.44
51	659.0	46.33	10.91	95.97	85.06	6.061	53.32	47.26	10.56
53	677.3	47.62	12.19	95.40	83.21	6.772	53.00	46.23	11.67
55	695.9	48.93	13.49	94.78	81.29	7.494	52.66	45.16	12.78
57	714.9	50.26	14.84	94.13	79.30	8.244	52.28	44.06	13.89
59	734.3	51.63	16.22	93.44	77.22	9.011	51.91	42.90	15.00
61	754.2	53.03	17.65	92.69	75.04	9.806	51.49	41.69	16.11
63	774.5	54.45	19.13	91.88	72.75	10.63	51.04	40.42	17.22
65	795.1	55.90	20.66	91.01	70.35	11.48	50.56	39.08	18.33
67	816.2	57.38	22.25	90.07	67.81	12.36	50.04	37.67	19.44
69	837.8	58.90	23.92	89.04	65.12	13.29	49.47	36.18	20.56
71	859.8	60.45	25.67	87.92	62.25	14.26	48.84	34.58	21.67
73	882.2	62.02	27.52	86.69	59.17	15.29	48.16	32.87	22.78
75	905.1	63.63	29.50	85.33	55.83	16.39	47.41	31.02	23.89
77	928.4	65.27	31.62	83.80	52.17	17.57	46.56	28.98	25.00
79	952.2	66.95	33.95	82.06	48.11	18.86	45.59	26.73	26.11
81	976.5	68.65	36.54	80.03	43.49	20.30	44.46	24.16	27.22
83	1001.0	70.377	39.53	77.60	38.07	21.96	43.11	21.15	28.33
85	1027.0	72.205	43.18	74.47	31.29	23.99	41.37	17.38	29.44
86	1039.0	73.049	45.45	72.46	27.00	25.25	40.26	15.00	30.00
87	1052.0	73.963	48.32	69.84	21.52	26.84	38.80	11.96	30.56
88	1065.0	74.877	52.78	65.62	12.84	29.32	36.46	7.133	31.11

PROPERTIES (Continued)
Carbon Dioxide, CO₂

Temp. °F	Spec. vol. sat. vap.		Density sat. vap.		Dens. liq. lb./ft. ³	Entropy from 32°F BTU/lb./°F		Temp. °C
	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³		Liq.	Vap.	
-20	0.4166	0.02601	2.401	38.46	64.34	-0.0514	0.2353	-28.89
-18	.4018	.02508	2.489	39.87	64.15	-.0495	.2342	-27.78
-16	.3876	.02420	2.580	41.33	63.94	-.0476	.2331	-26.67
-14	.3739	.02334	2.674	42.83	63.73	-.0458	.2319	-25.56
-12	.3608	.02252	2.772	44.40	63.49	-.0439	.2307	-24.44
-10	0.3482	0.02174	2.872	46.00	63.25	-0.0420	0.2296	-23.33
-8	.3360	.02098	2.976	47.67	63.01	-.0401	.2284	-22.22
-6	.3243	.02025	3.083	49.38	62.76	-.0382	.2273	-21.11
-4	.3131	.01955	3.194	51.16	62.50	-.0362	.2261	-20.00
-2	.3022	.01887	3.309	53.00	62.23	-.0343	.2249	-18.89
0	0.2918	0.01822	3.427	54.89	61.95	-0.0324	0.2237	-17.78
2	.2817	.01759	3.550	56.86	61.65	-.0304	.2225	-16.67
4	.2720	.01698	3.676	58.88	61.36	-.0285	.2213	-15.56
6	.2627	.01640	3.807	60.98	61.07	-.0266	.2201	-14.44
8	.2537	.01584	3.942	63.14	60.77	-.0246	.2189	-13.33
10	0.2450	0.01529	4.082	65.39	60.48	-0.0226	0.2176	-12.22
12	.2366	.01477	4.227	67.71	60.18	-.0206	.2164	-11.11
14	.2285	.01426	4.377	70.11	59.88	-.0186	.2151	-10.00
16	.2207	.01378	4.532	72.59	59.58	-.0166	.2139	-8.89
18	.2131	.01330	4.692	75.16	59.27	-.0146	.2126	-7.78
20	0.2058	0.01285	4.859	77.83	58.95	-0.0126	0.2113	-6.67
22	.1987	.01240	5.031	80.59	58.64	-.0105	.2100	-5.56
24	.1919	.01198	5.211	83.47	58.31	-.0085	.2087	-4.44
25	.1886	.01177	5.303	84.94	58.14	-.0074	.2080	-3.89
27	.1821	.01137	5.492	87.97	57.81	-.0053	.2066	-2.78
29	0.1758	0.01097	5.688	91.11	57.47	-0.0032	0.2053	-1.67
31	.1697	.01059	5.892	94.38	57.12	-.0011	.2039	-0.56
33	.1639	.01023	6.103	97.76	56.77	+ .0011	.2025	+ 0.56
35	.1581	.009870	6.323	101.3	56.41	.0033	.2010	1.67
37	.1526	.009527	6.553	105.0	56.03	.0055	.1996	2.78
39	0.1472	0.009189	6.792	108.8	55.65	0.0077	0.1981	3.89
41	.1420	.008865	7.040	112.8	55.25	.0099	.1965	5.00
43	.1370	.008553	7.300	116.9	54.84	.0122	.1950	6.11
45	.1321	.008247	7.571	121.3	54.41	.0146	.1934	7.22
47	.1273	.007947	7.854	125.8	53.97	.0169	.1918	8.33
49	0.1227	0.007660	8.151	130.6	53.51	0.0193	0.1901	9.44
51	.1182	.007379	8.461	135.5	53.04	.0218	.1884	10.56
53	.1138	.007104	8.787	140.8	52.55	.0243	.1867	11.67
55	.1095	.006836	9.132	146.3	52.05	.0268	.1849	12.78
57	.1053	.006574	9.497	152.1	51.53	.0294	.1830	13.89
59	0.1012	0.006318	9.880	158.3	50.99	0.0321	0.1811	15.00
61	.0972	.00607	10.29	164.8	50.42	.0348	.1790	16.11
63	.0933	.00582	10.72	171.7	49.80	.0377	.1770	17.22
65	.0894	.00558	11.18	179.1	49.14	.0406	.1748	18.33
67	.0856	.00534	11.67	186.9	48.44	.0436	.1725	19.44
69	0.0819	0.00511	12.21	195.6	47.69	0.0468	0.1701	20.56
71	.0782	.00488	12.82	205.4	46.87	.0501	.1675	21.67
73	.0745	.00465	13.43	215.1	45.99	.0536	.1647	22.78
75	.0708	.00442	14.13	226.3	45.05	.0573	.1618	23.89
77	.0671	.00419	14.90	238.7	44.06	.0613	.1585	25.00
79	0.0633	0.00395	15.81	253.2	43.04	0.0656	0.1550	26.11
81	.0592	.00370	16.90	270.7	41.95	.0704	.1509	27.22
83	.0548	.00342	18.25	292.3	40.62	.0759	.1461	28.33
85	.0500	.00312	20.00	320.4	38.76	.0826	.1401	29.44
86	.0474	.00296	21.09	337.8	37.41	.0868	.1363	30.00
87	0.0446	0.00278	22.42	359.1	35.34	0.0921	0.1314	30.56
88	.0401	.00250	24.95	399.6	32.79	.1002	.1237	31.11

THERMODYNAMIC

Sulfur Dioxide, SO₂

Temp. °F	Abs. press. sat. vap.		Heat content abv. -40°F BTU/lb.		Ht. of vaporiz. BTU/ lb.	Heat content abv. -40°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
-40	3.136	0.2205	0.00	178.61	178.61	0.00	99.228	99.228	-40.00
-30	4.331	.3045	2.93	179.90	176.97	1.63	99.945	98.317	-34.44
-20	5.883	.4136	5.98	181.07	175.09	3.32	100.59	97.272	-28.89
-10	7.863	.5528	9.16	182.13	172.97	5.09	101.18	96.095	-23.33
0	10.35	.7277	12.44	183.07	170.63	6.911	101.71	94.795	-17.78
2	10.91	0.7670	13.12	183.25	170.13	7.289	101.81	94.517	-16.67
4	11.50	.8085	13.78	183.41	169.63	7.656	101.89	94.239	-15.56
5	11.81	.8303	14.11	183.49	169.38	7.839	101.94	94.100	-15.00
6	12.12	.8521	14.45	183.57	169.12	8.028	101.98	93.956	-14.44
8	12.75	.8964	15.13	183.73	168.60	8.406	102.07	93.667	-13.33
10	13.42	0.9435	15.80	183.87	168.07	8.778	102.15	93.372	-12.22
12	14.12	.9927	16.48	184.01	167.53	9.156	102.23	93.072	-11.11
14	14.84	1.043	17.15	184.14	166.97	9.528	102.30	92.761	-10.00
16	15.59	1.096	17.84	184.28	166.44	9.911	102.38	92.467	-8.89
18	16.37	1.1509	18.52	184.40	165.88	10.29	102.44	92.156	-7.78
20	17.18	1.208	19.20	184.52	165.32	10.67	102.51	91.845	-6.67
22	18.03	1.268	19.90	184.64	164.74	11.06	102.58	91.522	-5.56
24	18.89	1.328	20.58	184.74	164.16	11.43	102.63	91.200	-4.44
26	19.80	1.392	21.26	184.84	163.58	11.81	102.69	90.878	-3.33
28	20.73	1.457	21.96	184.94	162.98	12.20	102.74	90.545	-2.22
30	21.70	1.526	22.64	185.02	162.38	12.58	102.79	90.211	-1.11
32	22.71	1.597	23.33	185.10	161.77	12.96	102.83	89.872	0.00
34	23.75	1.670	24.03	185.18	161.15	13.35	102.88	89.528	+ 1.11
36	24.82	1.745	24.72	185.25	160.53	13.73	102.92	89.183	2.22
38	25.95	1.824	25.42	185.31	159.89	14.12	102.95	88.828	3.33
40	27.10	1.905	26.12	185.37	159.25	14.51	102.98	88.472	4.44
42	28.29	1.989	26.81	185.42	158.61	14.89	103.01	88.117	5.56
44	29.52	2.075	27.51	185.46	157.95	15.28	103.03	87.750	6.67
46	30.79	2.165	28.21	185.50	157.29	15.67	103.06	87.383	7.78
48	32.10	2.257	28.92	185.54	156.62	16.07	103.08	87.011	8.89
50	33.45	2.352	29.61	185.56	155.95	16.45	103.09	86.639	10.00
52	34.86	2.451	30.31	185.58	155.27	16.84	103.10	86.261	11.11
54	36.31	2.553	31.00	185.59	154.59	17.22	103.11	85.883	12.22
56	37.80	2.658	31.72	185.61	153.89	17.62	103.12	85.495	13.33
58	39.33	2.765	32.42	185.61	153.19	18.01	103.12	85.106	14.44
60	40.93	2.878	33.10	185.59	152.49	18.39	103.11	84.717	15.56
62	42.58	2.994	33.79	185.57	151.78	18.77	103.09	84.322	16.67
64	44.27	3.112	34.49	185.55	151.06	19.16	103.08	83.922	17.78
66	46.00	3.234	35.19	185.53	150.34	19.55	103.07	83.522	18.89
68	47.78	3.359	35.88	185.50	149.62	19.93	103.06	83.122	20.00
70	49.62	3.489	36.58	185.46	148.88	20.32	103.03	82.711	21.11
72	51.54	3.624	37.28	185.42	148.14	20.71	103.01	82.300	22.22
74	53.48	3.760	37.97	185.37	147.40	21.09	102.98	81.889	23.33
76	55.48	3.901	38.67	185.31	146.64	21.48	102.95	81.467	24.44
78	57.56	4.047	39.36	185.24	145.88	21.87	102.91	81.045	25.56
80	59.68	4.196	40.05	185.17	145.12	22.25	102.87	80.622	26.67
82	61.88	4.351	40.73	185.09	144.36	22.63	102.83	80.200	27.78
84	64.14	4.509	41.43	185.01	143.58	23.02	102.78	79.767	28.89
86	66.45	4.672	42.12	184.92	142.80	23.40	102.73	79.333	30.00
88	68.84	4.840	42.80	184.82	142.02	23.78	102.68	78.900	31.11
90	71.25	5.009	43.50	184.72	141.22	24.17	102.62	78.456	32.22
92	73.70	5.182	44.19	184.61	140.42	24.55	102.56	78.011	33.33
94	76.30	5.364	44.86	184.49	139.62	24.92	102.49	77.567	34.44
96	79.03	5.556	45.54	184.37	138.83	25.30	102.43	77.128	35.56
98	81.77	5.749	46.22	184.25	138.03	25.68	102.36	76.683	36.67
100	84.52	5.942	46.90	184.10	137.20	26.06	102.28	76.222	37.78

PROPERTIES (Continued)
Sulfur Dioxide, SO₂

Temp. °F	Spec. vol. sat. vap.		Density sat. vap.		Dens. liq. lb./ft. ³	Entropy from -40°F BTU/lb./°F		Temp. °C
	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³		Liq.	Vap.	
-40	22.42	1.400	0.04460	0.7144	95.79	0.00000	0.42562	-40.00
-30	16.56	1.034	.06039	0.9673	94.94	.00674	.41864	-34.44
-20	12.42	0.7754	.08119	1.301	94.10	.01366	.41192	-28.89
-10	9.44	.5893	.1025	1.642	93.27	.02075	.40544	-23.33
0	7.280	.4545	.1374	2.201	92.42	.02795	.39917	-17.78
2	6.923	0.4322	0.1444	2.313	92.25	0.02941	0.39794	-16.67
4	6.584	.4110	.1501	2.404	92.08	.03084	.39670	-15.56
5	6.421	.4009	.1558	2.496	92.00	.03155	.39609	-15.00
6	6.266	.3912	.1596	2.556	91.91	.03228	.39547	-14.44
8	5.967	.3725	.1676	2.685	91.74	.03373	.39426	-13.33
10	5.682	0.3547	0.1760	2.819	91.58	0.03519	0.39306	-12.22
12	5.417	.3382	.1846	2.957	91.41	.03664	.39185	-11.11
14	5.164	.3224	.1936	3.101	91.24	.03808	.39065	-10.00
16	4.926	.3075	.2030	3.252	91.07	.03953	.38946	- 8.89
18	4.701	.2935	.2127	3.407	90.89	.04098	.38827	- 7.78
20	4.487	0.2801	0.2228	3.569	90.71	0.04241	0.38707	- 6.67
22	4.287	.2676	.2332	3.735	90.53	.04385	.38589	- 5.56
24	4.096	.2557	.2441	3.910	90.33	.04528	.38471	- 4.44
26	3.915	.2444	.2559	4.099	90.15	.04671	.38354	- 3.33
28	3.744	.2337	.2671	4.278	89.96	.04814	.38237	- 2.22
30	3.581	0.2236	0.2800	4.485	89.76	0.04956	0.38119	- 1.11
32	3.437	.2146	.2909	4.660	89.58	.05099	.38003	0.00
34	3.283	.2050	.3046	4.879	89.39	.05242	.37887	+ 1.11
36	3.144	.1963	.3181	5.095	89.18	.05384	.37772	2.22
38	3.013	.1881	.3319	5.316	89.00	.05527	.37657	3.33
40	2.887	0.1802	0.3464	5.549	88.81	0.05668	0.37541	4.44
42	2.769	.1729	.3611	5.784	88.62	.05809	.37425	5.56
44	2.656	.1658	.3765	6.031	88.43	.05949	.37311	6.67
46	2.548	.1591	.3925	6.287	88.24	.06090	.37197	7.78
48	2.446	.1527	.4088	6.548	88.05	.06231	.37083	8.89
50	2.348	0.1466	0.4259	6.822	87.87	0.06370	0.36969	10.00
52	2.256	.1408	.4433	7.101	87.67	.06509	.36857	11.11
54	2.167	.1353	.4615	7.392	87.51	.06646	.36743	12.22
56	2.083	.1300	.4801	7.690	87.31	.06785	.36629	13.33
58	2.003	.1250	.4992	7.996	87.13	.06923	.36517	14.44
60	1.923	0.1202	0.5194	8.320	86.95	0.07060	0.36405	15.56
62	1.853	.1157	.5396	8.643	86.77	.07196	.36293	16.67
64	1.783	.1113	.5609	8.984	86.59	.07333	.36181	17.78
66	1.716	.1071	.5827	9.334	86.41	.07469	.36070	18.89
68	1.652	.1031	.6054	9.697	86.22	.07602	.35958	20.00
70	1.590	0.09926	0.6290	10.08	86.02	0.07736	0.35846	21.11
72	1.532	.09564	.6527	10.45	85.82	.07871	.35736	22.22
74	1.476	.09214	.6777	10.86	85.62	.08003	.35624	23.33
76	1.422	.08877	.7030	11.26	85.42	.08135	.35512	24.44
78	1.371	.08559	.7295	11.69	85.23	.08268	.35401	25.56
80	1.321	0.08247	0.7570	12.13	85.03	0.08399	0.35291	26.67
82	1.274	.07953	.7850	12.57	84.84	.08525	.35177	27.78
84	1.229	.07672	.8140	13.04	84.64	.08653	.35065	28.89
86	1.185	.07393	.8440	13.52	84.44	.08783	.34954	30.00
88	1.144	.07142	.8740	14.00	84.25	.08910	.34843	31.11
90	1.104	0.06892	0.9058	14.51	84.05	0.09038	0.34731	32.22
92	1.065	.06649	.9390	15.04	83.86	.09165	.34620	33.33
94	1.028	.06418	.9730	15.59	83.67	.09289	.34508	34.44
96	0.9931	.06200	1.007	16.13	83.47	.09411	.34397	35.56
98	0.9591	.05987	1.043	16.71	83.27	.09532	.34285	36.67
100	0.9262	0.05782	1.080	17.30	83.07	0.09657	0.34173	37.78

THERMODYNAMIC

Butane, $\text{CH}_3(\text{CH}_2)_2\text{CH}_3$

Temp. °F	Abs. press. sat. vap.		Heat content abv. 32°F BTU/lb.		Ht. of vaporiz. BTU/ lb.	Heat content abv. 0°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
0	7.3	0.51	-17.2	153.3	170.5	-9.56	85.17	94.72	-17.78
10	9.2	0.65	-11.7	156.8	168.5	-6.50	87.11	93.61	-12.22
20	11.6	0.816	-6.7	160.3	167.0	-3.7	89.06	92.78	-6.67
30	14.4	1.01	-1.2	164.3	165.5	-0.67	91.28	91.94	-1.11
40	17.7	1.24	+4.3	167.8	163.5	+2.4	93.22	90.83	+4.44
50	21.6	1.52	9.8	171.3	161.5	5.4	95.17	89.72	10.00
60	26.3	1.85	15.8	175.3	159.5	8.78	97.39	88.61	15.56
70	31.6	2.22	21.3	178.8	157.5	11.8	99.33	87.50	21.11
80	37.6	2.64	27.3	182.3	155.0	15.2	101.3	86.11	26.67
90	44.5	3.13	33.8	185.8	152.0	18.8	103.2	84.44	32.22
100	52.2	3.67	39.8	189.3	149.5	22.1	105.2	83.06	37.78
110	60.8	4.27	46.3	193.3	147.0	25.7	107.4	81.67	43.33
120	70.8	4.98	52.8	196.3	143.5	29.3	109.1	79.72	48.89
130	81.4	5.72	59.3	199.8	140.5	32.9	111.0	78.06	54.44
140	92.6	6.51	66.3	203.8	137.5	36.8	113.2	76.39	60.00

Isobutane, $(\text{CH}_3)_3\text{CH}$

-20	7.50	0.527	-25.5	140.0	165.5	-14.2	77.78	91.94	-28.89
-10	9.28	0.652	-21.0	142.0	163.0	-11.7	78.89	90.56	-23.33
0	11.6	0.816	-16.5	144.0	160.5	-9.17	80.00	89.17	-17.78
+10	14.6	1.03	-11.5	147.0	158.5	-6.39	81.67	88.06	-12.22
20	18.2	1.28	-6.5	149.5	156.0	-3.6	83.06	86.67	-6.67
30	22.3	1.57	-1.0	152.5	153.5	-0.56	84.72	85.28	-1.11
40	26.9	1.89	+4.5	155.5	151.0	+2.5	86.39	83.89	+4.44
50	32.5	2.28	10.5	159.0	148.5	5.83	88.33	82.50	10.00
60	38.7	2.72	16.5	162.5	146.0	9.17	90.28	81.11	15.56
70	45.8	3.22	23.0	166.5	143.5	12.8	92.50	79.72	21.11
80	53.9	3.79	30.0	170.5	140.5	16.7	94.72	78.06	26.67
90	63.3	4.45	37.0	174.5	137.5	20.6	96.94	76.39	32.22
100	73.7	5.18	44.5	179.0	134.5	24.7	99.44	74.72	37.78
110	85.1	5.98	52.5	183.5	131.0	29.2	101.9	72.78	43.33
120	98.0	6.89	60.5	188.0	127.5	33.6	104.4	70.83	48.89
130	112.0	7.87	69.5	193.5	124.0	38.6	107.5	68.89	54.44
140	126.8	8.915	78.5	199.0	120.5	43.6	110.6	66.94	60.00

Propane, C_3H_8

-70	7.37	0.518	-55.2	134.3	189.5	-30.7	74.61	105.3	-56.67
-60	9.72	0.683	-50.2	136.8	187.0	-27.9	76.00	103.9	-51.11
-50	12.6	0.886	-44.7	139.8	184.5	-24.8	77.67	102.5	-45.56
-40	16.2	1.14	-39.7	141.8	181.5	-22.1	78.78	100.8	-40.00
-30	20.3	1.43	-34.2	144.8	179.0	-19.0	80.44	99.44	-34.44
-20	25.4	1.79	-29.2	146.8	176.0	-16.2	81.56	97.78	-28.89
-10	31.4	2.21	-23.7	149.8	173.5	-13.2	83.22	96.39	-23.33
0	38.2	2.69	-18.2	152.3	170.5	-10.1	84.61	94.72	-17.78
+10	46.0	3.23	-12.7	155.3	168.0	-7.06	86.28	93.33	-12.22
20	55.5	3.90	-7.2	157.8	165.0	-4.0	87.67	91.67	-6.67
30	66.3	4.66	-1.2	160.8	162.0	-0.67	89.33	90.00	-1.11
40	78.0	5.48	+4.8	163.8	159.0	+2.7	91.00	88.33	+4.44
50	91.8	6.45	10.8	166.8	156.0	6.00	92.67	86.67	10.00
60	107.1	7.530	16.8	169.8	153.0	9.33	94.33	85.00	15.56
70	124.0	8.718	22.8	172.3	149.5	12.7	95.72	83.06	21.11
80	142.8	10.04	29.3	175.3	146.0	16.3	97.39	81.11	26.67
90	164.0	11.53	35.8	178.3	142.5	19.9	99.06	79.17	32.22
100	187.0	13.15	42.3	180.8	138.5	23.5	100.4	76.94	37.78
110	213.0	14.98	48.8	182.8	134.0	27.1	101.6	74.44	43.33
120	240.0	16.87	55.3	184.3	129.0	30.7	102.4	71.67	48.89

PROPERTIES (Continued)

Butane, $\text{CH}_3(\text{CH}_2)_2\text{CH}_3$

Temp. °F	Spec. vol. sat. vap.		Density of sat. vap.		Density of liq.		Temp. °C
	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³	lb./ft. ³	kg/m ³	
0	11.1	0.693	0.0901	1.44	38.59	618.1	-17.78
10	8.95	.559	.112	1.79	38.24	612.5	-12.22
20	7.23	.451	.138	2.21	37.89	606.9	- 6.67
30	5.90	.368	.169	2.71	37.54	601.3	- 1.11
40	4.88	.305	.205	3.28	37.19	595.7	+ 4.44
50	4.07	.254	.246	3.94	36.82	589.8	10.00
60	3.40	.212	.294	4.71	36.45	583.9	15.56
70	2.88	.180	.347	5.56	36.06	577.6	21.11
80	2.46	.154	.407	6.52	35.65	571.0	26.67
90	2.10	.131	.476	7.62	35.24	564.5	32.22
100	1.81	.113	.552	8.84	34.84	558.1	37.78
110	1.58	.0986	.633	10.1	34.41	551.2	43.33
120	1.38	.0862	.725	11.6	33.96	544.0	48.89
130	1.21	.0755	.826	13.2	33.49	536.4	54.44
140	1.07	.0668	.934	15.0	32.93	528.3	60.00

Isobutane, $(\text{CH}_3)_3\text{CH}$

-20	10.5	0.655	0.0952	1.52	38.35	614.3	-28.89
-10	8.91	.556	.112	1.79	37.95	607.9	-23.33
0	7.17	.448	.139	2.23	37.60	602.3	-17.78
+10	5.75	.359	.174	2.79	37.20	595.9	-12.22
20	4.68	.292	.214	3.43	36.80	589.5	- 6.67
30	3.86	.241	.259	4.15	36.40	583.1	- 1.11
40	3.22	.201	.311	4.98	36.00	576.6	+ 4.44
50	2.71	.169	.369	5.91	35.60	570.2	10.00
60	2.28	.142	.439	7.03	35.20	563.8	15.56
70	1.94	.121	.515	8.25	34.80	557.4	21.11
80	1.66	.104	.602	9.64	34.35	550.2	26.67
90	1.42	.0886	.704	11.3	33.90	543.0	32.22
100	1.23	.0768	.813	13.0	33.45	535.8	37.78
110	1.07	.0668	.935	15.0	33.00	528.6	43.33
120	0.926	.0578	1.08	17.3	32.50	520.6	48.89
130	0.811	.0506	1.23	19.7	32.00	512.6	54.44
140	0.716	.0447	1.32	21.1	31.80	509.4	60.00

Propane, C_3H_8

-70	12.9	0.805	0.0775	1.24	37.40	599.1	-56.67
-60	9.93	.620	.111	1.78	37.00	592.7	-51.11
-50	7.74	.483	.129	2.07	36.60	586.3	-45.56
-40	6.13	.383	.163	2.61	36.19	579.7	-40.00
-30	4.93	.308	.203	3.25	35.78	573.1	-34.44
-20	4.00	.250	.250	4.00	35.37	566.6	-28.89
-10	3.26	.204	.307	4.92	34.96	560.0	-23.33
0	2.71	.169	.369	5.91	34.54	553.3	-17.78
+10	2.27	.142	.441	7.06	34.12	546.5	-12.22
20	1.90	.119	.526	8.43	33.67	539.3	- 6.67
30	1.60	.0999	.625	10.0	33.20	531.8	- 1.11
40	1.37	.0855	.730	11.7	32.73	524.3	+ 4.44
50	1.18	.0737	.847	13.6	32.24	516.4	10.00
60	1.01	.0631	.990	15.9	31.75	508.6	15.56
70	0.883	.0551	1.13	18.1	31.24	500.4	21.11
80	0.770	.0481	1.30	20.8	30.70	491.8	26.67
90	0.673	.0420	1.49	23.9	30.15	482.9	32.22
100	0.591	.0369	1.69	27.1	29.58	473.8	37.78
110	0.519	.0324	1.96	31.4	28.85	462.1	43.33
120	0.459	.0287	2.18	34.9	28.30	453.3	48.89

THERMODYNAMIC

Difluorodichloromethane, CCl_2F_2 ("F-12")

Temp. °F	Abs. press. sat. vap.		Heat content abv. -40°F BTU/lb.		Ht. of vaporiz. BTU/ lb.	Heat content abv. -40°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
-40	9.32	0.655	0	73.50	73.50	0	40.83	40.83	-40.00
-30	12.02	0.845	2.03	74.70	72.67	1.13	41.50	40.37	-34.44
-20	15.28	1.074	4.07	75.87	71.80	2.26	42.15	39.89	-28.89
-10	19.20	1.350	6.14	77.05	70.91	3.41	42.81	39.39	-23.33
0	23.87	1.678	8.25	78.21	69.96	4.58	43.45	38.87	-17.78
+10	29.35	2.064	10.39	79.36	68.97	5.772	44.09	38.32	-12.22
20	35.75	2.513	12.55	80.49	67.94	6.972	44.72	37.74	-6.67
30	43.16	3.034	14.76	81.61	66.85	8.200	45.34	37.14	-1.11
40	51.68	3.633	17.00	82.71	65.71	9.444	45.95	36.51	+ 4.44
50	61.39	4.316	19.27	83.78	64.51	10.71	46.54	35.84	10.00
60	72.41	5.091	21.57	84.82	63.25	11.98	47.12	35.14	15.56
70	84.82	5.963	23.90	85.82	61.92	13.28	47.68	34.40	21.11
80	98.76	6.944	26.28	86.80	60.52	14.60	48.22	33.62	26.67
90	114.3	8.036	28.70	87.74	59.04	15.94	48.74	32.80	32.22
100	131.6	9.252	31.16	88.62	57.46	17.31	49.23	31.92	37.78
110	150.7	10.60	33.65	89.43	55.78	18.69	49.68	30.99	43.33
120	171.8	12.08	36.16	90.15	53.99	20.09	50.08	29.99	48.89

Carbon Disulfide, CS_2

Temp. °F	Abs. press. sat. vap.		Heat content abv. 32°F BTU/lb.		Ht. of vaporiz. BTU/ lb.	Heat content abv. 0°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
0	1.10	0.0773	- 8.60	156.90	165.5	- 4.78	87.167	91.94	-17.78
10	1.46	.103	- 5.60	158.90	164.5	- 3.11	88.278	91.39	-12.22
20	1.89	.133	- 3.00	160.20	163.2	- 1.67	89.000	90.67	- 6.67
30	2.36	.166	- 0.50	161.70	162.2	- 0.28	89.833	90.11	- 1.11
40	3.03	.213	+ 2.05	163.25	161.2	+ 1.14	90.695	89.56	+ 4.44
50	3.90	.274	4.24	164.24	160.0	2.36	91.245	88.89	10.00
60	4.95	.348	7.20	166.40	159.2	4.00	92.445	88.44	15.56
70	5.85	.411	9.80	167.90	158.1	5.44	93.278	87.83	21.11
80	7.30	.513	11.70	168.60	156.9	6.500	93.667	87.17	26.67
90	9.15	.643	13.80	169.40	155.6	7.667	94.111	86.44	32.22
100	11.08	.7790	16.15	170.55	154.4	8.972	94.750	85.78	37.78
110	13.50	.9491	18.30	171.50	153.2	10.17	95.278	85.11	43.33
120	16.10	1.132	20.01	172.01	152.0	11.12	95.561	84.44	48.89

Carbon Tetrachloride, CCl_4

20	0.40	0.028	- 2.00	92.45	94.45	- 1.11	51.36	52.47	- 6.67
30	0.60	.042	- 0.25	93.45	93.70	- 0.14	51.92	52.06	- 1.11
40	0.84	.059	+ 1.60	94.80	93.20	+ 0.889	52.67	51.78	+ 4.44
60	1.42	.100	5.95	98.15	92.20	3.31	54.53	51.22	15.56
70	1.85	.130	8.20	99.53	91.40	4.56	55.29	50.78	21.11
80	2.40	.169	9.80	99.87	90.07	5.44	55.48	50.04	26.67
90	3.12	.219	11.60	101.62	90.02	6.444	56.46	50.01	32.22
100	4.00	.281	13.40	102.80	89.40	7.444	57.11	49.67	37.78
110	4.89	.344	15.80	104.50	88.70	8.778	58.06	49.28	43.33
120	5.95	.418	18.06	105.90	87.90	10.03	58.83	48.83	48.89

Ethyl Ether, $(\text{C}_2\text{H}_5)_2\text{O}$

0	1.3	0.091	-18.00	153.00	171.0	-10.00	85.000	95.00	-17.78
10	1.8	.13	-12.0	158.43	170.4	- 6.67	88.017	94.67	-12.22
20	2.5	.18	- 6.50	163.50	170.0	- 3.61	90.833	94.44	- 6.67
30	3.4	.24	- 1.50	167.90	169.4	- 0.333	93.278	94.11	- 1.11
40	4.4	.31	+ 4.00	172.40	168.4	+ 2.22	95.778	93.56	+ 4.44
50	5.5	.39	9.57	177.17	167.6	5.32	98.428	93.11	10.00
70	8.8	.62	20.04	185.44	165.4	11.13	103.02	91.89	21.11
80	10.9	.766	26.40	190.60	164.2	14.67	105.89	91.22	26.67
90	13.4	.942	31.50	194.50	163.0	17.50	108.06	90.56	32.22
100	16.0	1.12	36.50	197.50	161.5	20.28	109.72	89.72	37.78

PROPERTIES (Continued)

Difluorodichloromethane, CCl₂F₂ ("F-12")

Temp. °F	Spec. vol. sat. vap.		Density of vap.		Dens. liq. lb./ft. ³	Entropy from -40°F BTU/lb.°F		Temp. °C
	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³		Liq.	Vap.	
-40	3.911	0.2442	0.2557	4.096	94.58	0	0.17517	-40.00
-30	3.088	.1928	.3238	5.187	93.59	0.00471	.17387	-34.44
-20	2.474	.1544	.4042	6.474	92.58	.00940	.17275	-28.89
-10	2.003	.1250	.4993	7.998	91.57	.01403	.17175	-23.33
0	1.637	.1022	.6109	9.785	90.52	.01869	.17091	-17.78
+10	1.351	.08434	.7402	11.86	89.45	.02328	.17015	-12.22
20	1.121	.06998	.8921	14.29	88.37	.02783	.16949	- 6.67
30	0.939	.0586	1.065	17.06	87.24	.03233	.16887	- 1.11
40	.792	.0494	1.263	20.23	86.10	.03680	.16833	+ 4.44
50	.673	.0420	1.485	23.79	84.94	.04126	.16785	10.00
60	.575	.0359	1.740	27.87	83.78	.04568	.16741	15.56
70	.493	.0308	2.028	32.48	82.60	.05009	.16701	21.11
80	.425	.0265	2.353	37.69	81.39	.05446	.16662	26.67
90	.368	.0230	2.721	43.58	80.11	.05882	.16624	32.22
100	.319	.0199	3.135	50.22	78.80	.06316	.16584	37.78
110	.277	.0173	3.610	57.82	77.46	.06749	.16542	43.33
120	.240	.0150	4.167	66.75	76.02	.07180	.16495	48.89

Carbon Disulfide, CS₂

Temp. °F	Spec. vol. sat. vap.		Density sat. vap.		Temp. °C
	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³	
0	53.76	3.356	0.0186	0.2979	-17.78
10	43.47	2.714	.0230	.3684	-12.22
20	34.84	2.175	.0287	.4597	- 6.67
30	29.49	1.841	.0339	.5430	- 1.11
40	23.52	1.468	.0425	.6808	+ 4.44
50	20.60	1.286	.0482	.7721	10.00
60	18.00	1.124	.0555	.8890	15.56
70	13.20	0.824	.0758	1.214	21.11
80	10.40	0.649	.0961	1.539	26.67
90	8.30	0.518	.1204	1.929	32.22
100	7.03	0.439	.1369	2.193	37.78
110	5.80	0.362	.1724	2.762	43.33
120	5.10	0.318	.1960	3.140	48.89

Carbon Tetrachloride, CCl₄

20	69.5	4.34	0.01438	0.2303	- 6.67
30	53.0	3.31	.01886	.3021	- 1.11
40	40.0	2.50	.02500	.4005	+ 4.44
60	24.0	1.50	.04166	.6673	15.56
70	19.5	1.22	.05128	.8214	21.11
80	16.0	0.999	.06345	1.016	26.67
90	13.0	0.812	.07692	1.232	32.22
100	10.0	0.624	.1000	1.602	37.78
110	8.5	0.53	.1176	1.884	43.33
120	7.5	0.47	.1333	2.135	48.89

Ethyl Ether, (C₂H₅)₂O

0	38.0	2.37	0.0263	0.4213	-17.78
10	32.5	2.03	.0332	.5318	-12.22
20	27.0	1.69	.0372	.5959	- 6.67
30	21.4	1.34	.0468	.7496	- 1.11
40	17.0	1.06	.0588	.9419	+ 4.44
50	13.2	0.824	.0757	1.213	10.00
70	7.8	0.49	.1280	2.050	21.11
80	6.2	0.39	.1620	2.595	26.67
90	5.1	0.32	.1960	3.140	32.22
100	4.5	0.28	.2220	3.556	37.78

THERMODYNAMIC

Methyl Chloride, CH₃Cl

Temp. °F	Abs. press. sat. vap.		Heat content abv. 32°F BTU/lb.		Ht. of vaporiz. BTU/ lb.	Heat content abv. 0°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
-20	11.75	0.8261	-19.0	167.36	186.36	-10.6	92.978	103.53	-23.89
-10	15.0	1.055	-15.38	168.83	184.21	-8.544	93.795	102.34	-23.33
-5	16.79	1.180	-13.58	169.54	183.12	-7.544	94.189	101.73	-20.56
0	18.8	1.32	-11.75	170.23	181.98	-6.528	94.572	101.10	-17.78
+5	21.0	1.48	-9.93	170.96	180.84	-5.517	94.978	100.47	-15.00
10	23.3	1.64	-8.06	171.58	179.65	-4.478	95.322	99.806	-12.22
15	25.9	1.82	-6.74	172.24	178.47	-3.744	95.689	99.150	-9.44
20	28.8	2.02	-4.32	172.95	177.27	-2.400	96.083	98.483	-6.67
25	31.8	2.24	-2.48	173.63	176.10	-1.378	96.461	97.833	-3.89
30	35.2	2.47	-0.62	174.28	174.90	-0.344	96.822	97.167	-1.11
35	38.7	2.72	+1.75	174.92	173.77	+0.972	97.178	96.539	+1.67
40	42.6	3.00	3.15	175.57	172.42	1.75	97.539	95.789	4.44
45	46.9	3.30	5.04	176.20	171.16	2.80	97.889	95.089	7.22
50	51.5	3.62	6.88	176.78	169.90	3.82	98.211	94.389	10.00
55	56.4	3.97	8.80	177.45	168.65	4.89	98.583	93.695	12.78
60	61.6	4.33	10.70	178.05	167.35	5.944	98.917	92.972	15.56
65	67.3	4.73	12.62	178.64	166.02	7.011	99.245	92.233	18.33
70	73.3	5.15	14.52	179.17	164.65	8.067	99.539	91.472	21.11
75	79.2	5.57	16.46	179.78	163.28	9.144	99.878	90.711	23.89
80	85.3	6.00	18.36	180.24	161.88	10.20	100.13	89.933	26.67
85	94.1	6.62	20.12	180.74	160.48	11.18	100.41	89.156	29.44
90	102.1	7.178	22.13	181.22	159.09	12.29	100.68	88.383	32.22
95	110.3	7.755	24.07	181.76	157.70	13.37	100.98	87.611	35.00
100	118.8	8.352	26.06	182.36	156.30	14.48	101.31	86.833	37.78

Mercury, Hg

Temp. °F	Abs. press. sat. vap.		Heat content abv. 32°F BTU/lb.		Ht. of vaporiz. BTU/ lb.	Heat content abv. 0°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in. ²	kg/cm ²	Liq.	Vap.		Liq.	Vap.		
402	0.4	0.03	13.81	141.96	128.15	7.672	78.867	71.195	205.56
444	0.8	0.06	15.36	142.60	127.24	8.533	79.222	70.689	228.89
458	1.0	0.07	15.89	142.81	126.92	8.828	79.339	70.511	236.67
485	1.5	0.11	16.90	143.23	126.33	9.389	79.572	70.183	251.67
505	2.0	0.14	17.65	143.54	125.89	9.806	79.745	69.939	262.78
558	4.0	0.28	19.62	144.34	124.72	10.90	80.189	69.289	292.22
591	6.0	0.42	20.87	144.86	123.99	11.59	80.478	68.883	310.56
617	8.0	0.56	21.81	145.24	123.43	12.12	80.689	68.572	325.00
637	10.0	0.703	22.58	145.56	122.98	12.54	80.867	68.322	336.11
676	15.0	1.05	24.04	146.16	122.12	13.36	81.200	67.844	357.78
706	20.0	1.41	25.15	146.61	121.46	13.97	81.450	67.478	374.44
730	25.0	1.76	26.05	146.98	120.93	14.47	81.656	67.183	387.78
751	30.0	2.11	26.81	147.29	120.48	14.89	81.828	66.933	399.44
769	35.0	2.46	27.49	147.57	120.08	15.27	81.983	66.711	409.44
785	40.0	2.81	28.08	147.81	119.73	15.60	82.117	66.517	418.33
799	45.0	3.16	28.62	148.04	119.42	15.90	82.245	66.344	426.11
812	50	3.5	29.11	148.24	119.13	16.17	82.356	66.183	433.33
836	60	4.2	29.99	148.60	118.61	16.66	82.556	65.894	446.67
857	70	4.9	30.75	148.90	118.15	17.08	82.722	65.639	458.33
875	80	5.6	31.44	149.19	117.75	17.47	82.883	65.417	468.33
892	90	6.3	32.06	149.44	117.38	17.81	83.022	65.211	477.78
907	100	7.03	32.63	149.68	117.05	18.13	83.156	65.028	486.11
921	110	7.73	33.16	149.90	116.74	18.42	83.278	64.856	493.89
934	120	8.44	33.66	150.10	116.44	18.70	83.389	64.689	501.11
947	130	9.14	34.12	150.29	116.17	18.96	83.495	64.539	508.33
958	140	9.84	34.55	150.47	115.92	19.19	83.595	64.400	514.44
969	150	10.5	34.96	150.63	115.67	19.42	83.683	64.261	520.56
1000	180	12.7	36.09	151.10	115.01	20.05	83.945	63.894	537.78

PROPERTIES (Concluded) **Methyl Chloride, CH₃Cl**

Temp. °F	Spec. vol. sat. vap.		Spec. vol. liq.		Density sat. vap.		Density of liq.		Temp. °C
	ft. ³ /lb.	m ³ /kg	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³	lb./ft. ³	kg/m ³	
-20	8.09	.505	.015827	.0009880	0.124	1.98	63.185	1012.1	-28.89
-10	6.46	.403	.015985	.0009979	.155	2.48	62.560	1002.1	-23.33
-5	5.80	.362	.016013	.0009997	.172	2.76	62.450	1000.3	-20.56
0	5.18	.323	.016146	.001008	.193	3.09	61.936	992.09	-17.78
+5	4.68	.292	.016228	.001013	.214	3.42	61.623	987.08	-15.00
10	4.18	.261	.016310	.001018	.239	3.83	61.311	982.08	-12.22
15	3.88	.242	.016388	.001023	.258	4.13	61.022	977.45	-9.44
20	3.41	.213	.016474	.001028	.293	4.70	60.702	972.32	-6.67
25	3.09	.193	.016552	.001033	.324	5.18	60.415	967.73	-3.89
30	2.81	.175	.016645	.001039	.356	5.70	60.077	962.31	-1.11
35	2.50	.156	.016746	.001045	.400	6.41	59.715	956.51	+1.67
40	2.31	.144	.016809	.001049	.433	6.93	59.492	952.94	4.44
45	2.10	.131	.016929	.001057	.476	7.63	59.069	946.17	7.22
50	1.93	.120	.017023	.001063	.518	8.30	58.745	940.98	10.00
55	1.75	.109	.017118	.001069	.571	9.16	58.419	935.76	12.78
60	1.61	.101	.017219	.001075	.621	9.95	58.077	930.28	15.56
65	1.47	.0918	.017318	.001081	.680	10.9	57.742	924.91	18.33
70	1.34	.0837	.017421	.001088	.746	12.0	57.403	919.48	21.11
75	1.24	.0774	.017526	.001094	.806	12.9	57.058	913.96	23.89
80	1.14	.0712	.017632	.001101	.877	14.1	56.714	908.44	26.67
85	1.05	.0655	.017740	.001108	.952	15.3	56.369	902.92	29.44
90	0.98	.061	.017850	.001114	1.02	16.3	56.022	897.36	32.22
95	0.91	.057	.017961	.001121	1.10	17.6	55.675	891.80	35.00
100	0.85	.053	.018074	.001128	1.18	18.8	55.327	886.23	37.78

Mercury, Hg

Temp. °F	Spec. vol. sat. vap.		Density of sat. vap.		Entropy above 32°F BTU/lb./°F			Temp °C
	ft. ³ /lb.	m ³ /kg	lb./ft. ³	kg/m ³	Liq.	Vap.	Evap.	
402	114.50	7.1480	0.008733	0.1399	.0209	.1696	.1487	205.56
444	59.72	3.728	.016745	0.26822	.0227	.1635	.1408	228.89
458	48.45	3.025	.02064	0.3306	.0233	.1616	.1383	236.67
485	33.14	2.069	.03017	0.4833	.0244	.1581	.1337	251.67
505	25.32	1.581	.03948	0.6324	.0251	.1556	.1305	262.78
558	13.26	0.8278	.07540	1.208	.0271	.1497	.1226	292.22
591	9.096	.5678	.10993	1.7609	.0283	.1462	.1179	310.56
617	6.9630	.43469	.14361	2.3003	.0292	.1439	.1147	325.00
637	5.6610	.35341	.17664	2.8294	.0299	.1420	.1121	336.11
676	3.8923	.24299	.25691	4.1152	.0312	.1387	.1075	357.78
706	2.983	.1862	.3352	5.369	.0322	.1364	.1042	374.44
730	2.429	.1516	.4117	6.595	.0330	.1346	.1016	387.78
751	2.053	.1282	.4871	7.802	.0336	.1331	.0995	399.44
769	1.7815	.11122	.5613	8.991	.0342	.1319	.0977	409.44
785	1.5762	.098399	.6344	10.16	.0346	.1308	.0962	418.33
799	1.4147	.088317	.7069	11.32	.0351	.1300	.0949	426.11
812	1.284	.08016	.7788	12.47	.0355	.1291	.0936	433.33
836	1.086	.06780	.9204	14.74	.0361	.1276	.0915	446.67
857	0.9436	.05891	1.0597	16.974	.0367	.1265	.0898	458.33
875	.8349	.05212	1.1977	19.185	.0372	.1254	.0882	468.33
892	.7497	.04680	1.3338	21.365	.0377	.1247	.0870	477.78
907	.6811	.04252	1.4682	23.518	.0381	.1237	.0856	486.11
921	.6242	.03897	1.6020	25.661	.0385	.1230	.0845	493.89
934	.5767	.03600	1.7340	27.775	.0389	.1224	.0835	501.11
947	.5360	.03346	1.8656	29.883	.0392	.1218	.0826	508.33
958	.5012	.03129	1.9952	31.959	.0395	.1213	.0818	514.44
969	.4706	.02938	2.125	34.04	.0398	.1207	.0809	520.56
1000	.3990	.02491	2.506	40.14	.0406	.1194	.0788	537.78

HIGH AND LOW TEMPERATURES

Absolute zero, -273.18°C .

M.p. of helium.....	-272.2°C .	Oxy-acetylene flame.....	3500°C .
B.p. of helium.....	-268.9	Tungsten arc under pres-	
M.p. of hydrogen.....	-259.18	sure (Luckey).....	4785
B.p. of hydrogen.....	-252.8	Cored carbon arc (Suits)..	5500
B.p. of liquid air.....	-192	Iron welding arc (Suits)..	6020
		Tungsten arc, max.	
Industrial furnaces.....	1700°C .	(Suits).....	6440
Bunsen burner.....	1870	Exploding wires by high	
Oxy-hydrogen flame...	2800	voltage discharge (An-	
Tungsten tube furnace		derson).....	19700
(Forsythe).....	2800		
Carbon arc furnace		The Sun (Coblentz)....	6000°K .
(Forsythe).....	3200	Stars, max. estimated....	30000°K .

SCALE OF FUSIBILITY

Num- ber	Mineral	Approximate fusing point	Notes
1	Stibnite	525°C	Fuses easily in a candle flame.
2	Chalcopyrite	800°C	Fuses slowly in a gas flame.
3	Almandite	1050°C	Only finest splinters rounded in a gas flame.
4	Actinolite	1200°C	Standard-size fragments are rounded easily before the blowpipe.
5	Orthoclase	1300°C	Standard-size fragments are rounded with difficulty before the blowpipe.
6	Bronzite	1400°C	Only finest splinters rounded on points with difficulty before the blowpipe.
7	Quartz	$>1400^{\circ}\text{C}$	Entirely infusible before the blowpipe.

CONSTANT TEMPERATURE BATHS

The following substances may be utilized between the temperatures indicated (boiling points) by using pressures from 10 to 76 cm. The second temperature given is the boiling point at the latter pressure. Several of the liquids are inflammable and must be used with caution.

Substance	Temperature $^{\circ}\text{C}$
Ethyl chloride	-31.3 to 12.2
Ethyl ether	-12.1 to 34.5
Carbon disulfide	-4.8 to 46.3
Acetone	7.5 to 56.1
Chloroform	9.7 to 61.2
Methyl alcohol	20.62 to 64.5
Ethyl alcohol	34.4 to 78.5
Benzene	25.8 to 79.8
Water	51.7 to 100 .
Toluene	51.8 to 110.5
Chlorobenzene	70.3 to 132.1
Isoamyl acetate	142.5
Bromobenzene	90.7 to 156.2
Aniline	119.4 to 184.4
Naphthalene	144.3 to 217.9
Methyl salicylate	151 to 223.3
Isoamyl benzoate	262 .
Diphenylamine	221 to 302.0
Benzophenone	224 to 305.4
Mercury	261.5 to 356.9
Sulfur	330.7 to 444.6
Zinc	758 to 907 .

HYGROMETRIC AND BAROMETRIC TABLES

CONVERSION TABLE FOR BAROMETRIC READINGS

U. S. inches to cm.

Inches.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
27.0	68.580	.606	.631	.656	.682	.707	.733	.758	.783	.809
27.1	.834	.860	.885	.910	.936	.961	.987	*.012	*.037	*.063
27.2	69.088	.114	.139	.164	.190	.215	.241	.266	.291	.317
27.3	.342	.368	.393	.418	.444	.469	.495	.520	.545	.571
27.4	.596	.622	.647	.672	.698	.723	.749	.774	.799	.825
27.5	.850	.876	.901	.926	.952	.977	*.002	*.028	*.053	*.079
27.6	70.104	.130	.155	.180	.206	.231	.257	.282	.307	.333
27.7	.358	.384	.409	.434	.460	.485	.511	.536	.561	.587
27.8	.612	.638	.663	.688	.714	.739	.765	.790	.815	.841
27.9	.866	.892	.917	.942	.968	.993	*.018	*.044	*.069	*.095
28.0	71.120	.146	.171	.196	.222	.247	.273	.298	.323	.349
28.1	.374	.400	.425	.450	.476	.501	.527	.552	.577	.603
28.2	.628	.654	.679	.704	.730	.755	.781	.806	.831	.857
28.3	.882	.908	.933	.958	.984	*.009	*.035	*.060	*.085	*.111
28.4	72.136	.162	.187	.212	.238	.263	.289	.314	.339	.365
28.5	.390	.416	.441	.466	.492	.517	.543	.568	.593	.619
28.6	.644	.670	.695	.720	.746	.771	.797	.822	.847	.873
28.7	.898	.924	.949	.974	*.000	*.025	*.051	*.076	*.101	*.127
28.8	73.152	.178	.203	.228	.254	.279	.305	.330	.355	.381
28.9	.406	.432	.457	.482	.508	.533	.559	.584	.609	.635
29.0	.660	.686	.711	.736	.762	.787	.813	.838	.863	.889
29.1	.914	.940	.965	.990	*.016	*.041	*.067	*.092	*.117	*.143
29.2	74.168	.194	.219	.244	.270	.295	.321	.346	.371	.397
29.3	.422	.448	.473	.498	.524	.549	.575	.600	.625	.651
29.4	.676	.702	.727	.752	.778	.803	.829	.854	.879	.905
29.5	.930	.956	.981	*.006	*.032	*.057	*.083	*.108	*.133	*.159
29.6	75.184	.210	.235	.260	.286	.311	.337	.362	.387	.413
29.7	.438	.464	.489	.514	.540	.565	.591	.616	.641	.667
29.8	.692	.718	.743	.768	.794	.819	.845	.870	.895	.921
29.9	.946	.972	.997	*.022	*.048	*.073	*.099	*.124	*.149	*.175
30.0	76.200	.226	.251	.277	.302	.327	.353	.378	.404	.429
30.1	.454	.480	.505	.531	.556	.581	.607	.632	.658	.683
30.2	.708	.734	.759	.785	.810	.835	.861	.886	.912	.937
30.3	.962	.988	*.013	*.039	*.064	*.089	*.115	*.140	*.166	*.191
30.4	77.216	.242	.267	.293	.318	.343	.369	.394	.420	.445
30.5	.470	.496	.521	.547	.572	.597	.623	.648	.674	.699
30.6	.724	.750	.775	.801	.826	.851	.877	.902	.928	.953
30.7	.978	*.004	*.029	*.055	*.080	*.105	*.131	*.156	*.182	*.207
30.8	78.232	.258	.283	.309	.334	.359	.385	.410	.436	.461
30.9	.486	.512	.537	.563	.588	.613	.639	.664	.690	.715

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

U. S. Inches to Millibars

Based on the relation 1 inch of mercury at 32°F represents a pressure of 33.8639 millibars.

Note: Figures in last nine columns to be preceded by 7, 8 or 9 as indicated.

Inches	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
23.0	7 78.87	79.21	79.55	79.89	80.22	80.56	80.90	81.24	81.58	81.92
23.1	7 82.26	82.59	82.93	83.27	83.61	83.95	84.29	84.63	84.97	85.30
23.2	7 85.64	85.98	86.32	86.66	87.00	87.34	87.67	88.01	88.35	88.69
23.3	7 89.03	89.37	89.71	90.04	90.38	90.72	91.06	91.40	91.74	92.08
23.4	7 92.42	92.75	93.09	93.43	93.77	94.11	94.45	94.79	95.12	95.46
23.5	7 95.80	96.14	96.48	96.82	97.16	97.49	97.83	98.17	98.51	98.85
23.6	7 99.19	99.53	99.87	*00.20	*00.54	*00.88	*01.22	*01.56	*01.90	*02.24
23.7	8 02.57	02.91	03.25	03.59	03.93	04.27	04.61	04.94	05.28	05.62
23.8	8 05.96	06.30	06.64	06.98	07.32	07.65	07.99	08.33	08.67	09.01
23.9	8 09.35	09.69	10.02	10.36	10.70	11.04	11.38	11.72	12.06	12.39
24.0	8 12.73	13.07	13.41	13.75	14.09	14.43	14.77	15.10	15.44	15.78
24.1	8 16.12	16.46	16.80	17.14	17.47	17.81	18.15	18.49	18.83	19.17
24.2	8 19.51	19.85	20.18	20.52	20.86	21.20	21.54	21.88	22.22	22.55
24.3	8 22.89	23.23	23.57	23.91	24.25	24.59	24.92	25.26	25.60	25.94
24.4	8 26.28	26.62	26.96	27.30	27.63	27.97	28.31	28.65	28.99	29.33
24.5	8 29.67	30.00	30.34	30.68	31.02	31.36	31.70	32.04	32.37	32.71
24.6	8 33.05	33.39	33.73	34.07	34.41	34.75	35.08	35.42	35.76	36.10
24.7	8 36.44	36.78	37.12	37.45	37.79	38.13	38.47	38.81	39.15	39.49
24.8	8 39.82	40.16	40.50	40.84	41.18	41.52	41.86	42.20	42.53	42.87
24.9	8 43.21	43.55	43.89	44.23	44.57	44.90	45.24	45.58	45.92	46.26
25.0	8 46.60	46.94	47.27	47.61	47.95	48.29	48.63	48.97	49.31	49.65
25.1	8 49.98	50.32	50.66	51.00	51.34	51.68	52.02	52.35	52.69	53.03
25.2	8 53.37	53.71	54.05	54.39	54.72	55.06	55.40	55.74	56.08	56.42
25.3	8 56.76	57.10	57.43	57.77	58.11	58.45	58.79	59.13	59.47	59.80
25.4	8 60.14	60.48	60.82	61.16	61.50	61.84	62.17	62.51	62.85	63.19
25.5	8 63.53	63.87	64.21	64.55	64.88	65.22	65.56	65.90	66.24	66.58
25.6	8 66.92	67.25	67.59	67.93	68.27	68.61	68.95	69.29	69.62	69.96
25.7	8 70.30	70.64	70.98	71.32	71.66	72.00	72.33	72.67	73.01	73.35
25.8	8 73.69	74.03	74.37	74.70	75.04	75.38	75.72	76.06	76.40	76.74
25.9	8 77.08	77.41	77.75	78.09	78.43	78.77	79.11	79.45	79.78	80.12
26.0	8 80.46	80.80	81.14	81.48	81.82	82.15	82.49	82.83	83.17	83.51
26.1	8 83.85	84.19	84.53	84.86	85.20	85.54	85.88	86.22	86.56	86.90
26.2	8 87.23	87.57	87.91	88.25	88.59	88.93	89.27	89.60	89.94	90.28
26.3	8 90.62	90.96	91.30	91.64	91.98	92.31	92.65	92.99	93.33	93.67
26.4	8 94.01	94.35	94.68	95.02	95.36	95.70	96.04	96.38	96.72	97.05
26.5	8 97.39	97.73	98.07	98.41	98.75	99.09	99.43	99.76	*00.10	*00.44
26.6	9 00.78	01.12	01.46	01.80	02.13	02.47	02.81	03.15	03.49	03.83
26.7	9 04.17	04.50	04.84	05.18	05.52	05.86	06.20	06.54	06.88	07.21
26.8	9 07.55	07.89	08.23	08.57	08.91	09.25	09.58	09.92	10.26	10.60
26.9	9 10.94	11.28	11.62	11.95	12.29	12.63	12.97	13.31	13.65	13.99
27.0	9 14.33	14.66	15.00	15.34	15.68	16.02	16.36	16.70	17.03	17.37
27.1	9 17.71	18.05	18.39	18.73	19.07	19.40	19.74	20.08	20.42	20.76
27.2	9 21.10	21.44	21.78	22.11	22.45	22.79	23.13	23.47	23.81	24.15
27.3	9 24.48	24.82	25.16	25.50	25.84	26.18	26.52	26.85	27.19	27.53
27.4	9 27.87	28.21	28.55	28.89	29.23	29.56	29.90	30.24	30.58	30.92

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

U. S. Inches to Millibars (Continued)

Note: Figures in last nine columns to be preceded by 9 or 10 as indicated.

Inches	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
27.5	9 31.26	31.60	31.93	32.27	32.61	32.95	33.29	33.63	33.97	34.31
27.6	9 34.64	34.98	35.32	35.66	36.00	36.34	36.68	37.01	37.35	37.69
27.7	9 38.03	38.37	38.71	39.05	39.38	39.72	40.06	40.40	40.74	41.08
27.8	9 41.42	41.76	42.09	42.43	42.77	43.11	43.45	43.79	44.13	44.46
27.9	9 44.80	45.14	45.48	45.82	46.16	46.50	46.83	47.17	47.51	47.85
28.0	9 48.19	48.53	48.87	49.21	49.54	49.88	50.22	50.56	50.90	51.24
28.1	9 51.58	51.91	52.25	52.59	52.93	53.27	53.61	53.95	54.28	54.62
28.2	9 54.96	55.30	55.64	55.98	56.32	56.66	56.99	57.33	57.67	58.01
28.3	9 58.35	58.69	59.03	59.36	59.70	60.04	60.38	60.72	61.06	61.40
28.4	9 61.73	62.07	62.41	62.75	63.09	63.43	63.77	64.11	64.44	64.78
28.5	9 65.12	65.46	65.80	66.14	66.48	66.81	67.15	67.49	67.83	68.17
28.6	9 68.51	68.85	69.18	69.52	69.86	70.20	70.54	70.88	71.22	71.56
28.7	9 71.89	72.23	72.57	72.91	73.25	73.59	73.93	74.26	74.60	74.94
28.8	9 75.28	75.62	75.96	76.30	76.63	76.97	77.31	77.65	77.99	78.33
28.9	9 78.67	79.01	79.34	79.68	80.02	80.36	80.70	81.04	81.38	81.71
29.0	9 82.05	82.39	82.73	83.07	83.41	83.75	84.08	84.42	84.76	85.10
29.1	9 85.44	85.78	86.12	86.46	86.79	87.13	87.47	87.81	88.15	88.49
29.2	9 88.83	89.16	89.50	89.84	90.18	90.52	90.86	91.20	91.53	91.87
29.3	9 92.21	92.55	92.89	93.23	93.57	93.91	94.24	94.58	94.92	95.26
29.4	9 95.60	95.94	96.28	96.61	96.95	97.29	97.63	97.97	98.31	98.65
29.5	9 98.99	99.32	99.66	*00.00	*00.34	*00.68	*01.02	*01.36	*01.69	*02.03
29.6	10 02.37	02.71	03.05	03.39	03.73	04.06	04.40	04.74	05.08	05.42
29.7	10 05.76	06.10	06.44	06.77	07.11	07.45	07.79	08.13	08.47	08.81
29.8	10 09.14	09.48	09.82	10.16	10.50	10.84	11.18	11.51	11.85	12.19
29.9	10 12.53	12.87	13.21	13.55	13.89	14.22	14.56	14.90	15.24	15.58
30.0	10 15.92	16.26	16.59	16.93	17.27	17.61	17.95	18.29	18.63	18.96
30.1	10 19.30	19.64	19.98	20.32	20.66	21.00	21.34	21.67	22.01	22.35
30.2	10 22.69	23.03	23.37	23.71	24.04	24.38	24.72	25.06	25.40	25.74
30.3	10 26.08	26.41	26.75	27.09	27.43	27.77	28.11	28.45	28.79	29.12
30.4	10 29.46	29.80	30.14	30.48	30.82	31.16	31.49	31.83	32.17	32.51
30.5	10 32.85	33.19	33.53	33.86	34.20	34.54	34.88	35.22	35.56	35.90
30.6	10 36.24	36.57	36.91	37.25	37.59	37.93	38.27	38.61	38.94	39.28
30.7	10 39.62	39.96	40.30	40.64	40.98	41.31	41.65	41.99	42.33	42.67
30.8	10 43.01	43.35	43.69	44.02	44.36	44.70	45.04	45.38	45.72	46.06
30.9	10 46.39	46.73	47.07	47.41	47.75	48.09	48.43	48.76	49.10	49.44
31.0	10 49.78	50.12	50.46	50.80	51.14	51.47	51.81	52.15	52.49	52.83
31.1	10 53.17	53.51	53.84	54.18	54.52	54.86	55.20	55.54	55.88	56.22
31.2	10 56.55	56.89	57.23	57.57	57.91	58.25	58.59	58.92	59.26	59.60
31.3	10 59.94	60.28	60.62	60.96	61.29	61.63	61.97	62.31	62.65	62.99
31.4	10 63.33	63.67	64.00	64.34	64.68	65.02	65.36	65.70	66.04	66.37
31.5	10 66.71	67.05	67.39	67.73	68.07	68.41	68.74	69.08	69.42	69.76
31.6	10 70.10	70.44	70.78	71.12	71.45	71.79	72.13	72.47	72.81	73.15
31.7	10 73.49	73.82	74.16	74.50	74.84	75.18	75.52	75.86	76.19	76.53
31.8	10 76.87	77.21	77.55	77.89	78.23	78.57	78.90	79.24	79.58	79.92
31.9	10 80.26	80.60	80.94	81.27	81.61	81.95	82.29	82.63	82.97	83.31

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

Centimeters to Millibars

Based on the relation 1 centimeter of mercury at 0°C represents a pressure of 13.3322 millibars.

Note: Figures in last nine columns to be preceded by 9.

Centi- meters	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
68.0	9 06.59	06.72	06.86	06.99	07.12	07.26	07.39	07.52	07.66	07.79
68.1	9 07.92	08.06	08.19	08.32	08.46	08.59	08.72	08.86	08.99	09.12
68.2	9 09.26	09.39	09.52	09.66	09.79	09.92	10.06	10.19	10.32	10.46
68.3	9 10.59	10.72	10.86	10.99	11.12	11.26	11.39	11.52	11.66	11.79
68.4	9 11.92	12.06	12.19	12.32	12.46	12.59	12.72	12.86	12.99	13.12
68.5	9 13.26	13.39	13.52	13.66	13.79	13.92	14.06	14.19	14.32	14.46
68.6	9 14.59	14.72	14.86	14.99	15.12	15.26	15.39	15.52	15.66	15.79
68.7	9 15.92	16.06	16.19	16.32	16.46	16.59	16.72	16.86	16.99	17.12
68.8	9 17.26	17.39	17.52	17.66	17.79	17.92	18.06	18.19	18.32	18.46
68.9	9 18.59	18.72	18.86	18.99	19.12	19.26	19.39	19.52	19.66	19.79
69.0	9 19.92	20.06	20.19	20.32	20.46	20.59	20.72	20.86	20.99	21.12
69.1	9 21.26	21.39	21.52	21.65	21.79	21.92	22.05	22.19	22.32	22.45
69.2	9 22.59	22.72	22.85	22.99	23.12	23.25	23.39	23.52	23.65	23.79
69.3	9 23.92	24.05	24.19	24.32	24.45	24.59	24.72	24.85	24.99	25.12
69.4	9 25.25	25.39	25.52	25.65	25.79	25.92	26.05	26.19	26.32	26.45
69.5	9 26.59	26.72	26.85	26.99	27.12	27.25	27.39	27.52	27.65	27.79
69.6	9 27.92	28.05	28.19	28.32	28.45	28.59	28.72	28.85	28.99	29.12
69.7	9 29.25	29.39	29.52	29.65	29.79	29.92	30.05	30.19	30.32	30.45
69.8	9 30.59	30.72	30.85	30.99	31.12	31.25	31.39	31.52	31.65	31.79
69.9	9 31.92	32.05	32.19	32.32	32.45	32.59	32.72	32.85	32.99	33.12
70.0	9 33.25	33.39	33.52	33.65	33.79	33.92	34.05	34.19	34.32	34.45
70.1	9 34.59	34.72	34.85	34.99	35.12	35.25	35.39	35.52	35.65	35.79
70.2	9 35.92	36.05	36.19	36.32	36.45	36.59	36.72	36.85	36.99	37.12
70.3	9 37.25	37.39	37.52	37.65	37.79	37.92	38.05	38.19	38.32	38.45
70.4	9 38.59	38.72	38.85	38.99	39.12	39.25	39.39	39.52	39.65	39.79
70.5	9 39.92	40.05	40.19	40.32	40.45	40.59	40.72	40.85	40.99	41.12
70.6	9 41.25	41.39	41.52	41.65	41.79	41.92	42.05	42.19	42.32	42.45
70.7	9 42.59	42.72	42.85	42.99	43.12	43.25	43.39	43.52	43.65	43.79
70.8	9 43.92	44.05	44.19	44.32	44.45	44.59	44.72	44.85	44.99	45.12
70.9	9 45.25	45.39	45.52	45.65	45.79	45.92	46.05	46.19	46.32	46.45
71.0	9 46.59	46.72	46.85	46.99	47.12	47.25	47.39	47.52	47.65	47.79
71.1	9 47.92	48.05	48.19	48.32	48.45	48.59	48.72	48.85	48.99	49.12
71.2	9 49.25	49.39	49.52	49.65	49.79	49.92	50.05	50.19	50.32	50.45
71.3	9 50.59	50.72	50.85	50.99	51.12	51.25	51.39	51.52	51.65	51.79
71.4	9 51.92	52.05	52.19	52.32	52.45	52.59	52.72	52.85	52.99	53.12
71.5	9 53.25	53.39	53.52	53.65	53.79	53.92	54.05	54.19	54.32	54.45
71.6	9 54.59	54.72	54.85	54.99	55.12	55.25	55.39	55.52	55.65	55.79
71.7	9 55.92	56.05	56.19	56.32	56.45	56.59	56.72	56.85	56.99	57.12
71.8	9 57.25	57.39	57.52	57.65	57.79	57.92	58.05	58.19	58.32	58.45
71.9	9 58.59	58.72	58.85	58.99	59.12	59.25	59.39	59.52	59.65	59.79
72.0	9 59.92	60.05	60.19	60.32	60.45	60.59	60.72	60.85	60.98	61.12
72.1	9 61.25	61.38	61.52	61.65	61.78	61.92	62.05	62.18	62.32	62.45
72.2	9 62.58	62.72	62.85	62.98	63.12	63.25	63.38	63.52	63.65	63.78
72.3	9 63.92	64.05	64.18	64.32	64.45	64.58	64.72	64.85	64.98	65.12
72.4	9 65.25	65.38	65.52	65.65	65.78	65.92	66.05	66.18	66.32	66.45
72.5	9 66.58	66.72	66.85	66.98	67.12	67.25	67.38	67.52	67.65	67.78
72.6	9 67.92	68.05	68.18	68.32	68.45	68.58	68.72	68.85	68.98	69.12
72.7	9 69.25	69.38	69.52	69.65	69.78	69.92	70.05	70.18	70.32	70.45
72.8	9 70.58	70.72	70.85	70.98	71.12	71.25	71.38	71.52	71.65	71.78
72.9	9 71.92	72.05	72.18	72.32	72.45	72.58	72.72	72.85	72.98	73.12

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

Centimeters to Millibars (Continued)

Note: Figures in last nine columns to be preceded by 9 or 10.

Centi- meters	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
73.0	9 73.25	73.38	73.52	73.65	73.78	73.92	74.05	74.18	74.32	74.45
73.1	9 74.58	74.72	74.85	74.98	75.12	75.25	75.38	75.52	75.65	75.78
73.2	9 75.92	76.05	76.18	76.32	76.45	76.58	76.72	76.85	76.98	77.12
73.3	9 77.25	77.38	77.52	77.65	77.78	77.92	78.05	78.18	78.32	78.45
73.4	9 78.58	78.72	78.85	78.98	79.12	79.25	79.38	79.52	79.65	79.78
73.5	9 79.92	80.05	80.18	80.32	80.45	80.58	80.72	80.85	80.98	81.12
73.6	9 81.25	81.38	81.52	81.65	81.78	81.92	82.05	82.18	82.32	82.45
73.7	9 82.58	82.72	82.85	82.98	83.12	83.25	83.38	83.52	83.65	83.78
73.8	9 83.92	84.05	84.18	84.32	84.45	84.58	84.72	84.85	84.98	85.12
73.9	9 85.25	85.38	85.52	85.65	85.78	85.92	86.05	86.18	86.32	86.45
74.0	9 86.58	86.72	86.85	86.98	87.12	87.25	87.38	87.52	87.65	87.78
74.1	9 87.92	88.05	88.18	88.32	88.45	88.58	88.72	88.85	88.98	89.12
74.2	9 89.25	89.38	89.52	89.65	89.78	89.92	90.05	90.18	90.32	90.45
74.3	9 90.58	90.72	90.85	90.98	91.12	91.25	91.38	91.52	91.65	91.78
74.4	9 91.92	92.05	92.18	92.32	92.45	92.58	92.72	92.85	92.98	93.12
74.5	9 93.25	93.38	93.52	93.65	93.78	93.92	94.05	94.18	94.32	94.45
74.6	9 94.58	94.72	94.85	94.98	95.12	95.25	95.38	95.52	95.65	95.78
74.7	9 95.92	96.05	96.18	96.32	96.45	96.58	96.72	96.85	96.98	97.12
74.8	9 97.25	97.38	97.52	97.65	97.78	97.92	98.05	98.18	98.32	98.45
74.9	9 98.58	98.72	98.85	98.98	99.12	99.25	99.38	99.52	99.65	99.78
75.0	9 99.92	*00.05	*00.18	*00.31	*00.45	*00.58	*00.71	*00.85	*00.98	*01.11
75.1	10 01.25	01.38	01.51	01.65	01.78	01.91	02.05	02.18	02.31	02.45
75.2	10 02.58	02.71	02.85	02.98	03.11	03.25	03.38	03.51	03.65	03.78
75.3	10 03.91	04.05	04.18	04.31	04.45	04.58	04.71	04.85	04.98	05.11
75.4	10 05.25	05.38	05.51	05.65	05.78	05.91	06.05	06.18	06.31	06.45
75.5	10 06.58	06.71	06.85	06.98	07.11	07.25	07.38	07.51	07.65	07.78
75.6	10 07.91	08.05	08.18	08.31	08.45	08.58	08.71	08.85	08.98	09.11
75.7	10 09.25	09.38	09.51	09.65	09.78	09.91	10.05	10.18	10.31	10.45
75.8	10 10.58	10.71	10.85	10.98	11.11	11.25	11.38	11.51	11.65	11.78
75.9	10 11.91	12.05	12.18	12.31	12.45	12.58	12.71	12.85	12.98	13.11
76.0	10 13.25	13.38	13.51	13.65	13.78	13.91	14.05	14.18	14.31	14.45
76.1	10 14.58	14.71	14.85	14.98	15.11	15.25	15.38	15.51	15.65	15.78
76.2	10 15.91	16.05	16.18	16.31	16.45	16.58	16.71	16.85	16.98	17.11
76.3	10 17.25	17.38	17.51	17.65	17.78	17.91	18.05	18.18	18.31	18.45
76.4	10 18.58	18.71	18.85	18.98	19.11	19.25	19.38	19.51	19.65	19.78
76.5	10 19.91	20.05	20.18	20.31	20.45	20.58	20.71	20.85	20.98	21.11
76.6	10 21.25	21.38	21.51	21.65	21.78	21.91	22.05	22.18	22.31	22.45
76.7	10 22.58	22.71	22.85	22.98	23.11	23.25	23.38	23.51	23.65	23.78
76.8	10 23.91	24.05	24.18	24.31	24.45	24.58	24.71	24.85	24.98	25.11
76.9	10 25.25	25.38	25.51	25.65	25.78	25.91	26.05	26.18	26.31	26.45
77.0	10 26.58	26.71	26.85	26.98	27.11	27.25	27.38	27.51	27.65	27.78
77.1	10 27.91	28.05	28.18	28.31	28.45	28.58	28.71	28.85	28.98	29.11
77.2	10 29.25	29.38	29.51	29.65	29.78	29.91	30.05	30.18	30.31	30.45
77.3	10 30.58	30.71	30.85	30.98	31.11	31.25	31.38	31.51	31.65	31.78
77.4	10 31.91	32.05	32.18	32.31	32.45	32.58	32.71	32.85	32.98	33.11
77.5	10 33.25	33.38	33.51	33.65	33.78	33.91	34.05	34.18	34.31	34.45
77.6	10 34.58	34.71	34.85	34.98	35.11	35.25	35.38	35.51	35.65	35.78
77.7	10 35.91	36.05	36.18	36.31	36.45	36.58	36.71	36.85	36.98	37.11
77.8	10 37.25	37.38	37.51	37.65	37.78	37.91	38.05	38.18	38.31	38.45
77.9	10 38.58	38.71	38.85	38.98	39.11	39.24	39.38	39.51	39.64	39.78

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

U. S. Inches to Millibars

Based on the relation 1 inch of mercury at 32°F represents a pressure of 33.8639 millibars.

Note: Figures in last nine columns to be preceded by 7, 8 or 9 as indicated.

Inches	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
23.0	7 78.87	79.21	79.55	79.89	80.22	80.56	80.90	81.24	81.58	81.92
23.1	7 82.26	82.59	82.93	83.27	83.61	83.95	84.29	84.63	84.97	85.30
23.2	7 85.64	85.98	86.32	86.66	87.00	87.34	87.67	88.01	88.35	88.69
23.3	7 89.03	89.37	89.71	90.04	90.38	90.72	91.06	91.40	91.74	92.08
23.4	7 92.42	92.75	93.09	93.43	93.77	94.11	94.45	94.79	95.12	95.46
23.5	7 95.80	96.14	96.48	96.82	97.16	97.49	97.83	98.17	98.51	98.85
23.6	7 99.19	99.53	99.87	*00.20	*00.54	*00.88	*01.22	*01.56	*01.90	*02.24
23.7	8 02.57	02.91	03.25	03.59	03.93	04.27	04.61	04.94	05.28	05.62
23.8	8 05.96	06.30	06.64	06.98	07.32	07.65	07.99	08.33	08.67	09.01
23.9	8 09.35	09.69	10.02	10.36	10.70	11.04	11.38	11.72	12.06	12.39
24.0	8 12.73	13.07	13.41	13.75	14.09	14.43	14.77	15.10	15.44	15.78
24.1	8 16.12	16.46	16.80	17.14	17.47	17.81	18.15	18.49	18.83	19.17
24.2	8 19.51	19.85	20.18	20.52	20.86	21.20	21.54	21.88	22.22	22.55
24.3	8 22.89	23.23	23.57	23.91	24.25	24.59	24.92	25.26	25.60	25.94
24.4	8 26.28	26.62	26.96	27.30	27.63	27.97	28.31	28.65	28.99	29.33
24.5	8 29.67	30.00	30.34	30.68	31.02	31.36	31.70	32.04	32.37	32.71
24.6	8 33.05	33.39	33.73	34.07	34.41	34.75	35.08	35.42	35.76	36.10
24.7	8 36.44	36.78	37.12	37.45	37.79	38.13	38.47	38.81	39.15	39.49
24.8	8 39.82	40.16	40.50	40.84	41.18	41.52	41.86	42.20	42.53	42.87
24.9	8 43.21	43.55	43.89	44.23	44.57	44.90	45.24	45.58	45.92	46.26
25.0	8 46.60	46.94	47.27	47.61	47.95	48.29	48.63	48.97	49.31	49.65
25.1	8 49.98	50.32	50.66	51.00	51.34	51.68	52.02	52.35	52.69	53.03
25.2	8 53.37	53.71	54.05	54.39	54.72	55.06	55.40	55.74	56.08	56.42
25.3	8 56.76	57.10	57.43	57.77	58.11	58.45	58.79	59.13	59.47	59.80
25.4	8 60.14	60.48	60.82	61.16	61.50	61.84	62.17	62.51	62.85	63.19
25.5	8 63.53	63.87	64.21	64.55	64.88	65.22	65.56	65.90	66.24	66.58
25.6	8 66.92	67.25	67.59	67.93	68.27	68.61	68.95	69.29	69.62	69.96
25.7	8 70.30	70.64	70.98	71.32	71.66	72.00	72.33	72.67	73.01	73.35
25.8	8 73.69	74.03	74.37	74.70	75.04	75.38	75.72	76.06	76.40	76.74
25.9	8 77.08	77.41	77.75	78.09	78.43	78.77	79.11	79.45	79.78	80.12
26.0	8 80.46	80.80	81.14	81.48	81.82	82.15	82.49	82.83	83.17	83.51
26.1	8 83.85	84.19	84.53	84.86	85.20	85.54	85.88	86.22	86.56	86.90
26.2	8 87.23	87.57	87.91	88.25	88.59	88.93	89.27	89.60	89.94	90.28
26.3	8 90.62	90.96	91.30	91.64	91.98	92.31	92.65	92.99	93.33	93.67
26.4	8 94.01	94.35	94.68	95.02	95.36	95.70	96.04	96.38	96.72	97.05
26.5	8 97.39	97.73	98.07	98.41	98.75	99.09	99.43	99.76	*00.10	*00.44
26.6	9 00.78	01.12	01.46	01.80	02.13	02.47	02.81	03.15	03.49	03.83
26.7	9 04.17	04.50	04.84	05.18	05.52	05.86	06.20	06.54	06.88	07.21
26.8	9 07.55	07.89	08.23	08.57	08.91	09.25	09.58	09.92	10.26	10.60
26.9	9 10.94	11.28	11.62	11.95	12.29	12.63	12.97	13.31	13.65	13.99
27.0	9 14.33	14.66	15.00	15.34	15.68	16.02	16.36	16.70	17.03	17.37
27.1	9 17.71	18.05	18.39	18.73	19.07	19.40	19.74	20.08	20.42	20.76
27.2	9 21.10	21.44	21.78	22.11	22.45	22.79	23.13	23.47	23.81	24.15
27.3	9 24.48	24.82	25.16	25.50	25.84	26.18	26.52	26.85	27.19	27.53
27.4	9 27.87	28.21	28.55	28.89	29.23	29.56	29.90	30.24	30.58	30.92

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

U. S. Inches to Millibars (Continued)

Note: Figures in last nine columns to be preceded by 9 or 10 as indicated.

Inches	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
27.5	9 31.26	31.60	31.93	32.27	32.61	32.95	33.29	33.63	33.97	34.31
27.6	9 34.64	34.98	35.32	35.66	36.00	36.34	36.68	37.01	37.35	37.69
27.7	9 38.03	38.37	38.71	39.05	39.38	39.72	40.06	40.40	40.74	41.08
27.8	9 41.42	41.76	42.09	42.43	42.77	43.11	43.45	43.79	44.13	44.46
27.9	9 44.80	45.14	45.48	45.82	46.16	46.50	46.83	47.17	47.51	47.85
28.0	9 48.19	48.53	48.87	49.21	49.54	49.88	50.22	50.56	50.90	51.24
28.1	9 51.58	51.91	52.25	52.59	52.93	53.27	53.61	53.95	54.28	54.62
28.2	9 54.96	55.30	55.64	55.98	56.32	56.66	56.99	57.33	57.67	58.01
28.3	9 58.35	58.69	59.03	59.36	59.70	60.04	60.38	60.72	61.06	61.40
28.4	9 61.73	62.07	62.41	62.75	63.09	63.43	63.77	64.11	64.44	64.78
28.5	9 65.12	65.46	65.80	66.14	66.48	66.81	67.15	67.49	67.83	68.17
28.6	9 68.51	68.85	69.18	69.52	69.86	70.20	70.54	70.88	71.22	71.56
28.7	9 71.89	72.23	72.57	72.91	73.25	73.59	73.93	74.26	74.60	74.94
28.8	9 75.28	75.62	75.96	76.30	76.63	76.97	77.31	77.65	77.99	78.33
28.9	9 78.67	79.01	79.34	79.68	80.02	80.36	80.70	81.04	81.38	81.71
29.0	9 82.05	82.39	82.73	83.07	83.41	83.75	84.08	84.42	84.76	85.10
29.1	9 85.44	85.78	86.12	86.46	86.79	87.13	87.47	87.81	88.15	88.49
29.2	9 88.83	89.16	89.50	89.84	90.18	90.52	90.86	91.20	91.53	91.87
29.3	9 92.21	92.55	92.89	93.23	93.57	93.91	94.24	94.58	94.92	95.26
29.4	9 95.60	95.94	96.28	96.61	96.95	97.29	97.63	97.97	98.31	98.65
29.5	9 98.99	99.32	99.66	*00.00	*00.34	*00.68	*01.02	*01.36	*01.69	*02.03
29.6	10 02.37	02.71	03.05	03.39	03.73	04.06	04.40	04.74	05.08	05.42
29.7	10 05.76	06.10	06.44	06.77	07.11	07.45	07.79	08.13	08.47	08.81
29.8	10 09.14	09.48	09.82	10.16	10.50	10.84	11.18	11.51	11.85	12.19
29.9	10 12.53	12.87	13.21	13.55	13.89	14.22	14.56	14.90	15.24	15.58
30.0	10 15.92	16.26	16.59	16.93	17.27	17.61	17.95	18.29	18.63	18.96
30.1	10 19.30	19.64	19.98	20.32	20.66	21.00	21.34	21.67	22.01	22.35
30.2	10 22.69	23.03	23.37	23.71	24.04	24.38	24.72	25.06	25.40	25.74
30.3	10 26.08	26.41	26.75	27.09	27.43	27.77	28.11	28.45	28.79	29.12
30.4	10 29.46	29.80	30.14	30.48	30.82	31.16	31.49	31.83	32.17	32.51
30.5	10 32.85	33.19	33.53	33.86	34.20	34.54	34.88	35.22	35.56	35.90
30.6	10 36.24	36.57	36.91	37.25	37.59	37.93	38.27	38.61	38.94	39.28
30.7	10 39.62	39.96	40.30	40.64	40.98	41.31	41.65	41.99	42.33	42.67
30.8	10 43.01	43.35	43.69	44.02	44.36	44.70	45.04	45.38	45.72	46.06
30.9	10 46.39	46.73	47.07	47.41	47.75	48.09	48.43	48.76	49.10	49.44
31.0	10 49.78	50.12	50.46	50.80	51.14	51.47	51.81	52.15	52.49	52.83
31.1	10 53.17	53.51	53.84	54.18	54.52	54.86	55.20	55.54	55.88	56.22
31.2	10 56.55	56.89	57.23	57.57	57.91	58.25	58.59	58.92	59.26	59.60
31.3	10 59.94	60.28	60.62	60.96	61.29	61.63	61.97	62.31	62.65	62.99
31.4	10 63.33	63.67	64.00	64.34	64.68	65.02	65.36	65.70	66.04	66.37
31.5	10 66.71	67.05	67.39	67.73	68.07	68.41	68.74	69.08	69.42	69.76
31.6	10 70.10	70.44	70.78	71.12	71.45	71.79	72.13	72.47	72.81	73.15
31.7	10 73.49	73.82	74.16	74.50	74.84	75.18	75.52	75.86	76.19	76.53
31.8	10 76.87	77.21	77.55	77.89	78.23	78.57	78.90	79.24	79.58	79.92
31.9	10 80.26	80.60	80.94	81.27	81.61	81.95	82.29	82.63	82.97	83.31

CORRECTION FOR BAROMETER (Continued)

BRASS SCALE—ENGLISH UNITS

Standard Temperature of scale 62° F; of mercury, 32° F. Zero correction at 28.5° F; subtract corrections above, add below. Owing to the difference in the standard temperature of English and metric scales, readings taken in inches to be reduced to centimeters should *first* be corrected for temperature.

Temp. ° F	Observed height in inches								
	23.0 in.	23.5 in.	24.0 in.	24.5 in.	25.0 in.	25.5 in.	26.0 in.	26.5 in.	27.0 in.
0	+.060	+.061	+.063	+.064	+.065	+.067	+.068	+.069	+.070
2	.056	.057	.058	.060	.061	.062	.063	.065	.065
4	.052	.053	.054	.055	.056	.057	.058	.060	.061
6	.047	.048	.049	.051	.052	.053	.054	.055	.056
8	.043	.044	.045	.046	.047	.048	.049	.050	.051
10	.039	.040	.041	.042	.042	.043	.044	.045	.046
12	.035	.036	.036	.037	.038	.039	.039	.040	.041
14	.031	.031	.032	.033	.033	.034	.035	.035	.036
16	.026	.027	.028	.028	.029	.029	.030	.031	.031
18	.022	.023	.023	.024	.024	.025	.025	.026	.026
20	.018	.018	.019	.019	.020	.020	.020	.021	.021
22	.014	.014	.014	.015	.015	.015	.016	.016	.016
24	.010	.010	.010	.010	.011	.011	.011	.011	.011
26	.005	.006	.006	.006	.006	.006	.006	.006	.006
28	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.002	+.002
30	-.003	-.003	-.003	-.003	-.003	-.003	-.003	-.003	-.003
32	.007	.007	.007	.008	.008	.008	.008	.008	.008
34	.011	.011	.012	.012	.012	.012	.013	.013	.013
36	.015	.016	.016	.016	.017	.017	.017	.018	.018
38	.020	.020	.020	.021	.021	.022	.022	.023	.023
40	.024	.024	.025	.025	.026	.026	.027	.027	.028
42	.028	.029	.029	.030	.030	.031	.032	.032	.033
44	.032	.033	.033	.034	.035	.036	.036	.037	.038
46	.036	.037	.038	.039	.039	.040	.041	.042	.043
48	.040	.041	.042	.043	.044	.045	.046	.047	.047
50	.045	.046	.046	.048	.048	.050	.050	.052	.052
52	.049	.050	.051	.052	.053	.054	.055	.056	.057
54	.053	.054	.055	.057	.057	.059	.060	.061	.062
56	.057	.058	.060	.061	.062	.063	.064	.066	.067
58	.061	.063	.064	.065	.066	.068	.069	.071	.072
60	.065	.067	.068	.070	.071	.073	.074	.076	.077
62	.069	.071	.073	.074	.076	.077	.079	.080	.082
64	.074	.075	.077	.079	.080	.082	.083	.085	.086
66	.078	.079	.081	.083	.085	.087	.088	.090	.091
68	.082	.084	.085	.088	.089	.091	.093	.095	.096
70	.086	.088	.090	.092	.094	.096	.097	.100	.101
72	.090	.092	.094	.096	.098	.100	.102	.104	.106
74	.094	.096	.098	.101	.103	.105	.107	.109	.111
76	.098	.101	.103	.105	.107	.110	.111	.114	.116
78	.103	.105	.107	.110	.112	.114	.116	.119	.120
80	.107	.109	.111	.114	.116	.119	.121	.123	.125
82	.111	.113	.116	.119	.121	.123	.125	.128	.130
84	.115	.118	.120	.123	.125	.128	.130	.133	.135
86	.119	.122	.124	.127	.130	.133	.135	.138	.140
88	.123	.126	.129	.132	.134	.137	.139	.143	.145
90	.127	.130	.133	.136	.138	.142	.144	.147	.150
92	.132	.134	.137	.141	.143	.146	.149	.152	.154
94	.136	.139	.142	.145	.147	.151	.153	.157	.159
96	.140	.143	.146	.150	.152	.155	.158	.161	.164
98	.144	.147	.150	.154	.156	.160	.163	.166	.169
100	.148	.151	.154	.158	.161	.164	.167	.171	.174

CORRECTION FOR BAROMETER (Continued)

BRASS SCALE—ENGLISH UNITS

Temp. ° F.	Observed height in inches								
	27.5 in.	28.0 in.	28.5 in.	29.0 in.	29.5 in.	30.0 in.	30.5 in.	31.0 in.	31.5 in.
0	.072	.073	.075	.076	.077	.078	.080	.081	.082
2	.067	.068	.069	.070	.072	.073	.074	.075	.077
4	.062	.063	.064	.065	.066	.067	.069	.070	.071
6	.057	.058	.059	.060	.061	.062	.063	.064	.065
8	.052	.053	.054	.054	.056	.056	.057	.058	.059
10	.047	.047	.048	.049	.050	.051	.052	.053	.054
12	.042	.042	.043	.044	.045	.045	.046	.047	.048
14	.037	.037	.038	.039	.039	.040	.041	.041	.042
16	.032	.032	.033	.033	.034	.034	.035	.036	.036
18	.027	.027	.028	.028	.029	.029	.030	.030	.031
20	.022	.022	.022	.023	.023	.024	.024	.024	.025
22	.017	.017	.017	.017	.018	.018	.018	.019	.019
24	.012	.012	.012	.012	.012	.013	.013	.013	.013
26	.007	.007	.007	.007	.007	.007	.007	.007	.008
28	+ .002	+ .002	+ .002	+ .002	+ .002	+ .002	+ .002	+ .002	+ .002
30	— .003	— .003	— .004	— .004	— .004	— .004	— .004	— .004	— .004
32	— .008	— .009	— .009	— .009	— .009	— .009	— .009	— .009	— .010
34	.013	.014	.014	.014	.014	.015	.015	.015	.015
36	.018	.019	.019	.019	.020	.020	.020	.021	.021
38	.023	.024	.024	.025	.025	.026	.026	.026	.027
40	.028	.029	.030	.030	.031	.031	.032	.032	.033
42	.033	.034	.035	.035	.036	.036	.037	.038	.038
44	.038	.039	.040	.040	.041	.042	.043	.043	.044
46	.043	.044	.045	.046	.047	.047	.048	.049	.050
48	.048	.049	.050	.051	.052	.053	.054	.054	.055
50	.053	.054	.055	.056	.057	.058	.059	.060	.061
52	.058	.059	.061	.061	.063	.064	.065	.066	.067
54	.063	.064	.066	.067	.068	.069	.070	.071	.073
56	.068	.069	.071	.072	.073	.074	.076	.077	.078
58	.073	.074	.076	.077	.079	.080	.081	.082	.084
60	.078	.080	.081	.082	.084	.085	.087	.088	.090
62	.083	.085	.086	.088	.089	.091	.092	.094	.095
64	.088	.090	.092	.093	.095	.096	.098	.099	.101
66	.093	.095	.097	.098	.100	.101	.103	.105	.107
68	.098	.100	.102	.103	.105	.107	.109	.110	.113
70	.103	.105	.107	.109	.111	.112	.115	.116	.118
72	.108	.110	.112	.114	.116	.118	.120	.122	.124
74	.113	.115	.117	.119	.121	.123	.126	.127	.130
76	.118	.120	.122	.124	.127	.128	.131	.133	.135
78	.123	.125	.128	.129	.132	.134	.137	.138	.141
80	.128	.130	.133	.135	.137	.139	.142	.144	.147
82	.133	.135	.138	.140	.143	.145	.148	.149	.152
84	.138	.140	.143	.145	.148	.150	.153	.155	.158
86	.143	.145	.148	.150	.153	.155	.159	.161	.164
88	.148	.150	.153	.155	.159	.161	.164	.166	.169
90	.153	.155	.158	.161	.164	.166	.170	.172	.175
92	.158	.160	.163	.166	.169	.172	.175	.177	.181
94	.163	.165	.169	.171	.175	.177	.180	.183	.186
96	.168	.170	.174	.176	.180	.182	.186	.188	.192
98	.172	.175	.179	.181	.185	.188	.191	.194	.197
100	.177	.180	.184	.187	.190	.193	.197	.200	.203

TEMPERATURE CORRECTION, GLASS SCALE

METRIC

To reduce readings of a mercurial barometer with a glass scale to 0° C. subtract the appropriate quantity as found in table.

Temp. ° C.	Observed height in centimeters.								
	70 cm.	71 cm.	72 cm.	73 cm.	74 cm.	75 cm.	76 cm.	77 cm.	78 cm.
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	.012	.012	.013	.013	.013	.013	.013	.013	.014
2	.025	.025	.025	.026	.026	.026	.026	.027	.027
3	.036	.036	.037	.037	.038	.038	.039	.039	.040
4	.048	.049	.049	.050	.051	.051	.052	.053	.053
5	0.060	0.061	0.062	0.063	0.064	0.064	0.065	0.066	0.067
6	.073	.074	.074	.076	.077	.077	.078	.079	.080
7	.085	.086	.087	.088	.089	.091	.092	.093	.094
8	.096	.098	.099	.100	.101	.103	.104	.105	.107
9	.109	.110	.111	.113	.114	.116	.117	.119	.120
10	0.121	0.122	0.124	0.126	0.127	0.129	0.130	0.132	0.134
11	.133	.135	.137	.138	.140	.142	.144	.146	.147
12	.144	.146	.148	.150	.152	.154	.156	.158	.160
13	.157	.159	.161	.163	.165	.167	.169	.171	.174
14	.169	.171	.174	.176	.178	.180	.183	.185	.187
15	0.181	0.184	0.186	0.189	0.191	0.193	0.196	0.198	0.201
16	.194	.196	.199	.201	.204	.207	.209	.212	.214
17	.205	.208	.210	.213	.216	.219	.221	.224	.227
18	.217	.220	.223	.226	.229	.232	.235	.238	.241
19	.230	.233	.236	.239	.242	.245	.248	.251	.254
20	0.242	0.245	0.248	0.252	0.255	0.258	0.261	0.264	0.268
21	.254	.258	.261	.264	.268	.271	.275	.278	.281
22	.266	.269	.273	.276	.280	.283	.287	.290	.294
23	.278	.282	.285	.289	.293	.296	.300	.304	.308
24	.290	.294	.298	.302	.306	.310	.313	.317	.321
25	0.303	0.307	0.311	0.315	0.319	0.323	0.327	0.331	0.335
26	.315	.319	.323	.327	.332	.336	.340	.344	.348
27	.326	.331	.335	.339	.344	.348	.352	.357	.361
28	.339	.343	.348	.352	.357	.361	.366	.370	.375
29	.351	.356	.360	.365	.370	.374	.379	.384	.388
30	0.363	0.368	0.373	0.378	0.383	0.387	0.392	0.397	0.402

MASS OF WATER VAPOR IN SATURATED AIR

Mass in grams per cubic meter.

(From Smithsonian Tables.)

Temp. ° C.	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
-20	0.892	0.810	0.737	0.673	0.613	0.557	0.505	0.457	0.413	0.373
-10	2.154	1.978	1.811	1.658	1.519	1.395	1.282	1.177	1.079	0.982
- 0	4.835	4.468	4.130	3.813	3.518	3.244	2.988	2.752	2.537	2.340
+ 0	4.835	5.176	5.538	5.922	6.330	6.761	7.219	7.703	8.215	8.757
10	9.330	9.935	10.574	11.249	11.961	12.712	13.505	14.339	15.218	16.144
20	17.118	18.143	19.222	20.355	21.546	22.796	24.109	25.487	26.933	28.456
30	30.039	31.704	33.449	35.275	37.187	39.187	41.279	43.465	45.751	48.138

REDUCTION OF BAROMETER TO SEA LEVEL

The correction to be added to reduce barometric readings to "sea level" values depends principally on three factors: The temperature of the air column (assumed) from the station to sea level, the altitude of the station, and the value of the reading itself. Two tables are provided. Table I is entered with the altitude and assumed temperature and a factor "2000 m" taken out. Table II is entered with the above factor and the approximate barometer reading and the final correction taken out.

The correction is to be added. If B_0 is the corrected or sea level value; B the barometer reading at the station; C the correction,—

$$C = B_0 - B = B (10^m - 1)$$

The actual barometer reading at the station should be corrected for temperature of the mercury column by the usual methods before entering the tables or applying the sea level correction.

A complete explanation of the theory of the corrections and a more extended set of tables will be found in the Smithsonian Meteorological Tables.

LATITUDE FACTOR

The influence of the latitude on the value of the correction is usually negligible, being overshadowed by uncertainties in the assumed temperature of the air column. For cases where this correction is desirable the table below is provided. The value of the temperature-altitude factor "2000 m" obtained in Table I is corrected for latitude by subtracting for latitudes 0-45° and adding for latitudes from 45-90° the values found. With this corrected value of "2000 m" Table II is entered for the value of the correction.

LATITUDE FACTOR

To be used in connection with Tables I and II, either English or metric units, to obtain latitude corrections to temperature-altitude factor. For latitudes 0-45° subtract the correction. For latitudes 45-90° add the correction.

Temp.—Alt. from Table I	Latitude			
	0°	15°	30°	45°
100	0.3	0.2	0.1	0.0
200	0.5	0.5	0.3	0.0
300	0.8	0.7	0.4	0.0
	90°	75°	60°	45°

REDUCTION OF BAROMETER TO SEA LEVEL (Continued)

METRIC UNITS—TABLE I

Values of the temperature-altitude factor (2000 m.) for entering table II.

Altitude in meters	Assumed temperature of air column °C									
	-16°	-8°	0°	+4°	+8°	+12°	+16°	+20°	+24°	+28°
10	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
50	5.8	5.6	5.4	5.3	5.2	5.2	5.1	5.0	4.9	4.9
100	11.5	11.2	10.8	10.7	10.5	10.3	10.2	10.0	9.9	9.7
150	17.3	16.7	16.2	16.0	15.7	15.5	15.3	15.0	14.8	14.6
200	23.0	22.3	21.6	21.3	21.0	20.7	20.3	20.0	19.7	19.5
250	28.8	27.9	27.0	26.6	26.2	25.8	25.4	25.0	24.7	24.3
300	34.5	33.5	32.5	32.0	31.5	31.0	30.5	30.1	29.6	29.2
350	40.3	39.0	37.9	37.3	36.7	36.2	35.6	35.1	34.6	34.0
400	46.0	44.6	43.3	42.6	42.0	41.3	40.7	40.1	39.5	38.9
450	51.8	50.2	48.7	47.9	47.2	46.5	45.8	45.1	44.4	43.8
500	57.5	55.8	54.1	53.3	52.4	51.6	50.9	50.1	49.4	48.6
550	63.3	61.4	59.5	58.6	57.7	56.8	55.9	55.1	54.3	53.5
600	69.0	66.9	64.9	63.9	62.9	62.0	61.0	60.1	59.2	58.3
650	74.8	72.5	70.3	69.2	68.2	67.1	66.1	65.1	64.2	63.2
700	80.6	78.1	75.7	74.6	73.4	72.3	71.2	70.1	69.1	68.1
750	86.3	83.7	81.1	79.9	78.7	77.5	76.3	75.1	74.0	72.9
800	92.1	89.2	86.5	85.2	83.9	82.6	81.4	80.1	79.0	77.8
850	97.8	94.8	92.0	90.5	89.2	87.8	86.4	85.2	83.9	82.7
900	103.6	100.4	97.4	95.9	94.4	93.0	91.5	90.2	88.8	87.5
950	109.3	106.0	102.8	101.2	99.6	98.1	96.6	95.2	93.8	92.4
1000	115.1	111.5	108.2	106.5	104.9	103.3	101.7	100.2	98.7	97.3
1050	120.8	117.1	113.6	111.8	110.1	108.4	106.8	105.2	103.6	102.1
1100	126.6	122.7	119.0	117.2	115.4	113.6	111.9	110.2	108.6	107.0
1150	132.3	128.3	124.4	122.5	120.6	118.8	117.0	115.2	113.5	111.8
1200	138.1	133.8	129.8	127.8	125.9	123.9	122.0	120.2	118.4	116.7
1250	143.8	139.4	135.2	133.1	131.1	129.1	127.1	125.2	123.4	121.6
1300	149.6	145.0	140.6	138.5	136.3	134.3	132.2	130.2	128.3	126.4
1350	155.3	150.6	146.0	143.8	141.6	139.4	137.3	135.2	133.2	131.3
1400	161.1	156.2	151.4	149.1	146.8	144.6	142.4	140.2	138.2	136.2
1450	166.8	161.7	156.8	154.5	152.1	149.7	147.5	145.3	143.1	141.0
1500	172.6	167.3	162.3	159.8	157.3	154.9	152.5	150.3	148.0	145.9
1550	178.3	172.9	167.7	165.1	162.6	160.1	157.6	155.3	153.0	150.7
1600	184.1	178.5	173.1	170.4	167.8	165.2	162.7	160.3	157.9	155.6
1650	189.8	184.0	178.5	175.7	173.0	170.4	167.8	165.3	162.8	160.5
1700	195.6	189.6	183.9	181.1	178.3	175.6	172.9	170.3	167.8	165.3
1750	201.4	195.2	189.3	186.4	183.5	180.7	178.0	175.3	172.7	170.2
1800	207.1	200.8	194.7	191.7	188.8	185.9	183.1	180.3	177.6	175.0
1850	212.9	206.3	200.1	197.0	194.0	191.0	188.1	185.3	182.6	179.9
1900	218.6	211.9	205.5	202.4	199.3	196.2	193.2	190.3	187.5	184.8
1950	224.4	217.5	210.9	207.7	204.5	201.4	198.3	195.3	192.4	189.6
2000	230.1	223.0	216.3	213.0	209.7	206.5	203.4	200.3	197.4	194.5
2050	235.9	228.6	221.7	218.3	215.0	211.7	208.5	205.3	202.3	199.3
2100	241.6	234.2	227.1	223.7	220.2	216.8	213.5	210.4	207.2	204.2
2150	247.4	239.8	232.5	229.0	225.5	222.0	218.6	215.4	212.2	209.1
2200	253.1	245.4	237.9	234.3	230.7	227.2	223.7	220.4	217.1	213.9
2250	258.9	250.9	243.4	239.6	235.9	232.3	228.8	225.4	222.0	218.8
2300	264.6	256.5	248.8	245.0	241.2	237.5	233.9	230.4	227.0	223.6
2350	270.4	262.1	254.2	250.3	246.4	242.7	239.0	235.4	231.9	228.5
2400	276.1	267.7	259.6	255.6	251.7	247.8	244.0	240.4	236.8	233.4
2450	281.9	273.2	265.0	260.9	256.9	253.0	249.1	245.4	241.8	238.2
2500	287.6	278.8	270.4	266.2	262.2	258.1	254.2	250.4	246.7	243.1
2550	293.4	284.4	275.8	271.6	267.4	263.3	259.3	255.4	251.6	247.9
2600	299.1	290.0	281.2	276.9	272.6	268.5	264.4	260.4	256.6	252.8
2650	304.9	295.5	286.6	282.2	277.9	273.6	269.5	265.4	261.5	257.7
2700	310.6	301.1	292.0	287.5	283.1	278.8	274.5	270.4	266.4	262.5
2750	316.4	306.7	297.4	292.9	288.4	283.9	279.6	275.4	271.4	267.4
2800	322.1	312.3	302.8	298.2	293.6	289.1	284.7	280.4	276.3	272.2
2850	327.9	317.8	308.2	303.5	298.8	294.3	289.8	285.4	281.2	277.1
2900	333.6	323.4	313.6	308.8	304.1	299.4	294.9	290.4	286.2	282.0
2950	339.4	329.0	319.0	314.2	309.3	304.6	299.9	295.5	291.1	286.8
3000	345.1	334.5	324.4	319.5	314.6	309.7	305.0	300.5	296.0	291.7

REDUCTION OF BAROMETER TO SEA LEVEL (Continued)

METRIC UNITS—TABLE II

Values of Correction to be Added

Temp.—alt. factor	Barometer reading					Temp.—alt. factor	Barometer reading				
	780 mm	760 mm	740 mm	720 mm	700 mm		640 mm	620 mm	600 mm	580 mm	560 mm
1	0.9	0.9	0.9	0.8	0.8	170	138.4	134.0	129.7	125.4	121.1
5	4.5	4.4	4.3	4.2	4.0	175	142.9	138.4	133.9	129.5	125.0
10	9.0	8.8	8.6	8.3	8.1	180	147.4	142.8	138.2	133.6	129.0
15	13.6	13.2	12.9	12.5	12.2	185	151.9	147.2	142.4	137.7	132.9
20	18.2	17.7	17.2	16.8	16.3	190	156.5	151.6	146.7	141.8	136.9
25	22.8	22.2	21.6	21.0	20.4	195	161.1	156.1	151.0	146.0	141.0
30	27.4	26.7	26.0	25.3	24.6	200	165.7	160.5	155.4	150.2	145.0
35	.....	31.2	30.4	29.6	28.8	205	170.4	165.0	159.7	154.4	149.1
						210	.....	169.6	164.1	158.6	153.2
						215	.....	174.1	168.5	162.9	157.3
	760 mm	740 mm	720 mm	700 mm	680 mm	660 mm		620 mm	600 mm	580 mm	560 mm
40	35.8	34.9	33.9	33.0	32.0	31.1	215	174.1	168.5	162.9	157.3
45	40.4	39.3	38.3	37.2	36.2	35.1	220	178.7	172.9	167.2	161.4
50	45.0	43.8	42.7	41.5	40.3	39.1	225	183.3	177.4	171.5	165.6
55	49.7	48.4	47.1	45.8	44.5	43.1	230	188.0	181.9	175.8	169.8
60	.....	52.9	51.5	50.1	48.6	47.2	235	192.6	186.4	180.2	174.0
65	.....	57.5	55.9	54.4	52.8	51.3	240	.....	191.0	184.6	178.2
70	.....	62.1	60.4	58.7	57.1	55.4	245	.....	195.5	189.0	182.5
75	.....	66.7	64.9	63.1	61.3	59.5	250	.....	200.1	193.4	186.8
							255	.....	204.7	197.9	191.1
							260	.....	209.4	202.4	195.4
	720 mm	700 mm	680 mm	660 mm	640 mm			580 mm	560 mm	540 mm	520 mm
80	69.5	67.5	65.6	63.7	61.7		260	202.4	195.4	188.4	181.5
85	74.0	72.0	69.9	67.9	65.8		265	206.9	199.8	192.6	185.5
90	78.6	76.4	74.2	72.1	69.9		270	211.5	204.2	196.9	189.6
95	83.2	80.9	78.6	76.3	74.0		275	216.0	208.6	201.1	193.7
100	87.9	85.4	83.0	80.5	78.1		280	220.6	213.0	205.4	197.8
105	.....	89.9	87.4	84.8	82.2		285	225.2	217.5	209.7	201.9
110	.....	94.5	91.8	89.1	86.4		290	229.9	222.0	214.0	206.1
115	.....	99.1	96.3	93.4	90.6		295	.....	226.5	218.4	210.3
120	.....	103.7	100.7	97.8	94.8		300	.....	231.0	222.8	214.5
125	.....	108.3	105.3	102.2	99.1						
	680 mm	660 mm	640 mm	620 mm	600 mm			560 mm	540 mm	520 mm	500 mm
125	105.3	102.2	99.1	96.0	92.9		305	235.6	227.2	218.8	210.3
130	109.8	106.6	103.3	100.1	96.9		310	240.2	231.6	223.0	214.4
135	114.3	111.0	107.6	104.3	100.9		315	244.8	236.0	227.3	218.6
140	118.9	115.4	111.9	108.4	104.9		320	249.4	240.5	231.6	222.7
145	123.5	119.9	116.3	112.6	109.0		325	254.1	245.0	236.0	226.9
150	128.2	124.4	120.6	116.9	113.1		330	.....	249.6	240.3	231.1
155	.....	128.9	125.0	121.1	117.2		335	.....	254.1	244.7	235.3
160	.....	133.5	129.4	125.4	121.4		340	.....	258.7	249.1	239.6
165	.....	138.1	133.9	129.7	125.5		345	.....	263.3	253.6	243.8
170	.....	142.7	138.4	134.0	129.7						

REDUCTION OF BAROMETER TO SEA LEVEL (Continued)

ENGLISH UNITS—TABLE I

Values of the temperature-altitude factor (2000 m.) for entering table II.

Altitude feet	Assumed temperature of air column °F									
	-20	0	+10	+20	+30	+40	+50	+60	+70	+80
200	7.4	7.1	6.9	6.8	6.6	6.5	6.3	6.2	6.1	6.0
400	14.8	14.1	13.8	13.5	13.2	13.0	12.7	12.4	12.2	11.9
600	22.2	21.2	20.7	20.3	19.9	19.5	19.0	18.6	18.2	17.9
800	29.6	28.3	27.7	27.1	26.5	25.9	25.4	24.8	24.3	23.8
1000	37.0	35.3	34.6	33.8	33.1	32.4	31.7	31.1	30.4	29.8
1200	44.3	42.4	41.5	40.6	39.7	38.9	38.1	37.3	36.5	35.8
1400	51.7	49.5	48.4	47.4	46.4	45.4	44.4	43.5	42.6	41.7
1600	59.1	56.5	55.3	54.1	53.0	51.9	50.8	49.7	48.7	47.7
1800	66.5	63.6	62.2	60.9	59.6	58.4	57.1	55.9	54.7	53.6
2000	73.9	70.6	69.1	67.7	66.2	64.8	63.4	62.1	60.8	59.6
2200	81.3	77.7	76.0	74.4	72.9	71.3	69.8	68.3	66.9	65.5
2400	88.7	84.8	82.9	81.2	79.5	77.8	76.1	74.5	73.0	71.5
2600	96.1	91.8	89.9	87.9	86.1	84.3	82.5	80.7	79.1	77.5
2800	103.5	98.9	96.8	94.7	92.7	90.8	88.8	87.0	85.1	83.4
3000	110.9	106.0	103.7	101.5	99.3	97.2	95.2	93.2	91.2	89.4
3200	118.2	113.0	110.6	108.2	106.0	103.7	101.5	99.4	97.3	95.3
3400	125.6	120.1	117.5	115.0	112.6	110.2	107.9	105.6	103.4	101.3
3600	133.0	127.2	124.4	121.8	119.2	116.7	114.2	111.8	109.5	107.2
3800	140.4	134.2	131.3	128.5	125.8	123.2	120.5	118.0	115.5	113.2
4000	147.8	141.3	138.2	135.3	132.4	129.6	126.9	124.2	121.6	119.2
4200	155.2	148.3	145.1	142.1	139.1	136.1	133.2	130.4	127.7	125.1
4400	162.6	155.4	152.0	148.8	145.7	142.6	139.6	136.6	133.8	131.1
4600	170.0	162.5	159.0	155.6	152.3	149.1	145.9	142.8	139.9	137.0
4800	177.3	169.5	165.9	162.3	158.9	155.6	152.2	149.0	145.9	143.0
5000	184.7	176.6	172.8	169.1	165.6	162.0	158.6	155.2	152.0	148.9
5200	192.1	183.7	179.7	175.9	172.2	168.5	164.9	161.5	158.1	154.9
5400	199.5	190.7	186.6	182.6	178.8	175.0	171.3	167.7	164.2	160.8
5600	206.9	197.8	193.5	189.4	185.4	181.5	177.6	173.9	170.3	166.8
5800	214.3	204.8	200.4	196.2	192.0	188.0	184.0	180.1	176.3	172.8
6000	221.7	211.9	207.3	202.9	198.7	194.4	190.3	186.3	182.4	178.7
6200	229.1	219.0	214.2	209.7	205.3	200.9	196.6	192.5	188.5	184.7
6400	236.4	226.0	221.1	216.4	211.9	207.4	203.0	198.7	194.6	190.6
6600	243.8	233.1	228.0	223.2	218.5	213.9	209.3	204.9	200.7	196.6
6800	251.2	240.1	235.0	230.0	225.1	220.4	215.7	211.1	206.7	202.5
7000	258.6	247.2	241.9	236.7	231.8	226.8	222.0	217.3	212.8	208.5
7200	266.0	254.3	248.8	243.5	238.4	233.3	228.4	223.5	218.9	214.4
7400	273.4	261.3	255.7	250.2	245.0	239.8	234.7	229.7	225.0	220.4
7600	280.8	268.4	262.6	257.0	251.6	246.3	241.0	235.9	231.1	226.4
7800	288.1	275.4	269.5	263.8	258.2	252.8	247.4	242.2	237.1	232.3
8000	295.5	282.5	276.4	270.5	264.8	259.2	253.7	248.4	243.2	238.3
8200	302.9	289.6	283.3	277.3	271.5	265.7	260.1	254.6	249.3	244.2
8400	310.3	296.6	290.2	284.0	278.1	272.2	266.4	260.8	255.4	250.2
8600	317.7	303.7	297.1	290.8	284.7	278.7	272.7	267.0	261.4	256.1
8800	325.1	310.7	304.0	297.6	291.3	285.2	279.1	273.2	267.5	262.1
9000	332.5	317.8	310.9	304.3	297.9	291.6	285.4	279.4	273.6	268.0

REDUCTION OF BAROMETER TO SEA LEVEL (Continued)

ENGLISH UNITS—TABLE II

Value of Correction to be Added.

Temp. alt. factor	Barometer reading					Temp. alt. factor	Barometer reading				
	31	30	29	28	27		26	25	24	23	22
	in.	in.	in.	in.	in.		in.	in.	in.	in.	in.
1	0.04	0.03	0.03	.....	.....	165	5.44	5.23	5.02		
5	0.18	0.17	0.17	.....	.....	170	5.62	5.40	5.19		
10	0.36	0.35	0.34	0.32	.....	175	.....	5.58	5.36		
15	0.54	0.52	0.51	0.49	.....	180	.....	5.76	5.53	5.30	
20	0.72	0.70	0.68	0.65	.....	185	.....	5.93	5.70	5.46	
25	.....	0.88	0.85	0.82	.....	190	.....	6.11	5.87	5.62	
30	.....	1.05	1.02	0.98	.....	195	.....	6.29	6.04	5.79	
35	.....	1.23	1.19	1.15	.....	200	.....	6.47	6.21	5.96	
40	.....	1.41	1.37	1.32	1.27	205	.....	.....	6.39	6.12	
45	.....	1.60	1.54	1.49	1.44	210	.....	.....	6.56	6.29	
50	.....	.....	1.72	1.66	1.60	215	.....	.....	6.74	6.46	
55	.....	.....	1.90	1.83	1.76	220	.....	.....	6.92	6.63	6.34
60	.....	.....	2.07	2.00	1.93	225	.....	.....	7.10	6.80	6.51
65	.....	.....	2.25	2.18	2.10	230	.....	.....	7.28	6.97	6.67
70	.....	.....	2.43	2.35	2.27	235	.....	.....	7.46	7.15	6.84
75	.....	.....	.....	2.53	2.43	240	.....	.....	.....	7.32	7.00
80	.....	.....	.....	2.70	2.60	245	.....	.....	.....	7.49	7.17
	28	27	26	25	24		23	22	21	20	
	in.	in.	in.	in.	in.		in.	in.	in.	in.	
75	2.53	2.43	2.34	.....	.....	250	7.67	7.34			
80	2.70	2.60	2.51	.....	.....	255	7.85	7.51			
85	2.88	2.78	2.67	.....	.....	260	8.03	7.68	7.33		
90	3.06	2.95	2.84	.....	.....	265	8.21	7.85	7.49		
95	3.24	3.12	3.01	.....	.....	270	8.39	8.02	7.66		
100	3.42	3.29	3.17	.....	.....	275	8.57	8.19	7.82		
105	3.60	3.47	3.34	3.21	.....	280	.....	8.37	7.99		
110	.....	3.65	3.51	3.38	.....	285	.....	8.54	8.16		
115	.....	3.82	3.68	3.54	.....	290	.....	8.72	8.32		
120	.....	4.00	3.85	3.70	.....	295	.....	8.90	8.49	8.09	
125	.....	4.18	4.02	3.87	.....	300	.....	9.08	8.66	8.25	
130	.....	4.36	4.20	4.04	.....	305	.....	9.26	8.83	8.41	
135	.....	4.54	4.37	4.20	.....	310	.....	9.44	9.01	8.58	
140	.....	.....	4.55	4.37	4.20	315	.....	9.62	9.18	8.74	
145	.....	.....	4.72	4.54	4.36	320	.....	9.80	9.35	8.91	
150	.....	.....	4.90	4.71	4.52	325	.....	.....	9.53	9.08	
155	.....	.....	5.08	4.88	4.69	330	.....	.....	9.71	9.24	
160	.....	.....	5.26	5.06	4.85						

REDUCTION OF BAROMETER TO GRAVITY AT SEA LEVEL

METRIC UNITS

Correction to be subtracted given in millimeters

(From Smithsonian Physical Tables)

Height above sea level in meters	OBSERVED HEIGHT OF BAROMETER IN MILLIMETERS						
	500	550	600	650	700	750	800
100	.....	.....	.....	.....	.02	.02	.02
200	.....	.....	.....	.....	.04	.05	.05
300	.....	.....	.....	.....	.07	.07	.07
400	.....	.....	.....	.....	.09	.10	.10
500	.....	.....	.....	.....	.11	.12	.13
600	.....	.....	.....	.12	.13	.14	
700	.....	.....	.....	.14	.15	.16	
800	.....	.....	.....	.16	.18	.19	
900	.....	.....	.....	.18	.20	.22	
1000	.....	.18	.19	.20	.22	.24	
1100	.....	.19	.21	.22	.24		
1200	.....	.21	.23	.24	.26		
1300	.....	.22	.24	.26	.29		
1400	.....	.24	.26	.28	.31		
1500	.24	.26	.28	.30	.33		
1600	.25	.28	.30	.32			
1700	.27	.30	.32	.34			
1800	.28	.31	.34	.36			
1900	.30	.33	.36	.39			
2000	.31	.34	.38	.41			
2100	.33	.36	.40				
2200	.35	.38	.41				
2300	.36	.40	.43				
2400	.38	.42	.45				
2500	.39	.43	.47				

ENGLISH UNITS

Height above sea level in feet	OBSERVED HEIGHT IN INCHES						
	18	20	22	24	26	28	30
1000	.....	.....	.....	.....	.003	.003	.003
2000	.....	.....	.....	.004	.005	.005	.006
3000	.....	.....	.007	.007	.008	.008	
4000	.....	.....	.009	.009	.010		
4500	.....	.....	.010	.010	.011		
5000	.....	.010	.011	.011	.012		
5500	.....	.011	.012	.013			
6000	.....	.011	.013	.014			
6500	.011	.012	.014	.015			
7000	.012	.013	.015	.016			
7500	.013	.014	.016	.017			
8000	.014	.015	.017				
8500	.015	.016	.018				
9000	.016	.017	.019				
9500	.016	.018	.020				

REDUCTION OF BAROMETER TO LATITUDE 45°

METRIC SCALE

For latitudes below 45°, subtract the correction; for latitudes greater than 45° it is to be added. Corrections in cm.
(From Smithsonian Meteorological Tables.)

Latitude	OBSERVED HEIGHT OF BAROMETER IN CENTIMETERS					
	68	70	72	74	76	78
25° 65°	0.116	0.120	0.123	0.127	0.130	0.133
26 64	.111	.115	.118	.121	.125	.128
27 63	.106	.110	.113	.116	.119	.122
28 62	.101	.104	.107	.110	.113	.116
29 61	.096	.099	.102	.104	.107	.110
30 60	0.091	0.094	0.096	0.098	0.101	0.104
31 59	.085	.087	.090	.092	.095	.097
32 58	.079	.082	.084	.086	.089	.091
33 57	.074	.076	.078	.080	.082	.084
34 56	.068	.070	.072	.074	.076	.078
35 55	0.062	0.064	0.066	0.067	0.069	0.071
36 54	.056	.058	.059	.061	.063	.064
37 53	.050	.051	.053	.054	.056	.057
38 52	.044	.045	.046	.048	.049	.050
39 51	.038	.039	.040	.041	.042	.043
40 50	0.031	0.032	0.033	0.034	0.035	0.036
41 49	.025	.026	.027	.027	.028	.029
42 48	.019	.019	.020	.021	.021	.022
43 47	.013	.013	.013	.014	.014	.014
44 46	.006	.007	.007	.007	.007	.007

ENGLISH SCALE

Corrections in inches.

Latitude	OBSERVED HEIGHT IN INCHES					
	25	26	27	28	29	30
25° 65°	0.043	0.044	0.046	0.048	0.050	0.051
26 64	.041	.043	.044	.046	.048	.049
27 63	.039	.041	.042	.044	.045	.047
28 62	.037	.039	.040	.042	.043	.045
29 61	.035	.037	.038	.039	.041	.042
30 60	0.033	0.035	0.036	0.037	0.039	0.040
31 59	.031	.032	.034	.035	.036	.037
32 58	.029	.030	.032	.033	.034	.035
33 57	.027	.028	.029	.030	.031	.032
34 56	.025	.026	.027	.028	.029	.030
35 55	0.023	0.024	0.025	0.025	0.026	0.027
36 54	.021	.021	.022	.023	.024	.025
37 53	.018	.019	.020	.021	.021	.022
38 52	.016	.017	.017	.018	.019	.019
39 51	.014	.014	.015	.015	.016	.017
40 50	0.012	0.012	0.012	0.013	0.013	0.014
41 49	.009	.010	.010	.010	.011	.011
42 48	.007	.007	.008	.008	.008	.008
43 47	.005	.005	.005	.005	.005	.006
44 46	.002	.002	.003	.003	.003	.003

RELATIVE HUMIDITY—DEW-POINT

The table gives the relative humidity of the air for temperature t and dew-point d .

(From Smithsonian Meteorological Tables.)

Depression of dew-point $t-d^{\circ}$ C.	DEW-POINT (d).				
	-10	0	+10	+20	+30
0.0	100%	100%	100%	100%	100%
0.2	98	99	99	99	99
0.4	97	97	97	98	98
0.6	95	96	96	96	97
0.8	94	94	95	95	96
1.0	92	93	94	94	94
1.2	91	92	92	93	93
1.4	90	90	91	92	92
1.6	88	89	90	91	91
1.8	87	88	89	90	90
2.0	86	87	88	88	89
2.2	84	85	86	87	88
2.4	83	84	85	86	87
2.6	82	83	84	85	86
2.8	80	82	83	84	85
3.0	79	81	82	83	84
3.2	78	80	81	82	83
3.4	77	79	80	81	82
3.6	76	77	79	80	82
3.8	75	76	78	79	81
4.0	73	75	77	78	80
4.2	72	74	76	77	79
4.4	71	73	75	77	78
4.6	70	72	74	76	77
4.8	69	71	73	75	76
5.0	68	70	72	74	75
5.2	67	69	71	73	75
5.4	66	68	70	72	74
5.6	65	67	69	71	73
5.8	64	66	69	70	72
6.0	63	66	68	70	71
6.2	62	65	67	69	71
6.4	61	64	66	68	70
6.6	60	63	65	67	69
6.8	60	62	64	66	68
7.0	59	61	63	66	68
7.2	58	60	63	65	67
7.4	57	60	62	64	66
7.6	56	59	61	63	65
7.8	55	58	60	63	65

RELATIVE HUMIDITY—DEW-POINT (Continued)

Depression of dew-point $t-d^{\circ}\text{C.}$	DEW-POINT (d).				
	-10	0	+10	+20	+30
8.0	54	57	60	62	64
8.2	54	56	59	61	63
8.4	53	56	58	60	63
8.6	52	55	57	60	62
8.8	51	54	57	59	61
9.0	51	53	56	58	61
9.2	50	53	55	58	60
9.4	49	52	55	57	59
9.6	48	51	54	56	59
9.8	48	51	53	56	58
10.0	47	50	53	55	57
10.5	45	48	51	54	
11.0	44	47	49	52	
11.5	42	45	48	51	
12.0	41	44	47	49	
12.5	39	42	45	48	
13.0	38	41	44	46	
13.5	37	40	43	45	
14.0	35	38	41	44	
14.5	34	37	40	43	
15.0	33	36	39	42	
15.5	32	35	38	40	
16.0	31	34	37	39	
16.5	30	33	36	38	
17.0	29	32	35	37	
17.5	28	31	34	36	
18.0	27	30	33	35	
18.5	26	29	32	34	
19.0	25	28	31	33	
19.5	24	27	30	33	
20.0	24	26	29	32	
21.0	22	25	27		
22.0	21	23	26		
23.0	19	22	24		
24.0	18	21	23		
25.0	17	19	22		
26.0	16	18	21		
27.0	15	17	20		
28.0	14	16	19		
29.0	13	15	18		
30.0	12	14	17		

RELATIVE HUMIDITY FROM WET AND DRY

This table gives the approximate relative humidity directly from the reading of the air pressure of 74.27 cm Hg. Errors resulting from the use of this table for air temperatures

Condensed from Bulletin of the

$t-t'$ t	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	
-10	93	87	80	74	67	61	54	48	41	35	28	22	16	9	..	..	..	..
-9	94	88	81	75	69	63	57	51	45	39	33	27	21	15	9	..	..	..
-8	94	88	83	77	71	65	60	54	48	43	37	32	26	20	15	10	..	..
-7	95	89	84	78	73	67	62	57	52	46	41	36	31	25	20	15	10	5	
-6	95	90	85	79	74	69	64	59	54	49	45	40	35	30	25	20	15	11	
-5	95	90	86	81	76	71	66	62	57	52	48	43	39	34	29	25	20	16	
-4	95	91	86	82	77	73	68	64	59	55	51	46	42	38	33	29	25	21	
-3	96	91	87	82	78	74	70	66	62	57	53	49	45	41	37	33	29	25	
-2	96	92	88	84	79	75	71	68	64	60	56	52	48	44	40	37	33	29	
-1	96	92	88	84	81	77	73	69	66	62	58	54	51	47	43	40	36	33	
0	96	93	89	85	81	78	74	71	67	64	60	57	53	50	46	43	40	36	
1	97	93	90	86	83	80	76	73	70	66	63	59	56	53	49	46	43	40	
2	97	93	90	87	84	81	78	74	71	68	65	62	59	55	52	49	46	43	
3	97	94	91	88	84	82	78	76	72	70	67	64	61	58	55	52	49	46	
4	97	94	91	88	85	82	79	77	74	71	68	65	62	60	57	54	51	48	
5	97	94	91	88	86	83	80	77	75	72	69	67	64	61	58	56	53	51	
6	97	94	92	89	86	84	81	78	76	73	70	68	65	63	60	58	55	53	
7	97	95	92	89	87	84	82	79	77	74	72	69	67	64	62	59	57	54	
8	97	95	92	90	87	85	82	80	77	75	73	70	68	65	63	61	58	56	
9	98	95	93	90	88	85	83	81	78	76	74	71	69	67	64	62	60	58	
10	98	95	93	90	88	86	83	81	79	77	74	72	70	68	66	63	61	59	
11	98	95	93	91	89	86	84	82	80	78	75	73	71	69	67	65	62	60	
12	98	96	93	91	89	87	85	82	80	78	76	74	72	70	68	66	64	62	
13	98	96	93	91	89	87	85	83	81	79	77	75	73	71	69	67	65	63	
14	98	96	94	92	90	88	86	84	82	79	78	76	74	72	70	68	66	64	
15	98	96	94	92	90	88	86	84	82	80	78	76	74	73	71	69	67	65	
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
16	95	90	85	81	76	71	67	63	58	54	50	46	42	38	34	30	26	23	19
17	95	90	86	81	76	72	68	64	60	55	51	47	43	40	36	32	28	25	21
18	95	91	86	82	77	73	69	65	61	57	53	49	45	41	38	34	30	27	23
19	95	91	87	82	78	74	70	65	62	58	54	50	46	43	39	36	32	29	26
20	96	91	87	83	78	74	70	66	63	59	55	51	48	44	41	37	34	31	28
21	96	91	87	83	79	75	71	67	64	60	56	53	49	46	42	39	36	32	29
22	96	92	87	83	80	76	72	68	64	61	57	54	50	47	44	40	37	34	31
23	96	92	88	84	80	76	72	69	65	62	58	55	52	48	45	42	39	36	33
24	96	92	88	84	80	77	73	69	66	62	59	56	53	49	46	43	40	37	34
25	96	92	88	84	81	77	74	70	67	63	60	57	54	50	47	44	41	39	36
26	96	92	88	85	81	78	74	71	67	64	61	58	54	51	49	46	43	40	37
27	96	92	89	85	82	78	75	71	68	65	62	58	56	52	50	47	44	41	38
28	96	93	89	85	82	78	75	72	69	65	62	59	56	53	51	48	45	42	40
29	96	93	89	86	82	79	76	72	69	66	63	60	57	54	52	49	46	43	41
30	96	93	89	86	83	79	76	73	70	67	64	61	58	55	52	50	47	44	42
31	96	93	90	86	83	80	77	73	70	67	64	61	59	56	53	51	48	45	43
32	96	93	90	86	83	80	77	74	71	68	65	62	60	57	54	51	49	46	44
33	97	93	90	87	83	80	77	74	71	68	66	63	60	57	55	52	50	47	45
34	97	93	90	87	84	81	78	75	72	69	66	63	61	58	56	53	51	48	46
35	97	94	90	87	84	81	78	75	72	69	67	64	61	59	56	54	51	49	47
36	97	94	90	87	84	81	78	75	73	70	67	64	62	59	57	54	52	50	48
37	97	94	91	87	84	82	79	76	73	70	68	65	63	60	58	55	53	51	48
38	97	94	91	88	84	82	79	76	74	71	68	66	63	61	58	56	54	51	49
39	97	94	91	88	85	82	79	77	74	71	69	66	64	61	59	57	54	52	50
40	97	94	91	88	85	82	80	77	74	72	69	67	64	62	59	57	54	53	51

BULB THERMOMETER (CENT. SCALE)

temperature (dry bulb) (*t*°C) and the wet bulb (*t'*°C). It is computed for a barometric above -10°C and between 77.5 and 71 cm Hg will usually be within the errors of observation.

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<div><div><i>t</i> - <i>t'</i></div><div><i>t</i></div></div>	3.8	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
-10
-9
-8
-7
-6	6
-5	11	7
-4	17	12
-3	21	17	8
-2	25	22	12
-1	29	26	17	8	..	..	..	..	..	..	..	..	..	..	..	..
0	33	29	21	13	5	..	..	..	..	..	..	..	..	..	..	..
1	36	33	25	17	10	..	..	..	..	..	..	..	..	..	..	..
2	40	37	29	22	14	7	..	..	..	..	..	..	..	..	..	..
3	43	40	33	26	19	12	5	..	..	..	..	..	..	..	..	..
4	46	43	36	29	22	16	9	..	..	..	..	..	..	..	..	..
5	48	45	39	33	26	20	13	7	..	..	..	..	..	..	..	..
6	50	48	41	35	29	24	17	11	5	..	..	..	..	..	..	..
7	52	50	44	38	32	26	21	15	10	..	..	..	..	..	..	..
8	54	51	46	40	35	29	24	19	14	8	..	..	..	..	..	..
9	55	53	48	42	37	32	27	22	17	12	7	..	..	..	..	..
10	57	55	50	44	39	34	29	24	20	15	10	6	..	..	..	..
11	58	56	51	46	41	36	32	27	22	18	13	9	5	..	..	..
12	60	58	53	48	43	39	34	29	25	21	16	12	8	..	..	..
13	61	59	54	50	45	41	36	32	28	23	19	15	11	7	..	..
14	62	60	56	51	47	42	38	34	30	26	22	18	14	10	6	..
15	63	61	57	53	48	44	40	36	32	27	24	20	16	13	9	6
10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 16.0 17.0 18.0 19.0 20.0																
16	15	12	8	5	..	..	..	..	..	..	..	..	..	..	..	..
17	18	14	11	8	..	..	..	..	..	..	..	..	..	..	..	..
18	20	17	14	10	7	..	..	..	..	..	..	..	..	..	..	..
19	22	19	16	13	10	7	..	..	..	..	..	..	..	..	..	..
20	24	21	18	15	12	9	6	..	..	..	..	..	..	..	..	..
21	26	23	20	17	14	12	9	6	..	..	..	..	..	..	..	..
22	28	25	22	19	17	14	11	8	6	..	..	..	..	..	..	..
23	30	27	24	21	19	16	13	11	8	6	..	..	..	..	..	..
24	31	29	26	23	20	18	15	13	10	8	5	..	..	..	..	..
25	33	30	28	25	22	20	17	15	12	10	8	..	..	..	..	..
26	34	32	29	26	24	21	19	17	14	12	10	5	..	..	..	..
27	36	33	31	28	26	23	21	18	16	14	12	7	..	..	..	..
28	37	34	32	29	27	25	22	20	18	16	13	9	5	..	..	..
29	38	36	33	31	28	26	24	22	19	17	15	11	7	..	..	..
30	39	37	35	32	30	28	25	23	21	19	17	13	9	5	..	..
31	40	38	36	33	31	29	27	25	22	20	18	14	11	7	..	..
32	41	39	37	35	32	30	28	26	24	22	20	16	12	9	5	..
33	42	40	38	36	33	31	29	27	25	23	21	17	14	10	7	..
34	43	41	39	37	35	32	30	28	26	24	23	19	15	12	8	5
35	44	42	40	38	36	34	32	30	28	26	24	20	17	13	10	7
36	45	43	41	39	37	35	33	31	29	27	25	21	18	15	11	8
37	46	44	42	40	38	36	34	32	30	28	26	23	19	16	13	10
38	47	45	43	41	39	37	35	33	31	29	27	24	20	17	14	11
39	48	46	43	42	39	38	36	34	32	30	28	25	22	18	15	12
40	48	46	44	42	40	38	36	35	33	31	29	26	23	20	16	14

REDUCTION OF PSYCHROMETRIC OBSERVATION

For the reduction of observations with the wet and dry bulb thermometer. Assuming the relative velocity of the air to the thermometer bulbs is at least three meters per second; if t is the temperature of the air as indicated by the dry bulb, t_w , the temperature of the wet bulb, B , the barometric pressure, and E_w , the vapor tension of water corresponding to t_w , then the actual vapor tension is

$$E = E_w - 0.00066B(t - t_w)[1 + 0.00115(t - t_w)].$$

The value of the term

$$0.00066B(t - t_w)[1 + 0.00115(t - t_w)]$$

is given in the following table.

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

$t - t_w$	BAROMETRIC PRESSURE B IN CENTIMETERS							
	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0
$^{\circ}\text{C}$	cm	cm	cm	cm	cm	cm	cm	cm
1	0.047	0.048	0.048	0.049	0.050	0.050	0.051	0.052
2	.093	.094	.096	.097	.098	.100	.101	.103
3	.139	.141	.143	.145	.147	.149	.152	.154
4	.186	.189	.191	.194	.197	.199	.202	.204
5	0.232	0.236	0.239	0.243	0.246	0.249	0.252	0.256
6	.279	.283	.287	.291	.295	.299	.303	.307
7	.326	.331	.336	.340	.345	.350	.354	.359
8	.373	.379	.384	.389	.395	.400	.405	.411
9	.421	.427	.432	.438	.444	.450	.456	.462
10	0.468	0.474	0.481	0.488	0.494	0.501	0.508	0.515
11	.515	.522	.530	.537	.544	.551	.559	.566
12	.562	.570	.578	.586	.594	.602	.611	.619
13	.610	.618	.627	.636	.645	.653	.662	.671
14	.658	.667	.676	.686	.695	.705	.714	.723
15	0.706	0.716	0.726	0.736	0.746	0.756	0.766	0.776
16	.754	.764	.775	.786	.796	.807	.818	.829
17	.802	.813	.824	.836	.847	.859	.870	.882
18	.850	.862	.874	.886	.898	.910	.922	.935
19	.898	.911	.923	.936	.949	.962	.975	.987
20	0.946	0.960	0.973	0.987	1.000	1.014	1.027	1.041

CONSTANT HUMIDITY

The following table shows the % humidity and the aqueous tension at the given temperature within a closed space when an excess of the substance indicated is in contact with a saturated aqueous solution of the given solid phase.

Solid phase	t°C.	% humidity	Aq. tension
H ₃ PO ₄ . $\frac{1}{2}$ H ₂ O.....	24	9	1.99
ZnCl ₂ .1 $\frac{1}{2}$ H ₂ O*.....	20	10	1.74
KC ₂ H ₃ O ₂	168	13	738
LiCl.H ₂ O.....	20	15	2.60
KC ₂ H ₃ O ₂	20	20	3.47
KF.....	100	22.9	174
NaBr.....	100	22.9	174
NaCl, KNO ₃ and NaN ₃	16.39	30.49	4.23
CaCl ₂ .6H ₂ O.....	24.5	31	7.08
CaCl ₂ .6H ₂ O.....	20	32.3	5.61
CaCl ₂ .6H ₂ O.....	18.5	35	5.54
CrO ₃	20	35	6.08
CaCl ₂ .6H ₂ O.....	10	38	3.47
CaCl ₂ .6H ₂ O.....	5	39.8	2.59
Zn(NO ₃) ₂ .6H ₂ O.....	20	42	7.29
K ₂ CO ₃ .2H ₂ O.....	24.5	43	9.82
K ₂ CO ₃ .2H ₂ O.....	18.5	44	6.96
KNO ₂	20	45	7.81
KCNS.....	20	47	8.16
NaI.....	100	50.4	383
Ca(NO ₃) ₂ .4H ₂ O.....	24.5	51	11.6
NaHSO ₄ .H ₂ O.....	20	52	9.03
Na ₂ Cr ₂ O ₇ .2H ₂ O.....	20	52	9.03
Mg(NO ₃) ₂ .6H ₂ O.....	24.5	52	11.9
NaClO ₃	100	54	410
Ca(NO ₃) ₂ .4H ₂ O.....	18.5	56	8.86
Mg(NO ₃) ₂ .6H ₂ O.....	18.5	56	8.86
KI.....	100	56.2	427
NaBr.2H ₂ O.....	20	58	10.1
Mg(C ₂ H ₃ O ₂) ₂ .4H ₂ O.....	20	65	11.3
NaNO ₂	20	66	11.5
NH ₄ Cl and KNO ₃	30	68.6	21.6
KBr.....	100	69.2	526
NH ₄ Cl and KNO ₃	25	71.2	16.7
NH ₄ Cl and KNO ₃	20	72.6	12.6
NaClO ₃	20	75	13.0
(NH ₄) ₂ SO ₄	108.	75	754
NaC ₂ H ₃ O ₂ .3H ₂ O.....	20	76	13.2
H ₂ C ₂ O ₄ .2H ₂ O.....	20	76	13.2
Na ₂ S ₂ O ₃ .5H ₂ O.....	20	78	13.5
NH ₄ Cl.....	20	79.5	13.8

* Unstable form.

CONSTANT HUMIDITY (Continued)

Solid phase	°C.	% humidity	Aq. tension
NH ₄ Cl.....	25	79.3	18.6
NH ₄ Cl.....	30	77.5	24.4
(NH ₄) ₂ SO ₄	20	81	14.1
(NH ₄) ₂ SO ₄	25	81.1	19.1
(NH ₄) ₂ SO ₄	30	81.1	25.6
KBr.....	20	84	14.6
Tl ₂ SO ₄	104.7	84.8	768
KHSO ₄	20	86	14.9
Na ₂ CO ₃ ·10H ₂ O.....	24.5	87	20.9
BaCl ₂ ·2H ₂ O.....	24.5	88	20.1
K ₂ CrO ₄	20	88	15.3
Pb(NO ₃) ₂	103.5	88.4	760
ZnSO ₄ ·7H ₂ O.....	20	90	15.6
Na ₂ CO ₃ ·10H ₂ O.....	18.5	92	14.6
NaBrO ₃	20	92	16.0
K ₂ HPO ₄	20	92	16.0
NH ₄ H ₂ PO ₄	30	92.9	29.3
NH ₄ H ₂ PO ₄	25	93	21.9
Na ₂ SO ₄ ·10H ₂ O.....	20	93	16.1
NH ₄ H ₂ PO ₄	20	93.1	16.2
ZnSO ₄ ·7H ₂ O.....	5	94.7	6.10
Na ₂ SO ₃ ·7H ₂ O.....	20	95	16.5
Na ₂ HPO ₄ ·12H ₂ O.....	20	95	16.5
NaF.....	100	96.6	734
Pb(NO ₃) ₂	20	98	17.0
CaSO ₄ ·5H ₂ O.....	20	98	17.0
TiNO ₃	100.3	98.7	759
TiCl ₃	100.1	99.7	761

CONSTANT HUMIDITY WITH SULFURIC ACID SOLUTIONS

The relative humidity and pressure of aqueous vapor of air in equilibrium conditions above aqueous solutions of sulfuric acid are given below.

Density of acid solution	Relative humidity	Vapor pressure at 20°C	Density of acid solution	Relative humidity	Vapor pressure at 20°C
1.00	100.0	17.4	1.30	58.3	10.1
1.05	97.5	17.0	1.35	47.2	8.3
1.10	93.9	16.3	1.40	37.1	6.5
1.15	88.8	15.4	1.50	18.8	3.3
1.20	80.5	14.0	1.60	8.5	1.5
1.25	70.4	12.2	1.70	3.2	0.6

SOUND

VELOCITY OF SOUND

SOLIDS

Approximate values.
(From Smithsonian Tables.)

Substance	Temp. ° C	Veloc., meters per sec.	Veloc., feet per sec.	Observer
Metals:				
Aluminum.....	.....	5104	16740	Masson
Brass.....	.....	3500	11480	Various
Cadmium.....	.....	2307	7570	Masson
Cobalt.....	.....	4724	15500	Masson
Copper.....	20	3560	11670	Wertheim
Copper.....	100	3290	10800	Wertheim
Copper.....	200	2950	9690	Wertheim
Gold, soft.....	20	1743	5717	Wertheim
Gold, hard.....	.....	2100	6890	Various
Iron and soft steel.....	.....	5000	16410	Various
Iron.....	20	5130	16820	Wertheim
Iron.....	100	5300	17390	Wertheim
Iron.....	200	4720	15480	Wertheim
Iron cast steel.....	20	4990	16360	Wertheim
Iron cast steel.....	200	4790	15710	Wertheim
Lead.....	20	1227	4026	Wertheim
Magnesium.....	.....	4602	15100	Melde
Nickel.....	.....	4973	16320	Masson
Palladium.....	.....	3150	10340	Various
Platinum.....	20	2690	8815	Wertheim
Platinum.....	100	2570	8437	Wertheim
Platinum.....	200	2460	8079	Wertheim
Silver.....	20	2610	8553	Wertheim
Silver.....	100	2640	8658	Wertheim
Tin.....	.....	2500	8200	Various
Zinc.....	.....	3700	12140	Various
Various:				
Brick.....	.....	3652	11980	Chladni
Clay rock.....	.....	3480	11420	Gray and Milne
Cork.....	.....	500	1640	Stefan
Granite.....	.....	6000	19685	
Marble.....	.....	3810	12500	Gray and Milne
Paraffin.....	15	1304	4280	Warburg
Slate.....	.....	4510	14800	Gray and Milne
Tallow.....	16	390	1280	Warburg
Glass, from.....	.....	5000	16410	Various
Glass, to.....	.....	6000	19690	Various
Ivory.....	.....	3013	9886	Cicccone & Campanile
Vulcanized rubber.....	0	54	177	Exner
Wax.....	17	880	2890	Stefan
Woods:				
Ash, along the fiber.....	.....	4670	15310	Wertheim
Ash, across the rings.....	.....	1390	4570	Wertheim
Ash, along the rings.....	.....	1260	4140	Wertheim
Beech, along the fiber.....	.....	3340	10960	Wertheim
Elm, along the fiber.....	.....	4120	13516	Wertheim
Fir, along the fiber.....	.....	4640	15220	Wertheim
Maple, along the fiber.....	.....	4110	13470	Wertheim
Oak, along the fiber.....	.....	3850	12620	Wertheim
Pine, along the fiber.....	.....	3320	10900	Wertheim
Poplar, along the fiber.....	.....	4280	14050	Wertheim
Sycamore, along fiber.....	.....	4460	14640	Wertheim

VELOCITY OF SOUND (Continued)

LIQUIDS AND GASES
(From Smithsonian Tables.)

Substance	Temp. °C	Veloc., meters per sec.	Veloc., feet per sec.	Observer
Liquids:				
Alcohol, 95 %.....	12.5	1241.	4072.	Dorsing, 1908
Alcohol.....	20.5	1213.	3890.	Dorsing, 1908
Ammonia, conc.....	16.	1663.	5456.	Dorsing, 1908
Benzine.....	17.	1166.	3826.	Dorsing, 1908
Carbon bisulfide.....	15.	1161.	3809.	Dorsing, 1908
Chloroform.....	15.	983.	3225.	Dorsing, 1908
Ether.....	15.	1032.	3386.	Dorsing, 1908
NaCl, 10 % sol.....	15.	1470.	4823.	Dorsing, 1908
NaCl, 15 % sol.....	15.	1530.	5020.	Dorsing, 1908
NaCl, 20 % sol.....	15.	1650.	5414.	Dorsing, 1908
Turpentine oil.....	15.	1326.	4351.	Dorsing, 1908
Water, air-free.....	13.	1441.	4728.	Dorsing, 1908
Water, air-free.....	19.	1461.	4794.	Dorsing, 1908
Water, air-free.....	31.	1505.	4938.	Dorsing, 1908
Water, Lake Geneva....	9.	1435.	4708.	Colladon-Sturm
Water, Seine River.....	15.	1437.	4714.	Wertheim
Water, Seine River.....	30.	1528.	5013.	Wertheim
Water, Seine River.....	60.	1724.	5657.	Wertheim
Gases:				
Air, dry, CO ₂ -free.....	0.	331.78	1088.5	Rowland
Air, dry.....	0.	331.36	1087.1	Violle, 1900
Air, dry, CO ₂ -free.....	0.	331.92	1089.0	Thiesen, 1908
Air 1 atmosphere.....	0.	331.7	1088.	Mean
Air 25 atmospheres.....	0.	332.0	1089.	Mean (Witkowski)
Air 50 atmospheres.....	0.	334.7	1098.	Mean (Witkowski)
Air 100 atmospheres.....	0.	350.6	1150.	Mean (Witkowski)
Air.....	20.	344.	1129.	
Air.....	100.	386.	1266.	Stevens
Air.....	500.	553.	1814.	Stevens
Air.....	1000.	700.	2297.	Stevens
Ammonia.....	0.	415.	1361.	Masson
Carbon monoxide.....	0.	337.1	1106.	Wullner
Carbon dioxide.....	0.	258.0	846.	Bückendahl, 1906
Carbon disulfide.....	0.	189.	606.	Masson
Chlorine.....	0.	205.3	674.	Strecker
Ethylene.....	0.	314.	1030.	Dulong
Hydrogen.....	0.	1269.5	4165.	Dulong
Illuminating gas.....	0.	490.4	1609.	Zoch
Methane.....	0.	432.	1417.	Masson
Nitric oxide.....	0.	325.	1066.	Masson
Nitrous oxide.....	0.	261.8	859.	Dulong
Oxygen.....	0.	317.2	1041.	Dulong
Vapors:				
Alcohol.....	0.	230.6	756.	Masson
Ether.....	0.	179.2	588.	Masson
Water.....	0.	401.	1315.	Masson
Water.....	100.	404.8	1328.	Treitz, 1903
Water.....	130.	424.4	1392.	Treitz, 1903

MUSICAL SCALES

EQUAL TEMPERED CHROMATIC SCALE

$$A_4 = 440$$

American Standard pitch. Adopted by the American Standards Association in 1936

Note	Fre- quency	Note	Fre- quency	Note	Fre- quency	Note	Fre- quency
C ₀	16.35	C ₂	65.41	C ₄	261.63	C ₆	1046.50
C _{#0}	17.32	C _{#2}	69.30	C _{#4}	277.18	C _{#6}	1108.73
D ₀	18.35	D ₂	73.42	D ₄	293.66	D ₆	1174.66
D _{#0}	19.45	D _{#2}	77.78	D _{#4}	311.13	D _{#6}	1244.51
E ₀	20.60	E ₂	82.41	E ₄	329.63	E ₆	1318.51
F ₀	21.83	F ₂	87.31	F ₄	349.23	F ₆	1396.91
F _{#0}	23.12	F _{#2}	92.50	F _{#4}	369.99	F _{#6}	1479.98
G ₀	24.50	G ₂	98.00	G ₄	392.00	G ₆	1567.98
G _{#0}	25.96	G _{#2}	103.83	G _{#4}	415.30	G _{#6}	1661.22
A ₀	27.50	A ₂	110.00	A ₄	440.00	A ₆	1760.00
A _{#0}	29.14	A _{#2}	116.54	A _{#4}	466.16	A _{#6}	1864.66
B ₀	30.87	B ₂	123.47	B ₄	493.88	B ₆	1975.53
C ₁	32.70	C ₃	130.81	C ₅	523.25	C ₇	2093.00
C _{#1}	34.65	C _{#3}	138.59	C _{#5}	554.37	C _{#7}	2217.46
D ₁	36.71	D ₃	146.83	D ₅	587.33	D ₇	2349.32
D _{#1}	38.89	D _{#3}	155.56	D _{#5}	622.25	D _{#7}	2489.02
E ₁	41.20	E ₃	164.81	E ₅	659.26	E ₇	2637.02
F ₁	43.65	F ₃	174.61	F ₅	698.46	F ₇	2793.83
F _{#1}	46.25	F _{#3}	185.00	F _{#5}	739.99	F _{#7}	2959.96
G ₁	49.00	G ₃	196.00	G ₅	783.99	G ₇	3135.96
G _{#1}	51.91	G _{#3}	207.65	G _{#5}	830.61	G _{#7}	3322.44
A ₁	55.00	A ₃	220.00	A ₅	880.00	A ₇	3520.00
A _{#1}	58.27	A _{#3}	233.08	A _{#5}	932.33	A _{#7}	3729.31
B ₁	61.74	B ₃	246.94	B ₅	987.77	B ₇	3951.07
						C ₈	4186.01

EQUAL TEMPERED CHROMATIC SCALE

$$A_4 = 435$$

International Pitch, adopted 1891

Note	Fre- quency	Note	Fre- quency	Note	Fre- quency	Note	Fre- quency
C ₀	16.17	C ₂	64.66	C ₄	258.65	C ₆	1034.61
C _{#0}	17.13	C _{#2}	68.51	C _{#4}	274.03	C _{#6}	1096.13
D ₀	18.15	D ₂	72.58	D ₄	290.33	D ₆	1161.31
D _{#0}	19.22	D _{#2}	76.90	D _{#4}	307.59	D _{#6}	1230.37
E ₀	20.37	E ₂	81.47	E ₄	325.88	E ₆	1303.53
F ₀	21.58	F ₂	86.31	F ₄	345.26	F ₆	1381.04
F _{#0}	22.86	F _{#2}	91.45	F _{#4}	365.79	F _{#6}	1463.16
G ₀	24.22	G ₂	96.89	G ₄	387.54	G ₆	1550.16
G _{#0}	25.66	G _{#2}	102.65	G _{#4}	410.59	G _{#6}	1642.34
A ₀	27.19	A ₂	108.75	A ₄	435.00	A ₆	1740.00
A _{#0}	28.80	A _{#2}	115.22	A _{#4}	460.87	A _{#6}	1843.47
B ₀	30.52	B ₂	122.07	B ₄	488.27	B ₆	1953.08
C ₁	32.33	C ₃	129.33	C ₅	517.31	C ₇	2069.22
C _{#1}	34.25	C _{#3}	137.02	C _{#5}	548.07	C _{#7}	2192.26
D ₁	36.29	D ₃	145.16	D ₅	580.66	D ₇	2322.62
D _{#1}	38.45	D _{#3}	153.80	D _{#5}	615.18	D _{#7}	2460.73
E ₁	40.74	E ₃	162.94	E ₅	651.76	E ₇	2607.05
F ₁	43.16	F ₃	172.63	F ₅	690.52	F ₇	2762.08
F _{#1}	45.72	F _{#3}	182.89	F _{#5}	731.58	F _{#7}	2926.32
G ₁	48.44	G ₃	193.77	G ₅	775.08	G ₇	3100.33
G _{#1}	51.32	G _{#3}	205.29	G _{#5}	821.17	G _{#7}	3284.68
A ₁	54.38	A ₃	217.50	A ₅	870.00	A ₇	3480.00
A _{#1}	57.61	A _{#3}	230.43	A _{#5}	921.73	A _{#7}	3686.93
B ₁	61.03	B ₃	244.14	B ₅	976.54	B ₇	3906.17
						C ₈	4138.44

MUSICAL SCALES (Continued)

SCIENTIFIC OR JUST SCALE

$C_4 = 256$

Note	Fre- quency	Note	Fre- quency	Note	Fre- quency	Note	Fre- quency
C_0	16	C_2	64	C_4	256	C_6	1024
D_0	18	D_2	72	D_4	288	D_6	1152
E_0	20	E_2	80	E_4	320	E_6	1280
F_0	21.33	F_2	85.33	F_4	341.33	F_6	1365.33
G_0	24	G_2	96	G_4	384	G_6	1536
A_0	26.67	A_2	106.67	A_4	426.67	A_6	1706.67
B_0	30	B_2	120	B_4	480	B_6	1920
C_1	32	C_3	128	C_5	512	C_7	2048
D_1	36	D_3	144	D_5	576	D_7	2304
E_1	40	E_3	160	E_5	640	E_7	2560
F_1	42.67	F_3	170.67	F_5	682.67	F_7	2730.67
G_1	48	G_3	192	G_5	768	G_7	3072
A_1	53.33	A_3	213.33	A_5	853.33	A_7	3413.33
B_1	60	B_3	240	B_5	960	B_7	3840
						C_8	4096

SOUND ABSORPTION

SOUND ABSORPTION

TABLE I.—GENERAL BUILDING MATERIALS

The following table gives the absorption coefficients of various materials. The reverberation time is usually defined as the time required for the reverberant sound to sink to one millionth its initial intensity. This time is given in seconds by the relation, $T_0 = .05 \left(\frac{V}{a} \right)$, where V is the volume of the room in cubic feet and a is the absorption. The absorption a is computed by multiplying the area in square feet of each surface by its absorption coefficient and taking the sum of these products plus the absorbing power of objects, such as seats and furnishings.

Data in the following tables have been selected largely from the Official Bulletin of the Acoustical Materials Association.

Material	Coefficients		
	128	512	2048
Floor Coverings:			
Carpet unlined.....	.09	.20	.27
Carpet felt lined.....	.11	.37	.27
Carpet, pile, on concrete, $\frac{3}{8}$ ".....	.09	.21	.27
Carpet, pile, on $\frac{1}{8}$ " felt, $\frac{3}{8}$ ".....	.11	.37	.27
Carpet, rubber, on concrete, $\frac{1}{2}$ ".....	.04	.08	.03
Cocoa matting.....	.08	.17	.30
Cork flooring slabs, glued down, $\frac{3}{4}$ ".....	.08	.08	.21
Cork flooring, like above, waxed and polished, $\frac{3}{4}$ ".....	.04	.05	.07
Cork Tile, $\frac{1}{4}$ ".....	.04	.06	.7
Linoleum.....	.02	.03	.04
Linoleum, asphalt, rubber or cork tile on concrete.....	.11	.20	.52
Rug, Axminster.....	.10	.29	.40
Rug, Oriental.....			
Hair felt:			
1" Hair felt on $2'' \times 1\frac{1}{2}''$ battens 3' c/c.....	.09	.43	.33
1" Hair felt close against wall.....	.12	.41	.30
Hangings:			
Fabrics, hung straight:			
Light, 10 ozs. per sq. yd.....	.04	.11	.30
Medium, 14 ozs. per sq. yd.....	.06	.13	.40
Heavy, draped, 18 ozs. per sq. yd.....	.10	.50	.82
Hard Plasters, Masonry, Wood:			
Brick wall, painted.....	.012	.017	.023
Brick wall, unpainted.....	.024	.03	.049
Clay tile, burned, 1".....	.015	.028	.035
Cement.....		.025	

SOUND ABSORPTION (Continued)

TABLE I.—GENERAL BUILDING MATERIALS (Continued)

Material	Coefficients		
	128	512	2048
Hard Plasters, Masonry, Wood:			
Concrete or terrazzo.....	.01	.015	.02
Glass.....	.035	.027	.02
Interior Stucco, smooth finish, $\frac{1}{2}$ ".....	.03	.04	.04
Marble or glazed tile.....	.01	.01	.015
Plaster, gypsum or lime, smooth finish on tile or brick.....	.013	.025	.04
Plaster, gypsum or lime, smooth finish on lath.....	.02	.03	.04
Plaster, gypsum or lime, rough finish on lath.....	.039	.06	.054
Wood blocks, pitch pine, laid in mastic, $\frac{3}{4}$ ".....	.05	.06	.10
Wood flooring.....	.05	.03	.03
Wood paneling.....	.08	.06	.06
Combination of Acoustical Materials:			
Fibreglas Semi-rigid Panels and Boards			
Type TW-PF-2.5D 1" thick, 23 lbs. per sq. ft.....	.24	.65	.73
Type TW-PF-4D 2" thick, 71 lbs. per sq. ft.....	.41	.99	.84
Type TW-PF-12D 1" thick, 1.04 lbs. per sq. ft.....	.09	.79	.87
Fibreglas Metal Mesh Blankets (style HO)-			
Type TW-G-2D 1" thick, 42 lbs. per sq. ft.....	.24	.57	.70
Type TW-G-4D 2" thick, 97 lbs. per sq. ft.....	.54	.99	.88
Type TW-G-6D 2" thick, 1.31 lbs. per sq. ft.....	.55	.99	.91
Fibreglas Sewn Blankets—Muslin Faced (Styles PM 2 or FM 2)			
Type TW-G-4D 2" thick, 69 lbs. per sq. ft.....	.62	.99	.86
Openings:			
Stage, depending on furnishings.....		.25-.75	
Deep balcony, upholstered seats.....		.50-1.00	
Grills, ventilating.....		.15-.50	
Ventilators, 50% open.....	.30	.50	.50
Audience, Individual Persons, Chairs, etc.:			
Audience, seated, units per person, depending on character of seats, etc.....	1.0-2.0	3.0-4.3	3.5-6.0
Chairs, metal or wood.....	.15	.17	.20
Pew Cushions.....	.75-1.1	1.45-1.90	1.4-1.7
Theater and Auditorium Chairs			
Wood veneer seats and back.....		.25	
Upholstered in leatherette.....		1.6	
Heavily upholstered in plush or mohair.....		2.6-3.0	
Wood Pews.....		.40	

TABLE II.—SPECIAL ACOUSTICAL MATERIALS

The type of material and method of mounting are indicated by symbols as follows:

TYPES OF MATERIALS

TYPES OF MOUNTINGS

1. Cast units composed of small uniform mineral particles held together with Portland cement.
2. Cast units having a surface composed of or resembling small uniform granules. The binder may be gypsum or any other suitable mineral binder.
3. Cast units having a surface composed of or resembling irregular, rough granules. The binder may be gypsum or any other suitable mineral binder.
4. Units having a mechanically perforated surface, which acts as a covering for the sound absorbent material.
5. Units which are mechanically perforated, the perforations extending into the sound absorbent material.
6. Units having a fissured surface.
7. Compressed units composed of long wood fibers held together with a mineral binder. This type shall not have a mechanically perforated surface.
8. Felted fiber or wood pulp units which have a surface that is not mechanically perforated.

Material, trade name	†Thick-ness	Types		‡Mfgr. of product	Coefficients			*Noise red. coef.	Surface
		Mat-erial	Mount-ing		128	512	2048		
Absorbatone A.....	1"	7	2	L-S	.15	.82	.87	.75	Unpainted
Absorbatone A.....	1"	7	2	L-S	.11	.80	.80	.70	Painted by mfgr.
Absorbatone A.....	1"	7	5	L-S	.25	.99	.85	.85	Painted by mfgr.
Absorbex Type A.....	1"	7	1	C.C.	.13	.70	.79	.70	Painted by mfgr.
Absorbex Type A.....	1"	7	2	C.C.	.17	.85	.84	.75	Painted by mfgr.
		(18" o.c.)							
Absorbex Type A.....	1"	7	8	C.C.	.41	.96	.85	.85	Painted by mfgr.
		(18" o.c.)							
Absorbex Type F.....	1"	7	1	C.C.	.15	.59	.61	.60	Painted by mfgr.
Absorbex Type F.....	2"	7	1	C.C.	.20	.99	.90	.75	Painted by mfgr.

TABLE II.—SPECIAL ACOUSTICAL MATERIALS (Continued)

Material, trade name	†Thick- ness	Types		‡Mfgr. of product	Coefficients			*Noise red. coef.	Surface
		Mate- rial	Mount- ing		128	512	2048		
Acousteel-B, pad plus metal facing and supports.....	1 1/2"	4	3	C.C.	.29	.98	.85	.85	Perforated enameled metal .068" diameter perfora- tions, 4608 per sq. ft.
Acousteel-B, pad plus metal facing and supports.....	2"								50/50 Pattern, 1/2" perfo- rated enameled metal, backed with pads, same as above; 1/2" enameled metal unperforated, with- out pads.
Acoustex 30R.....	1 1/2"	4	3	C.C.	.25	.71	.55	.65	Painted by mfrg.
Acoustex 30R backed by 1" rock wool.....	1 1/2"	4	3	C.C.	.25	.71	.55	.65	Painted by mfrg.
Acoustex 40R.....	1 1/2"	7	2	N.G.	.09	.45	.77	.55	Painted by mfrg.
Acoustex 50R.....	1 1/2"	7	2	N.G.	.17	.98	.85	.80	Painted by mfrg.
Acoustex 60R.....	1 1/2"	7	2	N.G.	.09	.59	.75	.60	Painted by mfrg.
Acousti-Celotex, Type C-1....	1 1/2"	5	1	C.C.	.07	.57	.61	.50	Painted by mfrg.
Acousti-Celotex, Type C-2....	5/8"	5	1	C.C.	.16	.67	.69	.60	Painted by mfrg. Perfo- rated same as above, 1 1/8" deep.
Acousti-Celotex, Type C-3....	1 3/8"	5	1	C.C.	.15	.82	.63	.65	Same as above 1 1/8" deep.
Acousti-Celotex, Type C-3....	1 3/8"	5	2	C.C.	.22	.76	.66	.70	Same as above.
Acousti-Celotex, Type C-3....	1 3/8"	5	7	C.C.	.22	.76	.60	.70	Same as above.
Acousti-Celotex, Type C-4....	1 1/4"	5	1	C.C.	.13	.99	.60	.70	Painted by mfrg. Perfo- rated same as above, 1 1/8" deep.
Acousti-Celotex, Type C-5....	1 3/8"	5	1	C.C.	.12	.78	.83	.70	Painted by mfrg. Perfo- rated 441 holes per sq. ft.
Acousti-Celotex, Type C-6....	1 1/4"	5	2	C.C.	.30	.94	.69	.80	1" diameter, 1 1/8" deep. Painted by mfrg. Perfo- rated same as above, 1 1/8" deep.

SOUND ABSORPTION (Continued)

TABLE II.—SPECIAL ACOUSTICAL MATERIALS (Continued)

Material, trade name	†Thick- ness	Types		‡Mfgr. of product	Coefficients			*Noise red. coef.	Surface
		Matte- rial	Mount- ing		128	512	2048		
Acousti-Celotex, Type C-8....	1"	5	2	C.C.	.31	.58	.73	.65	Painted by mfr. Perfo- rated 441 holes per sq. ft. $\frac{1}{16}$ " diameter, $\frac{3}{8}$ " deep.
Acousti-Celotex, Type M-1....	$\frac{5}{16}$ "	5	1	C.C.	.10	.55	.89	.60	Painted by mfr. Perfo- rated 676 holes per sq. ft. $\frac{3}{16}$ " diameter, $\frac{1}{2}$ " deep.
Acousti-Celotex, Type M-2....	1"	5	1	C.C.	.12	.82	.80	.70	Painted by mfr. Perforated same as above, $\frac{1}{8}$ " deep.
Acoustimetal, Type P pad plus metal facing and pad supports	1 $\frac{1}{2}$ " 1 $\frac{3}{8}$ " 2 $\frac{1}{2}$ "	4	3	N.G.	.23	.99	.78	.85	Perforated enameled metal .068" diameter perfora- tions, 4608 per sq. ft.
Acoustone D.....	1 $\frac{1}{2}$ "	6	1	USG	.06	.61	.82	.60	Unpainted
Acoustone D.....	1 $\frac{1}{2}$ "	6	1	USG	.08	.73	.81	.65	Unpainted
Acoustone D.....	1 $\frac{1}{2}$ "	6	1	USG	.13	.79	.76	.65	Painted by mfr.
Acoustone D.....	1 $\frac{1}{2}$ "	6	1	USG	.15	.79	.85	.70	Unpainted
Acoustone D.....	1 $\frac{1}{2}$ "	6	1	USG	.20	.84	.85	.75	Unpainted
Acoustone F.....	1 $\frac{1}{2}$ "	6	1	USG	.11	.44	.90	.60	Unpainted
Acoustone F.....	1 $\frac{1}{2}$ "	6	1	USG	.14	.65	.85	.65	Unpainted
Acoustone F.....	1 $\frac{1}{2}$ "	6	1	USG	.14	.81	.85	.70	Unpainted
Acoustone F.....	1 $\frac{1}{2}$ "	6	1	USG	.16	.87	.83	.75	Unpainted
Airacoustic.....	1 $\frac{1}{2}$ "	8	6	J-M	.22	.48	.86	.60	Unpainted
Airacoustic.....	1 $\frac{1}{2}$ "	8	6	J-M	.50	.67	.86	.70	Unpainted
Calicel, Standard.....	1 $\frac{1}{2}$ "	2	1	C.C.	.12	.47	.78	.60	Painted by mfr.
Calicel, Standard.....	1"	2	1	C.C.	.11	.66	.74	.65	Painted by mfr.
Calistone, SW.....	1"	1	4	C.C.	.08	.40	.66	.50	Unpainted
Corkoustic B5.....	1 $\frac{1}{2}$ "	1	1	A.C.	.06	.73	.56	.55	Painted by mfr.
Corkoustic B5.....	1 $\frac{1}{2}$ "	6	2	A.C.	.18	.70	.58	.55	Painted by mfr.
Corkoustic B6.....	1 $\frac{1}{2}$ "	6	1	A.C.	.15	.82	.58	.55	Painted by mfr.
Corkoustic B6.....	1 $\frac{1}{2}$ "	6	2	A.C.	.22	.61	.51	.55	Painted by mfr.
Cushiontone A1.....	1 $\frac{1}{2}$ "	5	1	A.C.	.05	.58	.71	.55	Painted by mfr. Perfo- rated 484 holes per sq. ft. $\frac{3}{16}$ " diam.

SOUND ABSORPTION (Continued)

TABLE II.—SPECIAL ACOUSTICAL MATERIALS (Continued)

Material, trade name	†Thick- ness	Types		‡Mfg. of product	Coefficients			*Noise red. coef.	Surface
		Mate- rial	Mount- ing		128	512	2048		
Cushiontone A2.....	1"	5	1	A C.	.13	.59	.73	.60	Same as above, 1" deep
Cushiontone A2.....	1"	5	2	A C.	.11	.53	.70	.60	Same as above, 1" deep
Cushiontone A3.....	1"	5	1	A C.	.13	.75	.81	.70	Same as above, 1" deep
Econacoustic.....	1"	8	1	N G.	.05	.54	.76	.60	Painted by mfr.
Econacoustic.....	1"	8	2	N G.	.09	.73	.78	.65	Painted by mfr.
Econacoustic.....	1"	8	1	N G.	.25	.78	.79	.70	Painted by mfr.
Fiberglas Acoustical Tile Type TW-PF 9D.....	1"	..	2	O-C	.08	.67	.71	.65	Painted by mfr.
Fiberglas Acoustical Tile Type TW-PF 9D.....	1"	..	2	O-C	.22	.97	.68	.75	Painted by mfr.
Fibracoustic.....	1"	8	1	J-M.	.17	.79	.79	.75	Painted by mfr.
Fibracoustic.....	1"	8	2	J-M.	.18	.82	.85	.80	Painted by mfr.
Fibretext.....	1"	7	2	J-M.	.09	.45	.77	.55	Painted by mfr.
Fibretext.....	1"	7	2	J-M.	.14	.81	.83	.70	Painted by mfr.
Koustex.....	1"	6	1	DEK	.05	.61	.56	.50	Painted by mfr.
Koustex.....	1"	7	1	DEK	.10	.64	.77	.65	Unpainted by mfr.
Koustex.....	1"	7	2	DEK	.15	.75	.80	.70	Painted by mfr.
Macoustic Plaster, Type 55V Trowel finish.....	1"	..	..	NG	.32	.53	.68	.55	Finished with steel trowel
Muffetone (Std.).....	1"	2	1	C.C.	.17	.63	.74	.60	Unpainted
Muffetone (Std.).....	1"	2	1	C.C.	.18	.72	.79	.70	Painted by mfr.
Perfatone, pad plus metal.....	1"	4	3	USG	.23	.98	.87	.85	Perforated enameled metal, 4608 holes per sq. ft., .073" diameter
facing and pad supports.....	1"	..	..	..	..	..	..	..	Unpainted
plus furring.....	2"	..	..	..	..	..	..	..	Unpainted by mfr.
Permacoustic.....	1"	6	1	J-M	.19	.74	.75	.65	Painted by mfr.
Permacoustic.....	1"	6	1	J-M	.23	.71	.70	.65	Unpainted
Q-T Ductliner.....	1"	8	6	C.C.	.14	.43	.75	.60	Unpainted
Q-T Ductliner.....	1"	8	6	C.C.	.29	.78	.88	.75	Unpainted
Reverbolite Acoustical Plaster brush finish.....	1"	..	..	C.C.	.29	.40	.54	.45	Stippled with rice brush

SOUND ABSORPTION (Continued)

TABLE II.—SPECIAL ACOUSTICAL MATERIALS (Continued)

Material, trade name	†Thick- ness	Types		‡Mfg. of product	Coefficients			*Noise red. coef.	Surface
		Mate- rial	Mount- ing		128	512	2048		
Reverbolite Acoustical Plaster trowel finish.....	1"	..	..	C-C	.26	.47	.65	.50	Finished with steel trowel.
Sabrite Acoustical Plaster ..	1"	..	..	USG	.26	.32	.73	.50	Flotted with cork float.
Sunacoustic, pad plus metal...	1 1/8"	4	3	J-M	.25	.99	.91	.85	Perforated enameled metal .068" diam. perforations, 4608 per sq. ft.
facing and pad supports.....	1 3/8"								
plus furring.....	2 1/8"								
Sunacoustic, pad plus metal...	1 1/8"	4	3	J-M	.22	.63	.52	.65	50/50 pattern, 1/3 perfo- rated enameled metal backed with pad, .068" diam., 4608 holes/sq. ft.; 1/3 enameled metal unperforated, unbacked.
facing and pad supports.....	2 1/8"								
plus furring.....	2 3/8"								
Sound Isolation Blanket MK...	1"	..	4	J-M	.05	.48	.86	.55	Muslin covered, unpainted.
Sound Isolation Blanket MK...	1 1/2"	..	4	J-M	.15	.89	.89	.80	Muslin covered, unpainted.
Sound Isolation Blanket MK...	2"	..	4	J-M	.43	.97	.87	.85	Muslin covered, unpainted.
Transite Acoustical Unit, Pad...	1 1/8"	4	2	J-M	.28	.83	.76	.75	Painted by mfg. 576 holes per sq. ft., 5/8" diameter.
plus Transite facing.....	1 1/8"								
Travacoustic.....	1 1/2"	6	1	NG	.14	.80	.85	.75	Unpainted

* The noise reduction coefficient is the average of the coefficients at frequencies from 256 to 2048 cycles inclusive, given to the nearest 5%. This average coefficient is recommended for use in comparing materials for noise quieting purposes as in offices, hospitals, banks, corridors, etc.

† Unless otherwise noted, the thickness given is the thickness of the sound-absorbing element forming the face of the construction. The thickness of other sound-absorbing elements in the construction, if used, is indicated by the type of mounting.

‡ For auditorium treatment, attention should be directed to the coefficients at 512 cycles and other frequencies as explained elsewhere.

† Key to Manufacturer of Product

A.C.—Armstrong Cork Company

C.C.—The Celotex Corporation

DEK—David E. Kennedy, Inc.

J-M—Johns-Manville Sales Corp.

I-S—Lase-Stevenson Co.

N.G.—National Gypsum Co.

O-C—Owens-Corning Fiberglas Corp.

USG—United States Gypsum Company

ELECTRICITY AND MAGNETISM

SPARK-GAP VOLTAGES

Based on results of the American Institute of Electric Engineers
Air at 760 mm. 25° C.

Peak voltage, kilovolts	Diameter of spherical electrodes, cm				Needle points
	2.5	5	10	25	
Length of spark gap cm					
5	0.13	0.15	0.15	0.16	0.42
10	0.27	0.29	0.30	0.32	0.85
15	0.42	0.44	0.46	0.48	1.30
20	0.58	0.60	0.62	0.64	1.75
25	0.76	0.77	0.78	0.81	2.20
30	0.95	0.94	0.95	0.98	2.69
35	1.17	1.12	1.12	1.15	3.20
40	1.41	1.30	1.29	1.32	3.81
45	1.68	1.50	1.47	1.49	4.49
50	2.00	1.71	1.65	1.66	5.20
60	2.82	2.17	2.02	2.01	6.81
70	4.05	2.68	2.42	2.37	8.81
80	.. .. .	3.26	2.84	2.74	11.1
90	.....	3.94	3.28	3.11	13.3
100	.....	4.77	3.75	3.49	15.5
110	.....	5.79	4.25	3.88	17.7
120	.....	7.07	4.78	4.28	19.8
130	.....	.....	5.35	4.69	22.0
140	.....	.....	5.97	5.10	24.1
150	.....	.....	6.64	5.52	26.1
160	.....	.....	7.37	5.95	28.1
170	.....	.....	8.16	6.39	30.1
180	.....	.....	9.03	6.84	32.0
190	.....	.....	10.0	7.30	33.9
200	.....	.....	11.1	7.76	35.7
210	.....	.....	12.3	8.24	37.6
220	.....	.....	13.7	8.73	39.5
230	.....	.....	15.3	9.24	41.4
240	.....	.....	.....	9.76	43.3
250	.....	.....	.....	10.3	45.2
300	.....	.....	.....	13.3	54.7

CORRECTIONS FOR TEMPERATURE AND PRESSURE

Values found in the above table may be corrected for temperature and pressure by multiplying the values given by the appropriate correction factor found below:

Pressure mm				
Temp. ° C.	720	740	760	780
0	1.04	1.06	1.09	1.12
10	1.00	1.02	1.05	1.08
20	0.96	0.99	1.02	1.04
30	0.93	0.96	0.98	1.01

SPECIFIC INDUCTIVE CAPACITY

SOLIDS

Atmospheric temperatures except where noted.

(From Smithsonian Tables.)

Substance.	Wave length.	Specific inductive capacity.	Observer.
Asphalt.....	∞	2.68	v. Pirani, 1903
Caoutchouc.....	∞	2.22	Gordon, 1879
Calc spar:			
\perp to axis.....	∞	8.49	Fallinger, 1902
\parallel to axis.....	∞	7.56	Fallinger, 1902
Diamond.....	∞	16.5	v. Pirani, 1903
Ebonite.....	∞	2.72	Winklemann, 1889
Glass flint, extra heavy.....	∞	9.90	Hopkinson, 1891
hard crown.....	∞	6.96	Hopkinson, 1891
lead (Powell).....	∞	5.4-8.0	Gray-Dobbie, 1898
Jena, barium.....	∞	7.8-8.5	Löwe, 1898
Gutta percha.....		3.3-4.9	(submarine-data)
Ice—5° C.....	1200	2.85	Thwing, 1894
—18°.....	5000	3.16	Abegg, 1897
—190°.....	75	1.76-1.88	Behn-Kiebitz, 1904
Iodine, cryst.....	75	4.00	Schmidt, 1903
Marble, Carrara.....	75	8.3	Schmidt, 1903
Mica.....	∞	5.66-5.97	Elsas, 1891
Mica, Canadian amber.....	∞	3.0	E. Wilson
Paraffin.....	∞	2.10	Zietkowski, 1900
Phosphorus, yellow..	75	3.60	Schmidt, 1903
Porcelain, hard (Royal Berlin) ..	∞	5.73	Starke, 1897
Quartz:			
\perp to axis.....	∞	4.69	Fallinger, 1902
\parallel to axis.....	∞	5.06	Fallinger, 1902
Selenium.....	∞	6.13	Vonwiller-Mason, 1907
Shellac.....	∞	3.10	Winklemann, 1889
Sulphur, amorphous..	∞	3.98	v. Pirani, 1903
Sulphur, cast, fresh..	∞	4.22	v. Pirani, 1903
Wood, dry:			
red beech.....	∞	4.83-2.51	
red beech.....	∞	7.73-3.63	
oak.....	∞	4.22-2.46	
oak.....	∞	6.84-3.64	

SPECIFIC INDUCTIVE CAPACITY (Continued)

GASES

The specific inductive capacity of a vacuum is taken as unity. Wave-lengths of the measuring current greater than 10,000 cm.

(Dielectric constant.)

Gas.	Temp. ° C.	Pressure in atmos- pheres.	Specific inductive capacity.	Observer.
Air.....	0	1	1.000590	Boltzmann, 1875
Air.....	19	20	1.0108	Tangl, 1907
Air.....	....	40	1.0218	Tangl, 1907
Air.....	....	60	1.0330	Tangl, 1907
Air.....	....	80	1.0439	Tangl, 1907
Air.....	....	100	1.0548	Tangl, 1907
Ammonia.....	20	1	1.00718	Bädeker, 1901
Carbon bisulphide..	0	1	1.00290	Klemenčič
Carbon bisulphide..	100	1	1.00239	Bädeker
Carbon dioxide.....	0	1	1.000985	Klemenčič
Carbon dioxide.....	15	10	1.008	Linde, 1895
Carbon dioxide.....	....	20	1.020	Linde, 1895
Carbon dioxide.....	....	40	1.060	Linde, 1895
Carbon monoxide...	0	1	1.000690	Boltzmann
Ethylene.....	0	1	1.00131	Boltzmann
Hydrochloric acid...	100	1	1.00258	Bädeker
Hydrogen.....	0	1	1.000264	Boltzmann
Methane.....	0	1	1.000944	Boltzmann
Nitrous oxide (N ₂ O)...	0	1	1.00116	Boltzmann
Nitrous oxide (N ₂ O)...	15	10	1.010	Linde, 1895
Nitrous oxide (N ₂ O)...	....	20	1.025	Linde, 1895
Nitrous oxide (N ₂ O)...	....	40	1.070	Linde, 1895
Sulphur dioxide....	0	1	1.00993	Bädeker
Sulphur dioxide....	0	1	1.00905	Klemenčič
Water vapor.....	145	1	1.00705	Bädeker

LIQUIDS

Where the wave-length is not specified it is greater than 10,000 cm.

Liquid.	Temp. ° C.	Wave length, cm.	Specific induc- tive ca- pacity.	Observer.
Acetic acid.....	18	∞	9.7	Francke, 1893
Acetone.....	0	∞	26.6	Abegg, 1897
Air.....	-191	∞	1.43	v. Pirani, 1903
Alcohol:				
amyl.....	0	∞	17.4	Abegg-Seitz, 1899
amyl.....	+20	∞	16.0	Abegg-Seitz, 1899
ethyl.....	frozen	∞	2.7	Abegg-Seitz, 1899
ethyl.....	-120	∞	14.6	Abegg-Seitz, 1899

SPECIFIC INDUCTIVE CAPACITY (Continued)

LIQUIDS (Continued)

Liquid.	Temp. ° C.	Wave length, cm.	Specific induc- tive ca- pacity.	Observer.
Alcohol:				
ethyl.....	-80	∞	44.3	Abegg-Seitz, 1899
ethyl.....	-40	∞	35.3	Abegg-Seitz, 1899
ethyl.....	0	∞	28.4	Abegg-Seitz, 1899
ethyl.....	+20	∞	25.8	Abegg-Seitz, 1899
ethyl.....	17	200	24.4	Drude, 1896
ethyl.....	17	75	23.0	Drude, 1896
ethyl.....	17	53	20.6	Marx, 1898
ethyl.....	17	4	8.8	Marx, 1898
ethyl.....	17	0.4	5.0	Lampa, 1896
methyl.....	0	∞	35.0	Abegg-Seitz, 1899
methyl.....	+20	∞	31.2	Abegg-Seitz, 1899
propyl.....	0	∞	24.8	Abegg-Seitz, 1899
propyl.....	+20	∞	22.2	Abegg-Seitz, 1899
Ammonia.....	-34	75	21-23	Goodwin-Thomp- son, 1899
Amyl acetate.....	19	∞	4.81	Löwe, 1898
Anilin.....	18	∞	7.316	Turner, 1900
Benzol (Benzene)...	18	∞	2.288	Turner, 1900
Bromine.....	23	84	3.18	Schlundt
Carbon bisulphide...	20	∞	2.626	Tangl, 1903
Carbon dioxide.....	-5	∞	1.60	Linde, 1895
Chlorine.....	-60	∞	2.15	Linde, 1895
Chloroform.....	13	∞	5.2	Turner, 1900
Ethyl ether.....	0	∞	4.68	Abegg, 1897
Ethyl ether.....	20	∞	4.30	Tangl, 1903
Glycerine.....	15	1200	56.2	Thwing, 1894
Hydrogen peroxide 46% in H ₂ O....	18	75	84.7	Calvert, 1900
Hydrogen sulphide...	10	∞	5.93	Eversheim, 1904
Nitrous oxide, N ₂ O .	-88	∞	1.93	Hasenhörl, 1900
Oils:				
castor.....	11	∞	4.67	Arons-Rubens, 1892
cottonseed.....	14	∞	3.10	Salvioni, 1888
linseed.....	13	∞	3.35	Salvioni, 1888
olive.....	20	∞	3.11	Heinke, 1896
petroleum.....	....	2000	2.13	Marx
sperm.....	20	∞	3.17	Hopkinson, 1881
turpentine.....	20	∞	2.23	Hopkinson, 1881
Oxygen.....	-182	∞	1.49	Fleming-Dewar, 1896
Phenol.....	48	73	9.68	Drude, 1896
Sulphur dioxide....	20	∞	14.0	Eversheim, 1904
Water.....	18	∞	81.07	Turner, 1900

SPARKING POTENTIAL OR DIELECTRIC STRENGTH

VARIOUS INSULATORS.

Potential to puncture in kilovolts per centimeter. 1 kilovolt = 1000 volts.

Substance.	Thickness used mm.	Kilovolts per cm
Air, liquid.....	.....	40-90
Ebonite.....	.....	300-1100
Fiber.....	.....	20
Glass.....	.....	300-1500
Guttapercha.....	.....	80-200
Kerosene.....	1.0	164
Linen, varnished.....	.....	100-200
Mica.....	0.1	1500-2200
Mica.....	1.0	300-700
Oils:		
castor.....	0.2	190
castor.....	1.0	130
cottonseed.....	.....	70
lard.....	0.2	140
lard.....	1.0	40
linseed, raw.....	0.2	185
raw.....	1.0	90
boiled.....	0.2	190
boiled.....	1.0	80
lubricating.....	.....	50
olive.....	0.2	170
olive.....	1.0	75
paraffin.....	0.2	215
paraffin.....	1.0	160
sperm, mineral.....	0.2	180
mineral.....	1.0	85
natural.....	0.2	195
natural.....	1.0	90
turpentine.....	0.2	160
turpentine.....	1.0	110
Papers:		
beeswaxed.....	.....	770
blotting.....	.....	150
Manilla.....	.....	25
paraffined.....	.....	500
varnished.....	.....	100-250
Paraffin:		
melted.....	.....	75
solid, melt. point 43°.....	.....	350
solid, melt. point 70°.....	.....	450
Rubber.....	.....	160-500
Vaseline.....	.....	90-130
Xylol.....	0.2	140
Xylol.....	1.0	80

ELECTROMOTIVE FORCE AND COMPOSITION OF VOLTAIC CELLS

STANDARD CELLS
(From Smithsonian Tables.)

Name of cell.	Negative pole.	Solution.	Positive pole.	Depolarizer.	E.M.F. in volts.
Weston normal. Clark standard.	Cadmium amalgam. Zinc amalgam.	Saturated solution of CdSO_4 . Saturated solution of ZnSO_4 .	Mercury. Mercury.	Paste of Hg_2SO_4 and CdSO_4 . Paste of Hg_2SO_4 and ZnSO_4 .	1.0183 at 20° C. 1.4328 at 15° C.

Temperature equations:

$$E_t = 1.4328[1 - 0.00119(t - 15) - 0.000007(t - 15)^2] \text{ volt}$$

$$\text{Weston cell: } E_t = 1.0183[1 - 0.0000406(t - 20) - 0.00000095(t - 20)^2 + 0.00000001(t - 20)^3] \text{ volt}$$

DOUBLE FLUID CELLS

Name of cell.	Negative pole.	Solution.	Positive pole.	Solution.	E.M.F. in volts.
Bunsen.	Amal. zinc.	1 part H_2SO_4 to 12 parts H_2O .	Carbon.	Fuming nitric acid.	1.94
Bunsen.	Amal. zinc.	1 part H_2SO_4 to 12 parts H_2O .	Carbon.	HNO_3 , density, 1.38.	1.86
Bichromate.	Amal. zinc.	12 parts $\text{K}_2\text{Cr}_2\text{O}_7$ to 25 parts H_2SO_4 and 100 parts H_2O .	Carbon.	1 part H_2SO_4 to 12 parts H_2O	2.00
Bichromate.	Amal. zinc.	1 part H_2SO_4 to 12 parts H_2O .	Carbon.	12 parts $\text{K}_2\text{Cr}_2\text{O}_7$ to 100 parts H_2O .	2.03
Daniell.	Amal. zinc.	1 part H_2SO_4 to 4 parts H_2O .	Copper.	Saturated solution of $\text{CuSO}_4 + 5\text{H}_2\text{O}$.	1.06
Daniell.	Amal. zinc.	5% solution of $\text{ZnSO}_4 + 6\text{H}_2\text{O}$.	Copper.	Saturated solution of $\text{CuSO}_4 + 5\text{H}_2\text{O}$.	1.08
Daniell.	Amal. zinc.	1 part NaCl to 4 parts H_2O .	Copper.	Saturated solution of $\text{CuSO}_4 + 5\text{H}_2\text{O}$.	1.05
Grove.	Amal. zinc.	1 part H_2SO_4 to 12 parts H_2O .	Platinum.	Fuming nitric acid.	1.93
Grove.	Amal. zinc.	Solution of ZnSO_4 .	Platinum.	HNO_3 , density 1.33.	1.66

VOLTAIC CELLS (Continued)

ELECTROMOTIVE FORCE AND COMPOSITION OF VOLTAIC CELLS (Continued)

DOUBLE FLUID CELLS (Continued)

Name of cell.	Negative pole.	Solution.	Positive pole.	Solution.	E.M.F. in volts.
Grove.....	Amal. zinc.....	H ₂ SO ₄ solution, density 1.136.....	Platinum	HNO ₃ density 1.33.....	1.79
Grove.....	Amal. zinc.....	H ₂ SO ₄ solution, density 1.14.....	Platinum	HNO ₃ density 1.19.....	1.66
Grove.....	Amal. zinc.....	NaCl solution.....	Platinum	HNO ₃ density, 1.33.....	1.88

SINGLE FLUID CELLS

Name of cell.	Negative pole.	Solution.	Positive pole.	E.M.F.
Dry cell.....	Zinc.....	Ammonium Chloride.....	Carbon with MnO ₂	1.53
Leclanché.....	Amal. zinc.....	Solution of sal-ammoniac.....	Carbon, depolarizer: manganese peroxide with powdered carbon	1.46
Edison-Lalande.....	Amal. zinc.....	Solution of caustic potash.....	Copper, depolarizer, CuO.....	0.70
Chloride of silver.....	Zinc.....	23% sol. of sal-ammoniac.....	Silver, depolarizer: silver chloride.....	1.02

STORAGE CELLS

Name of cell.	Negative pole.	Solution.	Positive pole.	E.M.F.
Lead accumulator.....	Lead.....	H ₂ SO ₄ solution of density 1.1.....	PbO ₂	2.2
Regnier (1).....	Copper.....	CuSO ₄ + H ₂ SO ₄	PbO ₂	1.68 to 0.85, average, 1.3
Regnier (2).....	Amal. zinc.....	ZnSO ₄ solution.....	PbO ₂ in H ₂ SO ₄	2.36
Main.....	Amal. zinc.....	H ₂ SO ₄ , density about 1.1.....	PbO ₂	2.50
Edison.....	Iron.....	KOH, 20% solution.....	A nickel oxide.....	1.1, mean of full discharge

CONTACT POTENTIALS

Potential of metal at left minus potential of metal at top in volts. The values are given for room temperature and for pressures, indicated by the superscript. Figures indicate pressure in mm of Hg, *vac.*, vacuum, *atm.*, atmospheric pressure. The figures are for fresh surfaces.

	Brass	Plati- num	Other metals		Brass	Plati- num	Other metals
Aluminum	+1.04 ^{vac.}	+1.20	Fe, +0.87	CuO			Na, -2.52
	+0.19 ^{atm.}		Z, +0.29	Gold	-0.23 ^{atm.}		
Antimony	+0.15 ^{atm.}			Iron	+0.24 ^{vac}		Zn, -0.06 ^{vac}
Bismuth	+0.07 ^{atm.}	+0.35		Lead	+0.41 ^{atm.}		
Cadmium			Hg, -0.22 ^{os}	Magnesium	+1.47 ^{vac.}	+1.05	
C* + NH ₃			Cu, + 079	Mercury			Sb, -0.26 ^{os}
C + H ₂			Cu, +.096	Nickel	+0.16 ^{atm.}		Zn, +0.17 ^{os}
C + N ₂			Cu, + 129	Platinum	-0.32 ^{atm.}		
C + CO ₂			Cu, + 130	Potassium		+2.8	
C + NO			Cu, +.136	Silver	+0.05 ^{vac.}		
C + O ₂			Cu, +.142		-0.35 ^{atm.}		
C + O ₃			Cu, + 155	Sodium		+2.40	
Copper	+0.10 ^{vac.}	+0.13		Tin		+0.62	
	-0.04 ^{atm.}			Zinc		+0.90	
CuO			Li, -1.52				

* Coconut charcoal saturated with the gas named.

DIFFERENCE OF POTENTIAL BETWEEN METALS IN SOLUTIONS OF SALTS

The table gives the difference in potential in hundredths of a volt between zinc in a normal solution of sulphuric acid and the metal named at the head of the columns in the solution named at the side. The signs given refer to the external difference of potential.
(Magnanini.)

Strength of the solution in gramme molecules per liter.	Difference of potential in centivolts.					
	Zinc	Cad- mium	Lead	Tin	Cop- per	Silver
0.5 Sulphuric acid	0.0	36.6	51.3	51.3	100.7	121.3
1.0 Sodium hydroxide	-32.1	19.5	31.8	0.2	80.2	95.8
1.0 Potassium hydroxide	-42.5	15.5	32.0	-1.2	77.0	104.0
0.5 Sodium sulphate	1.4	35.6	50.8	51.4	101.3	120.9
1.0 Potassium nitrate	11.8	31.9	42.6	31.1	81.2	105.7
1.0 Sodium nitrate	11.5	32.3	51.0	40.9	95.7	114.8
0.5 Potassium bichromate	72.8	61.1	78.4	68.1	123.6	132.4
0.5 Potassium sulphate	1.8	34.7	51.0	40.9	95.7	114.8
0.2 Potassium chlorate	15. -10.	39.9	53.8	57.7	105.3	120.9
1.0 Ammonium chloride	2.9	32.4	51.3	50.9	81.2	101.7
1.0 Sodium chloride	.....	31.0	51.2	50.3	80.9	101.3
1.0 Potassium chloride	.....	32.1	51.6	52.6	81.6	107.6

ELECTROCHEMICAL EQUIVALENTS OF THE ELEMENTS

By G. A. Roush

Element	Valence	Mg per coulomb	Coulombs per mg	Grams per amp.-hr.	Amp.-hr. per gram	Lb./1000 amp.-hr.	Amp.-hr. per lb.
A	<i>n</i>	0.41393	2.41588	1.49014	0.67108	3.28519	304.396
Ab	7	0.32717	3.05656	1.17779	0.84904	2.59656	385.120
Ac	3	0.78411	1.27533	2.82280	0.35426	6.22320	160.689
Ag	1	1.11793 ¹	0.89451	4.02454	0.24848	8.87259	112.707
Al	3	0.09316	10.73415	0.33538	2.98171	0.73938	1352.480
As	5	0.15254	6.44106	0.55891	1.78918	1.23219	811.560
	3	0.25876	3.86464	0.93152	1.07351	2.05366	486.936
Au	3	0.68117	1.46805	2.45223	0.40779	5.40624	184.972
	1	2.04352	0.48935	7.35668	0.13593	16.21871	61.657
B	3	0.03737	26.75602	0.13455	7.43223	0.29662	3371.201
Ba	2	0.71171	1.40507	2.56216	0.39030	5.64858	177.035
Be	2	0.04674	21.39688	0.16825	5.94358	0.37092	2695.963
Bi	5	0.43316	2.30861	1.55938	0.64128	3.43784	290.880
	3	0.72193	1.38517	2.59896	0.38477	5.72973	174.528
Br	1	0.82815	1.20752	2.98132	0.33542	6.57269	152.145
C	4	0.03111	32.13989	0.11201	8.92775	0.24694	4049.558
	2	0.06223	16.06994	0.22402	4.46387	0.49388	2024.779
Ca	2	0.20767	4.81537	0.74761	1.33760	1.64819	606.726
Cb	5	0.19256	5.19320	0.69321	1.44255	1.52828	654.332
Cd	2	0.58244	1.71693	2.09677	0.47692	4.62258	216.329
Ce	3	0.48404	2.06594	1.74255	0.57387	3.84166	260.304
Cl	1	0.36743	2.72161	1.32275	0.75600	2.91616	342.917
Co	2	0.30539	3.27452	1.09931	0.90966	2.42356	412.617
Cr	6	0.08983	10.13247	0.32338	3.09235	0.71293	1402.668
	3	0.17965	5.56624	0.64676	1.54618	1.42585	701.334
Cs	1	1.37731	0.72606	4.95830	0.20168	10.93118	91.481
Cu	2	0.32938	3.03602	1.18576	0.84334	2.61416	382.532
	1	0.65876	1.51801	2.37152	0.42167	5.22831	191.266
D ²	1	0.020878	47.89771	0.075160	13.30492	0.16570	6035.011
Dy	3	0.56069	1.78351	2.01849	0.49542	4.44901	224.886
Er	3	0.57907	1.72691	2.08464	0.47970	4.59585	217.588
Eu	3	0.52504	1.90461	1.89016	0.52906	4.16708	241.911
F	1	0.19689	5.07895	0.70881	1.41082	1.56265	639.937
Fe	3	0.19291	5.18353	0.69451	1.43987	1.53113	653.114
	2	0.28938	3.45568	1.04176	0.95991	2.29669	435.409
Ga	3	0.24083	4.15232	0.86698	1.15342	1.91137	523.184
Gd	3	0.54179	1.84572	1.95046	0.51270	4.30002	232.737
Ge	4	0.18808	5.31680	0.67710	1.47689	1.49275	669.906
H	1	0.010446	95.73321	0.037605	26.59256	0.082904	12062.183
He	<i>n</i>	0.04147	24.11294	0.14930	6.69804	0.32914	3038.180
Hf	4	0.46269	2.16125	1.66570	0.60035	3.67223	272.313
Hg	2	1.03943	0.96207	3.74195	0.26724	8.24958	121.218
	1	2.07886	0.48103	7.48390	0.13362	16.49917	60.609
Ho	3	0.56974	1.75518	2.05107	0.48755	4.5218	221.149
I	1	1.31523	0.76032	4.73484	0.21120	10.43853	95.799
Il	3	0.50432	1.98288	2.72332	0.55080	3.90256	272.539
In	3	0.39641	2.52266	1.42707	0.70074	3.14614	317.849
Ir	4	0.50026	1.99896	1.80095	0.55546	3.97038	251.865
K	1	0.40514	2.46828	1.45850	0.68563	2.21545	310.998
Kr	<i>n</i>	0.86736	1.15293	3.12249	0.32026	6.88390	145.266

ELECTROCHEMICAL EQUIVALENTS OF THE ELEMENTS (Continued)

Element	Valence	Mg per coulomb	Coulombs per mg	Grams per amp.-hr.	Amp.-hr. per gram	Lb./1000 amp.-hr.	Amp.-hr. per lb.
La	3	0.47986	2.08393	1.72750	0.57887	3.80849	262.571
Li	1	0.07192	13.90490	0.25890	3.86247	0.57078	1751.988
Lu	3	0.60446	1.65438	2.17604	0.45955	4.79734	208.448
Ma	7	0.14478	6.90695	0.52121	1.91860	1.14908	870.262
Mg	2	0.12601	7.93586	0.45364	2.20440	1.00010	999.901
Mn	4	0.14230	7.02727	0.51229	1.95202	1.12941	885.421
	2	0.28461	3.51363	1.02458	0.97601	2.25881	442.711
Mo	6	0.16580	6.03125	0.59689	1.67535	1.31592	759.925
N	5	0.029032	34.44446	0.10452	9.56795	0.23042	438.995
	3	0.048387	20.66676	0.17419	5.74077	0.38403	260.397
Na	1	0.23831	4.19620	0.85792	1.16561	1.89139	528.712
Nd	3	0.49834	2.00665	1.79403	0.55740	3.95516	252.834
Ne	n	0.20915	4.78125	0.75294	1.32813	1.65995	602.428
Ni	2	0.30409	3.28846	1.09474	0.91346	2.41348	414.340
O	2	0.082902	12.06250	0.29845	3.35069	0.65796	1519.860
Os	4	0.49611	2.01567	1.78601	0.55991	3.93748	253.970
P	5	0.06421	15.57456	0.23115	4.32627	0.50959	1962.362
Pa	5	0.59845	2.08874	1.72352	0.58021	3.79972	263.177
Pb	4	0.53681	1.86284	1.93253	0.51746	4.26050	234.715
	2	1.07363	0.93142	3.86506	0.25873	8.52099	117.357
Pd	4	0.27642	3.61762	0.99513	1.00489	2.19388	455.812
Po	6	0.36269	2.75714	1.30570	0.76587	2.87857	347.394
Pr	3	0.48677	2.05436	1.75237	0.57065	3.86332	258.846
Pt	4	0.50578	1.97716	1.82080	0.54921	4.01417	249.117
Ra	2	1.17124	0.85379	4.21648	0.23716	9.29574	107.576
Rb	1	0.88580	1.12892	3.18889	0.31359	7.03030	142.241
Re	7	0.27581	3.62568	0.99292	1.00713	2.18901	456.828
Rh	4	0.26661	3.75085	0.95978	1.04190	2.11596	472.599
Rn	n	2.30052	0.43468	8.28187	0.12075	18.25839	54.769
Ru	4	0.26347	3.79548	0.94850	1.05430	2.09108	478.222
S	6	0.05537	18.05989	0.19934	5.01664	0.43946	2275.508
	4	0.08306	12.03993	0.29901	3.34442	0.65919	1517.005
	2	0.16611	6.01996	0.59801	1.67221	1.31839	758.503
Sb	5	0.25235	3.96272	0.90847	1.10075	2.00283	499.294
	3	0.42059	2.37763	1.51411	0.66045	3.33805	299.576
Sc	3	0.15579	6.41907	0.56083	1.78307	1.23642	808.789
Se	6	0.13637	7.33283	0.49094	2.03690	1.08234	923.921
Si	4	0.07269	13.75624	0.26170	3.82118	0.57695	1733.257
Sm	3	0.51962	1.92448	1.87063	0.53458	4.12404	242.451
Sn	4	0.30751	3.25190	1.10705	0.90330	2.44062	409.732
	2	0.61503	1.62595	2.21409	0.45165	4.88124	204.866
Sr	2	0.45404	2.20244	1.63455	0.61179	3.60356	277.503
Ta	5	0.37488	2.66751	1.34957	0.74098	2.97529	336.101
Tb	3	0.54991	1.181847	1.97969	0.50513	4.36447	229.113
Te	6	0.22040	4.53726	0.79343	1.26037	1.74921	571.686
Th	4	0.60135	1.66293	2.16485	0.46193	4.77268	209.526
Ti	4	0.12409	8.05846	0.44674	2.23846	0.98488	1015.348
Tl	3	0.70601	1.41641	2.54164	0.39345	5.59002	178.571
Tm	3	0.58516	1.70897	2.10653	0.47471	4.64410	215.327
U	6	0.41117	2.43206	1.48023	0.67557	3.26168	306.591

ELECTROCHEMICAL EQUIVALENTS OF THE ELEMENTS (Continued)

Element	Valence	Mg per coulomb	Coulombs per mg	Grams per amp.-hr.	Amp.-hr. per gram	Lb./1000 amp.-hr.	Amp.-hr. per lb.
V	5	0.10560	9.47007	0.38015	2.63057	0.83808	1193.209
Vi	1	2.32124	0.43080	8.35648	0.11967	18.42288	54.280
W	6	0.31779	3.14674	1.14404	0.87409	2.52218	396.483
Xe	<i>n</i>	1.36062	0.73496	4.89824	0.20416	10.79877	92.603
Y	3	0.30715	3.25574	1.10574	0.90437	2.43774	410.216
Yb	3	0.59772	1.67302	2.15179	0.46473	4.74389	210.797
Zn	2	0.33876	2.95197	1.21952	0.81999	2.68859	371.942
Zr	4	0.23632	4.23153	0.85076	1.17542	1.87560	533.164

The above compilation is abridged from a complete table published in Volume 73 of the Transactions of the Electrochemical Society, but has been corrected to correspond to the 1942 atomic weights as published by the American Chemical Society and the best values obtainable for the few elements not listed in the official table; in most cases the only valence covered is that which determines the placing of the element in the periodic table, though in a few cases the most important valence from an electrochemical standpoint is given precedence, and for a few of the more important elements two or more valences are given; values for elements in the O group of the periodic system are calculated on the basis of unit valence, listed as *n*, to distinguish them from elements with a true unit valence. For uses where a more complete table is required, the reader is referred to the original publication.

Digits printed in italics may, if desired, be dropped from the values, rounding them off to the nearest preceding digit; such digits have been carried as a matter of convenience and uniformity in calculating and tabulating, but are in excess of the number of significant figures in the primary data, and hence do not add to the true accuracy of the results.

¹ This value varies from the basic figure of 1.1180 mg because of the rounding off of the value of the Faraday to 96,500 coulombs; other values also differ in the same proportion.

² This is the second isotope of hydrogen, and is the only isotope included in the table, as no others have as yet been isolated to a sufficient degree to have their atomic weights determined.

INTERNAL RESISTANCE OF VARIOUS VOLTAIC CELLS

The internal resistance is subject to large variations; the values given can be considered only approximate.

Cell	Resistance, ohms	Cell	Resistance, ohms
Edison-Lalande . . .	0.03	Grove	0.1-0.2
Daniell	0.85	Bunsen	0.1-0.2
Gravity	1-5	Bichromate	0.08-0.40
Silver chloride . . .	4.	Storage	0.004-0.02
Dry cell	0.05-0.10	Clark standard . . .	20-50
Leclanché	0.4-0.2	Weston standard . . .	20-50

IONIZATION POTENTIALS

THE ELEMENTS

The following table gives the ionization potentials in volts for the elements in the atomic state. The degree of ionization is indicated by the numerals I, II, etc. Doubtful values are indicated by parentheses.

El.	At. No.	Ionization potential, volts					
		I	II	III	IV	V	VI
A	18	15.68	27.76	40.75	(61)	(78)	.....
Ac	89	.....	.....	.....	.....	.....	.....
Ag	47	7.542	21.4	35.9	.....	.....	.....
Al	13	5.96	18.74	28.31	119.37	153.4	.....
As	33	10.5	20.1	28.0	49.9	62.5	.....
Au	79	9.18	19.95	.....	.....	.....	.....
B	5	8.257	25.00	37.75	258.1	338.5	.....
Ba	56	5.19	9.95	.....	.....	.....	.....
Be	4	9.28	18.12	153.1	216.6	.....	.....
Bi	83	8.0	16.6	25.42	45.1	55.7	.....
Br	35	11.80	19.1	25.7	(50)	.....	.....
C	6	11.217	24.27	47.65	64.22	390.1	.....
Ca	20	6.09	11.82	50.96	69.7	.....	.....
Cb	41	.....	.....	24.2	.....	49.3	.....
Cd	48	8.96	16.84	38.0	.....	.....	.....
Ce	58	6.54	14.8	.....	(36.5)	.....	.....
Cl	17	12.952	23.67	39.69	53.16	67.4	.....
Co	27	7.81	17.3	.....	.....	.....	.....
Cr	24	6.74	16.6	.....	.....	(73)	.....
Cs	55	3.87	23.4	(35)	(51)	(58)	.....
Cu	29	7.68	20.34	29.5	.....	.....	.....
Dy	66	6.8	.....	.....	.....	.....	.....
Er	68	.....	.....	.....	.....	.....	.....
Eu	63	5.64	11.4	.....	.....	.....	.....
F	9	17.34	34.81	62.35	86.72	113.67	156.37*
Fe	26	7.83	16.16	.....	.....	.....	.....
Ga	31	5.97	20.43	30.6	63.8	.....	.....
Gd	64	6.7	.....	.....	.....	.....	.....
Ge	32	8.09	15.86	34.07	45.5	93.0	.....
H	1	13.527	.....	.....	.....	.....	.....
He	2	24.46	54.14	.....	.....	.....	.....
Hf	72	.....	(14.8)	.....	.....	.....	.....
Hg	80	10.39	18.65	34.3	(72)	(82)	.....
Ho	67	.....	.....	.....	.....	.....	.....
I	53	10.6	19.4	.....	.....	.....	.....
Il	61	.....	.....	.....	.....	.....	.....
In	49	5.76	18.79	27.9	57.8	.....	.....
Ir	77	.....	.....	.....	.....	.....	.....
K	19	4.318	31.66	46.5	.....	.....	.....
Kr	36	13.93	26.4	36.8	(68)	.....	.....
La	57	5.6	11.4	(20.4)	.....	.....	.....
Li	3	5.363	75.26	121.8	.....	.....	.....
Lu	71	.....	.....	.....	.....	.....	.....
Ma	43	.....	.....	.....	.....	.....	.....
Mg	12	7.61	14.96	79.72	108.9	.....	.....
Mn	25	7.41	15.70	.....	.....	(76)	.....
Mo	42	7.35	.....	.....	.....	60.8	.....
N	7	14.48	29.47	47.40	77.0	97.4	.....
Na	11	5.12	47.06	70.72	.....	.....	.....
Nd	60	6.3	.....	.....	.....	.....	.....
Ne	10	21.47	40.9	63.2	.....	.....	.....

* Seventh ionization potential of fluorine, 184.26 volts.

IONIZATION POTENTIALS (Continued)

THE ELEMENTS (Continued)

El.	At. No.	Ionization potential, volts					
		I	II	III	IV	V	VI
Ni	28	7.61	18.2	.....	76.99	113.	137.5
O	8	13.550	34.93	54.87	76.99	113.	137.5
Os	76	(8.7)	.....	.....	.....	.....	.....
P	15	10.9	19.56	30.012	51.106	64.698	.....
Pa	91	.....	.....	.....	.....	.....	.....
Pb	82	7.38	14.96	(31.9)	42.11	69.4	.....
Pd	46	8.3	19.8	.....	.....	.....	.....
Po	84	.....	.....	.....	.....	.....	.....
Pr	59	5.8	.....	.....	.....	.....	.....
Pt	78	8.88	.....	.....	.....	.....	.....
Ra	88	5.252	10.099	.....	.....	.....	.....
Rb	37	4.159	27.36	(47)	(80)	.....	.....
Re	75	.....	.....	.....	.....	.....	.....
Rh	45	7.7	.....	.....	.....	.....	.....
Rn	86	10.698	.....	.....	.....	.....	.....
Ru	44	7.7	.....	.....	.....	.....	.....
S	16	10.30	23.3	34.9	47.08	63.	87.65
Sb	51	8.5	(18)	24.7	44.0	55.5	.....
Sc	21	6.7	12.8	24.61	(73.9)	(97.0)	.....
Se	34	9.70	21.3	33.9	42.72	72.8	.....
Si	14	8.12	16.27	33.35	44.93	165.6	.....
Sm	62	6.6	11.4	.....	.....	.....	.....
Sn	50	7.30	14.5	30.5	39.4	80.7	.....
Sr	38	5.667	10.98	.....	.....	.....	.....
Ta	73	.....	.....	.....	.....	.....	.....
Tb	65	6.7	.....	.....	.....	.....	.....
Te	52	8.96	.....	30.5	37.7	60.0	(72)
Th	90	.....	.....	29.4	.....	.....	.....
Ti	22	6.81	13.6	27.6	42.98	(99.6)	.....
Tl	81	6.07	20.32	29.7	50.5	.....	.....
Tm	69	.....	.....	.....	.....	.....	.....
U	92	.....	.....	.....	.....	.....	.....
V	23	6.71	14.1	(26.4)	(48)	(65)	.....
W	74	8.1	.....	.....	.....	.....	.....
Xe	54	12.08	(21.1)	32.0	(46)	(76)	.....
Y	39	6.5	12.3	20.4	.....	.....	.....
Yb	70	7.1	.....	.....	.....	.....	.....
Zn	30	9.36	17.89	40.0	.....	.....	.....
Zr	40	6.92	13.97	24.00	33.8	.....	.....

COMPOUNDS

The first ionization potential of the molecules indicated is given in volts.

Compound	Ionization potential I volts	Compound	Ionization potential I volts
Br ₂	12.8	CH ₃ Cl, methyl chloride	10.7
BrCl.....	12.9 (calc.)	CH ₃ I, methyl iodide....	9.1
C ₂	12	CH ₄ , methane.....	14.5
CH ₂ O, formaldehyde.....	11.3	CN.....	14
CH ₃ Br, methyl bromide..	10.0	CO.....	14.1

IONIZATION POTENTIALS (Continued)

COMPOUNDS (Continued)

Compound	Ionization potential I volts	Compound	Ionization potential I volts
CO ₂	14.4	HI.....	12.8
CS.....	10.6	H ₂ O.....	12.56
CS ₂	10.4	H ₂ S.....	10.42
C ₂ H ₂ , acetylene.....	11.6	I ₂	9.7
C ₂ H ₄ , ethylene.....	12.2	IBr.....	11.6 (calc.)
C ₂ H ₆ , ethane.....	12.8	ICl.....	11.9 (calc.)
C ₆ H ₆ , benzene.....	9.6	N ₂	15.51
C ₇ H ₈ , toluene.....	8.5	NH ₃	11.2
Cl ₂	13.2	NO.....	9.5
F ₂	17.8 (calc.)	NO ₂	11.0
H ₂	15.6	N ₂ O.....	12.9
HBr.....	13.2	O ₂	12.5
HCN.....	14.8	S ₂	10.7
HCl.....	13.8	SO ₂	13.1
HF.....	17.7 (calc.)		

PROPERTIES OF METALS AS CONDUCTORS

Metal.	Resistivity microhm- centimeters 20° C.	Temp. coefficient 20° C.	Specific gravity.	Tensile strength, lbs./in.	Melting point ° C.
Advance. See <i>constantan</i>					
Aluminum.....	2.824	0.0039	2.70	30,000	659
Antimony.....	41.7	.0036	6.6	.....	630
Arsenic.....	33.3	.0042	5.73	.....	.....
Bismuth.....	120	.004	9.8	.....	271
Brass.....	7	.002	8.6	70,000	900
Cadmium.....	7.6	.0038	8.6	.....	321
Calido. See <i>nichrome</i>					
Climax.....	87	.0007	8.1	150,000	1250
Cobalt.....	9.8	.0033	8.71	.....	1480
Constantan.....	49	.00001	8.9	120,000	1190
Copper: annealed...	1.7241	.00393	8.89	30,000	1083
hard-drawn.....	1.771	.00382	8.89	60,000	.....
Eureka. See <i>constantan</i>					
Excello.....	92	.00016	8.9	95,000	1500
Gas Carbon.....	5000	— .0005	.....	.....	3500
German silver, 18% Ni	33	.0004	8.4	150,000	1100
Gold.....	2.44	.0034	19.3	20,000	1063
Ideal. See <i>constantan</i>					
Iron, 99.98% pure..	10	.005	7.8	.....	1530
Lead.....	22	.0039	11.4	3,000	327
Magnesium.....	4.6	.004	1.74	33,000	651
Manganin.....	44	.00001	8.4	150,000	910
Mercury.....	95.783	.00089	13.546	0	—38.9
Molybdenum, drawn	5.7	.004	9.0	.....	2500
Monel metal.....	42	.0020	8.9	160,000	1300
Nichrome.....	100	.0004	8.2	150,000	1500
Nickel.....	7.8	.006	8.9	120,000	1452
Palladium.....	11	.0033	12.2	39,000	1550
Phosphor bronze...	7.8	.0018	8.9	25,000	750
Platinum.....	10	.003	21.4	50,000	1755
Silver.....	1.59	.0038	10.5	42,000	960
Steel, E. B. B.....	10.4	.005	7.7	53,000	1510
Steel, B. B.....	11.9	.004	7.7	58,300	1510
Steel, Siemens-Martin	18	.003	7.7	100,000	1510
Steel, manganese....	70	.001	7.5	230,000	1260
Tantalum.....	15.5	.0031	16.6	.....	2850
Therlo.....	47	.00001	8.2	.....	.....
Tin.....	11.5	.0042	7.3	4,000	232
Tungsten, drawn....	5.6	.0045	19	500,000	3400
Zinc.....	5.8	.0037	7.1	10,000	419

RESISTIVITY

Giving the resistivity ρ for metals, including alloys and carbon. Temperature coefficients of resistance are given in a succeeding table.

Material	Temp. °C.	Resistivity ohm-cm	Authority
Advance,	0	47.—49.	
Aluminum, commercial Al 99.57, Si 0.29, Fe 0.14 pure	20 -189 -100 0 +100 400	2.828×10^{-6} .64 1.53 2.63 3.86 8.0	Bureau of Standards Nicolai, 1907 " " "
Aluminum bronze Cu 97, Al 3 Cu 90, Al 10 Cu 6, Al 94	0 0 0 0	12.—13. 8.26 12.6 3.1	Various Pechoux, 1909 "
Antimony liquid	20 -190 +860	41.7 10.5 120.	Bureau of Standards Eucken, Gehloff de la Rive
Argentan Cu 56, Ni 26	15	42.	Matthiessen
Arsenic	0	35.	"
Bismuth	18	119.0	Jäger, Diesselhorst
	100	160.2	"
	-200	34.8	Various
	-100	75.6	"
	+100	156.5	Northrup, 1914
	200	214.5	"
liquid	300	128.9	"
"	500	139.9	"
"	700	150.8	"
Brass various	0	6.4—8.4	Various
hard drawn Cu	0	8.2	Siemens
70.2, Zn 29.8	0	7.0	"
annealed	0	7.0	"
Bronze Cu 88, Sn 12	20	18	
Cu 89, Sn 6, Zn 4	15	13.5	
Cadmium, drawn	18	7.54	Jäger, Diesselhorst
	100	9.82	"
	-252.9	0.17	Euchen, Gehlloff, 1912
	-200	1.66	"
	-100	4.80	"
	+300	16.50	Northrup, 1913
liquid	400	33.70	"
	500	35.12	"
	700	35.78	"
Caesium	0	19	Various
	-187	5.25	Guntz, Broniewski
	27	22.2	Hackspill
liquid	30	36.6	"
Calcium, Ca 99.57 %	20	4.6	Swisher, 1917
Calido,	0	110	
Carboloy	20	19.6	
Carbon	0	3500	
	500	2700	
	1000	2100	
	2000	1100	
	2500	900	

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Chromium	0	2.6×10^{-8}	Shukow
Climax,	20	87	Bureau of Standards
Cobalt, Co 99.8 %	20	9.7	Reichardt, 1901
Constantan, Cu 60, Ni 40	20	49	Bureau of Standards
	-200	42.4	Niccolai
	-150	43.0	"
	-100	43.5	"
	-50	43.9	"
	0	44.1	"
	+100	44.6	"
	400	44.8	"
Copper, commercial annealed	20	1.7241*	Bureau of Standards
hard drawn	20	1.77	"
pure, annealed	20	1.692	Wolff, Dellinger 1910
	-258.6	.014	Niccolai
	-206.6	.163	"
	-150	.567	"
	-100	.904	"
	+100	2.28	Northrup, 1914
	200	2.96	"
	500	5.08	"
	1000	9.42	"
liquid	1500	24.62	"
Copper-manganese			
Mn 0.98	0	4.83	Münker, 1912
Mn 1.49	0	6.66	"
Mn 4.2	20	17.9	Sebast & Gray, 1916
Mn 7.4	20	19.7	" " " "
Mn 15	20	50	Klein, 1924
Copper-manganese- iron			
Cu 91, Mn 7.1, Fe 1.9	0	20	Blood
Cu 70.6, Mn 23.2, Fe 6.2	0	77	"
Copper-manganese- nickel			
Cu 73, Mn 24, Ni 3	0	48	Feussner, Lindeck
Eureka	0	47	Drysdale, 1907
Excello	20	92	Bureau of Standards
Gallium	0	53	Guntz, Broniewski
German silver, Ni 18 %	20	33	Bureau of Standards
Cu 60.16, Zn 25.37, Ni 14.03, Fe 0.3, Co and Mn trace	-200	27.9	Dewar, Fleming
	-100	29.3	
	+100	33.1	
Gold, pure, drawn	20	2.44	Jäger, Diesselhorst
	-252.8	.018	Niccolai
	-200	.601	"
99.9 pure	-183	.68	Dewar, Fleming
	-150	.997	Niccolai, 1907
	-100	1.400	"
	+100	2.97	Northrup, 1914

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Gold, 99.9 pure	200	3.83×10^{-6}	Northrop, 1914
	500	6.62	"
	1000	12.52	"
	1500	3.70	"
Gold-copper-silver			Matthiessen
Au 58.3, Cu 26.5,	0	13.2	"
Ag 15.2			"
Au 66.5, Cu 15.4,	0	14.6	"
Ag 18.1			"
Au 7.4, Cu 78.3,	0	3.6	"
Ag 14.3			
Gold-silver			
Au 90, Ag 10	0	6.3	
Au 67, Ag 33	0	10.8	
Graphite	0	800	
	500	830	
	1000	870	
	2000	1000	
	2500	1100	
Ia — Ia			
Cu 60, Ni 40	0	50	Drysdale, 1907
Ideal, (See constantan)			
Illium		91.61	Knipp, Hall 1922
Indium	0	8.37	Erhardt, 1881
Invar (See steel)			
Iridium	-186	1.92	Broniewski, Hackspill
	0	6.10	"
	100	3.30	"
Iron 99.98% pure	20	10	Bureau of Standards
	-252.7	0.011	Niccolai
	-205.3	.652	Dewar, Fleming
	-200.	2.27	Niccolai
	-192.5	.844	"
	-100	5.92	"
	+100	16.61	"
	200	24.50	"
	400	43.29	"
(See also under steel)			
Lead	20	22.	Bureau of Standards
	-252.9	.59	Schimank, Nernst
	-203	4.42	"
	-192.8	5.22	"
	-103	11.8	
	+100	27.8	Northrup
	200	38	"
	219	50	"
liquid	333	95.0	"
"	400	98.3	"
"	600	107.2	"
"	800	116.2	"
cold pressed	-183	6.02	Dewar, Fleming
"	-78	14.1	
"	0	20.4	
"	90.4	28.0	
"	196.1	36.9	
Lithium	-187	1.34	Guntz, Broniewski
	0	8.55	"
	99.3	12.7	"

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Lithium liquid	230	45.2×10^{-6}	Bernini, 1905
Magnesium	20	4.6	Bureau of Standards
Zn free	-183	1.00	Dewar, Fleming
"	-78	2.97	"
"	0	4.35	"
"	98.5	5.99	"
pure	400	11.9	Niccolai, 1907
Manganese		5.0	Shukow
Manganese-copper			
Mn 30, Cu 70	0	100	Feussner, Lindeck
Manganin, Cu 84, Mn 12, Ni 4	20	44	Bureau of Standards
	22.5	45	Kimura, Sakamaki
	-200	37.8	Niccolai
	-100	38.5	"
	-50	38.7	"
	0	38.8	"
	100	38.9	"
	400	38.3	"
Mercury	20	95.783	Bureau of Standards
solid	-183.5	6.97	Dewar, Fleming
"	-102.9	15.04	"
"	-50.3	12.3	"
"	-39.2	25.5	"
liquid	-36.1	80.6	"
"	0	94.07	"
"	50	98.50	Grimaldi
"	100	103.25	Vincentini, Omodei
"	200	114.27	"
"	350	135.5	"
"	100	103.1	Northrup
"	200	114.0	"
"	300	127.0	"
Molybdenum, drawn	20	5.7	Bureau of Standards
Monel metal	20	42	Bureau of Standards
Nichrome	20	100	Bureau of Standards
Nickel	20	7.8	Bureau of Standards
pure	-182.5	1.44	Fleming, 1900
"	-78.2	4.31	"
"	0	6.93	"
"	94.9	11.1	"
"	400	60.2	Niccolai, 1907
Nickel-copper-zinc	0	20.3	Matthiessen
Ni 12.84, Cu 30.59 Zn 6.57 by vol.			
Nickelin	0	33	Feussner, Lindeck
Ni 18.46, Cu 61.63 Zn 19.67, Fe 0.24 Co 0.19, Mn 0.18			
Osmium	20	60.2	Niccolai
Palladium	20	11	Bureau of Standards
	-183	2.78	Dewar, Fleming
	-78	7.17	"
	0	10.21	"
	98.5	13.79	"
Patent nickel	0	34	Feussner, Lindeck
Ni 25.1, Cu 74.41 Fe 0.42, Zn 0.23 Mn 0.13, Co trace			
Phosphor bronze			
Sn 5.08, P 0.01		10.5	
Sn 2	0	5-6	

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Platinoid, Cu 62, Ni 15, Zn 22	-160	32.5×10^{-6}	Lees, 1908
Platinum	18	34.4	"
	20	10	Bureau of Standards
	-203.1	2.44	Dewar, Fleming
	-97.5	6.87	"
	0	10.96	"
	+100	14.85	"
	400	26	Niccolai
	-265	.10	Nernst
	-253	.15	"
	-233	.54	"
	-153	4.18	"
	-73	7.82	"
	0	11.05	"
	+100	14.1	Pirani
	200	17.9	"
	400	25.4	"
	800	40.3	"
	1000	47.0	"
	1200	52.7	"
	1400	58.0	"
	1600	63.0	"
Platinum-iridium			
P 90, Ir 10	0	24	Barnes, 1888
P 80, Ir 20	0	31	"
Platinum-rhodium	-200	14.49	Dewar, Fleming
Pt 90, Rh 10	-100	18.05	"
	0	21.14	"
	+100	24.20	"
Platinum-silver	0	24.2	
Pt 67, Ag 33			
Platinite, nickel steel	0	45	
Ni 46-48%			
Potassium	-200	1.72	Guntz, Broniewski
	-100	3.72	"
	-75	4.0	Hackspill
	0	6.1	"
	+55	8.4	"
liquid	100	15.31	Northrup
Rheotan	0	53	Feussner, Lindeck
Cu 53.28, Ni 25.31			
Zn 16.80, Fe 4.46			
Mn 0.37			
Rhodium	-186	0.7	Broniewski, Hackspill
	-78.3	3.09	"
	0	4.69	"
	+100	6.60	"
Rose metal	0	64	
Bi 49, Pb 28,			
Sm 23			
Rubidium	-190	2.5	Hackspill
	0	11.6	
	+35	13.4	
liquid	40	19.6	
Silicium (silicon)	20	58.	
Silicium bronze	0	2.4	
Silver 99.98%	18	1.629	Jäger, Diesselhorst
electrolytic	-183	0.390	Dewar, Fleming
"	-78	1.021	"

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Silver, 99.98 % electrolytic	0	1.468×10^{-8}	Dewar, Fleming
"	+98.15	2.062	" "
"	192.1	2.608	" "
"	-258.6	.009	Niccolai
"	-200	.357	"
"	-100	.916	"
"	0	1.506	"
"	+100	2.15	Northrup
"	200	2.80	"
"	400	3.46	"
"	750	6.65	"
liquid	1000	11.3	"
"	1500	15.3	"
Sodium	-180	1.0	Hackspill
"	-75	2.8	"
"	0	4.3	"
"	55	5.4	"
liquid	116	10.2	"
"	-200	0.605	Various
"	140	10.34	Northrup
Sodium-amalgam	0	95	
Hg 98, Na 2			
Steel			
aluminum	20	64	Portevin, 1909
Al 5, C 0.2			"
Al 15, C 0.9	20	88	"
chromium	20	60	"
Cr 13, C oz			
Cr 40, C 0.8	20	71	
invar			
35 % Ni	20	81	Bureau of Standards
manganese	20	70	" "
nickel			
Ni 10, C 0.1	20	29	
Ni 25, C 0.1	20	39	
Ni 80, C 0.1	20	82	Portevin, 1909
piano wire	0	11.8	Stronhal, Barnes
Siemens-martin	20	18	Bureau of Standards
silicon, Si 25 %	20	45	
Si 4 %	20	62	
tempered glass			
hard		45.7	Stronhal, Barnes
tempered yellow		27	" "
" blue		20.5	" "
" soft		15.9	" "
titanium			
Ti 2.5, C 0.15,	20	16	Portevin, 1909
tungsten			
W 5, C 0.2	20	20	"
W 20, C 0.2	20	24	"
vanadium			
V 5, C 1.1	20	121	"
Strontium	20	24.8	Matthiessen
Tantalum	27	13.85	Malter, 1939
"	727	44.1	" "
Tellurium	19.6	200,000	Matthiessen
Thallium, pure	-183	4.08	Dewar, Fleming
"	-78	11.8	" "
"	0	17.60	" "
"	+98.5	24.7	" "

RESISTIVITY (Concluded)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Therlo	20	47×10^{-6}	Bolton, 1909
Thorium	15	40.1	Rentschler, Marden, 1925
	20	18	Bureau of Standards
Tin	20	11.5	Bureau of Standards
	-184	3.40	Dewar, Fleming
	-78	8.8	" "
	0	13.0	" "
	+91.45	18.2	" "
	200	20.30	Northrup
	225	22.00	"
liquid	235	47.60	"
	750	61.22	"
Tin-bismuth			
Sn 90.5, Bi 9.5,	12	16	
Sn 2., Bi 98	0	244	
Tin-lead			
Sn 90, Pb 10	15	13.5	
Sn 33.3, Pb 66.7	15	16	Laport, 1897
Titanium		3.2	Shukow
Tungsten	20	5.51	Langmuir, 1916
	727	25.3	"
	1227	41.4	"
	1727	59.4	"
	2727	98.9	"
	3237	118	
Wood's metal			
Bi 56, Pb 14, Sn 14	0	52	
Zinc	-183	1.62	Dewar, Fleming
	-78	3.34	" "
	0	5.75	" "
	+92.5	8.00	
	191.5	10.37	
liquid	440	37.2	de la Rive
	100	7.95	Northrup
	300	13.25	"
	415	17.00	"
liquid	427	37.30	"
"	500	36.60	"
"	600	35.90	"
"	700	35.60	"
"	800	35.60	"
"	850	35.74	"

Material	Temp. °C.	Resistivity ohm-cm	Temperature coefficient
Alloy 193	0	$87-96 \times 10^{-6}$	0.000014-.0008
Alumel	0	33.3	0.0012
Chromel	0	70-110	0.00011-.000054
Copel	0	49.5	0.00000
Dowmetal	0	13-17	.....
Duralumin	0	3.35	.....
Nichrome II	0	109-111	0.00015
" III	0	90-97	0.00005-.00019
" IV	0	98-103	0.00018

TEMPERATURE COEFFICIENT OF RESISTIVITY

Giving the temperature coefficient of resistivity for degrees centigrade for various metals including alloys.

Material	T °C.	α	Authority
Advance (<i>See constantan</i>)			
Aluminum	18	0.0039	Jäger, Diesselhorst, 1900
	25	.0034	Somerville, 1910
	100	.0040	"
	500	.0050	"
annealed, highest purity	0-100	.00445	Holborn, 1921
Aluminum-bronze			
Cu 97, Al 3		.00102	
Cu 90, Al 10		.00320	
Cu 6, Al 94		.00380	
Antimony	20	.0036	
Arsenic		.0042	
Bismuth	20	.004	Bureau of Standards
	0-100	.00446	Holborn, 1921
Brass	20	.002	Bureau of Standards
Cu 66, Zn 34	15	.0020	
Cu 60, Zn 40	15	.0010	
Bronze			
Cu 88, Sn 12	20	.0005	
Cadmium	20	.0038	Bureau of Standards
drawn			
annealed, pure	0-100	.00424	Holborn, 1921
	0	.0042	
Carbon		-.0005	
Climax	20	+.0007	Bureau of Standards
Cobalt	0	.0033	
	0-100	.00658	Holborn, 1921
Constantan	12	.000008	Somerville, 1911
	25	.000002	"
	100	.000033	"
	200	.000020	"
	500	.000027	"
Copper, annealed	20	.00393	Bureau of Standards
hard drawn	20	.00382	"
	100	.0038	Somerville, 1911
	400	.0042	"
	1000	.0062	"
electrolytic	0	.0041	
pure, annealed	0-100	.00433	Holborn, 1921
Copper-manganese			
Cu 96.5, Mn 3.5		.00022	Feussner, Lindeck
Cu 95, Mn 8		.000026	" "
Cu 70, Mn 30		.00004	" "
Copper-manganese-iron			
Cu 91, Mn 7.1, Fe 1.9	0	.000120	Blood
Cu 70.6, Mn 23.2, Fe 6.2	0	.000022	"
Copper-manganese-nickel			
Cu 73, Mn 24, Ni 3	0	-.00003	Feussner, Lindeck
Eureka	0	+.00005	Drysdale, 1907
Excello	20	.00016	Bureau of Standards
German-silver			
Ni 18%	20	.0004	Bureau of Standards
Cu 60, Zn 25, Ni 15	0	.00036	Feussner, Lindeck
Gold	20	.0034	Bureau of Standards
	100	.0025	Somerville, 1910
	500	.0035	"
	1000	.0049	"
	0-100	.00400	Holborn, 1921

TEMPERATURE COEFFICIENT OF RESISTIVITY

(Continued)

Material	T °C.	α	Authority
Gold-copper-silver			
Au 58.3, Cu 26.5, Ag 15.2	0	.000574	Matthiessen
Au 66.5, Cu 15.4, Ag 18.1	0	.000529	"
Au 7.4, Cu 78.3, Ag 14.3	0	.001830	"
Gold-silver			
Au 90, Ag 10	0	.0012	
Au 67, Ag 33	0	.00065	
Ia Ia			
Cu 60, Ni 40	0	-.00003	Drysdale, 1907
Plum	0	+.000479	Knipp-Hall, 1922
Indium	0	.0047	
Iridium	0-100	.00411	Holborn, 1921
Iron	20	.0050	Bureau of Standards
	0	.0062	Dewar, Fleming
	25	.0052	Somerville, 1910
	100	.0068	"
	500	.0147	"
	1000	.0050	"
	0-100	.00657	Holborn, 1912
Lead	18	.0043	Jäger, Diesselhorst
pure	0-100	.00422	Holborn, 1921
Lithium	0	.0047	
	230	.0027	
Magnesium	20	.004	Bureau of Standards
	0	.0038	Vincentini, Omodei
	25	.0050	Somerville, 1910
	100	.0045	"
	500	.0036	"
	600	.0100	"
	0	.000040	Feussner-Lindeck
Manganese-copper			
Mn 30, Cu 70			
Manganin			
Cu 84, Mn 12, Ni 4	12	.000006	Somerville, 1910
	25	.000000	"
	100	-.000042	"
	250	-.000052	"
	475	.000000	"
	500	+.00011	"
Mercury	20	.00089	Bureau of Standards
	0	.00088	Glazebrook
Molybdenum	25	.0033	Somerville
	100	.0034	"
	1000	.0048	"
	0-100	.00435	Holborn, 1921
Monel-metal	20	.0020	Bureau of Standards
Nichrome	20	.0004	Bureau of Standards
Nickel	20	.006	Bureau of Standards
	0	.006	Vincentini
	25	.0043	Somerville
	100	.0043	"
	500	.0030	"
	1000	.0037	"
pure, annealed	0-100	.00675	Holborn, 1912
Palladium	20	.0033	Bureau of Standards
pure	0-100	.00377	Holborn
"	0	.0035	Dewar, Fleming
Phosphor-bronze	0	.0040 -	
		.0030	

TEMPERATURE COEFFICIENT OF RESISTIVITY

(Concluded)

Material	T °C.	α	Authority
Platinite, nickel steel, Ni 46-48 %	0	.003	
Platinum	20	.003	Bureau of Standards
	0	.0037	Dewar, Fleming
	0-100	.00392	Holborn, 1921
Platinum-iridium			
Pt 90, Ir 18	0	.0012	Barnes, 1888
Pt 80, Ir 20	0	.0008	"
Platinum-rhodium			
Pt 90, Rh 10	0	.0013	Le Chatelier, 1900
Platinum-silver			
Pt 33, Ag 67	0	.00024	
Potassium	0	.0055	
liquid	100	.0042	
Rheotan	0	.0004	
Rhodium	0-100	.00443	Holborn
Rose metal	0	.0020	
Rubidium	0	.0060	
Silicium bronze	0	.0038-	
		.0023	
Silver	20	.0038	Bureau of Standards
	25	.0030	Somerville, 1910
	100	.0036	"
	500	.0044	"
pure, annealed	0-100	.00410	Holborn, 1921
Sodium	0	.0044	
liquid	120	.0033	
Steel			
invar	0	.0020	
Ni 36, C 0.2			
piano wire	0	.0032	Strouhal, Barnes
Siemens-Martin	20	.003	Bureau of Standards
Silicon			
Si 4 %	20	.0008	
tempered glass hard	0	.0016	Strouhal, Barnes
tempered blue	0	.0033	"
Tantalum	20	.0031	Bureau of Standards
	0-100	.00347	Holborn, 1921
Thallium	0	.0040	
liquid	295	.00035	
Therlo	20	.00001	Bureau of Standards
Thorium	20-1800	.0021	Rentschler, Marden, 1925
Tin	20	.0042	Bureau of Standards
Tungsten	18	.0045	Jäger, Diesselhorst
	500	.0057	Somerville
	1000	.0089	"
pure, annealed	0-100	.00465	Holborn, 1921
Wood's metal	0	.0020	
Zinc	20	.0037	Bureau of Standards
	0	.0040	
	0-100	.00415	Holborn, 1921

RATIO TABLES FOR BRIDGE CALCULATIONS

The Leeds & Northrup Co.

$$\frac{A}{1000 - A}$$

The first table gives values of the ratio, $A/(1000 - A)$, the value of A being measured from the zero at one end of the scale. If the balance point is at 500, $A = 500$ and the ratio is unity.

UNITS

A	0	1	2	3	4	5	6	7	8	9
0	.0000	1001	2004	3010	4016	5025	6036	7049	8064	9082
10	.0101	1112	1214	1317	1420	1523	1626	1730	1833	1937
20	.02041	2145	2250	2354	2459	2564	2670	2775	2881	2987
30	.03093	3199	3306	3413	3520	3627	3735	3843	3950	4058
40	.04167	4275	4384	4493	4602	4712	4820	4931	5042	5152
50	.05263	5374	5485	5596	5708	5820	5932	6044	6156	6269
60	.06383	6496	6610	6724	6838	6952	7066	7180	7296	7412
70	.07527	7643	7759	7875	7992	8109	8225	8342	8460	8578
80	.08696	8814	8933	9051	9170	9290	9408	9528	9649	9770
90	.09889	1001	1013	1025	1037	1050	1062	1074	1086	1099
100	.1111	.1123	.1136	.1148	.1160	.1173	.1186	.1198	.1211	.1223
110	.1236	.1248	.1261	.1274	.1287	.1300	.1312	.1325	.1338	.1351
120	.1364	.1377	.1390	.1403	.1416	.1429	.1442	.1455	.1468	.1481
130	.1494	.1507	.1521	.1534	.1547	.1561	.1574	.1587	.1601	.1615
140	.1628	.1641	.1655	.1669	.1682	.1695	.1710	.1723	.1737	.1751
150	.1765	.1778	.1792	.1806	.1821	.1834	.1848	.1862	.1876	.1890
160	.1905	.1919	.1933	.1947	.1962	.1976	.1990	.2005	.2019	.2034
170	.2048	.2063	.2077	.2092	.2106	.2121	.2136	.2151	.2165	.2180
180	.2195	.2210	.2225	.2240	.2255	.2270	.2285	.2300	.2315	.2331
190	.2346	.2361	.2376	.2392	.2407	.2423	.2438	.2454	.2469	.2485
200	.2500	.2516	.2532	.2547	.2563	.2579	.2595	.2610	.2625	.2642
210	.2658	.2674	.2690	.2706	.2722	.2739	.2755	.2772	.2788	.2804
220	.2820	.2837	.2853	.2870	.2887	.2903	.2920	.2937	.2954	.2971
230	.2987	.3004	.3020	.3038	.3055	.3072	.3089	.3106	.3123	.3140
240	.3157	.3175	.3192	.3210	.3228	.3245	.3262	.3280	.3298	.3316
250	.3333	.3351	.3369	.3387	.3405	.3423	.3440	.3459	.3477	.3495
260	.3513	.3532	.3550	.3568	.3587	.3606	.3624	.3643	.3662	.3681
270	.3699	.3717	.3736	.3755	.3774	.3793	.3812	.3831	.3850	.3869
280	.3889	.3908	.3928	.3947	.3966	.3986	.4005	.4024	.4044	.4064
290	.4084	.4104	.4124	.4144	.4164	.4185	.4205	.4225	.4245	.4265
300	.4285	.4306	.4326	.4347	.4368	.4389	.4409	.4430	.4450	.4471
310	.4493	.4514	.4535	.4556	.4577	.4598	.4619	.4640	.4661	.4683
320	.4705	.4727	.4749	.4771	.4793	.4814	.4836	.4858	.4881	.4903
330	.4925	.4947	.4969	.4992	.5015	.5038	.5060	.5083	.5106	.5129
340	.5152	.5174	.5197	.5220	.5244	.5267	.5290	.5313	.5336	.5360
350	.5384	.5407	.5431	.5455	.5480	.5504	.5528	.5553	.5576	.5600
360	.5625	.5650	.5674	.5698	.5723	.5748	.5773	.5798	.5823	.5848
370	.5873	.5899	.5924	.5949	.5974	.6000	.6025	.6051	.6077	.6103
380	.6129	.6155	.6181	.6207	.6233	.6260	.6286	.6313	.6340	.6367
390	.6394	.6420	.6447	.6474	.6502	.6529	.6557	.6584	.6611	.6638
400	.6666	.6694	.6722	.6750	.6778	.6806	.6834	.6862	.6891	.6920
410	.6949	.6978	.7007	.7036	.7065	.7094	.7123	.7152	.7181	.7211
420	.7241	.7271	.7301	.7331	.7361	.7391	.7421	.7451	.7482	.7512
430	.7543	.7574	.7605	.7636	.7667	.7698	.7729	.7760	.7792	.7824
440	.7857	.7889	.7921	.7953	.7986	.8018	.8050	.8084	.8117	.8150
450	.8182	.8215	.8248	.8282	.8316	.8349	.8382	.8416	.8450	.8484
460	.8518	.8552	.8586	.8620	.8655	.8691	.8727	.8762	.8798	.8834
470	.8868	.8904	.8939	.8975	.9011	.9048	.9084	.9120	.9157	.9194
480	.9231	.9267	.9304	.9341	.9379	.9417	.9454	.9493	.9531	.9570
490	.9609	.9649	.9687	.9725	.9764	.9803	.9842	.9881	.9920	.9960

RATIO TABLES FOR BRIDGE CALCULATIONS (Continued)

UNITS

A	0	1	2	3	4	5	6	7	8	9
500	1.000	1.004	1.008	1.012	1.016	1.020	1.024	1.028	1.032	1.036
510	1.041	1.045	1.049	1.053	1.058	1.062	1.066	1.071	1.075	1.079
520	1.083	1.088	1.092	1.097	1.101	1.105	1.110	1.114	1.119	1.123
530	1.128	1.132	1.137	1.141	1.146	1.151	1.155	1.160	1.165	1.169
540	1.174	1.179	1.183	1.188	1.193	1.198	1.203	1.208	1.212	1.217
550	1.222	1.227	1.232	1.237	1.242	1.247	1.252	1.257	1.262	1.267
560	1.273	1.278	1.283	1.288	1.294	1.299	1.304	1.309	1.314	1.320
570	1.326	1.331	1.336	1.342	1.347	1.353	1.359	1.364	1.370	1.375
580	1.381	1.386	1.392	1.398	1.404	1.410	1.415	1.421	1.427	1.433
590	1.439	1.445	1.451	1.457	1.463	1.469	1.475	1.481	1.487	1.494
600	1.500	1.506	1.513	1.519	1.525	1.531	1.538	1.544	1.551	1.557
610	1.564	1.571	1.577	1.584	1.591	1.597	1.604	1.611	1.618	1.625
620	1.632	1.639	1.645	1.652	1.659	1.667	1.674	1.681	1.688	1.695
630	1.703	1.710	1.717	1.724	1.732	1.740	1.747	1.755	1.763	1.770
640	1.778	1.786	1.793	1.801	1.809	1.817	1.825	1.833	1.841	1.849
650	1.857	1.865	1.873	1.882	1.890	1.899	1.907	1.916	1.924	1.933
660	1.941	1.950	1.958	1.967	1.976	1.985	1.994	2.003	2.012	2.021
670	2.030	2.039	2.048	2.058	2.068	2.078	2.087	2.096	2.106	2.115
680	2.125	2.135	2.145	2.155	2.165	2.175	2.185	2.195	2.205	2.215
690	2.225	2.236	2.247	2.257	2.268	2.278	2.289	2.300	2.311	2.322
700	2.333	2.344	2.355	2.367	2.378	2.389	2.401	2.413	2.425	2.436
710	2.448	2.460	2.472	2.485	2.497	2.509	2.521	2.534	2.546	2.559
720	2.571	2.584	2.597	2.610	2.623	2.636	2.650	2.663	2.676	2.690
730	2.703	2.716	2.731	2.745	2.759	2.774	2.788	2.802	2.817	2.831
740	2.846	2.861	2.876	2.891	2.907	2.922	2.937	2.953	2.968	2.984
750	3.000	3.016	3.032	3.049	3.065	3.081	3.098	3.115	3.132	3.150
760	3.168	3.185	3.202	3.220	3.237	3.255	3.273	3.291	3.310	3.329
770	3.348	3.367	3.386	3.405	3.425	3.445	3.464	3.484	3.505	3.525
780	3.546	3.566	3.587	3.608	3.630	3.652	3.674	3.695	3.717	3.740
790	3.762	3.785	3.808	3.831	3.854	3.878	3.902	3.926	3.950	3.975
800	4.000	4.025	4.050	4.075	4.102	4.127	4.154	4.181	4.209	4.236
810	4.263	4.290	4.319	4.348	4.376	4.405	4.435	4.464	4.494	4.525
820	4.556	4.587	4.618	4.650	4.682	4.715	4.748	4.781	4.814	4.848
830	4.882	4.917	4.953	4.988	5.025	5.061	5.097	5.135	5.173	5.211
840	5.250	5.290	5.330	5.370	5.411	5.451	5.493	5.536	5.580	5.623
850	5.666	5.711	5.757	5.803	5.850	5.898	5.945	5.994	6.043	6.093
860	6.143	6.194	6.247	6.300	6.353	6.407	6.463	6.519	6.576	6.634
870	6.693	6.752	6.812	6.873	6.937	7.000	7.064	7.129	7.196	7.264
880	7.334	7.403	7.474	7.546	7.620	7.696	7.772	7.849	7.928	8.009
890	8.091	8.175	8.259	8.346	8.434	8.524	8.616	8.709	8.804	8.901
900	9.000	9.101	9.204	9.309	9.416	9.526	9.638	9.753	9.870	9.989
910	10.11	10.23	10.36	10.49	10.63	10.76	10.90	11.05	11.19	11.34
920	11.50	11.66	11.82	11.99	12.16	12.33	12.51	12.70	12.89	13.08
930	13.28	13.49	13.71	13.93	14.15	14.38	14.62	14.87	15.13	15.40
940	15.66	15.95	16.24	16.54	16.86	17.18	17.52	17.87	18.23	18.61
950	19.00	19.41	19.83	20.28	20.75	21.22	21.73	22.26	22.81	23.38
960	24.00	24.64	25.32	26.03	26.77	27.57	28.41	29.30	30.25	31.26
970	32.33	33.49	34.70	36.04	37.46	39.00	40.67	42.48	44.44	46.62
980	49.00	51.63	54.55	57.83	61.50	65.67	70.43	75.93	82.33	89.91
990	99.00	110.1	124.0	141.9	165.7	199.0	249.0	332.3	499.0	999.0

RATIO TABLES FOR BRIDGE CALCULATIONS (Continued)

$$\frac{4500 + A}{5500 - A}$$

The second table gives values of the ratio $(4500 + A)/(5500 - A)$, the value of A being measured from the 4500 division on a total scale of 10,000. If the balance point is at 5000, $A = 500$ and the ratio is unity.

UNITS

A	0	1	2	3	4	5	6	7	8	9
0	.8182	.8185	.8188	.8192	.8195	.8198	.8202	.8205	.8208	.8212
10	.8215	.8218	.8221	.8225	.8228	.8232	.8235	.8238	.8241	.8245
20	.8248	.8251	.8254	.8258	.8262	.8265	.8268	.8272	.8275	.8278
30	.8281	.8285	.8288	.8292	.8295	.8298	.8302	.8305	.8308	.8312
40	.8315	.8318	.8322	.8325	.8328	.8332	.8335	.8338	.8341	.8345
50	.8349	.8353	.8356	.8360	.8363	.8366	.8370	.8373	.8376	.8379
60	.8382	.8385	.8389	.8392	.8396	.8399	.8403	.8406	.8409	.8413
70	.8416	.8419	.8423	.8426	.8424	.8433	.8436	.8440	.8443	.8447
80	.8450	.8453	.8457	.8460	.8464	.8467	.8470	.8474	.8477	.8481
90	.8484	.8487	.8491	.8495	.8498	.8501	.8505	.8509	.8513	.8517
100	.8519	.8522	.8525	.8529	.8532	.8536	.8539	.8543	.8546	.8549
110	.8553	.8556	.8560	.8563	.8567	.8570	.8574	.8577	.8581	.8584
120	.8587	.8591	.8594	.8598	.8601	.8605	.8608	.8612	.8615	.8619
130	.8622	.8626	.8629	.8633	.8636	.8640	.8643	.8646	.8650	.8653
140	.8657	.8660	.8664	.8667	.8671	.8674	.8678	.8681	.8685	.8688
150	.8692	.8695	.8699	.8702	.8706	.8709	.8713	.8716	.8720	.8723
160	.8727	.8730	.8734	.8737	.8741	.8744	.8748	.8751	.8755	.8758
170	.8762	.8765	.8769	.8772	.8776	.8779	.8783	.8786	.8790	.8793
180	.8797	.8800	.8804	.8808	.8811	.8815	.8818	.8822	.8825	.8829
190	.8832	.8836	.8839	.8843	.8847	.8850	.8854	.8857	.8861	.8864
200	.8868	.8871	.8875	.8879	.8882	.8885	.8889	.8893	.8896	.8900
210	.8903	.8907	.8910	.8914	.8917	.8921	.8925	.8929	.8932	.8936
220	.8939	.8942	.8946	.8950	.8953	.8957	.8960	.8964	.8968	.8972
230	.8975	.8979	.8982	.8986	.8990	.8993	.8997	.9001	.9004	.9008
240	.9011	.9015	.9018	.9022	.9025	.9029	.9032	.9037	.9040	.9044
250	.9048	.9051	.9055	.9059	.9063	.9066	.9070	.9073	.9077	.9080
260	.9084	.9088	.9091	.9095	.9098	.9101	.9105	.9108	.9112	.9116
270	.9120	.9123	.9127	.9131	.9135	.9139	.9142	.9146	.9150	.9153
280	.9157	.9161	.9165	.9168	.9172	.9175	.9179	.9183	.9186	.9190
290	.9194	.9198	.9202	.9205	.9209	.9212	.9215	.9220	.9223	.9227
300	.9231	.9234	.9238	.9242	.9245	.9249	.9253	.9257	.9260	.9264
310	.9268	.9272	.9276	.9279	.9282	.9286	.9290	.9294	.9298	.9301
320	.9305	.9309	.9312	.9316	.9320	.9324	.9327	.9331	.9335	.9339
330	.9342	.9346	.9350	.9354	.9357	.9361	.9365	.9369	.9372	.9376
340	.9380	.9384	.9388	.9391	.9395	.9399	.9403	.9406	.9410	.9414
350	.9417	.9421	.9425	.9429	.9432	.9436	.9440	.9444	.9448	.9451
360	.9455	.9459	.9463	.9467	.9470	.9474	.9478	.9482	.9486	.9489
370	.9493	.9497	.9500	.9504	.9508	.9512	.9516	.9520	.9523	.9527
380	.9531	.9535	.9539	.9543	.9547	.9550	.9554	.9558	.9562	.9566
390	.9570	.9573	.9577	.9581	.9585	.9589	.9592	.9596	.9600	.9604
400	.9608	.9611	.9615	.9619	.9623	.9627	.9631	.9635	.9639	.9643
410	.9646	.9650	.9654	.9658	.9661	.9665	.9669	.9673	.9677	.9681
420	.9685	.9689	.9693	.9697	.9700	.9704	.9708	.9712	.9716	.9720
430	.9724	.9728	.9732	.9736	.9740	.9744	.9748	.9751	.9755	.9759
440	.9763	.9767	.9771	.9774	.9778	.9782	.9786	.9790	.9795	.9798
450	.9802	.9806	.9810	.9814	.9818	.9822	.9826	.9830	.9834	.9837
460	.9841	.9846	.9849	.9853	.9857	.9861	.9865	.9869	.9873	.9877
470	.9881	.9885	.9889	.9893	.9897	.9900	.9904	.9908	.9912	.9916
480	.9920	.9924	.9928	.9932	.9936	.9940	.9944	.9948	.9952	.9956
490	.9960	.9964	.9968	.9972	.9976	.9980	.9984	.9988	.9992	.9996

RATIO TABLES FOR BRIDGE CALCULATIONS (Continued)

UNITS

A	0	1	2	3	4	5	6	7	8	9
500	1.0000	1.0004	1.0008	1.0012	1.0016	1.0020	1.0024	1.0028	1.0032	1.0036
510	1.0040	1.0044	1.0048	1.0052	1.0056	1.0061	1.0065	1.0069	1.0073	1.0077
520	1.0081	1.0085	1.0089	1.0093	1.0097	1.0101	1.0105	1.0109	1.0113	1.0117
530	1.0121	1.0125	1.0129	1.0133	1.0137	1.0142	1.0146	1.0150	1.0154	1.0158
540	1.0162	1.0166	1.0170	1.0174	1.0178	1.0183	1.0187	1.0192	1.0196	1.0200
550	1.0203	1.0207	1.0211	1.0215	1.0219	1.0224	1.0228	1.0232	1.0236	1.0240
560	1.0244	1.0248	1.0252	1.0256	1.0260	1.0264	1.0269	1.0273	1.0277	1.0281
570	1.0285	1.0289	1.0293	1.0297	1.0301	1.0305	1.0309	1.0313	1.0317	1.0321
580	1.0325	1.0329	1.0333	1.0337	1.0341	1.0345	1.0350	1.0354	1.0358	1.0362
590	1.0366	1.0370	1.0375	1.0379	1.0383	1.0388	1.0392	1.0396	1.0400	1.0405
600	1.0409	1.0413	1.0417	1.0421	1.0425	1.0429	1.0434	1.0438	1.0442	1.0446
610	1.0450	1.0454	1.0458	1.0463	1.0467	1.0471	1.0475	1.0479	1.0484	1.0488
620	1.0492	1.0496	1.0500	1.0505	1.0509	1.0513	1.0517	1.0521	1.0526	1.0530
630	1.0534	1.0538	1.0542	1.0547	1.0551	1.0555	1.0559	1.0563	1.0568	1.0572
640	1.0576	1.0580	1.0585	1.0589	1.0593	1.0598	1.0602	1.0606	1.0610	1.0615
650	1.0619	1.0623	1.0628	1.0632	1.0636	1.0641	1.0645	1.0649	1.0653	1.0658
660	1.0662	1.0666	1.0670	1.0675	1.0679	1.0683	1.0687	1.0691	1.0696	1.0700
670	1.0704	1.0708	1.0713	1.0717	1.0721	1.0726	1.0730	1.0734	1.0738	1.0743
680	1.0747	1.0751	1.0755	1.0760	1.0764	1.0768	1.0772	1.0776	1.0781	1.0785
690	1.0789	1.0794	1.0798	1.0803	1.0807	1.0811	1.0816	1.0821	1.0825	1.0830
700	1.0834	1.0838	1.0843	1.0847	1.0851	1.0856	1.0860	1.0864	1.0868	1.0873
710	1.0877	1.0881	1.0886	1.0890	1.0895	1.0899	1.0903	1.0908	1.0912	1.0917
720	1.0921	1.0925	1.0930	1.0934	1.0939	1.0943	1.0947	1.0952	1.0956	1.0961
730	1.0965	1.0969	1.0974	1.0978	1.0982	1.0987	1.0991	1.0995	1.0999	1.1004
740	1.1008	1.1013	1.1017	1.1022	1.1026	1.1031	1.1035	1.1040	1.1044	1.1049
750	1.1053	1.1057	1.1062	1.1066	1.1071	1.1075	1.1079	1.1084	1.1088	1.1093
760	1.1097	1.1102	1.1106	1.1111	1.1115	1.1120	1.1124	1.1129	1.1133	1.1138
770	1.1142	1.1147	1.1151	1.1156	1.1160	1.1165	1.1169	1.1174	1.1178	1.1183
780	1.1187	1.1192	1.1196	1.1201	1.1205	1.1210	1.1214	1.1219	1.1223	1.1228
790	1.1232	1.1236	1.1241	1.1245	1.1250	1.1254	1.1258	1.1263	1.1267	1.1272
800	1.1276	1.1281	1.1285	1.1290	1.1294	1.1299	1.1304	1.1308	1.1313	1.1317
810	1.1322	1.1327	1.1331	1.1336	1.1340	1.1345	1.1349	1.1354	1.1358	1.1363
820	1.1367	1.1372	1.1376	1.1381	1.1385	1.1390	1.1395	1.1400	1.1404	1.1408
830	1.1413	1.1418	1.1422	1.1427	1.1431	1.1436	1.1441	1.1445	1.1450	1.1454
840	1.1459	1.1464	1.1468	1.1473	1.1477	1.1482	1.1487	1.1491	1.1496	1.1500
850	1.1505	1.1510	1.1514	1.1519	1.1523	1.1528	1.1533	1.1537	1.1542	1.1546
860	1.1551	1.1556	1.1560	1.1565	1.1570	1.1575	1.1579	1.1584	1.1589	1.1593
870	1.1598	1.1603	1.1608	1.1612	1.1617	1.1622	1.1627	1.1632	1.1636	1.1641
880	1.1646	1.1651	1.1655	1.1660	1.1664	1.1669	1.1674	1.1678	1.1683	1.1687
890	1.1692	1.1697	1.1701	1.1706	1.1710	1.1715	1.1720	1.1724	1.1729	1.1733
900	1.1738	1.1743	1.1748	1.1752	1.1757	1.1762	1.1767	1.1772	1.1776	1.1781
910	1.1786	1.1791	1.1796	1.1800	1.1805	1.1810	1.1815	1.1820	1.1824	1.1829
920	1.1834	1.1839	1.1844	1.1848	1.1853	1.1858	1.1863	1.1868	1.1872	1.1877
930	1.1882	1.1887	1.1892	1.1896	1.1901	1.1906	1.1911	1.1916	1.1920	1.1925
940	1.1930	1.1935	1.1939	1.1944	1.1949	1.1954	1.1958	1.1963	1.1968	1.1972
950	1.1977	1.1982	1.1987	1.1992	1.1997	1.2002	1.2006	1.2011	1.2016	1.2021
960	1.2026	1.2031	1.2036	1.2041	1.2046	1.2051	1.2055	1.2060	1.2065	1.2070
970	1.2075	1.2080	1.2085	1.2090	1.2095	1.2100	1.2104	1.2109	1.2114	1.2119
980	1.2124	1.2129	1.2134	1.2139	1.2144	1.2149	1.2153	1.2158	1.2163	1.2168
990	1.2173	1.2178	1.2183	1.2188	1.2193	1.2198	1.2202	1.2207	1.2212	1.2217

RESISTANCE OF ELECTROLYTES

Resistance of aqueous solutions of various salts and acids in ohms per centimeter cube for a temperature of 18° C.

(From observations by Kohlrausch.)

Salt.	Number of grams of salt in 100 grams solution.							
	5	10	15	20	25	30	40	50
Acetic acid.....	...	654.	616.	622.5	658.	714.	925.	1351.
Ammonium chloride....	10.89	5.63	3.86	2.97	2.48			
Copper nitrate.....	27.4	15.7	11.7	9.82	9.17			
sulphate.....	52.9	31.2	23.7					
Hydrochloric acid.....	2.54	1.59	1.34	1.31	1.38	1.51	1.94	
Potassium iodide.....	29.5	14.7	.....	6.89	.....	4.34	3.16	2.55
Silver nitrate.....	39.0	21.0	14.64	11.46	9.45	8.07	6.39	5.39
Sodium carbonate.....	22.2	14.2	12.0					
chloride.....	14.94	8.33	6.10	5.11	4.69			
hydroxide.....	5.08	3.20	2.89	3.06	3.68	4.95	8.61	
Sulphuric acid.....	4.79	2.55	1.84	1.53	1.39	1.35	1.47	
Zinc chloride.....	20.70	13.75	.....	10.96	.....	10.80	11.83	15.87
sulphate.....	52.3	31.2	24.1	21.4	20.8	22.5		
(Concentration).....	6.2	12.4	18.6	24.8	31.	37.2	43.4	
Nitric acid.....	3.2	1.84	1.45	1.30	1.28	1.32	1.43	
(Concentration).....	8.4	12.6	16.8	21.	25.2	29.4	33.6	
Potassium hydroxide....	3.67	2.66	2.19	1.96	1.85	1.84	1.91	

SAFE CARRYING CAPACITY OF COPPER WIRE

(From Collins' Design and Construction of Induction Coils, by permission.)

Brown & Sharpe gauge.	Diameter in mils.	Area in circular mils.	Number of amperes, exposed work.	Number of amperes, confined spaces.
18	40	1.624	5	3
17	45	2.048	6	4
16	51	2.583	8	6
15	57	3.257	10	8
14	64	4.106	16	12
13	72	5.178	19	14
12	81	6.530	23	17
11	91	8.234	27	21
10	102	10.380	32	25
9	114	13.090	39	29
8	128	16.510	46	33
7	144	20.820	56	39
6	162	26.250	65	45
5	182	33.100	77	53
4	204	41.740	92	63
3	229	52.630	110	75
2	258	66.370	131	88
1	289	83.690	156	105
0	325	105.500	185	125
00	365	133.100	220	150

CONDUCTIVITY OF STANDARD SOLUTIONS

Giving the conductivity in reciprocal ohms (mho) per cm. for NaCl, KCl, H₂SO₄ and MgSO₄ for various temperatures. Solutions are as follows:—

H₂SO₄,—maximum conductivity (18° C.); dissolve 378 g. of 97% acid in pure water and dilute to 1 liter. Density at 18° C., 1.223.

MgSO₄,—maximum conductivity (18° C.); dissolve in 1 liter of distilled water 552 g. of MgSO₄·7H₂O. Density at 18° C., 1.190.

NaCl,—solution saturated at all temperatures given. An excess of NaCl in distilled water, about 450 g. per liter. D = 1.2014 (18° C.).

KCl,—normal solution, 74.59 grams per liter of solution at 18° C. Dissolve 74.555 grams (weighed in air) of KCl and dilute to 1 liter. Density, 1.04492.

Solution.	0° C.	5°	10°	15°
H ₂ SO ₄	0.5184	0.5792	0.6408	0.7028
MgSO ₄	0.02877	0.03402	0.03963	0.04555
NaCl.....	0.1345	0.1555	0.1779	0.2014
KCl, normal.....	0.06541	0.07414	0.08319	0.09252
KCl, 1/10 normal...	0.00715	0.00822	0.00933	0.01048
KCl, 1/100 normal..	0.000776	0.000896	0.001020	0.001147

	16°	17°	18°	19°	20°
H ₂ SO ₄	0.7151	0.7275	0.7398	0.7522	0.7645
MgSO ₄	0.04676	0.04799	0.04922	0.05046	0.05171
NaCl.....	0.2062	0.2111	0.2160	0.2209	0.2259
KCl, n.....	0.09441	0.09631	0.09822	0.10014	0.10207
KCl, 1/10 n....	0.01072	0.01095	0.01119	0.01143	0.01167
KCl, 1/100 n...	0.001173	0.001199	0.001225	0.001251	0.001278

	21°	22°	23°	24°	25°
H ₂ SO ₄	0.7768	0.7890	0.8013	0.8135	0.8257
MgSO ₄	0.05297	0.05424	0.05551	0.05679	0.05808
NaCl.....	0.2309	0.2360	0.2411	0.2462	0.2513
KCl, n.....	0.10400	0.10594	0.10789	0.10984	0.11180
KCl, 1/10, n...	0.01191	0.01215	0.01239	0.01264	0.01288
KCl, 1/100 n...	0.001305	0.001332	0.001359	0.001386	0.001413

	26°	27°	28°	29°	30°
H ₂ SO ₄	0.8378	0.8499	0.8620	0.8740	0.8860
MgSO ₄	0.05937	0.06067	0.06197	0.06328	0.06459
NaCl.....	0.2565	0.2616	0.2669	0.2721	0.2774
KCl, n.....	0.11377	0.11574	.....	.....	.....
KCl, 1/10 n....	0.01313	0.01337	0.01362	0.01387	0.01412
KCl, 1/50 n...	0.002819	0.002873	0.002927	0.002981	0.003036

EQUIVALENT CONDUCTANCE OF AQUEOUS SOLUTIONS

The equivalent conductance is given in reciprocal ohms. Concentration is given in milli-equivalents of solute per liter of solution. Corrected for conductance of water except in case of the strong acids.

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Acetic acid.....	0.	347.	773.
	10.	14.50	25.1
	30.	8.50	14.7
	80.	5.22	9.05
	100.	4.67	8.10
*Ammonium acetate.....	0.	99.8	338.
	10.	91.7	300.
	25.	88.2	286.
*Ammonium chloride.....	0.	131.1	415.
	2.	126.5	399.
	10.	122.5	382.
	30.	118.1	.....
Ammonium hydroxide.....	0.	238.	647.
	10.	9.66	23.2
	30.	5.66	13.6
	100.	3.10	7.47
Barium ferrocyanide.....	0.	91.	521.
	2.	46.9	202.3
	12.5	30.4	129.8
Barium hydroxide.....	0.	222.	645.
	2.	215.	591.
	10.	207.	548.
	50.	191.1	478.
	100.	180.1	443.
Barium nitrate.....	0.	116.9	385.
	2.	109.7	352.
	10.	101.	322.
	40.	88.7	280.
	80.	81.6	258.
	100.	79.1	249.
Calcium ferrocyanide.....	0.	88.	512.
	100.	21.9	84.3
	200.	20.6	77.5
	400.	202.	76.2
Calcium nitrate.....	0.	70.4	369.
	2.	66.5	346.5
	50.	55.6	276.8
	100.	51.9	255.5
	200.	48.3	234.4

* Values have been corrected for hydrolysis.

EQUIVALENT CONDUCTANCE OF AQUEOUS SOLUTIONS (Continued)

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Hydrochloric acid.....	0.	379.	850.
	2.	373.6	826.
	10.	368.1	807.
	80.	353.	762.
	100.	350.6	754.
Lanthanum nitrate.....	0.	75.4	413.
	2.	68.9	363.5
	12.5	61.4	311.2
	50.	54.	261.4
	100.	49.9	236.7
Magnesium sulphate.....	200.	46.	210.8
	0.	114.1	426.
	2.	94.3	302.
	10.	76.1	234.
	20.	67.5	190.
Nitric acid.....	40.	59.3	160.
	80.	52.	136.
	100.	49.8	130.
	200.	43.1	110.
	0.	377.	826.
Phosphoric acid.....	2.	371.2	806.
	10.	365.	786.
	50.	353.7	750.
	100.	346.4	728.
	0.	338.3	730.
Potassium chloride.....	2.	283.1	498.
	10.	203.	308.
	50.	122.7	168.
	100.	95.7	128.
	0.	130.1	414.
Potassium citrate.....	2.	126.3	393.
	10.	122.4	377.
	80.	113.5	342.
	100.	112.	336.
	0.	76.4	420.
Potassium nitrate.....	2.	71.	381.2
	5.	67.6	357.2
	50.	54.4	273.
	100.	50.2	247.5
	300.	43.5	209.5
Potassium nitrate.....	0.	80.8	384.
	2.	78.6	370.3
	12.5	75.3	351.5

EQUIVALENT CONDUCTANCE OF AQUEOUS SOLUTIONS (Continued)

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Potassium nitrate	50.	70.7	326.1
	100.	67.2	308.5
Potassium ferrocyanide	0.	98.4	527.
	2.	84.8	427.6
	50.	58.2	272.4
	100.	53.	245.
	206.	48.8	222.3
	400.	45.4	203.1
Potassium oxalate	0.	79.4	419.
	2.	74.9	389.3
	50.	63.	312.2
	100.	59.3	288.9
	200.	55.8	265.1
Potassium sulphate	0.	132.8	455.
	2.	124.8	402.
	10.	115.7	365.
	40.	104.2	320.
	80.	97.2	294.
	100.	95.	286.
Silver nitrate	0.	115.8	367.
	2.	112.2	353.
	10.	108.	337.
	20.	105.1	326.
	40.	101.3	312.
	80.	96.5	294.
	100.	94.6	289.
Sodium acetate	0.	78.1	285.
	2.	74.5	268.
	10.	71.2	253.
	80.	63.4	221.
Sodium chloride	0.	109.	362.
	2.	105.6	349.
	10.	102.	336.
	80.	93.5	301.
	100.	92.0	296.
Sodium hydroxide	0.	216.5	594.
	2.	212.1	582.
	20.	205.8	559.
	50.	200.6	540.
Sulphuric acid	0.	383.	891.
	2.	353.9	571.
	10.	309.	446.
	50.	253.5	384.
	100.	233.3	369.

THE EQUIVALENT CONDUCTANCE OF THE SEPARATE IONS

(From Smithsonian Physical Tables)

Ion.	0°	18°	25°	50°	75°	100°	128°	156°
K.....	40.4	64.6	74.5	115	159	206	263	317
Na.....	26.	43.5	50.9	82	116	155	203	249
NH ₄	40.2	64.5	74.5	115	159	207	264	319
Ag.....	32.9	54.3	63.5	101	143	188	245	299
$\frac{1}{2}$ Ba.....	33.	55.	65.	104	149	200	262	322
$\frac{1}{2}$ Ca.....	30.	51.	60.	98	142	191	252	312
$\frac{1}{3}$ La.....	35.	61.	72.	119	173	235	312	388
Cl.....	41.1	65.5	75.5	116	160	207	264	318
NO ₃	40.4	61.7	70.6	104	140	178	222	263
C ₂ H ₃ O ₂	20.3	34.6	40.8	67	96	130	171	211
$\frac{1}{2}$ SO ₄	41.	68.	79.	125	177	234	303	370
$\frac{1}{2}$ C ₂ O ₄	39.	63.	73.	115	163	213	275	336
$\frac{1}{3}$ C ₆ H ₅ O ₇ ...	36.	60.	70.	113	161	214		
$\frac{1}{4}$ Fe(CN) ₆ ...	58.	95.	111.	173	244	321		
H.....	240.	314.	350.	465	565	644	722	777
OH.....	105.	172.	192.	284	360	439	525	592

RESISTIVITY OF DIELECTRICS

Giving the volume resistivity ρ , the variation of the volume resistivity with temperature, given as the ratio of the value at 20° C. to that at 30° C., and the surface resistivity for various dielectrics. The surface resistivity is the resistance between the opposite edges of a centimeter square. A large part of the data are from Curtis, Bulletin of the Bureau of Standards 1915. Temperatures, unless otherwise stated, are 22° C. The numbers in parentheses refer to the source of information.

Material	Volume resistivity			Surface resistivity, ohm-cm	
	Temp. °C.*	ρ ohm-cm	ρ^{20}/ρ^{30}	Humidity 50 %	Humidity 90 %
Amberite	22	5×10^{16}		2×10^{15}	3×10^{12}
Amber		5×10^{16}		6×10^{14}	1×10^{11}
Bakelite†					
No. 1		2×10^{11}		3×10^{11}	2×10^8
140		2×10^{17}	2.4	3×10^9	2×10^5
150		4×10^{12}	3.6	3×10^{12}	4×10^9
190		1×10^{11}	3.6	1×10^{11}	5×10^8
L 558		2×10^{16}	2.6	8×10^{15}	8×10^{14}
G5074		4×10^{10}		3×10^{11}	5×10^5
5199RGRB		5×10^{12}		6×10^{12}	1×10^{10}
5200		4×10^{11}	5.3	1×10^{12}	5×10^9
Bakelite micarta ...		5×10^{10}	2.4	2×10^{10}	1×10^8
Beeswax					
yellow, unrefined.	20	20×10^{14}	16.0	$**6 \times 10^{14}$	$**5 \times 10^{14}$
white	22	$8 \times 10^{14}(1)$			
Celluloid	16	6×10^{14}	1.8	5×10^{10}	2×10^9
		$5 \times 10^{14}(1)$			
		2×10^{10}			
		$4 \times 10^{10}(2)$			
		$> 5 \times 10^{18}$		$> **1 \times 10^{17}$	$> **1 \times 10^{17}$
Ceresin					
Condensite					
black		4×10^{10}	2.9	6×10^{10}	8×10^8
yellow		4×10^{10}	2.9	3×10^{11}	6×10^9
Dielectrite		5×10^{12}	3.0	5×10^{11}	4×10^7
Duranoid		3×10^{15}		6×10^{12}	3×10^8
Electrose, No. 8...		2×10^{16}		1×10^{15}	2×10^{12}
black		1×10^{14}	2.0	1×10^{12}	6×10^9
yellow		5×10^{15}	2.3	3×10^{14}	5×10^8
Fibre, hard		2×10^{10}	3.2	5×10^9	3×10^7
red	20	5×10^9	2.6	2×10^{10}	2×10^8
		$1 \times 10^8(3)$			
Galalith,					
black		2×10^{10}		8×10^{10}	3×10^9
white		1×10^{10}		4×10^{10}	6×10^8
Glass, German		5×10^{13}	2.5	4×10^{11}	6×10^8
Kavalier	18	$5 \times 10^{11}(4)$	4.5	4×10^{12}	1×10^9
opal	17	8×10^{15}			
plate, commercial		$1 \times 10^{16}(5)$	2.8		
ordinary	20	2×10^{13}	3.2	5×10^{10}	2×10^9
Bohemian	20	9×10^{13}			
Glyptal		6×10^{12}	3.0		
Gummon		1×10^{16}	1.4	2×10^{12}	3×10^8
Halowax 1001		3×10^{12}	2.5	$*6 \times 10^{15}$	$*5 \times 10^{11}$
5055 B...		2×10^{13}			
		2×10^{16}			

* Temperature is 22°C. except where otherwise stated.

† For composition of bakelite samples see table following.

** Leakage resistivity.

RESISTIVITY OF DIELECTRICS (Continued)

Material	Volume resistivity			Surface resistivity, ohm-cm	
	Temp. °C.	ρ ohm-cm	$\frac{\rho^{20}}{\rho^{30}}$	Humidity 50 %	Humidity 90 %
Hard Rubber.....		1×10^{18} 2×10^{15} (6) 3×10^{16} (?)		3×10^{15}	2×10^9
Hemit.....		1×10^{10}	1.2	1×10^{10}	3×10^8
Insulate.....		8×10^{15}	1.0	3×10^{14}	3×10^{11}
Ivory.....		2×10^8	1.5	5×10^9	1×10^9
Khotinsky Cement.		2×10^{15}	11.0	$*7 \times 10^{14}$	$*5 \times 10^{11}$
Lavite.....		2×10^{10}		1×10^{11}	1×10^8
Marble					
Italian.....		1×10^{11} 1×10^{10} (?)		3×10^9	2×10^7
Pink Tennessee..		5×10^9		5×10^9	3×10^7
Blue Vermont....		1×10^9		8×10^9	1×10^7
Mica.....	20	9×10^{15} (6)			
black African....		4×10^{13}		3×10^{12}	3×10^9
brown African....		2×10^{15}	1.2	3×10^{11}	1×10^9
colorless.....		2×10^{17}	2.0	2×10^{13}	8×10^9
India ruby.....		5×10^{13}	2.7	1×10^{10}	9×10^7
stained.....		2×10^{13} (7)			
Indian ruby.....		5×10^{15}	1.0		
slightly stained		4×10^{13} (7)			
Moulded mica.....		1×10^{15}	1.2	5×10^{13}	3×10^9
Paraffin (special) ..		$>5 \times 10^{18}$		$*9 \times 10^{15}$	$*6 \times 10^{15}$
parowax.....		1×10^{16}	2.0		
	17	3×10^{18} (8) 5×10^{16} (5) 3×10^{14}	1.6	6×10^{11} 2×10^{12}	5×10^9 5×10^9
Porcelain, unglazed					
glazed.....					
Quartz crystal					
|| to axis.....	17	2×10^{14} (5)			
	20	1×10^{14} (6)			
⊥ to axis.....	17	2×10^{16} (5)			
	20	3×10^{16} (6)			
fused.....		$>5 \times 10^{18}$		3×10^{12}	2×10^9
cleaned with chromic acid				3×10^{14}	2×10^{12}
Redmonite.....		2×10^{14}	2.0	5×10^{13}	3×10^{10}
Rosin.....		5×10^{16}	3.6	5×10^{14}	2×10^{14}
	17	7×10^{15} (5)			
Sealing wax.....		8×10^{15}	0.9	2×10^{15}	9×10^{10}
	19	1×10^{15} (1)			
Shellac.....		1×10^{16}	1.5	5×10^{13}	6×10^9
		9×10^{15} (?)			
Slate.....		1×10^8 2×10^8 (?)		9×10^6	1×10^6
Stabalite.....		3×10^{13}	1.6	2×10^{13}	4×10^7
Sulfur.....		1×10^{17}	4.9	7×10^{15}	1×10^{14}
	17	8×10^{15} (5) 2×10^{12}			
Tegit.....			1.4		
Tetrachloronaphthalene.....		5×10^{13}	2.9	$*1 \times 10^{14}$	$*1 \times 10^{14}$
Wood, paraffined					
mahogany.....		4×10^{13}		3×10^{12}	5×10^9
maple.....		3×10^{10}	3.6	8×10^{11}	2×10^8
poplar.....		5×10^{11}	3.6	1×10^{12}	1×10^9

* Leakage resistivity.

RESISTIVITY OF DIELECTRICS (Continued)

DESCRIPTION OF MATERIALS

Amberite is made by compressing scrap amber.
Bakelite. A phenol condensation product, with various fillers. The various samples were made as follows:

Number	Percent pure Bakelite	Filler	Phenolic Body	Condensing Agent
1		Paper	Cresols	Ammonia
140	50	Vegetable	Phenol	Caustic soda
150	50	Fiber	"	Ammonia
190	50	"	Cresols	"
5199	50	"	Phenol	"
5200	50	Fiber & clay	"	Caustic soda
5074	35	Talc	"	"
588	100	None	"	Ammonia
1 Regular	100	None	Cresols	

Ceresin is a waxy material refined from the mineral ozokerite, m.p. below 100° C. sp. gr. 0.91-0.97. Condensite is a phenol condensation product.

Hard fiber, soft cotton paper, treated with zinc chloride, dried and pressed.

Galalith is made from the casein of milk.

Kavalier glass is hard combustion tubing having a large potassium and calcium content.

Glyptal is an artificial resin resembling amber.

Gummon, hemit, and tegit are coal tar products.

Halowax, chlorinated naphthalenes.

Moulded mica is ground mica and asbestos with shellac.

Stabalite is a rubber compound.

REFERENCES

1. Dietrich, 1909
2. Addenbrooke, 1911
3. Rayner, 1905
4. Campbell, 1913
5. Thornton, 1910
6. Curie, 1889
7. Wilson-Mitchell, 1905
8. Braum, 1887

LIQUIDS

Resistance in ohms per centimeter cube.

Substance.	Temp. ° C.	Resistance, ohms.
Alcohol, ethyl.....	15	$.3 \times 10^6$
methyl.....		$.14 \times 10^6$
Oils, olive.....		5×10^{12}
paraffin.....		1×10^{16}
Petroleum.....		2×10^{16}
Water distilled.....	18	0.5×10^6

FUSED SALTS (Poincaré.)

Substance.	Temp. ° C.	Resistance, ohms.
Calcium chloride.....	750	.862
Potassium bromide.....	750	.714
chlorate fused.....	355	2.20
Silver nitrate.....	350	.820
Sodium chloride fused.....	750	.294

STANDARD CALIBRATION TABLES FOR THERMOCOUPLES

The following tables which represent the Temperature-E. M. F. functions of various thermocouples should be used with appropriate correction curves if precise results are desired. These curves must be determined for each individual couple by plotting ΔE , the difference between the observed and the standard E. M. F., against the standard E. M. F. at three or more fixed temperature points. The value ΔE as shown by such a correction curve is then subtracted algebraically from the observed E. M. F. to give the true E. M. F. reading.

In the following tables the fixed or "cold junction" is at 0° C.; when the cold junction is not maintained at 0° C. the readings of the E. M. F. must be corrected as follows: $E_t = E_{(t-t_c)} + E_{tc}$ where $E_{(t-t_c)}$ is the observed reading, E_{tc} is the E. M. F. for the temperature corresponding to the cold junction temperature as read from the standard table and E_t is the E. M. F. produced by the hot junction corrected to the value which would be obtained with the cold junction at 0° C. The temperature corresponding to E_t is then obtained by reference to the standard table.

Since the E. M. F.-temperature function is not linear the cold junction should be maintained at a temperature very close to that at which the thermocouple was calibrated. Otherwise considerable error will result despite the above correction.

TEMPERATURE-E. M. F. VALUES FOR PLATINUM- PLATINUM (90%), RHODIUM (10%) THERMO- ELEMENTS

E. M. F. values are in millivolts; temperatures are in degrees Centigrade
(Computed from values in the International Critical Tables)

Degree C.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0	0.06	0.11	0.17	0.24	0.30	0.36	0.43	0.50	0.57
100°	0.64	0.72	0.79	0.87	0.95	1.02	1.10	1.18	1.26	1.35
200°	1.43	1.52	1.60	1.69	1.78	1.86	1.95	2.04	2.13	2.22
300°	2.31	2.40	2.50	2.59	2.68	2.77	2.87	2.96	3.05	3.15
400°	3.24	3.34	3.44	3.53	3.63	3.73	3.82	3.92	4.02	4.12
500°	4.22	4.31	4.41	4.51	4.61	4.71	4.82	4.92	5.02	5.12
600°	5.22	5.32	5.43	5.53	5.63	5.74	5.84	5.94	6.05	6.16
700°	6.26	6.37	6.47	6.58	6.68	6.79	6.89	7.01	7.11	7.22
800°	7.33	7.44	7.55	7.66	7.77	7.88	7.99	8.10	8.21	8.32
900°	8.43	8.54	8.66	8.77	8.89	9.00	9.11	9.22	9.34	9.46
1000°	9.57	9.68	9.80	9.92	10.03	10.15	10.27	10.38	10.50	10.62
1100°	10.74	10.86	10.98	11.10	11.21	11.33	11.45	11.57	11.69	11.81
1200°	11.93	12.05	12.17	12.29	12.41	12.53	12.65	12.77	12.89	13.01
1300°	13.13	13.25	13.37	13.49	13.61	13.73	13.85	13.97	14.09	14.21
1400°	14.33	14.45	14.58	14.70	14.82	14.94	15.06	15.19	15.31	15.43
1500°	15.55	15.67	15.79	15.91	16.03	16.15	16.27	16.39	16.51	16.63
1600°	16.75	16.87	16.99	17.11	17.23	17.35	17.47	17.59	17.71	17.83
1700°	17.95	18.07	18.19	18.31	18.43	18.55	.....	.....	.....	.....

CALIBRATION TABLES **FOR THERMOCOUPLES (Continued)**

TEMPERATURE-E. M. F. VALUES FOR PLATINUM- PLATINUM (87%) RHODIUM (13%) THERMO- ELEMENTS

E. M. F. values are in millivolts; temperatures are in degrees Centigrade
(From values given in Bulletin No. 325, Charles Engelhard, Inc., New York)

Degree C	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0	0.06	0.12	0.18	0.25	0.31	0.38	0.45	0.52	0.60
100°	0.67	0.75	0.83	0.90	0.99	1.07	1.15	1.23	1.32	1.40
200°	1.49	1.58	1.67	1.76	1.85	1.94	2.03	2.12	2.21	2.30
300°	2.40	2.49	2.59	2.68	2.77	2.87	2.98	3.08	3.19	3.29
400°	3.40	3.51	3.61	3.72	3.82	3.93	4.04	4.15	4.25	4.36
500°	4.47	4.58	4.69	4.81	4.92	5.03	5.14	5.26	5.37	5.49
600°	5.60	5.72	5.83	5.95	6.06	6.18	6.30	6.42	6.53	6.65
700°	6.77	6.89	7.01	7.13	7.25	7.37	7.49	7.62	7.74	7.87
800°	7.99	8.12	8.24	8.37	8.49	8.62	8.75	8.88	9.00	9.13
900°	9.26	9.39	9.52	9.66	9.79	9.92	10.05	10.18	10.32	10.45
1000°	10.58	10.72	10.85	10.99	11.12	11.26	11.40	11.54	11.67	11.81
1100°	11.95	12.09	12.23	12.38	12.52	12.66	12.80	12.94	13.09	13.23
1200°	13.37	13.52	13.66	13.81	13.95	14.10	14.25	14.40	14.54	14.69
1300°	14.84	14.99	15.14	15.30	15.45	15.60	15.75	15.90	16.06	16.21
1400°	16.36	16.52	16.67	16.83	16.98	17.14	17.30	17.46	17.61	17.77
1500°	17.93	18.09	18.25	18.42	18.58	18.74	18.90	19.06	19.23	19.39
1600°	19.55	19.71	19.88	20.04	20.21	20.37	.....	.....	.....	.....

THERMAL E. M. F. FOR CHROMEL P-ALUMEL THERMOCOUPLE

FAHRENHEIT

E. M. F. values are in millivolts; temperatures are in degrees Fahrenheit
Roesser, Dahl and Gowens, Bur. Stds. Jour. Res. 14, 239 (1935)

Temp. °F.	0	10	20	30	40	50	60	70	80	90
-300	-5.51	-5.60	.....	.....	.....	.....	-5.08	-5.19	-5.30	-5.41
-200	-4.29	-4.43	-4.57	-4.71	-4.84	-4.96	-5.08	-5.19	-5.30	-5.41
-100	-2.65	-2.83	-3.01	-3.19	-3.36	-3.52	-3.68	-3.84	-4.00	-4.15
0	-0.68	-0.89	-1.10	-1.30	-1.50	-1.70	-1.90	-2.09	-2.28	-2.47
0	-0.68	-0.47	-0.26	-0.04	+0.18	0.40	0.62	0.84	1.06	1.29
100	1.52	1.74	1.97	2.20	2.43	2.66	2.89	3.12	3.36	3.59
200	3.82	4.05	4.28	4.51	4.74	4.97	5.19	5.42	5.64	5.87
300	6.09	6.31	6.53	6.75	6.98	7.20	7.42	7.64	7.87	8.09
400	8.31	8.53	8.76	8.98	9.20	9.43	9.66	9.88	10.11	10.33
500	10.56	10.79	11.02	11.25	11.47	11.70	11.93	12.16	12.39	12.62
600	12.85	13.08	13.31	13.55	13.78	14.01	14.24	14.48	14.71	14.94
700	15.18	15.41	15.64	15.88	16.11	16.35	16.58	16.82	17.05	17.29
800	17.52	17.75	17.99	18.22	18.46	18.70	18.93	19.17	19.41	19.64
900	19.88	20.12	20.36	20.59	20.83	21.07	21.30	21.54	21.78	22.01
1000	22.25	22.49	22.72	22.96	23.20	23.43	23.67	23.91	24.14	24.38
1100	24.62	24.85	25.09	25.33	25.57	25.80	26.04	26.27	26.51	26.74
1200	26.98	27.21	27.45	27.68	27.92	28.15	28.39	28.62	28.86	29.09
1300	29.33	29.56	29.79	30.02	30.26	30.49	30.72	30.96	31.19	31.42
1400	31.65	31.88	32.11	32.34	32.57	32.80	33.03	33.26	33.49	33.71
1500	33.94	34.17	34.40	34.62	34.85	35.08	35.30	35.53	35.75	35.98
1600	36.20	36.42	36.65	36.87	37.10	37.32	37.54	37.76	37.99	38.21
1700	38.43	38.65	38.87	39.09	39.31	39.53	39.75	39.96	40.18	40.40
1800	40.62	40.83	41.05	41.27	41.48	41.70	41.91	42.13	42.34	42.56
1900	42.77	42.98	43.20	43.41	43.62	43.83	44.04	44.26	44.47	44.68
2000	44.89	45.10	45.31	45.52	45.73	45.93	46.14	46.35	46.56	46.76
2100	46.97	47.18	47.38	47.59	47.79	47.99	48.20	48.40	48.61	48.81
2200	49.01	49.21	49.41	49.61	49.81	50.01	50.21	50.41	50.61	50.80
2300	51.00	51.20	51.39	51.59	51.78	51.98	52.17	52.37	52.56	52.75
2400	52.95	53.14	53.33	53.52	53.71	53.90	54.09	54.28	54.47	54.66
2500	54.85	.....	.....	.....	.....	.....	.....	.....	.....	.....

CALIBRATION TABLES FOR THERMOCOUPLES (Continued) THERMAL E. M. F. FOR CHROMEL P-ALUMEL THERMOCOUPLE

CENTIGRADE

E. M. F. values are in millivolts; temperatures are in degrees Centigrade
Roeser, Dahl and Gowens, Bur. Sids. Jour. Res. 14, 239 (1935)

Temp. °C.	0	10	20	30	40	50	60	70	80	90
-200	-5.75	.....	.....	.....	.....	.....	.....	.....	.....	.....
-100	-3.49	-3.78	-4.05	-4.32	-4.57	-4.81	-5.03	-5.24	-5.43	-5.60
0	0.00	-0.39	-0.77	-1.14	-1.50	-1.86	-2.21	-2.55	-2.87	-3.19
0	0.00	0.40	0.80	1.20	1.61	2.02	2.43	2.85	3.26	3.68
100	4.10	4.51	4.92	5.33	5.73	6.13	6.53	6.93	7.33	7.73
200	8.13	8.53	8.93	9.34	9.74	10.15	10.56	10.97	11.38	11.80
300	12.21	12.62	13.04	13.45	13.87	14.29	14.71	15.13	15.55	15.97
400	16.39	16.82	17.24	17.66	18.08	18.50	18.93	19.36	19.78	20.21
500	20.64	21.07	21.49	21.92	22.34	22.77	23.20	23.62	24.05	24.48
600	24.90	25.33	25.75	26.18	26.60	27.03	27.45	27.87	28.29	28.72
700	29.14	29.56	29.98	30.40	30.82	31.23	31.65	32.07	32.48	32.90
800	33.31	33.71	34.12	34.53	34.94	35.35	35.75	36.16	36.56	36.96
900	37.36	37.76	38.16	38.56	38.96	39.35	39.75	40.14	40.53	40.92
1000	41.31	41.70	42.08	42.47	42.86	43.24	43.62	44.00	44.38	44.76
1100	45.14	45.52	45.89	46.27	46.64	47.01	47.38	47.75	48.12	48.48
1200	48.85	49.21	49.57	49.94	50.29	50.65	51.00	51.36	51.71	52.06
1300	52.41	52.75	53.10	53.45	53.79	54.13	54.47	54.81	55.15	55.48
1400	55.81	.....	.....	.....	.....	.....	.....	.....	.....	.....

TEMPERATURE-E. M. F. VALUES FOR COPPER-CONSTANTAN

E. M. F. values are in millivolts; reference junctions at 0°C.; temperatures are in degrees Centigrade

Roeser and Wensel, National Bureau of Standards

Degree C	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
-200°	-5.54	.....	.....	.....	.....	.....	.....	.....	.....	.....
-100°	-3.35	-3.62	-3.89	-4.14	-4.38	-4.60	-4.82	-5.02	-5.20	-5.38
0°	0	-0.38	-0.75	-1.11	-1.47	-1.81	-2.14	-2.46	-2.77	-3.06
0°	0	0.39	0.79	1.19	1.61	2.03	2.47	2.91	3.36	3.81
100°	4.28	4.75	5.23	5.71	6.20	6.70	7.21	7.72	8.23	8.76
200°	9.29	9.82	10.36	10.91	11.46	12.01	12.57	13.14	13.71	14.28
300°	14.86	15.44	16.03	16.62	17.22	17.82	18.42	19.03	19.64	20.25
400°	20.87	.....	.....	.....	.....	.....	.....	.....	.....	.....

TEMPERATURE-E. M. F. VALUES FOR COPPER-CONSTANTAN

E. M. F. values are in millivolts; reference junctions at 32°F.; temperatures are in degrees Fahrenheit

Roeser and Wensel, National Bureau of Standards

Degree F	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
-300°	-5.28	.....	.....	.....	.....	.....	.....	.....	.....	.....
-200°	-4.11	-4.25	-4.38	-4.50	-4.63	-4.75	-4.86	-4.97	-5.08	-5.18
-100°	-2.56	-2.73	-2.90	-3.06	-3.22	-3.38	-3.53	-3.68	-3.83	-3.97
0°	-0.67	-0.87	-1.07	-1.27	-1.47	-1.66	-1.84	-2.03	-2.21	-2.39
0°	-0.67	-0.46	-0.26	-0.04	+0.17	0.39	0.61	0.83	1.06	1.29
100°	1.52	1.75	1.99	2.23	2.47	2.71	2.96	3.21	3.46	3.71
200°	3.97	4.22	4.48	4.75	5.01	5.28	5.55	5.82	6.09	6.37
300°	6.64	6.92	7.21	7.49	7.77	8.06	8.35	8.64	8.93	9.23
400°	9.52	9.82	10.12	10.42	10.72	11.03	11.33	11.64	11.95	12.26
500°	12.57	12.89	13.20	13.52	13.83	14.15	14.47	14.79	15.12	15.44
600°	15.77	16.10	16.42	16.75	17.08	17.42	17.75	18.08	18.42	18.75
700°	19.09	19.43	19.77	20.11	20.45	20.80	.....	.....	.....	.....

CALIBRATION TABLES **FOR THERMOCOUPLES (Continued)** **TEMPERATURE-E. M. F. VALUES FOR** **IRON-CONSTANTAN THERMOCOUPLES**

E. M. F. values are in millivolts; reference junctions at 32°F.; temperatures are in degrees Fahrenheit
 Roeser and Wensel, National Bureau of Standards

Degrees F	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
-300°	-7.87									
-200°	-6.01	-6.22	-6.43	-6.63	-6.83	-7.02	-7.20	-7.38	-7.55	-7.72
-100°	-3.63	-3.88	-4.13	-4.38	-4.63	-4.87	-5.11	-5.34	-5.57	-5.79
0°	-0.92	-1.20	-1.48	-1.76	-2.04	-2.31	-2.58	-2.85	-3.11	-3.37
0°	-0.92	-0.63	-0.35	-0.06	+0.23	0.52	0.82	1.11	1.41	1.70
100°	2.00	2.30	2.60	2.90	3.20	3.50	3.81	4.11	4.42	4.72
200°	5.03	5.34	5.64	5.95	6.26	6.57	6.88	7.19	7.50	7.81
300°	8.12	8.43	8.75	9.06	9.37	9.68	10.00	10.31	10.62	10.93
400°	11.24	11.56	11.87	12.18	12.49	12.80	13.11	13.42	13.73	14.04
500°	14.35	14.65	14.96	15.27	15.58	15.89	16.20	16.50	16.81	17.12
600°	17.43	17.73	18.04	18.34	18.65	18.95	19.26	19.56	19.87	20.18
700°	20.48	20.79	21.09	21.40	21.70	22.01	22.31	22.62	22.92	23.23
800°	23.53	23.84	24.14	24.45	24.75	25.06	25.37	25.67	25.98	26.29
900°	26.59	26.90	27.21	27.52	27.83	28.14	28.45	28.76	29.07	29.39
1000°	29.70	30.01	30.33	30.64	30.96	31.28	31.60	31.92	32.24	32.56
1100°	32.88	33.20	33.53	33.86	34.18	34.51	34.84	35.17	35.50	35.84
1200°	36.17	36.50	36.84	37.18	37.52	37.86	38.20	38.54	38.88	39.23
1300°	39.58	39.93	40.28	40.63	40.98	41.34	41.69	42.05	42.40	42.76
1400°	43.12	43.48	43.84	44.20	44.56	44.92	45.28	45.65	46.01	46.37
1500°	46.74	47.10	47.47	47.83	48.20	48.56	48.93	49.29	49.66	50.02
1600°	50.39	50.75	51.12	51.49	51.85	52.22	52.55	52.88	53.21	53.54
1700°	53.87	54.20	54.52	54.85	55.18	55.51	55.84	56.17	56.50	56.83
1800°	57.16									

TEMPERATURE-E. M. F. VALUES FOR **IRON-CONSTANTAN THERMOCOUPLES**

E. M. F. values are in millivolts; reference junctions at 0°C.; temperatures are in degrees Centigrade
 Roeser and Wensel, National Bureau of Standards

Degree C	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
-200°	-8.27									
-100°	-4.82	-5.25	-5.66	-6.06	-6.44	-6.80	-7.14	-7.46	-7.75	-8.02
0°	0.00	-0.52	-1.03	-1.53	-2.03	-2.52	-3.00	-3.47	-3.93	-4.38
0°	0.00	0.52	1.05	1.58	2.12	2.66	3.20	3.75	4.30	4.85
100°	5.40	5.95	6.51	7.07	7.63	8.19	8.75	9.31	9.87	10.43
200°	10.99	11.56	12.12	12.68	13.23	13.79	14.35	14.90	15.46	16.01
300°	16.56	17.12	17.67	18.22	18.77	19.32	19.87	20.42	20.97	21.52
400°	22.07	22.62	23.17	23.72	24.27	24.82	25.37	25.92	26.47	27.03
500°	27.58	28.14	28.70	29.26	29.82	30.39	30.96	31.53	32.11	32.69
600°	33.27	33.86	34.45	35.04	35.64	36.24	36.84	37.45	38.06	38.68
700°	39.30	39.93	40.56	41.19	41.83	42.48	43.12	43.77	44.42	45.07
800°	45.72	46.37	47.03	47.69	48.34	49.00	49.66	50.32	50.97	51.63
900°	52.29	52.88	53.47	54.06	54.65	55.25	55.84	56.43	57.03	57.63
1000°	58.22									

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE

Emfs are expressed in microvolts and temperatures in °C. Cold junctions at 0°C.
ROSEB AND WENSEL, NATIONAL BUREAU OF STANDARDS

E(μv)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	E(μv)
0	0	146.9	265.0	373.7	477.7	578.1	675.3	769.5	861.0	0
100	17.7	159.4	276.2	384.2	487.9	588.0	684.8	778.8	870.0	100
200	34.4	171.7	287.3	394.7	498.1	597.8	694.3	788.0	879.0	200
300	50.2	183.8	298.3	405.2	508.2	607.6	703.8	797.2	888.0	300
400	65.4	195.8	309.3	415.7	518.3	617.4	713.3	806.4	897.0	400
500	80.0	207.6	320.2	426.1	528.4	627.1	722.7	815.6	905.9	500
600	94.1	219.3	331.0	436.5	538.4	636.8	732.1	824.7	914.8	600
700	107.8	230.9	341.7	446.8	548.4	646.5	741.5	833.8	923.7	700
800	121.1	242.4	352.4	457.1	558.3	656.1	750.9	842.9	932.6	800
900	134.1	253.7	363.1	467.4	568.2	665.7	760.2	852.0	941.4	900
1,000	146.9	265.0	373.7	477.7	578.1	675.3	769.5	861.0	950.2	1,000

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh
THERMOCOUPLE (Continued)

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE (Continued)
Emfs are expressed in microvolts and temperatures in °C. Cold junctions at 0°C.

E(μv)	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	E(μv)
0	950.2 8.8	1,037.2 8.6	1,122.3 8.5	1,206.4 8.3	1,290.0 8.3	1,373.8 8.4	1,458.0 8.4	1,542.6 8.5	1,627.8 8.6	0
100	959.0 8.8	1,045.8 8.6	1,130.8 8.4	1,214.7 8.4	1,298.3 8.4	1,382.2 8.4	1,466.4 8.4	1,551.1 8.5	1,636.4 8.5	100
200	967.8 8.7	1,054.4 8.5	1,139.2 8.4	1,223.1 8.3	1,306.7 8.4	1,390.6 8.4	1,474.8 8.5	1,559.6 8.5	1,644.9 8.6	200
300	976.5 8.8	1,062.9 8.6	1,147.6 8.4	1,231.4 8.4	1,315.1 8.4	1,399.0 8.4	1,483.3 8.5	1,568.1 8.5	1,653.5 8.6	300
400	985.3 8.7	1,071.5 8.5	1,156.0 8.4	1,239.8 8.4	1,323.5 8.3	1,407.4 8.4	1,491.8 8.4	1,576.6 8.5	1,662.1 8.6	400
500	994.0 8.7	1,080.0 8.5	1,164.4 8.4	1,248.2 8.3	1,331.8 8.4	1,415.8 8.4	1,500.2 8.5	1,585.1 8.6	1,670.7 8.6	500
600	1,002.7 8.6	1,088.5 8.5	1,172.8 8.4	1,256.5 8.4	1,340.2 8.4	1,424.2 8.5	1,508.7 8.5	1,593.7 8.5	1,679.3 8.6	600
700	1,011.3 8.7	1,097.0 8.4	1,181.2 8.4	1,264.9 8.3	1,348.6 8.4	1,432.7 8.4	1,517.2 8.4	1,602.2 8.5	1,687.9 8.6	700
800	1,020.0 8.6	1,105.4 8.5	1,189.6 8.4	1,273.2 8.4	1,357.0 8.4	1,441.1 8.4	1,525.6 8.5	1,610.7 8.6	1,696.5 8.6	800
900	1,028.6 8.6	1,113.9 8.4	1,198.0 8.4	1,281.6 8.4	1,365.4 8.4	1,449.5 8.5	1,534.1 8.5	1,619.3 8.5	1,705.1 8.6	900
1,000	1,037.2	1,122.3	1,206.4	1,290.0	1,373.8	1,458.0	1,542.6	1,627.8	1,713.7	1,000

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE (Continued)

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE

Emfs are expressed in microvolts and temperatures in °F. Cold junctions at 32°F.
ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

E(μv)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	E(μv)
0	32.0	296.4	509.0	704.7	891.9	1,072.6	1,247.5	1,417.1	1,581.8	0
100	31.9	22.5	20.1	19.0	18.4	17.7	17.1	16.7	16.2	100
	63.9	318.9	529.1	723.7	910.3	1,090.3	1,264.6	1,433.8	1,598.0	
200	30.0	22.1	20.0	18.9	18.3	17.7	17.1	16.6	16.2	200
	93.9	341.0	549.1	742.6	928.6	1,108.0	1,281.7	1,450.4	1,614.2	
300	28.5	21.8	19.9	18.8	18.2	17.7	17.1	16.6	16.2	300
	122.4	362.8	569.0	761.4	946.8	1,125.7	1,298.8	1,467.0	1,630.4	
400	27.3	21.6	19.8	18.8	18.1	17.6	17.1	16.5	16.1	400
	149.7	384.4	588.8	780.2	964.9	1,143.3	1,315.9	1,483.5	1,646.5	
500	26.3	21.3	19.6	18.8	18.1	17.5	17.0	16.5	16.1	500
	176.0	405.7	608.4	799.0	983.0	1,160.8	1,332.9	1,500.0	1,662.6	
600	25.4	21.0	19.4	18.7	18.1	17.5	16.9	16.5	16.0	600
	201.4	426.7	627.8	817.7	1,001.1	1,178.3	1,349.8	1,516.5	1,678.6	
700	24.6	20.9	19.3	18.6	18.0	17.4	16.9	16.4	16.0	700
	226.0	447.6	647.1	836.3	1,019.1	1,195.7	1,366.7	1,532.9	1,694.6	
800	24.0	20.7	19.3	18.5	17.9	17.3	16.9	16.3	16.0	800
	250.0	468.3	666.4	854.8	1,037.0	1,213.0	1,383.6	1,549.2	1,710.6	
900	23.4	20.4	19.2	18.6	17.8	17.3	16.8	16.3	15.9	900
	273.4	488.7	685.6	873.4	1,054.8	1,230.3	1,400.4	1,565.5	1,726.5	
1,000	23.0	20.3	19.1	18.5	17.8	17.2	16.7	16.3	15.9	1,000
	296.4	509.0	704.7	891.9	1,072.6	1,247.5	1,417.1	1,581.8	1,742.4	

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE (Continued)

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE (Continued)

Emfs are expressed in microvolts and temperatures in °F. Cold junctions at 32°F.

E(μ v)	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	E(μ v)
0	1,742.4 15.8	1,899.0 15.5	2,052.1 15.2	2,203.5 15.0	2,354.0 15.0	2,504.8 15.2	2,656.4 15.1	2,808.7 15.3	2,962.0 15.4	0
100	1,758.2 15.8	1,914.5 15.4	2,067.3 15.2	2,218.5 15.0	2,369.0 15.1	2,520.0 15.1	2,671.5 15.2	2,824.0 15.3	2,977.4 15.4	100
200	1,774.0 15.7	1,929.9 15.4	2,082.5 15.2	2,233.5 15.0	2,384.1 15.1	2,535.1 15.1	2,686.7 15.2	2,839.3 15.3	2,992.8 15.5	200
300	1,789.7 15.8	1,945.3 15.4	2,097.7 15.1	2,248.5 15.1	2,399.2 15.1	2,550.2 15.1	2,701.9 15.3	2,854.6 15.3	3,008.3 15.5	300
400	1,805.5 15.7	1,960.7 15.3	2,112.8 15.1	2,263.6 15.1	2,414.3 15.0	2,565.3 15.1	2,717.2 15.2	2,869.9 15.3	3,023.8 15.5	400
500	1,821.2 15.6	1,976.0 15.3	2,127.9 15.1	2,278.7 15.0	2,429.3 15.1	2,580.4 15.2	2,732.4 15.3	2,885.2 15.4	3,039.3 15.4	500
600	1,836.8 15.6	1,991.3 15.2	2,143.0 15.2	2,293.7 15.1	2,444.4 15.1	2,595.6 15.2	2,747.7 15.3	2,900.6 15.4	3,054.7 15.5	600
700	1,852.4 15.6	2,006.5 15.2	2,158.2 15.1	2,308.8 15.0	2,459.5 15.1	2,610.8 15.2	2,763.0 15.2	2,916.0 15.3	3,070.2 15.5	700
800	1,868.0 15.5	2,021.7 15.2	2,173.3 15.1	2,323.8 15.1	2,474.6 15.1	2,626.0 15.2	2,778.2 15.2	2,931.3 15.4	3,085.7 15.5	800
900	1,883.5 15.5	2,036.9 15.2	2,188.4 15.1	2,338.9 15.1	2,489.7 15.1	2,641.2 15.2	2,793.4 15.3	2,946.7 15.3	3,101.2 15.5	900
1,000	1,899.0	2,052.1	2,203.5	2,354.0	2,504.8	2,656.4	2,808.7	2,962.0	3,116.7	1,000

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE (Continued)

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE

Emfs are expressed in microvolts and temperatures in °C. Cold junctions at 0°C.
ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

E(μv)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	E(μv)
0	0	145.3	258.8	361.0	457.4	549.8	638.3	723.5	806.0	886.1	0
100	17.9	12.2	10.6	9.9	9.5	9.0	8.7	8.4	8.1	7.9	100
200	17.9	157.5	269.4	370.9	466.9	558.8	647.0	731.9	814.1	894.0	200
300	16.7	12.0	10.5	9.8	9.4	9.0	8.6	8.4	8.1	7.8	300
400	34.6	169.5	279.9	380.7	476.3	567.8	655.6	740.3	822.2	901.8	400
500	15.8	11.7	10.4	9.8	9.4	9.0	8.6	8.3	8.1	7.9	500
600	50.4	181.2	290.3	390.5	485.7	576.8	664.2	748.6	830.3	909.7	600
700	15.1	11.5	10.3	9.7	9.3	8.9	8.6	8.3	8.0	7.8	700
800	65.5	192.7	300.6	400.2	495.0	585.7	672.8	756.9	838.3	917.5	800
900	14.5	11.4	10.2	9.7	9.3	8.9	8.5	8.2	8.0	7.8	900
1,000	80.0	204.1	310.8	409.9	504.3	594.6	681.3	765.1	846.3	925.3	1,000
	13.9	11.2	10.2	9.6	9.2	8.8	8.5	8.2	8.0	7.8	
	93.9	215.3	321.0	419.5	513.5	603.4	689.8	773.3	854.3	933.1	
	13.4	11.1	10.1	9.5	9.1	8.8	8.5	8.2	8.0	7.8	
	107.3	226.4	331.1	429.0	522.6	612.2	698.3	781.5	862.3	940.9	
	13.0	10.9	10.0	9.5	9.1	8.7	8.4	8.2	8.0	7.8	
	120.3	237.3	341.1	438.5	531.7	620.9	706.7	789.7	870.3	948.7	
	12.6	10.8	10.0	9.5	9.1	8.7	8.4	8.1	7.9	7.7	
	132.9	248.1	351.1	448.0	540.8	629.6	715.1	797.8	878.2	956.4	
	12.4	10.7	9.9	9.4	9.0	8.7	8.4	8.2	7.9	7.7	
	145.3	258.8	361.0	457.4	549.8	638.3	723.5	806.0	886.1	964.1	

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE (Continued)

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE (Continued)

Emfs are expressed in microvolts and temperatures in °C. Cold junctions at 0°C.

E(μv)	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	18,000	19,000	E(μv)
0	964.1 7.6	1,040.0 7.4	1,113.9 7.3	1,186.9 7.2	1,259.3 7.3	1,331.8 7.2	1,404.3 7.3	1,476.9 7.3	1,550.0 7.4	1,623.6 7.4	0
100	971.7 7.7	1,047.4 7.5	1,121.2 7.4	1,194.1 7.3	1,266.6 7.2	1,339.0 7.2	1,411.6 7.3	1,484.2 7.3	1,557.4 7.4	1,631.0 7.4	100
200	979.4 7.6	1,054.9 7.4	1,128.6 7.3	1,201.4 7.3	1,273.8 7.3	1,346.2 7.3	1,418.9 7.2	1,491.5 7.3	1,564.8 7.3	1,638.4 7.4	200
300	987.0 7.7	1,062.3 7.4	1,135.9 7.3	1,208.7 7.3	1,281.1 7.2	1,353.5 7.3	1,426.1 7.2	1,498.8 7.3	1,572.1 7.4	1,645.8 7.4	300
400	994.7 7.6	1,069.7 7.4	1,143.2 7.3	1,215.9 7.3	1,288.3 7.2	1,360.8 7.2	1,433.3 7.2	1,506.1 7.3	1,579.5 7.3	1,653.2 7.4	400
500	1,002.3 7.6	1,077.1 7.3	1,150.5 7.3	1,223.2 7.2	1,295.5 7.2	1,368.0 7.3	1,440.5 7.3	1,513.4 7.3	1,586.8 7.4	1,660.6 7.4	500
600	1,009.9 7.6	1,084.4 7.4	1,157.8 7.3	1,230.4 7.2	1,302.7 7.2	1,375.3 7.3	1,447.8 7.2	1,520.7 7.3	1,594.2 7.3	1,668.0 7.4	600
700	1,017.5 7.5	1,091.8 7.4	1,165.1 7.2	1,237.6 7.2	1,309.9 7.3	1,382.6 7.2	1,455.0 7.3	1,528.0 7.3	1,601.5 7.4	1,675.4 7.4	700
800	1,025.0 7.5	1,099.2 7.3	1,172.3 7.3	1,244.8 7.3	1,317.2 7.3	1,389.8 7.3	1,462.3 7.3	1,535.3 7.4	1,608.9 7.3	1,682.8 7.4	800
900	1,032.5 7.5	1,106.5 7.4	1,179.6 7.3	1,252.1 7.2	1,324.5 7.3	1,397.1 7.2	1,469.6 7.3	1,542.7 7.3	1,616.2 7.4	1,690.2 7.4	900
1,000	1,040.0	1,113.9	1,186.9	1,259.3	1,331.8	1,404.3	1,476.9	1,550.0	1,623.6	1,697.6	1,000

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE (Continued)

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE

Emfs are expressed in microvolts and temperatures in °F. Cold junctions at 32°F.

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E(μv)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	E(μv)
0	32.0	293.5	497.8	681.8	855.3	1,021.6	1,180.9	1,334.3	1,482.8	1,627.0	0
100	64.2	315.5	516.9	699.6	872.3	1,037.8	1,196.5	1,349.4	1,497.4	1,641.2	100
200	94.3	337.1	535.8	717.3	889.3	1,054.0	1,212.1	1,364.5	1,512.0	1,655.3	200
300	122.7	358.2	554.5	734.9	906.2	1,070.2	1,227.6	1,379.5	1,526.5	1,669.4	300
400	149.9	378.9	573.1	752.4	923.0	1,086.3	1,243.0	1,394.4	1,540.9	1,683.5	400
500	176.0	399.3	591.5	769.8	939.7	1,102.3	1,258.3	1,409.2	1,555.3	1,697.5	500
600	201.0	419.5	609.8	787.1	956.3	1,118.2	1,273.6	1,424.0	1,569.7	1,711.6	600
700	225.1	439.5	628.0	804.3	972.7	1,134.0	1,288.9	1,438.8	1,584.1	1,725.6	700
800	248.5	459.2	646.0	821.4	989.1	1,149.7	1,304.1	1,453.5	1,598.5	1,739.6	800
900	271.2	478.6	664.0	838.4	1,005.4	1,165.3	1,319.2	1,468.1	1,612.8	1,753.5	900
1,000	293.5	497.8	681.8	855.3	1,021.6	1,180.9	1,334.3	1,482.8	1,627.0	1,767.4	1,000

REFERENCE TABLE FOR Pt TO Pt-13 PER CENT Rh THERMOCOUPLE (Continued)

REFERENCE TABLE FOR Pt TO Pt-13 PER CENT Rh THERMOCOUPLE (Continued)

Emfs are expressed in microvolts and temperatures in °F. Cold junctions at 32°F.

E(μv)	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	18,000	19,000	E(μv)
0	1,767.4 13.8	1,904.0 13.4	2,037.0 13.2	2,168.4 13.0	2,298.7 13.1	2,429.2 13.0	2,559.7 13.1	2,690.4 13.2	2,822.0 13.3	2,954.5 13.3	0
100	1,781.2 13.7	1,917.4 13.4	2,050.2 13.2	2,181.4 13.1	2,311.8 13.0	2,442.2 13.0	2,572.8 13.1	2,703.6 13.1	2,835.3 13.3	2,967.8 13.3	100
200	1,794.9 13.7	1,930.8 13.3	2,063.4 13.2	2,194.5 13.1	2,324.8 13.1	2,455.2 13.1	2,585.9 13.0	2,716.7 13.1	2,848.6 13.2	2,981.1 13.3	200
300	1,808.6 13.8	1,944.1 13.3	2,076.6 13.2	2,207.6 13.1	2,337.9 13.0	2,468.3 13.1	2,598.9 13.0	2,729.8 13.2	2,861.8 13.3	2,994.4 13.4	300
400	1,822.4 13.7	1,957.4 13.3	2,089.8 13.1	2,220.6 13.1	2,350.9 13.0	2,481.4 13.0	2,611.9 13.0	2,743.0 13.1	2,875.1 13.2	3,007.8 13.3	400
500	1,836.1 13.7	1,970.7 13.3	2,102.9 13.1	2,233.7 13.1	2,363.9 13.0	2,494.4 13.1	2,624.9 13.1	2,756.1 13.2	2,888.3 13.3	3,021.1 13.3	500
600	1,849.8 13.6	1,984.0 13.3	2,116.0 13.1	2,246.7 13.0	2,376.9 13.0	2,507.5 13.1	2,638.0 13.0	2,769.3 13.1	2,901.6 13.2	3,034.4 13.3	600
700	1,863.4 13.6	1,997.3 13.3	2,129.1 13.1	2,259.7 13.0	2,389.9 13.1	2,520.6 13.0	2,651.0 13.1	2,782.4 13.2	2,914.8 13.2	3,047.7 13.3	700
800	1,877.0 13.5	2,010.6 13.2	2,142.2 13.1	2,272.7 13.0	2,403.0 13.1	2,533.6 13.1	2,664.1 13.1	2,795.6 13.2	2,928.0 13.2	3,061.0 13.4	800
900	1,890.5 13.5	2,023.8 13.2	2,155.3 13.1	2,285.7 13.0	2,416.1 13.1	2,546.7 13.0	2,677.2 13.2	2,808.8 13.2	2,941.2 13.3	3,074.2 13.3	900
1,000	1,904.0 13.5	2,037.0 13.2	2,168.4 13.1	2,298.7 13.0	2,429.2 13.1	2,559.7 13.0	2,690.4 13.2	2,822.0 13.2	2,954.5 13.3	3,087.7 13.3	1,000

THERMOELECTRIC POWER

The table gives the thermoelectric power in microvolts per degree Centigrade difference in temperature when the cold junction is at 0°C.

The values given are with respect to lead except where noted. A is the thermoelectric power at 0°C, B is the coefficient of t in the equation for the thermoelectric power at any temperature t ,—

$$Q = A + Bt.$$

The values are regarded as positive if the current flows from the metal listed to the reference metal (usually lead) at the cold junction.

Metal	Microvolts per °C		Temp. range °C
	A	B	
		$\times 10^{-2}$	
Aluminum, 99% pure.....	— 0.4717	+ 0.2718	—200—+100
commercial.....	— 0.38	— 0.01	} 0-100
	— 0.53	+ 0.21	
Antimony, used in cast form, solid rods soldered end to end.....	+35.58	+14.50	0-100
Bismuth, commercial.....	—43.688	—46.47	—200—+100
electrolytic.....	—74.42	+ 3.2	0-100
Brass, 85.8 Cu, 14.22 Zn.....	+ 0.710	+ 0.56	— 78—+100
66.3 Cu, 33.72 Zn.....	+ 0.699	+ 0.69	— 78—+100
Cadmium.....	+ 3.059	+ 2.856	—200—+100
cold drawn.....	+ 2.85	+ 3.89	0-100
Calcium, 99.57% pure.....	— 8.20	— 2.9	0-400
Caesium.....	+ 0.66	— 0.10	—183-0
	+ 7.735	— 3.34	28-100
Carbon, filament.....	+11.056	+ 3.578	—200—+100
Cerium, 97.7% Ce, 1.2% Fe, remain- der cerium oxide and cerium carbide	+ 4.39	— 1.26	0-200
Cobalt.....	—10.7	— 5.70	0-1200
Constantan, 60 Cu, 40 Ni.....	—38.105	— 8.88	0-400
Copper, electrolytic.....	+ 2.705	+ 0.7866	—270—+200
pure, hard drawn.....	+ 2.76	+ 1.22	0-100
German silver, commercial.....	—10.861	— 3.29	—200—+100
Germanium.....	+302.5	+72.5	—200—+125
Gold.....	+ 2.90	+ 0.68	—260-0
	+ 2.90	+ 0.934	0-200
Indium.....	+ 2.40	+ 0.190	0-100
Iridium, Heraeus made.....	+ 2.44	— 0.28	— 80—+100
Iron.....	—51.34	—20.4	—260—200
transformer iron.....	+16.65	— 2.966	—230—+100
Lithium.....	+14.37	+ 8.76	—200—+ 50
Magnesium.....	— 0.2010	+ 0.2572	—200—+100
Heraeus made.....	— 0.120	+ 0.193	0-200
Manganin, 84 Cu, 12 Mn, 4 Ni.....	+ 1.366	+ 0.083	0-100
Mercury.....	— 8.8103	— 3.333	0-200
Molybdenum.....	+ 5.892	+ 4.334	0-100
Nichrome, 58.5 Ni, 22.5 Fe 16 Cr, 3. Mn (Against Pt)	+ 25.0	.....	0-420
Nickel.....	— 19.067	— 3.022	0-200
	— 17.633	— 5.016	—260-0
Nickel-chromium, 84 Ni, 16 Cr (Against Pt)	+ 30.22	.....	600-1200
90 Ni, 10 Cr (Against Pt)	+ 30.3	0.0	0-1200
Palladium.....	— 7.409	— 3.922	—200—+100
Platinoid.....	— 10.620	— 2.77	—200—+100
Platinum.....	— 3.038	— 3.248	—200—+300
	— 6.677	+ 0.1528	—260-0

THERMOELECTRIC POWER—(Continued)

Metal	Microvolts per °C		Temp. range °C
	A	B	
Platinum		$\times 10^{-2}$	
Baker's platinum.....	— 1.788	— 3.460	0-100
Platinum-iridium, 85 Pt, 15 Ir.....	+ 14.083	+ 1.06	0-1200
90 Pt, 10 Ir.....	+ 13.208	+ 0.75	0-1200
Platinum-rhodium, 90 Pt, 10 Rh	+ 7.013	+ 0.64	0-1600
(Against Pt)			
85 Pt, 15 Rh	+ 6.69	+ 1.07	0-1600
(Against Pt)			
Potassium.....	— 11.33	— 3.76	—183-0
Rubidium.....	— 8.26	— 3.02	—183-0
	— 0.28	— 6.00	38-100
Silicon.....	—408.2	—46.96	—200+350
Silver, annealed.....	+ 2.50	+ 1.15	0-100
electrolytic.....	+ 2.947	+ 0.6782	—200+100
Sodium.....	— 4.16	— 1.44	—183-0
Steel (piano wire).....	+ 10.763	— 1.56	—200+100
Thallium.....	+ 1.659	— 0.268	0-100
Tin.....	+ 0.0684	+ 0.0038	—200+100
	+ 0.230	— 0.134	0-100
Tungsten.....	+ 1.594	+ 3.41	0-100
Zinc.....	+ 3.096	+ 3.191	—260-0
	+ 3.047	— 0.99	0-100

HYSTERESIS

The dissipation of energy due to hysteresis in metals is expressed by Steinmetz by the following equation:

$$E = \eta B^{1.6}$$

Values of η as found by Steinmetz appear below. C. G. S. units.

MATERIAL

Iron		
Norway iron.....		.00227
Wrought bar.....		.00326
Commercial ferrottype plate.....		.00548
Annealed " ".....		.00458
Thin tin plate.....		.00286
Medium thickness tin plate.....		.00425
Steel		
Soft galvanized wire.....		.00349
Annealed cast steel.....		.00848
Soft annealed cast steel.....		.00457
Very soft annealed cast steel.....		.00318
Same above tempered in cold water.....		.02792
Tool steel glass hard tempered in water.....		.07470
" " tempered in oil.....		.02670
" " annealed.....		.01899
Cast iron		
Gray cast iron.....		.01300
" " " " $\frac{1}{8}\%$ aluminum.....		.01365
" " " " $\frac{1}{2}\%$ ".....		.01459
Nickel		
Soft wire.....		.0122
Annealed wire.....		.0156
Hardened.....		.0385
Cobalt		
2% of iron.....		.0210
Iron Filings		
180 cycles per second.....		.0457
114 " " ".....		.0396
79-91 " " ".....		.0373

MAGNETIC CONSTANTS OF IRON

Permeability of Transformer Iron

Giving M , the total magneto motive force applied. M/l , the magneto motive force per unit length of iron circuit. B the total induction, B/a the induction per unit cross-section of iron, M/B , the magnetic reluctance of the iron circuit and Bl/Ma , the permeability; showing the typical relations of the magnetic constants for varying field.

(From Smithsonian Tables.)

M .	M/l .	B .	B/a .	Reluctance $M/B = K$.	Permea- bility Bl/Ma $= \mu$.
20	0.597	218×10^3	1406	0.917×10^{-4}	2360
40	1.194	587	3790	0.681	3120
60	1.791	878	5660	0.683	3180
80	2.338	1091	7040	0.734	2960
100	2.985	1219	7860	0.819	2640
120	3.582	1330	8580	0.903	2410
140	4.179	1405	9060	0.994	2186
160	4.776	1475	9510	1.090	2000
180	5.373	1532	9880	1.180	1850
200	5.970	1581	10200	1.270	1720
220	6.567	1618	10430	1.360	1590
260	7.761	1692	10910	1.540	1410

MAGNETIC PROPERTIES OF IRON AND STEEL

(From Gumlich, 1909.)

Sample.	Coer- cive force.	Residual B .	Maximum permea- bility.	B for $H = 150$.	$4\pi I$ for satu- ration.
Electrolytic iron.....	2.83	11400	1850	19200	21620
The same annealed.....	0.36	10800	14400	18900	21630
Cast steel.....	1.51	10600	3550	18800	21420
The same annealed.....	0.37	11000	14800	19100	21420
Steel hardened.....	52.4	7500	110	11700	18000
Cast iron.....	11.4	5100	240	10400	16400
The same annealed.....	4.6	5350	600	11000	16800
Electrical iron in sheets annealed.....	1.30	9400	3270	18200	20500

SATURATION CONSTANTS FOR MAGNETIC SUBSTANCES

Substance.	Field in- tensity. (For sat	Induced magnet- ization. uration.)	Substance.	Field in- tensity. (For sat	Induced magnet- ization. uration.)
Cobalt.....	9000	1300	Nickel, hard....	8000	400
Iron, wrought....	2000	1700	annealed.....	7000	515
cast.....	4000	1200	Vicker's steel....	15000	1600
Manganese steel.	7000	200			

MAGNETIC SUSCEPTIBILITY

The following tables give the specific susceptibility χ for various substances. The relation to volume susceptibility κ is shown by the equation $\chi = \kappa/d$, where d is the density of the substance. Unit of χ , 1×10^{-6} cgs electromagnetic units. Room temperature is to be understood where no other is stated. The values are positive for paramagnetic bodies, negative for diamagnetic.

ELEMENTS AND INORGANIC COMPOUNDS

Substance	Formula	Temp. °C	Suscepti- bility 10 ⁻⁶ cgs	Ob- server
Aluminum.....	Al	-170 sol.	0.60	31
		18	0.65	16
		230	0.64	16
		500	0.57	16
		1000 liq.	0.57	16
Aluminum bromide.....	AlBr ₃	19	-0.32	27
Aluminum chloride.....	AlCl ₃	19	-0.60	27
Aluminum oxide.....	Al ₂ O ₃		-0.098	45
Aluminum sulfate.....	Al ₂ (SO ₄) ₃	18	-0.48	27
Alum, ammonium, iron...	Fe ₂ (SO ₄) ₃ · (NH ₄) ₂ SO ₄ · 24H ₂ O	-258.4 -196 17	598. 114.7 30.4	29 29 29
Ammonia.....	NH ₃	16 gas	-1.1	33
Ammonium chloroplatinate	(NH ₄) ₂ PtCl ₆		-0.42	11
Ammonium metavanadate.	NH ₄ VO ₃	15	-0.12	27
Antimony.....	Sb	18 sol.	-0.87	1
		800 liq.	-0.49	16
Antimony bromide.....	SbBr ₃		-0.275	33
Antimony pentachloride...	SbCl ₅		-0.371	31
Antimony trichloride.....	SbCl ₃		-0.364	33
Antimony trioxide.....	Sb ₂ O ₃	14	-0.19	27
Argon.....	A	20 gas	-0.45	15
Arsenic.....	As	18	-0.31	1
Arsenous oxide.....	As ₂ O ₃	18	-0.27	27
Arsenous sulfide.....	As ₂ S ₃	18	-0.03	27
Barium.....	Ba	18	0.9	31
Barium bromide.....	BaBr ₂		-0.39	27
	BaBr ₂ ·2H ₂ O		-0.371	8
Barium carbonate.....	BaCO ₃		-0.298	33
Barium chloride.....	BaCl ₂		-0.41	27
	BaCl ₂ ·2H ₂ O		-0.368	8
Barium hydroxide.....	Ba(OH) ₂	18	-0.32	27
	Ba(OH) ₂ ·8H ₂ O		-0.497	33
Barium iodide.....	BaI ₂	22	-0.39	24
	BaI ₂ ·2H ₂ O	19	-0.38	27
Barium nitrate.....	Ba(NO ₃) ₂		-0.254	33
Barium oxide.....	BaO	20	-0.13	27
Barium sulfate.....	BaSO ₄		-0.306	33
Barium sulfide.....	BaS	18	-0.32	27
Beryllium.....	Be	20	-1.0	31
Beryllium chloride.....	BeCl ₂	17	-0.60	27
Beryllium hydroxide.....	Be(OH) ₂		-0.537	33
Beryllium oxide.....	BeO	16	0.0	27
Beryllium sulfate.....	BeSO ₄	18	-0.46	27
	BeSO ₄ ·4H ₂ O	17	-0.51	27
Bismuth.....	Bi	-259 -100 18 150 260	-1.55 -1.52 -1.35 -1.19 -1.02	30 31 1 16 16
Bismuth bromide.....	BiBr ₃		-0.328	12

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti- bility 10 ⁻⁶ cgs	Ob- server
Bismuth iodide.....	BiI ₃	20	-0.49	27
Bismuth nitrate.....	Bi(NO ₃) ₃ ·5H ₂ O	.....	-0.365	12
Bismuth sulfide.....	Bi ₂ S ₃	.....	-0.385	12
Bismuth trichloride.....	BiCl ₃	.....	-0.322	12
Bismuth trioxide.....	Bi ₂ O ₃	.....	-0.170	8
Boron.....	B	18	-0.69	1
Boric acid.....	H ₃ BO ₃	.....	-0.52	26
Boron oxide.....	B ₂ O ₃	14	-0.55	27
Bromine.....	Br	-170 sol.	-0.40	31
		- 8	-0.40	31
		18 liq.	-0.39	1
Cadmium.....	Cd	18	-0.18	1
		400	-0.16	16
Cadmium bromide.....	CdBr ₂	18	-0.38	27
Cadmium chloride.....	CdCl ₂	18	-0.32	27
Cadmium iodide.....	CdI ₂	18	-0.32	27
Cadmium oxide.....	CdO	15	-0.30	27
Caesium.....	Cs	18	-0.10	31
Caesium carbonate.....	Cs ₂ CO ₃	.....	-0.320	33
Caesium chloride.....	CsCl	.....	-0.363	33
Caesium nitrate.....	CsNO ₃	.....	-0.412	33
Caesium sulfate.....	Cs ₂ SO ₄	.....	-0.322	33
Calcium.....	Ca	18	1.10	31
Calcium carbonate.....	CaCO ₃	.....	-0.382	33
Calcium chloride.....	CaCl ₂	17	-0.49	27
	CaCl ₂ ·6H ₂ O	17	-0.54	27
Calcium hydroxide.....	Ca(OH) ₂	16	-0.39	27
Calcium oxide.....	CaO	16	-0.27	27
Calcium sulfate.....	CaSO ₄	.....	-0.364	33
	CaSO ₄ ·H ₂ O	.....	-0.384	33
Carbon (diamond).....	C	-170	-0.49	31
		20	-0.49	16
		200	-0.50	16
		400	-0.51	16
		900	-0.54	16
		1200	-0.56	16
Carbon (gas carbon).....	C	20	-2.0	16
		100	-2.0	16
		500	-1.8	16
		850	-1.6	16
		1150	-1.5	16
Carbon (graphite).....	C	-170	-6.0	31
		20	-3.5	31
		300	-2.7	31
		600	-2.0	31
		900	-1.4	31
		1000	-1.3	31
Carbon dioxide.....	CO ₂	20 gas	-0.423	35
Carbon disulfide.....	CS ₂	.....	-0.54	26
Cerium.....	Ce	-170	38.	31
		-150	35.	31
		-100	26.	31
		18	15.	31
		100	12.	31
		200	11.	31
Ceric oxide.....	CeO ₂	.....	0.39	26
Cerous bromide.....	CeBr ₃	18	6.0	5
Cerous chloride.....	CeCl ₃	19	6.1	27
Cerous sulfate.....	Ce ₂ (SO ₄) ₃	.....	7.8	39
Chlorine.....	Cl	-60 liq.	-0.57	33
Chromium.....	Cr	18	3.6	1
		500	3.8	16
		1100	4.2	16

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti- bility 10 ⁻⁶ cgs	Ob- server
Chromic chloride.....	CrCl ₃	19	44.3	17
Chromic oxide.....	Cr ₂ O ₃	18	25.5	18
Chromic sulfate.....	Cr ₂ (SO ₄) ₃	21	29.5	19
Chromium trioxide.....	CrO ₃	17	0.51	18
Chromous chloride.....	CrCl ₂	.....	84.	38
Chromous hydroxide.....	Cr(OH) ₂	.....	48.5	34
Chromous sulfate.....	CrSO ₄	.....	66.	2
Chromous sulfide.....	CrS	20	28.4	41
Cobaltic oxide.....	Co ₂ O ₃	.....	34.3	45
Cobalto cobaltic oxide.....	Co ₃ O ₄	.....	39 to 43.6	45
Cobaltous bromide.....	CoBr ₂	.....	46.8	9
Cobaltous chloride.....	CoCl ₂	25	90.5	19
Cobaltous iodide.....	CoI ₂	18	32.	25
Cobaltous nitrate.....	Co(NO ₃) ₂ ·6H ₂ O	.....	33.1	8
Cobaltous oxide.....	CoO	.....	74.5	45
Cobaltous sulfate.....	CoSO ₄	22	59.6	19
	CoSO ₄ ·H ₂ O	.....	53.6	11
	CoSO ₄ ·7H ₂ O	19.9	37.0	21
Columbium.....	Cb	18	1.5	1
Copper.....	Cu	18	-0.086	1
		500	-0.075	16
		1050	-0.070	16
Cupric bromide.....	CuBr ₂	31	3.10	19
Cupric chloride.....	CuCl ₂	19	9.10	19
	CuCl ₂ ·2H ₂ O	17	8.35	11
Cupric nitrate.....	Cu(NO ₃) ₂ ·6H ₂ O	.....	5.50	8
Cupric oxide.....	CuO	.....	3.8	45
Cupric sulfate.....	CuSO ₄	.....	8.6	11
	CuSO ₄ ·5H ₂ O	.....	5.9	11
Cupric sulfide.....	CuS	17	-0.20	27
Cuprous oxide.....	Cu ₂ O	.....	1.2	45
Cuprous sulfide.....	Cu ₂ S	18	-0.18	27
Dysprosium oxide.....	Dy ₂ O ₃	16	229.	29
Erbium.....	Er	18	22.	18
Erbium chloride.....	ErCl ₃	18	114.	5
Erbium oxide.....	Er ₂ O ₃	20	189.1	43
Erbium sulfate.....	Er ₂ (SO ₄) ₃	.....	118.	40
Ferric bromide.....	FeBr ₃	18	48.	25
Ferric chloride.....	FeCl ₃	20	86.2	19
Ferric hydroxide.....	Fe(OH) ₃	.....	157.	27
Ferric nitrate.....	Fe(NO ₃) ₃ ·6H ₂ O	.....	31.3	8
Ferric oxide.....	Fe ₂ O ₃	18	20.6	18
Ferric sulfate.....	Fe ₂ (SO ₄) ₃	23	57.3	19
Ferrous ammonium sulfate	FeSO ₄ ·(NH ₄) ₂ - SO ₄ ·6H ₂ O	-258.6 17.2	547. 32.6	21 21
Ferrous chloride.....	FeCl ₂	17	101.2	19
	FeCl ₂ ·4H ₂ O	19	60.1	19
Ferrous iodide.....	FeI ₂	18	40.	25
Ferrous sulfate.....	FeSO ₄	19	74.2	19
	FeSO ₄ ·7H ₂ O	16.5	41.5	21
Gadolinium chloride.....	GdCl ₃	18	91.	5
Gadolinium oxide.....	Gd ₂ O ₃	20	130.1	43
Gadolinium sulfate.....	Gd ₂ (SO ₄) ₃	.....	92.6	11
Gallium.....	Ga	-170 sol.	-0.26	31
		18	-0.24	31
		30	-0.23	31
		100 liq.	-0.04	31
Germanium.....	Ge	-170 sol.	-0.30	31
		18	-0.12	31
		900 liq.	-0.30	31

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti- bility 10 ⁻⁶ cgs	Ob- server
Gold.....	Au	18	-0.15	1
Gold chloride.....	AuCl ₃	21	0.43	27
Hafnium oxide.....	HfO ₂	.....	-0.110	27
Helium.....	He	20 gas	-0.47	15
Holmium chloride.....	HoCl ₃	.....	172.	46
Holmium nitrate.....	Ho(NO ₃) ₃	.....	123.6	46
Holmium oxide.....	Ho ₂ O ₃	.....	243.	46
Hydrochloric acid.....	HCl	22	-0.661	8
Hydrogen.....	H	20 gas	-1.97	1
Indium.....	In	20	-0.11	16
Indium trichloride.....	InCl ₃	18	-0.39	27
Iodine.....	I	-100 sol.	-0.32	31
		-60	-0.33	31
		0	-0.35	31
		18	-0.36	1
		50	-0.37	16
		113 liq.	-0.39	16
		160	-0.33	16
Iridium.....	Ir	18	0.14	1
		200	0.17	16
		450	0.20	16
		850	0.26	16
		1150	0.31	16
Iron carbonyl.....	Fe(CO) ₅	19	-0.40	32
Lanthanum.....	La	18	1.04	31
Lanthanum chloride.....	LaCl ₃	15	5.6	27
Lanthanum sesquioxide.....	La ₂ O ₃	24	-0.40	43
Lanthanum sulfate.....	La ₂ (SO ₄) ₃	.....	-0.30	39
Lead.....	Pb	-170 sol.	-0.14	31
		-18	-0.12	1
		330 liq.	-0.08	16
Lead bromide.....	PbBr ₂	20	-0.28	27
Lead chloride.....	PbCl ₂	15	-0.32	27
Lead iodide.....	PbI ₂	19	-0.33	27
Lead monoxide.....	PbO	18	-0.13	27
Lead nitrate.....	Pb(NO ₃) ₂	.....	-0.248	37
Lead oxide (red).....	Pb ₃ O ₄	18	-0.24	27
Lithium.....	Li	16	0.50	31
Lithium carbonate.....	Li ₂ CO ₃	.....	-0.413	33
Lithium chloride.....	LiCl	.....	-0.573	33
Lithium nitrate.....	LiNO ₃	19	-0.48	27
Lithium oxide.....	Li ₂ O	20	-0.57	27
Lithium sulfate.....	Li ₂ SO ₄	15	-0.38	27
Magnesium.....	Mg	18 sol.	0.55	16
		700 liq.	0.55	16
Magnesium bromide.....	MgBr ₂	20	-0.57	27
Magnesium carbonate.....	MgCO ₃	.....	-0.51	27
	MgCO ₃ ·3H ₂ O	.....	-0.525	33
Magnesium chloride.....	MgCl ₂	18	-0.58	27
	MgCl ₂ ·6H ₂ O	18	-0.57	27
Magnesium oxide.....	MgO	17	-0.25	27
Magnesium sulfate.....	MgSO ₄	.....	-0.45	36
	MgSO ₄ ·7H ₂ O	.....	-0.551	33
Manganese.....	Mn	18	9.9	1
Manganese bromide.....	MnBr ₂	18	68.	25
Manganese chloride.....	MnCl ₂	24	107.0	19
Manganese dioxide.....	MnO ₂	21	38.4	18
Manganese hydroxide (ous).....	Mn(OH) ₂	.....	49.	34
Manganese iodide.....	MnI ₂	18	47.	25
Manganese nitrate.....	Mn(NO ₃) ₂ ·6H ₂ O	.....	45.5	8
Manganese oxide (ous).....	MnO	21	75.9	18

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti- bility 10 ⁻⁶ cgs	Ob- server
Manganese oxide (ic).....	Mn ₂ O ₃	21	69.0	18
Manganese oxide (ous-ic)...	Mn ₃ O ₄	20	55.8	18
Manganese phosphate.....	MnPO ₄	.....	69.	38
Manganese sulfate (ous)....	MnSO ₄	24	88.5	18
Manganese sulfide (ous)...	MnS	10	44.32	41
Mercury.....	Hg	- 80 sol. 18 liq. 310	-0.15 -0.19 -0.193	31 1 16
Mercuric bromide.....	HgBr ₂	15	-0.30	27
Mercuric chloride.....	HgCl ₂	17	-0.19	27
Mercuric iodide.....	HgI ₂	17	-0.33	27
Mercuric oxide.....	HgO	16	-0.24	27
Mercuric sulfide.....	HgS	16	-0.23	27
Mercurous chloride.....	HgCl	19	-0.23	27
Molybdenum.....	Mo	18	0.04	16
Molybdenum dioxide.....	MoO ₂	20	0.33	41
Molybdenum trioxide.....	MoO ₃	20	0.88	41
Molybdenum sesquioxide....	Mo ₂ O ₃	16	-0.35	27
Neodymium.....	Nd	18	36.	31
Neodymium oxide.....	Nd ₂ O ₃	.....	30.3	39
Neodymium sulfate.....	Nd ₂ (SO ₄) ₃	.....	18.3	39
Neon.....	Ne	20 gas	-0.33	15
Nickel bromide.....	NiBr ₂	18	19.	25
Nickel carbonyl.....	Ni(CO) ₄	19	-0.481	32
Nickel chloride.....	NiCl ₂	24	44.7	19
Nickel hydroxide (ous)....	Ni(OH) ₂	.....	48.3	45
Nickel monoxide.....	NiO	.....	53.7	45
Nickel nitrate.....	Ni(NO ₃) ₂ ·6H ₂ O	.....	13.6	8
Nickel sulfate.....	NiSO ₄	15.9	26.7	21
	NiSO ₄ ·6H ₂ O	.....	15.6	11
	NiSO ₄ ·7H ₂ O	19.1	16.0	21
Nitric acid.....	HNO ₃	22	-0.467	8
Nitrogen.....	N	20 gas	-0.342	1
Nitrogen dioxide.....	NO	22 gas	48.66	35
Nitrogen monoxide.....	N ₂ O	12 liq.	-0.429	35
Nitrogen pentoxide.....	N ₂ O ₅	16 sol.	-0.332	35
Nitrogen peroxide.....	N ₂ O ₄	- 16 sol.	-0.276	35
	NO ₂	135 gas	3.26	35
Nitrogen trioxide.....	N ₂ O ₃	18 liq.	-0.206	35
Osmium.....	Os	18	0.05	1
Oxygen (1st modification)...	O	-259 sol.	54.	30
		-240	60.	30
(2nd modification).....		-240	118.	30
		-219	113.	30
(liquid).....		-219 liq.	310.	30
		-203	273.	30
		-196	260.	30
		20 gas	106.2	1
Palladium.....	Pd	-258	10.9	29
		-196	8.1	29
		-103	6.9	29
		0	5.4	31
		18	5.4	1
		200	4.6	16
		750	2.6	16
		1230	1.7	16
Phosphorus (white).....	P	20 sol.	-0.90	1
Phosphorus (red).....	P	20	-0.67	3
		45 liq.	-0.90	16
Phosphorus pentoxide.....	P ₂ O ₅	18	-0.46	27
Platinum.....	Pt	-170	1.31	31

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti- bility 10 ⁻⁶ cgs	Ob- server
Platinum (continued).....	Pt	-100	1.20	31
		18	1.10	1
		250	0.66	16
		700	0.45	16
		1220	0.30	16
Platinum tetrachloride.....	PtCl ₄	22	0.0	24
Potassium.....	K	18	0.52	1
Potassium acid fluoride.....	KHF ₂		-0.428	8
Potassium bromide.....	KBr		-0.377	8
Potassium carbonate.....	K ₂ CO ₃		-0.488	8
Potassium chlorate.....	KClO ₃		-0.30	26
Potassium chloride.....	KCl		-0.516	33
Potassium chloroplatinate.....	K ₂ PtCl ₆		-0.393	11
Potassium chloroplatinite.....	K ₂ PtCl ₄		-0.356	11
Potassium cyanate.....	KCNO		-0.465	33
Potassium dichromate.....	K ₂ Cr ₂ O ₇		0.129	8
Potassium ferricyanide.....	K ₃ Fe(CN) ₆	21	7.08	19
Potassium ferrocyanide.....	K ₄ Fe(CN) ₆ ·3H ₂ O		-0.420	32
Potassium hydroxide.....	KOH	22	-0.33	24
Potassium iodide.....	KI		-0.422	8
Potassium nitrate.....	KNO ₃		-0.326	33
Potassium permanganate.....	KMnO ₄	21	0.175	19
Potassium sulfate.....	K ₂ SO ₄		-0.403	33
Potassium tetrathionate.....	K ₂ S ₄ O ₆		-0.412	33
Praseodymium.....	Pr	-170 sol.	90.	31
		-100	53	31
		20	25.	31
		200	14.	31
		600	8.	31
		900 liq.	7.	31
Praseodymium chloride.....	PrCl ₃	19	17.	27
Praseodymium sulfate.....	Pr ₂ (SO ₄) ₃		13.7	28
Praseodymium trioxide.....	Pr ₂ O ₃		15.6	28
Quartz (<i>see Silicon dioxide</i>)	SiO ₂			
Rhodium.....	Rh	-180	0.90	31
		-40	1.05	31
		18	1.11	1
		280	1.31	16
		730	1.52	16
		1140	1.86	16
Rubidium.....	Rb	18	0.09	1
Rubidium carbonate.....	Rb ₂ CO ₃		-0.321	33
Rubidium chloride.....	RbCl		-0.327	33
Rubidium nitrate.....	RbNO ₃		-0.281	33
Rubidium sulfate.....	Rb ₂ SO ₄		-0.331	33
Ruthenium.....	Ru	-170	0.55	31
		18	0.50	1
		750	0.65	16
		1100	0.75	16
Samarium oxide.....	Sa ₂ O ₃	22	6.02	43
Scandium nitrate.....	Sc(NO ₃) ₃	21	0.0	27
Scandium oxide.....	Sc ₂ O ₃		-0.018	26
Scandium sulfate.....	Sc ₂ (SO ₄) ₃		-0.33	39
Selenium.....	Se	18	-0.32	1
Selenious acid.....	H ₂ SeO ₃	18	-0.36	27
Silicon.....	Si	18	-0.13	1
Silicochloroform.....	SiHCl ₃		-0.515	33
Silicon dioxide.....	SiO ₂		-0.493	33
Silicon tetrabromide.....	SiBr ₄		-0.360	33
Silicon tetrachloride.....	SiCl ₄		-0.537	33
Silver.....	Ag	-170 sol.	-0.16	31

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti- bility 10 ⁻⁶ cgs	Ob- server
Silver (continued)	Ag	- 80	-0.18	31
		- 40	-0.19	31
		18	-0.20	31
		270	-0.23	16
		945	-0.26	16
		1000 liq.	-0.28	16
Silver bromide	AgBr	19	-0.33	27
Silver chloride	AgCl	17	-0.35	27
Silver iodide	AgI	19	-0.37	27
Sodium	Na	18	0.51	1
Sodium acetate	NaC ₂ H ₃ O ₂ ·3H ₂ O		-0.50	26
Sodium acid carbonate	NaHCO ₃		-0.21	26
Sodium bromide	NaBr	18	-0.47	27
Sodium carbonate	Na ₂ CO ₃	17	-0.24	27
	Na ₂ CO ₃ ·10H ₂ O	17	-0.58	27
Sodium chloride	NaCl	18	-0.499	19
Sodium fluoride	NaF	21	-0.51	27
Sodium hydroxide	NaOH	17	-0.59	27
Sodium iodide	NaI·2H ₂ O		-0.402	8
Sodium nitrate	NaNO ₃		-0.28	26
di-Sodium phosphate	Na ₂ HPO ₄		-0.399	33
di-Sodium phosphite	Na ₂ HPO ₃		-0.451	33
Sodium sulfate	Na ₂ SO ₄ ·10H ₂ O		-0.86	26
Sodium sulfite	Na ₂ SO ₃ ·7H ₂ O		-0.462	33
Sodium tetraborate	Na ₂ B ₄ O ₇ ·10H ₂ O		-0.59	26
Sodium thiosulfate (hypo)	Na ₂ S ₂ O ₃		-0.391	33
Stannic bromide	SnBr ₄		-0.354	33
Stannic chloride	SnCl ₄		-0.442	33
Stannic hydroxide	Sn(OH) ₄		-0.321	33
Stannic oxide	SnO ₂	15	-0.050	27
Stannous chloride	SnCl ₂	18	-0.37	27
Stannous oxide	SnO	17	-0.11	27
Stannous sulfate	SnSO ₄	18	-0.29	27
Strontium	Sr	18	-0.2	31
Strontium bromide	SrBr ₂	19	-0.39	27
Strontium carbonate	SrCO ₃		-0.316	33
Strontium chloride	SrCl ₂	20	-0.56	27
Strontium iodide	SrI ₂	19	-0.44	27
Strontium oxide	SrO	20	-0.060	27
Strontium sulfate	SrSO ₄		-0.315	33
Sulfur (rhombic)	S	-170 sol.	-0.49	16, 31
		18	-0.49	1
		112	-0.49	16, 31
		113 liq.	-0.49	16, 31
		220	-0.49	16, 31
Sulfur dioxide	SO ₂	liq.	-0.285	33
Sulfur trioxide	SO ₃	16	-0.289	33
Sulfuric acid	H ₂ SO ₄	22	-0.441	8
Tantalum	Ta	-170	0.83	31
		18	0.87	1
		420	0.88	16
		820	0.77	16
Tellurium	Te	-160 sol.	-0.46	31
		- 60	-0.36	31
		0	-0.32	31
		18	-0.31	1
		130	-0.32	16
		436	-0.31	16
		470 liq.	-0.071	16
Tellurium dioxide	TeO ₂	18	-0.14	27
Thallium	Tl	18	-0.24	1

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti- bility 10 ⁻⁶ cgs	Ob- server
Thallium monochloride.....	TlCl	20	-0.19	27
Thallium sulfate (ous).....	Tl ₂ SO ₄	20	-0.25	27
Thallium trichloride.....	TlCl ₃	20	-0.23	27
Thorium.....	Th	-170	0.05	31
		18	0.13	1
		150	0.23	16
		390	0.29	16
Thorium nitrate.....	Th(NO ₃) ₄		-0.14	27
Tin.....	Sn	18 sol.	0.025	1
(gray).....		18	-0.35	16
		400 liq.	-0.036	16
tin tetraethyl.....	Sn(C ₂ H ₅) ₄		-0.138	33
Tin tetramethyl.....	Sn(CH ₃) ₄		-0.218	33
Titanium.....	Ti	-170	1.6	31
		20	1.25	31
Titanium dioxide.....	TiO ₂		0.066	40
Titanium sulfide.....	TiS ₂		0.56	40
Tungsten.....	W	18	0.28	1
Tungsten trioxide.....	WO ₃	15	0.81	41
Tungstic acid.....	H ₂ WO ₄	18	-1.1	27
Uranium.....	U	18	2.6	31
Uranium dioxide.....	UO ₂	17	7.5	41
Uranium oxide (ous-ic).....	U ₃ O ₈	15	0.95	41
Uranium tetrachloride.....	UCl ₄	19	-0.40	27
Uranium trioxide.....	UO ₃	16	1.08	41
Uranyl nitrate.....	UO ₂ (NO ₃) ₂	15	-0.44	27
Vanadium.....	V	18	1.4	1
Vanadium oxide.....	VO ₂	13	3.73	41
Vanadium pentoxide.....	V ₂ O ₅	15	0.85	41
Vanadium trioxide.....	V ₂ O ₃	15	13.9	41
Water.....	H ₂ O	-120 to 0 sol.	-0.699	19
Ytterbium.....	Yb	-160	16.8	31
		20	5.3	31
Ytterbium chloride.....	YbCl ₃		25.	5
Ytterbium oxide.....	Yb ₂ O ₃		38.	27
Yttrium chloride.....	YCl ₃	17	20.	27
Yttrium oxide.....	Y ₂ O ₃	22	0.53	43
Yttrium sulfate.....	Y ₂ (SO ₄) ₃		-0.24	39
Zinc.....	Zn	18 sol.	-0.157	1
		450 liq.	-0.09	16
Zinc bromide.....	ZnBr ₂	19	-0.40	27
Zinc chloride.....	ZnCl ₂	22	-0.47	24
Zinc hydroxide.....	Zn(OH) ₂		-0.487	45
Zinc oxide.....	ZnO		-0.362	8
Zinc sulfate.....	ZnSO ₄ ·7H ₂ O		-0.48	26
Zirconium.....	Zr	18	-0.45	1
Zirconium dioxide.....	ZrO ₂	15	-0.112	27

ORGANIC COMPOUNDS

Room temperature is to be understood where no other is stated.

Substance	Formula	Susceptibility 10 ⁻⁶ cgs	Ob- server
Acetaldehyde.....	C ₂ H ₄ O	-0.502	33
Acetamide.....	C ₂ H ₅ NO	-0.577	
Acetic acid.....	C ₂ H ₄ O ₂	-0.526	
Acetic anhydride.....	C ₄ H ₆ O ₃	-0.517	

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Susceptibility 10^{-6} cgs	Ob- server
Acetone.....	C_3H_6O	-0.581	
Acridine.....	$C_{13}H_9N$	-0.688	
n-Amyl alcohol.....	$C_6H_{12}O$	-0.766	26
iso-Amyl alcohol.....	$C_6H_{12}O$	-0.799	33
tert.-Amyl alcohol.....	$C_6H_{12}O$	-0.804	
iso-Amyl ether.....	$C_{10}H_{22}O$	-0.813	
Amyl nitrate.....	$C_5H_{11}NO_3$	-0.574	
Aniline.....	C_6H_7N	-0.692 (10°)	32
Anisole.....	C_7H_8O	-0.672	33
Anthracene.....	$C_{14}H_{10}$	-0.726	
Anthraquinone.....	$C_{14}H_8O_2$	-0.575	
Benzaldehyde.....	C_7H_6O	-0.573	
Benzene.....	C_6H_6	-0.712 (16.8°)	19, 20
Benzoic acid.....	$C_7H_6O_2$	-0.556	13, 14
Benzophenone.....	$C_{13}H_{10}O$	-0.594	33
Benzoyl chloride.....	C_7H_5ClO	-0.539 (20°)	
Benzyl alcohol.....	C_7H_8O	-0.705	
Bromobenzene.....	C_6H_5Br	-0.540 (-20°)	32
Bromoform.....	$CHBr_3$	-0.316	33
n-Butyl alcohol.....	$C_4H_{10}O$	-0.743	26
iso-Butyl alcohol.....	$C_4H_{10}O$	-0.798	33
iso-Butylamine.....	$C_4H_{11}N$	-0.843	
n-Butyric acid.....	$C_4H_8O_2$	-0.632	
iso-Butyric acid.....	$C_4H_8O_2$	-0.646	
Cacodylic acid.....	$C_2H_7AsO_2$	-0.579	
Camphor.....	$C_{10}H_{16}O$	-0.68	10
Camphoric acid.....	$C_{10}H_{16}O_4$	-0.746	13, 14
Carbon tetrabromide.....	$CBBr_4$	-0.293	33
Carbon tetrachloride.....	CCl_4	-0.429	
Carbon tetraiodide.....	CI_4	-0.261	
Chloral.....	C_2HCl_3O	-0.459	
Chloroacetone.....	C_3H_5ClO	-0.550	
Chlorobenzene.....	C_6H_5Cl	-0.664 (-30°)	32
Chloroform.....	$CHCl_3$	-0.488	33
Chrysene.....	$C_{18}H_{12}$	-0.648	
Cinnamic aldehyde.....	C_9H_8O	-0.566	
Cyanogen.....	C_2N_2	-0.415	
Cyanuric acid.....	$C_3H_3N_3O_3$	-0.490	
Cyclohexane.....	C_6H_{12}	-0.810	
Cyclohexene.....	C_6H_{10}	-0.711	
Cymene.....	$C_{10}H_{14}$	-0.769	
Decane.....	$C_{10}H_{22}$	-0.876	
Diethylamine.....	$C_4H_{11}N$	-0.835	
m-Dinitrobenzene.....	$C_6H_4N_2O_4$	-0.398	
Diphenyl.....	$C_{12}H_{10}$	-0.677	
Diphenylamine.....	$C_{12}H_{11}N$	-0.634	
Ethyl acetate.....	$C_4H_8O_2$	-0.607 (-6°)	19, 20
Ethyl acetoacetate (fresh).....	$C_6H_{10}O_3$	-0.576	33
Ethyl alcohol.....	C_2H_6O	-0.744	
Ethyl benzoate.....	$C_9H_{10}O_2$	-0.628	
Ethyl bromide.....	C_2H_5Br	-0.489	
Ethyl cinnamate.....	$C_{11}H_{12}O_2$	-0.610	
Ethyl ether.....	$C_4H_{10}O$	-0.766	26
Ethyl formate.....	$C_3H_6O_2$	-0.581	33
Ethyl iodide.....	C_2H_5I	-0.679	26
Ethylene.....	C_2H_4	-1.6	6, 7
Ethylene bromide.....	$C_2H_4Br_2$	-0.422	33
Ethylene chloride.....	$C_2H_4Cl_2$	-0.602	
Ethylene iodide.....	$C_2H_4I_2$	-0.381	
Ethylidene chloride.....	$C_2H_4Cl_2$	-0.580	
Eucalyptol.....	$C_{10}H_{18}O$	-0.754	
Eugenol and iso-eugenol.....	$C_{10}H_{12}O_2$	-0.622	
Fluorobenzene.....	C_6H_5F	-0.608	

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Susceptibility 10 ⁻⁶ cgs	Ob- server
Formaldehyde.....	CH ₂ O	-0.62	26
Formamide.....	CH ₃ NO	-0.486	33
Formic acid.....	CH ₂ O ₂	-0.432	
Fumaric acid.....	C ₄ H ₄ O ₄	-0.426	13, 14
Furfural.....	C ₅ H ₄ O ₂	-0.492	33
Glycerol.....	C ₃ H ₈ O ₃	-0.538	26
Glycol.....	C ₂ H ₆ O ₂	-0.624	33
Hexachlorobenzene.....	C ₆ Cl ₆	-0.518	
Hexane.....	C ₆ H ₁₄	-0.888	
Iodobenzene.....	C ₆ H ₅ I	-0.471	
Maleic acid.....	C ₄ H ₄ O ₄	-0.427	13, 14
Methane.....	CH ₄	-2.5	6, 7
Methyl acetate.....	C ₃ H ₆ O ₂	-0.590	33
Methyl alcohol.....	CH ₄ O	-0.65 (-3°)	19, 20
Methylamine.....	CH ₅ N	-0.870	33
Methyl benzoate.....	C ₈ H ₈ O ₂	-0.602	
Methyl bromide.....	CH ₃ Br	-0.603	
Methyl chloride.....	CH ₃ Cl	-0.633	
Methyl ether.....	C ₂ H ₆ O	-0.716	22
Methyl formate.....	C ₂ H ₄ O ₂	-0.518	33
Methyl iodide.....	CH ₃ I	-0.403	
Methyl propionate.....	C ₄ H ₈ O ₂	-0.628	
Methyl salicylate.....	C ₈ H ₈ O ₃	-0.580	
Methylene bromide.....	CH ₂ Br ₂	-0.379	33
Methylene chloride.....	CH ₂ Cl ₂	-0.549	
Methylene iodide.....	CH ₂ I ₂	-0.349	
Naphthalene.....	C ₁₀ H ₈	-0.717	
Naphthol.....	C ₁₀ H ₈ O	-0.673	
Nitrobenzene.....	C ₆ H ₅ NO ₂	-0.499 (20°)	32
Nitroethane.....	C ₂ H ₅ NO ₂	-0.472	33
Nitrosobenzene.....	C ₆ H ₅ NO	-0.514	
Octane.....	C ₈ H ₁₈	-0.872	
Oleic acid.....	C ₁₈ H ₃₄ O ₂	-0.742	
Paraldehyde.....	C ₆ H ₁₂ O ₃	-0.652	
Phenetole.....	C ₈ H ₁₀ O	-0.692	
Phenol.....	C ₆ H ₆ O	-0.648	
Phenyl cyanide.....	C ₇ H ₅ N	-0.651	
Phthalic acid.....	C ₈ H ₆ O ₄	-0.446	13, 14
Piperidine.....	C ₅ H ₁₁ N	-0.755	33
Propionic acid.....	C ₃ H ₆ O ₂	-0.587	
Propyl alcohol.....	C ₃ H ₈ O	-0.766	
Pyridine.....	C ₅ H ₅ N	-0.623	
Quinoline.....	C ₉ H ₇ N	-0.662	
Quinone.....	C ₆ H ₄ O ₂	-0.382	
Resorcinol.....	C ₆ H ₆ O ₂	-0.617	
Stilbene.....	C ₁₄ H ₁₂	-0.666	
Succinic acid.....	C ₄ H ₆ O ₄	-0.461	13, 14
Terpineol.....	C ₁₀ H ₁₈ O	-0.725	33
Tetrabromethylene.....	C ₂ Br ₄	-0.334	
Tetrachloroethylene.....	C ₂ Cl ₄	-0.508	
Toluene.....	C ₇ H ₈	-0.729	
o-Toluidine.....	C ₇ H ₉ N	-0.701	33
Trichlorobenzene.....	C ₆ H ₃ Cl ₃	-0.587	
Trichloronitromethane.....	CCl ₃ NO ₂	-0.458	
Triethylphosphine.....	C ₆ H ₁₅ P	-0.762	
Trinitrobenzene-1, 3, 5.....	C ₆ H ₃ N ₃ O ₆	-0.352	
Urea.....	CH ₄ N ₂ O	-0.560	
o-Xylene.....	C ₈ H ₁₀	-0.662 (-10°)	32
m-Xylene.....	C ₈ H ₁₀	-0.743	33

MAGNETIC SUSCEPTIBILITY (Continued)

MISCELLANEOUS

Substance	Susceptibility	Ob- server
Air, 20°C, 1 atm.....	24.16 gas	1
Celluloid.....	-0.13	23, 24
Ebonite.....	0.6	44
Glass (crown).....	-0.90	23, 24
Glass (heavy flint).....	-1.2	23, 24
Linseed oil.....	-0.74	10
Marble (CaCO ₃).....	-0.8	44
Paraffin.....	-0.6	44
Petroleum.....	-0.83	26
Shellac.....	-0.30	26
Wax (white).....	-0.6	44
Wood.....	-0.3 to 0.7	44

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- | | |
|---|---|
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MAGNETIC INCLINATION OR DIP AND HORIZONTAL INTENSITY

The mean or limiting values are given for the territory covered by the State named. The horizontal intensity is given in gausses. The table is compiled from the results of the U. S. Coast and Geodetic Survey for 1911 and 1912.

State.	Dip, degrees.		Horizontal intensity.	
Alabama.....	62.	to 66.	.23 to	.26
Alaska.....	67.	74.	.16	.21
Arizona.....	59.		.27	
Arkansas.....	63.	65.	.24	.25
California.....	58.	62.	.25	.27
Colorado.....	67.	68.	.22	.23
Connecticut.....	72.	73.	.17	.18
Delaware.....	70.	71.5	.19	.20
Florida.....	57.	58.	.27	.29
Georgia.....	62.	66.	.23	.26
Hawaii.....	39.		.29	
Idaho.....	69.		.21	
Indiana.....	69.	72.	.18	.21
Iowa.....	71.	73.	.18	.20
Kansas.....	67.	69.	.21	.23
Kentucky.....	68.	70.	.20	.22
Maine.....	74.	76.	.14	.16
Maryland.....	70.		.20	
Massachusetts.....	73.		.17	
Michigan.....	73.	76.	.15	.18
Mississippi.....	61.	66.	.24	.26
Missouri.....	67.	71.	.20	.22
Montana.....	70.	72.	.18	.20
Nebraska.....	70.	71.	.20	
New Hampshire.....	73.	74.	.16	.17
New Jersey.....	71.		.19	
New Mexico.....	63.	65.	.24	.25
New York.....	74.		.16	.17
North Carolina.....	66.	68.	.21	.23
North Dakota.....	74.	77.	.15	.16
Ohio.....	71.	73.	.18	.20
Oklahoma.....	63.	67.	.23	.25
Oregon.....	68.	69.	.21	
Pennsylvania.....	71.	72.	.18	.19
Philippines.....	0.	23.	.37	.39
Porto Rico.....	49.	50.	.29	.30
South Carolina.....	66.	67.	.23	
South Dakota.....	71.	74.	.17	.19
Tennessee.....	66.	68.	.22	.23
Texas.....	57.	63.	.25	.29
Utah.....	66.	67.	.22	.23
Vermont.....	73.	75.	.16	.17
Virginia.....	68.	70.	.20	.21
Washington.....	71.		.19	
West Virginia.....	70.5		.20	
Wisconsin.....	74.	76.	.15	.17
Wyoming.....	68.	72.	.19	.22

MAGNETIC DECLINATION

(Selected from tables of the U. S. Coast and Geodetic Survey)

State.	Station.	Magnetic declination in degrees and tenths					
		1870 °	1880 °	1890 °	1900 °	1910 °	1920 °
Ala.....	Ashland.....	4.7 E	4.1 E	3.4 E	3.0 E	2.9 E	3.0 E
	Tuscaloosa.....	6.1 E	5.5 E	4.8 E	4.4 E	4.4 E	4.6 E
Alas.....	Sitka.....	29.0 E	29.3 E	29.5 E	29.7 E	30.2 E	30.4 E
	Kodiak.....	25.7 E	25.2 E	24.8 E	24.5 E	24.2 E	24.2 E
	Unalaska.....	20.1 E	19.6 E	19.0 E	18.3 E	17.5 E	17.2 E
	St. Michael.....	.....	24.7 E	23.1 E	22.1 E	21.5 E	21.0 E
Ariz.....	Holbrook.....	13.8 E	13.6 E	13.4 E	13.5 E	14.1 E	14.5 E
	Prescott.....	13.7 E	13.7 E	13.6 E	13.7 E	14.4 E	14.9 E
Ark.....	Augusta.....	7.1 E	6.5 E	5.9 E	5.5 E	5.6 E	5.8 E
	Danville.....	8.6 E	8.1 E	7.6 E	7.2 E	7.4 E	7.7 E
Calif.....	Bagdad.....	14.3 E	14.4 E	14.4 E	14.6 E	15.3 E	15.7 E
	Mojave.....	14.6 E	14.9 E	14.9 E	15.1 E	15.8 E	16.3 E
	Modesto.....	16.1 E	16.1 E	16.2 E	16.6 E	17.3 E	17.7 E
	Redding.....	18.1 E	18.2 E	18.3 E	18.7 E	19.4 E	19.7 E
Colo.....	Pueblo.....	13.7 E	13.5 E	13.0 E	12.8 E	13.3 E	13.7 E
	Ourray.....	15.2 E	15.0 E	14.6 E	14.6 E	15.1 E	15.5 E
Conn.....	Hartford.....	8.7 W	9.4 W	9.8 W	10.4 W	11.2 W	12.1 W
Del.....	Dover.....	4.7 W	5.3 W	5.9 W	6.5 W	7.2 W	8.0 W
D. C.....	Washington.....	2.4 W	3.0 W	3.6 W	4.2 W	4.9 W	5.6 W
Fla.....	Miami.....	3.3 E	2.7 E	2.2 E	1.7 E	1.5 E	1.5 E
	Bartow.....	3.2 E	2.6 E	2.1 E	1.6 E	1.4 E	1.3 E
	Jacksonville.....	3.0 E	2.4 E	1.8 E	1.3 E	1.1 E	0.9 E
	Tallahassee.....	4.2 E	3.6 E	3.0 E	2.5 E	2.4 E	2.4 E
Ga.....	Millen.....	2.7 E	2.1 E	1.5 E	0.9 E	0.7 E	0.5 E
	Americus.....	4.1 E	3.5 E	2.9 E	2.4 E	2.2 E	2.2 E
Haw.....	Honolulu.....	9.5 E	9.8 E	10.1 E	10.4 E	10.7 E	11.1 E
Idaho.....	Pocatello.....	18.0 E	17.9 E	17.8 E	17.9 E	18.5 E	18.8 E
	Boise.....	18.8 E	18.8 E	18.6 E	18.8 E	19.5 E	19.8 E
	Pierce.....	21.2 E	21.1 E	21.2 E	21.4 E	22.0 E	22.2 E
	Kankakee.....	5.3 E	4.8 E	4.1 E	3.5 E	3.3 E	3.1 E
Ind.....	Rushville.....	7.0 E	6.4 E	5.7 E	5.2 E	5.1 E	5.1 E
	Indianapolis.....	3.3 E	2.7 E	2.1 E	1.5 E	1.1 E	0.9 E
Iowa.....	Walker.....	8.2 E	7.5 E	6.8 E	6.2 E	6.2 E	6.2 E
	Sac City.....	10.2 E	9.6 E	8.8 E	8.4 E	8.6 E	8.6 E
Kans.....	Emporia.....	11.2 E	10.8 E	10.2 E	9.9 E	10.1 E	10.3 E
	Ness City.....	12.2 E	11.9 E	11.3 E	11.2 E	11.4 E	11.7 E
Ky.....	Manchester.....	1.6 E	1.0 E	0.3 E	0.3 W	0.6 W	0.8 W
	Louisville.....	3.2 E	2.5 E	1.9 E	1.5 E	1.3 E	1.2 E
	Princeton.....	5.5 E	4.8 E	4.2 E	3.9 E	3.7 E	3.8 E
La.....	Winfield.....	8.2 E	7.6 E	7.1 E	6.8 E	7.0 E	7.4 E
Me.....	Eastport.....	18.5 W	18.8 W	19.0 W	19.3 W	20.0 W	21.0 W
	Bangor.....	15.9 W	16.4 W	16.7 W	17.1 W	17.8 W	18.8 W
	Portland.....	13.1 W	13.6 W	14.1 W	14.5 W	15.3 W	16.3 W
Md.....	Baltimore.....	3.8 W	4.4 W	5.0 W	5.6 W	6.3 W	7.0 W
Mass.....	Boston.....	11.0 W	11.5 W	12.0 W	12.6 W	13.4 W	14.4 W
	Pittsfield.....	9.3 W	10.0 W	10.4 W	11.0 W	11.8 W	12.7 W
Mich.....	Marquette.....	4.7 E	3.8 E	3.0 E	2.4 E	2.1 E	1.7 E
	Lapeer.....	0.3 E	0.5 W	1.2 W	1.8 W	2.3 W	2.8 W
	Grand Haven.....	3.1 E	2.4 E	1.6 E	1.1 E	0.7 E	0.3 E
Minn.....	St. Paul.....	10.9 E	10.3 E	9.5 E	8.9 E	8.8 E	8.7 E
	Marshall.....	11.0 E	10.5 E	9.8 E	9.3 E	9.4 E	9.4 E
	Hibbing.....	9.7 E	9.0 E	8.2 E	7.6 E	7.7 E	7.5 E
Miss.....	Bagley.....	12.3 E	11.7 E	11.0 E	10.4 E	10.6 E	10.5 E
	Meridian.....	6.5 E	5.9 E	5.2 E	4.8 E	4.9 E	5.1 E
	Vicksburg.....	7.6 E	7.1 E	6.4 E	6.0 E	6.1 E	6.4 E
Mo.....	Hermann.....	8.3 E	7.7 E	7.0 E	6.5 E	6.5 E	6.6 E

MAGNETIC DECLINATION (Continued)
(Selected from tables of the U. S. Coast and Geodetic Survey)

State.	Station.	Magnetic declination in degrees and tenths.					
		1870 °	1880 °	1890 °	1900 °	1910 °	1920 °
Mo.....	Sedalia.....	9.3 E	8.7 E	8.0 E	7.6 E	7.8 E	8.0 E
Mont.....	Miles City.....	17.7 E	17.4 E	16.9 E	16.9 E	17.3 E	17.6 E
	Lewistown.....	20.1 E	19.9 E	19.6 E	19.6 E	20.1 E	20.4 E
	Ovando.....	21.2 E	21.1 E	20.9 E	21.1 E	21.6 E	22.0 E
Nebr.....	Albion.....	12.5 E	12.0 E	11.4 E	11.0 E	11.2 E	11.5 E
	Vaentine.....	13.9 E	13.4 E	12.8 E	12.6 E	12.8 E	13.1 E
	Alliance.....	15.3 E	14.8 E	14.3 E	14.2 E	14.5 E	14.8 E
Nev.....	Elko.....	17.7 E	17.7 E	17.6 E	17.8 E	18.4 E	18.9 E
	Hawthorne.....	16.8 E	17.0 E	17.0 E	17.3 E	18.0 E	18.4 E
N. H.....	Hanover.....	11.1 W	11.6 W	12.0 W	12.6 W	13.2 W	14.2 W
N. J.....	Trenton.....	6.0 W	6.7 W	7.2 W	7.8 W	8.6 W	9.4 W
N. Mex.....	Santa Rosa.....	12.7 E	12.4 E	12.0 E	11.9 E	12.5 E	12.9 E
	Laguna.....	13.6 E	13.4 E	13.0 E	13.0 E	13.6 E	14.1 E
N. Y.....	Albany.....	9.2 W	10.0 W	10.3 W	10.9 W	11.6 W	12.5 W
	Elmira.....	5.4 W	6.3 W	7.0 W	7.5 W	8.2 W	9.0 W
	Buffalo.....	3.8 W	4.7 W	5.4 W	5.9 W	6.5 W	7.2 W
N. C.....	Newbern.....	1.0 W	1.7 W	2.3 W	2.9 W	3.4 W	4.0 W
	Greensboro.....	1.0 E	0.3 E	0.3 W	0.8 W	1.3 W	1.8 W
	Asheville.....	2.0 E	1.3 E	0.7 E	0.2 E	3.2 W	0.5 W
N. D.....	Jamestown.....	13.7 E	13.2 E	12.5 E	12.2 E	12.4 E	12.5 E
	Bismarck.....	16.1 E	15.6 E	15.0 E	14.7 E	15.0 E	15.2 E
	Dickinson.....	17.5 E	17.1 E	16.5 E	16.3 E	16.7 E	16.9 E
Ohio.....	Canton.....	0.0	0.7 W	1.3 W	1.9 W	2.5 W	3.1 W
	Urbana.....	2.4 E	1.8 E	1.1 E	0.5 E	0.1 E	0.3 W
Okla.....	Okmulgee.....	9.8 E	9.5 E	9.1 E	8.7 E	8.9 E	9.2 E
	Enid.....	11.0 E	10.6 E	10.2 E	9.8 E	10.1 E	10.5 E
Ore.....	Sumpter.....	20.0 E	20.2 E	20.2 E	20.4 E	21.1 E	21.4 E
	Detroit.....	20.1 E	20.3 E	20.5 E	20.8 E	21.6 E	21.9 E
Pa.....	Wilkes-Barre.....	5.3 W	6.0 W	6.6 W	7.2 W	8.0 W	8.8 W
	Lock Haven.....	4.3 W	5.0 W	5.6 W	6.3 W	7.0 W	7.7 W
	Indiana.....	2.0 W	2.6 W	3.3 W	3.9 W	4.6 W	5.2 W
P. R.....	San Juan.....				1.0 W	2.0 W	3.4 W
R. I.....	Newport.....	10.3 W	10.8 W	11.3 W	11.9 W	12.7 W	13.7 W
S. C.....	Marion.....	0.9 E	0.3 E	0.4 W	1.0 W	1.4 W	1.8 W
	Aiken.....	2.5 E	1.9 E	1.3 E	0.7 E	0.4 E	0.1 E
S. D.....	Huron.....	12.7 E	12.3 E	11.7 E	11.2 E	11.5 E	11.7 E
	Murdo.....	14.7 E	14.3 E	13.7 E	13.4 E	13.7 E	13.9 E
	Rapid City.....	16.3 E	15.8 E	15.3 E	15.1 E	15.4 E	15.7 E
Tenn.....	Knoxville.....	1.8 E	1.1 E	0.5 E	0.0	0.3 W	0.5 W
	Shelbyville.....	4.9 E	4.3 E	3.7 E	3.2 E	3.0 E	2.9 E
	Huntingdon.....	6.1 E	5.5 E	4.9 E	4.4 E	4.3 E	4.4 E
Tex.....	Houston.....	8.9 E	8.4 E	7.9 E	7.7 E	8.1 E	8.6 E
	San Antonio.....	9.5 E	9.2 E	8.7 E	8.7 E	9.2 E	9.7 E
	Pecos.....	11.0 E	10.8 E	10.4 E	10.3 E	10.8 E	11.3 E
	Wytheville.....	0.8 E	0.1 E	0.5 W	1.1 W	1.5 W	1.9 W
Utah.....	Manti.....	16.8 E	16.7 E	16.4 E	16.5 E	17.1 E	17.5 E
Vt.....	Rutland.....	10.5 W	11.2 W	11.6 W	12.1 W	12.8 W	13.8 W
Va.....	Richmond.....	1.8 W	2.5 W	3.1 W	3.7 W	4.2 W	4.9 W
	Lynchburg.....	0.7 W	1.4 W	2.0 W	2.6 W	3.1 W	3.7 W
	Stanley.....	7.8 E	7.1 E	6.3 E	5.8 E	5.6 E	5.4 E
Wash.....	Wilson Creek.....	21.8 E	21.9 E	22.1 E	22.4 E	23.0 E	23.3 E
	Seattle.....	22.0 E	22.2 E	22.4 E	22.8 E	23.5 E	23.8 E
W. Va.....	Sutton.....	0.4 W	1.1 W	1.8 W	2.4 W	2.9 W	3.4 W
Wis.....	Shawano.....	5.9 E	5.0 E	4.3 E	3.7 E	3.4 E	3.1 E
	Floydada.....	11.2 E	10.9 E	10.4 E	10.3 E	10.7 E	11.1 E
Wyo.....	Douglas.....	16.0 E	15.8 E	15.3 E	15.2 E	15.7 E	16.0 E
	Green River.....	17.0 E	16.8 E	16.5 E	16.6 E	17.2 E	17.5 E

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS

Radiation traversing a layer of substance is reduced in intensity by a constant fraction μ per centimeter. After penetrating to a depth x the intensity is $I = I_0 e^{-\mu x}$ where I_0 is the intensity at the surface. μ/ρ is the mass absorption coefficient where ρ is the density of the material.

Values of μ/ρ for $\lambda = .005 \text{ \AA}$ to $\lambda = 44.6 \text{ \AA}$. Where two values of μ/ρ for one value of λ occur they represent the maximum and minimum values at an absorption discontinuity.

Compiled by S. J. M. Allen

$\lambda = 44.6 - 2.74 \text{ \AA}$

$\lambda, \text{ \AA}$	He	C	N	O	Ne	Al	S	Cl	A
44.6	3600	2170	3850	5765	13100	.....	.....	.....	45700
11.88	6850	850	.....	.....	.....
9.87	1063	1796	2540	4310	500	1320	1570	1860
8.32	656	1109	1585	2750	330	794	962	1160
7.94	280	.....	.....	.....
6.97	390	645	976	1727	3700	.....	.....	.....
5.39	185	312	476	865	2800	500	610	748
5.17	160	273	413	763	1450	249	310	360
5.01	1350	221	277	324
4.38	210	.....	.....
4.36	2260	.....	.....
4.15	97.8	166	258	478	815	1570	178	.....
3.93	84.6	144	222	416	720	1350	1830	.....
3.87	71.0	121	183	356	635	1175	1800	202
3.69	1476	174
3.51	1256	153
3.38	148
3.35	1460
3.24	55.2	96	150	279	500	928	966	1215
3.03	46.0	79.5	117	231	425	795	880	1025
2.74	43.0	.....	.....	.....	417	780	870	1015
.....	35.0	.....	84.0	175	323	595	670	760
.....	25.0	.....	60.0	135	250	454	520	600

$\lambda, \text{ \AA}$	Fe	Ni	Cu	Zn	Kr	Ag	Sn	Xe	Pt	Au
44.6	.....	.....	.....	.....	31800	.....	.....	6740	.....	12500
11.88	.....	6900	7550	.....	.....	.....	.....	.....	.....	.....
9.87	.....	4540	5030	.....	.....	2700	.....	.....	2440	.....
8.32	.....	3140	3450	.....	.....	1800	.....	.....	1560	.....
7.94	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6.97	.....	2000	2130	.....	.....	1300	.....	.....	1190	.....
5.39	.....	1250	1290	.....	.....	845	.....	.....	1645	.....
5.17	.....	1150	1190	.....	.....	790	.....	.....	.....	.....
5.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4.36	610	715	760	910	.....	535	640	.....	.....	.....
4.15	540	630	690	820	.....	461	550	.....	1290	.....
3.93	470	555	610	715	.....	408	490	.....	.....	.....
3.87	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3.69	.....	.....	.....	.....	.....	354	.....	.....	.....	.....
3.59	.....	.....	.....	.....	.....	1410	.....	.....	.....	.....
3.51	375	450	495	575	.....	1330	.....	.....	1370	.....
3.38	.....	.....	.....	.....	.....	1300	.....	.....	.....	.....
3.35	320	380	.....	495	.....	1510	.....	.....	.....	.....
3.24	312	375	404	480	.....	.....	.....	.....	.....	.....
3.03	.....	.....	.....	.....	.....	1310	.....	.....	1120	.....
2.74	245	290	315	375	.....	1230	.....	.....	.....	.....
.....	185	239	262	283	.....	1440	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	1290	.....	.....	939	.....
.....	.....	.....	.....	.....	.....	925	.....	.....	756	.....

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

$$\lambda = 2.50 - .900 \text{ \AA}$$

$\lambda, \text{\AA}$	H	Li	Be	B	C	N	O	Ne	Na
2.50	.52	4.0	6.1	9.1	17.8	.....	44.5	100	128
2.29	.....	.....	.....	.....	15.0	.....	36.4	75.5	.....
1.93	.50	2.10	3.05	4.7	8.75	14.0	21.7	49.0	61.3
1.74	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.656	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.539	.48	1.10	1.60	2.45	4.52	7.45	11.1	24.0	32.1
1.484	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.432	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.389	.47	.86	1.25	1.87	3.35	5.50	8.1	17.0	23.4
1.377	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.293	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.280	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.235	.46	.67	.95	1.35	2.42	3.95	5.7	12.4	17.1
1.104	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.071	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.038	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.000	.45	.43	.55	.76	1.36	2.10	3.13	6.5	8.8
.980	.....	.....	.....	.....	.....	.....	.....	.....	.....
.949	.....	.....	.....	.....	1.20	.....	.....	.....	.....
.932	.....	.....	.....	.....	.....	.....	.....	.....	.....
.900	.....	.....	.....	.....	1.05	.....	.....	.....	.....

$\lambda, \text{\AA}$	Mg	Al	S	Cl	A	Ca	Fe	Ni	Cu
2.50	161	193	355	400	475	620	147	180	197
2.29	.....	150	285	315	355	480	115	137	153
1.93	77.2	93.5	173	198	235	306	71.2	89.5	96.2
1.74	.....	83.0	.....	.....	.....	.....	54	.....	.....
							465		
1.656	.....	60.7	110	126	143	195	410	59.2	63.5
1.539	40.8	49.0	91	103	114	163	325	48.0	50.9
1.484	.....	.....	.....	.....	.....	.....	.....	40.5	.....
								338	
1.432	.....	40.0	75	85	93	130	285	325	42
1.389	31.5	36.8	68.5	76.7	85.7	125	252	275	38.5
1.377	.....	.....	.....	.....	.....	.....	.....	.....	37.0
									307
1.293	.....	29.8	55.3	60	72	102	212	233	260
1.280	.....	28.8	.....	.....	.....	.....	.....	225	252
1.235	21.4	26.3	49.5	55.5	62.5	90	181	208	230
1.104	.....	18.6	38.0	44	50	67	135	155	175
1.071	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.038	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.000	11.8	14.12	26.7	29.7	34.5	49	100	121	130
.980	.....	.....	.....	.....	.....	.....	.....	.....	.....
.949	.....	12.0	22.0	24.5	.....	42	86	99	114
.932	.....	.....	.....	.....	.....	.....	.....	.....	.....
.900	.....	10.4	.....	.....	.....	.....	74.5	86.5	98.5

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

$\lambda = 2.50 - .900 \text{ \AA}$

$\lambda, \text{\AA}$	Zn	Br	Mo	Ag	Sn	I	W	Pt	Au	Pb
2.50	228	...	..	710	850	...	...	596	.....	...
2.29	180	...	..	550	670	...	...	480	.....	...
1.93	110	...	..	405	470	...	300	358	385	428
1.74	...	...	..	...	...	...	...	...	...	...
1.656	72.5	...	..	285	...	...	...	228	...	...
1.539	58.6	89	..	217	247	290	176	202	213	230
1.484	...	...	..	...	...	...	...	...	...	...
1.432	49.3	...	..	192	220	...	130	172	179	202
1.389	45.2	...	..	174	209	...	...	155	166	185
1.377	...	...	..	...	...	...	...	...	...	...
1.293	39	...	..	146	176	...	...	132	138	154
1.280	36	...	..	127	146	...	...	...	...	...
...	287	...	..	...	...	...	...	...	...	...
1.235	250	...	..	125	140	...	95	115	122	137
1.104	208	...	..	96.5	115	...	...	99	107	120
1.071	...	...	..	...	...	...	...	77.5	...	...
...	...	...	..	...	...	...	...	198	...	...
1.038	...	...	..	...	...	...	...	...	76.5	...
...	...	...	..	...	...	...	...	...	194	...
1.000	145	...	52	73.0	86.0	...	...	165	174	75
.980	...	...	..	...	...	...	...	155	168	73
.949	129	...	..	63.0	75.5	...	...	146	156	68
...	...	...	..	...	...	...	...	...	...	168
.932	...	...	..	...	...	...	...	136	148	159
...	...	...	..	...	...	...	...	184	...	...
.900	112	150	..	54.2	65.0	...	...	168	134	145
...	...	...	..	...	...	...	...	182	...	...

$\lambda = .892 - .184 \text{ \AA}$

$\lambda, \text{\AA}$	H	Li	Be	B	C	N	O	Ne	Na	Mg	Al
.892	...	...	...	...	...	...	...	...	...	...	...
.880	.440	.350	.425	.580	.990	1.50	2.20	4.55	6.10	8.34	9.75
.862	...	...	...	...	...	...	...	...	...	...	...
.850	...	...	...	...	.907	...	...	...	...	...	8.85
.814	...	...	...	...	.814	...	...	...	...	...	7.85
.780	...	...	...	...	.750	...	...	...	...	...	6.86
.710	.435	.260	.315	.365	.598	.870	1.22	2.50	3.30	4.30	5.22
.680	...	...	...	...	.550	...	...	...	...	...	4.52
.631	.435	.225	.255	.305	.467	.610	.900	1.80	2.30	3.0	3.73
.618	...	...	...	...	...	...	...	...	...	...	...
.560	...	...	...	...	.370	...	...	...	...	...	2.60
.497	.435	.198	.210	.220	.315	.400	.520	.930	1.18	1.52	1.90
.485	...	...	...	...	.308	...	...	...	...	...	1.77
.476	.430	...	...	.215	.304	...	.485	...	...	...	1.74
.424	...	...	...	...	...	...	...	...	...	...	1.23
.417	.390	.180	.185	.198	.256	.310	.372	.580	.750	.940	1.170
.380	...	...	...	...	.230	...	...	...	...	...	.950
.331	...	...	...	...	...	...	...	...	...	...	...
.260	.385	.156	.166	.175	.185	.200	.210	.270	.305	.343	.402
.220	...	...	...	...	.178	...	...	...	...	...	.300
.200	.375	.151	.160	.165	.175	.180	.183	.210	.225	.250	.270
.184	...	...	...	...	.166	...	...	...	...	...	.246

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

$\lambda = .892 - .184 \text{ \AA}$

$\lambda, \text{\AA}$	S	Cl	A	Ca	Fe	Ni	Cu	Zn	Br	Sr	Mo
.892											
.880	18.2	20.7	24.0	34.8	69.5	82	91.2	103			36.0
.862											
.850					63.5	74	84.5	96.5			
.814					57	66	75.7	86			28
.780					50.5	59.5	67.5	77			
.710	9.90	11.6	13.0	18.6	38.5	48.1	51.0	59.0	80	106	19.9
.680					32.7	41	45.3	52.7			
.631	6.90	8.40	9.80	13.3	27.0	34	36.2	41.0	56.8	72.5	15.0
.618											12.5
											88.0
.560					18.2	24	25.5	30.7			
.497	3.50	4.20	5.0	6.60	13.9	17.9	18.4	21.0	32.0	40.5	50.2
.485					12.4	15.4	16.9	19.5			
.476							16.6				42
.424											
.417	2.10	2.47	2.95	3.97	8.45	10.5	11.45	12.3	19.0	24.0	30.0
.380					6.32	7.70	8.42	9.95			22
.331											
.260	.650	.750	.850	1.10	2.28	2.89	3.16	3.58	5.30	6.50	8.20
.220					1.42	1.80	2.00	2.32			
.200	.400	.445	.500	.630	1.10	1.45	1.55	1.78	2.4	3.32	4.30
.184						1.24					

$\lambda, \text{\AA}$	Ag	Sn	I	Ba	Ta	W	Pt	Au	Pb	Bi	U
.892							165	178	142		
.880	50	60					201				
.862							195	170	135		
							185	163	130		
.850	46	56					179	186	124		
.814	41	49.5					160	167	111		
.780	36	44.5					144	150	150		
.710	27.5	34.0	38.5	42.0	100	104	115	120	136		
.680	23.5	28.4					102	108	120		
.631	19.6	23.0	26.4	31.1	72	75	84.5	87	98		
.618											
.560	13.3	16.2					62	66	75		
.497	10.5	11.8	15.6	17.8	36	38	47	48.5	52.8		
.485	9.8	11.1									
	62.5										
.476	60						42		47.5		
.424	43.5	8.0									
		46.6									
.417	41	45	9.2	10.5	21.5	22.5	27.4	28.4	32.0		
.380	31.2	34				17.3	21.1	22	26.4	27.8	
.331	21.7	24.5		5.4					18.1	19.5	
				28.0							
.260	11.4	12.8	14.2	16.1	6.7	6.85	8.0	8.3	10.0	11.0	
.220	7.05	7.80				4.25	5.25	5.50	5.92	6.4	
.200	5.48	6.20	7.0	8.0	3.4	3.50	4.25	4.40	4.90	5.1	5.40
.184	4.45				2.8		3.45	3.60	4.05	4.2	
					11.8						

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

$\lambda = .178 - .005 \text{ \AA}$

$\lambda, \text{\AA}$	H	Li	Be	B	C	N	O	Ne	Na	Mg	Al
.178					164						.235
.175	.360	.144	.150	.155	.163	.166	.169	.185	.195	.205	.228
.158					.160						.208
.155											
.146	.340				.155		.162		.170	.176	.195
.142	.330				.153						.191
.130	.320	.132		.149	.152		.157		.160	.168	.186
.120					.150		.154			.163	.172
.113	.310				.147		.153		.155	.160	.166
.107											
.098	.280	.125		.138	.142		.144		.150	.152	.156
.080	.255				.137						.146
.072	.250	.118		.132	.136		.137		.139	.140	.143
.064	.245	.110		.126	.130		.130		.130	.130	.130
.050						.120					.115
.040	.205				.110						.105
.030	.180				.095						.093
.024	.165				.080						.079
.010	.117				.059						.058
.005	.078				.0385						.0380

$\lambda, \text{\AA}$	S	Cl	A	Ca	Fe	Ni	Cu	Zn	Br	Sr	Mo
.178							1.15				
.175	.335	.341	.400	.460	.800	1.05	1.12	1.26	1.90	2.24	2.95
.158					.640	.815	.862	.990			
.155											
.146	.249	.280		.345	.520		.680				
.142					.515	.630	.670	.780			1.55
.130	.220	.230		.290	.424		.551				
.120	.200				.368	.430	.455	.537			
.113	.189	.195		.230	.337		.422				
.107											
.098	.166	.176		.200	.265		.325				.790
.080		.164			.235	.264	.268	.308			
.072	.150	.158		.180	.202		.232				
.064	.139	.142		.155	.178		.198				.413
.050					.140		.155				
.040					.118		.126				
.030					.095		.100				
.024					.080		.081				
.010					.058		.057				
.005							.0380				

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

$$\lambda = .178 - .005 \text{ A}$$

$\lambda, \text{\AA}$	Ag	Sn	I	Ba	Ta	W	Pt	Au	Pb	U
.178	.....	.....	.....	.....	.....	2.7 11.3	3.16	3.30	3.55	.....
.175	3.96	4.50	5.10	5.70	10.0	10.5	2.97	3.13	3.48	3.95
.158	3.00	3.40	.....	.....	.....	8.6	2.45 9.40	2.43	2.60	.....
.155	.....	.....	.....	.....	.....	.....	.....	2.30 8.80	.....	.....
.146	2.48	2.66	.....	.....	6.75	.....	7.60	7.85	2.35	2.70
.142	2.31	2.64	.....	.....	.....	6.75	7.20	7.33	2.10 7.75	.....
.130	1.97	2.12	.....	.....	5.10	.....	6.30	6.40	6.55	2.20
.120	1.61	1.77	.....	2.20	.....	4.60	4.92	4.98	5.20	1.90
.113	1.47	1.60	.....	.....	3.80	.....	4.40	4.50	4.75	.....
.107	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.62 4.65
.098	1.05	1.17	.....	.....	2.80	.....	3.15	3.21	3.50	3.90
.080	.73	.79	.....	.....	.....	2.30	2.40	2.42	2.50	2.70
.072	.584	.614	.....	.....	1.75	.....	2.00	2.05	2.10	2.25
.064	.465	.490	.....	.....	1.35	.....	1.52	1.55	1.64	1.80
.050	.....	.320	.....	.....	.....	.....	.86	.88	1.00	.....
.040	.....	.21	.....	.....	.....	.....	.....	.....	.62	.....
.030	.....	.13	.....	.....	.....	.....	.....	.....	.38	.....
.024	.....	.10	.....	.....	.....	.....	.....	.....	.21	.....
.010	.....	.060	.....	.....	.....	.....	.....	.....	.071	.082
.005	.....	.0385	.....	.....	.....	.....	.....	.....	.0425	.044

ATOMIC ABSORPTION COEFFICIENTS

$$\frac{\mu}{\nu} = \frac{\mu}{\rho} \times \frac{W}{N}$$

The values are multiplied by 10^{23}

A.U.	H 1	Li 3	C 6	N 7	O 8	Al 13	Fe 26	Cu 29	Mo 42	Ag 47	Pb 82	H ₂ O (H)
.025	..	.....	.....	.....	.....	.317	.625	.....	.....	.....	2.60	.....
.100	.....	.....	.285	.....	.....	.724	.....	3.3	.....	.....	.....	.....
.125	.04	.....	.305	.....	.385	.792	3.67	4.8	21.3	.....	103.	.478
.150	.05	.....	.323	.376	.430	.889	5.38	8.3	31.0	.....	53.6	.534
.175	.06	.....	.329	.395	.459	1.04	7.55	11.8	44.7	66.5	86.1	.578
.20	.05	.....	.343	.409	.482	1.19	9.75	16.4	63.5	107.	157.	.591
.25	.05	.....	.370	.446	.546	1.62	17.3	29.0	117.	203.	290.	.650
.30	.04	.197	.400	.518	.641	2.34	28.4	47.2	201.	323.	485.	.730
.35	.04	.215	.433	.580	.763	3.31	43.9	72.9	302.	483.	772.	.840
.40	.05	.238	.475	.....	.886	4.56	64.5	106.	422.	686.	1150.	.992
.50	.08	.280	.602	.....	1.29	8.44	127.	197.	769.	204.	2070.	1.458
.60	.09	.350	.780	.....	1.92	14.0	208.	332.	1277.	348.	.....	2.11
.70	.10	.462	1.052	.....	2.85	22.1	325.	512.	297.	.....	.....	3.04
.80	.17	.....	1.40	.....	4.03	32.4	466.	.....	430.	.....	.....	4.38
1.00	..	.....	2.51	.....	.....	61.6	830.	.....	838.	2000.	.....	8.01

X-RAY SPECTRA

X-RAY SPECTRA

Compiled by J. M. Cork

EMISSION WAVE-LENGTHS IN THE K AND L SERIES, $\lambda \times 10^{-8}$ cm.
For calcite $d = 3.02904 \times 10^{-8}$ cm.

At. No.	Element	K Series				L Series								
		α_2	α_1	β_1	β_2	1	α_2	α_1	γ	β_1	β_4	β_3	β_2	γ_1
11	Sodium.....	11.885		11.594										
12	Magnesium.....	9.869		9.539										
13	Aluminum.....	8.320		7.965										
14	Silicon.....	7.111		6.7545										
15	Phosphorus.....	6.142		5.7921										
16	Sulphur.....	5.3637	5.3613	5.0211										
17	Chlorine.....	4.7212	4.7182	4.3942										
18	Argon.....													
19	Potassium.....	3.7371	3.7337	3.4468										
20	Calcium.....	3.3549	3.3517	3.0834										
21	Scandium.....	3.0284	3.0250	2.7739										
22	Titanium.....	2.7468	2.7432	2.5090										
23	Vanadium.....	2.5021	2.4984	2.2797			24.3							
24	Chromium.....	2.2889	2.2850	2.0806			21.52							
25	Manganese.....	2.1015	2.0975	1.9062			19.39							
26	Iron.....	1.9360	1.9321	1.7530		20.12	17.58					15.61		
27	Cobalt.....	1.7892	1.7853	1.6174		18.20	15.94							
28	Nickel.....	1.6584	1.6545	1.4970		16.55	14.53							
29	Copper.....	1.5412	1.5374	1.3894		15.19	13.306							
30	Zinc.....	1.4360	1.4322	1.2926		13.95	12.23							
31	Gallium.....	1.3409	1.3372	1.2052		12.89	11.27							
32	Germanium.....	1.2552	1.2513	1.1267		11.922	10.415							

X-RAY SPECTRA (Continued)

X-RAY SPECTRA (Continued)

EMISSION WAVE-LENGTHS IN THE K AND L SERIES, $\lambda \times 10^{-3}$ cm.

At. No.	Element	K Series				L Series								β_2	β_1	γ_1
		α_2	α_1	β_1	β_2	I	α_2	α_1	η	β_1	β_2	β_3	β_4			
33	Arsenic.....	1.1774	1.1734	1.0551	1.0428	11.048	9.652	10.711	8.718	6.801	6.769	5.574	5.024	5.374	5.024	5.024
34	Selenium.....	1.1065	1.1025	99013	97791	10.272	8.972	9.939	8.718	6.392	6.358	5.974	5.574	5.024	5.024	5.024
35	Bromine.....	1.0417	1.0376	93087	91853	9.564	8.358	9.235	8.109	6.204	6.008	5.619	5.574	5.024	5.024	5.024
37	Rubidium.....	9278	9236	82696	81476	.....	.....	.....	.....	6.610	6.388	6.008	5.974	5.024	5.024	5.024
38	Strontium.....	8776	8734	78130	76921	7.822	6.849	7.506	7.031	6.204	6.008	5.619	5.574	5.024	5.024	5.024
39	Yttrium.....	8313	8271	73919	72713	.....	6.436	7.031	6.594	5.824	5.652	5.619	5.574	5.024	5.024	5.024
40	Zirconium.....	7885	7843	70028	68850	6.899	6.057	6.594	6.196	5.480	5.330	5.297	5.226	5.024	5.024	5.024
41	Columbium.....	7489	7446	66438	65280	6.510	5.718	5.712	5.836	5.166	5.041	5.005	4.910	5.024	5.024	5.024
42	Molybdenum.....	71210	70783	63098	61970	.....	5.401	5.395	5.836	5.166	5.041	5.005	4.910	5.024	5.024	5.024
44	Ruthenium.....	64606	64174	57131	56051	5.486	4.843	4.836	4.611	4.513	4.476	4.362	4.173	4.173	4.173	4.173
45	Rhodium.....	61637	61202	54449	53396	5.2070	4.5956	4.5878	4.9112	4.3640	4.2802	4.247	4.1221	3.9357	3.9357	3.9357
46	Palladium.....	58860	58422	51961	50928	4.9396	4.3666	4.3585	4.6502	4.1373	4.0623	4.0257	3.9007	3.7164	3.7164	3.7164
47	Silver.....	56265	55824	49622	48607	4.6976	4.1538	4.1456	4.4101	3.9266	3.8611	3.8245	3.6938	3.5149	3.5149	3.5149
48	Cadmium.....	53831	53388	47413	46429	4.4713	3.9564	3.9478	4.1875	3.7501	3.6743	3.6364	3.5064	3.3280	3.3280	3.3280
49	Indium.....	51547	51104	45365	44408	4.2593	3.7724	3.7637	3.9761	3.5478	3.4990	3.4619	3.3312	3.1513	3.1513	3.1513
50	Tin.....	49404	48961	43430	42507	4.0633	3.6011	3.5922	3.7818	3.3779	3.3363	3.2989	3.1679	2.9949	2.9949	2.9949
51	Antimony.....	47394	46943	41630	40715	3.8803	3.4408	3.4318	3.5996	3.2184	3.1843	3.1451	3.0166	2.8451	2.8451	2.8451
52	Tellurium.....	45496	45045	39928	39043	3.7101	3.2910	3.2820	.....	3.0700	3.0400	3.0013	2.8761	2.7065	2.7065	2.7065
53	Iodine.....	43698	43246	38315	37466	3.5497	3.1509	3.1417	.....	2.9309	2.9059	2.8682	2.7461	2.5775	2.5775	2.5775
54	Xenon.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
55	Caesium.....	40404	39953	35362	34516	3.2596	2.8956	2.8861	2.9833	2.6778	2.6605	2.6299	2.5064	2.3425	2.3425	2.3425
56	Barium.....	38891	38438	34022	33222	3.1287	2.7790	2.7696	2.8371	2.5622	2.5498	2.5110	2.3993	2.2366	2.2366	2.2366
57	Lanthanum.....	37463	37000	32726	31966	3.0000	2.6688	2.6597	2.7340	2.4532	2.4438	2.4053	2.2980	2.1372	2.1372	2.1372
58	Cerium.....	36103	35642	31501	30770	2.8857	2.5651	2.5560	2.6147	2.3510	2.3442	2.3059	2.2041	2.0443	2.0443	2.0443
59	Prasodymium...	34805	34340	30360	29625	2.7781	2.4676	2.4577	2.5070	2.2539	2.2501	2.2124	2.1148	1.9568	1.9568	1.9568

X-RAY SPECTRA (Continued)

EMISSION WAVE-LENGTHS IN THE K AND L SERIES, $\lambda \times 10^{-8}$ cm.

At. No.	Element	K Series				L Series								
		α_2	α_1	β_1	β_2	1	α_2	α_1	η	β_1	β_4	β_3	β_2	γ_1
60	Neodymium.....	33596	33128	29275	28573	2.6703	2.3756	2.3653	2.4042	2.1622	2.1622	2.1222	2.0314	1.8738
62	Samarium.....	31311	30844	27250	26575	2.4770	2.2057	2.1950	2.2140	1.9936	1.9964	1.9580	1.8781	1.7231
63	Europium.....	30267	29795	26394	25645	2.3903	2.1273	2.1163	.....	1.9163	1.9221	1.8827	1.8082	1.6543
64	Gadolinium.....	29251	28778	25394	24762	2.3071	2.0526	2.0419	.....	1.8425	1.8493	1.8109	1.7419	1.5886
65	Terbium.....	28294	27820	24551	23912	2.2290	1.9823	1.9715	.....	1.7727	1.7814	1.7425	1.6790	1.5266
66	Dysprosium.....	27369	26895	23710	23128	2.1540	1.9156	1.9046	1.8922	1.7066	1.7167	1.6777	1.6198	1.4697
67	Holmium.....	26499	26030	.....	.....	2.0821	1.8521	1.8410	1.8230	1.6435	1.6553	1.6160	1.5637	1.4142
68	Erbium.....	25669	25198	22215	21671	2.0151	1.7914	1.7804	1.7548	1.5834	1.5964	1.5579	1.5106	1.3623
69	Thulium.....	24861	24387	21487	.....	1.9511	1.7339	1.7228	1.6923	1.5268	1.5412	1.5023	1.4602	1.3127
70	Ytterbium.....	24099	23625	20834	20322	1.8900	1.6789	1.6678	1.6310	1.4725	1.4882	1.4494	1.4128	1.2648
71	Lutecium.....	23358	22882	20171	19649	1.8318	1.6264	1.6155	1.5738	1.4207	1.4372	1.3982	1.3672	1.2203
72	Hafnium.....	22653	22173	19515	19042	1.7774	1.5770	1.5661	1.5197	1.3711	1.3893	1.3497	1.3235	1.1765
73	Tantalum.....	21973	21488	18911	18451	1.7249	1.5298	1.5188	1.4679	1.3242	1.3431	1.3041	1.2819	1.1356
74	Tungsten.....	21345	20862	18422	17898	1.6750	1.4844	1.4734	1.4181	1.2792	1.2988	1.2599	1.2420	1.0963
76	Osmium.....	20131	19645	17361	16875	.....	1.3987	1.3886	.....	1.1949	.....	1.1688	1.1029	.....
77	Iridium.....	19550	19065	16850	16376	.....	1.3598	1.3485	1.2817	1.1554	1.1771	1.1385	1.1329	98876
78	Platinum.....	19004	18523	16370	15887	1.4964	1.3215	1.3103	1.2403	1.1176	1.1398	1.1016	1.0937	95599
79	Gold.....	18483	17996	15902	15426	1.4569	1.2850	1.2737	1.2003	1.0813	1.1042	1.0655	1.0680	9246
80	Mercury.....	.....	.....	.....	.....	1.4184	1.2495	1.2386	1.1616	1.0465	1.0692	1.0305	1.0377	8946
81	Thallium.....	17466	16980	15011	14539	1.3819	1.2163	1.2049	1.1254	1.0130	1.0370	9985	1.0082	8657
82	Lead.....	17004	16516	14606	14125	1.3474	1.1841	1.1726	1.0900	9808	1.0056	9672	9808	8380
83	Bismuth.....	16525	16041	14025	13541	1.3137	1.1530	1.1415	1.0655	9500	9750	9367	9532	8114
90	Thorium.....	1368	1323	1169	1134	1.1128	9658	9540	8528	7636	7919	7532	7919	6517
92	Uranium.....	1309	1264	1119	1084	1.0649	9206	9087	8035	7185	7464	7088	7531	6136

Wave-lengths in Ångstrom units as determined by Crystal.

X-RAY SPECTRA (Continued)

EMISSION WAVE-LENGTHS IN THE M SERIES, $\lambda \times 10^{-8}$ cm.

Atomic Number	Element	α_2	α_1	β	γ
58	Cerium.....		14.030	13.755	11.511
59	Praesodymium.....				10.975
60	Neodymium.....		12.650	12.375	10.483
62	Samarium.....	11.475	11.406	11.238	9.580
63	Europium.....	11.003	10.932	10.723	9.192
64	Gadolinium.....	10.428	10.394	10.233	8.826
65	Terbium.....	9.946	9.917	9.772	8.468
66	Dysprosium.....	9.555	9.524	9.345	8.127
67	Holmium.....	9.165	9.143	8.947	7.849
68	Erbium.....	8.794	8.783	8.576	7.530
70	Ytterbium.....	8.138	8.122	7.893	7.009
71	Lutecium.....		7.824	7.585	6.748
72	Hafnium.....		7.524	7.289	6.530
73	Tantalum.....		7.237	7.008	6.299
74	Tungsten.....		6.969	6.743	6.076
75	Rhenium.....		6.715	6.491	5.875
76	Osmium.....		6.477	6.254	5.670
77	Iridium.....	6.262	6.249	6.025	5.490
78	Platinum.....	6.045	6.034	5.816	5.309
79	Gold.....	5.842	5.828	5.612	5.135
81	Thalium.....	5.461	5.450	5.239	4.815
82	Lead.....	5.288	5.274	5.065	4.665
83	Bismuth.....	5.119	5.108	4.899	4.522
90	Thorium.....	4.143	4.130	3.934	3.672
92	Uranium.....	3.916	3.902	3.708	3.473

GRATING SPACE IN CRYSTALS

Calcite.....	3.02904×10^{-8} cm.	Millikan
Potassium ferrocyanide..	8.408	Siegbahn
Rock salt, plane parallel to face.....	2.81	Bragg
Calcium fluoride.....	5.455 (Cu radiation)	Gerlach
	5.478 (Ni radiation)	"
Mica.....	9.845 (1st order)	Davis, Terrill
	9.958 (7th order)	" "
Silicon.....	5.415 (Cu radiation)	Gerlach
	5.410 (Ni radiation)	"
Zinc blende.....	5.90 (Cu radiation)	"

X-RAY CRYSTALLOGRAPHIC DATA*

Compiled with the collaboration of John G. Albright

The following table presents crystallographic data for about 1300 compounds. For convenience they have been separated into; elements, inorganic compounds, minerals, metal-organic compounds and organic compounds. Alloys will be found among the inorganic compounds under one or the other of the metal constituents.

The crystal system is given using abbreviations indicated below. The type of structure is indicated by reference to certain characteristic compounds. The space group is indicated by the symbols of the Schoenflies system. The dimensions of the unit cell a , b , and c in angstrom units are given in order followed in some cases by axial angles. The last column indicates the number of molecules per unit cell.

For an explanation of the space group symbols, structure types or other details of crystallographic data see Wyckoff: The Structure of Crystals and also Davey: Study of Crystal Structure and its Applications (p. 672).

Abbreviations: b.c., body centered; c.p., close packed; cub., cubic; dia., diamond; f.c., face centered; hex., hexagonal; monocl., monoclinic; rhbdr., rhombohedral; rhomb., rhombic; tetr., tetragonal; tricl., triclinic.

THE ELEMENTS

Substance	System, struct. type	Space group	Lattice constants	Atoms
			a , b , c , Ax. ang.	
A (-235°C).....	cub., f.c., Cu	O_h^5	5.43	4
Ag	cub., f.c., Cu	O_h^5	4.0776	4
Al.....	cub., f.c., Cu	O_h^5	4.04145	4
As.....	hex., rhbdr.	D_{3d}^5	4.151, $\omega = 53^{\circ} 49'$	2
As.....	rhbdr., f.c.		5.599, $\omega = 84^{\circ} 18'$	8
Au.....	cub., f.c., Cu	O_h^5	4.0702	4
Ba.....	cub., b.c., W	O_h^9	5.015	2
Be.....	hex., c.p., Mg	D_{6h}^4	2.283, , 3.607 2.2679, , 3.5942 (Neuburger, 1933)	2
Bi.....	hex., rhbdr., As	D_{6h}^5	4.749, $\omega = 57^{\circ} 16'$	2
Bi.....	rhbdr., f.c.		6.578, $\omega = 87^{\circ} 34'$	8
Br (-150°C).....	rhomb., I	V_h^{18}	4.48, 6.67, 8.72	8
C (diamond, 18°C)....	cub., f.c.	O_h^7	3.5597	8
C (graphite).....	hex.	D_{6h}^4	2.455, , 6.69	4
Ca.....	cub., f.c., Cu	O_h^5	5.56	4
Cb (Nb).....	cub., b.c., W	O_h^9	3.03	2
Cd.....	hex., c.p., Mg	D_{6h}^4	2.973, , 5.606	2
Ce (α).....	hex., c.p., Mg	D_{6h}^4	3.65, , 5.91	2
Ce (β).....	cub., f.c., Cu	O_h^5	5.12	4
Cl (-185°C)	tetr.	D_{4h}^{16}	8.56, , 6.12	8
Co (α)	hex., c.p., Mg	D_{6h}^4	2.514, , 4.105	2
Co (β)	cub., f.c., Cu	O_h^5	3.554	4
Cr (α)	cub., b.c., W	O_h^9	2.878	2
Cr (β).....	hex., c.p., Mg	D_{6h}^4	2.717, , 4.418	2

* See also Supplementary Table following.

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System. struct. type	Space group	Lattice constants	Atoms
			a, b, c, Ax. ang.	
Cr (γ).....	cub., b.c..	T_d^3	8.717	58
Cs (-173°C).....	cub., b.c., W	O_h^9	6.05	2
Cu.....	cub., f.c.	O_h^5	3.608	4
Er.....	hex., c.p., Mg	D_{6h}^4	3.74, 6.09	2
Fe (α)	cub., b.c., W	O_h^9	2.86106	2
Fe (β) (800°C).....	cub., b.c.	.....	2.90	2
Fe (γ) (1100°C).....	cub., f.c.	O_h^5	3.63	4
Fe (δ) (1425°C).....	cub., b.c.	.....	2.93	2
Ga.....	rhomb.	V_h^{18}	4.5167, 4.5107, 7.6448	
Ga.....	tetr. (simple)	D_{4h}^{16}	4.51, 7.51	8
Ge.....	cub., f.c., Dia.	O_h^7	5.647	8
H ₂ (-271°C).....	hex.	.....	3.75 6.11	4
Hg (-46°C).....	rhbdr.	D_{3d}^5	2.997, $\omega = 70^\circ 32'$	1
Hg (-46°C).....	rhbdr., f.c.	.....	4.578, $\omega = 98^\circ 13'$	4
Hf.....	hex., c.p., Mg	D_{6h}^4	3.200, 5.077	2
I ₂	rhomb., 4I ₂ groups	V_h^{18}	4.795, 7.255, 9.780	8
In.....	tetr., f.c.	D_{4h}^{17}	4.583, 4.936	4
Ir.....	cub., f.c., Cu	O_h^5	3.823	4
K.....	cub., b.c., W	O_h^9	5.333	2
Kr (-252.5°C).....	cub., f.c., Cu	O_h^5	5.59	4
La.....	hex., c.p., Mg	D_{6h}^4	3.72, 6.06	2
La (β).....	cub., f.c.	.....	5.296	
Li (-173°C).....	cub., b.c., W	O_h^9	3.46	2
Mg.....	hex., c.p.	D_{6h}^4	3.203, 5.196	2
Mn (α).....	cub., b.c.	T_d^3	3.894	58
Mn (β)	cub.	O_6 or O_7	6.300	20
Mn (γ).....	tetr., f.c., In	D_{4h}^{17}	3.774, 3.526	4
Mo.....	cub., b.c., W	O_h^9	3.1401	2
N ₂ (α) (-252°C).....	cub.	T^4	5.66 (4N ₂)	8
Na (-173°C).....	cub., b.c., W	O_h^9	4.24	2
Ne (-268°C).....	cub., f.c., Cu	O_h^5	4.52	4
Ni (α).....	hex., c.p., Mg	D_{6h}^4	2.66, 4.29	2
Ni (β).....	cub., f.c., Cu	O_h^5	3.517	4
O ₂ (-252°C).....	rhomb., b.c.	.....	5.50, 3.82, 3.44	4
O ₃ (β).....	rhbdr.	.....	6.19, $\alpha = 99.1^\circ$	6
O ₂ (γ) (-223°C).....	cub.	T_h^6	6.83	8

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Atoms
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Os.....	hex., c.p., Mg	D _{6h} ⁴	2.724, , 4.314	2
P (metallic).....	hex., rhbdr., As	D _{3d} ⁶	5.14, $\omega = 34^\circ 7'$	2
P (metallic).....	rhbdr., f.c.	.....	5.96, $\omega = 60^\circ 47'$	8
P (red and black)*.....	rhomb., f.c.	V _h ¹⁸	3.31, 4.38, 10.50	8
P (white, -35°C).....	cub.	.....	7.17 (4P ₄)	16
Pb.....	cub., f.c., Cu	O _h ⁶	4.941	4
Pd.....	cub., f.c., Cu	O _h ⁶	3.879	4
Po.....	monocl.	C ₂ ³	7.42, 4.29, 14.10, $\beta = 92^\circ (?)$	
Pt.....	cub., f.c., Cu	O _h ⁶	3.9142	4
Rb (-173°C).....	cub., b.c., W	O _h ⁹	5.62	2
Re.....	hex., c.p., Mg	D _{6h} ⁴	2.765, , 4.470	2
Rh.....	cub., f.c., Cu	O _h ⁶	3.7944	4
Ru.....	hex., c.p., Mg	D _{6h} ⁴	2.695, , 4.273	2
S.....	rhomb., f.c.	V _h ²⁴	10.48, 12.92, 24.55	128
Sb.....	hex., rhbdr., As	D _{3d} ⁶	4.501, $\omega = 57^\circ 5'$	2
Sb.....	rhbdr., f.c.	.....	6.226, $\omega = 87^\circ 24'$	8
Se.....	hex.	D ₃ ⁴ or D ₃ ⁶	4.337, , 4.944	3
Se (α).....	monocl.	C _{2h} ²	8.992, 8.973, 11.52, $\beta = 91^\circ 34' (48\text{es})$	32
Se (β).....	monocl.	C _{2h} ²	12.74, 8.04, 9.25, $\beta = 93^\circ 4'$	32
Si.....	cub., f.c., Dia.	O _h ⁷	5.4173	8
Sn (α , gray).....	cub., f.c., Dia.	O _h ⁷	6.46	8
Sn (β , white).....	tetr., double b.c.	D _{4h} ¹⁹	5.818, , 3.174	4
Sr.....	cub., f.c., Cu	O _h ⁶	6.075	4
Ta.....	cub., b.c., W	O _h ⁹	3.281	2
Te.....	hex., Se	D ₃ ⁴ or D ₃ ⁶	4.495, , 5.912	3
Th.....	cub., f.c., Cu	O _h ⁶	5.074	4
Ti.....	hex., c.p., Mg	D _{6h} ⁴	2.951, , 4.692	2
Ti (β) (above 900°C).....	cub., b.c.	.....	3.32	2
Tl (α).....	hex., c.p., Mg	D _{6h} ⁴	3.450, , 5.520	2
Tl (β) (above 230°C).....	cub., f.c., Cu	O _h ⁶	4.841	4
U.....	cub., b.c., W	O _h ⁹	3.43	2
U.....	monocl. (Wilson, 1933)	C _{2h} ³	2.829, 4.887, 3.308	2
V.....	cub., b.c., W	O _h ⁹	3.011	2

* Crystalline and "amorphous" black and red phosphorus all give similar x-ray patterns.

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Atoms
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
W (α).....	cub., b.c.	O_h^2	3.1588	2
W (β).....	cub.	O^2 or O_h^3	5.04	8
Xe (-173°C).....	cub., f.c., Cu	O_h^6	6.18	4
Zn.....	hex., c.p., Mg	D_{6h}^4	2.6585, . . . , 4.9342	2
Zr.....	hex., c.p., Mg	D_{6h}^4	3.223, . . . , 5.123	2

INORGANIC COMPOUNDS

Substance	System, struct. type	Space group	Lattice constants	Atoms
AgBr.....	cub., NaCl	O_h^5	5.755	Mol. 4
AgBrO ₃	tetr., AgClO ₃	V_d^{11} or D_{4h}^{17}	8.59, . . . , 8.01	8
AgCN.....	hex.	C_{3v}^5	4.60, $\alpha = 81^\circ 14'$	
AgCa.....	cub., f.c.		9.07	
AgCd (β -phase).....	cub., CsCl	O_h^1	3.33	1
AgCl.....	cub., NaCl	O_h^5	5.545	4
AgClO ₃	tetr.	V_d^{11} or D_{4h}^{17}	8.47, . . . , 7.90	8
AgClO ₄ (200°C).....	cub., KClO ₄	T_d^2	6.92	4
Ag[Co(NH ₃) ₂ (NO ₂) ₄]..	tetr.	D_{4h}^4	6.97, . . . , 10.43	2
AgF.....	cub., NaCl	O_h^5	4.92	4
AgI.....	cub., ZnS	T_d^2	6.47	4
AgI.....	hex, ZnO	C_{6v}^4	4.58, . . . , 7.49	2
AgI (α) (145.8-550°C) ..	cub.		5.034	2
AgIO ₄	tetr.	C_{4h}^5	5.368, . . . , 12.013	4
AgK(CN) ₂	hex.	D_{3d}^2	7.384, . . . , 17.55	
AgMg.....	cub., CsCl	O_h^1	3.28	
AgMnO ₄	monocl.	C_{2h}^5	5.66, 8.27, 7.12, $\beta = 92^\circ 29'$	4
AgNO ₂	rhomb.	C_v^{20} or D_{2h}^{13}	3.505, 6.14, 5.16	2
AgNO ₃	rhomb.	$V^1 - V^4$	6.97, 7.34, 10.14	8
[AgNO ₃ .CO(NH ₂) ₂]n...	monocl	C_{2h}^2 (C_{2v}^2)	10.23, 16.84, 6.25	8
AgN ₃	rhomb.(pseudotetr.)	V_h^{26}	5.89, 5.58, 5.96	4
AgRhO ₄	tetr.	C_{4h}^5	5.349, . . . , 11.916	4
Ag (Sb. Bi)S ₂	tricl.		5.67, 5.69, 5.62	2
AgZn.....	cub., CsCl	O_h^1	3.156	1
Ag ₂ F.....	hex., CdI ₂	D_{3d}^3	3.0, . . . , 5.74	1
Ag ₂ HgI ₄	tetr.	V_d^1	6.340	

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Ag ₂ HgI ₄ (α , >50°C) ..	cub.	T _d ²	6.383	1
Ag ₂ MoO ₄	cub., MgAl ₂ O ₄	O _h ⁷	9.26	8
Ag ₂ O	cub., Cu ₂ O	O _h ⁴	4.72	2
Ag ₂ S (α)	cub., b.c.	.....	4.88	2
Ag ₂ SO ₄ .4NH ₃	tetr.	V ₄ ^d	8.44, ..., 6.35	2
Ag ₂ Se (α)	cub., b.c.	.....	4.983	2
Ag ₂ Te (α)	cub., f.c.	.....	6.572	4
Ag ₃ Al	cub., β -Mn	.....	6.920	5
Ag ₃ AsO ₄	cub., Ag ₃ PO ₄	T _d ¹	6.12	2
Ag ₃ Hg ₄	cub.	O _h ⁹	10.09	4
Ag ₃ PO ₄	cub.	O _h ²	5.99	2
Ag ₃ SbS ₃	hex. (rhbdr.)	.....	7.07, $\alpha = 104^\circ 1'$	2
Ag ₅ Cd ₃	cub., Cu ₅ Zn ₃	T _d ³	9.96	4
Ag ₅ Zn ₃	cub., Cu ₅ Zn ₃	T _d ³	9.33	4
AlAs	cub., ZnS	T _d ²	5.62	
AlB ₂	hex.	.....	3.00, ..., 3.245	1
AlB ₁₂	tetr.	.....	12.55, ..., 10.18	16
AlCl ₃	monocl.	C ₂ ³	5.91, 10.24, 6.16, $\beta = 71^\circ 21'$	4
AlCl ₃	pseudo-hex.	D ₃ ³ or D ₃ ⁵	5.91, ..., 17.52	6
AlCl ₃ .6H ₂ O	hex. (rhbdr.)	D _{3d} ⁵	7.85	2
AlCu	hex.	.....	3.89, $\alpha = 94^\circ 36'$	4
AlCu ₂ Mn	cub., AlCu ₃	.....	5.950	4
AlCu ₃	cub., f.c.	.....	3.47	4
AlF ₃	hex.	D ₃ ⁷	4.914, ..., 12.46	6
AlF ₃	rhbdr.	.....	5.029, $\alpha = 58^\circ 31'$	2
AlH(SiW ₁₂ O ₄₀).28H ₂ O ..	rhbdr.	D _{3d} ⁵	16.45, $\alpha = 56^\circ 18'$	2
AlN	hex., ZnO	C _{6v} ⁴	3.104, ..., 4.965	2
Al(OH) ₃	monocl.	C _{2h} ⁵	8.6236, 5.06021, 9.699, $\beta = 85^\circ 26'$	8
AlP	cub., ZnS	T _d ²	5.42	
Al(PO ₃) ₃	cub.	T _d ⁶	13.63	16
AlSb	cub., ZnS	T _d ²	6.13	4
(Al, Se) ₂ O ₃	cub.	O _i ¹⁰	9.22	16
Al ₂ Cu	tetr., b.c.	D _{4h} ¹⁸	6.04, ..., 4.86	4
Al ₂ O ₃ (α , corundum) ..	hex. (rhbdr.), Fe ₂ O ₃	D _{3d} ⁵	5.12, $\alpha = 55^\circ 17'$	2
Al ₂ O ₃ (β)	hex.	.....	5.56, ..., 22.55	
Al ₂ O ₃ (γ)	cub., MgAl ₂ O ₄	O _h ⁷	7.895	10 $\frac{1}{2}$
Al ₂ O ₃ .H ₂ O	rhomb.	.....	4.38, 9.35, 2.82	
Al ₃ SiO ₆ (cyanite)	tricl.	O _i ¹	7.09, 7.72, 5.56, $\beta = 101^\circ 2'$	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Al ₃ Mg ₄	cub.	.....	4.80	1
Al ₄ C ₃	rhbdr.	D _{3d} ⁵	8.53, $\alpha = 22^\circ 28'$	1
Al ₄ Cu ₉	cub., Cu ₈ Zn ₈	T _d ³	8.70	4
Al ₅ C ₃ N.....	hex.	C _{6v} ⁴	3.280, ..., 21.55	2
AsI ₃	hex.	C ₃ ¹	7.187, ..., 21.39	6
AsI ₃	rhbdr.	C _{3i} ²	8.25, $\alpha = 51^\circ 20'$	2
As ₂ O ₃	cub.	O _i ⁷	11.06	16
AuCu.....	tetr.	.....	3.98, ..., 3.72	1
AuCu ₃	cub.	.....	3.75	
AuSb ₂	cub., FeS ₂	T _h ⁶	6.636	4
AuSn.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	4.307, ..., 5.494	2
AuZn.....	cub., CsCl	O _h ¹	3.19	1
AuZn ₃ (α).....	cub.	.....	7.88	8
Au ₂ Bi.....	cub.	O _h ⁷	7.942	8
Au ₂ Pb.....	cub.	.....	7.91	8
Au ₅ Zn ₈	cub., Cu ₅ Zn ₈	T _d ³	9.27	4
BAsO ₄	tetr.	S ₄ ²	4.458, ..., 6.796	2
BN.....	hex., graphite	D _{6h} ⁴ , C _{3h} *	2.51, ..., 6.69	4, 2*
BPO ₄	tetr.	S ₄ ²	4.332, ..., 6.64	2
B ₂ H ₆	hex.	D _{6h} ⁴	4.54, ..., 8.69	2
B ₁₀ H ₁₄	rhomb.	V _h ²¹	14.46, 20.85, 5.69	2
BaC ₂	tetr., f.c., CaC ₂	D _{4h} ¹⁷	4.39, ..., 7.04	
BaCO ₃	rhomb., KNO ₃	V _h ¹⁶	5.29, 8.88, 6.41	4
Ba(ClO ₄) ₂ ·3H ₂ O.....	hex.	.....	7.28, ..., 9.64	2
BaF ₂	cub., CaF ₂	O _h ⁵	6.184	4
BaMoO ₄	tetr., CaWO ₄	C _{6h} ⁶	5.56, ..., 12.76	4
Ba(NO ₃) ₂	cub.	T _h ⁶	8.11	4
Ba(N ₃) ₂	monocl.	C _{2h} ¹ or C _{2h} ²	6.22, 29.29, 7.02, $\beta = 105^\circ 14'$	10
BaNi(CN) ₄ ·4H ₂ O.....	monocl.	.....	11.89, 14.08, 6.54, $\beta = 103^\circ 42'$	4
BaO.....	cub., NaCl	O _h ⁵	5.50	4
BaO ₂	tetr.	O _{4h} ¹⁷	5.34, ..., 6.77	4
BaS.....	cub., NaCl	O _h ⁵	6.35	
BaSO ₄	rhomb.	V _h ¹⁶	8.85, 5.44, 7.13	4
BaS ₃	rhomb.	.....	8.32, 9.64, 4.82	■

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Ba(SbO ₃) ₂ ·8H ₂ O.....	monocl., b.c. (pseudo-rhomb.)	.....	9.961, 12.506, 10.129, $\beta = 87^\circ 17'$	
BaSe.....	cub., NaCl	O _h ⁶	6.62	4
BaTe.....	cub., NaCl	O _h ⁶	6.986	4
BaTiO ₃	cub., CaTiO ₃	.....	3.97	
BaWO ₄	tetr., CaWO ₄	C _{4h} ⁶	5.60, , 12.69	4
BeO.....	hex., ZnO	C _{6v} ⁴	2.70, , 4.39	2
BeS.....	cub., ZnS	T _d ²	4.85	
BeSO ₄ ·4H ₂ O.....	tetr.	D _{2d} ¹⁰ or D _{4h} ¹⁸	8.03, , 10.75	
BeSe.....	cub., ZnS	T _d ²	5.07	
BeSiO ₃ ·AlO ₂ H.....	monocl.	C _{2h} ²	4.63, 14.30, 4.71, $\beta = 100^\circ 16'$	4
BeTe.....	cub., ZnS	T _d ²	5.54	
Be ₂ C.....	cub., CaF ₂	O _h ⁶	4.33	
Be ₂ SiO ₄ (phenacite) . . .	rhbdr.	C _{2i} ³	7.68	6
Be ₂ SiW ₁₂ O ₄₀ ·31H ₂ O . . .	cub.	O _h ⁷	23.3	8
BiF ₃	cub.	.....	5.85	
BiI ₃	hex., AsI ₃	C ₃ ¹	7.498, , 20.67	6
CBr ₄ (above 47°).....	cub.	T _h ⁶	11.34	8
CBr ₄	monocl.	C _{2h} ³ or C _{2h} ⁶	12.10, 3.41, 10.20, $\beta = 125^\circ 3'$	8
Cl ₄	cub.	T _h ⁶	11.62	8
CO (temp. liq. H ₂)	cub., $\alpha - N_2$	T ₄	5.63	4
COS (temp. liq. air) . . .	hex. (trig.)	C ₃ ⁴ or C _{3v} ⁶	4.08	1
CO ₂ (−190° C)	cub.	T _h ⁶	5.575	4
CS ₂ (−185° C)	tetr.	.....	8.12, , 3.77	
CaB ₂ O ₄	rhomb.	V _h ¹⁴	6.19, 11.60, 4.28	4
CaB ₆	cub.	.....	4.145	1
CaCN ₂	hex., CsCl ₂ I	D _{3d} ⁶	5.11, $\alpha = 43^\circ 50'$	1
CaCO ₃ (aragonite)	rhomb., KNO ₃	V _h ¹⁶	4.94, 7.94, 5.72	4
CaCO ₃ (calcite).....	rhbdr., NaNO ₃	D _{3d} ⁶	6.361, $\alpha = 46^\circ 6'$	2
CaCO ₃ (vaterite).....	hex.	.....	4.120, , 8.556	2
CaC ₂	tetr.	O _{4h} ¹⁷	3.87, , 6.37	2
CaC ₂ O ₄ ·3H ₂ O.....	.....	.....	12.375, , 7.377	8
CaCl ₂	rhomb.	V _h ¹²	6.24, 6.43, 4.20	2
CaCrO ₄	tetr.	D _{4h} ¹⁹	7.25, , 6.34	
CaCrO ₄ ·H ₂ O.....	rhomb.	V _h ¹⁶	7.99, 12.77, 8.11	8
CaCrO ₄ ·2H ₂ O.....	rhomb.	V _h ¹¹	16.02, 11.39, 5.60	8

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
CaF ₂ (fluorite).....	cub.	O _h ⁵	5.451	4
CaI ₂	hex.	.....	4.48,, 6.96	.....
CaIn ₂ O ₄	tetr., Mn ₃ O ₄	D _{4h} ¹⁹	6.201,, 9.822	4
Ca (Mg, Fe) (CO ₃) ₂ ...	hex.	C _{3h} ²	6.02, $\alpha = 47^\circ 7'$	1
CaMoO ₄	tetr., CaWO ₄	C _{4h} ⁶	5.23,, 11.44	4
Ca(NO ₃) ₂	cub., Ba(NO ₃) ₂	T _h ⁶	7.60	4
CaO.....	cub., NaCl	O _h ⁵	4.797	4
3CaO.Al ₂ O ₃	cub., b.c.	O _h ¹	7.624	3
5CaO.3Al ₂ O ₃	cub.	T _d ⁶	11.95	.....
Ca(OH) ₂	hex., CdI ₂	D _{3d} ³	3.582,, 4.902	1
CaPb ₃	cub.	.....	4.891	.....
CaS.....	cub., NaCl	O _h ⁵	5.68	4
CaSO ₄ (anhydrite)....	rhomb.	V _h ¹⁷	6.22, 6.96, 6.97	4
CaSO ₄ .2H ₂ O.....	monocl.	C _{2h} ³	10.47, 15.15, 6.51, $\beta = 151^\circ 33'$	4
CaSO ₄ .4CO(NH ₂) ₂	tricl.	.....	14.74, 14.95, 6.47, $\alpha = 91^\circ 26'$, $\gamma = 86^\circ 50'$	4
CaSe.....	cub., NaCl	O _h ⁵	5.91	4
CaSiO ₃ BO ₂ H.....	monocl.	C _{2h} ⁶	9.64, 7.62, 4.82, $\beta = 90^\circ 9'$	4
CaSi ₂	hex. (rhbdr.)	D _{3d} ⁵	10.4, $\alpha = 21^\circ 30'$	2
CaSnO ₃	cub. (?), CaTiO ₃	.....	3.92	.....
CaSn ₃	cub.	.....	4.732	.....
CaTe.....	cub., NaCl	O _h ⁵	6.345	4
CaTi ₃	cub.	.....	4.794	.....
CaWO ₄ (scheelite)....	tetr.	C _{4h} ⁶	5.24,, 11.38	4
CaZrO ₃	cub. (?), CaTiO ₃	.....	3.99	.....
Ca ₃ Al ₂ Si ₃ O ₁₂	cub., b.c.	O _h ¹⁰	11.840	8
Ca ₃ Cr ₂ Si ₃ O ₁₂	cub., b.c.	O _h ¹⁰	11.950	8
Ca ₃ Fe ₂ Si ₃ O ₁₂	cub., b.c.	O _h ¹⁰	12.026	8
CbC.....	cub., NaCl	O _h ⁵	4.40	4
CbN.....	cub., NaCl	O _h ⁵	4.41	4
CbO ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.77,, 2.96	2
CdBr ₂	hex., CdCl ₂	D _{3d} ⁵	6.63, $\alpha = 34^\circ 42'$	1
CdCO ₃	hex., NaNO ₃	D _{3d} ⁶	6.112, $\alpha = 47^\circ 24'$	2
CdCl ₂	hex. (rhbdr.)	D _{3d} ⁵	6.35, $\alpha = 36^\circ 40'$	1
CdCr ₂ O ₄	cub., MgAl ₂ O ₄	.....	8.59	.....

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
CdF ₂	cub., CaF ₂	O _h ⁶	5.40	4
CdFe ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.73	8
CdI ₂	hex.	D _{3d} ³	4.24, ..., 6.84	4
CdIn ₂ O ₄	tetr., Mn ₂ O ₄	D _{4h} ¹⁹	6.117, ..., 9.875	4
Cd(NH ₃) ₄ (ReO ₄) ₂	cub.	T _d ²	10.53	4
CdO.....	cub., NaCl	O _h ⁵	4.689	4
CdO.Fe ₂ O ₃	cub.		8.67	8
Cd(OH) ₂	hex., CdI ₂	D _{3d} ³	3.47, ..., 4.64	1
Cd(OH)Cl.....	hex.	C _{6v} ⁴	3.66, ..., 10.27	2
CdS (α).....	hex., ZnO	C _{6v} ⁴	4.14, ..., 6.72	2
CdS (β).....	cub., ZnS	T _d ²	5.82	4
3CdSO ₄ .8H ₂ O.....	monocl.	C _{2h} ⁶	9.44, 11.87, 16.49, β = 117° 16'	4
CdSb.....	rhomb.	V _h , V or C _{2v}	8.492, 8.320, 6.390	8
CdSe.....	hex., ZnO	C _{6v} ⁴	4.30, ..., 7.02	2
CdTe.....	cub., ZnS	T _d ²	6.41	
CdTiO ₃	cub. (?)		3.75	
Cd ₃ As ₂	cub., Zn ₃ As ₂		6.29	2
Cd ₃ P ₂	cub., Zn ₃ As ₂		6.06	2
CeC ₂	tetr., CaC ₂	D _{4h} ¹⁷	3.87, ..., 6.48	2
CeF ₃	hex.	D ₆ ⁶	7.114, ..., 7.273	6
CeN.....	cub., f.c.		5.01	
CeO ₂	cub., CaF ₂	O _h ⁵	5.41	4
CeP.....	cub., f.c.		5.89	
CePb ₃	cub.		4.864	
CeSn ₃	cub.		4.711	
Ce ₂ O ₃	hex., La ₂ O ₃	D _{3d} ³	3.880, ..., 6.057	1
Ce ₂ (WO ₄) ₃	tetr.		5.336, ..., 11.620	
CoAl ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.059	8
CoAs.....	rhomb.		5.96, 5.15, 3.51	
CoAsS.....	cub.	T _d ⁴	5.60	4
CoBr ₂	hex., CdI ₂	D _{3d} ³	3.685, ..., 6.120	1
CoCO ₃	hex. (rhbdr.), NaNO ₃	D _{3d} ⁵	5.67, α = 48° 14' (5.91, α = 103° 22')	2 (4)
CoCl ₂	rhbdr.	C _{3v} ⁵ (?)	6.16, α = 33° 26'	1
CoCr ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.319	8
CoF ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.69, ..., 3.19	2
CoFe ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.35	8
CoI ₂	hex., CdI ₂	D _{3d} ³	3.96, ..., 6.65	1

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
[Co.4NH ₃ .2H ₂ O]Co (CN) ₆	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	7.02, $\alpha = 95^\circ 51'$	1
[Co.5NH ₃ .H ₂ O]ClO ₃ . SO ₄	cub., (NH ₄) ₂ PtCl ₆	.....	10.73	
[Co.5NH ₃ .H ₂ O] (ClO ₄) ₃	cub., (NH ₄) ₃ FeF ₆	.....	11.32	
[Co.5NH ₃ .H ₂ O] ClO ₄ .SO ₄	cub., (NH ₄) ₂ PtCl ₆	.....	10.89	
[Co.5NH ₃ .H ₂ O]Co (CN) ₆	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	7.18, $\alpha = 96^\circ 49'$	1
[Co.5NH ₃ .H ₂ O]Fe (CN) ₆	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	7.18, $\alpha = 96^\circ 53'$	1
[Co.5NH ₃ .H ₂ O]I ₃	cub., (NH ₄) ₃ FeF ₆	.....	10.81	
[Co.5NH ₃ .H ₂ O]SO ₄ Br	cub., (NH ₄) ₂ PtCl ₆	.....	10.45	
[Co.5NH ₃ .H ₂ O]SO ₄ I...	cub., (NH ₄) ₂ PtCl ₆	.....	10.62	
[Co.5NH ₃ .H ₂ O] SeO ₄ Br	cub., (NH ₄) ₂ PtCl ₆	.....	10.63	
[Co.6NH ₃]ClO ₃ .SO ₄	cub., (NH ₄) ₂ PtCl ₆	.....	10.80	
[Co.6NH ₃](ClO ₄) ₃	cub., (NH ₄) ₃ FeF ₆	.....	11.39	
[Co.6NH ₃]ClO ₄ .SO ₄	cub., (NH ₄) ₂ PtCl ₆	.....	10.95	
[Co.6NH ₃]Co(CN) ₆	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	7.24, $\alpha = 97^\circ 28'$	1
[Co.6NH ₃]Cr(CN) ₆	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	7.40, $\alpha = 97^\circ 48'$	1
[Co.6NH ₃]I ₃	cub., (NH ₄) ₃ FeF ₆	.....	10.88	
[Co.6NH ₃]SO ₄ Br.....	cub., (NH ₄) ₂ PtCl ₆	.....	10.51	
[Co.6NH ₃]SO ₄ I.....	cub., (NH ₄) ₂ PtCl ₆	.....	10.71	
[Co.6NH ₃]SeO ₄ I.....	cub., (NH ₄) ₂ PtCl ₆	.....	10.79	
CoO.....	cub., NaCl	O _h ⁵	4.24	4
Co(OH) ₂	hex., CdI ₂	D _{3d} ³	3.19, ..., 4.66	1
CoP.....	rhomb.	.....	5.588, 5.066, 3.274	
CoS.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	3.37, ..., 5.14	2
CoSO ₃ .6H ₂ O.....	hemi. trig.	C ₃ ⁴	8.822, ..., 9.040, $\alpha = 96^\circ 22'$	
CoSO ₄	rhomb.	.....	4.65, 6.66, 8.46	
CoSO ₄ .7H ₂ O.....	monocl., FeSO ₃ .7H ₂ O	C _{2h} ⁶	15.45, 13.08, 20.04, $\beta = 104^\circ 40'$	16
CoS ₂	cub., FeS ₂	T _h ⁶	5.64	4
CoSb.....	hex., NiAs	C _{6v} ⁴	3.866, ..., 5.188	2
CoSe.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	3.614, ..., 5.278	2
CoSi.....	cub.	T _h ⁴	4.438	
CoSiF ₆ .6H ₂ O.....	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	6.26, $\alpha = 96^\circ 1'$	1
CoTe.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	3.886, ..., 5.360	2
Co ₂ Al ₅	hex.	D _{6h} ⁴	7.656, ..., 7.593	4
Co ₂ O ₃ .2Fe ₂ O ₃	cub.	.....	8.35	
Co ₂ Si.....	rhomb.	V _h ¹⁶	7.095, 4.908, 3.730	4
Co ₂ SnO ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.60	8
Co ₃ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.110	8
Co ₃ S ₄	cub., Mg Al ₂ O ₄	O _h ⁷	9.36	8

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Cr(CO) ₆	rhomb.	C _{2v} ⁹	11.72, 6.27, 10.89	4
CrCl ₃	hex. (rhhdr.)	D ₃ ³ or D ₃ ⁵	6.02, , 17.3	6
CrCl ₃ .6H ₂ O.....	hex. (rhhdr.)	D _{3d} ⁶	7.98	2
CrH(SiW ₁₂ O ₄₀).24H ₂ O.....			15.98, α = 58° 32'	
CrH(SiW ₁₂ O ₄₀).28H ₂ O.....	hex. (rhhdr.)	D _{3d} ⁶	16.47, α = 56° 14'	2
CrN.....	cub., NaCl	O _h ⁵	4.140	4
[Cr.5NH ₃ .H ₂ O](ClO ₄) ₃	cub., (NH ₄) ₃ FeF ₆		11.47	
[Cr.5NH ₃ .H ₂ O]SO ₄ Br.....	cub., (NH ₄) ₂ PtCl ₆		10.535	
[Cr.6NH ₃](ClO ₄) ₃	cub., (NH ₄) ₃ FeF ₆		11.545	
CrS.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	3.44, , 5.67	2
CrSb.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	4.107, , 5.468	2
CrSe.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	3.59, , 5.80	2
CrSi.....	cub.	T ⁴	4.620	4
CrSi ₂	hex.	D ₆ ⁴	4.422, , 6.351	3
CrTe.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	3.981, , 6.211	2
Cr ₂ O ₃	hex., Fe ₂ O ₃	D _{3d} ⁶	5.35, α = 54° 58'	2
Cr ₃ C ₂	rhomb.		2.82, 5.52, 11.46	4
Cr ₃ Si.....	cub.		4.555	2
Cr ₄ C.....	cub.		10.64	24
Cr ₅ Al ₃	rhhdr. (pseudo-cub.)		7.7894, α = 109° 7.6'	2
Cr ₇ C ₃	hex.		13.98	80
CsAl(SO ₄) ₂ .12H ₂ O.....	cub.	T _h ⁶	12.31	4
CsBr.....	cub., CsCl	O _h ¹	4.287	1
CsBr ₂ I.....	rhomb.	V _h ¹⁶	6.57, 9.18, 10.66	4
CsCdBr ₃	cub. (?), CaTiO ₃		5.33	
CsCdCl ₃	cab. (?), CaTiO ₃		5.20	
CsCl.....	cub.	O _h ¹	4.110	1
CsCl(>445°C).....	cub., NaCl	O _h ⁵	7.02	
CsClO ₄	rhomb., BaSO ₄	V _h ¹⁶	9.82, 6.00, 7.79	4
CsClO ₄ (250°C).....	cub., KClO ₄		7.96	1
CsCl ₂ I.....	hex.	D _{3d} ⁵	5.46, α = 70° 42'	1
CsF.....	cub., NaCl	O _h ⁵	6.01	4
CsHgBr ₃	cub. (?), CaTiO ₃		5.77	
CsHgCl ₃	cub. (?), CaTiO ₃		5.44	
CsI.....	cub., CsCl	O _h ¹	4.562	1
CsIBr ₂	rhomb.	V _h ¹⁶	6.57, 9.18, 10.66	4
CsICl ₂	rhhdr.	D _{3d} ⁵		1
CsIO ₃	cub. (?), CaTiO ₃		4.66	
CsI ₃	rhomb.	V _h ¹⁶	6.82, 9.94, 11.01	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
CsSH.....	cub., CsCl	O_h^1	4.29	
Cs ₂ AgAuCl ₆	cub.		5.33	
Cs ₂ AuAuCl ₆	cub.		5.33	
Cs ₂ CrO ₄	rhomb.	V_h^{16}	6.226, 11.135, 8.363	4
Cs ₂ GeF ₆	cub., (NH ₄) ₂ PtCl ₆	O_h^5	8.99	4
Cs ₂ PbCl ₆	cub.	O_h^5	10.416	
Cs ₂ PtCl ₆	cub.	O_h^5	10.192	4
Cs ₂ SO ₄	rhomb., K ₂ SO ₄	V_h^{16}	6.24, 10.92, 8.22	4
Cs ₂ S ₂ O ₆	hex.		6.326, ..., 11.535	2
Cs ₂ S ₂ O ₈	monocl.	C_{2h}^5	8.13, 8.33, 6.46, $\beta = 95^\circ 19'$	2
Cs ₂ SeCl ₆	cub.	O_h^5	10.260	
Cs ₂ SnCl ₆	cub.	O_h^5	10.347	
Cs ₂ TeCl ₆	cub.	O_h^5	10.445	
Cs ₂ TiCl ₆	cub.	O_h^5	10.219	
Cs ₂ ZrCl ₆	cub.	O_h^5	10.407	
Cs ₃ As ₂ Cl ₉	hex.	D_3^2	7.37, ..., 8.91	1
Cs ₃ CoCl ₅	tetr.	D_{4h}^{18}	9.18, ..., 14.47	4
Cs ₃ Co(NO ₂) ₆	cub.		11.15	4
Cs ₃ Fe(CN) ₆	rhomb.		11.8, 10.1, 7.0	2
Cs ₃ Tl ₂ Cl ₉	rhbdr.	D_{3d}^6	9.58, $\alpha = 83^\circ 48'$	2
Cs ₃ W ₂ Cl ₉	hex.	C_{6h}^2	7.35, ..., 17.06	2
CuAl ₂	tetr.	D_{4h}^{18}	6.052, ..., 4.878	4
CuAl ₂ O ₄	cub., MgAl ₂ O ₄	O_h^7	8.070	8
CuBe.....	cub., CsCl	O_h^1	2.698	
CuBe ₂	cub., Cu ₂ Mg	O_h^7	5.940	8
CuBr.....	cub., ZnS	T_d^2	5.681	4
CuBr ₂ .2Br(NH ₄).2H ₂ O	tetr.	D_{4h}^{14}	7.98, ..., 8.41	2
CuCl.....	cub., ZnS	T_d^2	5.407	4
CuCl ₂ .2Cl(NH ₄).2H ₂ O	tetr.	D_{4h}^{14}	7.63, ..., 7.97	2
CuCo ₂ O ₄	cub., MgAl ₂ O ₄	O_h^7	8.039	8
CuCo ₂ S ₄	cub., MgAl ₂ O ₄	O_h^7	9.458	8
CuFe ₂ O ₄	cub., MgAl ₂ O ₄	O_h^7	8.445	8
CuH.....	hex., ZnO	C_{6v}^4	2.893, ..., 4.614	2
CuI.....	cub., ZnS	T_d^2	6.047	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
CuMg ₂	hex.		5.281, , 18.29	8
CuO.....	monocl.		4.66, 3.40, 5.09, $\alpha = 99^\circ 30'$	
CuPd.....	cub., CsCl	O _h ¹	2.988	1
CuPt.....	hex.		3.779, $\alpha = 90^\circ 54'$	1
CuS.....	hex.	D _{6h} ⁴	3.802, . . . , 16.43	6
CuSO ₄	rhomb.		4.88, 6.66, 8.32	2
CuSO ₄ ·5H ₂ O.....	tricl.		6.07, 10.78, 5.89, $\alpha = 82^\circ 5'$, $\beta = 107^\circ 8'$, $\gamma = 102^\circ 41'$	
CuSn.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	4.190, , 5.086	2
CuZn.....	cub., CsCl	O _h ¹	2.945	1
Cu _{1.5} S.....	cub., f.c.		5.564	4
Cu ₂ HgI ₄	tetr.		6.08, , 6.135	1
Cu ₂ HgI ₄ (α) (>70°C).....	cub.	T ²	6.103	
Cu ₂ HgI ₄ (β).....			6.041, , 6.115	
Cu ₂ Mg.....	cub.	O _h ⁷	7.029	8
Cu ₂ MnSn.....	cub., AlCu ₃		6.167	4
Cu ₂ O (cuprite).....	cub.	O _h ⁴	4.26	2
Cu ₂ S.....	cub., CaF ₂	O _h ⁶	5.59	4
Cu ₂ Sb.....	tetr.		3.99, , 6.17	2
Cu ₂ Se (α).....	cub., f.c.	O _h ⁶	5.840	4
Cu ₂ Zn ₃	cub.		4.01	4
Cu ₃ Pd.....	cub., AuCu ₃		3.69	
Cu ₃ Pt.....	cub., AuCu ₃		3.71	1
Cu ₃ Sb.....			2.78, , 4.37	
Cu ₃ Sn.....	hex.		2.75, , 4.32	
Cu ₅ Zn ₈	cub.	T _d ³	8.85	52
Cu ₉ Al ₄	cub.	T _d ¹	8.70	52
Cu ₉ Ga ₄ (δ).....	cub.		8.711	
Cu ₃₁ Sn ₈	cub.		8.955	
Dy ₂ O ₃	cub., Ti ₂ O ₃	T _h ⁷	10.63	16
Er ₂ O ₃	cub., Ti ₂ O ₃	T _h ⁷	10.54	16
Eu ₂ O ₃	cub., Ti ₂ O ₃	T _h ⁷	10.84	16
FeAl ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.12	8
FeAl ₃	rhomb.	V _h ²³	47.43, 15.46, 8.08	4
FeAs (η).....	rhomb.		3.266, 6.016, 5.428	
FeAs ₂	rhomb.	V _h ¹² or V _h ¹³	6.35, 4.86, 5.80	4
FeB.....	rhomb.	V _h ¹⁶	5.495, 4.053, 2.946	
FeBe ₂	hex., MgZn ₂	D _{6h} ⁴	4.212, , 6.834	4
FeBe ₅	cub., Cu ₂ Mg	O _h ⁷	5.878	4
FeBr ₂	hex., CdI ₂	D _{3d} ³	3.740, , 6.171	1
[Fe(CN) ₂] ₃	cub.		15.9	16

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
FeCO ₃	hex., NaNO ₃	D _{3d} ⁶	5.82, $\alpha = 47^\circ 45'$	2
Fe(CO) ₄	monocl.	C _{2h} ⁶	13.00, 11.41, $\beta = 85^\circ 35'$	
FeCl ₂	hex, CdCl ₂	D _{3d} ⁶	6.20, $\alpha = 33^\circ 33'$	1
FeCl ₃	hex.	C _{3i} ²	5.92, , 17.26	6
(Fe, Co)S.....	hex.	C _{6v} ⁴	3.36, , 5.29	2
FeF ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.670, , 3.297	2
FeHSiW ₁₂ O ₄₀ .20H ₂ O . .	tricl.	Ci	19.11, 22.50, 23.92, $\alpha = 87^\circ 55', \beta = 105^\circ 57', \gamma = 92^\circ 25'$	8
FeHSiW ₁₂ O ₄₀ .28H ₂ O . .	rhbdr.	D _{3d} ⁵	16.46, $\alpha = 56^\circ 30'$	2
FeHSiW ₁₂ O ₄₀ .30H ₂ O . .	cub.	O _h ⁷	23.10	8
FeI ₂	hex., CdI ₂	D _{3d} ³	4.04, , 6.75	1
FeO.....	cub., NaCl	O _h ⁶	4.294	4
FeOCl.....	rhomb.	V _h ¹³	3.75, 7.95, 3.4	2
Fe(OH) ₂	hex., CdI ₂	D _{3d} ³	3.24, , 4.47	1
FeP.....	rhomb.	.....	5.782, 5.177, 3.089	
FeS.....	hex.	C _{6v} ⁴	3.43, , 5.79	2
FeSO ₄	rhomb.	.....	4.82, 6.84, 8.67	
FeSO ₄ .7H ₂ O.....	monocl.	C _{2h} ⁶	15.34, 12.98, 20.02, $\beta = 104^\circ 15'$	16
FeSO ₄ .(NH ₄) ₂ SO ₄ .6H ₂ O	monocl.	C _{2h} ⁵	9.28, 12.58, 6.22, $\beta = 106^\circ 50'$	
FeS + S _x	hex.	C _{6v} ⁴	3.43, , 5.68	2
Fe (S, Se).....	hex.	C _{6v} ⁴	3.54, , 5.91	2
FeS ₂ (marcasite).....	rhomb., FeAs ₂	V _h ¹²	3.35, 4.40, 5.35	2
FeS ₂ (pyrite).....	cub.	T _h ⁸	5.404	4
FeSb.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	4.06, , 5.13	2
FeSb ₂ (γ).....	rhomb.	V _h ¹² or V _h ¹³	3.189, 5.819, 6.520	
FeSe.....	hex., NiAs	C _{6v} ⁴	3.61, , 5.87	2
FeSe + Se _x	hex.	C _{6v} ⁴	3.51, , 5.55	
FeSi.....	cub.	T _h ⁴	4.467	4
FeSiF ₆ .6H ₂ O.....	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	6.42, $\alpha = 96^\circ 59'$	1
FeSi ₂	tetr.	.....	2.69, , 5.08	1
FeTa ₂ O ₆ (tapiolite)....	tetr.	D _{4h} ¹⁴	4.74, , 9.21	2
FeTe.....	hex., NiAs	C _{6v} ⁴ or D _{6h} ⁴	3.800, , 5.651	2
Fe ₂ As (ε).....	tetr.	.....	3.627, , 5.973	2
Fe ₂ B.....	tetr.	V _d ¹¹	5.078, , 4.233	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> . Ax. ang.	
Fe ₂ (CO) ₉	hex.	C _{6v} ⁴ or D _{6h} ⁴	6.45, 15.8	2
Fe ₂ O ₃ (hematite).....	hex.	D _{3d} ⁶	5.42, $\alpha = 55^\circ 17'$	2
Fe ₂ O ₃ (magnetic).....	cub.	.....	8.30	.....
Fe ₂ O ₃ ·H ₂ O.....	rhomb., Al ₂ O ₃ ·H ₂ O	.....	4.55, 9.90, 3.01	2
Fe ₂ P (ζ).....	hex.	D ₃ ²	5.852, 3.453	3
Fe ₂ W.....	hex.	.....	4.727, , 7.704	4
Fe ₃ Al ₂ Si ₃ O ₁₂	cub., b.c.	O _h ¹⁰	11.497	8
Fe ₃ C.....	rhomb.	V _h ¹⁶	4.518, 5.069, 6.736	4
Fe ₃ Mo ₂	hex.	.....	4.743, 25.63	8
Fe ₃ N (ϵ').....	hex.	D ₆ ⁶	2.695, 4.362	.....
Fe ₃ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.37	8
Fe ₃ P (ϵ).....	tetr.	S ₄ ²	9.09, 4.446	8
Fe ₃ W ₂	hex.	.....	4.731, 25.76	8
Fe ₃ Zn ₁₀	cub.	O _h ⁹	8.93	52
Fe ₄ N.....	cub.	.....	3.789	1
GaAs.....	cub., ZnS	T _d ²	5.635	.....
(Ga, In) ₂ O ₃	cub.	O _h ¹⁰	9.76	16
GaP.....	cub., ZnS	T _d ²	5.436	.....
GaSb.....	cub., ZnS	T _d ²	6.118	.....
Ga ₂ O ₃	hex., Fe ₂ O ₃	D _{3d} ⁶	5.281, $\alpha = 55^\circ 35'$	2
GdPMo ₁₂ O ₄₀ ·30H ₂ O....	cub.	O _h ⁷	23.1	8
Gd ₂ O ₃	cub., Ti ₂ O ₃	T _h ⁷	10.79	16
GeI ₄	cub., SnI ₄	T _h ⁶	11.89	8
GeO ₂	hex., α SiO ₂	D ₃ ⁴	4.98, 5.64	3
GeS.....	rhomb.	V _h ¹⁶	4.29, 10.42, 3.64	4
GeS ₂	rhomb.	C _{2v} ¹⁹	11.66, 22.34, 6.86	24
HCl (−168°C).....	cub.	.....	5.50	4
HI.....	cub., HCl	.....	6.18	4
HIO ₃	rhomb.	V ₁ − V ₄	5.53, 5.92, 7.75	4
H ₂ O (ice)*.....	hex.	D _{6h} ⁴	4.535, , 7.41	4
H ₂ O ₂	tetr.	.....	4.02, 8.02	4
H ₂ S (α , β & γ).....	cub., f.c.	O _h ⁵	5.77	4
H ₂ Se (−170°C).....	cub.	O _h ⁵	6.020	4
H ₃ BO ₃	tricl.	.....	7.04, 7.04, 6.56, $\alpha = 92^\circ 30'$, $\beta = 101^\circ 10'$, $\gamma = 120^\circ$	4
H ₃ PMo ₁₂ O ₄₀ ·30H ₂ O....	cub.	O _h ⁷	23.1	8

* See also *ice* under minerals.

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants		Mol.
			a, b, c.	Ax. ang.	
H ₃ PW ₁₂ O ₄₀ .5H ₂ O.....	cub.	O _h ⁴	12.14		2
H ₃ PW ₁₂ O ₄₀ .29H ₂ O.....	cub.		23.28		8
H ₄ N ₄ S ₄	rhomb.	V _h ¹	12.08, 6.76, 7.86		4
HfF ₄	monocl.	C _{2h} ⁶	9.45, 9.84, 7.62, $\beta = 94^\circ 29'$		12
HfO ₂	cub., CaF ₂	O _h ⁵	5.115		4
HfP ₂ O ₇	cub.	T _h ⁶	8.18		4
HgBr ₂	rhomb.	C _{2v} ¹²	4.67, 6.85, 12.45		4
Hg(CN) ₂	tetr.	V _d ¹²	9.67, ..., 8.92		8
HgCl ₂	rhomb.	V _h ¹⁶	5.963, 12.735, 4.325		4
HgI ₂	rhomb.	C _{2v} ¹²	4.676, 7.32, 13.76		4
HgO.....	rhomb.		3.296, 3.513, 5.504		4
HgS (cinnabar).....	hex.	D ₃ ² or D ₃ ⁶	4.14, ..., 9.49		3
HgS (metacinnabarite).	cub., ZnS	T _d ²	5.84		4
HgSe.....	cub., ZnS	T _d ²	6.07		
HgTe.....	cub., ZnS	T _d ²	6.36		
Hg ₂ Br ₂	tetr., Hg ₂ Cl ₂	D _{4h} ¹⁷	4.65, ..., 11.10		2
Hg ₂ Cl ₂	tetr.	D _{4h} ¹⁷	4.47, ..., 10.89		2
Hg ₂ I ₂	tetr., Hg ₂ Cl ₂	D _{4h} ¹⁷	4.92, ..., 11.61		2
Ho ₂ O ₃	cub., Th ₂ O ₃	T _h ⁷	10.58		16
InSb.....	cub., ZnS	T _d ²	6.45		
In ₂ O ₃	cub., Th ₂ O ₃	T _h ⁷	10.12		16
IrO ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.49, ..., 3.14		
KAl(SO ₄) ₂	hex.	D ₃ ²	4.706, ..., 7.960		1
KAl(SO ₄) ₂ .12H ₂ O.....	cub.	T _h ⁶	12.11		4
KAlSi ₃ O ₈	monocl.	C _{2h} ³	8.57, 13.01, 7.23, $\beta = 116^\circ 7'$		4
KBr.....	cub., NaCl	O _h ⁵	6.578		4
KBrO ₃	hex.	C _{3v} ⁵	4.403, $\alpha = 86^\circ 0'$		1
KCN.....	cub., NaCl	O _h ⁵	6.55		4
KCNO.....	tetr., KN ₃	D _{4h} ¹⁴	6.070, ..., 7.030		4
KCNS.....	rhomb.	V _h ¹¹	6.67, 6.65, 7.54		4
KCbo ₃	cub. (?), CaTiO ₃		4.01		
KCl.....	cub., NaCl	O _h ⁵	6.28		4
KCl.MgCl ₂ .6H ₂ O.....	rhomb.	V _h ⁵	9.53, 16.08, 22.25		12

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
KClO ₃	monocl.	C _{2h} ²	4.647, 5.585, 7.085, $\beta = 109^\circ 38'$	2
KClO ₄	rhomb., BaSO ₄	V _h ¹⁶	8.834, 5.650, 7.240	
KClO ₄ (340°C).....	cub.	T _d ² or T ²	7.47	
KCr(SO ₄) ₂	hex., KAl(SO ₄) ₂	D ₃ ²	4.737, , 8.030	1
KCr(SO ₄) ₂ .12H ₂ O.....	cub.	T _h ⁵	12.14	4
KF.....	cub., NaCl	O _h ⁵	5.33	4
KHC ₂	tetr., CaC ₂		4.28, , 8.42	4
KHF ₂	tetr., KN ₃	D _{4h} ¹⁸	5.67, , 6.81	4
KH ₂ PO ₄	tetr.	V _h ¹²	7.43, , 6.97	4
KI.....	cub., NaCl	O _h ⁵	7.052	4
KIO ₃	cub. (?), CaTiO ₃		4.46	
KIO ₄	tetr., CaWO ₄	C _{4h} ⁵	8.13, , 12.63	4
KI ₃	monocl.		9.36, $b = c = a$ approx., $\beta = 90^\circ \pm$	4
KLiSO ₄	hex.	C ₆ ⁵	5.13, , 8.60	2
KMgF ₃	cub. (?), CaTiO ₃		4.00	
KMnO ₄	rhomb., BaSO ₄	V _h ¹⁶	9.10, 5.69, 7.40	4
KNO ₂	monocl., f.c.	C _s ²	4.45, 4.99, 7.31, $\beta = 114^\circ 50'$	2
KNO ₃	rhomb.	V _h ¹⁶	5.43, 9.17, 6.45	4
KN ₃	tetr.	D _{4h} ¹⁸	6.094, , 7.056	4
KNiF ₃	cub. (?), CaTiO ₃		4.008	
KOsNO ₃	tetr.	C _{4h} ⁵		4
(KPbCl ₃) ₃ .H ₂ O.....	monocl.	C _i ¹	14.35, 9.05, 14.50, $\beta = 113^\circ$	4
KPb ₂ Br ₆	tetr.	D _{4h} ¹⁸	8.14, , 14.1	4
KReO ₄	tetr., CaWO ₄	C _{4h} ⁵	5.615, , 12.50	4
KSH.....	rhbdr.	D _{3d} ⁵	4.37, $\alpha = 68^\circ 51'$	
KZnF ₃	cub. (?), CaTiO ₃		4.050	
K ₂ Ba[Co(NO ₂) ₆].....	cub.		10.45	4
K ₂ Ba[Ni(NO ₂) ₆].....	cub.		10.67	4
K ₂ Ca[Co(NO ₂) ₆].....	cub.		10.17	4
K ₂ Ca[Ni(NO ₂) ₆].....	cub.		10.29	4
K ₂ Cd(CN) ₄	cub., MgAl ₂ O ₄	O _h ⁷	12.84	8
K ₂ CrO ₄	rhomb., K ₂ SO ₄	V _h ⁶	5.92, 10.40, 7.61	4
K ₂ Cr ₂ O ₇ (α).....	tricl.		7.50, 7.38, 13.40, $\alpha = 82^\circ 0'$, $\beta = 96^\circ 13'$, $\gamma = 90^\circ 51'$	4
K ₂ Cr ₂ O ₇ (β).....	monocl.		7.47, 7.35, 12.97, $\beta = 91^\circ 55'$	4
K ₂ CuCl ₄ .2H ₂ O.....	tetr., (NH ₄) ₂ CuCl ₄ . 2H ₂ O	O _{4h} ¹⁴	7.45, , 7.88	2

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
K ₂ Hg(CN) ₄	cub., MgAl ₂ O ₄	O _h ⁷	12.76	8
K ₂ OsBr ₆	cub.	.....	10.30	
K ₂ OsCl ₆	cub.	.....	9.729	
K ₂ OsO ₂ Cl ₄	tetr., f.c.	D _{4h} ¹⁷	9.90, , 8.75	2
K ₂ PbCo(NO ₂) ₆	cub.	.....	10.49	4
K ₂ PbCu(NO ₂) ₆	cub.	.....	10.52	4
K ₂ PbNi(NO ₂) ₆	cub.	.....	10.55	4
K ₂ PdCl ₄	tetr., K ₂ PtCl ₄	D _{4h} ¹	7.04, , 4.10	1
K ₂ PtBr ₆	cub., (NH ₄) ₂ PtCl ₆	O _h ⁵	10.35	4
K ₂ PtCl ₄	tetr.	D _{4h} ¹	6.99, , 4.13	1
K ₂ PtCl ₆	cub., (NH ₄) ₂ PtCl ₆	O _h ⁵	9.725	
K ₂ Pt(SCN) ₆	hex.	D _{3d} ¹	6.77, , 10.45	1
K ₂ ReCl ₆	cub., K ₂ PtCl ₆	O _h ⁵	9.861	
K ₂ S.....	cub., CaF ₂	O _h ⁵	7.35	
K ₂ SO ₄	rhomb.	V _h ¹⁶	5.731, 10.008, 7.424	4
K ₂ S ₂ O ₅	monocl.	C _{2h} ²	6.95, 6.19, 7.55	
K ₂ S ₂ O ₆	hex.	D ₃ ²	9.756, , 6.274	3
K ₂ S ₂ O ₈	tricl.	C _i ¹	5.10, 6.83, 5.40, $\alpha = 106^{\circ} 54'$, $\beta = 90^{\circ} 10'$, $\gamma = 102^{\circ} 35'$	
K ₂ S ₃ O ₆	rhomb.	V _h ¹⁶	9.77, 13.63, 5.76	4
K ₂ SeBr ₆	cub.	.....	10.363	
K ₂ SeO ₄	rhomb.	V _h ¹⁶	6.02, 10.40, 7.60	4
K ₂ SnCl ₆	cub., (NH ₄) ₂ PtCl ₆	O _h ⁵	9.983	4
K ₂ Sn(OH) ₆	hex. (rhbdr.)	D _{3d} ⁵	5.67, $\alpha = 70^{\circ} 1'$	1
K ₂ Sr[Co(NO ₂) ₆].....	cub.	.....	10.23	4
K ₂ Sr[Ni(NO ₂) ₆].....	cub.	.....	10.49	4
K ₂ TeCl ₆	monocl.	C _{2h} ³	7.17, 7.17, 10.14, $\beta = 90^{\circ}$ approx.	
K ₂ Zn(CN) ₄	cub., MgAl ₂ O ₄	O _h ⁷	12.54	8
K ₃ Co(NO ₂) ₆	cub.	.....	10.44	4
K ₃ Co(NO ₂) ₆ ·1½H ₂ O.....	cub.	.....	10.32	
K ₃ Cr(CN) ₆	rhomb.	V _h ¹⁴	13.55, 10.60, 8.60	4
K ₃ Fe(CN) ₆	monocl.	C _{2h} ⁵	13.42, 10.40, 8.38	4
K ₃ Ir(CN) ₆	rhomb.	V _h ¹⁴	13.70, 10.53, 8.34	4
K ₃ Mn(CN) ₆	rhomb.	V _h ¹⁴	13.56, 10.60, 8.50	4
K ₃ Na(SO ₄) ₂	hex.	D _{3d} ³	5.65, , 7.29	1
K ₃ TlCl ₆ ·2H ₂ O.....	tetr.	D _{4h} ¹⁷	15.841, , 18.005	14
K ₃ W ₂ Cl ₉	hex.	C _{6h} ²	7.16, , 16.17	2

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
K ₄ Co(NO ₂) ₆	cub.		10.32	
K ₄ Ni(NO ₂) ₆	cub.		10.49	
LaAlO ₃	cub. (?), CaTiO ₃		3.78	
LaAl ₄			13.2 (?), . . . , 10.2 (?)	16
LaC ₂	tetr., CaC ₂	D _{4h} ¹⁷	3.92, . . . , 6.55	2
LaF ₃	hex., CeF ₃	D _{6h} ⁸	7.163, . . . , 7.329	6
LaGaO ₃	cub. (?), CaTiO ₃		3.89	
LaN.....	cub., f.c.		5.275	
LaP.....	cub., f.c.		6.013	
La ₂ O ₃	hex.	D _{3d} ²	3.945, . . . , 6.151	1
LiAl.....	cub., b.c.		6.360	
LiAl ₅ O ₈	cub.	O _h ⁷	7.903	
LiBr.....	cub., NaCl	O _h ⁸	5.49	4
LiCbO ₃	hex., MgTiO ₃	C _{3i} ²	5.47, α = 55° 43'	2
LiCd.....	cub.		3.32	
LiCd ₃	cub.		8.62	8
LiCl.....	cub., NaCl	O _h ⁸	5.14	4
LiCl·H ₂ O.....	tetr.		3.81, . . . , 3.88	1
LiClO ₄ ·3H ₂ O.....	hex.	C _{3v} ⁴	7.71, . . . , 5.42	2
LiF.....	cub., NaCl	O _h ⁸	4.01	4
LiH.....	cub., NaCl	O _h ⁸	4.085	4
LiD.....			4.065	
LiHg ₃	hex.		6.240, . . . , 4.794	2
LiI.....	cub., NaCl	O _h ⁸	6.00	4
LiI·3H ₂ O.....	hex.	C _{3v} ⁴	7.45, . . . , 5.45	2
LiIO ₃	hex.	D _{6h} ⁶	5.469, . . . , 3 155	2
LiKSO ₄	hex.	C _{6h} ⁶	5.13, . . . , 8.00	2
LiN.....	hex.		3.658, . . . , 3.882	3
LiNO ₃	hex., NaNO ₃	D _{3d} ⁶	5.74, α = 48° 3'	2
LiNaCO ₃	hex.	D _{3h} ¹ or D _{3h} ³	8.22, . . . , 3.27	3
LiOH.....	tetr.	D _{4h} ⁷	3.549, . . . , 4 334	
Li ₂ SO ₄ ·H ₂ O.....	monocl.	C ₂ ²	5.43, 4.83, 8.14. β = 107° 35'	2
LiZn (β').....	hex.		2.782, . . . , 4 385	
LiZn (γ').....	hex., pseudo		4.362, . . . , 2.510	
Li ₂ BeF ₄	hex.		8.15, α = 107° 40'	
Li ₂ MoO ₄	hex., Be ₂ SiO ₄		8 77, α = 108° 10'	
Li ₂ O.....	cub., CaF ₂	O _h ⁸	4.61	4
Li ₂ S.....	cub., CaF ₂	O _h ⁸	5.70	4
Li ₂ SO ₄	monocl.	C _{2h} ⁵	8.25, 4.95, 8.44. β = 107° 54'	4
Li ₂ Se.....	cub., CaF ₂	O _h ⁸	5.94	

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Li ₂ Te.....	cub., CaF ₂	O _h ⁸	6.47	
Li ₂ WO ₄	hex., Be ₂ SiO ₄	C _{3i} ²	8.77, $\alpha = 108^\circ 10'$	
Li ₃ Hg.....	cub., AlCu ₃		6.584	
Li ₃ N.....	cub.		5.50	
Lu ₂ O ₃	cub., Tl ₂ O ₃	O _h ¹⁰	10.37	16
MgAl ₂ O ₄	cub.	O _h ⁷	8.090	8
MgAu.....	cub., CsCl	O _h ¹	3.259	1
MgBr ₂	hex., CdI ₂	D _{3d} ³	3.815, ..., 6.256	1
MgBr ₂ .6H ₂ O.....	monocl.	C _{2h} ³	10.25, 7.40, 6.30, $\beta = 93^\circ 30'$	2
MgCO ₃	hex., NaNO ₃	D _{3d} ⁵	5.61, $\alpha = 48^\circ 12'$	2
MgCl ₂	hex., CdCl ₂	D _{3d} ⁵	6.22, $\alpha = 33^\circ 36'$	1
MgCl ₂ .6H ₂ O.....	monocl.	C _{2h} ³	9.90, 7.15, 6.10, $\beta = 94^\circ$	2
MgCo ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.107	8
MgCrO ₄ .7H ₂ O.....	rhomb., MgSO ₄ .7H ₂ O	V ⁴	11.89, 12.01, 6.89	4
MgCr ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.290	8
MgF ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.66, ..., 3.08	2
MgFe ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.342	8
MgHg.....	cub., CsCl	O _h ¹	3.442	1
MgI ₂	hex.		4.14, ..., 6.88	
MgO.....	cub., NaCl	O _h ⁵	4.203	4
MgO.Fe ₂ O ₃	cub.		8.36	8
Mg(OH) ₂	hex., CdI ₂	D _{3d} ³	3.11, ..., 4.74	1
MgPr.....	cub.		3.88	1
MgPt(CN) ₄ .7H ₂ O.....	tetr.	D _{4h} ¹⁷	14.6, ..., 6.26	2
MgS.....	cub., NaCl	O _h ⁵	5.190	4
MgSO ₃ .6H ₂ O.....	hemi. trig.	C ₃ ¹	8.820, ..., 9.052, $\alpha = 96^\circ 20'$	
MgSO ₄	rhomb.		4.82, 6.72, 8.33	
MgSO ₄ .7H ₂ O.....	rhomb.	V ⁴	11.91, 12.02, 6.87	4
MgSO ₄ .(NH ₄) ₂ SO ₄ .6H ₂ O.....	monocl.	C _{2h} ⁵	9.28, 12.57, 6.20, $\beta = 107^\circ 6'$	2
Mg(SbO ₃) ₂ .12H ₂ O.....	hex.	D _{3d} ¹	16.079, ..., 9.84	2
MgSe.....	cub., NaCl	O _h ⁵	5.451	4
MgSiF ₆ .6H ₂ O.....	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	6.43, $\alpha = 96^\circ 3'$	1
MgSnF ₆ .6H ₂ O.....	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	6.56, $\alpha = 96^\circ 20'$	1
MgTe.....	hex., ZnO	C _{6v} ⁴	4.52, ..., 7.33	2
MgTiF ₆ .6H ₂ O.....	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	6.52, $\alpha = 96^\circ 57'$	1

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			$a, b, c, \text{Ax. ang.}$	
MgTiO ₃	hex.	C _{3i} ²	5.40, $\alpha = 55^\circ 1'$	2
MgWO ₄	monocl.	.....	4.67, 5.66, 4.92, $\beta = 89^\circ 35'$	2
MgZn.....	hex.	.....	10.66,, 17.16	
MgZn ₂	hex.	D _{6h} ⁴	5.17,, 8.50	2
MgZn ₃	hex.	.....	9.92,, 16.48	
Mg ₂ Al ₂ O ₄	cub.	O _h ⁷	8.08	
Mg ₂ Pb.....	cub., CaF ₂	O _h ⁶	6.75	4
Mg ₂ Si.....	cub., CaF ₂	O _h ⁵	6.39	4
Mg ₂ SiMo ₁₂ O ₄₀ .31H ₂ O..	cub.	O _h ⁷	23.04	8
Mg ₂ Sn.....	cub., CaF ₂	O _h ⁵	6.78	4
Mg ₂ SnO ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.58	8
Mg ₂ Zn ₁₁	cub.	O _h	8.53	3
Mg ₃ Al ₂ Si ₃ O ₁₂	cub., b.c.	O _h ¹⁹	11.510	8
Mg ₃ As ₂	cub., Zn ₃ As ₂	.....	6.10	2
Mg ₃ Cu ₇ Al ₁₀	cub.	.....	8.29	
Mg ₃ N ₂	cub., b.c.	.....	9.93	12
Mg ₃ P ₂	cub., Zn ₃ As ₂	.....	5.92	2
MnAl ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.263	8
MnAs.....	rhomb.	.....	6.38, 5.63, 3.62	
MnBr ₂	hex., CdI ₂	D _{3d} ³	3.82,, 6.19	1
MnCO ₃	hex., NaNO ₃	D _{3d} ⁶	5.84, $\alpha = 47^\circ 45'$	2
MnCl ₂	hex., CdCl ₂	D _{3d} ⁵	6.20, $\alpha = 34^\circ 35'$	1
(Mn, Co)(Co, Mn) ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.268	8
MnCr ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.487	8
MnF ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.865,, 3.284	2
MnFe ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.572	8
MnI ₂	hex., CdI ₂	D _{3d} ³	4.16,, 6.82	1
MnMn ₂ O ₄	tetr., Mn ₃ O ₄	D _{4h} ¹⁹	5.75,, 9.42	4
MnO.....	cub., NaCl	O _h ⁵	4.435	4
MnO ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.44,, 2.89	2
Mn(OH) ₂	hex., CdI ₂	D _{3d} ³	3.34,, 4.68	1
MnP.....	rhomb.	.....	5.905, 5.249, 3.167	
MnS.....	cub., NaCl	O _h ⁵	5.21	4
MnSO ₄	rhomb.	.....	4.86, 6.84, 8.58	
MnS ₂	cub., FeS ₂	T _h ⁶	6.10	4
MnSb.....	hex., NiAs	D _{6h} ⁴	4.120,, 5.784	2

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax ang.	
MnSe.....	cub., NaCl	O_h^5	5.448	4
MnSi	cub., FeSi	T^4	4.548	
MnSiF ₆ .6H ₂ O.....	hex., NiSnCl ₆ .6H ₂ O	C_{3i}^2	6.45, $\alpha = 96^\circ 53'$	1
MnSi ₂	tetr.		5.513, 17.422	16
MnTe.....	hex., NiAs	D_{6h}^4	4.124, 6.698	2
MnTe ₂	cub., FeS ₂	T_h^6	6.943	4
Mn ₂ O ₃	cub., Ti ₂ O ₃	T_h^7	9.41	16
Mn ₂ O ₃ .H ₂ O.....	rhomb.		4.46, 5.28, 2.88	
Mn ₂ Sb.....	tetr.	D_{4h}^7	4.08, 5.56	
Mn ₃ Al ₂ Si ₃ O ₁₂	cub., b.c.	O_h^{10}	11.603	8
Mn ₃ Si.....	hex.		6.898, 4.802	4
Mn ₄ N.....	cub.		3.860	1
Mo(CO) ₆	rhomb.	C_{2v}^9	12.02, 6.48, 11.23	4
MoO ₂	tetr., SnO ₂	D_{4h}^{14}	4.86, 2.79	2
MoO ₃	rhomb.	Q_h^{16}	3.92, 13.94, 3.66	4
MoS ₂	hex.	D_{6h}^4	3.15, 12.30	2
MoSi ₂	teti.	D_{2h}^{17}	3.20, 7.86	2
NH ₃ (−80°C).....	cub.	T^4	5.15	4
(NH ₄) ₃ AlF ₆	cub., (NH ₄) ₃ FeF ₆	T_h^6	8.40	4
NH ₄ Al(SO ₄) ₂	hex., KAl(SO ₄) ₂	D_3^2	4.724, 8.225	1
NH ₄ Al(SO ₄) ₂ .12H ₂ O...	cub.	T_h^6	12.18	4
NH ₄ BF ₄	rhomb.	V_h^{16}	9.06, 5.64, 7.23	4
(NH ₄) ₂ BeF ₄	rhomb., K ₂ SO ₄	V_h^{16}	5.8, 10.2, 7.5	
NH ₄ Br.....	cub., CsCl	O_h^1	4.047	1
NH ₄ Br(250°C).....	cub., NaCl	O_h^5	6.90	4
NH ₄ Cl.....	cub., CsCl	O_h^1	3.866	1
NH ₄ Cl(250°C).....	cub., NaCl	O_h^5	6.53	4
NH ₄ ClO ₄	rhomb.	V_h^{16}	9.202, 5.816, 7.449	4
NH ₄ ClO ₄ (270°C).....	cub., KClO ₄		7.63	1
(NH ₄) ₃ Co(NO ₂) ₆	cub.		10.81	4
(NH ₄) ₂ Cr ₂ O ₇	monocl.		7.78, 7.54, 13.27, $\beta = 93^\circ 42'$	4
(NH ₄) ₂ CuCl ₄ .2H ₂ O .	tetr.	D_{4h}^{14}	7.58, 7.95	2
NH ₄ F.....	hex ZnO	C_{6v}^4	4.39, 7.02	2
(NH ₄) ₃ FeF ₆	cub.	O_h^5	9.10	4
NH ₄ Fe(SO ₄) ₂	hex., KAl(SO ₄) ₂	D_3^2	4.825, 8.310	1

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
$\text{NH}_4\text{Fe}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$...	cub.	T_h^6	12.14	4
NH_4HF_2	rhomb.	V_h^7	8.33, 8.14, 3.68	4
$\text{NH}_4(\text{H}_2\text{PO}_4)$	rhomb.	V_h^{21}	3.98, 7.57, 11.47	4
$(\text{NH}_4)_2\text{H}_2\text{PO}_4$	tetr., KH_2PO_4	V_d^{12}	7.530, ..., 7.542	4
$(\text{NH}_4)_3\text{HfF}_7$	cub.	O_h^4	9.400	4
NH_4I	cub., NaCl	O_h^5	7.244	4
$\text{NH}_4\text{I}(-17^\circ\text{C})$	cub., CsCl	O_h^1	4.37	1
NH_4IO_4	tetr., CaWO_4	C_{4h}^6	5.94, ..., 12.80	4
NH_4I_3	rhomb.	V_h^{16}	6.64, 9.66, 10.82	4
$(\text{NH}_4)_2\text{MoO}_4\text{F}_3$	cub., $(\text{NH}_4)_3\text{FeF}_6$	O_h^5	9.10	4
NH_4NO_3	rhomb.	V_h^{13}	4.928, 5.434, 5.732	2
NH_4N_3	rhomb.	D_{2h}^7	8.930, 8.642, 3.800	4
$(\text{NH}_4)_2\text{PbCl}_6$	cub., $(\text{NH}_4)_2\text{PtCl}_6$	O_h^5	10.135	4
$\text{NH}_4\text{Pb}_2\text{Br}_6$	tetr.	D_{4h}^{18}	8.39, ..., 14.34	4
$(\text{NH}_4)_2\text{PdCl}_4$	tetr., K_2PtCl_4	D_{4h}^1	7.21, ..., 4.26	1
$(\text{NH}_4)_2\text{PtCl}_6$	cub.	O_h^5	9.834	4
$(\text{NH}_4)_2\text{Pt}(\text{SCN})_6$	hex., $\text{K}_2\text{Pt}(\text{SCN})_6$	D_{3d}^1 or D_{3d}^3	6.77, ..., 10.45	1
NH_4SH	tetr.		6.01, ..., 4.01	
$(\text{NH}_4)_2\text{SO}_4$	rhomb., K_2SO_4	V_h^{16}	5.951, 10.560, 7.729	4
$(\text{NH}_4)_2\text{S}_2\text{O}_8$	monocl.	C_{2h}^5	7.83, 8.04, 6.13, $\beta = 95^\circ 9'$	2
$(\text{NH}_4)_2\text{SeCl}_6$	cub.	O_h^5	9.935	
$(\text{NH}_4)_2\text{SiF}_6$	cub., $(\text{NH}_4)_2\text{PtCl}_6$	O_h^5	8.38	4
$(\text{NH}_4)_2\text{SiF}_6$	hex.	D_{3d}^3	5.76, ..., 4.77	
$(\text{NH}_4)_2\text{SnCl}_6$	cub., $(\text{NH}_4)_2\text{PtCl}_6$	O_h^5	10.038	4
$(\text{NH}_4)_2\text{TeCl}_6$	cub.	O_h^5	10.178	
$(\text{NH}_4)_3\text{W}_2\text{Cl}_9$	hex.	C_{6h}^2	7.16, ..., 16.17	2
$(\text{NH}_4)_3\text{ZrF}_7$	cub.	O_h^4	9.353	4
NO_2	cub.	T^5	7.77	6
$\text{N}_2\text{H}_5\text{Cl}_2$	cub., FeS_2	T_h^5	7.89	4
N_2O	cub., CO_2	T^4	5.77	4
N_4S_4	rhomb.	V_h^1	8.87 8.47, 7.20	4
NaBr	cub., NaCl	O_h^5	5.94	4
NaBrO_3	cub., NaClO_3	T^4	6.71	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
NaC ₂ O ₃	cub., CaTiO ₃	O _h ¹	3.89	1
NaCl (18°C).....	cub.	O _h ⁵	5.62737	4
Rock salt.....			5.62768	
NaClO ₃	cub.	T _d ⁴	6.570	4
NaClO ₄ (380°C).....	cub.		7.25	
NaClO ₄	rhomb., CaSO ₄	V _h ¹⁷	6.48, 7.06, 7.08	4
NaF.....	cub., NaCl	O _h ⁵	4.62	4
NaHCO ₃	monocl.	C _{2h} ⁵	7.51, 9.70, 3.53, $\beta = 93^\circ 19'$	4
NaHC ₂	tetr., CaC ₂	D _{4h} ¹⁷	3.82, ..., 8.17	2
NaHF ₂	hex. (rhbdr.), CsCl ₂ I.	D _{3d} ⁵	5.17, $\alpha = 39^\circ 44'$	1
NaI.....	cub., NaCl	O _h ⁵	6.46	4
NaIO ₃	rhomb.	V _h ¹⁹	5.75, 6.37, 4.05	2
NaIO ₄	tetr., CaWO ₄	C _{4h} ⁶	5.32, ..., 11.93	4
NaIO ₄ ·3H ₂ O.....	hex.	C ₃ ⁴	5.58, $\alpha = 65^\circ 1'$	1
NaNO ₂	rhomb.		3.55, 5.56, 5.37	2
NaNO ₃	rhbdr.	D _{3d} ⁶	6.3108, $\alpha = 47^\circ 15' 59''$	
NaN ₃	hex. (rhbdr.), CsCl ₂ I	D _{3d} ⁵	5.48, $\alpha = 38^\circ 43'$	1
NaSH.....	rhbdr.	D _{3d} ⁵	3.99, $\alpha = 68^\circ 5'$	
NaSb(AlO ₃) ₂	hex.	D _{6h} ⁴	5.40, ..., 8.81	2
Na ₂ B ₄ O ₇ ·10H ₂ O.....	monocl.	C _{2h} ⁶	11.82, 10.61, 12.30, $\alpha = 106^\circ 35'$	4
Na ₂ CO ₃ ·H ₂ O (73°C).....	rhomb.		10.721, 6.440, 5.243	4
Na ₂ Ca(CO ₃) ₂	hex.		20.3, ..., 12.02	32
Na ₂ CaSiO ₄	cub.		7.497	4
Na ₂ CrO ₄	rhomb.	V _h ⁶	5.91, 9.23, 7.20	4
Na ₂ Mg(CO ₃) ₂	hex.	C ₃ ¹	4.95, ..., 16.50	6
Na ₂ S.....	cub., CaF ₂	O _h ⁵	6.53	4
Na ₂ SO ₃	hex.		5.441, ..., 6.133	2
Na ₂ SO ₄	rhomb.	V _h ²⁴	5.85, 12.29, 9.75	8
Na ₃ AlF ₆	monocl.	C _{2h} ¹ or C _{2h} ²	5.39, 5.59, 7.76, $\beta = 90^\circ 11'$	2
Na ₄ Ca(SiO ₃) ₃	cub. (?)		7.547	
Na ₁₆ Pb ₄	cub.	T _d ⁶	13.29	
Na ₁₆ Sn ₄	rhomb.		9.79, 22.78, 5.56	2
NdAl.....	cub.		3.73	1
NdC ₂	tetr., CaC ₂	D _{4h} ¹⁷	3.82, ..., 6.23	2
NdF ₃	hex., CeF ₃	D ₆ ⁶	7.021, ..., 7.196	6
NdPMO ₁₂ O ₄₀ ·30H ₂ O.....	cub.	O _h ⁷	23.1	8

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Nd ₂ O ₃	hex., La ₂ O ₃	D _{3d} ³	3.841, , 6.009	1
NiAl.....	cub., CsCl	O _h ¹	2.82	1
NiAl ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.045	8
NiAl ₃ (ε).....	rhomb.	C _{2h} ¹⁶	6.5982, 7.3515, 4.8021	4
NiAs.....	hex.	D _{6h} ⁴	3.61, , 5.03	2
NiAsS.....	cub., CoAsS	T ⁴	5.68	4
NiBe.....	cub., CsCl	O _h ¹	2.603	
NiBr ₂	hex.		3.71, , 18.30	
NiBr ₂	rhbdr.		6.46, α = 16° 40'	
NiBr ₂ .6NH ₃	cub., (NH ₄) ₂ PtCl ₆	O _h ⁵	10.48	4
NiCl ₂	hex., CdCl ₂	D _{3d} ⁵	6.13, α = 33° 36'	1
NiCl ₂ .6NH ₃	cub., (NH ₄) ₂ PtCl ₆	O _h ⁵	10.09	4
(Ni, Co) (Co, Ni) ₂ O ₄ ..	cub., MgAl ₂ O ₄	O _h ⁷	8.112	8
NiF ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.710, , 3.118	2
(Ni, Fe)S (synthetic) ..	hex.	C _{6v} ⁴	3.408, , 5.434	2
NiFe ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.340	8
NiI ₂	hex.		3.89, , 19.63	
NiI ₂	rhbdr.		6.92, α = 16° 20'	
NiI ₂ .6NH ₃	cub., (NH ₄) ₂ PtCl ₆	O _h ⁵	11.01	4
Ni(NH ₃) ₆ (NO ₃) ₂	cub., (NH ₄) ₂ PtCl ₆	T _h ⁵	10.96	4
NiO.....	cub., NaCl	O _h ⁵	4.172	4
Ni(OH) ₂	hex., CdI ₂	D _{3d} ³	3.07, , 4.605	1
NiS (β).....	hex.		3.42, , 5.30	
NiS (γ).....	rhbdr.		9.61, , 3.15	
NiS (synthetic).....	hex., NiAs	D _{6h} ⁴	3.42, , 5.30	2
NiSO ₃ .6H ₂ O.....	hemi. trig.	C ₃ ⁴	8.773, , 9.013, α = 96° 18'	
NiSO ₄	rhomb.		4.62, 6.51, 8.49	
NiSO ₄ .7H ₂ O.....	rhomb., MgSO ₄ .7H ₂ O	V ⁴	11.86, 12.08, 6.81	4
NiS ₂	cub., FeS ₂	T _h ⁵	5.74	4
NiSb.....	hex., NiAs	D _{6h} ⁴	3.94, , 5.14	2
Ni(SbO ₃) ₂ .12H ₂ O.....	hex.	D _{3d} ¹	16.019, , 9.768	2
NiSbS.....	cub., CoAsS	T ⁴	5.91	4
NiSe (β).....	hex., NiAs	D _{6h} ⁴	3.66, , 5.33	2
NiSe (γ).....	rhbdr.		9.84, , 3.18	
NiSi.....	cub., FeSi	T ⁴	4.437	
NiSiF ₆ .6H ₂ O.....	hex., NiSnCl ₆ .6H ₂ O	C _{3i} ²	6.21, α = 96° 20'	1
NiSn.....	hex., NiAs	D _{6h} ⁴	4.081, , 5.174	2

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
NiSnCl ₆ ·6H ₂ O.....	hex. (rhhdr.)	C _{3i} ²	7.09, $\alpha = 96^\circ 45'$	1
NiTe.....	hex., NiAs	D _{6h} ⁴	3.957, ..., 5.354	2
NiTiO ₃	hex., MgTiO ₃	C _{3i} ²	5.448, $\alpha = 55^\circ 0'$	2
Ni ₂ SiMo ₁₂ O ₄₀ ·31H ₂ O..	cub.	O _h ⁷	23.0	8
Ni ₂ SiO ₄	rhomb.	.....	4.705, 10.11, 5.914	
Ni ₃ C.....	hex.	.....	2.646, ..., 4.329	
Ni ₃ S ₂	cub. (?)	.....	4.08	1
OsO ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.51, ..., 3.19	2
OsS ₂	cub., FeS ₂	T _h ⁶	5.64	4
OsSe ₂	cub., FeS ₂	T _h ⁶	5.933	4
OsTe ₂	cub., FeS ₂	T _h ⁶	6.369	4
PH ₄ I.....	tetr., PbO	D _{4h} ⁷	6.34, ..., 4.62	2
PSBr ₃	cub.	T _h ⁶	11.03	8
P ₂ O ₅	hex.	.....	11.12, ..., 1.12	12
P ₃ N ₃ Cl ₆	rhomb.	V _h ¹⁶	.....	4
P ₄ N ₄ Cl ₈	tetr.	C _{4h} ⁴	10.79, ..., 5.93	2
PbBr ₂	rhomb.	V _h ¹⁶	4.71, 8.02, 9.48	4
PbCO ₃	rhomb., KNO ₃	V _h ¹⁶	5.14, 8.45, 6.10	4
PbCl ₂	rhomb., HgCl ₂	V _h ¹⁶	4.496, 7.667, 9.153	4
PbCrO ₄	monocl.	C _{2h} ⁵	6.82, 7.48, 7.16, $\beta = 102^\circ 33'$	4
PbF ₂.....	.....	.....	3.80, 6.41, 7.61	4
PbF ₂ (β).....	cub., CaF ₂	O _h ⁵	5.93	4
PbI ₂	hex., CdI ₂	D _{3cd} ³	4.54, ..., 6.86	1
PbMoO ₄	tetr., CaWO ₄	C _{4h} ⁶	5.41, ..., 12.08	4
Pb(NO ₃) ₂	cub., Ba(NO ₃) ₂	T _h ⁶	7.84	4
PbO (red).....	tetr., PbO	D _{4h} ⁷	3.98, ..., 5.01	2
PbO (yellow).....	rhomb.	V _h ¹⁹	5.50, 4.72, 5.88	4
PbO ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.97, ..., 3.40	2
PbS.....	cub., NaCl	O _h ⁵	5.97	4
PbSO ₄	rhomb., BaSO ₄	V _h ¹⁶	8.45, 5.38, 6.93	4
PbSe.....	cub., NaCl	O _h ⁵	6.14	4
PbTe.....	cub., NaCl	O _h ⁵	6.34	4
PbTiO ₃ (375°C).....	rhomb.	D _{2h} ¹	4.000, 4.211, 3.875	
PbWO ₄	tetr., CaWO ₄	C _{4h} ⁶	5.44, ..., 12.01	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Pb ₂ O.....	cub., Cu ₂ O	O _h ⁴	5.38	2
Pb ₃ (PO ₄) ₂	hex.	.....	9.66, , 7.11	3
PdAs ₂	cub., FeS ₂	T _h ⁶	5.970	4
Pd(NH ₄) ₄ Cl ₂ .H ₂ O.....	tetr.	D _{4h} ⁵ (?)	10.302, , 4.34	2
PdO.....	tetr., PbO	D _{4h} ⁷	3.209, , 5.314	2
PdSb.....	hex., NiAs	D _{6h} ⁴	4.070, , 5.582	2
PdSb ₂	cub., FeS ₂	T _h ⁶	6.439	4
PdTe.....	hex., NiAs	D _{6h} ⁴	4.127, , 5.663	2
PdTe ₂	hex., CdI ₂	D _{3d} ³	4.028, , 5.118	1
PrC ₂	tetr., CaC ₂	D _{4h} ¹⁷	3.85, , 6.38	2
PrF ₃	hex., CeF ₃	D ₆ ⁶	7.061, , 7.218	6
PrN.....	cub., f.c.	.....	5.155	.....
PrO ₂	cub., CaF ₂	O _h ⁵	5.36	4
PrP.....	cub., f.c.	.....	5.86	.....
Pr ₂ O ₃	hex., La ₂ O ₃	D _{3d} ³	3.851, , 5.996	1
Pr ₆ O ₁₁	cub.	.....	10.98	.....
PtAs ₂	cub., FeS ₂	T _h ⁶	5.957	4
PtBr ₂	cub., f.c.	.....	10.35	4
PtP ₂	cub., FeS ₂	T _h ⁶	5.683	4
PtS ₂	hex., CdI ₂	D _{3d} ³	3.537, , 5.019	1
PtSb.....	hex., NiAs	D _{6h} ⁴	4.130, , 5.472	2
PtSb ₂	cub., FeS ₂	T _h ⁶	6.428	4
PtSe ₂	hex., CdI ₂	D _{3d} ³	3.724, , 5.062	1
PtSn.....	hex., NiAs	D _{6h} ⁴	4.103, , 5.428	2
PtTe ₂	hex., CdI ₂	D _{3d} ³	4.010, , 5.201	1
PtTl.....	hex.	.....	5.605, , 4.639	3
RaF ₂	cub.	.....	6.368	4
RbAl(SO ₄) ₂ .12H ₂ O.....	cub.	T _h ⁶	12.20	4
RbBF ₄	rhomb.	V _h ¹⁶	9.07, 5.60, 7.23	4
RbBr.....	cub., NaCl	O _h ⁵	6.868	4
RbCl.....	cub., NaCl	O _h ⁵	6.571	4
RbCl(α) (temp. liq. air)	cub., CsCl	O _h ¹	3.742	.....
RbClO ₄	rhomb., BaSO ₄	V _h ¹⁶	9.27, 5.81, 7.53	4
RbClO ₄ (320°C).....	cub.	T _d ²	7.65	.....
RbF.....	cub., NaCl	O _h ⁵	5.63	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol
			a, b, c, Ax. ang.	
RbI.....	cub., NaCl	O_h^6	7.325	4
RbIO ₃	cub., CaTiO ₃	O_h^1	4.52	1
Rb(NO ₃).....	rhomb.	C_{3v}^2	18.08, 10.45, 7.38	18
RbN ₃	tetr., KN ₃	D_{4h}^{18}	6.36, , 7.41	4
RbPb ₂ Br ₅	tetr.	D_{4h}^{18}	8.41, , 14.5	4
RbSH.....	rhbdr.	D_{3d}^5	4.53, $\alpha = 69^\circ 20'$	
Rb ₂ CuCl ₄ ·2H ₂ O.....	tetr., (NH ₄) ₂ CuCl ₄ · 2H ₂ O	D_{4h}^{14}	7.81, . . . , 8.00	2
Rb ₂ PbCl ₆	cub.	O_h^6	10.195	
Rb ₂ PtCl ₆	cub.	O_h^5	9.884	4
Rb ₂ Pt(SCN) ₆	hex., K ₂ Pt(SCN) ₆	D_{3d}^1 or D_{3d}^3	6.75, , 10.47	1
Rb ₂ SO ₄	rhomb., K ₂ SO ₄	V_h^{16}	5.949, 10.391, 7.780	4
Rb ₂ S ₂ O ₆	hex.	D_3^2	10.144, , 6.409	3
Rb ₂ SeCl ₆	cub.	O_h^5	9.978	
Rb ₂ SnCl ₆	cub.	O_h^5	10.099	
Rb ₂ TeCl ₆	cub.	O_h^5	10.233	
Rb ₂ TiCl ₆	cub.	O_h^5	9.922	
Rb ₂ ZrCl ₆	cub.	O_h^5	10.178	
Rb ₃ Co(NO ₂) ₆	cub.		10.73	4
Rb ₃ N.....	tetr.	D_{4h}^1	4.497, , 3.707	1
Rb ₃ W ₂ Cl ₉	hex.	C_{6h}^2	7.24, , 16.95	2
Rh(NH ₃) ₅ ClCl ₂	rhomb.	V_h^{16}	13.32, 6.71, 10.42	4
RhS ₂	cub., FeS ₂	T_h^6	5.574	4
Rh ₂ O ₃	hex., Fe ₂ O ₃	D_{3d}^5	5.47, $\alpha = 55^\circ 40'$	2
RuO ₂	tetr., SnO ₂	D_{4h}^{14}	4.51, , 3.11	2
RuS ₂	cub., FeS ₂	T_h^5	5.57	4
RuSe ₂	cub., FeS ₂	T_h^5	5.921	4
RuTe ₂	cub., FeS ₂	T_h^5	6.360	4
SaF ₃	hex., CeF ₃	D_6^6	6.98, , 7.15	6
Sa ₂ O ₃	cub., Ti ₂ O ₃	T_h^7	10.85	16
SbI ₃	hex., AsI ₃	C_3^1	7.466, , 20.89	6
SbSn(43-55 % Sb).....	cub., NaCl	O_h^6	6.130	4
Sb ₂ O ₃	cub., As ₂ O ₃	O_h^7	11.06	16

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Sb ₂ S ₃	rhomb.	V _h ¹⁶	11.39, 11.48, 3.89	4
Sb ₂ Tl ₇	cub.	.....	11.59	6
(Se, In) ₂ O ₂	cub.	O _h ¹⁰	9.90	16
SeN.....	cub., NaCl	O _h ⁵	4.44	4
Se ₂ O ₃	cub., Ti ₂ O ₃	T _h ⁷	9.79	16
SiC (I).....	hex.	C _{3v} ⁵	12.78, $\alpha = 13^\circ 55'$	15
SiC (II).....	hex.	C _{6v} ⁴	3.095,, 15.17	6
SiC (III).....	hex.	C _{6v} ⁴	3.095,, 10.10	4
SiC (IV).....	cub., ZnS	T _d ²	4.348	
SiC (V).....	hex.	.....	43.15, $\alpha = 4^\circ 6'$	51
SiI ₄	cub.	T _h ⁶	11.99	8
SiO ₂ (β cristobalite) (290°C)	cub.	O _h ⁷	7.12	8
SiO ₂ (α quartz).....	hex.	D ₃ ⁴ or D ₃ ⁵	4.903,, 5.393	3
SiO ₂ (β quartz) (600°C)	hex.	D ₆ ⁴ or D ₆ ⁵	5.01,, 5.47	
SiO ₂ (α tridymite).....	rhomb.	D _{6h} ⁴	9.88, 17.1, 16.3	64
SiO ₂ (β tridymite).....	hex.	D _{6h} ⁴	5.03,, 8.22	64
SiO ₃ ZnO ₂ H ₂	rhomb.	C _{2v} ²⁰	8.41, 5.14, 10.73, $\beta = 90^\circ$	4
SiP ₂ O ₇	cub.	T _h ⁶	7.46	4
SmPMo ₁₂ O ₄₀ .30H ₂ O.....	cub.	O _h ⁷	23.1	8
SnAs.....	cub., NaCl	O _h ⁵	5.716	4
SnI ₄	cub.	T _h ⁶	12.23	8
SnO.....	tetr., PbO	D _{4h} ⁷	3.77,, 4.77	2
SnO ₂	tetr.	D _{4h} ¹⁴	4.72,, 3.16	2
SnP ₂ O ₇	cub.	T _h ⁶	7.89	4
SnS ₂	hex., CdI ₂	D _{3d} ³	3.639,, 5.868	1
SnSb.....	rhbdr.	.....	6.117, $\alpha = 89.70^\circ$	
SnTe.....	cub., NaCl	O _h ⁵	6.285	4
Sn ₃ As ₂	rhbdr.	D _{3d} ⁵	12.23, $\alpha = 19.22^\circ$	7 at.
Sn ₈ Cu ₃₁	cub.	.....	17.91	
SrCO ₃	rhomb., KNO ₃	V _h ¹⁶	5.13, 8.42, 6.10	4
SrC ₂	tetr., CaC ₂	D _{4h} ¹⁷	5.81,, 6.68	2
SrC ₂ O ₄ .2.5H ₂ O.....	tetr.	.....	12.795,, 7.509	8
SrCl ₂	cub., CaF ₂	O _h ⁵	7.00	4
SrCl ₂ .6H ₂ O.....	hex.	C _{3i} ²	7.906,, 4.07	1

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
SrF ₂	cub., CaF ₂	O _h ⁵	5.86	4
SrMoO ₄	tetr., CaWO ₄	C _{4h} ⁶	5.36,, 11.94	4
Sr(NO ₃) ₂	cub., Ba(NO ₃) ₂	T _h ⁶	7.81	4
SrO.....	cub., NaCl	O _h ⁵	5.10	4
Sr(OH) ₂ .8H ₂ O.....	tetr.	D _{4h} ¹	6.41,, 5.807	1
SrO ₂	tetr., CaC ₂	O _{4h} ¹⁷	5.02,, 6.55	
SrO ₂ .8H ₂ O.....	tetr.		6.32,, 5.56	1
SrPb ₃	tetr.		4.955,, 5.025	
SrS.....	cub., NaCl	O _h ⁵	5.87	4
SrSO ₄	rhomb., BaSO ₄	V _h ¹⁶	8.36, 5.36, 6.84	4
SrSe.....	cub., NaCl	O _h ⁵	6.23	4
SrTe.....	cub., NaCl	O _h ⁵	6.48	4
SrTiO ₃	cub., CaTiO ₃	O _h ¹	3.92	1
SrZrO ₃	cub., CaTiO ₃	O _h ¹	4.09	1
TaC.....	cub., NaCl		4.53	4
TaN.....	hex., ZnO	C _{6v} ⁴	3.05,, 4.94	2
Tb ₂ O ₃	cub., Ti ₂ O ₃	T _h ⁷	10.70	16
Tb ₄ O ₇	cub.		10.55	
TeO ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.79,, 3.77	2
TeO ₆ H ₆	cub.	O _h ⁵	7.83	4
TeO ₆ H ₆	monocl.	C _{2h} ⁵	5.54, 9.30, 9.74, $\beta = 104^\circ 30'$	4
ThB ₆	cub.		4.32	1
ThC ₂	tetr.		5.85,, 5.28	4
ThO ₂	cub., CaF ₂	O _h ⁵	5.59	4
TiBr ₄	cub.		11.25	
TiC.....	cub., NaCl	O _h ⁵	4.311	4
TiI ₄	cub.		12.00	
TiN.....	cub., NaCl	O _h ⁵	4.40	4
TiO.....	cub., NaCl	O _h ⁵	4.235	4
TiO ₂ (anatase).....	tetr.	D _{4h} ¹⁹	3.73,, 9.37	4
TiO ₂ (brookite).....	rhomb.	V _h ¹⁵	9.166, 5.436, 5.135	8
TiO ₂ (rutile).....	tetr., SnO ₂	D _{4h} ¹⁴	4.58,, 2.95	2
TiP ₂ O ₇	cub.	T _h ⁵	7.80	4
TiS ₂	hex., CdI ₂	D _{3d} ³	5.691,, 3.397	1
TiSe ₂	hex., CdI ₂	D _{3d} ³	5.995,, 3.533	1

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
TiTe ₂	hex., CdI ₂	D _{3d} ³	6.539, , 3.774	1
Ti ₂ O ₃	hex., Fe ₂ O ₃	D _{3d} ⁶	5.37, α = 56° 48'	2
TiAl(SO ₄) ₂ ·12H ₂ O.....	cub.	T _h ⁶	12.21	4
TiBi.....	cub., CsCl	O _h ¹	3.98	1
TiBr.....	cub., CsCl	O _h ¹	3.97	1
TiCNS.....	rhomb.	V _h ¹¹	6.80, 6.78, 7.52	4
TiCl.....	cub., CsCl	O _h ¹	3.84	1
TiClO ₄	rhomb., BaSO ₄	V _h ¹⁸	9.42, 5.88, 7.50	4
TiClO ₄ (280°C).....	cub., KClO ₄	T _d ²	7.61	
TiF.....	rhomb., f.c.	V _{2h} ²³	5.180, 5.495, 6.080	4
TiHF ₂	cub.		8.58	8
TiI.....	rhomb.	D _{2h} ¹⁷	5.24, 4.57, 12.92	4
TiN ₃	tetr., KN ₃	D _{4h} ¹⁸	6.21, , 7.37	
TiSb (Ti in excess).....	cub., CsCl	O _h ¹	3.84	1
Tl ₂ O ₃	cub.	T _h ⁷	10.57	16
Tl ₂ PtCl ₆	cub.	O _h ⁵	9.755	
Tl ₂ SnCl ₆	cub.	O _h ⁵	9.970	
Tl ₂ TeCl ₆	cub.	O _h ⁵	10.107	
Tl ₃ Co(NO ₂) ₆	cub.		10.72	4
Tl ₃ W ₂ Cl ₉	hex.	C _{6h} ²	7.15, , 16.33	2
Tm ₂ O ₃	cub., Tl ₂ O ₃	T _h ⁷	10.52	16
UO ₂	cub., CaF ₂	O _h ⁵	5.47	4
UO ₂ (NO ₃) ₂ ·6H ₂ O.....	rhomb.	V _h ¹⁷	11.42, 13.15, 8.02	4
VC(ε).....	cub., NaCl	O _h ⁵	4.30	4
VN.....	cub., NaCl	O _h ⁵	4.28	4
VO ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.54, , 2.88	2
V ₂ O ₃	hex., Fe ₂ O ₃	D _{3d} ⁶	5.43, α = 53° 53'	2
V ₂ O ₅			11.48, 4.36, 3.55	2
WC.....	hex.		2.901, , 2.830	1
W(CO) ₆	rhomb.	C _{2v} ⁹	11.90, 6.42, 11.27	4
WO ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.86, , 2.77	2
WS ₂	hex., MoS ₂	D _{6h} ⁴	3.18, , 12.5	2
WSi ₂	tetr.	D _{4h} ¹⁷	3.212, , 7.880	2

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
W ₂ C (β) (2600°C).....	hex.	.....	2.99, , 4.72	1
YAlO ₃	cub., CaTiO ₃	O _h ¹	3.67	1
(Y Bi) ₂ O ₃	cub.	O _h ¹⁰	10.72	16
YCbO ₄	tetr.	.....	7.76, , 11.32	8
YF ₃	cub.	.....	5.49	4
YPO ₃	tetr., ZrSiO ₄	D _{4h} ¹⁹	6.88, , 6.03	4
YTaO ₄	tetr.	.....	7.75, , 11.41	8
(Y, Tl) ₂ O ₃	cub.	O _h ¹⁰	10.53	16
Y(VO ₃) ₃	tetr.	D _{4h} ¹⁹	7.126, , 6.197	4
Y ₂ O ₃	cub., Tl ₂ O ₃	T _h ⁷	10.60	16
Yb ₂ O ₃	cub., Tl ₂ O ₃	T _h ⁷	10.39	16
ZnAl ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.099	8
Zn(BrO ₃) ₂ ·6H ₂ O.....	cub., (NH ₄) ₂ PtCl ₆	T _h ⁶	10.31	4
ZnCO ₃	hex., NaNO ₃	D _{3d} ⁶	5.704, $\alpha = 48^\circ 6'$	2
ZnCl ₂	hex., CdCl ₂	D _{3d} ⁵	6.31, $\alpha = 34^\circ 48'$	1
ZnCo ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.108	8
ZnCr ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.323	8
ZnF ₂	tetr., SnO ₂	D _{4h} ¹⁴	4.715, , 3.131	2
ZnFe ₂ O ₄	cub., MgAl ₂ O ₄	O _h ⁷	8.403	8
Zn(NH ₃) ₂ Br ₂	rhomb.	D _{2h} ²⁸	8.12, 8.81, 8.41	4
Zn(NH ₃) ₂ Cl ₂	rhomb.	D _{2h} ²⁸	7.78, 8.50, 8.08	4
ZnO.....	hex.	C _{6v} ⁴	3.24265, , 5.1948	2
ZnO·Fe ₂ O ₃	cub.	.....	8.41	8
Zn(OH) ₂	rhomb.	V ₄	5.16, 8.53, 4.92	4
ZnS (α) (wurzite).....	hex., ZnO	C _{6v} ⁴	3.84, , 6.28	2
ZnS (β) (blende).....	cub.	T _d ⁹	5.43	4
ZnSO ₄	rhomb.	.....	4.71, 6.73, 8.51	4
ZnSO ₄ ·7H ₂ O.....	rhomb., MgSO ₄ ·7H ₂ O	V ₄	11.85, 12.09, 6.83	4
ZnSO ₄ ·(NH ₄) ₂ SO ₄ ·6H ₂ O.....	monocl.	C _{2h} ⁵	9.20, 12.47, 6.23, $\beta = 106^\circ 52'$	2
ZnSe.....	cub., ZnS	T _d ²	5.65	4
ZnSiF ₆ ·6H ₂ O.....	hex., NiSnCl ₆ ·6H ₂ O	C _{3i} ²	6.27, $\alpha = 96^\circ 5'$	1
ZnSnF ₆ ·6H ₂ O.....	hex., NiSnCl ₆ ·6H ₂ O	C _{3i} ²	6.54, $\alpha = 95^\circ 51'$	1
ZnSnO ₃	cub.	.....	8.650	.....
ZnTe.....	cub., ZnS	T _d ²	6.07	4
ZnTiF ₆ ·6H ₂ O.....	hex., NiSnCl ₆ ·6H ₂ O	C _{3i} ²	6.41, $\alpha = 96^\circ 20'$	1
ZnTiO ₃	cub.	.....	8.460	.....

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
ZnZrF ₆ ·6H ₂ O.....	hex., NiSnCl ₈ ·6H ₂ O	C _{3i} ²	6.57, α = 96° 5'	1
Zn ₂ SnO ₄	cub., MgAl ₂ O ₄	O _h ¹	8.65	8
Zn ₂ TiO ₄	cub., MgAl ₂ O ₄	O _h ¹	8.46	8
Zn ₃ As ₂	cub.		5.81	2
Zn ₃ P ₂	cub., Zn ₃ As ₂		5.68	2
ZrC.....	cub., NaCl	O _h ⁵	4.73	4
ZrCl ₄	cub., SnI ₄	T _h ⁶	10.32	8
ZrF ₄	monocl.	C _{2h} ⁶	9.46, 9.87, 7.64, β = 94° 30'	12
ZrN.....	cub., NaCl	O _h ⁵	4.61	4
ZrO ₂	cub., CaF ₂	O _h ⁵	5.07	4
ZrO ₂	hex.		3.598, ..., 5.875	
ZrO ₂	monocl.		5.21, 5.26, 5.37, β = 80° 32'	4
ZrO ₂	tetr.		5.07, ..., 5.16	4
ZrP ₂ O ₇	cub.	T _h ⁶	8.20	4
ZrS ₂	hex., CdI ₂	D _{3d} ³	3.68, ..., 5.85	1
ZrSe ₂	hex., CdI ₂	D _{3d} ³	3.79, ..., 6.18	1
ZrSi ₂	rhomb.	V _h ¹⁷	3.72, 14.61, 3.67	4
ZrW ₂	cub., f.c.		7.61	8

MINERALS

Name	Formula	Crystal system	Space group	Lattice constants	Mol.
				a, b, c, Ax. ang.	
Actinolite.....	H ₂ Ca ₂ (Mg,Fe) ₅ (SiO ₃) ₈	monocl.		9.8, 17.9, 5.27, β = ca 74°	
Aenigmatite.....		tricl.		18.3, 18.3, 10.6, α = 96° 30', β = 96° 30', γ = 113° 30'	
Analcite.....	NaAlSi ₂ O ₆ ·H ₂ O	cub.		13.64	
Andalusite.....	Al ₂ SiO ₅	rhomb.	V _h ¹²	7.76, 7.90, 5.56	4
Anhydrite.....	CaSO ₄	rhomb.	V _h ¹⁷	6.22, 6.96, 6.97	4
Anthophyllite.....	H ₂ Mg ₇ (SiO ₃) ₈	rhomb.		18.52, 18.04, 5.27	
Apatite.....	Ca(F,Cl)Ca ₄ (PO ₄) ₃	hex.	C _{3h} ²	9.37, ..., 6.88	2
Apophyllite.....	4(Si ₂ O ₆ H ₂ ·CaO ₂ ·H ₂)KF(?)	tetr.		12.71, ..., 15.86	
Aragonite.....	CaCO ₃	rhomb.	V _h ¹⁶	4.94, 7.94, 5.72	4
Atonite.....	(Ca,Mn,Na) ₂ Sb ₂ (O, OH, F) ₇	cub.		10.27	8
Babingtonite.....		tricl.		6.73, 7.54, 12.43, α = 112° 22', β = 93° 48', γ = 86° 9'	

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Name	Formula	Crystal system	Space group	Lattice constants	Mol.
				a, b, c, Ax. ang.	
Bastnäsite.....	(Ce,Ln)FCO ₃	hex.	D _{3h} ³	7.094, ..., 4.859	3
Benitoite.....	BaTiSi ₃ O ₉	hex.	.....	6.60, ..., 9.71	
Beryl.....	Be ₃ Al ₂ (SiO ₃) ₆	hex.	D _{6h} ²	9.21, ..., 9.17	2
Berzeliite.....	NaCa ₂ Mn ₂ As ₅ O ₁₂	cub.	.....	12.36	
Bixbyite.....	(Fe,Mn) ₂ O ₃	cub.	T _h ⁷	9.365	16
Boracite.....	Mg ₆ Cl ₂ B ₁₄ O ₂₆	rhomb.	.....	16.97, 16.97, 12.00	8
Bornite.....	Cu ₅ FeS ₄	cub.	.....	10.91	
Braggite.....	Approx. Pt ₆ Pd ₃ Ni ₂ Si ₁₆	tetr.	C _{4h} ²	6.37, ..., 6.58	8
Calaverite.....	AuTe	monocl.	.....	7.18, 4.40, 5.07, $\beta = 90^\circ \pm 30'$	2
Calcite.....	CaCO ₃	rhbdr.	D _{3d} ⁶	6.361, $\alpha = 46^\circ 6'$	2
Cancrinite.....	3SiO ₄ AlNa. CaCO ₃ (?)	hex.	.....	12.60, ..., 5.18	
Chalcopryite.....	CuFeS ₂	tetr.	V _d ⁵	3.726, ..., 5.194	1
Chondrodite.....	Mg ₃ [Mg(F,OH)] ₂ (SiO ₃) ₂	monocl.	C _{2h} ⁵	4.733, 10.27, 7.87, $\alpha = 109^\circ 2'$	2
Chromite.....	(Fe,Mg)Cr ₂ O ₄	cub.	O _h ⁷	8.35	8
Chrysoberyl.....	BeAl ₂ O ₄	rhomb.	V _h ¹⁶	4.420, 9.390, 5.470	4
Chrysotile.....	H ₄ Mg ₃ Si ₂ O ₉	rhomb.	.....	14.66, 18.5, 5.33, $\beta = 93^\circ 16'$	
Cinnabar.....	HgS	hex.	D ₃ ⁴ or D ₃ ⁶	4.14, ..., 9.49	3
Clinohumite.....	Mg ₇ [Mg(F,OH)] ₂ (SiO ₃) ₄	monocl.	C _{2h} ⁵	4.745, 10.27, 13.68, $\alpha = 100^\circ 50'$	2
Columbite.....	(Fe,Mn)(Cb,Ta) ₂ O ₆	rhomb.	.....	5.082, 14.24, 5.730	
Cooperite.....	PtS	tetr.	D _{4h} ⁹	4.91, ..., 6.10	8
Cordierite.....	Mg ₂ Si ₅ O ₁₂ .2Al ₂ O ₃	rhomb.	.....	9.78, 17.1, 9.33	
Covellite.....	.....	hex.	D _{6h} ⁴	3.802, ..., 16.43	6
Cryolithionite.....	Na ₃ Al ₂ Li ₃ F ₁₂	cub.	.....	12.10	
Cumengeite.....	PbCl ₂ CuO ₂ H ₂ (?)	tetr.	.....	15.17, ..., 24.71	
Cyanite.....	Al ₂ SiO ₅	tricl.	C _i ¹	7.09, 7.72, 5.56, $\beta = 101^\circ 2'$	4
Danburite.....	CaB ₂ Si ₂ O ₈	rhomb.	.....	8.75, 8.01, 7.72	
Datolite.....	CaSiO ₃ .HBO ₂	monocl.	.....	9.64, 7.62, 4.82, $\beta = 90^\circ 9'$	
Davynite.....	3SiO ₄ AlNa.Ca (SO ₄ ,Cl ₂)	hex.	.....	12.80, ..., 5.35	
Dietzeite.....	Ca(IO ₃) ₂ .CaCrO ₄	monocl.	.....	10.16, 7.30, 14.03, $\beta = 106^\circ 32'$	4
Diopside.....	CaMg(SiO ₃) ₂	monocl.	C _{2h} ⁶	9.71, 8.89, 5.24, $\beta = 74^\circ 10'$	
Diopase.....	CuH ₂ SiO ₄	hex.	.....	14.66, ..., 7.83	
Dolomite.....	CaMg(CO ₃) ₂	hex., (rhbdr.)	C _{3i} ²	6.02, $\alpha = 47^\circ 30'$	1
Dysanalyte.....	(CaTiO ₃ ,NaCbO ₃)	cub.	.....	3.826	
Enstatite.....	MgSiO ₃	rhomb.	.....	18.20, 8.86, 5.20	
Epididymite.....	NaBeSi ₃ O ₇ (OH)	rhomb.	.....	12.71, 7.33, 13.62	
Eucrase.....	BeSiO ₃ .HAlO ₂	monocl.	.....	4.63, 14.30, 4.71, $\beta = 100^\circ 16'$	
Eudialyte.....	(Na,Ca,Fe) ₆ ZrSi ₁₈ O ₁₈ (OH,Cl)	hex.	.....	13.01, $\alpha = 66^\circ 44'$	

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Name	Formula	Crystal system	Space group	Lattice constants	Mol.
				a, b, c. Ax. ang.	
Eudymite.....	NaBeSi ₃ O ₇ (OH)	monocl.	.....	12.62, 7.37, 13.99, $\beta = 103^\circ 43'$	
Finnemanite.....	9PbO.3As ₂ O ₃ .	hex.	.....	10.21,, 6.97	1
Fluorite.....	CaF ₂	cub.	O _h ⁵	5.451	4
Garnet.....	(Fe'', Mn'') ₃ Al ₂ (SiO ₄) ₃	cub.	O _h ⁶	11.40	8
Gehlenite.....	.....	tetr.	.....	11.11,, 5.06	
Granerite.....	H ₂ Fe ₇ (SiO ₃) ₃	monocl.	.....	9.4, 17.9, 5.27, $\beta = ca\ 74^\circ$	
Granite.....	Al ₂ Ca ₃ (SiO ₄) ₃	cub.	O _h ¹⁰	11.83	8
Haematophanite.....	Pb(Cl,OH) ₂ .4PbO.	tetr.	.....	7.80,, 15.23	3
Hardystonite.....	2Fe ₂ O ₃	.....	.....	.....	.....
.....	Ca ₂ ZnSi ₂ O ₇	tetr.	.....	7.83,, 4.99	
Häuyite.....	cub.	.....	.....	9.04	
Helvite.....	Be ₃ (Mn,Fe) ₃ (SiO ₄) ₃ MnS	cub.	.....	8.25	
Hematite.....	Fe ₂ O ₃	hex.	D _{3d} ⁶	5.42, $\alpha = 55^\circ 17'$	2
Hemimorphite.....	Zn ₂ SiO ₄ .H ₂ O	rhomb.	.....	8.41, 5.14, 10.73	
Heulandite.....	H ₂ CaAl ₂ Si ₆ O ₁₈ .3H ₂ O	monocl.	.....	7.54, 17.97, 15.91, $\beta = 83^\circ 34'$	
Hornblende.....	H ₂ (Ca,Na,K) ₂₋₃ (Mg,Fe,Al) ₅ (Si,Al) ₃ O ₁₃	monocl.	.....	ca 9.8, 17.9, 5.28, $\beta = ca\ 74^\circ$	
Humite.....	Mg ₃ [Mg(F,OH)] ₂ (SiO ₄) ₃	rhomb.	V _h ¹⁶	4.738, 10.23, 20.86	4
Ice (α).....	H ₂ O	hex.	D _{6h} (?)	4.52,, 7.34	4
Ice (β).....	H ₂ O	rhbdr.	C _{3i} or C ₃	4.52,, 7.34	4
Ice II (low temp.).....	H ₂ O	rhomb., f.c.	V ₅	7.80, 4.50, 5.56	8
Ice III.....	H ₂ O	rhomb.	V _h ²⁶	10.20, 5.87, 7.17	16
Ilmenite.....	FeTiO ₃	rhbdr.	C _{3i} ²	5.40	2
Jacobsite.....	(Mg,Mn,Fe)Fe ₂ O ₄	cub.	O _h ⁷	8.42	8
Julienite.....	Na ₂ Co(SCN) ₄ .8H ₂ O	tetr.	.....	9.22,, 5.56	1
Kaliophilite.....	KAlSiO ₄	hex.	.....	15.59,, 8.59	
Kernite.....	Na ₂ B ₄ O ₇ .4H ₂ O	monocl.	C _{2h} ⁴	6.96, 9.14, 15.52, $\beta = 108^\circ 52'$	4
Krennerite.....	AuTe ₂	rhomb.	C _{2v} ⁴	16.51, 8.80, 4.45	8
Kunfferite.....	H ₂ Mg ₇ (SiO ₃) ₅	monocl.	.....	9.7, 17.8, 5.25, $\beta = ca\ 74^\circ$	
Lautarite.....	Ca(IO ₃) ₂	monocl.	C _{2h} ⁶	7.18, 11.38, 7.32, $\beta = 106^\circ 22'$	4
Leucite.....	K ₂ O.Al ₂ O ₃ .4SiO ₂	tetr.	.....	12.95,, 13.65	
Magneto-plumbite.....	2(Pb,Mn)O.3Fe ₂ O ₃	hex.	.....	6.06,, 23.69	4
Manganite.....	Mn(OH)O	monocl.	.....	8.86, 5.24, 5.70, $\beta = 90^\circ$	
Marcasite.....	FeS ₂	rhomb.	V _h ¹²	3.35, 4.40, 5.35	2
Mauzeilite.....	(Ca ₃ ,Na ₂)(Sb ₈ ,Ti ₂)O ₃₁ F ₄	cub.	.....	12.30	
Melilite.....	(Ca,Na) ₂ (Mg,Al)(Si,Al) ₂ O ₇	tetr.	.....	7.73,, 5.01	
Meliphanite.....	(Ca,Na) ₂ Be(Si,Al) ₂ (O,F) ₇	tetr.	.....	7.47,, 4.92	
Metacinnabar.....	HgS	cub.	T _d ²	5.84	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Name	Formula	Crystal system	Space group	Lattice constants	Mol.
				a, b, c, Ax. ang.	
Metavoltine.....	$K_2H_7(SO_4)_6 \cdot 3FeO_3H_3 \cdot H_2O$	hex.		19.43, , 18.60	8
Miersite.....	$4AgI \cdot CuI$	cub.	T_{d}^2	6.35	4
Millerite.....	NiS	hex., (rhhbdr.)	C_{3v}^5	5.655, $\alpha = 116^\circ 36'$	3
Mimetite.....	$9PbO \cdot 3As_2O_3 \cdot PbCl_2$	hex.		10.01, , 7.28	1
Monticellite.....	$CaMgSiO_4$	rhomb.		4.815, 11.08, 6.37	
Mossite.....	$Fe(Cb, Ta)_2O_6$	tetr.	D_{4h}^{14}	4.71, , 9.12	2
Muscovite.....	$KH_2Al_2Si_3AlO_{12}$	monocl.		5.18, 9.02, 20.04, $\beta = 95^\circ 30'$	
Natrolite.....	$Na_2Al_2Si_3O_{16} \cdot 2H_2O$	rhomb.	C_{2v}^{10}	18.19, 18.62, 6.58	8
Nephelite.....	$NaAlSiO_4$	hex.		10.09, , 8.49	
Neptunite.....	$Na_2FeSi_2O_6 \cdot Si_2TiO_6$	monocl.		16.54, 12.64, 10.04, $\beta = 115^\circ 38'$	
Norbergite.....	$Mg(F, OH)_2Mg_2SiO_4$	rhomb.	V_h^{16}	4.70, 10.2, 8.72	4
Olivine.....	$(Mg, Fe'')_2SiO_4$	rhomb.	V_h^5	4.77, , 6.00	4
Pentlandite.....	$(Ni, Fe)S$	cub.	O_h^5	10.00	32
Perovskite.....	$CaTiO_3$	cub.	O_h^1	3.80	1
Petalite.....	$LiAlSiO_4 \cdot 3SiO_2$	monocl.		11.77, 5.13, 15.17, $\beta = 112^\circ 44'$	
Phenacite.....	Be_2SiO_4	hex.		7.684, $\alpha = 108^\circ 1'$	
Plumboferrite.....	$PbO \cdot 2Fe_2O_3$	hex.		11.86, , 47.14	42
Pollucite.....	$[Si_4Al_2O_{12}]Cs_2 \cdot H_2O$	cub.	O_h^{10}	13.71	2
Polvdymite.....	Ni_3S_4	cub.	O_h^7	9.65	8
Proustite.....	Ag_3AsS_3	rhhbdr. trig.	C_{3v}^{16}		
Pseudo-boleite.....	$5PbCl_2 \cdot 4CuO \cdot 6H_2O$	tetr.		15.4, , 31.2	12
Pseudobrookite.....	Fe_2TiO_5	rhomb.		9.78, 9.80, 3.65	4
Pyrargyrite.....	Ag_3SbS_3	rhhbdr. trig.	C_{3v}^{16}		
Pyrite.....	FeS_2	cub.	T_h^6	5.404	4
Quartz (α).....	SiO_2	hex.	D_3^4 or D_3^6	4.903, , 5.393	3
Rhodonite.....	$Mn_4Ca(SiO_3)_5$	tricl.		7.77, 12.45, 6.74, $\alpha = 85^\circ 10'$, $\beta = 94^\circ 4'$, $\gamma = 111^\circ 29'$	
Rutile.....	TiO_2	tetr.	D_{4h}^{14}	4.58, , 2.95	2
Scapolite.....	$nNa_4Al_3Si_9O_{24}Cl + mCa_4Al_6Si_9O_{25}$	tetr.	C_{4h}^6	12.72, , 7.66	2
Scheelite.....	$CaWO_4$	tetr.	C_{4h}^6	5.24, , 11.38	4
Sillimanite.....	$Al_2O_3 \cdot SiO_2$	rhomb.		7.43, 7.58, 5.74	
Skutterudite.....	$CoAs_3$	cub.	T_h^5	8.18	8
Sodalite.....	$Na_4Al_3Si_3O_{12}Cl$	cub.		8.87	
Spinel.....	Al_2MgO_4	cub.	O_h^7	8.09	8
Spodumene.....	$Li_2O \cdot Al_2O_3 \cdot 4SiO_2$	monocl.		9.50, 8.30, 5.24, $\beta = 69^\circ 40'$	4
Staurolite.....	$Fe(OH)_2 \cdot 2Al_2SiO_5$	rhomb.	V_h^{17}	7.82, 16.52, 5.63	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Name	Formula	Crystal system	Space group	Lattice constants	Mol.
				a, b, c, Ax. ang.	
Sulfohalite.....	$2\text{Na}_2\text{SO}_4 \cdot \text{NaCl} \cdot \text{NaF}$	cub., f.c.		10.08	4
Sulvanite.....	Cu_3VS_4	cub.	T_d^2	5.370	1
Talc.....	$3\text{MgO} \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$	pseudo-hex. (monocl. or rhomb.)	C_6^4	5.25	
Tetrahedrite.....	Cu_3SbS_3	cub.		10.32	
Thortveitite.....	$\text{Sc}_2\text{Si}_2\text{O}_7$	monocl.		6.56, 8.58, 4.74, $\beta = 103^\circ 8'$	
Tincalconite.....	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 5\text{H}_2\text{O}$	hex.		11.3, ..., 20.9	9
Tincalconite.....	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 5\text{H}_2\text{O}$	rhbdr.	C_{3i}^2	9.46, $\alpha = 71^\circ 42'$	3
Titanite.....	CaTiSiO_6	monocl.		6.55, 8.70, 7.43, $\beta = 119^\circ 43'$	
Topaz.....	$\text{Al}_2\text{F}_2\text{SiO}_4$	rhomb.	V_h^{16}	4.64, 8.78, 8.37	4
Tourmaline.....		hex.	C_{3v}^1	16.23, ..., 7.26	
Tremolite.....	$\text{H}_2\text{Ca}_2\text{Mg}_5(\text{SiO}_3)_8$	monocl.		9.78, 17.8, 5.26, $\beta = 73^\circ 58'$	
Tridymite (α).....	SiO_2	rhomb.	D_{6h}^4	9.88, 17.1, 16.3	64
Tridymite (β).....	SiO_2	hex.	D_{6h}^4	5.03, ..., 8.22	64
Trimerite.....	$\text{Be}(\text{Ca}, \text{Mn})\text{SiO}_4$	hex.		16.11, ..., 7.60	
Tysonite.....	$(\text{Ce}, \text{La}, \dots)\text{F}_3$	hex.	D_{6h}^3	7.124, ..., 7.280	6
Vaterite.....	CaCO_3	hex.		4.120, ..., 8.556	2
Vesuvianite.....		tetr.		22.03, ..., 11.89	
Vivianite.....	$3\text{FeO} \cdot \text{P}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$	monocl., one-f.c.		9.997, 13.37, 4.696, $\beta = 104^\circ 16'$	
Voltaite.....		cub.		27.33	20
Willemite.....	Zn_2SiO_4	hex.		8.63, $\alpha = 107^\circ 45'$	
Wollastonite.....	CaSiO_3	monocl.		15.31, 7.35, 7.08, $\beta = 95^\circ 25'$	
Wurtzite.....		hex.	C_{6v}^4	3.811, ..., 6.234	
Zircon.....	ZrSiO_4	tetr.	D_{4h}^{19}	6.58, ..., 5.93	4

METAL-ORGANIC COMPOUNDS

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Aluminum acetylacetone.....	monocl.	C_{2h}^5	14.1, 7.42, 16.5, $\beta = 98^\circ 54'$	4
Ammonium chlorofumarate.....	monocl.	C_2^2	9.30, 6.70, 6.735, $\beta = 108^\circ 25'$	2
hydrogen fumarate.....	tricl.	C_i^1	7.00, 7.44, 6.56, $\alpha = 107^\circ 1'$, $\beta = 117^\circ 58'$, $\gamma = 69^\circ 16'$	2
oxalate + $1\text{H}_2\text{O}$	rhomb.	V^3	8.06, 10.34, 3.82	2
Barium dicalcium propionate.....	cub.	O_h^7	18.20	8
formate.....	rhomb.	V^4	6.78, 8.89, 7.68	4
succinate.....	tetr.	D_{4h}^{19}	7.57, ..., 10.28	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol
			a, b, c, Ax. ang.	
Beryllium oxalate + 3H ₂ O.....	rhomb.	V _h ¹⁶	6.37, 7.53, 12.45	4
oxyacetate.....	cub.	T _h ⁴	15.72	8
oxypivalate.....	monocl.	C _{2h} ⁶	19.3, 12.4, 35.4, $\beta = 91^\circ 21'$	8
oxypropionate.....	monocl.	.....	16.00, 9.76, 9.15, $\beta = 116^\circ 7'$	2
Bismuth chloride thiourea....	hex.	C ₃ ⁴	14.81, $\alpha = 111^\circ 54'$	1
cobalticyanide..... thiourea	hex.	D _{3d} ⁵	9.13, $\alpha = 100^\circ 30'$	1
Calcium barium propionate..	cub.	O ⁴	18.3	8
formate.....	rhomb.	V _h ¹⁶	10.16, 13.38, 6.26	8
Chromium acetylacetone.....	monocl.	C _{2h} ⁵	14.2, 7.62, 16.5, $\beta = 99^\circ 8'$	4
Cobalt acetylacetone.....	monocl.	C _{2h} ⁶	14.2, 7.50, 16.4, $\beta = 98^\circ 38'$	4
Cupric formate + 2H ₂ O....	monocl.	C _{2h} ⁵	8.952, 6.726, 8.235	4
Gallium acetylacetone (α)...	monocl.	C _{2h} ⁵	14.0, 7.63, 16.3, $\beta = 99^\circ 12'$	4
acetylacetone (β)....	rhomb.	C _{2v} ⁷	8.20, 13.1, 16.3	4
acetylacetone (γ)....	rhomb.	C _{2v} ⁹	15.71, 13.74, 32.76	16
Germanium tetraphenyl.....	tetr.	V _d ⁴	11.60, ..., 6.85	2
Indium acetylacetone.....	rhomb.	C _{2v} ⁷	8.24, 13.4, 16.5	4
Iron acetylacetone.....	rhomb.	C _{2v} ⁹	15.74, 13.68, 33.0	16
Lead formate.....	rhomb.	V ⁴	6.52, 8.75, 7.41	4
tetraphenyl.....	tetr.	V _d ⁴	12.06, ..., 6.50	2
Lithium acetate.....	rhomb.	.....	12.80, 11.63, 7.43	12
butyrate.....	hex.	.....	27.7, ..., 10.1	48
iso-butyrate.....	tetr.	.....	19.75, ..., 9.25	24
caprylate.....	hex.	.....	42.1, ..., 10.9	72
crotonate.....	hex.	.....	24.8, ..., 10.7	48
formate.....	monocl.	.....	7.61, 6.03, 4.87, $\beta = 95^\circ 42'$	4
formate + H ₂ O.....	rhomb.	C _{2v} ⁹	6.49, 10.01, 4.85	4
heptylate.....	tetr.	.....	27.4, ..., 9.3	32
laurate.....	tetr.	.....	28.3, ..., 11.7	24
nonylate.....	tetr.	.....	36.6, ..., 9.3	48
oleate.....	hex.	.....	64.6, ..., 9.5	72
oxalate.....	rhomb.	.....	6.58, 7.74, 6.61	4
propionate.....	rhomb.	.....	16.98, 12.15, 9.45	16
stearate.....	hex.	.....	62.5, ..., 9.8	72
trimethylacetate.....	cub.	.....	18.56	36
undecylate.....	tetr.(?)	.....	41.8, ..., 9.2	48
undecylenate.....	hex. (?)	.....	52.6, ..., 9.5	72
valerate.....	tetr.(?)	.....	24.5, ..., 9.4	32
iso-valerate.....	rhomb.(?)	.....	11.7, 8.70, 6.93	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Manganese acetylacetone.....	monocl.		14.1, 7.68, 16.5, $\beta = 99^\circ 24'$	4
Potassium acid chloromaleate..	rhomb.	V_h^{16}	7.62, 15.74, 10.95	8
bitartrate.....			7.614, 10.70, 7.80	4
borotartrate.....	rhomb.	V_2	4.88, 18.00, 7.65	2
chlorosulfoacetate.....	rhomb.	V_h^{14}	8.58, 8.60, 23.76	8
mesotartrate + $2H_2O$	tricl.		7.02, 6.90, 11.02, $\alpha = 95^\circ 44'$, $\beta = 102^\circ 52'$, $\gamma = 61^\circ 46'$	2
rhodium oxalate.....	hex.	D_3^4 or D_3^6	11.28, ..., 20.25	6
Rubidium tartrate.....	hex.	D_3^4 or D_3^6	7.17, ..., 13.19	3
Scandium acetylacetone.....	rhomb.	C_{2v}^7 or V_h^{13}	8.20, 13.52, 16.15	4
Silicon tetraphenyl.....	tetr.	V_d^4 or D_{4h}^8	11.50, 6.97	2
Silver uranyl acetate.....	tetr.	C_{4h}^6	12.98, ..., 28.10	16
Sodium acid acetate.....	cub.	T_h^7	15.9	24
palmitate (α) (below $42.7^\circ C$)	rhomb.	D_{2h}^9	8.06, 9.24, 47.70	8
palmitate (β) (above $42.7^\circ C$)	monocl.	C_{2h}^3	7.83, 5.40	4
stearate (α) (below $51.5^\circ C$)	rhomb.	D_{2h}^9	8.04, 9.24, 51.77	8
stearate (β) (above $51.5^\circ C$)	monocl.	C_{2h}^3	7.80, 5.33,	4
uranyl acetate.....	cub.	T^4	10.670	4
Strontium formate.....	rhomb.	V^4	6.86, 8.72, 7.24	4
formate + $2H_2O$	rhomb.	V^4	7.30, 11.99, 7.13	4
Thallium mesotartrate.....	tricl.		13.26, 16.12, 7.63, $\alpha = 75^\circ 54'$, $\beta = 86^\circ 37'$, $\gamma = 82^\circ 14'$	4
Tin tetraphenyl.....	tetr.	V_d^4	11.83, ..., 6.42	2

ORGANIC COMPOUNDS

Acenaphthene.....	rhomb.		8.32, 14.15, 7.26	4
Acetaldehyde ammonia	hex.	D_{3d}^5	8.18, $\alpha = 84^\circ 50'$	6
Acetamide.....	hex.	C_{3v}^6	8.05, $\alpha = 91^\circ 17'$	6
Acetonyl pyrrole.....	tetr.	C_4^2 or C_4^4	10.09, ..., 23.85	4
Acetoxybisorallochol- anic acid	monocl.		57.1, 7.69, 19.45, $\beta = 97.5^\circ$	
Acetylenedicarboxylic acid	monocl.		7.88, 9.04, 6.62, $\beta = 111^\circ 6'$	4
Acetylsalicylic acid....	monocl.	C_{2h}^5	11.37, 6.54, 11.37, $\beta = 95.7^\circ$	4
Adipic acid	monocl.	C_{2h}^5	10.27, 5.16, 10.02, $\beta = 137^\circ 5'$	2

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Aminoazobenzene (p) ..	monocl.	.....	13.69, 5.604, 14.18, $\beta = 81^\circ 49'$	4
Aminophenol (o)	rhomb.	V_h^{15}	7.26, 7.71, 19.51	8
Aminophenol (m)	rhomb.	C_{2v}^4	6.14, 11.10, 8.38	4
Aminophenol ($\alpha - p$) ..	rhomb.	C_{2v}^5	8.25, 5.32, 13.06	4
Aminophenol ($\beta - p$) ..	rhomb.	C_{2v}^1	12.07, 11.85, 5.82	6
Anthracene	monocl.	C_s^4	8.58, 6.02, 11.18, $\beta = 125^\circ$	2
Anthranilic acid I	rhomb.	V_h^{11}	.....	8
Anthranilic acid II	rhomb.	V_h^8	.....	8
Anthraquinone	rhomb.	V_h^{13}	12.05, 15.05, 2.69	2
Arabinose	rhomb.	V^4	6.48, 19.30, 4.81	4
Azelaic acid (α)	monocl.	C_{2h}^5	9.72, 4.83, 27.14, $\beta = 129^\circ 30'$	4
Azelaic acid (β)	monocl.	C_{2h}^2	5.61, 9.58, 27.20, $\beta = 136^\circ 30'$	4
Azobenzene	monocl.	C_{2h}^5	12.65, 6.06, 15.60, $\beta = 114^\circ 24'$	4
Azotoluene (o)	monocl.	C_{2h}^5	13.93, 6.604, 14.55, $\beta = 101^\circ 4'$	4
Azoxyphenetol (p)	monocl.	.....	15.9, 5.42, 17.5, $\beta = 94^\circ 20'$	4
Behenic acid	monocl.	C_{2h}^4 or C_{2h}^5	9.551, 4.886, 59.10, $\beta = 53^\circ 30'$	4
Benzanthracene (1:2) ..	monocl.	C_2^2	7.91, 6.43, 23.96, $\beta = 99^\circ$	4
Benzanthracene (2:3) ..	tricl.	.....	7.94, 6.02, 13.5, $\alpha = 80^\circ 40'$, $\beta = 67^\circ 50'$, $\gamma = 92^\circ 40'$	2
Benzene ($-20^\circ C$)	rhomb.	V_h^{15}	9.76, 7.39, 6.85	4
Benzene hexabromide ..	monocl.	C_{2h}^4	8.44, 4.04, 17.3, $\beta = 116^\circ 30'$	2
Benzene hexachloride ..	monocl.	C_{2h}^4	8.10, 3.86, 16.68, $\beta = 116^\circ 50'$	2
Benzil	hex.	D_3^4 or D_3^6	8.15,, 13.46	3
Benzoic acid	monocl.	.....	5.44, 5.18, 21.6, $\beta = 97^\circ 5'$	4
Benzophenone .....	.....	D_2^4	10.17, 12.06, 7.98	4
Brassylic acid	monocl.	C_{2h}^5	9.63, 4.82, 37.95, $\beta = 128^\circ 20'$	4
Bromostearic acid	monocl.	C_{2h}^4 or C_{2h}^5	11.039, 4.904, 52.84, $\beta = 43^\circ 17'$	4
Carotene (β)	monocl.	C_{2h}^5	7.75, 9.5, 25.0, $\beta = 105^\circ$	2
Catechol	monocl.	C_{2h}^3	17.46, 10.74, 5.48, $\beta = 94^\circ 15'$	8
Cellobiose (d)	monocl.	C_2^2	5.00, 13.2, 11.1, $\beta = 90^\circ$	2
Cellulose	tetr.	.....	7.79,, 10.26	4
Cellulose hydrate	monocl.	.....	8.14, 10.3, 9.14, $\beta = 62^\circ$	4
Cellulose natural	monocl.	.....	8.3, 10.3, 7.9, $\beta = 84^\circ$	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Cetyl palmitate	monocl.	C _{2h} ⁵	5.61, 7.42, 88.79, $\beta = 61.3^\circ$	4
Chlorobromobenzene	monocl.		15.15, 4.12, 5.81, $\beta = 113^\circ 9'$	2
Chloronaphthalene	monocl.		8.245, 10.1, 15.78, $\beta = 116^\circ 12'$	4
tetrachloride (α)			20.8, 11.27, 10.72, $\beta = 90^\circ$	
Cholestane dibromide			19.6, 7.62, 7.9, $\beta = 93^\circ$	
Cholestanedione			16.3, 9.35, 17.5, $\beta = 73.6^\circ$	
Cholesteryl acetate			8.34, 6.18, 25.0, $\beta = 115.8^\circ$	4
Chrysene	monocl.	C _{2h} ⁶	11.65, 14.10, 4.26, $\beta = 98^\circ 36'$	4
Cinnamic acid (<i>trans</i>)	monocl.		7.90, 6.74, 9.04, $\beta = 90^\circ$	4
Cyanuric acid	pseud. rhomb.	C _{2h} ⁶	8.73,, 5.96	4
Cyanuric triazide	hex.			2
Cyclohexane- α -diol-1,2	rhomb.	V _h ¹⁵	7.62, 8.55, 19.57	8
Cyclohexane- β -diol-1,4	monocl.	C _{2h} ⁵	6.32, 21.2, 7.27, $\beta = 96.0^\circ$	6
Cyclohexane- γ -diol-1,2	monocl.	C _{2h} ⁶	19.13, 9.92, 7.23, $\beta = 103.9^\circ$	8
Cyclohexyl diacetate-1,4 (β)	monocl.	C _{2h} ⁵	13.56, 5.83, 6.72, $\beta = 107.4^\circ$	2
Cyclopentenophenanthrene (1: 2-)	monocl.	C _{2h} ⁵	18.38, 5.83, 23.61, $\beta = 114.3^\circ$	8
Dibenzalpentaaerythritol	hex.	D ₆ ⁴	6.03,, 36.7	3
Dibenzcarbazole (1: 2: 5: 6-)	rhomb.	D _{2h} ¹⁵ (?)	31.10, 9.65, 26.61, $\beta = 90^\circ$	24
Dibenzcarbazole (1: 2: 7: 8-)	monocl.	C _{2h} ² (?)	14.63, 7.64, 12.08, $\beta = 96^\circ$	4
Dibenzcarbazole (1: 2: 7: 8-)	rhomb.	D ₂ ⁷ (?)	10.27, 10.26, 50.5, $\beta = 90^\circ$	16
Dibenzcarbazole (3: 4: 5: 6-)	rhomb.	D ₂ ⁵ (?)	14.07, 6.10, 15.36, $\beta = 90^\circ$	4
Dibenzyl	monocl.	C _{2h} ⁵	12.82, 6.18, 7.74, $\beta = 116^\circ$	2
Dibromobenzene (<i>p</i>)	monocl.		15.46, 4.11, 5.80, $\beta = 112^\circ 38'$	2
Dibromotetramethylethane (<i>sym.</i>)	tetr.		10.45,, 8.14	4
Dichlorobenzene (<i>p</i>)	monocl.		14.83, 4.10, 5.88, $\beta = 112^\circ 30'$	2
Dichloronaphthalene tetrachloride	monocl.	C _s ⁴	7.8, 12.3, 13.9, $\beta = 116^\circ 14'$	4
Dicyanodiamide	monocl.	C _{2h} ³	13.8, 4.4, 6.2, $\beta = 90^\circ 35'$	4
Diethyl phthalyl ketone	tetr.	D _{4h} ¹⁰	7.25,, 20.47	4
Diiodoethane (<i>sym.</i>)	monocl.	C _{2h} ⁵		2
Diiodoethane (<i>sym.</i>)	rhomb.	V _h ¹⁸	7.582, 12.897, 5.810	4
Diiodoethylene (<i>sym.</i>)	monocl.	C _{2h} ⁵		2
Diiodoethylene (<i>sym.</i>)	rhomb.	V _h ¹⁸	7.280, 13.310, 5.553	4
Dimesityl	monocl.	C _{2h} ⁵	8.21, 8.58, 22.25, $\beta = 96^\circ 30'$	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Dimethyldiethyl ammonium chlorostannate	tetr.	.....	9.06, , 14.12	2
Dimethylethyl sulfonium chlorostannate	cub.(?)	.....	12.80	
Dimethylurea (1, 2) . . .	rhomb.	C_{2v}^7	4.53, 10.9, 5.14	2
Dinitrobenzene (<i>o</i>)	monocl.	C_{2h}^5	7.95, 13.0, 7.45, $\beta = 112^\circ 7'$	4
Dinitrobenzene (<i>m</i>)	rhomb.	V_h^{16}	13.3, 14.2, 3.82	4
Dinitrobenzene (<i>p</i>)	monocl.	C_{2h}^5	11.3, 5.55, 5.8, $\beta = 92^\circ 18'$	2
4, 6-Dinitro-1, 3-xylo . .	monocl.	C_{2h}^2	11.5, 5.49, 7.2, $\beta = 98^\circ$	2
Diphenic acid	rhomb.	.....	14.12, 11.90, 13.75	8
Diphenyl	monocl.	C_{2h}^5	8.11, 5.67, 9.57, $\beta = 94^\circ 30'$	2
Diphenylbenzene (<i>p</i>) . . .	monocl.	.....	8.08, 5.60, 13.59, $\beta = 91^\circ 55'$	2
Diphenylbutadiene	monocl.	C_{2h}^2	7.71, 11.70, 13.31/sin β , $\beta = 97^\circ$	
Diphenylfurazane . . . . .	.....	D_2^4	11.89, 12.95, 6.99	4
Diphenylglyoxime (α) . .	monocl.	C_{2h}^6	25.08, 8.68, 11.92	8
Diphenylglyoxime peroxide	monocl.	C_{2h}^5	12.85, 6.27, 14.96	4
Distearin (α , α')	hex. (?)	.....	81.5, , 10.8	48
Dulcitol	monocl.	C_{2h}^5	8.61, 11.60, 9.05, $\beta = 113^\circ 45'$	4
Durene	monocl.	C_{2h}^5	11.57, 5.77, 7.03, $\beta = 113.3^\circ$	2
Elaidic acid	tetr. (?)	.....	26.5, , 10.3	16
Ephedrine hydrobromide (<i>d</i>)	rhomb.	V^4	24.68, 6.93, 6.78	
Ephedrine hydrobromide (<i>l</i>)	monocl.	C_2^2	12.74, 6.20, 7.62, $\beta = 100^\circ 48'$	
Ephedrine hydrochloride (<i>d</i>)	rhomb.	V^4	25.49, 6.48, 6.91	
Ephedrine hydrochloride (<i>l</i>)	monocl.	C_2^2	12.64, 6.15, 7.34, $\beta = 102^\circ 6'$	
Ephedrine hydroiodide (<i>d</i>)	rhomb.	V^4	11.39, 6.83, 15.62	
Ephedrine hydroiodide (<i>l</i>)	rhomb.	V^3	25.66, 7.33, 19.14	
Ergosterol acetate . . . . .	.....	.....	34.8, 7.58, 10.48, $\beta = 92.6^\circ$	
Ergosterol acetate-maleic anhydride I	monocl.	C_2^2	31.1, 9.58, 10.60, $\beta = 95.0^\circ$	
Ergosterol acetate-maleic anhydride II	monocl.	C_2^2	32.2, 7.91, 25.3, $\beta = 92.1^\circ$	
Erythritol (<i>i</i>)	tetr.	C_{4h}^6	12.76, , 6.83	8
Ethane	hex.	D_{6h}^4	4.46, , 8.19	2
Ethylene ($-175^\circ C$) . . .	rhomb.	.....	6.46, 4.87, 4.14	2
Ethylene diamine sulfate	tetr.	D_4^4 or D_4^8	5.96, , 17.99	4
Ethylene oxide dicarboxylic acid (<i>cis</i> .)	monocl.	C_{2h}^6	21.50, 6.90, 6.89, $\beta = 91^\circ 10'$	8

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang.	
Eulytine.....	cub.	T_d^6	10.272	1
Fluorene.....	monocl.	C_{2h}^5	8.48, 5.73, 19.24, $\beta = 101^\circ 53'$	4
Fructose (d).....	rhomb.	V^4	8.06, 10.06, 9.12	4
Fumaric acid.....	monocl.	C_{2h}^5	7.60, 15.11, 6.61, $\beta = 111^\circ 5'$	6
Glucose (d).....	rhomb.	V^4	10.40, 14.89, 4.99	4
Glutaric acid (α).....	monocl.	C_{2h}^5	10.34, 5.08, 32.9, $\beta = 129^\circ$	8
Glutaric acid (β).....	monocl.	C_{2h}^5	10.06, 4.87, 17.4, $\beta = 132^\circ 35'$	4
Glycine.....	monocl.	C_{2h}^5	5.1, 11.9, 5.43, $\beta = 111^\circ 38'$	4
Glyoxaline.....	monocl.	C_{2h}^1	7.67, 5.44, 5.12, $\beta = 63^\circ 11'$	2
Glyoxaline-4-sulfonic acid	tetr.	V_d^4	11.08, ..., 9.22	8
Guanidine carbonate..	tetr.	D_4^4 or D_4^8	6.95, ..., 19.45	4
Guanidine dichromate..	monocl.	.....	(0.8232:1:0.6942), $\beta = 100^\circ 0'$	.....
Guanidine monochromate	tricl.	.....	(1.1013:1:1.041) (?), $\alpha = 82^\circ 34'$, $\beta = 90^\circ 10'$, $\gamma = 53^\circ 20'$	.....
Guanidine tartrate (d).....	monocl.	.....	(0.7056:1:0.3366), $\beta = 104^\circ 57'$	2
Guanidine trichromate	monocl.	.....	(1.686:1:2.138), $\beta = 122^\circ 48'$	.....
Guanidonium bromide..	rhomb.	V_h^{16}	6.77, 8.64, 8.305	4
Guanidonium iodide...	hex.	C_{6v}^4	7.19, ..., 12.30	4
Harmine.....	rhomb.	.....	19.22, 9.57, 5.78	4
Hexaminobenzene.....	cub.	O_h^3	15.14	16
Hexabromobutylene...	monocl.	C_{2h}^5	11.5, 6.40, 10.0, $\beta = 44^\circ 27'$	2
Hexachlorethane (above $71^\circ C$)	cub.	.....	7.43	2
Hexachlorobenzene...	monocl.	C_{2h}^5	8.07, 3.84, 16.61, $\beta = 116^\circ 52'$	2
Hexachloroethane.....	rhomb.	V_h^{16}	11.51, 10.14, 6.39	4
Hexadecanedicarboxylic acid	monocl.	C_{2h}^5	9.76, 4.92, 25.10, $\beta = 131^\circ 10'$	2
Hexaethylbenzene.....	tricl.	.....	9.90, 9.84, 6.10, $\alpha = 58^\circ 5'$, $\beta = 103^\circ 54'$, $\gamma = 123^\circ 43'$	1
Hexahydrobenzene hexabromide (β)	cub.	T_h^6	10.49	4
Hexahydrobenzene hexachloride (β)	cub.	T_h^6	10.07	4
Hexamethylbenzene...	tricl.	C_i^1	9.01, 8.926, 5.344, $\alpha = 44^\circ 27'$, $\beta = 116^\circ 43'$, $\gamma = 119^\circ 34'$	1
Hexamethylethane (above $-125^\circ C$)	cub.	.....	7.69	2
Hexamethylenetetramine	cub.	T_d^4	7.02	2
Hexane ($\alpha - n$).....	rhomb.	.....	3.51, 4.26, 11.6	1

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Hexane ($\beta - n$).....	monocl.		3.87, 4.61, 12.0, $\beta = 120^\circ$	1
Hydrazobenzene.....	rhomb.		11.10, 9.93, 9.33	4
Hydrobenzoin, <i>iso</i>	monocl.	C_2^2	12.40, 7.92, 5.81, $\beta = 92^\circ 53'$	2
Hydrocinnamic acid....	monocl.		12.90, 9.20, 6.98, $\beta = 103^\circ 36'$	4
Hydroquinol.....	monocl.		13.58, 5.22, 8.13, $\beta = 107^\circ$	4
Hydroxycholestenone dibromide			15.35, 7.58, 11.55, $\beta = 93.7^\circ$	
Iodobenzoic acid (<i>o</i>)...	monocl.	C_{2h}^6	11.30, 15.17, 4.336, $\beta = 90^\circ 43' 47''$	4
Iodobenzoic acid (<i>m</i>)..	monocl.	C_{2h}^6	6.206, 4.683, 25.14	4
Iodoform.....	hex.	C_6^6 or C_{6h}^2	6.87	2
Iodosuccinimide.....	tetr.	C_4^2 or C_4^4	6.29, ..., 15.55	4
Inositol (<i>i</i>).....	monocl.	C_{2h}^5	6.64, 12.0, 19.7, $\beta = 105.8^\circ$	8
Inositol (<i>l</i>).....	monocl.	C_2^2	6.17, 9.11, 6.83, $\beta = 106.6^\circ$	2
Inositol dihydrate (<i>i</i>)..	monocl.	C_{2h}^5	8.98, 16.59, 6.49, $\beta = 109.8^\circ$	4
Lauric acid.....	monocl.	C_{2h}^1	9.73, 4.98, 36.9, $\beta = 48^\circ 6'$	4
Malachite.....	monocl.	C_{2h}^5	9.38, 11.95, 3.18, $\beta = 91^\circ 3'$	4
Maleic acid.....	monocl.	C_{2h}^5	7.49, 10.14, 7.12, $\beta = 117^\circ 7'$	4
Maleic anhydride.....	rhomb.		6.58, 11.43, 5.90	4
Malonic acid.....	tricl.	C_1^1	8.36, 5.33, 5.14, $\alpha = 94^\circ 56'$, $\beta = 103^\circ 56'$, $\gamma = 71^\circ 30'$	2
Malonic acid (α).....	rhomb.		8.70, 11.53, 17.05, $\beta = 90^\circ$	16
Mannitol (<i>d</i>).....	rhomb.	V_4	8.66, 16.58, 5.501	4
Mannose.....	rhomb.	Q_4	7.62, 18.18, 5.67	4
Metaldehyde.....	tetr., b.c.	C_4^5	10.40, ..., 4.11	8
Methane.....	cub.	T_d^2	5.89	4
7-Methoxy-1:2-cyclopentenophenanthrene	monocl.	C_{2h}^5	29.9, 5.68, 8.49, $\beta = 117.5^\circ$	4
7-Methoxy-3':3'-dimethyl-1:2-cyclopentenophenanthrene	monocl.	C_{2h}^5	8.75, 6.21, 28.02, $\beta = 95.0^\circ$	4
Methylbixin.....	monocl.	C_{2h}^5	10.56, 13.4, 20.62	4
Methyl glycoside (α)..	rhomb.		10.80, 14.60, 5.61	4
Methyl oxalate.....	monocl.	C_{2h}^2	3.93, 11.84, 6.17, $\beta = 103^\circ 22'$	2
Methyl tartrate.....	rhomb.	V_2	18.50, 10.00, 8.45	8
Methyl urea.....	rhomb.	V_4	6.89, 6.96, 8.45	4
Methyl xyloside ($\beta - d$)	monocl.	C_2^2	7.82, 6.89, 7.74, $\beta = 113^\circ 10'$	2
Monoamyl ammonium bromide (<i>n</i>)	tetr.		5.00, ..., 16.95	

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Monoamyl ammonium chloride (<i>n</i>)	tetr.	.....	5.01, , 16.69	
Monoamyl ammonium iodide (<i>n</i>)	tetr.	.....	5.18, , 17.42	
Monobutyl ammonium bromide (<i>n</i>)	tetr.	.....	5.02, , 15.23	
Monobutyl ammonium chloride (<i>n</i>)	tetr.	.....	5.02, , 14.85	
Monobutyl ammonium iodide (<i>n</i>)	tetr.	.....	5.18, , 15.30	
Monodecyl ammonium iodide (<i>n</i>)	tetr.	.....	5.18, , 28.09	
Monoethyl ammonium bromide	monocl.	.....	8.32, 6.24, 4.63, $\beta = 86^\circ 59'$	
Monoethyl ammonium chloroplatinate	hex.	.....	7.13, , 8.53	
Monoethyl ammonium chlorostannate	hex.	.....	7.24, , 8.41	
Monoethyl ammonium iodide	monocl.	.....	8.68, 6.63, 4.81, $\beta = 87^\circ 54'$	
Monoheptyl ammonium chloride (<i>n</i>)	tetr.	.....	4.96, , 21.09	
Monoheptyl ammonium iodide (<i>n</i>)	tetr.	.....	5.18, , 21.82	
Monoheptyl ammonium bromide (<i>n</i>)	tetr.	.....	4.93, , 19.78	
Monoheptyl ammonium chloride (<i>n</i>)	tetr.	.....	4.98, , 19.55	
Monoheptyl ammonium iodide (<i>n</i>)	tetr.	.....	5.18, , 19.50	
Monomethyl ammonium aluminum alum	cub.	.....	12.44	
Monomethyl ammonium bromide	tetr.	.....	5.09, , 8.76	
Monomethyl ammonium chloride	tetr.	.....	4.28, , 5.13	
Monomethyl ammonium chloroplatinate	hex.	.....	8.31, $\alpha = 48^\circ 46'$	
Monomethyl ammonium chlorostannate	hex.	.....	8.42, $\alpha = 50^\circ 14'$	
Monomethyl ammonium iodide	tetr.	.....	5.11, , 8.97	
Monomethyl triethyl ammonium chlorostannate	cub.	.....	13.51	
Monomethyl triethyl phosphonium chlorostannate	cub.	.....	13.93	
Monooctyl ammonium iodide (<i>n</i>)	tetr.	.....	5.18, , 23.70	
Monopropyl ammonium bromide (<i>n</i>)	tetr.	.....	4.57, , 7.36	
Monopropyl ammonium chloride (<i>n</i>)	tetr.	.....	4.48, , 7.40	
Monopropyl ammonium iodide (<i>n</i>)	tetr.	.....	4.85, , 7.33	
Myristic acid	hex.	.....	57.4, , 11.4	72
Naphthalene	monocl.	C_{2h}^5	8.34, 5.98, 8.68, $\beta = 122^\circ 44'$	2
Naphthalene tetrabromide	monocl.	C_2^4	10.75, 8.97, 13.25, $\beta = 112^\circ 57'$	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Naphthalene tetra- chloride	monocl.	C_s^4	7.88, 10.30, 14.20, $\beta = 112^\circ 40'$	4
Naphthol (α)	monocl.		13.1, 4.9, 13.4, $\beta = 117^\circ 10'$	4
Naphthol (β)	monocl.		11.70, 4.28, 17.4, $\beta = 119^\circ 48'$	4
Nitroaniline (<i>o</i>)	rhomb.	V_h^{17}	10.09, 29.44, 8.52	16
Nitroaniline (<i>m</i>)	rhomb.	C_{2v}^5	19.23, 6.48, 5.06	4
Nitrotoluene (<i>p</i>)	rhomb.	V_h^1	10.1, 11.18, 12.3	8
Nonicosane	rhomb.	V_h^{16}	7.45, 4.97, 77.2	4
Octane ($\alpha - n$)	rhomb.		3.50, 4.36, 15.0	1
Octane ($\beta - n$)	monocl.		3.87, 4.72, 14.4, $\beta = 120^\circ$	1
Oxalic acid + 2H ₂ O	monocl.		6.12, 3.61, 12.03, $\beta = 106^\circ 12'$	2
Palmitic acid (α)			9.41, 5.00, 45.9, $\beta = 50^\circ 50'$	4
Pentabromofluorethane	rhomb.	V_h^{16}	11.84, 10.75, 6.55	4
Pentaerythritol	tetr.	C_{4v}^9	6.16, , 8.76	2
Pentaerythritol tetra- acetate	tetr.	C_{4h}^4	12.18, , 5.58	2
Pentaerythritol tetra- formate	rhomb.	V_h^{15}	19.80, 9.90, 11.70	8
Pentaerythritol tetra- nitrate	tetr.	V_d^4	9.38, , 6.69	2
Pentamethylethanol	rhomb.	C_{2v}^{21}	21.35, 10.77, 7.84	8
Pentane ($\alpha - n$)	rhomb.		3.35, 4.31, 10.3	1
Pentane ($\beta - n$)	monocl.		3.86, 4.61, 10.0, $\beta = 120^\circ$	1
Pentatriacontane	rhomb.	V_h^{16}	7.43, 4.97, 46.2	2
Phenanthrene	monocl.		8.60, 6.11, 19.24, $\beta = 98^\circ 15'$	4
Phenylacetic acid	monocl.	C_{2h}^5	14.2, 4.90, 10.1, $\beta = 101^\circ$	4
Phenylaminoacetic acid (<i>acel.</i>)	rhomb.	C_{2v}^5	15.2, 5.05, 9.66	4
Phenylbutyric acid (γ)	monocl.	C_{2h}^5	17.8, 4.90, 10.3, $\beta = 98^\circ 30'$	4
Phenylpropionic acid (β) (hydrocinnamic acid)	monocl.	C_{2h}^5	32.2, 9.83, 5.54, $\beta = 101^\circ 13'$	8
Phenylvaleric acid (δ)	monocl.		(?), 7.13, 11.32	4
Phenylene diamine (<i>o</i>)	monocl.	C_{2h}^4	7.74, 7.56, 11.76, $\beta = 121^\circ 10'$	4
Phenylene diamine (<i>m</i>)	rhomb.	V_h^1	11.97, 8.14, 23.61	16
Phenylene diamine (<i>p</i>)	monocl.	C_{2h}^2	8.29, 5.93, 24.92, $\beta = 112^\circ 58'$	8
Phthalic acid (<i>o</i>)	monocl.		9.33, 7.13, 5.10, $\beta = 94^\circ 36'$	2
Phthalic anhydride (<i>o</i>)	rhomb.		7.74, 13.66, 5.86	4
Phthalocyanine	monocl.	C_{2h}^5	19.85, 4.72, 14.8, $\beta = 122.25^\circ$	2
Picric acid	rhomb.	C_{2v}^5	9.25, 19.08, 9.68	8

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Pimelic acid	monocl.	C_{2h}^5	9.93, 4.82, 22.12, $\beta = 130^\circ 40'$	4
Pyrene trinitrobenzene	tricl.		6.7, 8.4, 16, $\alpha = 87^\circ$, $\beta = 84^\circ$, $\gamma = 77^\circ$	2
Quaterphenyl	monocl.	C_{2h}^5	8.05, 5.55, 17.81, $\beta = 95.8^\circ$	2
Quercitol	monocl.		6.83, 8.53, 6.45, $\beta = 110^\circ 57'$	2
Quinol (α)	hex.	C_{3i}^1	22.07, , 5.62	18
Quinol (β)	hex.	C_i^1	16.24, , 5.53	9
Quinol (γ)	monocl.	C_{2h}^5	13.24, 5.20, 8.11, $\beta = 73^\circ$	4
Quinone (α)	monocl.		11.40, 6.43, 6.85, $\beta = 93^\circ 20'$	4
Resorcinol	rhomb.	C_{2v}^9	9.56, 10.5, 5.68	4
Rhamnose hydrate . . .	monocl.	C_2^2	7.84, 7.84, 6.61	2
Saccharose	monocl.		10.65, 8.70, 8.00, $\beta = 105^\circ 44'$	2
Salicylic acid	monocl.		11.56, 11.22, 4.93, $\beta = 91^\circ 23'$	4
Sebacic acid	monocl.	C_{2h}^5	10.05, 4.96, 15.02, $\beta = 133^\circ 50'$	2
Sorbose	rhomb.	V^4	6.12, 18.24, 6.43	4
Stearic acid	monocl.	C_{2h}^4 or C_{2h}^5	5.546, 7.381, 48.84, $\beta = 63^\circ 38'$	4
Stearic acid (β)			5.68, 7.39, 50.7, $\beta = 60^\circ$	4
Stearolic acid	monocl.	C_{2h}^4 or C_{2h}^5	9.551, 4.686, 49.15, $\beta = 53^\circ 4'$	4
Stilbene	monocl.	C_{2h}^5	12.42, 5.73, 16.0, $\beta = 114^\circ$	4
Stilbene	pseud. rhomb.		12.20, 5.72, 29.0	
Strychnine	rhomb.	V^4	11.92, 12.13, 11.30	4
Suberic acid	monocl.	C_{2h}^5	10.12, 5.06, 12.58, $\beta = 135^\circ 0'$	2
Succinic acid (α)	monocl.	C_{2h}^3	5.70, 26.2, 7.57, $\beta = 115^\circ 45'$	8
Succinic acid (β)	monocl.	C_{2h}^2	5.06, 8.81, 7.57, $\beta = 133^\circ 37'$	2
Succinic anhydride . . .	rhomb.	C_{2v}^1 or V_h^1	6.95, 11.66, 5.41	4
Succinimide	rhomb.	V_h^1	7.50, 9.60, 12.75	8
Tartaric acid (<i>dI</i>) . . .	tricl.	C_i^1	7.18, 9.71, 4.98, $\alpha = 82^\circ 20'$, $\beta = 118^\circ 0'$, $\gamma = 72^\circ 58'$	2
Tartaric acid (<i>dI</i>) + H_2O	tricl.	C_i^1	8.09, 10.03, 4.81	2
Tartaric acid (<i>d</i>)	monocl.	C_2^2	7.70, 6.04, 6.20, $\beta = 100^\circ 17'$	2
Tartaric acid (<i>meso</i> -) . .	tricl.		9.24, 6.33, 5.45, $\alpha = 70^\circ 30'$, $\beta = 78^\circ 0'$, $\gamma = 79^\circ 30'$	2
Tartramic acid	rhomb.	V_2	12.30, 7.96, 6.00	4
Tartramide	rhomb.	V_1	10.0, 12.2, 4.90	4
Tetrabromodimethyl-ethane	tetr.		8.806 , 11.27	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			a, b, c, Ax. ang	
Tetrabromodimethyl-ethane	rhomb.	V_h^{16}	11.70, 10.44, 6.57	4
Tetracarboic acid methane, tetramethyl ester	tetr.	C_{4h}^2	9.12, , 7.02	2
Tetrachlorodibromomethane (<i>sym.</i>)	rhomb.	V_h^{16}	11.73, 10.37, 6.50	4
Tetrachlorodibromomethane (<i>unsym.</i>)	rhomb.	V_h^{16}	11.61, 10.35, 6.51	4
Tetraethyl ammonium iodide	tetr.	S_4^2	8.87, , 6.95	
Tetramethyl ammonium bromide	tetr.	D_{4h}^7	7.76, , 5.53	
Tetramethyl ammonium perchlorate	tetr.	.....	8.290, , 6.006	
Tetramethyl ammonium chloride	tetr.	D_{4h}^7	7.78, , 5.53	
Tetramethyl ammonium chloroplatinate	cub.	.....	12.65	
Tetramethyl ammonium chlorostannate	cub.	O_h^5	12.87	4
Tetramethyl ammonium fluosilicate	tetr.	C_{4h}^5	7.88, , 11.19	2
Tetramethyl ammonium iodide	tetr.	D_{4h}^7	7.96, , 5.75	
Tetramethyl ammonium permanganate	tetr.	D_{4h}^7	8.439, , 6.019	2
Tetramethyl ammonium methane	cub.	O_h^7	12.48	8
Tetranitromethane . . .	cub.	T^4 or T_d^1	9.2	4
Tetraphenyl methane . .	tetr.	V_d^4	10.86	2
Thallic dimethyl bromide	tetr., b.c.	D_{4h}^{17}	4.47, , 13.78	2
Thallic dimethyl chloride	tetr., b.c.	D_{4h}^{17}	4.29, , 14.01	2
Thallic dimethyl iodide	tetr., b.c.	D_{4h}^{17}	4.78, , 13.43	2
Thiophene (-170°C) . .	tetr.	.....	7.22, , 9.53	4
Thiourea	rhomb.	V_h^{16}	5.50, 7.68, 8.57	4
Tolane	pseud. rhomb.	.....	12.80, 5.68, 28.4	
Toluidine (<i>o</i>)	rhomb.	V^4	6.50, 7.48, 23.62	4
Toluidine (<i>p</i>)	rhomb.	.....	5.98, 9.05, 23.3	8
Toluolsulfamide (<i>o</i>) . . .	tetr.	C_{4h}^6	18.8, , 9.15	16
Tribromobenzonitrile (2,4,6)	monocl.	C_{2h}^2	12.50, 10.30, 4.87, $\beta = 135^\circ 36'$	2
Trichlorotribromomethane	rhomb.	V_h^{16}	11.77, 10.44, 6.54	4
Triethyl ammonium bromide	hex.	.....	8.56, , 7.49	
Triethyl ammonium chloride	hex.	.....	8.38, , 7.08	
Triethyl ammonium iodide	hex.	.....	8.78, , 7.74	
Triethyl methyl ammonium chlorostannate	cub.	.....	13.51	4
Trimethyl ammonium chlorostannate	cub.	T_h^6	12.19	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants	Mol.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.	
Trimethyl ethyl ammonium chlorostannate	cub.	T_b^d	13.17	4
Trimethyl sulfonium chlorostannate	cub.		12.41	
Trimethylene trinitro-amine	rhomb.	V_b^1	11.63, 13.25, 10.78	8
Trinitrocellulose	monocl.		13.9, 25.6, 9.0, $\beta = 90^\circ$	
Triphenyl	monocl.	C_{2h}^5	8.14, 5.64, 14.1, $\beta = 105^\circ$	2
Triphenylbenzene (<i>sym.</i>)	rhomb.	V_b^{16}	11.12, 19.8, 7.6	4
Triphenylbenzene (<i>sym.</i>) (1-3-5-)	rhomb.	C_{2v}^9	7.55, 19.76, 11.22	4
Triphenyl bromomethane	hex.	D_{3d}^5	10.8, $\alpha = 81^\circ 30'$	3
Triphenylene	rhomb.		13.20, 16.81, 5.26	4
Triphenylcarbinol	hex.		16.5,, 8.8	6
Triphenylmethane	rhomb.		15.16, 26.25, 7.66	8
Triphenyl methanol	hex.	D_{3d}^5	11.1, $\alpha = 107^\circ 42'$	3
Tyrosine hydrochloride (<i>d</i>)	monocl.	C_2^2	5.03, 8.97, 22.50, $\beta = 101^\circ 28'$	4
Urea	tetr.	V_d^3	5.670,, 4.726	2
Veronal	rhomb.	V_h^{17}		4
Xylose	rhomb.	V^4	9.21, 12.48, 5.56	4

X-RAY CRYSTALLOGRAPHIC DATA

SUPPLEMENTARY TABLE

The following data have been reported since the original compilation.
Key to references will be found at the end of the Table.

THE ELEMENTS

Substances	System, structure, type	Space group	Lattice constants	Atoms	Refs.
			<i>a</i> , <i>b</i> , <i>c</i> , Ax. ang.		
Au (20°)	cub.		4.0700		ZK (1)
Be	hex.		5.12,, 15.77		GC (1)
Li (20°C)	cub. b.c.	Oh_9	3.502		ZC (7)
Na (20°C)	cub. b.c.		4.282	2	ZK (2)
Ni (170°C)	hex.		2.65,, 4.32		CR (1)
U	rhomb.	V_h^{17}	2.852, 5.865, 4.945	4	AC (1)

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

INORGANIC COMPOUNDS

Substance	System, structure, type	Space group	Lattice constants				Mol.	Refs.
			a,	b,	c,	Ax. ang.		
Ag ₂ Te.....	rhomb.	D _{6h} ¹	13.0, 12.7, 12.2				57	UT (1)
AgClO ₃	tetr.	C _{4h} ⁶	8.486, 7.894, 4.37				8	ZK (39)
AlB ₁₂	monocl.	C ₃ ² or C ₃ ³	8.50, 10.98, 9.40, 110° 54'				lg. no.*	ZK (15)
AlB ₁₂	pseudo-cub.		14.50, 14.30				lg. no.*	ZK (15)
AlB ₁₂	tetr.	C ₄ ⁶ , D ₄ ⁴	10.28,, 14.30				lg. no.*	ZK (15)
AlKFe(CN) ₆	cub.		9.78					GC (2)
Al ₂ Ca.....	cub.	O _h ⁷	8.02					ZK (16)
AuPr ₂ CN.....	rhomb.	C _{2v} ⁵	17.06, 22.36, 10.0				16	PI (2)
Bi ₂ O ₃	monocl.	C ₂ ¹ or C ₂ ²	5.83, 8.14, 7.48, β = 67°.07				4	AK (1)
Ca ₃ Al ₂ O ₆	cub.		15.24				24	JR (1)
CoSb ₂	rhomb.	V _h ¹²	3.20, 5.78, 6.41					ZC (1)
Co ₂ Fe(CN) ₆	cub.		10.1					GC (2)
CrAs.....			3.479, 6.210, 5.730					ZC (3)
Cr ₂ As.....			3.613, 6.33					ZC (3)
Cr ₃ P.....	tetr.	S ₄ ²	9.12,, 4.56				8	ZC (4)
Cs ₂ CuCl ₄	rhomb.	D _{2h} ¹⁶	9.69, 12.33, 7.58				4	ZK (17)
Cs ₂ SnBr ₆	cub., f.c.		10.81				4	ZK (18)
CuCl ₄ .2NH ₃ .(NH ₄) ₂	tetr.		7.74, 8.84					CR (2)
CuMg ₂	rhomb.	D _{2h} ²⁴	5.273, 9.05, 18.21				16	AK (2)
Cu ₂ Cr(CN) ₆	cub.	O _h ⁵	9.91					GC (3)
Cu ₂ Fe(CN) ₆	cub.		10.0					GC (2)
Cu ₃ [Co(CN) ₆] ₂	cub.	O _h ⁵	9.91					GC (3)
C ₂ N ₂ H ₄	monocl.	C _{2h} ⁶	15.00, 4.44, 13.12, β = 115° 20'				8	AC (7)
EuS.....	cub., f.c.	O _h ⁵	5.957				4	ZK (19)
FeKFe(CN) ₆	cub.		10.2					GC (2)
Fe ₂ Fe(CN) ₆	cub.		10.2					GC (2)
HgClC ₂ H ₅ S.....	monocl.	C _{2h} ⁵	9.34, 7.45, 7.81, 82.5				4	AK (3)
HgClCH ₃ S.....	monocl.	C _{2h} ⁵	7.45, 7.37, 7.82, β = 86.4				4	AK (3)
K ₂ CbF ₇	monocl.	C _{2h} ⁵	5.58, 12.67, 8.50, β = 90°				4	AC (8)
K ₂ CdFe(CN) ₆	cub.		10.03					GC (2)
K ₂ HgCl ₄ .H ₂ O.....		D _{2h} ³	8.27, 11.63, 8.89				4	ZK (20)
K ₂ SNBr ₆	tetr.	D ₄ ²	7.43,, 10.61					ZK (18)
K ₂ SnCl ₄ .H ₂ O.....	rhomb.	D _{2h} ¹⁶	8.21, 12.05, 9.10				4	ZK (21)

* Large number.

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System structure, type	Space group	Lattice constants				Mol.	Refs.
			a,	b,	c,	Δx ang.		
K ₂ TaF ₇	monocl.	C _{2h} ⁵	5.58, 12.67, 8.50, $\beta = 90^\circ$				4	AC (8)
K ₂ ZnFe(CN) ₆	cub.	.....	9.98					GC (2)
K ₃ ZrF ₇	cub., f.c.	O _h ⁵	8.95				4	AC (9)
K ₄ Mo(CN) ₈ .2H ₂ O.....	rhomb.	D _{2h} ¹⁶	16.55, 11.70, 8.68				4	AC (10)
KB ₅ O ₈ .4H ₂ O or KB ₃ O ₁₀ H ₂ .(H ₃ O) ₂	rhomb.	C _{2v} ¹⁷	11.08, 11.14, 8.97				4	ZK (22)
KBrCuBr ₂	monocl.	C _{2h} ²	4.28, 14.43, 9.71, $\beta = 108^\circ 23'$					CR (3)
KClI.....	monocl.	C _{2h} ⁵	13.09, 14.18, 4.2, $\beta = 95^\circ 7'$				4	ZK (23)
KHF ₂	tetr.	D ₄	7.98,, 6.74				8	RS (1)
KNO ₃	hex.	C _{3v} ⁵	4.365,, $\alpha = 76^\circ 56'$				1	ZC (5)
LiCl (25°C).....	cub.	O _h ⁵	5.12952				4	ZC (6)
LiOH.H ₂ O.....	monocl.	C _{2h} ³	7.37, 8.26, 3.19, $\beta = 110^\circ 18'$				4	ZK (24)
MnBi.....	hex.	.....	4.3, 6.1				2	CR (4)
Mn ₂ Bi.....	rhomb.	.....	4.30, 5.24, 6.30					ZC (1)
Mn ₃ P.....	tetr.	S ₄ ²	9.160,, 4.599				8	ZC (4)
NaAu ₂ .(18.4°C).....	cub.	O _h ⁷	7.7872				8	ZK (1)
NaBr.....	cub.	O _h ⁵	5.96095				4	ZC (5)
NaBrO ₃	cub.	T ⁴	6.71				4	ZK (25)
NaCN.....	rhomb.	.....	3.74, 4.71, 5.61					ZK (26)
NaNCO.....	hex. (rhbdr.)	C _{3v} ⁵	3.576, 5.10				1	CR (5)
NaHCO ₂	monocl.	C _{2h} ⁵	6.19, 6.72, 6.49, $\beta = 120^\circ 42'$				4	AC (11)
NaN ₃	rhbdr.	.....	5.488,, $\alpha = 38^\circ 43'$					CR (6)
Na ₃ (B ₃ O ₆).....	hex. (rhbdr.)	D _{3d} ⁵	7.22,, $\alpha = 111^\circ 29'$				6	ZK (27)
NH ₄ CdCl ₃	rhomb.	D _{2h} ¹⁶	8.96, 14.87, 3.97				4	AC (12)
NH ₄ BrICl.....	rhomb.	V _h ¹⁶	6.13, 8.50, 9.94					ZK (28)
NH ₄ HgCl ₃	tetr.	.....	4.19,, 7.94					ZK (29)
(NH ₄) ₂ SnBr ₆	cub., f.c.	.....	10.59				4	ZK (18)
(NH ₄) ₃ ZrF ₇	cub. f.c.	O _h ⁵	9.365.....				4	AC (9)
(NH ₄ Cl) ₂ CuCl ₂ .2H ₂ O.....	tetr.	D _{2h} ¹⁴	7.5139,, 8.245					JC (1)
Ni ₂ Fe(CN) ₆	cub.	.....	9.98					GC (2)
Ni ₃ P.....	tetr.	S ₄ ²	8.91,, 4.39				8	ZC (4)
PbBr ₂	rhomb.	D _{2h} ¹⁶	9.48, 8.02, 4.17					ZK (30)
PbP ₂ O ₇ (300°).....	cub. f.c.	T _h ⁶	8.01					GC (4)
PdCl ₂	rhomb.	Pnmm*	3.81, 3.34, 11.0				2	ZK (31)
Pt ₃ O ₄	cub.	.....	6.226				2	JC (2)
Rb ₂ SNBr ₈	cub. f.c.	.....	10.64				4	ZK (18)

* Zurich notation.

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, structure, type	Space group	Lattice constants	Mol.	Refs.
			a, b, c, Ax. ang.		
Rb ₂ S ₂ O ₆	hex. (rhhdr.)	D ₃ ²	10.02, ..., 6.35	3	ZK (32)
ScF ₃	rhhdr.	D ₃ ⁷	5.667, ..., 7.017	1	ZK (33)
ScF ₃	pseudo-cub.	D ₃ ⁷	4.022,, $\beta = 89^\circ 34\frac{1}{2}'$	1	ZK (33)
SrBr ₂	rhomb.	D _{2h} ¹⁶	9.20, 11.42, 4.3	4	ZK (30)
Sr(OH) ₂ ·8H ₂ O.....	tetr.	D _{4h} ⁹	8.97,, 11.55	4	ZK (34)
TeO ₂	monocl.	V _h ¹⁵	5.50, 11.75, 5.59	8	ZK (35)
TlSe.....	tetr.	D _{4h} ¹⁸	8.02,, 7.00		ZK (36)
Tl ₂ S.....	hex.	C ₃ ⁴	12.20, ... 18.17	27	ZK (37)
Zn(SbO ₃) ₂	tetr., b.c.	D _{2d} ⁸	6.585, 0.783	2	ZK (38)

MINERALS

Name	Formula	Crystal system	Space group	Lattice constants	Mol.	Refs.
				a, b, c, Ax. ang.		
Albite...	Na ₂ O·Al ₂ O ₃ ·6SiO	monocl.	.....	7.94, 12.90, 7.12, $\beta = 116^\circ$		ZK (3)
Axinite...	HCa ₃ Al ₂ BSi ₄ O ₁₆	.....	.....	7.13, 8.91, 9.14, $\alpha = 91^\circ 51'$, $\beta = 102^\circ 52'$, $\gamma = 81^\circ 57'$		ZK (4)
Nacrite...	Al ₂ O ₃ ·2SiO ₂ ·2H ₂ O	monocl.	C _s ⁴	8.94, 5.14, 43.0, $\beta = 90^\circ 20'$		ZK (5)
Schizolite.	HNa(Ca,Mn) ₂ Si ₃ O ₉	tricl.	.....	8.09, 7.24, 7.05, $\alpha = 90^\circ$, $\beta = 95^\circ$, $\gamma = 101^\circ 56'$	2	ZK (6)

METAL-ORGANIC COMPOUNDS

Substance	System structure, type	Space group	Lattice constants	Mol.	Refs.
			a, b, c, Ax. ang.		
Cuprous acetate + H ₂ O	monocl.	C _{2h} ⁶	13.176, 8.463, 13.89, $\beta = 117^\circ .06'$	8	UP (1)
Nickel acetate (ous) + 4H ₂ O.....	monocl.	C _{2h} ⁵	8.46, 11.75, 4.754, $\beta = 93^\circ 34'$	2	UP (1)

ORGANIC COMPOUNDS

Acetamide.....	hex.	C _{3v} ⁶	11.44,, 13.49	18	AC (2)
Bromanil.....	monocl.	C _{2h} ⁵	8.62, 6.22, 17.94, $\beta = 102^\circ$	4	ZK (7)

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, structure, type	Space group	Lattice constants				Mol.	Refs.
			a,	b,	c,	Ax. ang.		
Chloranil.....	monocl.	C_{2h}^6	8.77, 5.78, 17.05, $\beta = 103\frac{1}{2}^\circ$				4	ZK (8)
Creatinine.....	monocl.	C_{2h}^1	14.86, 13.14, 5.85, $\beta = 110^\circ 36'$				8	IJ (1)
Cyclohexane (180°)....	cub.	T_h^2	8.41				4	PM (1)
Dicetyl ether.....	monocl.	C_{2h}^5	5.49, 7.45, 86.45, $\beta = 63.2^\circ$				4	ZK (9)
Diketopiperazine.....	monocl.	C_{2h}^5	5.19, 11.50, 3.96, $\beta = 83^\circ$				2	AC (3)
1, 8 Dimethylpicene...	monocl.	C_2^2	8.16, 6.36, $c \sin \beta = 11.92$, $\beta = 84^\circ$					ZK (10)
Diphenylamine.....	monocl.		14.0, 13.9, 39.5				32	IJ (2)
Diphenylselenium dibromide	rhomb.	D_{2h}^{14}	13.95, 5.78, 15.40				4	AC (4)
Glycine.....	monoc.	C_{2h}^5	5.10, 11.96, 5.45, $\beta = 111^\circ 38'$				4	AC (5)
β -Glycine.....	monocl.	C_{2h}^2	5.07, 6.23, 5.37, $\beta = 113^\circ 27'$					AJ (1)
Hendecamethylcello- triose.....		D_2^4	21.3, 34.5, 4.50				4	CS (1)
Insulin.....	hex. (rhbdr.)	C_3^4	74.8 , 30.9					PR (1)
Menthol.....	hex.		11.82.....				8	JA (1)
β -Octamethylcello- biose.....		D_2^4	12.0, 43.7, 4.50				4	CS (1)
n-Paraffin ($C_{30}H_{62}$)...	rhomb.	D_{2h}^{16}	7.452, 4.965, 81.60				4	ZK (11)
Pentaerythritol (above 179.5°C)	cub., f.c.		8.963.....					CS (2)
Phenoxselenine.....	rhomb.	D_2^4	5.93, 7.85, 20.5				4	PM (2)
Phenoxtellurine.....	rhomb.	D_2^4	5.97, 8.16, 20.5				4	PM (2)
Phenoxthionine.....	rhomb.	D_2^4	5.94, 7.76, 20.5				4	PM (2)
Phenthiasine.....	rhomb.	C_{2v}^9 or D_{2h}^{16}	5.91, 7.90, 2.10				4	PM (2)
Phloroglucine dihydrate		D_{2h}^{12}	6.80, 8.103, 13.70				4	IJ (3)
Selanthren.....	monocl.	C_{2h}^6	14.5, 6.24, 12.1, $\beta = 110^\circ 20'$				4	PM (2)
Succinic acid.....	monocl.	C_{2h}^6	5.10, 8.88, 7.61, $\beta = 133^\circ 37'$				2	ZK (12)
Sulfanilamide.....	rhomb.	D_{2h}^{15}	14.18, 5.6, 18.4, 1.476				8	GC
Thianthren.....	monocl.	C_{2h}^5	14.4, 6.11, 11.9, $\beta = 110^\circ 0'$				4	PM (2)
Tricyanobromomethane	rhomb.	D_{2h}^{11}	6.05, 11.33, 17.17				8	ZC (2)
Trimethylstibine dibromide	hex.	D_{2h}^2	7.38, , 8.90					ZK (13)
Trimethylstibine chloride	hex.	D_{2h}^2	7.27, , 8.44					ZK (13)
Trimethylstibine diiodide	hex.	D_{2h}^2	7.53, , 9.59					ZK (13)
Trinitrobenzene.....	rhomb.	Q_h^{16}	12.77, 26.97, 9.74				16	ZK (14)
Trisodium-Tricyan- melamine Trihydrate	hex.	D_{3h}^4	10.23, , 5.56					AC (6)

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LIGHT

PHOTOMETRIC QUANTITIES, UNITS AND STANDARDS

Photometric quantities and units are also given in the section Quantities and Units under the sub-division Light.

Candle (or International Candle). The candle is the unit of luminous intensity. It is a specified fraction of the average horizontal candlepower of a group of 45 carbon-filament lamps preserved at the Bureau of Standards.

Lumen. The lumen is the unit of luminous flux. It is equal to the flux through a unit solid angle (steradian) from a uniform point source of one candle, or to the flux on a unit surface all points of which are at unit distance from a uniform point source of one candle.

Illumination. Illumination is the density of the luminous flux on a surface. It is the quotient of the flux by the area of the surface when the latter is uniformly illuminated.

Least Mechanical Equivalent of Light. One lumen at the wavelength of maximum visibility (0.556μ) equals 0.00161 watts ($=0.000385$ gram calories per sec.); one watt at the same wavelength equals 621 lumens.

Relative Visibility. The relative visibility factor for a particular wavelength is the ratio of the visibility factor for that wavelength to the maximum visibility factor.

Values of the relative visibility are given as a part of the specification of the standard observer under Colorimetry.

Efficiency of a Source of Light. The efficiency of a source is the ratio of the total luminous flux to the total power consumed. In the case of an electric lamp it is expressed in lumens per watt.

Spherical Candlepower. The spherical candlepower of a lamp is the average candlepower of the lamp in all directions in space. It is equal to the total luminous flux of the lamp in lumens divided by 4π .

FLAME STANDARDS

VALUE OF VARIOUS FORMER STANDARDS IN INTERNATIONAL CANDLES

Standard Pentane Lamp, burning pentane.....	10.0 candles
Standard Hefner Lamp, burning amyl acetate...	0.9 "
Standard Carcel Lamp, burning colza oil.....	9.6 "

The *Carcel unit* is the horizontal intensity of the carcel lamp, burning 42 grams of colza oil per hour. For a consumption between 38 and 46 grams per hour the intensity may be considered proportional to the consumption.

The *Hefner unit* is the horizontal intensity of the Hefner lamp burning amyl acetate, with a flame 4 cm. high. If the flame is l mm. high, the intensity $I = 1 + 0.027(l - 40)$.

EFFICIENCIES OF ILLUMINANTS

The rating listed is the commercial rating of the lamp. The absolute efficiency is the equivalent power in light flux (at 0.556μ) per watt input. Efficiency is given in lumens per watt input.

Lamp	Rating, or Specifications	Eff.	Ab. Eff.
Acetylene.....	1.0 liters per hour	.67	0.0011
Arc, Electric			
Carbor, Enclosed, d.c..	6.6 amp., opal globe and reflector	5.9	0.0095
Carbon, Open, d.c.....	9.6 amp., clear globe	11.8	0.0190
High Intensity.....	150. amp., bare arc	18.5	0.0298
Magnetite, d.c.....	6.6	21.6	0.0348

EFFICIENCIES OF ILLUMINANTS (Continued)

Lamp	Rating, or Specifications	Eff.	Ab. Eff.
Gas burner, Open flame..	Bray high pressure	0.22	0.00035
Gas mantle, Incandescent (high pressure).....	.578 lumens per B.t.u. per hr.	2.0	0.0031
(low pressure).....	.350 lumens per B.t.u. per hr.	1.2	0.0019
Incandescent electric			
Carbon filament.....	4. watts per candle	2.6	0.0042
Treated Carbon.....	1.25 watts per candle	8.0	0.0129
Tungsten, Mazda C....	40. watts, 115 volts	10.9	0.0176
Tungsten, Mazda C....	75. watts, 115 volts	13.9	0.0224
Tungsten, Mazda C....	100. watts, 115 volts	15.3	0.0247
Tungsten, Mazda C....	1,000. watts, 115 volts	19.3	0.0311
Tungsten, Mazda C....	5,000. watts, 115 volts	29.0	0.0467
Tungsten, vacuum.....	10. watts, 115 volts	7.9	0.0127
Tungsten, vacuum.....	40. watts, 115 volts	11.3	0.0182
Mercury in Glass			
Low pressure, d.c.....	6.6 amp., 50 in. tube	13.	0.0210
Optimum pressure, a.c.	400. watts	35.	0.0565
Mercury in Quartz.....	110. volts, d.c. (Arc only)	22.	0.0354
Moore nitrogen vacuum tube.....	220-v. 60-cycle, 113 ft.	5.21	0.0083
Nernst lamp.....		4.8	0.0076
Sodium Arc.....	11,000. lumens	60.	0.0966

INTRINSIC BRILLIANCY OF LIGHT SOURCES

Brightness of source is given in candles per square centimeter.

Source	$\frac{\text{cd}}{\text{cm}^2}$
Carbon Filament at 2200° K.....	107
Clear sky, average.....	.4
Crater, Low Intensity Carbon arc.....	17,500
Crater, High Intensity Carbon Arc 150 amp.....	83,000
Flames, candle.....	0.4-0.6
gas, argand burner.....	1.14
Kerosene, flat wick.....	1.2
Mercury, High Pressure.....	27.0
Mercury, Low Pressure.....	2.1
Moon (Full).....	0.25
Sodium Arc.....	4.7
Star (Algol).....	840,000
Sun (Max).....	160,000
Tungsten at 15 lumens per watt.....	380
Tungsten at 30 lumens per watt.....	1,550
Tungsten lamp, 40-watt vacuum, filament.....	206
Tungsten lamp, 40-watt vacuum, frosted-bulb.....	2.5
Tungsten lamp, projection 1000 watt, color temperature 3175° K.....	2,065

VELOCITY OF LIGHT (IN VACUO)

$$(2.99776 \pm .00004) \times 10^{10} \text{ cm/sec.}$$

$$299,776. \text{ km/sec.}$$

$$186,272. \text{ miles/sec.}$$

WAVE LENGTHS OF VARIOUS RADIATIONS

	Ångströms
Cosmic Rays.....	0.0005
Gamma Rays.....	0.010-1.40
X-Rays.....	10-150
Ultra Violet, below.....	4000
Limit of suns U.V. at earth's surface.....	2920
Visible Spectrum.....	4000-7000
Violet, representative, 4100, limits.....	4000-4240
Blue, representative, 4700, limits.....	4240-4912
Green, representative, 5200, limits.....	4912-5750
Maximum visibility.....	5560
Yellow, representative 5800, limits.....	5750-5850
Orange, representative, 6000, limits.....	5850-6470
Red, representative, 6500, limits.....	6470-7000
Infra Red, greater than.....	7000
Hertzian Waves, beyond.....	2.20×10^6

BRIGHTNESS OF TUNGSTEN

Characteristics of Straight Tungsten Wire in a Vacuum
(Forsythe and Worthing, 1924).

Temperature °K			Brightness Candles/cm ²	$\frac{B}{dB} \frac{dt}{T}$
Absolute	Brightness	Color		
1000	966	1006	0.00012	22.0
1200	1149	1210	0.006	20.0
1400	1330	1414	0.11	17.2
1600	1509	1619	0.92	15.2
1800	1684	1825	5.05	13.7
2000	1857	2033	20.0	12.3
2200	2026	2242	61.3	11.2
2400	2192	2452	157.0	10.3
2600	2356	2663	347.0	9.6
2800	2516	2878	694.0	8.9
3000	2673	3094	1257.0	8.3
3200	2827	3311	2110.0	7.8
3400	2978	3533	3370.0	7.6
3655*	3165	3817	5740.0	7.3

* Melting-point of tungsten.

WAVE LENGTHS OF THE FRAUNHOFER LINES

SUN'S SPECTRUM

At 15° C and 76 cm pressure. Wave length in Ångström units (Fabry and Buisson system).

Line	Due to	Wave length	Line	Due to	Wave length
<i>U</i>	Fe	2947.9	<i>h</i>	H	4101.750
<i>I</i>	Fe	2994.4	<i>g</i>	Ca	4226.742
<i>T</i>	Fe	3021.067	<i>G</i>	{Fe	4307.914
<i>s</i>	Fe	3047.623		{Ca	4307.749
<i>S</i> ₁ }	{Fe	3100.683	<i>G'</i>	H	4340.477
<i>S</i> ₂ }	{Fe	3100.326	<i>F</i>	H	4861.344
	{Fe	3099.943	<i>b</i> ₁	{Fe	5167.510
	{Ca	3181.277		{Mg	5167.330
<i>R</i>	{Ca	3179.343	<i>b</i> ₂	Mg	5172.700
<i>Q</i>	Fe	3286.773	<i>b</i> ₁	Mg	5183.621
<i>P</i>	Ti	3361.194	<i>E</i> ₂	Fe	5269.557
<i>O</i>	Fe	3441.020	<i>D</i> ₂	Na	5889.977
<i>N</i>	Fe	3581.210	<i>D</i> ₁	Na	5895.944
<i>M</i>	Fe	3727.636	<i>C</i>	H	6562.816
<i>L</i>	Fe	3820.438	<i>B</i>	O	6869.955
<i>K</i>	Ca	3933.684		{O	7621
<i>H</i>	Ca	3968.494	<i>A</i>	{O	7594
			<i>Z</i>	....	8228.5
			<i>Y</i>	....	8990.0

WAVE LENGTHS FOR SPECTROSCOPE CALIBRATION

Source	Wave Length	Source	Wave Length
Potassium flame.....	0.7699 μ	<i>E</i> , solar.....	0.5270 μ
Potassium flame.....	0.7665	<i>b</i> ₁ , solar or magnesium flame	0.5184
Mercury arc.....	0.6907	<i>b</i> ₂ , solar or magnesium flame	0.5173
<i>B</i> , solar.....	0.6869	Mercury arc.....	0.4960
Lithium flame.....	0.6708	Mercury arc.....	0.4916
<i>C</i> , solar or hydrogen tube....	0.6563	<i>F</i> , solar or hydrogen tube...	0.4861
Mercury arc.....	0.6234	Strontium flame.....	0.4608
<i>D</i> ₁ , solar or sodium flame....	0.5896	Mercury arc.....	0.4358
<i>D</i> ₂ , solar or sodium flame....	0.5890	<i>G'</i> , solar or hydrogen tube..	0.4340
Mercury arc.....	0.5791	Mercury arc.....	0.4047
Mercury arc.....	0.5770	<i>H</i> ₁ , solar.....	0.3969
Mercury arc.....	0.5461	<i>K</i> , solar.....	0.3934
Thallium flame.....	0.5351		

FLAME SPECTRA

Compiled by T. G. Kennard

Listed below are the prominent lines and bands given by volatile compounds when introduced into a gas flame. Additional, weaker lines are often observed. Wave lengths are stated in ångströms, and in the case of bands refer to the position of the band head. Bands are designated by the symbol (b); the most sensitive or persistent lines or bands are designated by P.

Barium....	5137 (b) 5347 (b) 5535 (b) P	Boron....	5193 (b) 5440 (b) 5481 (b) P	Calcium..	5544 (b) 6182 (b) P 6203 (b) P
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FLAME SPECTRA (Continued)

Cesium.....	4555.5	P	Potassium....	4044.16	
	4593.18	P		4047.22	
	6213.0			7664.94	P
	6723.3			7699.01	P
	6973.3			4201.8	P
Indium.....	4101.76		Rubidium.....	4215.6	P
	4511.31	P		7806.30	
				7947.63	
Lithium.....	6103.59		Sodium.....	5889.965	
	6707.86	P		5895.932	
Manganese chloride....	5158	(b)	Strontium....	6060	(b) P
	5193	(b)		6628	(b)
	5230	(b)		6747	(b)
	5360	(b)			
	5392	(b)	Thallium....	5350.47	
	5424	(b)			
	5592	(b)			

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS

SECTION I

Ultraviolet below 2000 Å

Wave lengths are stated in angstroms

1 angstrom (Å) = 10^{-8} cm = 10^{-4} microns (μ) = 10^{-1} millimicrons ($m\mu$) = 100 $\mu\mu$

Intensities of lines are indicated by the numbers 1 to 10, the latter, the higher intensity, except as otherwise indicated.

Characteristics of the lines are indicated by symbols as follows:

I, II, III etc indicate lines produced by the neutral, ionized or doubly ionized atom respectively.

2, 3, 4, etc. unresolved lines of 2, 3, or 4 components

n broad or nebulous

N very broad and diffuse

p persistent lines

P the most sensitive of the persistent lines

r easily reversed

R wide, self reversed

ALUMINUM			ANTIMONY (Continued)			ARGON (Continued)		
Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Geissler tube	
III 695.82	..	3	805.	..	5	1589.5	4	
III 696.23	..	2	861.	..	6	1600.7	5	
III 854.98	..	3	976.	..	10	1669.7	7	
III 856.80	..	3	981.	..	10	1673.5	7	
II 1190.07	..	2	1012.	..	10	1675.6	7	
II 1191.83	..	2	1042.	..	10	1788.1	5	
II 1211.93	..	1	1048.	..	10	1820.0	7	
1310. ?	..	6	1162.	..	10	1830.6	10	
1319. ?	..	6	1168.	..	10	1831.4	9	
III 1384.	..	5	1171.	..	10	1836.3	9	
III 1606.	..	8	1193.	..	10	1843.1	9	
III 1612.	..	8	1205.	..	10	1855.7	9	
II 1671. p	..	10	1211.	..	10	1865.9	8	
II 1719.	..	9	1225.	..	10	1868.7	8	
II 1721.	..	9	1307.	..	10	1873.2	10	
II 1725.	..	10	1438.	..	10	1877.7	8	
II 1750.	..	2	1514.	..	10	1879.7	8	
1752.	..	3	1566.3	..	8	1886.1	7	
II 1760.1	..	7	1585.	..	8			
II 1761.9	..	7	1712.	..	6			
II 1763.9	..	10 ₍₂₎	1725.	..	6	ARSENIC		
II 1765.7	..	7	1731.	..	5	Wave length	Arc	Spark
II 1767.6	..	9	1762.	..	10			
1777.	..	4	1783.	..	10			
1792.	..	3	1810.	..	5			
1818.3	..	2	1867.	..	8			
III 1854.67 p	..	10	1870.6	..	10	529.	..	1
II 1858.15 p	..	7	1926.6	..	5	827.	..	5
II 1862.48 p	..	10				873.	..	8
III 1862.90 p	..	10				878.	..	8
II 1930.3	..	2	ARGON			926.	..	8
III 1935.2	..	7	Wave length	Geissler tube		952.	..	8
II 1989.8	..	8				956.	..	8
						963.	..	10
						984.	..	10
						1001.	..	10
						1009.	..	10
						1081.	..	50
						1093.	..	20
						1106.	..	10
ANTIMONY								
456.	..	1	1333.7	5				
691.	..	2	1334.5	7				
723.	..	3	1335.8	7				
			1460.1	5				

I. EMISSION SPECTRA BELOW 2000 Å (Continued)

ARSENIC (Continued)			BISMUTH (Continued)			CADMIUM (Continued)			
Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark	
1171.	..	15	1776.7	3	4	1921.8	..	2	
1208.	..	30	1787.1	3	4	1939.	..	2	
1267.	..	40	1791.7	4	4	I 1942.	..	2	
1287.	..	10	1823.5	3	5	1995.	..	3	
1700.2	..	10	1902.5	..	1	CALCIUM			
1733.0	..	15	1959.6	..	3	404.	..	6	
1742.9	..	20	1973.2	..	3	410.	..	6	
1890. p.	..	4r	BORON			537.	..	5	
1936. p	..	5	III 677.01 }	..	5	655.	..	6	
1972. p	..	4r	III 677.16 }	..	5	669.	..	6	
King's Intensity Scale			III 758.47 }	..	3	688.	..	5	
Wave length	Arc		III 758.68 }	..	3	718.	..	6	
1889.85	1000 R		II 1624.4 }	..	8 ⁽⁵⁾	832.	..	10	
1937.02	1000 R		I 1825.87 }	..	1	840.	..	6	
1958.29	20 r		I 1826.41 }	..	1	902.	..	10	
1972.03	1000 R		BROMINE			II 1434.	..	6	
1989.71	200 R		Wave length	Geissler tube		II 1553.	..	7	
1990.49	50 r		1251.8	4		II 1555.	..	8 ⁽²⁾	
1994.25	25		1384.6	8		1562.	..	4	
1994.79	100 r		1488.6	8		1667.	..	5	
BARIUM			1531.9	7		II 1807.8	..	7	
Wave length	Arc	Spark	1540.8 p	6		II 1815.0	..	8	
1331.	..	2	1575.0	9		II 1838.	..	9 ⁽²⁾	
1415.	..	3	1576.5	6		II 1840.2	..	10	
1504.	..	4	1582.4	8		II 1843.7	..	6	
1554.	..	3	1633.6 p	10		II 1851.3	..	7	
1674.	..	4	CADMIUM			CARBON			
II 1694.	..	6	Wave length	Arc	Spark	Wave length	Arc	Spark	Geissler tube
II 1869.	..	5	396.	..	1	313.	..	1	..
BERYLLIUM			847.	..	10	372.	..	1	..
II 1036.32	..	3	1369.	..	20	III 459.7	..	6	..
II 1512.30	..	8	1397.	..	20	II 533.9	..	1	..
II 1512.45	..	10	1462.	..	20	III 538.4	..	7	..
II 1776.12	..	6	1466.	..	8	II 543.4	..	2	..
II 1776.34	..	8	1472.	..	8	II 560.5	..	2	..
BISMUTH			1514.	..	20	574.4	..	6	..
670.	..	1	1628.7	..	6	II 594.9	4	5	..
791.	..	2	1707.5	..	8	II 636.2	..	2	..
967.	..	3	1747.9	..	6	651.	2	6 ⁽²⁾	..
1045.	..	10	1768.8	..	6	II 687.1	8	7	8
1051.	..	10	1773.1	..	6	II 858.2	8	8	8
1306.	..	10	1844.5	..	10	II? 904.	4	10 ⁽⁴⁾	..
1317.	..	15	1856.0	..	15	III 977.02	..	12	..
1346.	..	10	1873.6	..	15	I 1010.1	9	10	..
1533.7	5	3	1900.7	..	6	II 1036.2	..	10	5
						II 1036.8	..	10	5
						1176.	10	15 ⁽⁵⁾	..
						1323.7	7	7	..
						1329.1	8	4	..
						1329.6	8	4	..
						1334.5 p	10	10	..
						1335.7 p	10	10	..

I. EMISSION SPECTRA BELOW 2000 Å (Continued)

CARBON (Continued)				CHROMIUM			COPPER (Continued)		
Wave length	Arc	Spark	Geissler tube	Wave length	Arc	Spark	Wave length	Arc	Spark
IV 1550.9		3	.....	202.6	..	1	1750.	..	6
I 1561.3	5	5	5	438.3	..	4	1769.	..	4
1657.	6	6 ⁽⁴⁾	456.8	..	4	1783.	..	3
III 1930.98	5	7 ⁽²⁾	464.0	..	4	1840.	..	8
				469.8	..	4	1979.2	4	1
				575.3	..	5	1999.6	5	2
				619.9	..	6			
CERIUM				629.9	..	6	FLUORINE		
Wave length	Arc	Spark		637.8	..	6	Wave length	Geissler tube	
399.	..	1		648.7	..	5	378.6	1	
741.	..	5		667.1	..	5	420.1	1	
830.	..	20		681.3	..	5	III 430.15	4	
1332.	..	20		840.	..	3	III 467.70	7	
1373.	..	20		885.2	..	10	II 546.84	4	
				925.5	..	2	IV 572.65	4	
				1004.4	..	3	II 605.67	8	
				1018.7	..	3	II 606.27	7	
				1816.4	..	10	II 606.81	9	
							II 606.95	4	
							II 607.48	7	
							II 608.06	8	
							III 656.10	7	
							III 656.86	6	
							III 658.34	8	
							IV 676.06	4	
							IV 677.17	5	
							IV 679.19	5	
							I 951.81	5	
							I 954.78	7	
							I 955.53	6	
							I 958.49	5	
							GALLIUM		
							Wave length	Arc	Spark
							124.	..	0
							425.	..	4
							509.	..	3
							511.	..	3
							645.	..	2
							800.4	..	5
							828.8	..	5
							839.9	..	5
							860.4	..	5
							874.4	..	6
							909.3	..	5
							938.5	..	6
							989.5	..	6
							1050.2	..	6
							1102.7	..	7
							1120.6	..	5
							1133.6	..	6
							1135.9	..	5

I. EMISSION SPECTRA BELOW 2000 Å (Continued)

GALLIUM (Continued)			GERMANIUM (Continued)			HAFNIUM (Continued) King's Intensity Scale					
Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark			
1136.9	..	5	1229.8	..	10	1774.81	..	10			
1156.1	..	7	1237.0	..	6	1815.71	..	9			
1163.5	..	6	1393.8	..	8	1919.52	..	20			
1170.4	..	9	1402.8	..	6	1922.11	..	9			
1192.9	..	6	1500.6	..	6	1922.74	..	12			
1195.0	..	6	1733.	..	6	1955.66	..	12			
1228.0	..	7	GOLD			1963.75	..	9			
1258.8	..	9				1964.23	..	15			
1264.6	..	6	GOLD			HELIUM					
1267.1	..	7									
1279.2	..	7	GOLD			HELIUM					
1285.3	..	7									
1293.5	..	6	458.	..	1	HELIUM					
1295.9	..	10	832.	..	5						
1299.5	..	9	854.	..	4	HELIUM					
1303.5	..	10	864.	..	5						
1338.1	..	7	975.	..	20	HELIUM					
1414.4	..	10	1402.	..	2						
1483.9	..	6	1435.	..	4	HELIUM					
1495.4	..	10	1488.	..	4 ⁽²⁾						
1534.5	..	10	1500.	..	4 ⁽²⁾	HELIUM					
1586.3	..	8	1534.	..	3						
1625.3	..	7	1562.	..	3	HELIUM					
1799.2	..	7	1590.	..	3						
1802.3	..	7	1600.	..	3	HYDROGEN					
1813.9	..	■	1622.	..	4						
1845.0	..	8	1629.	..	3	HYDROGEN					
GERMANIUM			1639.	..	3						
			1659.	..	3	HYDROGEN					
GERMANIUM			1673.	..	6						
			1694.	..	6	HYDROGEN					
GERMANIUM			1699.	..	3						
			1720.	..	3	HYDROGEN					
GERMANIUM			1726.	..	4						
			1727.	..	3	HYDROGEN					
GERMANIUM			1740.	..	4						
			1767.	..	3	HYDROGEN					
GERMANIUM			1784.	..	5						
			1795.	..	5	HYDROGEN					
GERMANIUM			1802.	..	5						
			1822.4	..	4	HYDROGEN					
GERMANIUM			1845.7	..	3						
			1850.1	..	2	HYDROGEN					
GERMANIUM			1861.1	..	3						
			1871.1	..	3	HYDROGEN					
GERMANIUM			I 1879.1	..	3						
			1886.3	..	4	HYDROGEN					
GERMANIUM			1889.8	..	2						
			1903.9	..	2	HYDROGEN					
GERMANIUM			I 1918.9	..	4						
			1921.0	..	4	HYDROGEN					
GERMANIUM			I 1951.2	..	3						
			1977.3	..	3	HYDROGEN					
GERMANIUM			HAFNIUM King's Intensity Scale								
GERMANIUM			1623.06	..	12	HYDROGEN					
			1628.91	..	12						

HAFNIUM (Continued) King's Intensity Scale		
Wave length	Arc	Spark
1774.81	..	10
1815.71	..	9
1919.52	..	20
1922.11	..	9
1922.74	..	12
1955.66	..	12
1963.75	..	9
1964.23	..	15

HELIUM		
Wave length	Geissler tube	
I 585.? p	10	
II 1215.? p	..	
II 1640.? p	5	

HYDROGEN		
972.54	..	
992.	..	
1025.73	..	
1086.	..	
1215.68 p	..	

INDIUM		
Wave length	Arc	Spark
161.8	..	0
583.	..	1
684.	..	2
752.	..	1
882.	..	4
954.7	..	4
973.	..	3
1031.5	..	5
1054.	..	6
1082.	..	6
1222.5	..	6
1233.	..	6
1320.	..	7
1381.	..	9
1406.	..	8
1435.	..	5

I. EMISSION SPECTRA BELOW 2000 Å (Continued)

INDIUM (Continued)			IRON (Continued)			LEAD (Continued)		
Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
III 1488.	..	8	1373.9	..	2	1534.	..	7
1521.6	..	9	1387.8	..	2	1554.	..	10
1533.5	..	9	1409.4	..	2	1660.	..	2
II 1625.6	..	10	1430.6	..	2	1671.	..	2
III 1749.2	1	12	1525.5	..	2	1682.5 p	■	2
1966.7	2	9	1532.3	..	2	1726.	6	2
1977.3	2	8	1538.3	..	2	1781.	..	2
IODINE			1597.7	..	2	1796.5	6	3
Wave length	Geissler tube		1630.9	..	2	1822.	8	3
1234.2	3		1702.0	..	3	1869.	..	5
1336.7	6		1718.3	..	2	MAGNESIUM		
1355.5	6		1724.0	..	2	1231.6	..	2
1390.9	5		1787.0	..	5	1320.9	..	5
1425.7	8		1788.3	..	5	1323.2	..	4
1458.2	6		1843.9	..	2	II 1735.	1	6
1459.2	6		1869.7	..	4	II 1737.	2	7
1514.8	9		1895.6	..	4	1741.	5	..
1518.3	7		1913.3	..	4	1744.	5	..
1641.1	7		1914.2	..	3	II 1750.9	..	5
1642.5	7		1953.6	..	2	II 1753.6	..	6
1782.9 p	9		KRYPTON			I 1828.	3	..
1830.4	10		King's Intensity Scale			1856.	5	..
1844.5	9		Wave length	Geissler tube		1864.	4	..
1876.4	7		II 886.29	8		1886.	5	..
IRON			II 964.93	12		1931.	6	..
Wave length	Arc	Spark	I 1164.88	20		MANGANESE		
294.3	..	2	I 1235 85	30		311.	..	1
365.8	..	5	LEAD			648.	..	2
381.1	..	4	Wave length	Arc	Spark	893.	..	10
392.9	..	7	884.	..	5	1113.	..	5
417.5	..	4	890.	..	5	1118.	..	5
552.1	..	7	894.	..	7	1438.	..	5
602.4	..	4	907.	..	7	1573.?	..	5
609.1?	..	9	927.	..	7	1789.	..	10
666.9	..	4	954.	..	3	1892.0	..	4
669.9	..	4	1004.	..	3	1904.	..	5
859.9	..	4	1029.	..	10	1952.1	..	3
863.2	..	3	1166.	..	7	1993.	..	5
929.2	..	3	1203.	..	7	MERCURY		
983.8	..	3	1213.	..	3	I 1269 7	..	5
1006.0	..	2	1232.	..	7	1527.	..	5
1017.6	..	6	1250.	..	10	1592.	..	8
1031.8	..	4	1267.	..	7	1599.	..	7
1062.1	..	2	1316.	..	10	II 1650. p	..	10
1143.4	..	2	1349.	..	3	1677.9	..	10
1186.4	..	2	1434.	..	10	1738.3	..	8
1228.9	..	2				1798.7	..	9
1254.1	..	2				I 1849. P	10	10
1260.8	..	2				II 1942. p	10	5
1272.2	..	2						

I. EMISSION SPECTRA BELOW 2000 Å (Continued)

MOLYBDENUM			OXYGEN (Continued)			OXYGEN (Continued)		
Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
1377.	..	1	III 525.79	..	6	1175.6	..	10
1548.	..	4	IV 553.33	..	5	1200.	..	10 ⁽³⁾
1692.	..	2	IV 554.07	..	5	1217.62	..	10
1697.	..	4	IV 554.52	..	5	1247.7	..	10 ⁽³⁾
1809.8	..	7	IV 555.23	..	5	1277.	..	5
			580.41	..	3	I 1302.3 p	10	..
			580.98	..	4	I 1305.0 p	10	..
NICKEL			II 616.31	..	5	I 1306.1 p	10	..
1398.	..	2	II 617.06	..	5	I 1355.7	8	..
1499.	..	2	II 644.16	..	6	I 1358.7	5	..
1527.	..	2	II 672.91	..	5	1743.1	..	5
1653.	..	6	II 673.75	..	5	1760.9	..	8
1693.	..	7	III 702.33	..	6	1781.4	..	7
1709.	..	6	III 702.82	..	6	1787.0	..	7
1767.	..	6	III 702.90	..	6	II 1961.60	..	3 ⁽³⁾
1855.	..	5	III 703.85	..	7			
1929.7	..	5	II 718.50	..	7	PALLADIUM		
1979.3	..	6	II 718.57	..	7	II 1596.8	..	5
			V 758.69	..	4	II 1625.8	..	5
			V 759.45	..	4	II 1667.6	..	7
			V 760.23	..	3	II 1693.4	..	6
			V 760.46	..	5	II 1704.3	..	8
			V 761.13	..	4	II 1741.0	..	6
			V 762.00	..	4	II 1781.8	..	6
			II 796.61	..	6			
			II 832.76	..	8	PHOSPHORUS		
			III 832.93	..	7	Wave length	Spark	Geissler tube
			II 833.33	..	9	IV 823.21	5	..
			III 833.74	..	8	IV 824.76	6	..
			II 834.46	..	10	IV 827.95	6	..
			III 835.09	..	3	III 859.69	6	..
			III 835.29	..	9	V 865.48	4	..
			889.7	..	8	V 871.42	5	..
			904.7	..	10	III 913.99	4	..
			916.4	..	15	III 917.14	5	..
			917.8	..	15	III 918.69	5	..
III 685.5	5 ⁽⁴⁾		I 948.7	4	..	III 921.86	5	..
II 916.82	2 ⁽⁴⁾		I 950.2	4	..	III 998.03	5	..
IV 922.02	..		I 950.9	4	..	III 1003.64	5	..
IV 922.57	..		I 952.4	4	..	IV 1035.54	4	..
IV 923.18	..		I 953.0	2	..	V 1118.02	10	..
IV 923.68	..		I 971.76	8	8	V 1128.04	10	..
IV 924.31	..		I 973.26	5	5	1671.5	..	3
III 989.90 p	2		I 973.92	4	4	1685.8	..	5
III 991.66 p	3		I 976.50	5	5	1693.8	..	4
1085.	10 ⁽⁴⁾		I 978.00	5	5	1774.8 p	..	7
1184.1	10		I 978.62	4	4	1782.7 p	..	7
1200.4 p	10		990.	..	10 ⁽²⁾	1787.5 p	..	6
V 1242.2	4		991.5	..	10 ⁽²⁾	1834.5	..	4
II 1276.0	10 ⁽³⁾		1010.5	..	10	I 1846.8	..	7
1335.3	10		I 1026.0	9	5			
I 1492.83	3		I 1027.5	8	..			
I 1494.78	3		I 1028.2	7	..			
1561.1	7		1036.9	..	7			
1657.2	7		I 1039.26	8	8			
I 1742.81	5		I 1041.0	8	8			
I 1745.31	5		I 1041.71	5	7			
			1066.3	..	5			
			1085.2	..	10			
			1128.4	..	5			
			1132.3	..	10			
			1134.8	..	10 ⁽²⁾			
			1152.6	..	6			
NITROGEN								
Wave length	Geissler tube							
III 685.5	5 ⁽⁴⁾							
II 916.82	2 ⁽⁴⁾							
IV 922.02	..							
IV 922.57	..							
IV 923.18	..							
IV 923.68	..							
IV 924.31	..							
III 989.90 p	2							
III 991.66 p	3							
1085.	10 ⁽⁴⁾							
1184.1	10							
1200.4 p	10							
V 1242.2	4							
II 1276.0	10 ⁽³⁾							
1335.3	10							
I 1492.83	3							
I 1494.78	3							
1561.1	7							
1657.2	7							
I 1742.81	5							
I 1745.31	5							
OXYGEN								
Wave length	Arc	Spark						
136.6	..	0						
305.7	..	3						
374.3	..	4						
III 507.38	..	4						
III 507.68	..	5						
III 508.18	..	6						

I. EMISSION SPECTRA BELOW 2000 Å (Continued)

[illegible]

I. EMISSION SPECTRA BELOW 2000 Å (Continued)

SODIUM (Continued)			THALLIUM			TITANIUM (Continued)		
Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
1659.7	..	4	395.	..	1	1264.6	..	5
1668.7	..	4	662.	..	3	III 1294.3	..	2
1669.3	..	4	697.	..	4	III 1298.8	..	2
1698.9?	..	10	817.	..	3	1437.3	..	5
1703.5	..	9	908.	..	2	1658.7	..	10
1749.3	..	8	1029.	..	4	1671.2	..	10
1770.8	..	6	1082.	..	4	TUNGSTEN		
1773.5	..	6	III 1266.	..	8	1550.2	..	3
1787.4	..	4	1337.	..	4	1679.2	..	3
STRONTIUM			1478.	..	4	1785.5	..	5
			1492.	..	4	1787.0	..	5
			III 1559.	..	10	1788.3	..	5
			1561.	..	8	1895.5	..	6
			1660.	..	10	URANIUM		
			1793.	..	9	397.	..	1
			1815.	..	10	764.	..	5
			1828.	..	6	1587.	..	5
			1893.	..	10	1833.	..	5
			TIN			1981.	..	5
						1985.	..	5
			392.	..	1	VANADIUM		
			410.	..	2	483.0	..	5
			502.	..	2	684.5?	..	5
			508.	..	2	723.	..	3
			752.	..	3	1112.	..	2
			784.	..	3	1437.3	..	2
			892.	..	3	1454.	..	2
			902.	..	15	YTTRIUM III		
			907.	..	3	King's Intensity Scale		
			910.	..	3	Wave length	Intensity	
			956.	..	10	989.21	1	
			1019.	..	15	996.37	2	
			1044.	..	15	ZINC		
			1058.	..	3	Wave length	Arc	Spark
			1062.	..	3	677.9	..	5
			1086.	..	5	I 1457.	..	8
			1089.	..	5	I 1539.	..	10
			1132.	..	12	I 1601.2	..	6
			1158.	..	20	1620.0	..	6
			1224.	..	10	1622.9	..	7
			1251.	..	20	1629.4	..	9
			1314.7	..	10	1639.5	..	9
			1327.	..	7	1645.0	..	8
			1347.	..	4	1651.9	..	7
			1370.	..	4	1673.2	..	7
			1387.	..	5	1707.	..	7
			1410.8	..	5	1743.	..	10
			1437.7	..	10	1746.	..	8
			1475.	..	6	1750.	..	7
			1570.	..	4	1767.8	..	7
			1757.	..	10	1811.	..	7
			1811.	..	10	1834.	..	7
			1899.	3	10	1839.3	..	6
			1951.4	3 r	..	1864.	..	5
			1983.4	3 r	..	TITANIUM		
						324.	..	1
						781.6	..	10
						834.0?	..	2
						1113.4	..	5
						1120.5	..	5
TELLURIUM								
509.	..	1						
634.	..	1						
813.	..	5						
928.	..	4						
931.	..	4						
1004.	..	5						
1007.	..	5						
1064.	..	5						
1107.	..	5						
1117.	..	5						
1123.	..	7						
1150.	..	5						
1167.	..	10						
1174.	..	7						
1216.	..	7						
1219.	..	7						
1223.	..	7						
1291.	..	5						
1297.	..	5						
1345.	..	7						
1461.	..	7						
1826.	..	5						

SECTION II

2000 to 10,000 Å

Wave lengths are given in angstroms

Intensities are given according to the M. I. T. Wave length Tables.
Characteristics of the lines are indicated by symbols as follows:

- hh band head
- d double line
- l shaded or displaced to longer wavelengths (asymmetrical)
- m mean value
- n hazy, diffuse, nebulous
- r narrow or wide self-reversal
- s shaded or displaced to shorter wavelengths (asymmetrical)
- w wide or complex
- W Very wide or complex
- () Discharge tube intensity
- I line classified as emitted by normal atom
- II line classified as emitted by singly ionized atom

ACTINIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4088.37	..	100	4359.09	..	30	4413.17	..	100
4168.40	..	100	4386.37	..	100	4812.25	..	60
4179.93	..	60						

ALUMINUM

II 2016.91	..	(80)	II 2650.10	..	(30)	II 4585.82	..	(40)
II 2087.00	..	(40)	I 2652.49	150 r	60	II 4588.19	..	(30)
II 2094.3	..	(50)	I 2660.39	150 r	60	II 4898.76	..	(30)
II 2094.8	..	(50)	II 2669.17	3	100	II 4902.77	..	(30)
II 2095.2	..	(40)	2748.86	..	(30 n)	II 5280.21	..	(50)
II 2099.68	..	(40)	2805.65	..	(30)	II 5283.77	..	(100)
II 2243.05	..	(30)	II 2868.52	..	(80)	II 5285.85	..	(50)
I 2263.45	60 r	25	II 2881.46	..	(30)	II 5312.32	..	(35)
I 2269.09	60 r	25	2884.20	..	(30)	II 5316.07	..	(70)
I 2367.06	150 r	50 r	II 3041.28	..	(50)	II 5371.84	..	(50)
I 2373.13	100 r	30	II 3074.66	..	(50)	II 5593.23	..	(200)
I 2373.36	200 r	100 r	I 3082.15	800	800	II 5853.62	..	(35)
I 2378.41	40	20	I 3092.71	1000	1000	II 5971.94	..	(35)
II 2392.15	..	(30)	3092.84	50 r	18	II 6001.76	..	(60)
II 2459.82	..	(30)	II 3428.92	..	(50)	II 6001.88	..	(50)
II 2475.26	..	(30)	II 3586.55	..	(200)	II 6006.42	..	(30)
II 2476.30	..	(30)	II 3586.69	..	(200)	II 6068.43	..	(60)
II 2540.12	..	(30)	II 3586.80	..	(200 wn)	II 6068.53	..	(30)
II 2545.60	..	(50)	II 3586.91	..	(500 n)	II 6231.76	..	(35)
II 2552.12	..	(40)	II 3587.06	..	(100)	II 6243.36	..	(80)
II 2556.01	..	(30)	II 3587.44	..	(80)	I 6695.97	..	(50)
II 2557.71	..	(40)	3612.47	..	(80 n)	I 7362.31	5 nl	(50)
II 2565.68	..	(30)	II 3651.06	..	(50)	I 7835.33	..	(40)
2567.99	200 r	80 r	II 3655.00	..	(100)	I 7836.15	..	(50)
2575.10	200 r	80 r	II 3900.68	..	(200)	II 8354.35	..	(50)
2575.41	30	30	I 3944.03	2000	1000	II 8359.57	..	(40)
II 2586.95	..	(50)	I 3961.53	3000	2000	II 8363.52	..	(30)
II 2597.18	..	(50)	II 3995.86	..	(30)	II 8640.70	..	(30)
II 2627.68	..	(60)	II 4026.5	..	(30)	I 8772.88	..	(80)
II 2631.55	..	(60)	II 4226.81	..	(35)	I 8773.91	..	(150)
II 2637.70	..	(40)	II 4227.50	..	(30)	I 8774.56	100	..
II 2638.26	..	(30)						

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

ANTIMONY

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2068.38	300 r	3	I 3232.50	150	250 wn	II 5354.24	..	(200)
I 2175.89	300	40	3241.28	..	(350 Wn)	II 5464.08	..	(100)
2179.26	35	40	I 3267.50	150	150 Wn	II 5567.0	..	40
2201.40	40	25	3304.11	..	40 wn	II 5568.09	6	200 wn
2262.54	40	25	3383.14	40	50	II 5631.97	15	(40)
2306.50	35	30	3473.91	3	300 wn	II 5635.18	..	(40)
I 2311.47	150 r	50	II 3498.46	..	300 wn	II 5639.74	..	100 wn
2373.62	75	25	II 3520.47	..	(125)	II 5895.09	..	(150 wn)
2383.63	75	20	3559.24	2 n	50 wn	II 6004.6	..	200 n
2395.20	50	15	3596.96	..	(100)	II 6005.21	..	(200)
2422.14	50	20	3597.51	2	200 wnl	6079.55	20	100 n
2426.35	75	25	3637.83	2 n	60	II 6079.80	..	(60)
2445.51	75	30	II 3722.79	40 Ws	50	II 6129.98	10 n	150 n
2478.31	75	100	4033.54	70	60	6154.94	8 n	(40)
2510.53	50	20	II 4195.17	..	50	6647.44	..	(60)
I 2528.53	300 r	200	II 4596.90	..	(70)	6778.38	5	40
2574.11	30	40	II 4599.09	..	(40)	II 7275.	..	35
I 2598.06	200	100	II 4612.92	..	(50)	II 7428.	..	35
2612.30	50	60	II 4647.32	..	(80)	7844.41	100	..
2652.61	50	75	II 4711.26	..	(100)	7924.65	300	..
2670.64	50	35	II 4765.36	..	(40)	7969.6	50 n	..
2682.76	50	35	4784.03	..	(70)	8411.70	60	..
2692.25	40	40	II 4802.01	..	(40)	8572.61	200	..
2718.89	50	50	II 4877.24	..	(60)	8617.7	40 n	..
2769.94	100	75	II 4948.52	..	(50)	8619.52	150 n	..
2851.11	50	45	II 5010.42	..	(40)	8682.7	100 n	..
I 2877.91	250 W	150	5044.56	..	(100)	8700.1	50 Wn	..
2980.96	..	(125 nd)	5113.86	..	70	8735.7	40 Wn	..
3011.07	..	70	5141.2	..	40	9518.68	400	..
II 3022.19	..	60	II 5176.55	..	(50)	9578.68	400	..
3029.81	100	200 wn	II 5238.94	..	(50 wn)	9949.14	400 n	..
II 3040.67	..	(400 wn)						

ARGON

Wave length	Arc	Discharge Tube	Wave length	Arc	Discharge Tube	Wave length	Arc	Discharge Tube
2137.2	..	40	2313.74	..	60	3169.68	..	50
II 2152.6	..	60 n	2314.99	..	40	I 3172.96	..	150
II 2159.0	..	60 n	2316.31	..	100	3181.05	..	25
2162.74	..	60 n	2331.45	..	60	I 3200.39	..	100
2164.17	..	100	2337.79	..	60	I 3234.51	..	100
II 2171.41	..	60	2357.60	..	60	3249.82	..	25
II 2179.25	..	40	II 2360.07	..	40	I 3257.58	..	100
II 2183.3	..	40	2364.14	..	40	3293.66	..	25
2213.0	..	60	II 2383.50	..	40	I 3319.34	..	300
2218.87	..	60	2385.00	..	40	I 3323.82	..	30
2221.94	..	40	II 2387.96	..	40	I 3325.50	..	100
2222.93	..	60	2534.74	..	40	I 3373.48	..	300
2224.76	..	40	2544.72	..	40	II 3376.46	..	25
2227.70	..	60	2708.28	..	40	3388.54	..	25
II 2235.77	..	40	2806.16	..	40	I 3392.81	..	100
II 2238.2	..	60	II 2891.61	..	40	I 3393.75	..	250
2280.6	..	60	II 2942.90	..	100	I 3406.17	..	30
2282.05	..	40	II 2955.39	..	40	I 3461.08	..	300
2287.8	..	60	II 2979.05	..	40	3491.54	..	50
2298.17	..	40	II 3093.41	..	50	I 3506.46	..	30
2309.16	..	40	3139.02	..	25	3514.39	..	125

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

ARGON (Continued)

Wave length	Arc	Discharge Tube	Wave length	Arc	Discharge Tube	Wave length	Arc	Discharge Tube
3545.58	..	300	I 4181.88	..	1000	I 4835.97	..	30
II 3545.84	..	125	I 4190.71	..	600	I 4836.69	..	150
3548.51	..	25	I 4191.03	..	1200	4847.90	..	80
I 3554.31	..	300	I 4198.32	..	1200	I 4876.26	..	200
I 3555.97	..	100	I 4200.67	..	1200	4879.90	..	300
I 3563.26	..	100	4228.18	..	40	I 4883.27	..	30
I 3564.27	..	100	II 4237.23	..	40	I 4886.29	..	30
I 3567.66	..	300	I 4251.18	..	800	I 4887.95	..	200
I 3572.29	..	300	I 4259.36	..	1200	I 4894.69	..	150
3576.62	..	300	I 4266.29	..	1200	II 4904.75	..	30
3582.35	..	50	4266.53	..	200	I 4921.04	..	80
I 3582.70	..	30	I 4272.17	..	1200	4933.24	..	30
3588.44	..	300	II 4277.55	..	80	I 4937.72	..	30
I 3606.52	..	1000	4282.90	..	40	I 4956.75	..	100
I 3632.68	..	300	I 4300.10	..	1200	4965.12	..	40
I 3634.46	..	300	II 4300.66	..	30	I 4989.94	..	80
II 3639.85	..	25	4331.25	..	200	5009.35	..	200
I 3643.09	..	100	4332.06	..	80	II 5017.16	..	60
I 3649.83	..	800	I 4333.56	..	1000	I 5032.02	..	60
I 3659.50	..	100	I 4335.34	..	800	I 5048.81	..	500
I 3670.64	..	300	II 4337.10	..	30	I 5054.18	..	300
I 3675.22	..	300	I 4345.17	..	1000	I 5056.53	..	200
I 3690.90	..	300	4348.11	..	500 n	I 5060.08	..	500
3729.29	..	200	4352.23	..	30	5062.07	..	200
I 3743.76	..	100	I 4363.79	..	80	I 5070.99	..	40
I 3770.37	..	400	II 4370.76	..	30	I 5073.08	..	200
3780.84	..	50	4371.36	..	80	I 5078.03	..	40
I 3781.36	..	300	4379.74	..	80	I 5087.09	..	60
3809.49	..	25	4400.09	..	30	I 5118.20	..	60
I 3834.68	..	800	4401.02	..	40	I 5127.78	..	60
3850.57	..	400	4420.90	..	40	5145.36	..	200
3868.53	..	50	I 4423.99	..	80	I 5151.39	..	200
3875.26	..	25	4426.01	..	300	I 5162.28	..	500
3891.97	..	25	4430.18	..	100	I 5177.53	..	40
I 3894.66	..	300	4431.02	..	80	I 5187.75	..	800
I 3899.86	..	100	II 4481.83	..	80	I 5192.72	..	60
3914.76	..	25	I 4510.73	..	1000	I 5210.49	..	200
3928.62	..	125	I 4522.32	..	800	I 5214.77	..	200
3932.55	..	25	4544.75	..	30	I 5216.28	..	60
3944.27	..	50	4545.08	..	200	I 5219.30	..	40
II 3946.10	..	25	4579.39	..	80	I 5221.27	..	500
I 3947.50	..	1000	I 4589.29	..	80	I 5229.86	..	40
I 3948.98	..	2000	II 4589.93	..	150	I 5241.10	..	60 n
3968.36	..	200	I 4596.10	..	1000	I 5246.24	..	40
3979.36	..	25	II 4609.60	..	300	I 5249.20	..	40
3992.06	..	25	I 4626.78	..	30	I 5252.79	..	300
4013.87	..	200	I 4628.44	..	1000	I 5254.48	..	60
4033.83	..	30	II 4637.25	..	30	5280.40	..	60
II 4035.47	..	30	I 4642.15	..	80	I 5286.08	..	60
4038.82	..	40	I 4647.49	..	40	I 5309.52	..	200
II 4042.91	..	80	4657.94	..	150	I 5317.73	..	60
I 4044.42	..	1200	I 4702.32	..	1200	I 5347.41	..	200
I 4045.97	..	150	I 4709.50	..	30	I 5373.49	..	500
I 4054.52	..	80	4726.91	..	200	I 5387.37	..	40
II 4072.01	..	150	4735.93	..	400	I 5389.10	..	40
4072.40	..	40	I 4746.82	..	80	I 5390.72	..	40
4082.40	..	30	I 4752.94	..	150	I 5393.97	..	200
4103.91	..	200	4764.89	..	150	I 5410.47	..	500
II 4131.73	..	80	I 4768.67	..	150	I 5421.35	..	500
4154.50	..	80	I 4798.74	..	30	I 5439.97	..	500
I 4158.59	..	1200	4806.07	..	500	I 5442.22	..	500
I 4164.18	..	1000	I 4834.10	..	30	I 5443.21	..	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

ARGON (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 5451.65	..	500	II 6114.92	..	100	I 7635.10	..	500
I 5457.37	..	200	I 6145.43	..	100	I 7670.04	..	50
I 5473.44	..	500	I 6155.23	..	60	I 7723.76	..	200
I 5490.13	..	60	I 6170.18	..	100	I 7724.21	..	200
I 5492.06	..	40	I 6173.11	..	100	I 7798.55	..	30
I 5495.87	..	1000	I 6212.51	..	100	I 7868.20	..	40
I 5506.11	..	500	I 6215.94	..	60	I 7891.07	..	100
I 5524.93	..	300	I 6307.66	..	30	I 7948.17	..	400
I 5528.93	..	40	I 6369.58	..	30	I 8006.16	..	600
I 5534.45	..	60	I 6384.72	..	100	I 8014.79	..	800
I 5540.90	..	40	I 6416.31	..	100	II 8017.55	..	60
I 5558.70	..	500	I 6538.11	..	30	I 8046.13	..	50
I 5559.62	..	200	I 6604.85	..	30	I 8053.31	..	100
I 5572.55	..	500	II 6638.24	..	30	I 8103.69	..	2000
I 5581.83	..	60	II 6643.79	..	100	I 8115.31	..	5000
I 5588.69	..	500	I 6660.64	..	100	II 8119.18	..	50
I 5597.46	..	500	I 6664.02	..	100	I 8178.84	..	40
I 5600.43	..	40	I 6677.28	..	30	I 8255.07	..	50
I 5601.08	..	60	II 6684.36	..	30	I 8264.52	..	1000
I 5606.73	..	500	I 6698.85	..	100	I 8384.73	..	60
I 5617.97	..	60	I 6719.20	..	100	I 8392.28	..	80
I 5620.89	..	60	I 6752.83	..	200	I 8408.21	..	2000
I 5623.76	..	60	I 6756.10	..	100	I 8424.65	..	2000
I 5635.54	..	60	I 6766.56	..	100	I 8490.30	..	40
I 5639.11	..	100	I 6827.24	..	30	I 8521.44	..	2000
I 5641.34	..	60	I 6871.29	..	150	I 8605.78	..	150
I 5648.66	..	200	I 6879.59	..	40	I 8620.47	..	100
I 5650.70	..	1500	I 6888.17	..	100	I 8667.94	..	400
I 5659.13	..	500	I 6937.67	..	100	I 8678.43	..	60
I 5681.90	..	500	I 6965.43	..	400	I 8761.72	..	200
I 5683.73	..	40	I 7030.26	..	100	II 8771.88	..	100
I 5689.64	..	200	I 7067.22	..	400	I 8784.59	..	30
I 5689.91	..	200	I 7068.73	..	30	I 8799.13	..	100
I 5700.86	..	60	I 7107.50	..	200	I 8849.97	..	150
I 5739.52	..	500	I 7125.80	..	30	I 8962.19	..	40
II 5772.12	..	100	I 7147.04	..	30	II 9017.59	..	50
I 5774.00	..	40	I 7158.83	..	30	I 9066.77	..	40
I 5783.52	..	40	I 7206.99	..	100	I 9073.34	..	50
I 5802.08	..	40	I 7272.94	..	100	I 9075.42	..	60
I 5834.26	..	60	I 7311.71	..	100	I 9122.97	..	500
I 5860.31	..	60	I 7316.00	..	30	I 9194.68	..	150
I 5882.62	..	100	I 7353.32	..	100	I 9198.61	..	50
I 5888.59	..	300	I 7372.12	..	100	I 9224.50	..	1000
I 5912.08	..	500	I 7383.98	..	400	I 9291.58	..	100
I 5928.80	..	200	I 7435.33	..	30	I 9354.22	..	200
I 5942.67	..	40	II 7440.46	..	90	I 9459.09	..	100
I 5987.29	..	40	I 7503.87	..	700	II 9475.20	..	30
I 6032.12	..	60	II 7505.13	..	100	I 9478.39	..	50
I 6043.23	..	100	I 7514.65	..	200	I 9657.78	..	1500
I 6052.72	..	30	II 7589.33	..	250	I 9666.86	..	50
I 6059.37	..	100	II 7618.03	..	80	I 9784.50	..	1000
I 6098.81	..	60	I 7618.33	..	30	II 9906.12	..	100 n
I 6105.64	..	60	I 7628.86	..	50			

ARSENIC

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2002.54	20 r	..	I 2013.32	25 r	8	I 2065.41	20	3
I 2003.34	300 r	10 n	.. 2031.4	..	75	I 2069.83	18	3
I 2009.18	50 r	8	I 2047.59	25	3	.. 2074.5	..	20

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

ARSENIC (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2113.01	50	5	II 4084.13	..	15	II 4787.29	..	15
I 2133.81	18	..	4119.85	..	50	II 4888.74	..	50
I 2144.10	50 r	..	II 4157.64	..	30	II 4985.60	..	50
I 2165.52	50 r	3	II 4197.61	..	30	II 5105.80	..	150
I 2271.36	25	1	II 4208.00	..	30	II 5107.80	..	150
I 2288.12	250 r	5	4243.26	..	100	5161.25	..	30
I 2344.03	25	..	4265.13	..	30	II 5182.32	..	30
I 2349.84	250 r	18	II 4315.86	..	50	II 5223.27	..	15
I 2369.67	40 r	20	II 4324.10	..	50	II 5231.50	..	60
I 2370.77	50 r	3	II 4336.85	..	100	II 5331.54	..	200
I 2381.18	75	4	II 4352.25	..	200	II 5385.52	..	15
I 2437.23	25	2	II 4353.02	..	100	II 5471.92	..	15
I 2456.53	100 r	8	II 4371.38	..	50	II 5497.98	..	200
I 2492.91	25	5	II 4404.53	..	15	II 5558.31	..	200
I 2780.20	75 r	75	II 4413.64	..	50	II 5651.53	..	200
II 2830.45	..	25	II 4427.38	..	200	II 5657.20	..	60
I 2860.45	50 r	50	II 4431.73	..	200	5685.74	..	60
I 2884.51	..	25	4456.86	..	15	II 5731.96	..	15
I 2898.71	25 r	40	4458.74	..	30	II 5783.51	..	20
2959.70	..	75	4461.27	..	30	5838.19	..	125
I 2990.99	10	18	II 4466.60	..	80	II 6022.81	..	150
3003.93	..	50	4474.60	..	200	6076.82	..	15
I 3032.84	125	70	4475.69	..	30	II 6110.30	..	150
II 3053.49	..	15	II 4494.59	..	200	II 6110.66	..	150
II 3058.10	..	15	II 4507.92	..	30	6136.01	..	15
I 3075.32	60	35	II 4516.14	..	15	II 6170.47	..	150
II 3116.63	..	150	II 4539.97	..	200	I 7960.26	25	..
I 3119.60	100	50	4543.76	..	200	I 8305.62	50	..
II 3126.99	..	15	II 4549.23	..	125	I 8428.94	100	..
II 3671.92	..	15	II 4552.37	..	50	I 8541.65	50	..
3683.58	..	15	4591.02	..	30	I 8564.71	100	..
II 3720.31	..	15	II 4602.73	..	200	I 8654.16	100	..
II 3749.77	..	100	4607.46	..	200	I 8821.76	150	..
II 3787.18	..	15	4627.80	..	200	I 8869.69	100	..
II 3842.82	..	50	II 4630.14	..	200	I 8935.58	50	..
II 3931.28	..	15	4648.32	..	30	I 8993.08	20	..
II 3948.74	..	50	II 4672.70	..	50	I 9134.81	15	..
3982.45	..	25	II 4707.82	..	200	I 9267.29	25	..
II 4006.34	..	50	II 4730.92	..	125	I 9300.62	50	..
II 4082.57	..	15						

BARIUM

II 2304.23	60 r	80 r	I 3993.40	100 r	50 r	4599.75	50	10
II 2335.27	60 r	100 r	II 4130.66	50 r	60 wn	I 4619.98	25	..
2347.58	30	40	II 4166.01	12	50	4628.33	40	4
II 2528.51	..	50 r	II 4216.04	..	(25)	4673.62	40	5
I 2596.68	40	..	II 4267.95	..	(80)	4691.62	100	40
II 2634.78	30	50	4285.11	25	20	I 4700.44	25	3
II 2647.29	10	40	II 4309.32	..	(80)	II 4708.94	..	(80)
I 2702.64	50	5 n	II 4325.73	..	(50)	I 4726.45	80	30
I 2785.26	50	..	4350.37	40	20	II 4843.46	..	(80)
2816.07	..	30	4402.55	80	10	I 4877.65	30 wn	8
I 3071.59	100 r	50 r	4431.90	60	30	II 4899.97	30 n	200 l
I 3261.96	40	..	I 4488.97	80	3	II 4934.09	400 n	400 n
I 3281.50	25	..	I 4493.64	60	5	II 4957.16	..	(50)
I 3322.87	30 r	..	4505.93	60	20	II 5013.08	..	50
I 3356.89	40 r	3	4523.24	60	10	5159.92	50 n	10
I 3501.12	1000	20	II 4524.95	80	30	I 5267.03	25	12
II 3891.78	18	25	II 4554.04	1000 r	200	II 5361.35	..	(40)
I 3909.92	50 r	20 r	4573.85	50	20	II 5391.60	..	(50)
I 3935.72	80 r	30 r	4579.67	75	40	I 5424.62	100 r	30 r

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

BARIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 5519.11	200 wn	60	I 6693.88	600	100	I 7905.72	300	..
I 5535.55	1000 r	200 r	I 6771.85	60 n	..	I 7911.30	200	..
5680.20	60	..	I 6865.71	200	..	I 8210.24	200	..
I 5777.66	500 r	100 r	I 6867.87	100 n	..	I 8325.39	25	..
II 5784.18	..	(40)	I 7059.96	2000	..	I 8514.28	40 n	..
I 5800.28	100	20	I 7090.00	100 nl	..	I 8559.95	400	..
5805.69	70	..	I 7120.31	800 nl	..	I 8581.98	50 nl	..
I 5826.29	150 wn	..	I 7153.58	80 nl	..	I 8654.07	40	..
5853.68	300	100 n	I 7195.23	200	..	I 8799.76	100 n	..
I 5971.70	150	50	I 7228.81	200 nl	..	I 8860.99	80	..
5972.78	100	..	I 7280.27	1000	..	I 8914.96	100	..
II 5981.25	..	(40)	I 7375.53	50 nl	..	I 9189.58	70	..
I 5997.09	150 wn	50	II 7392.42	400	..	I 9215.36	25 n	..
I 6019.47	150 Wn	50	I 7409.96	30 nl	..	I 9219.72	125	..
I 6063.12	200 wn	60	I 7417.52	100	..	I 9253.09	25	..
I 6110.78	200 Wn	60	I 7459.75	300 nl	..	I 9308.16	50 n	..
6141.72	2000 wn	2000 wn	I 7476.18	30 n	..	I 9324.58	50 n	..
6341.68	90	50	I 7488.06	200	..	I 9367.49	40 n	..
6450.85	100	20	I 7610.46	60	..	I 9370.09	300	..
6482.91	100 Wn	50	I 7636.85	40	..	I 9455.98	100	..
6496.90	800 r	200 Wn	I 7642.88	100	..	I 9524.76	40 n	..
6498.76	60	20	I 7672.02	400	..	I 9589.37	50	..
6527.31	200	20	I 7706.50	25	..	I 9608.90	150	..
I 6595.32	1000	300	I 7751.73	40	..	I 9645.76	25 n	..
I 6654.05	50	..	I 7775.32	25	..	I 9713.77	25 n	..
I 6675.27	500	100	I 7780.43	300	..	I 9830.37	300 nl	..

BERYLLIUM

I 2056.52	100	..	I 3046.52	..	(15)	I 3865.43	30	..
I 2175.07	25	3	II 3046.68	10	(20)	I 3866.03	15	..
I 2348.61	2000 r	50	I 3110.84	20	..	I 4253.05	..	(20)
I 2350.68	25	2	I 3110.96	15	..	I 4253.76	..	(15)
II 2413.45	..	(25)	II 3130.42	200	200	II 4360.69	..	(35)
I 2494.56	30	..	II 3131.07	200	150	II 4361.02	..	(40)
I 2494.58	25	..	II 3197.16	..	15	4364.0	..	50
I 2494.73	30	20	I 3229.69	15	..	I 4407.91	20	(35)
I 2650.47	100	15	II 3241.65	5	(15)	I 4572.67	15	15
I 2650.55	30	..	II 3241.83	5	(50)	4573.1	..	40
I 2650.61	20	15	II 3274.64	..	(50)	4672.2	..	100
I 2650.64	25	..	I 3321.01	50	..	II 4673.46	..	(100)
I 2650.78	25	..	I 3321.09	100	15	II 4828.12	..	(25)
I 2898.19	15	..	I 3321.34	1000 r	30	5272.7	..	20
I 2898.27	20	..	I 3367.62	25	..	I 6981.00	15	..
I 2986.46	15	..	I 3455.20	20	..	I 8254.10	100	..
I 3019.34	30	..	I 3515.55	30	..			
I 3019.51	15	..	I 3813.42	50	..			

BISMUTH

I 2021.21	40 wn	15	I 2134.31	100 r	5 n	I 2400.88	200 r	100
2023.99	50	..	2152.91	50 r	..	2430.45	30	6
2041.96	100	15	2153.53	40 wn	..	2433.45	30	..
2049.69	25	20	2156.95	75 r	..	I 2448.06	50	8
I 2057.68	40	4 n	II 2186.92	..	30	2499.51	25	12
I 2061.70	300 r	100	I 2189.59	25 n	5 n	I 2515.69	100	25
2064.79	50	4 n	I 2228.25	100 r	50	I 2524.49	100	25
I 2110.26	250 r	50	I 2230.61	100 r	30 r	2532.57	25 wn	..
I 2133.63	100 W	40	I 2276.58	100 r	40	2582.14	35	5

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

BISMUTH (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2627.91	200 w	200	II 3588.5	..	(60)	II 5209.29	..	600 n
2696.61	100	100	I 3596.11	150 wn	50	II 5260.8	..	25
I 2696.76	25 r	15 r	3613.82	..	30	II 5269.71	8	30
I 2730.50	200	100	3695.55	..	50	5552.35	500 wnl	100 l
I 2780.52	200 w	100	II 3724.9	..	(60)	5742.55	30	10
I 2798.68	200	25	3792.8	..	500 n	II 5973.01	..	40
II 2803.48	2 n	30	II 3793.0	..	(25)	II 6058.96	..	(40)
I 2809.62	200 W	100	II 3811.14	..	(150)	II 6128.11	..	30
I 2863.75	80 w	18	II 3815.8	..	(300)	I 6134.82	50	30
I 2897.97	500 W _r	500 W _r	3816.17	..	25 n	II 6600.2	..	70
I 2938.30	300 w	300 w	II 3841.6	..	(25)	II 6808.6	..	70
I 2989.03	250 wn	100 wn	II 3845.8	..	(100)	II 7033.	..	25
I 2993.34	200 wn	100 wn	3846.03	..	100	7838.70	400 nl	..
I 3024.63	250 wn	50	II 3863.9	..	(100)	II 7965.	..	(50)
3034.87	30	30	3864.2	..	150 n	7975.9	30 W _n	..
I 3035.18	60 n	..	I 3888.23	40	2	II 8050.	..	(30)
II 3053.7	..	(60)	II 4079.21	2 n	(40 w)	II 8328.	..	(40)
I 3067.72	3000 nr	2000 wn	I 4121.53	125 wn	50	II 8388.	..	(40)
II 3111.67	..	(25)	II 4259.62	..	60 wn	II 8532.	..	(80)
3115.42	..	500	II 4302.14	2 n	50 wn	I 8544.52	40	..
3302.55	150	..	I 4308.18	50	12	8628.0	100 W _n	..
II 3355.1	..	(35)	II 4340.59	..	40 n	II 8653.	..	(60)
I 3397.21	100 wn	50	II 4379.4	25	20	I 8754.92	40	..
3405.33	40	10	II 4705.35	..	50	8761.53	100 wn	..
I 3405.66	60	..	I 4722.55	1000	100	II 8863.	..	60
II 3430.10	..	(25 d)	II 4730.3	..	(25)	I 8907.9	200 wn	..
II 3430.30	..	(35)	II 5091.29	2 n	30 wn	9058.6	50 W _l	..
II 3430.53	..	(60)	II 5118.2	..	25	9342.55	500 n	..
II 3430.83	..	(200)	II 5124.3	..	100 wn	9417.0	100 n	..
II 3431.23	..	(150)	II 5144.48	2	300 n	9650.1	50 n	..
II 3455.27	..	100 n	II 5201.01	..	30	9657.2	2000 d	..
I 3510.85	200 wn	30	II 5208.8	5 wn	70	9828.02	300	..

BORON

I 2088.93	100	15	2785.14	..	35	II 3452.28	5	30
I 2089.59	150	20	bh 2809.9	60	..	bh 3677.8	50	..
II 2363.88	..	15	bh 2850.6	50	..	bh 3679.1	200	..
bh 2364.5	50	..	bh 2892.2	200	..	II 3792.5	..	(500)
2369.96	..	20	bh 2934.9	100	..	bh 3830.2	50	..
II 2395.07	..	15	II 3032.28	..	10	bh 3847.0	100	..
bh 2398.5	200	..	bh 3043.6	100	..	bh 3848.7	200	..
II 2432.29	..	35	bh 3088.6	100	..	3871.39	..	20 n
2434.95	..	20	II 3179.35	5	100	bh 4037.4	25	..
bh 2437.1	250	..	3191.84	3	10	II 4121.95	..	20
I 2496.78	300	300	bh 3257.0	100	..	bh 4339.6	25	..
I 2497.73	500	400	II 3260.74	4	10	bh 4342.0	25	..
2514.39	..	50	3282.01	4	12	bh 4363.4	40	..
bh 2551.4	150	..	3302.51	..	10	bh 4365.9	25	..
II 2566.26	..	15	bh 3305.4	50	..	bh 4588.8	25	..
bh 2588.0	50	..	II 3323.34	..	10	bh 4615.4	40	..
bh 2675.3	60	..	II 3323.61	..	10	bh 4744.0	25	..
bh 2713.8	200	..	3360.09	2	20	bh 4746.9	25	..
bh 2753.4	100	..	II 3451.41	..	100	bh 5040.1	12	..
2779.26	..	100	..	..	..	..	..	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

BROMINE

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
2337.90	..	25	I 4614.60	..	100 l	5506.78	..	300
2386.74	..	25	4622.75	..	200	5536.30	..	50
2389.69	..	70	I 4643.52	..	25 l	5589.93	..	250
2395.34	..	25	4651.99	..	25	5600.83	..	30
2488.37	..	40	4678.69	..	200	5691.43	..	30
2521.66	..	50	4693.27	..	40	5718.91	..	30
2541.45	..	40	II 4704.86	..	250	5737.13	..	30
2556.93	..	25	4719.77	..	80	5783.31	..	40
2656.83	..	25	4742.70	..	200	5830.74	..	100
2660.49	..	25	I 4752.27	..	100	I 5833.43	..	80
2709.67	..	35	II 4766.00	..	50	I 5852.10	..	150
2713.74	..	25	4767.10	..	200	I 5940.53	..	60 l
2799.00	..	35	I 4775.21	..	25	I 6122.12	..	50 l
2872.59	..	25	4776.42	..	200	I 6148.62	..	200
2893.44	..	35	I 4780.31	..	125	I 6177.40	..	40
2972.22	..	25	II 4785.50	..	400	6285.04	..	25
3659.50	..	25	I 4802.65	..	25	I 6350.74	..	200 l
II 3891.63	..	25	II 4816.71	..	300	6352.94	..	25
II 3914.28	..	150	I 4834.46	..	25	I 6410.32	..	30
II 3924.10	..	35	II 4848.75	..	150	I 6544.61	..	100
3950.61	..	30	I 4849.37	..	25	I 6559.81	..	150
II 3980.39	..	25	4928.79	..	150	6567.53	..	25
4014.32	..	25	4930.66	..	50	I 6582.19	..	100
4140.21	..	30	I 4979.76	..	125 l	I 6631.64	..	200 l
I 4175.79	..	50	I 5002.70	..	40	I 6682.29	..	90
4179.64	..	40	5020.58	..	30	I 6692.16	..	70
II 4193.46	..	25	5038.77	..	60	I 6728.29	..	40
4202.50	..	25	5054.65	..	200	I 6786.77	..	30
4223.88	..	80	II 5182.36	..	100	I 6790.05	..	70
4236.88	..	25	5199.33	..	30	I 6861.21	..	30
4291.40	..	150	II 5238.23	..	100	I 6971.97	..	40
4365.60	..	200	5249.05	..	30	I 7005.21	..	200 l
I 4391.61	..	25	5304.10	..	30	I 7111.63	..	30
4393.56	..	25	5332.04	..	100	I 7142.28	..	40
I 4441.74	..	80	5335.11	..	70	7162.14	..	45
I 4472.62	..	125 l	I 5345.43	..	80 l	I 7184.34	..	30
I 4477.75	..	200 W	I 5395.52	..	150 l	7260.49	..	50
I 4490.43	..	25	5422.78	..	30	I 7348.56	..	500 l
I 4513.44	..	100 l	I 5450.06	..	30	I 7425.89	..	100
I 4525.62	..	125 l	I 5466.23	..	150 l	I 7513.01	..	50 l
I 4529.77	..	80	5479.99	..	30	I 8272.46	..	70 l
4542.93	..	250	5488.79	..	70	I 8446.55	..	50
I 4575.75	..	100 l	5495.06	..	150	I 8638.66	..	25
4579.95	..	25						

CADMIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2033.03	..	(20)	2239.86	80	30	II 2321.15	..	100 n
II 2036.79	..	(30)	II 2265.02	25 d	300	2321.94	..	(20)
II 2096.63	..	(100)	II 2265.81	..	30	2329.28	50	60
II 2144.38	50	200 r	2267.47	20	30	II 2377.63	..	15
2145.04	..	(20)	I 2288.02	1500 r	300 r	II 2418.70	..	20
II 2155.70	..	(30)	2288.74	..	20	II 2419.49	..	(25)
II 2188.55	..	(50)	2306.61	20	30	II 2469.84	..	(500)
2194.63	5	100 n	II 2312.84	1	200	II 2470.61	..	(50)
2195.35	..	15	2313.49	..	(30)	II 2487.94	..	15

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CADMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2495.73	..	(30)	II 2911.64	..	(15)	I 3649.60	20	15
II 2499.85	..	15	II 2914.69	..	(45)	I 3729.06	15 r	..
II 2509.25	..	(30)	II 2929.28	..	50	II 4134.78	..	15
II 2516.34	..	25	2948.16	..	35	4414.63	..	200
I 2518.79	15 n	(1)	2951.82	..	25	II 4415.70	1	20
2525.39	25 n	..	I 2961.47	20	15	I 4678.16	200 W	200 W
I 2544.71	50	(5)	I 2980.63	1000 r	500	I 4799.92	300 w	300 w
II 2552.18	5 n	(100)	I 2981.34	200 r	(40)	I 5085.82	1000 wn	500
I 2553.56	25	(2)	I 2981.89	50	(10)	II 5337.49	5	25
I 2580.30	50	(5)	2987.2	..	(25)	II 5378.04	5	50
I 2592.14	30	..	2996.03	..	25	II 5381.82	2	20
I 2602.18	25 n	(5)	I 3005.41	25	4	I 5598.77	15	..
II 2618.97	..	(30)	3064.95	..	15 n	II 5843.17	3	(40)
I 2629.05	50	10	I 3080.83	150	100 l	I 6031.38	30	..
I 2632.24	40	(3)	I 3082.68	30	..	I 6099.18	300	..
I 2639.50	75	15	3084.87	10	40 n	I 6111.52	100	..
I 2660.40	50 n	(5)	II 3092.39	10	15	I 6116.19	50	..
I 2677.64	100	25	I 3133.17	200	300	I 6128.66	15	..
II 2680.08	..	(15)	II 3185.55	..	(15)	I 6198.22	15	..
II 2707.14	..	(30)	3217.8	..	(15)	I 6325.19	100	..
I 2712.57	75	20	3243.15	..	15	I 6329.97	30	..
2726.93	..	(15)	II 3250.17	..	100	II 6354.72	5	40
I 2733.86	50	25	I 3250.30	..	25	II 6359.93	10	50
II 2748.58	5	200	I 3252.52	300	300	I 6438.47	2000	1000
I 2756.79	50 n	..	I 3261.06	300	300	II 6464.98	5	50
I 2763.89	100 n	50	3298.97	15	..	II 6725.83	..	100
2764.11	50 n	25	II 3343.15	..	15	II 6759.26	..	30
I 2775.05	50	20	II 3385.40	..	(40)	I 6778.10	30	..
2780.28	..	(25)	I 3403.65	800	500 n	I 7132.27	30	..
2805.59	..	30	II 3417.40	10	15	7237.01	..	15
II 2823.19	..	(20)	I 3466.20	1000	500	II 7284.38	..	25
II 2834.19	..	(100)	I 3467.66	800	400	I 7346.2	1000	..
I 2836.91	200	80	3495.34	..	(100)	7383.9	1000	..
I 2862.31	15	10	I 3500.00	25	15	I 7385.3	800	..
I 2868.26	100	80	II 3535.69	5	15	7393.0	70	..
I 2880.77	200 r	125	I 3610.51	1000	500	I 7399.2	70	..
I 2881.23	50 r	(30)	I 3612.87	800	500	II 8066.99	..	15
2910.8	..	(30)	I 3614.45	60	100			

CALCIUM

II 2103.24	10	25	I 3099.34	10	2	I 3350.36	15	3
II 2112.76	10	25	I 3108.58	30	3	I 3361.92	125	10
I 2150.78	10	..	3117.65	10	2	I 3362.13	15	5
II 2197.79	20	40	I 3136.00	15	3	bh 3409.10	12	..
I 2200.72	20	..	I 3140.78	15	3	I 3468.48	20	3
II 2208.61	20	50	I 3150.74	50	2	I 3474.70	40	5
I 2275.47	40	5	I 3158.87	100	300 w	bh 3475.0	30	..
I 2398.56	100 r	20	I 3169.85	10	2 n	I 3487.59	100	2
II 2573.09	3	150	II 3179.33	100	400 w	bh 3564.0	20	..
I 2680.36	15	..	I 3180.52	20	..	I 3624.11	150	15
I 2721.64	20	2	II 3181.27	8	15	I 3630.75	150	9
I 2994.96	25	3	I 3209.93	30	2	I 3630.95	10	..
2997.31	25	5	I 3215.13	20	4 w	I 3644.41	200	15
I 2999.64	20	10	I 3225.90	80	10	I 3644.76	30	..
I 3000.86	20	6	I 3269.10	10	2	bh 3656.6	12	..
I 3006.86	25	5	I 3274.66	20	..	I 3675.31	10 n	2
I 3009.20	20	5	I 3286.07	30	2	I 3678.23	15	2 n
I 3080.83	20	2	I 3344.51	100	7	II 3706.03	15	40
I 3095.28	10	2	I 3350.21	100	10	II 3736.90	12	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CALCIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3748.37	12	..	I 4454.78	200	5 nl	I 6162.17	40	45
I 3750.35	20	3	I 4455.89	100	75	I 6163.76	10	7
I 3753.37	30	3	I 4456.62	20	15	I 6166.44	15	5
I 3870.51	15	..	4499.90	..	10 n	I 6169.05	25	15
I 3875.81	50	..	I 4512.28	10	..	I 6169.56	40	20
II 3933.67	600 r	600 r	I 4526.93	100	3 wn	I 6439.07	150	50
I 3948.90	40	15	I 4578.56	80	5	I 6449.81	60	12
I 3957.05	80	3	I 4581.40	100	10	I 6455.60	10	7
II 3968.47	500 r	500 r	I 4585.87	125	10	I 6462.56	125	50
I 3972.57	12	..	I 4685.26	25	1	6471.66	40	15
I 3973.71	200	15	I 4878.13	100	10	I 6493.78	80	30
4030.3	10	2 n	5021.15	10	..	I 6499.65	30	15
I 4092.63	15	2	I 5041.62	30	..	I 6572.78	50	..
I 4094.93	15	7	I 5188.85	50	6 w	bh 6956.2	20	..
I 4098.53	15	3	I 5261.70	20	6	I 7148.15	500	..
4196.60	12 w	1 n	I 5262.25	20	8	I 7202.19	30	..
4207.28	..	10	I 5264.24	15	8	I 7203.17	200	..
I 4226.73	500 r	50 r	I 5265.56	20	10	I 7326.15	400	..
I 4240.46	10	10	I 5270.28	20	10	bh 8153.0	40	..
4248.96	2 n	10	5271.97	10	..	II 8498.02	300	..
I 4283.01	40	20	I 5349.47	12	12	II 8542.09	1000	..
I 4289.36	35	20	I 5581.97	20	12	bh 8652.2	20	..
I 4298.99	30	18	I 5588.75	35	25	II 8662.14	1000	..
I 4302.53	50	25	I 5590.11	15	10	bh 9228.9	20	..
I 4307.74	45	20	I 5594.45	35	20	9233.4	20	..
I 4318.65	60	20	I 5598.47	35	20	I 9688.6	15	..
I 4355.10	50	..	I 5601.26	15	10	bh 9700.0	10	..
4374.61	10	2 n	I 5602.84	15	10	I 9701.7	20	..
4399.64	..	10	I 5857.46	40	30	bh 9775.0	15	..
I 4425.44	100	20	I 6102.72	80	50	bh 9807.3	20	..
I 4434.96	150	25	I 6122.22	100	100	bh 9834.7	30	..
I 4435.69	100	15	I 6161.29	10	6			

CARBON

bh 2012.3	30	..	II 3876.41	..	60	II 5151.08	..	30
bh 2026.2	25	..	II 3876.67	..	40	bh 5239.3	70	..
bh 2047.5	30	..	II 3918.98	..	80	II 5259.62	..	30
bh 2068.8	30	..	II 3920.68	..	200	bh 5354.1	100	..
bh 2090.0	30	..	II 4074.53	..	50	I 5380.24	..	(300)
bh 2150.6	30	..	II 4074.89	..	40	bh 5473.3	70	..
bh 2162.6	30	..	II 4076.00	..	80	bh 5597.9	50	..
2163.60	..	30	II 4267.02	..	350	II 5648.08	..	30
bh 2173.4	30	..	II 4267.27	..	500	II 5662.51	..	50
bh 2196.9	30	..	II 4317.42	..	30	bh 5730.0	150	..
bh 2221.8	30	..	4348.07	..	(30)	I 5793.51	30	..
bh 2286.7	30	..	II 4368.14	..	(30 n)	bh 5858.2	400	..
bh 2312.0	30	..	I 4371.33	..	30	II 5889.97	..	60
bh 2382.0	30	..	II 4372.49	..	30	II 5891.65	..	30
bh 2408.0	30	..	II 4374.28	..	40	bh 5992.6	100	..
bh 2435.0	30	..	4410.06	..	30	II 6098.62	..	30
I 2478.57	400	(400)	II 4411.20	..	40	II 6578.03	..	500
II 2509.11	..	200	II 4411.52	..	40	II 6582.85	..	200
II 2511.71	..	60	bh 4612.7	50	..	I 6587.75	..	(50)
II 2512.03	..	400	II 4618.85	..	25 n	II 6779.74	..	50
II 2746.50	..	25	I 4762.41	..	(30)	II 6783.75	..	100
II 2747.31	..	40	I 4771.72	..	(30)	II 6791.30	..	30
bh 2785.4	30	..	I 4932.00	..	40	II 6800.50	..	30
bh 2799.7	50	..	I 5039.05	..	(30)	II 7231.12	..	100
II 2836.71	..	200	I 5041.66	..	(30)	II 7236.19	..	150 n
II 2837.60	..	40	I 5052.12	..	(100)	I 8335.19	..	(150)
II 3876.05	..	40	II 5132.96	..	30	9045.1*	150	..
II 3876.19	..	125	II 5145.16	..	70	I 9061.48	350	(200)

* Also credited to nitrogen.

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CARBON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 9062.53	..	(150)	I 9094.89	500	(300)	I 9602.8	60	..
I 9078.32	150	(70)	I 9111.85	150	(100)	I 9620.86	125	(5)
I 9088.57	200	(100)	I 9405.77	300	(200)	I 9658.49	250	(15)

CERIUM

2180.67	..	100	3343.86	50	6	II 3967.05	35	6
2222.04	..	100	II 3344.76	50	8	3968.47	35	35 w
2225.10	..	100	II 3349.97	30	1	II 3971.68	35	6
2242.33	..	60	3353.33	10	30	3978.65	35	6
2318.69	..	40	3357.21	30	3	3978.89	50	50
2350.15	..	50	3360.54	35	4	II 3980.88	35	8
2372.37	..	50	II 3366.55	30	3	II 3982.90	30	6
2390.16	..	50	3377.13	50	5 s	3984.67	40	8
2795.52	30 s	8	3379.17	30	2	II 3992.39	50	8
2814.81	40 d	..	3393.02	30	1	3993.82	50	6
2830.90	30	..	3417.45	30	5	II 3999.24	80	20
2833.31	50 d	..	II 3420.18	35	2	4003.77	40	18
2837.29	50 s	..	3422.71	30	10	I, II 4012.39	60	20
2852.12	50 d	1	3426.21	30	6	II 4014.90	60	12
2854.67	30 s	..	3441.21	35	5	II 4028.41	35	8
2874.13	30 w	..	3454.47	10	40	II 4031.34	40	8
2881.58	40	2	3476.84	35	10	II 4040.76	70	5
2908.42	30 s	..	3485.05	30	10	I, II 4042.58	50	3
2918.66	30 s	..	3488.55	35	5 n	I, II 4046.34	30	10
2990.87	40	1	3517.38	40	6	II 4053.51	40	8
2995.64	30	1	I, II 3520.52	30	2	4062.22	40	8
3008.79	40	3	3521.88	35	5	4071.81	30	5
II 3056.78	40	3	3534.05	35	10	4073.48	50	8
3063.01	40	10	II 3539.09	100	10	4073.73	30	3
3084.47	40 s	3	3560.80	300	2	4081.22	40	8
3110.28	30	1	3577.46	300	12	4083.23	35 d	6
II 3127.53	40	..	3590.60	50	1	4101.77	35	6
3130.33	30	1	3609.69	40	10	4104.42	30	1
3130.87	30	2	I, II 3623.84	60	5	4104.99	40	3
II 3145.28	30	..	I, II 3631.19	50	3	4106.13	30	2
II 3146.41	30	..	3660.64	40	10	II 4107.42	30	8
II 3164.15	40	..	3667.98	80 s	15	4110.38	35	10 n
3169.18	30	..	3725.67	40	10	4111.39	35	5
3176.80	30	..	3728.42	50	10	II 4113.73	30	3
3183.52	40	..	II 3803.10	35	5	4115.37	40	6
3186.13	40	..	I, II 3808.12	35	35	4117.01	30	6
II 3189.64	30	..	3815.83	50	5	4117.59	30	5
3201.71	50	10	3838.54	35	3	4127.37	30	12
3204.16	30	..	3840.45	30	35	II 4131.10	30	8
I, II 3218.38	30	2	3889.99	50	8	4133.80	35	8
3218.94	50	8	I, II 3895.12	40	6	4142.34	35	6
3220.87	30	..	I, II 3896.80	35	6	4142.40	30	30
II 3221.17	50	8	3898.27	80	6	4151.97	30	8
II 3231.24	30	10	3907.29	35	6	II 4159.03	30	5
II 3233.44	30	2	3908.41	30	6	II 4165.61	40	6
I, II 3234.16	40	8	II 3909.31	35	3	II 4185.33	30	4
II 3236.73	35	8	I, II 3912.44	50	5	II 4186.60	80	25
I, II 3246.67	35	3	3918.28	60	6	II 4187.32	35	15
3252.48	30	3	3919.81	45	2	4190.63	30	3
II 3254.01	30	4	I, II 3931.09	35	8	II 4193.87	35	5
3272.25	40	15	3933.73	60	60	II 4202.94	40	18
3274.86	35	8	II 3938.09	35	6	I, II 4214.04	35	4
I, II 3279.84	30	5	II 3940.34	35	6	4222.60	80	18
II 3285.22	35	5	II 3942.15	35	8	4226.73	50	30
I, II 3295.29	30	3	3942.75	50	20	4227.75	40	5
3300.15	30	3	II 3943.89	40	15	4231.74	30	5
3304.84	30	3	II 3952.54	60	30	4234.21	30	2
3312.21	30	5	3956.28	30	8	4236.02	30	1
I, II 3341.87	40	5	II 3960.91	40	8			

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CERIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4239.91	35	4	4418.78	40	10	5079.68	30	..
4246.71	30	4	4429.27	35	5	5129.58	30	..
4248.68	60	8	4444.39	30	4	5159.69	30	..
4253.36	40 s	3	4444.70	35	6	5161.48	30	..
4255.78	40	6	4449.34	50	8	5187.45	50	..
4263.43	40	..	4450.73	35	5	5191.67	30 wn	..
II 4288.67	30	..	4460.21	60	20	5211.92	50 s	..
4289.94	50	25	4461.14	30	6	5245.92	30	..
4296.68	40	25	4463.41	35	6	5274.24	50	3
II 4300.33	40	15	4467.54	30	4	5353.53	50	30
4306.72	30	15	4471.24	35	8	5393.39	30	..
II 4310.70	30 s	3	4479.36	40	18	5409.22	50	..
II 4320.72	50	8	4483.90	40	10	5512.08	50 s	..
II 4330.44	50	5	4484.82	30	3	5522.99	100	..
4332.71	35 s	4	4486.91	40	15	5556.25	35	..
II 4349.79	40	5	4497.85	30	4	5564.96	40	..
I, II 4352.71	40	5	4523.08	35	25	5565.97	35	..
4364.66	30	6	4527.35	50	25	5601.30	50	..
4372.40	35	1	4528.47	30	15	5655.13	40	..
4373.82	40	4	4554.03	35 s	..	5669.97	50	..
4375.92	40	5	4562.36	40	40	5696.99	40	..
4380.06	30	2	4572.28	35 s	35	5699.23	40	..
4382.17	40	12	4593.93	30	30	5719.03	40	..
4391.66	40	15	4747.14	30	..	5773.12	30	..
4393.19	35	3	4882.46	30	..	5812.93	40	..
4394.78	30	3	4899.90	30	..	5940.85	40	..
4399.20	35	6	5009.09	30	..	6024.19	50	..
4407.28	40	3	5040.85	30	..	6043.39	30	..
4413.19	35	2	5048.82	30	..			

CESIUM

II 2254.94	..	(20)	2810.81	..	(20)	II 3925.58	..	(25)
II 2267.66	..	(20)	2817.98	..	(20)	II 3959.49	..	(20)
II 2273.88	..	(20)	2838.09	..	(20)	II 3965.19	..	(25)
2425.15	..	(20)	2845.67	..	(20)	4001.68	..	(20)
2427.65	..	(20)	2851.23	..	(20)	4006.54	..	(30)
2477.58	..	(20)	2859.32	..	(20)	4039.84	..	(50)
2485.42	..	(20)	2881.16	..	(20)	4043.42	..	(20)
2495.04	..	(20)	2886.67	..	(20)	II 4047.18	..	(20)
2525.68	..	(20)	2921.03	..	(20)	II 4067.96	..	(30)
2533.44	..	(20)	2931.11	..	(20)	II 4068.77	..	(30)
2543.92	..	(20)	2938.5	..	(20)	II 4151.27	..	(20)
2573.05	..	(20)	2995.34	..	(20)	4158.61	..	(18)
2591.17	..	(20)	II 3265.92	..	(30)	II 4213.13	..	(30)
2596.95	..	(20)	II 3267.13	..	(30)	II 4227.10	..	(50)
2600.36	..	(20)	II 3271.63	..	(20)	II 4228.35	..	(35)
2605.40	..	(20)	I 3347.44	30	..	4232.19	..	(25)
2609.43	..	(20)	II 3368.50	..	(30)	4234.41	..	(20)
2642.63	..	(20)	I 3398.14	60	..	4264.67	..	(50)
2644.7	..	(20)	I 3400.00	30	..	II 4277.10	..	(50)
2650.7	..	(20)	3476.88	100	..	II 4288.35	..	(35)
2678.92	..	(20)	I 3480.13	50	..	II 4300.64	..	(30)
2701.18	..	(20)	I 3611.52	200	..	II 4330.24	..	(20)
2706.79	..	(20)	I 3617.41	60	..	II 4363.27	..	(50)
2748.18	..	(20)	II 3785.42	..	(20)	II 4373.02	..	(30)
2755.20	..	(20)	II 3805.10	..	(25)	II 4384.43	..	(25)
2764.42	..	(20)	I 3876.39	300	..	4399.49	..	(20)
2776.42	..	(20)	I 3888.65	150	10	4403.85	..	(20)
2788.22	..	(20)	II 3906.93	..	(20)	II 4405.25	..	(35)

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CESIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4410.21	..	(20)	II 5096.60	..	(40)	6586.02	35	..
4425.66	..	(20)	II 5227.00	..	(200)	I 6586.51	500	(5)
I 4435.71	..	(20)	II 5249.37	..	(80)	I 6628.65	35	12
II 4501.52	..	(35)	II 5274.04	..	(40)	6723.28	500	6
II 4526.72	..	(35)	II 5306.61	..	(25)	I 6870.45	200	(5)
II 4538.94	..	(30)	5348.95	..	(25)	II 6955.52	..	(20)
I 4555.35	2000 r	100	II 5349.16	..	(25)	6973.29	500	..
I 4593.18	1000 r	50 r	II 5358.53	..	(500)	I 6983.49	25	..
II 4603.75	..	(60)	II 5370.98	..	(80)	7228.53	500	(2)
II 4623.09	..	(20)	5302.79	..	(40)	I 7229.01	35 l	..
II 4646.51	..	(25)	II 5419.69	..	(60)	I 7279.95	35 l	..
II 4670.28	..	(20)	II 5563.02	..	(125)	7609.01	500 l	..
II 4701.79	..	(25)	5566.7	..	(40)	7944.11	800	..
II 4732.97	..	(20)	II 5814.18	..	(25)	7990.68	100 s	..
4733.06	..	(20)	II 5831.16	..	(60)	I 8015.71	200	..
II 4739.66	..	(20)	5832.6	..	(25)	8053.35	100 s	..
4763.62	..	(25)	I 5844.7	30 w	..	I 8078.92	100	..
II 4830.16	..	(30)	5925.65	..	(60)	I 8079.02	1000	..
II 4870.03	..	(30)	I 6010.33	50	(10)	I 8521.10	5000 r	..
II 4952.83	..	(30)	I 6034.09	35	(2)	I 8761.38	500	..
II 4972.59	..	(25)	II 6128.62	..	(20)	I 8943.50	2000 r	..
II 5043.80	..	(80)	I 6212.87	100	(10)	I 9172.24	1000	..
II 5052.70	..	(25)	6386.94	25 l	..	I 9208.46	200	..
II 5059.87	..	(25)						

CHLORINE

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
2251.50	..	40	II 3353.39	..	125	II 3868.62	..	40
2253.16	..	30	II 3479.82	..	30	II 3913.92	..	30
II 2430.16	..	30	II 3509.39	..	40	II 4132.48	..	200
II 2434.10	..	50	II 3513.22	..	35	II 4147.09	..	30
II 2498.53	..	30	II 3522.14	..	40	II 4157.82	..	25
II 2502.75	..	40	II 3526.13	..	30	II 4208.03	..	30
II 2549.85	..	50	II 3750.00	..	30	II 4234.09	..	50
II 2646.88	..	25	II 3767.57	..	30	II 4235.49	..	25
II 2658.74	..	100	II 3774.25	..	25	II 4241.38	..	60
II 2667.36	..	40	II 3781.23	..	30	II 4253.51	..	75
II 2672.19	..	50	II 3793.75	..	25	II 4259.52	..	35
II 2676.95	..	150	II 3798.80	..	50	II 4270.61	..	25
II 2688.04	..	150	II 3805.24	..	75	II 4276.51	..	30
II 2754.10	..	25	II 3809.51	..	40	II 4291.76	..	50
II 2996.63	..	40	II 3810.10	..	30	II 4304.07	..	40
II 3022.93	..	30	II 3818.40	..	30	II 4307.42	..	75
II 3037.98	..	35	II 3820.25	..	100	II 4309.06	..	50
II 3058.00	..	40	II 3827.62	..	150	II 4336.26	..	45
II 3071.35	..	40	II 3843.26	..	100	II 4343.62	..	100
II 3092.22	..	50	II 3845.42	..	50	II 4372.91	..	80
II 3096.72	..	25	II 3845.68	..	75	I 4389.76	..	25
II 3276.81	..	40	II 3845.82	..	30	II 4490.00	..	50
II 3306.45	..	40	II 3851.02	..	100	I 4526.21	..	25
II 3307.90	..	50	II 3851.42	..	75	II 4569.42	..	50
II 3315.44	..	100	II 3851.69	..	30	II 4572.13	..	100
II 3316.86	..	50	II 3854.75	..	30	II 4721.43	..	25
II 3320.14	..	30	II 3860.83	..	150	II 4740.40	..	150
II 3329.12	..	150	II 3860.99	..	100	II 4755.64	..	50
II 3333.64	..	40	II 3861.34	..	50	II 4768.68	..	150

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CHLORINE (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 4771.09	..	40	II 5104.08	..	25	II 6653.75	..	25
II 4778.93	..	45	II 5113.36	..	40	II 6661.68	..	75
II 4781.32	..	75	II 5173.15	..	25	II 6686.04	..	45
II 4781.82	..	50	II 5189.70	..	25	II 6713.43	..	40
II 4785.44	..	50	II 5217.92	..	100	II 6759.42	..	35
II 4794.54	..	250	II 5221.34	..	70	II 6831.62	..	30
II 4810.06	..	200	II 5423.25	..	150	II 6850.21	..	40
II 4819.46	..	200	II 5423.52	..	100	II 6952.13	..	25
II 4819.79	..	25	II 5424.36	..	25	I 7256.65	..	200
II 4896.77	..	200	II 5443.42	..	100	I 7414.12	..	150
II 4904.76	..	125	II 5444.25	..	60	I 7547.09	..	25
II 4917.72	..	125	II 5456.27	..	50	I 8221.76	..	25
II 4936.99	..	25	II 5457.02	..	75	I 8333.31	..	30
II 4970.12	..	50	II 5457.47	..	30	I 8375.97	..	40
II 4995.52	..	60	II 5790.50	..	25	I 8428.27	..	30
II 5078.25	..	150	II 6094.65	..	100	I 8575.27	..	25
II 5099.30	..	100	I 6140.25	..	30	I 8585.99	..	30
II 5102.86	..	30	6398.64	..	40	I 9744.33	..	30
II 5103.04	..	125	6434.80	..	25	I 9875.95	..	50

CHROMIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2039.31	25 n	..	I 2396.37	30	3	2639.43	30	..
II 2055.52	100	300	2397.77	5	35	2642.12	35	3
II 2061.49	100	200	I 2399.06	50	2	I 2653.59	12	35
II 2065.42	50	150	I 2399.58	40	..	II 2658.59	18	35
2117.56	..	50	I 2408.62	150 r	2 r	II 2671.81	30	15
2213.70	..	30	I 2408.75	40	1	II 2677.16	35	300 r
2226.70	..	30	2438.47	..	35	II 2678.79	10	80
2235.93	..	50	2474.07	35	..	II 2687.09	30	60
2237.58	..	40	I 2491.34	30	1	I 2688.04	30	..
2241.84	..	30	I 2492.57	50	..	I 2690.26	30	2
2243.31	..	25	I 2495.08	35	..	II 2691.04	35	125
2243.62	..	30	I 2496.31	125 r	2	2693.52	1	40
2256.05	..	50	2502.53	100 r	3	I 2696.54	30	1
2297.19	10	50	I 2504.31	150 r	3	2697.50	1	35
2314.74	8	50	I 2508.11	35	1	2697.91	3	35
2320.08	10	30	I 2508.98	25	1	II 2698.41	12	35
2324.89	..	50	2511.96	25	1	II 2698.69	12	35
2333.48	..	25	I 2516.92	35	2	2698.85	..	35
2345.33	8	60	I 2519.51	150 r	6	I 2700.59	30	2
I 2362.23	25	2 n	I 2528.01	35	1	I 2701.99	35	8
I 2365.97	25	8	I 2528.24	30	..	2703.55	..	50
I 2366.85	60	60	I 2530.45	35	1	II 2703.86	8	30
I 2368.49	30	2	2538.29	..	25	2708.79	3	40
I 2370.39	40	3	I 2541.35	60	3	2709.31	2	60
2372.89	40	3	I 2549.53	25	2	2710.23	50 n	..
I 2373.73	60	..	I 2557.15	35	2	2710.92	1	70
2381.48	3	25	I 2560.69	30	15	II 2712.31	30	70
I 2385.74	25	..	I 2571.74	50 r	35	II 2717.51	12	40
I 2389.46	25	..	I 2577.65	35	3	2720.07	5	35
2389.76	..	25	2584.10	1	25	2720.26	1	30
2392.37	25	2 n	I 2591.85	100 r	12	II 2722.75	30	80
I 2392.89	40	2 n	I 2603.57	30	1	2723.63	..	35
2394.01	..	50	2607.91	1	35	2724.04	1	40
I 2395.79	25	2 n	2622.86	25	2	I 2726.51	300 r	40

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CHROMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2727.26	4	70	2826.75	70	3	2910.65	..	50
2728.16	..	25	2830.47	15	80 n	I 2910.90	60 r	8
I 2731.91	300 r	30	2832.46	2	125	I 2911.14	40	8
I 2736.47	300 r	50	2834.26	..	125	..	..	40
2739.38	35	25	II 2835.63	100	400 r	2913.73	60 r	5
II 2740.09	20	60	2837.88	2	35	2915.23	1	25
2741.07	35	30	2838.79	3	80	2921.24	1	25
II 2742.03	15	50	2840.02	25	125	II 2921.82	4	60
2742.17	30	3	II 2843.25	125	400 r	2923.68	1	25
II 2743.64	30	125	2846.02	25	4	II 2926.16	2	40
2744.59	..	40	2846.44	2	25	2927.08	2	80
2746.18	..	25	2848.40	6	30	2929.44	..	40
I 2748.29	300	5	2849.29	35	30	2930.85	..	50
II 2748.98	35	200	II 2849.84	80	150 r	2932.70	2	25
II 2750.73	30	150	2851.36	20	80	2933.97	2 n	40
I 2751.60	30	..	2853.22	5	100 r	2934.49	25 n	..
II 2751.87	20	125	2855.07	4	100	2935.14	8	40
I 2752.88	300 r	40	II 2855.68	60	200 Wn	2940.22	..	30
2754.28	3	50	II 2856.77	20	60	I 2941.88	12	25
2755.27	50 d	2	II 2857.40	20	80	2946.84	5	30
2756.30	1	100	2857.97	2	40	2947.50	..	25
2756.93	..	30 r	II 2858.65	18	30	2953.36	4	50
I 2757.10	300 r	10	II 2858.91	50	80 Wn	2953.71	6	25
II 2757.72	35	150	II 2860.93	60	100	2961.73	10	60
2758.62	..	30	II 2862.57	80	300 r	2966.05	2	70
2758.98	1	40	II 2865.11	60	200 r	I 2967.64	60 r	30
2759.39	10	35	II 2866.74	80	125 r	I 2971.11	80 r	15
I 2761.75	300 r	35	2867.10	20	35	2971.91	8	30 Wn
II 2762.59	40	100	II 2867.65	80	100 r	I 2975.48	100 r	50
2763.06	35	4	II 2870.44	25	300 W	2979.74	10	60
2763.59	1	30	2871.45	..	80	I 2980.79	75 r	50
2763.97	..	30	I 2871.63	50	2	2985.32	10	60
I 2764.35	200 r	6	2873.19	25	..	I 2985.85	25 r	15
2765.86	..	35	II 2873.48	30	125	I 2985.99	25 r	15
II 2766.54	40	300 r	II 2873.82	20	40	I 2986.47	125 r	125
2767.54	30	8 d	II 2875.99	30	80 wn	I 2988.65	200 r	150
2768.59	1	60	II 2876.24	25	80 Wn	2989.19	10	90
I 2769.91	400 r	40	II 2877.98	30	100	I 2991.89	125 r	60
2773.31	1	40	2878.45	20	80	I 2994.07	150	50
2774.44	..	100	I 2879.27	60	12	I 2995.10	200 r	75
2775.67	30	..	II 2880.87	20	25	I 2996.58	300 r	125
2776.65	..	25	2881.14	25	2	I 2998.79	200 r	70
2777.67	40	1	2881.93	1	30	I 3000.89	150 r	125
2778.06	12	60	I 2886.99	100	18	3003.92	1	150
2780.30	..	100	2887.77	..	35	I 3005.06	300 r	125
I 2780.70	600 r	15	2888.74	3	40	3010.64	..	40
2782.35	..	35	I 2889.26	60 r	30	I 3013.03	80	40
2783.84	..	35	2889.48	2	25	I 3013.71	200 r	150
2785.70	5	80	2891.10	10	40	I 3014.76	300 r	100
2786.49	1	30	2891.41	30	15	I 3014.91	300 r	100
2787.63	5	30	2891.88	..	35	I 3015.19	200 r	80
2792.16	5	80	I 2893.25	80 r	10	3015.51	1	150
2795.82	35	3	2894.17	40	2	I 3017.57	300 r	200
2800.17	..	40	II 2894.25	..	25	I 3018.50	200 r	125
2800.77	12	150	2896.46	6	30	I 3018.82	200 r	60
2803.36	1	30	I 2896.75	60 r	30	I 3020.67	200 r	100
2808.02	..	30	2897.70	3	25	I 3021.56	300 r	200 r
2812.01	8	80	2898.54	12	40	I 3024.35	300 r	125
2816.84	3	30	I 2899.21	50	25	3026.65	8	125
2818.36	8	80	2899.48	2	40	3028.12	2	125
2822.01	10	80	I 2905.49	60 r	8	I 3029.16	70	50
2822.37	20	100	I 2909.05	60 r	12	I 3030.24	200 r	150

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CHROMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3031.35	40	30	3162.44	25	..	II 3312.18	5	125
II 3032.93	10	100	3163.76	40	25	3313.72	30	1
I 3034.19	200 r	60	3169.19	2	50	3314.05	..	30
3034.54	..	30	I 3169.58	25	2	3314.56	10	100
I 3037.04	200 r	100	3172.08	2	200	3318.08	80 Wn	..
I 3039.78	80	35	3173.56	..	25	3323.25	25	..
I 3040.86	500 r	200	3179.28	100	10 n	3324.35	10	60
3041.74	2	125	II 3180.70	30	150	3326.59	40	18
II 3042.79	1	100	II 3181.43	15	40	II 3328.35	20	40
3043.88	..	50	3183.32	6	150	I 3329.05	30	6
3047.45	25	6	3184.34	..	30	3330.60	80	..
3050.14	10	150	3186.74	..	30	3332.88	30	10
I 3053.88	3 r	150	3188.01	150 n	60 n	3333.60	125	3 n
3057.86	..	30	I 3192.11	30	2	3334.69	150 wn	..
II 3058.34	..	30	II 3197.08	35	30 n	II 3336.33	18	80
II 3059.52	8	60	3198.11	40	10	II 3339.80	25	150
3065.07	20	50	3201.26	1	50	3341.43	50	1
II 3067.16	25	40	3205.10	1	40	II 3342.59	30	125
3073.68	35	25	II 3208.59	20	40	I 3343.34	30	10
3077.25	..	40	II 3209.18	40	125	3343.74	30 n	..
I 3077.83	25	125 r	3211.31	35	12	3346.02	35	35
3079.33	..	25	3212.89	..	30	3346.74	150 r	80 r
3083.60	..	35	3216.56	3	125	II 3347.84	35	125
3084.45	..	35	3217.40	30	20	3349.07	125	40
3087.88	..	40	3218.69	80 wn	2 wn	3349.32	35	50
3093.49	1	100	3219.13	..	30	3351.60	35	8
3093.95	..	25	I 3226.55	30	1	I 3351.97	50	50
3095.86	125	3	3229.20	35	..	3353.03	20	30
3096.13	1	100	I 3233.23	30	4	3353.13	15	50
3096.53	35	..	3234.06	10	150	3353.61	30	..
3098.16	..	30	3237.73	40	30	3356.40	35 wn	..
3103.47	..	50	3238.09	30	20	3356.72	35 wn	..
3107.57	2	125	3238.51	25	8	3357.41	6	125
3108.65	..	35	3238.76	6	200	II 3358.50	40	200
3109.34	30	12	I 3240.95	35	2	3359.18	25	..
3110.86	25	8	I 3244.11	30	4	II 3360.29	50	200
II 3111.94	..	40	3251.58	30	..	II 3361.77	10	100
II 3115.27	..	30	3251.84	35	..	I 3362.21	80	8
3115.64	..	40	3252.49	..	25 n	I 3362.71	40	..
3116.74	..	35	3254.94	50 wn	..	II 3363.73	8	35
3117.26	1	30	3257.82	40	30	3365.52	25	2
II 3118.65	35	200	3258.77	..	50	I 3367.53	50 wn	..
3119.71	30	6	3259.97	50	30	II 3368.05	35	125
II 3120.37	40	150	3264.26	6	50	3370.23	30	1 n
II 3122.60	10	80	I 3266.63	35	4	3372.13	..	30
II 3124.98	20	125	3269.76	..	35	3374.60	25	2
II 3128.70	30	150	3270.72	50	1	3374.93	25	4
II 3132.06	25	125	3271.96	60 wn	..	3376.15	25 n	..
3134.31	3	50	3283.06	..	35	3376.40	30	20
3135.34	1	25	3290.99	30 wn	..	II 3378.34	25	150
II 3136.68	20	50	3291.76	10	200	I 3379.17	40	6
3144.41	50	12	3293.83	30	1	II 3379.37	6	100
II 3145.10	10	35	II 3295.43	10	200	I, II 3379.82	15	100
3145.77	..	25	3298.32	30	8	3382.08	30	1
II 3147.23	25	150	3302.19	50 n	1 n	II 3382.68	35	200
3148.44	30	15	3302.88	30	2	I 3384.24	35	..
3149.82	6	40	I 3304.33	30 n	..	I 3384.64	40	1
3150.11	6	50	3305.23	25	..	3385.33	30	2
3155.15	30	25	I 3307.75	40	8	3386.52	30	2
3158.02	1	35	3309.84	30	2	I 3388.71	40	4
II 3159.10	4	25	3310.65	2	200	3390.77	30	3
3159.59	60 wn	20 n	II 3311.93	6	125	II 3391.43	4	150

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CHROMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 3392.99	10	100	I 3479.12	30	1	I 3748.61	40	30
II 3393.84	15	125	I 3479.31	35 r	..	I 3749.00	125 r	125 r
3394.29	15	150	I 3480.29	30	1	II 3754.57	8	30
3395.61	2	100	I 3481.30	15	35	I 3757.17	50	30
3399.53	1	60	3481.54	30	30	I 3757.66	50	50
II 3402.40	25	80	3483.52	15	30	I 3758.04	50	35
II 3403.32	30	200	II 3484.15	8	35	I 3768.24	60	60
3403.59	35	3	3488.45	35	10	I 3768.73	35	25
3407.27	50 wn	1 wn	3494.97	35	25	I 3788.87	60	10
3408.04	40 wn	1 wn	II 3495.38	12	35	I 3789.72	50	10
II 3408.76	35	100	3502.31	35	6	I 3790.23	30	10
3409.40	60 wn	1 wn	3510.54	40	8	I 3790.45	50	15
3411.05	80 wn	3 wn	II 3511.84	20	50	I 3791.38	80	40
II 3421.21	50	200	3527.09	30	5	I 3792.14	60	40
II 3422.74	35	125	I 3550.63	70	60	I 3793.29	50	30
3425.98	25	2	3566.16	80 wn	12 wn	I 3793.88	50	30
3427.66	40	1	I 3572.75	25	5	I 3794.61	50	30
3431.28	35	8	I 3573.64	60	15	I 3797.13	50	30
3431.99	25	4	I 3574.04	50	15	I 3797.72	100	20
3432.32	25	6	I 3578.69	500 r	400 r	3801.20	35 n	3 n
II 3433.31	30	150	3582.62	35	12	I 3804.80	100	30
I 3433.60	50	35	II 3585.51	6	35	3806.83	35	35
I 3434.11	30	25	I 3593.49	500 r	400 r	I 3807.93	25	12
3435.82	30	12	3599.39	30	20	3812.25	40	15
I 3436.19	50	50	I 3601.67	50	30	3814.62	35	30
3439.37	30	2	I 3603.74	15	50	3815.43	35	12
I 3441.11	30	25	I 3605.33	500 r	400 r	I 3816.17	30	10
I 3441.44	80	90	3612.61	35	25	I 3817.84	30	20
3443.79	30	25	I 3615.64	30	10	I 3818.48	50	20
3445.62	100	80	3619.46	30	8	I 3919.56	60	40
I 3447.01	35	25	II 3631.69	10	60	I 3823.52	40	30
I 3447.43	35	35	3632.84	80	35	I 3825.39	40	15
I 3447.76	35	30	3634.99	25	12	I 3826.42	40	20
3450.83	25	4	I 3635.28	25	8	I 3830.03	150 w	50
I 3453.33	35	35	I 3636.59	60	30	I 3831.03	40	25
I 3453.74	30	25	I 3639.80	60	25	I 3834.73	25	12
3454.99	..	100	I 3640.39	30	5	I 3836.07	25	8
3455.28	35	10	I 3641.47	30	25	I 3841.28	150	80
3455.60	50	35	I 3641.83	40	15	I 3848.98	80 d	50 d
3457.63	4	125	II 3643.20	5	30	I 3849.36	40 n	30 n
3458.09	35	15	I 3649.00	40	20	I 3850.04	40 r	40 r
3459.29	..	35	3650.34	..	40	I 3852.22	60	12
I 3460.43	40	30	I 3653.91	100	25	I 3854.22	40	15
3464.84	30	3	I 3656.26	80	25	I 3855.29	35	35
3465.25	35	30	II 3662.84	25	8	I 3855.57	30	30
3465.58	30	8	I 3663.21	35	20	I 3857.63	50	25
I 3467.02	50	20	3664.94	1	40	I 3858.89	35 wn	20 wn
3467.71	50	30	3667.45	..	25	3862.55	25	20
3468.75	30	8	3676.32	40	15	I 3870.27	80 W	3 W
I 3469.59	50	15	II 3677.68	6	35	I 3874.53	70	12
I 3470.40	30	8	II 3677.89	3 l	70	I 3879.22	60	15
I 3470.53	25	6	3679.82	40	8	I 3881.21	60	18
I 3471.50	30	3	3697.99	..	40	I 3881.86	50	6
3472.07	..	80	II 3712.95	12 s	125	I 3883.29	60	80
I 3472.76	30	8	3715.43	..	30	I 3883.66	30	20
3472.91	30	8	I 3730.81	60	12	I 3885.22	40	50
I 3473.61	35	10	I 3732.03	50	15	I 3886.79	125	125
3474.38	35	8	II 3738.38	6	40	I 3891.93	40	25
I 3474.86	35	3	I 3742.97	25	10	I 3894.03	60	40
I, II 3475.13	6	40	I 3743.58	40	40	I 3897.65	40	25
I 3477.16	25	5	I 3743.88	40	40	3902.11	40	30
I 3478.77	35	3	I 3744.49	30	12	I 3902.91	100	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CHROMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3903.16	35	30	4056.05	30	8	4209.76	80	20
3907.78	30	10	4058.77	80	50	4211.35	100	30
I 3908.75	200	150	4065.72	80	35	I 4212.66	80	8
3912.00	40 wn	..	4066.94	25	30	4213.17	60	8
I 3915.84	125	80	4067.84	30	4	I 4216.36	60	25
I 3916.24	109	60	4074.86	25	10	I 4217.63	150	70
I 3916.98	30	8	4076.06	30	15	4221.57	80	35
I 3919.16	300 r	125	4077.09	35	10	I 4222.73	100	15
I 3921.02	150	40	4077.68	30	10	4224.51	60	12
3926.65	35	25	4081.74	25	2	4226.76	125	30
I 3928.64	150	40	4090.30	30	15	I 4230.48	70	8
3929.70	35 wn	..	4092.17	25	2	II 4230.64	..	(30)
3938.34	40	3	4099.02	30	8	4232.22	70	5
I 3941.49	200 r	60	4101.16	30	2	I 4232.87	60	..
3945.49	50	15	4104.87	35	8	4234.51	60	2
3945.97	50	7	I 4108.40	30	4	4237.71	70	..
3948.85	25	2	I 4109.58	40	10	I 4238.96	100	15
I 3951.10	50	8	I 4120.61	40	10	4240.70	200	30
I 3951.76	40	5	4121.26	35	8	II 4242.38	4	50
I 3952.40	60	18	4121.82	40	10	I 4248.34	30	2
I 3953.16	60	12	I 4122.16	30	5	4248.71	35	2
3960.76	40	8	4123.39	35	15	I 4252.24	35	10
I 3963.69	300	300	I 4126.52	100	50	I 4254.35	5000 r	1000 r
I 3969.06	80	50	4126.92	30	4	4255.50	30	30
I 3969.75	200	90	I 4127.64	30	10	I 4257.37	35	1
I 3971.25	80	50	4131.36	30	20	I 4259.16	35	1
I 3972.69	60	12	4134.39	25	3	I 4261.35	125	50
I 3976.66	300	300	4142.19	35	8	4261.61	35	8
I 3978.68	80	40	4146.69	25	2	II 4261.91	..	30
I 3979.80	80	20	4152.77	50	12	4262.13	40	8
I 3981.23	100	50	I 4153.07	40	6	4262.36	30	2
I 3983.91	200	60	I 4153.82	50	30	4263.14	125	80
I 3984.34	80	60	4161.41	50	30	4266.82	30	1
3989.99	80	40	4163.62	100	50	4268.79	30	3
I 3991.12	200	60	4165.52	80	35	4269.95	40	6
I 3991.67	100	50	4169.84	80	25	4271.06	30	12
I 3992.84	150	70	4170.20	70	15	I 4272.91	40	30
I 3993.97	60	20	4171.67	70	8	I 4274.80	4000 r	800 r
3998.86	25	2	4172.77	35	15	4275.97	30	15
3999.68	40	10	I 4174.79	100	40	4277.79	25 wn	..
4001.44	200	80	4175.23	30	8	4280.40	80	50
4003.92	30	12	4175.94	40	10	I 4284.22	..	30
4012.47	70	60	4177.90	40 n	1 n	I 4284.72	40	8
4014.69	40	8	4179.26	100	40	I 4289.72	3000 r	800 r
4018.20	35	8	4179.96	25	1	4291.96	35	20
4022.26	80	40	4184.89	35	10	I 4293.56	50	8
4023.74	40	15	4185.34	30	3	I 4295.76	125	40
4025.01	100	25	4186.36	50	10	I 4297.05	100	15
4026.17	100	35	4190.13	40	15	4297.74	125	30
4027.10	80	30	I 4191.27	70	15	I 4299.72	100	50
4028.02	35	..	I 4191.75	50	6	4300.51	100	20
4030.68	40	30	4192.10	40	15	4301.18	100	25
4031.13	30	6	4193.66	100	25	4302.77	40	2
I 4033.26	30	8	4194.95	70	25	I 4305.45	150	20
I 4037.29	80	12	4197.23	70	25	4307.49	35	1
4039.10	100	40	4198.52	100	30	4312.47	30	1
I 4042.25	30	1	4200.10	80	8	I 4319.64	100	20
4043.70	30	2	I 4203.59	100	20	I 4320.59	125	6
I 4046.76	30	3	I 4204.20	50	6	4321.24	70	2
4048.78	80	50	4204.47	80	30	4321.62	70	3
4049.78	30	6	4206.90	80	25	4323.52	100	15
I 4050.03	30	1	4208.36	100	25	4325.07	125	130
4051.33	35	8	4209.37	100	40	4332.57	125	2

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CHROMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 4337.57	500	300	I 4545.33	25	12	4727.15	80	20
4338.41	35	4	I 4545.96	200	125	4729.72	30	6
4338.80	50	8	4554.83	25	2	4730.71	100	50
I 4339.45	300 r	300	II 4555.03	..	40 n	4737.35	200	80
I 4339.72	150	150	4555.09	15	50	4743.11	40	..
I 4340.13	80	30	4556.17	40	12	I 4745.31	80	2
I 4343.16	60	12	II 4558.66	20	600 wn	4752.08	100	40
I 4344.51	400 r	300	I 4565.51	20	30	4754.74	80	..
4345.08	30	3	4569.64	50	10	I 4755.14	70	..
4346.83	200	40	4571.68	50	40	4756.11	300	100
4347.50	30	1	4575.12	25	5	4757.33	25	..
I 4351.05	100	150	4578.33	25	2	4757.59	35	1
I 4351.77	300	300	I 4580.06	300	125	4761.24	25	..
I 4359.63	200	150	4586.14	25	6	4764.29	200	35
4363.13	25	35	I 4587.87	30	..	I 4764.64	35	..
I 4371.28	200	150	II 4588.22	10	600 n	I 4766.63	80	6
I 4373.25	50	50	II 4591.39	200	125	4767.86	100	8
4374.16	50	60	II 4592.06	3	35 n	I 4770.67	35	..
4375.33	25	30	4592.54	25	1	4775.14	35	..
4377.55	25	10	4595.59	50	60	4783.08	25 n	..
I 4381.11	30	25	4600.10	20	50	I 4789.38	300	100
I 4384.98	150	200	I 4600.75	150	150	I 4790.34	100	1
I 4391.75	50	35	4605.82	30	..	4792.51	200	40
I 4397.25	25	5	I 4613.37	150	60	4796.17	125	1 n
4403.50	15 d	25	I 4616.14	300 r	200	4797.71	25	..
I 4410.30	25	8	II 4616.66	..	50	4801.03	200	70
I 4412.25	35	10	II 4618.83	6	80 n	4804.70	35	..
4413.87	25	15	4619.55	50	30	I 4806.25	80	..
I 4424.28	25	35	4621.96	50	40	4810.73	30	..
I 4428.50	25	6	4622.49	30	30	4814.26	100	..
4432.17	30	15	I 4626.19	100	125	4816.14	30	..
I 4458.54	50	125	4632.18	25	8	4823.92	25	..
I 4459.74	25	25	II 4634.09	5	80 n	II 4824.12	4	35
I 4460.77	25	..	I 4646.17	100	150	I 4829.38	200	40
I 4473.78	25	1	I 4646.81	35	3	4831.63	25	..
I 4475.34	40	6 n	4648.13	40	6	I 4836.86	80	..
4482.88	25	12	4648.87	50	3	4851.46	35	..
4488.05	25	15	4649.46	60	3	I 4857.29	25	..
4489.47	25	15	I 4651.28	100	100	I 4861.20	80	..
I 4491.68	25 d	1	I 4652.16	200 r	150	4861.84	125	8
4491.86	50	4	I 4654.74	70	8	4870.80	150	25
4492.31	80	15	4656.19	50	4	4880.04	25	..
I 4496.86	200	200	I 4663.33	40	25	I 4884.95	25	..
4498.73	30	15	I 4663.83	50	15	I 4885.78	60	..
4500.29	50	30	I 4664.80	70	20	4887.01	125	30
4501.11	40	30	4666.21	35	8	I 4888.53	100	..
4506.85	30	30	I 4666.51	50	25	4894.36	125	..
4511.90	80	100	I 4669.34	50	20	I 4903.24	125	..
I 4514.53	30	8	I 4680.54	50	25	4905.05	30	..
4515.44	25	10	4680.87	60	8	4920.94	50	..
4521.14	25	10	I 4689.37	80	35	4922.27	200	40
I 4526.47	50	30	4693.95	50	20	4930.18	35	..
I 4529.85	25	8	4695.15	50	4	4936.33	200	5
I 4530.74	150	125	I 4697.06	50	12	I 4942.49	125	3
I 4535.15	50	30	I 4698.46	60	12	4944.58	35	..
I 4535.72	125	100	I 4698.61	40	8	4954.81	100	8
I 4539.79	40	25	4699.59	30	1	4985.96	25	..
I 4540.50	40 d	40	I 4700.61	50	4	I 5013.32	60	2
4540.72	40 d	40	4706.10	30	1	I 5048.75	30	..
I 4541.07	30	8	I 4708.04	200	150	I 5051.90	50	..
4541.51	30	6	I 4718.43	200	150	I 5065.91	30	..
4542.62	30	8	4723.10	125	8	I 5067.71	50	..
I 4544.62	100	70	4724.42	125	10	I 5072.92	35	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

CHROMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 5091.89	25	..	I 5340.44	50	..	6789.17	40	..
I 5110.75	40	..	I 5345.81	300 r	25	I 6883.03	70 n	..
I 5113.13	25	..	I 5348.32	150 r	15	I 6924.13	60 n	..
5139.65	50	1	5400.61	30	1	I 6925.20	50 n	..
I 5144.67	30	..	I 5409.79	300 r	30	I 6978.48	125 wn	..
5166.23	80	2	I 5628.64	25	2	I 7355.90	80	..
I 5177.43	50 l	..	I 5694.73	35	..	I 7400.21	80	..
I 5184.59	60	1	I 5698.33	30	2	I 7462.31	80	..
I 5192.00	50	..	5783.11	30 n	..	I 8163.18	35	..
I 5196.44	50	3	5783.93	30 l	..	I 8235.89	30	..
I 5200.19	30	..	5787.99	50 wn	..	I 8287.38	25	..
I 5204.52	400 r	100	I 5791.00	40 wn	..	I 8947.15	50	..
I 5206.04	500 r	200	I 6330.10	200	8	I 8976.83	30	..
I 5208.44	500 r	100	I 6362.87	150	8	I 9009.91	100	..
5221.75	25	..	6421.37	35	..	I 9017.03	100	..
I 5238.97	60	..	6501.21	35	..	I 9021.65	100	..
I 5243.39	50	..	6529.20	40 n	..	I 9035.85	50	..
I 5247.56	60	15	I 6437.95	35	..	I 9208.27	25	..
I 5261.75	25	..	I 6572.90	25	..	I 9263.96	25	..
I 5264.15	100 r	20	I 6580.91	30	..	I 9290.38	75	..
I 5265.72	30	10	6594.67	60 wn	..	I 9446.95	75	..
I 5272.01	25	1	6597.56	40	..	I 9571.74	25	..
I 5287.19	40	..	6608.89	25	..	I 9574.24	50	..
I 5298.27	15 r	25	I 6630.01	50	..	I 9667.22	25	..
I 5300.75	25	4	I 6661.08	100	..	I 9670.49	50	..
I 5312.88	40	..	I 6669.26	80	..	I 9730.27	25	..
I 5318.77	30	..	6762.41	50	..	I 9734.51	50	..

COBALT

2011.50	15	50	2299.75	4	30	II 2414.06	8	30
II 2022.34	18	75	II 2301.40	10	25	I 2414.46	40 r	15
II 2025.75	10 l	30	II 2307.86	25	50 w	I 2415.30	40 r	18
II 2027.02	15	50	II 2311.60	15	50	2417.33	25	..
II 2036.59	8	30	II 2314.05	25	35	2420.73	8	80
II 2058.81	10	40	II 2314.98	25	30	2422.56	30 w	3
II 2063.76	12	35	II 2324.32	20	50	I 2424.93	250 r	..
II 2065.53	10	35	I 2325.61	50 w	..	I 2429.23	25	3
2082.68	3	25	II 2326.48	20	30	I 2432.21	40 r	..
2104.73	25	2	II 2347.39	10	25	2432.52	..	80
2106.80	25	2	II 2353.42	10	35	2436.66	50 r	25
II 2174.54	15	25	I 2358.18	20	30	2446.02	2	40
I 2174.60	30 r	12	II 2363.79	25	50	2447.76	4	100 r
2178.95	25	..	II 2378.62	25	50 w	II 2449.16	12	30
II 2181.72	80	8	II 2383.46	15	30	2450.00	40	200
II 2192.49	2	25	II 2386.36	10	25	2459.49	1	30
II 2193.60	4	30	II 2388.91	10	35	II 2464.19	40	150
2200.69	80	..	2396.77	90	..	2467.06	2	80
II 2202.96	3	30	II 2397.39	4	25	I 2476.64	40 w	25
II 2207.92	..	30	I 2400.56	30	..	I 2483.61	..	25
2216.48	4	25	I 2400.84	30	2	II 2485.36	25	75
II 2245.13	15	35	2401.11	30	2	II 2486.44	1	40
2256.74	..	35	I 2401.60	30	2	2490.39	5	80
2260.01	2	25	I 2402.17	30 r	..	2493.93	30 w	1
2266.56	..	35	II 2404.17	30 w	50	2497.50	1	40
2281.88	3	25	I 2406.27	25	1	2498.83	2	80
I 2284.85	30	..	I 2407.25	100	2	II 2506.46	50 w	200 n
II 2286.16	40	30 l	II 2408.75	25 w	25	I 2507.68	40 w	8
II 2292.99	10	30	2410.51	40 w	..	2507.96	2	30
II 2299.42	..	25	I 2411.62	250 r	50	2517.41	..	40 W

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COBALT (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2519.82	40	200	II 2653.70	5	40	II 2834.94	2	75
2521.36	75 r	150	II 2663.53	15 w	60 w	I 2837.15	75 r	..
2522.94	..	30	II 2669.91	..	100 wn	I 2842.38	30	..
2524.60	..	30	I 2673.93	25	..	II 2845.63	..	50
II 2524.96	50 w	700	2679.76	75 W	..	II 2848.37	..	60 n
2528.18	..	40	2680.11	25	3	I 2850.04	75	..
II 2528.61	4	200	I 2685.34	75 w	..	I 2850.95	30	..
I 2528.97	50 r	..	2689.82	..	40	I 2859.66	40	..
I 2530.13	40 w	300	2693.01	..	25	I 2862.60	50	..
I 2532.17	..	75	2693.12	..	25	II 2870.03	..	50 wn
2533.81	5 r	60	I 2694.40	25	..	2871.24	..	100
I 2535.96	10 r	40	II 2694.68	25	200 w	II 2879.62	25	..
2540.65	6	40	I 2695.85	50 w	..	II 2880.29	..	50 wa
II 2541.94	40	300 n	II 2697.04	..	60	I 2882.22	30	..
I 2544.25	50 r	100	II 2702.11	..	25 wn	I 2886.44	50	2
2545.04	3	30	I 2705.85	15 w	100 w	2892.25	25	..
2546.74	1	50	II 2706.74	..	100 wn	I 2899.82	25	1
I 2548.34	20	75	II 2707.50	..	100 wn	2903.19	25	1
II 2550.02	..	60	2708.82	30	2	I 2919.55	30	..
I 2553.00	40 r	..	II 2709.05	..	30 wn	I 2927.67	50	1
I 2556.76	50 w	150	II 2714.42	12	200 W	I 2928.81	50	1 n
2557.35	2	30	I 2715.99	75 w	75	I 2929.51	75	..
II 2559.41	10	60 wn	2719.58	25	..	II 2930.43	..	150 wn
2560.09	1 d	60 wd	I 2722.11	50 w	..	II 2943.15	..	100 wn
2561.28	25	12 n	2731.11	50 W	15	I 2943.48	30	..
II 2564.04	15 w	100 wn	I 2740.46	50	4	2954.74	2	100
I 2567.35	50 r	..	I 2745.10	50	60	2955.39	30	..
2569.74	..	30	I 2746.03	50	..	2957.67	50	1
I 2572.24	50 w	12	I 2752.07	40	1	2966.90	30	..
2573.40	40	12	I 2758.54	30	..	I 2978.01	30	..
2573.54	30 r	12	I 2761.37	75	5	I 2987.16	75 r	50
2574.86	3	40	I 2764.19	100 r	..	I 2989.59	75 r	30
2576.10	30	..	2766.22	50	45	I 2995.15	50	1
I 2578.93	30	..	I 2766.39	50	3	I 3000.55	80	1
II 2580.33	15 w	100 wn	2769.08	..	35 n	I 3005.76	100	2
I 2580.84	50 W	4	2772.70	30 n	..	I 3013.60	60 r	4
II 2582.24	50 w	500 wn	I 2774.96	50	..	I 3015.68	60	2
2583.18	..	40 w	II 2775.18	30 n	100 n	I 3017.26	60	..
I 2585.34	50 W	..	I 2775.58	50	..	I 3017.55	100 r	5
II 2587.22	10 w	100 n	I 2778.82	75	8	3020.64	60	..
I 2590.59	75 W	..	I 2785.96	50	..	I 3022.36	60	2
2604.41	..	30	2790.28	30 n	..	I 3026.37	100	40
2605.68	30	200	I 2791.C1	50	..	I 3034.43	80	2
I 2606.12	40	..	I 2792.44	40	3	I 3038.31	25	..
I 2610.76	40 w	1 n	2794.82	100 r	15	I 3039.57	70	..
2613.49	25	..	I 2796.23	50	5	I 3042.48	80 r	8
I 2614.13	30	..	I 2797.08	50	2	3044.00	400 r	..
II 2614.36	6	60 w	2802.71	100	200 n	I 3048.11	25	..
I 2616.26	40 w	2	I 2803.77	100	12	I 3048.89	150 r	..
I 2617.86	50 w	..	II 2807.17	1	25	I 3050.50	60	..
2618.91	..	30	II 2810.86	5	75 n	I 3050.93	60	..
I 2619.28	50 w	4	I 2811.13	50	..	I 3054.72	60	..
2619.80	..	40	I 2811.52	50 w	..	I 3060.05	150	1
I, II 2622.06	40 w	20	I 2814.98	25	..	I 3061.82	200 r	125
II 2622.43	30 r	15	I 2815.56	50 r	..	I 3062.20	60	1
I 2623.75	40	3	I 2818.60	30	..	I 3064.37	100	..
I 2627.64	50 W	..	I 2820.01	50	..	3071.96	80	2
I 2629.97	30	1	II 2821.74	30 n	10 n	I 3072.34	200 r	100
II 2632.24	10 w	40 w	I 2825.15	75 w	..	I 3073.52	60	2
2636.02	..	40	II 2825.24	5	200	I 3079.40	80	2
I 2648.63	5	40 w	I 2826.80	50 W	..	3082.62	150 r	50
I 2649.94	50 w	5	I 2833.92	40	..	I 3082.84	35	..
I 2650.27	50 w	25	I 2834.43	50	..	I 3086.40	80	2

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COBALT (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3086.78	200 r	..	I 3246.99	35	..	I 3374.30	60	..
I 3087.81	60	..	I 3247.18	80	..	I 3377.06	100	..
I 3089.59	100 r	..	I 3250.00	60	..	I 3378.36	30	2
I 3090.25	80	1	I 3254.21	300 r	..	3378.74	40	2
I 3095.72	60	2	I 3258.02	60	..	I 3381.50	100 W	..
I 3096.40	60	3	I 3260.82	70	4	I 3383.92	60	..
I 3096.70	60	3	I 3263.21	30	..	I 3385.22	250 r	15
I 3098.20	100 r	5	I 3264.84	35	2	I 3388.17	250 r	12
I 3099.67	50	..	I 3265.35	35	2	I 3390.40	30	2
I 3102.41	60	4	I 3271.78	60	..	I 3395.37	400 r	50
I 3103.74	80	2	I 3276.48	35	2	I 3405.12	2000 r	150
I 3103.98	60 r	..	I 3277.32	60 W	..	3405.82	30 r	..
I 3105.92	30	..	I 3278.84	70	2	I 3409.18	1000 r	125
I 3107.04	70	3	I 3279.26	60	2	I 3412.34	1000 r	100
I 3109.51	60	1 n	I 3283.46	80	..	I 3412.63	1000 r	40
I 3110.02	60	2	I 3283.77	60 W	..	I 3414.74	200 W	..
I 3110.82	60	2	I 3287.19	60	..	II 3415.78	100 r	20
I 3113.48	100	4	I 3293.86	40 r	..	I 3417.16	400 r	..
I 3118.25	60	2	I 3298.68	70	2	I 3417.67	25	..
I 3121.41	150 r	6	I 3303.88	60 r	..	I 3417.79	30	2
I 3121.57	60 r	3	I 3307.15	80	..	I 3420.79	80	2
I 3126.72	70	..	I 3308.49	30	..	I 3424.51	80	2
I 3127.25	100	..	I 3308.81	40	..	3428.23	100 W	2
I 3128.99	25	..	I 3312.15	60	2	3429.68	30	..
I 3129.48	40	2	I 3314.08	100	..	I 3431.57	500 r	40
I 3132.22	40	..	I 3318.40	35	..	I 3432.32	60 W	..
I 3136.73	60	..	I 3319.16	60	..	I 3433.04	1000 r	150
I 3137.33	150 r	..	3319.48	80	..	I 3437.69	150 W n	..
I 3137.45	50	..	I 3319.82	35	2	I 3438.71	80 w	..
I 3137.75	60	2	I 3321.91	25	..	I 3438.91	30	..
I 3139.94	150 r	10	I 3322.20	100 W	..	I 3442.93	400 r	15
I 3145.02	30	..	I 3325.24	80	3	3443.20	25	2
I 3147.06	150 r	..	I 3326.56	60	..	I 3443.64	500 r	100
I 3149.31	60	..	3326.99	100	..	I 3446.09	60 n	..
I 3152.71	100	..	I 3328.21	40	..	II 3446.39	3	60
3154.68	100	..	I 3329.47	80	..	I 3449.17	500 r	125
I 3154.79	100	4 n	I 3333.39	100	..	I 3449.44	500 r	125
I 3158.77	150 r	..	3334.14	250 r	..	I 3453.50	3000 r	200
I 3159.66	100	2 n	I 3337.17	60	2	I 3455.23	2000 r	10
I 3161.65	60	..	I 3339.78	150 w	..	I 3456.93	30	2
I 3168.06	100	..	3341.34	60	2	I 3458.03	60 w	..
3169.77	100	..	I 3341.95	25	..	I 3461.18	100 w n	3
I 3174.90	80	..	I 3342.73	150 W	..	I 3462.80	1000 r	80
3177.27	100	..	I 3346.93	100	2	I 3465.80	2000 r	25
I 3182.12	80	2 n	I 3348.11	80	..	I 3471.38	80	25 w n
I 3185.95	40	..	I 3351.54	35	2	I 3474.02	3000 r	100
I 3186.35	70	..	II 3352.80	..	30	I 3474.53	30	..
I 3188.37	100	2 n	3354.21	30	..	I 3476.36	100 r	..
I 3189.76	60	3	I 3354.38	200 r	..	I 3478.55	40	2
I 3191.30	35	..	I 3356.47	150 W	2	I 3478.74	60	2
I 3192.22	35	..	I 3356.84	25	..	I 3480.02	80 W	2 n
I 3193.16	50	..	I 3359.08	35	..	I 3483.41	300 r	10
I 3198.66	60	2	I 3359.29	100	2	3485.37	100 w n	3
I 3199.32	35	..	I 3361.56	80	2	I 3489.40	100 r	25
I 3203.03	40	..	I 3362.80	80	..	I 3490.74	60	..
I 3210.23	80	2	I 3363.27	30	2	I 3491.32	200 r	8
I 3219.15	60	..	I 3363.76	80 r	..	I 3495.69	1000 r	25
I 3224.64	60	..	I 3364.25	30	2	I 3496.68	150 r	4
3226.98	80 r	..	I 3367.11	300 r	30	I 3496.79	30	..
I 3232.87	60	25	I 3370.33	80	2	II 3501.72	5	100
I 3235.54	60	..	II 3370.94	..	50	I 3502.28	2000 r	20
I 3237.03	100	..	I 3373.23	60	..	I 3502.62	60	5
I 3243.84	100	..	I 3373.97	60	..	I 3506.31	400 r	15

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COBALT (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3509.84	400 r	40	I 3734.14	70	..	I 3990.30	80	10
I 3512.64	400 r	100	I 3734.87	60	..	I 3991.54	30	..
I 3513.48	300 r	25	I 3735.93	200 r	..	I 3991.69	60	6
I 3518.35	200 W	100	I 3740.19	60	..	I 3994.54	60	..
I 3519.82	2 n	25 n	I 3745.50	300 r	..	I 3995.31	1000 r	20
I 3520.08	100 W	..	I 3749.93	60	5	I 3997.91	200	20
I 3521.57	200 r	25	I 3751.63	100	60	I 4013.94	300	..
I 3523.43	300 r	25	I 3754.35	30	3	I 4019.30	80	..
I 3526.85	300 r	25	I 3755.45	100	..	I 4020.90	500 w	..
I 3529.03	200 r	..	I 3759.69	30	..	I 4023.40	200	..
I 3529.81	1000 r	30	I 3760.39	30	..	I 4027.04	200	4
I 3533.36	200 w	..	I 3774.60	200 W	..	I 4035.55	150	3
I 3543.26	35	..	I 3777.54	200	..	I 4045.39	400	..
II 3545.04	2	30	I 3808.11	200 w	7	I 4052.92	40	..
I 3550.59	200	..	I 3811.07	30	..	I 4057.20	100	..
I 3558.78	40 w	..	I 3812.47	100 w	..	I 4058.19	100	..
I 3560.89	200	25	I 3813.92	30 r	..	I 4058.60	100	..
I 3564.95	150 w	..	I 3814.46	35	..	I 4068.54	150	100
I 3569.38	40 r	100	I 3816.33	60	50 r	I 4076.13	70	..
I 3574.96	200	25	I 3816.47	60	..	I 4077.41	100 wn	2 n
I 3575.36	200 r	25	I 3816.87	70	5	I 4082.60	50	..
II 3578.03	..	30	I 3841.46	60	..	I 4086.31	400	15
I 3584.80	25	..	I 3842.05	400 r	20	I 4088.30	50	..
I 3585.16	60	..	I 3843.69	60	..	I 4092.39	600 W	15
I 3587.19	200 r	50 n	I 3845.47	500 r	100	I 4092.85	25	10
I 3594.87	200 W	..	I 3850.95	100	..	I 4104.43	30	2
I 3602.08	200	35	I 3856.80	80	2	I 4104.75	50	..
I 3605.36	60	..	I 3861.16	300 r	15	I 4110.53	600	..
I 3611.70	25	..	I 3863.61	30	..	I 4118.77	1000 r	..
II 3621.18	15	50 n	I 3870.53	70	8	I 4121.32	1000 r	25
I 3627.81	200	..	I 3873.11	500 r	80	I 4158.42	25 n	5
I 3631.39	50 W	25	I 3873.95	400 r	80	I 4187.25	50	3
I 3632.84	60	..	I 3876.83	300 w	40	I 4233.99	100 W	..
I 3634.71	70	10	I 3878.74	70 r	..	I 4252.31	150	..
I 3636.72	40	6	I 3881.87	300 r	30	I 4285.79	125	..
I 3637.32	30	5	I 3884.61	100	..	I 4339.62	50	..
I 3639.44	200	20	I 3885.29	70	4	I 4371.13	25 wn	..
I 3641.79	60	8	I 3894.08	1000 r	100	I 4445.04	40	2
I 3643.18	80	15	I 3894.98	300 r	3	I 4445.71	125	2
I 3645.19	60	3	I 3898.49	80 r	6	I 4466.89	300	5
I 3647.09	30	4	I 3906.29	150	..	I 4469.55	300	5
I 3647.66	100	8	I 3909.93	200 W	..	I 4471.55	100	4
I 3649.35	200	4	I 3917.11	80	10	I 4477.24	30 wn	..
I 3652.54	200 r	..	I 3920.73	25	..	I 4478.32	100	3
I 3654.45	35	..	I 3922.75	100	..	I 4483.93	100	..
I 3656.97	60	6	I 3933.65	80	..	I 4484.51	60	..
I 3662.16	100	25	I 3933.91	60	..	I 4486.71	50	1
I 3676.55	100	35	I 3935.97	400 r	15	I 4494.75	100	..
I 3683.05	200 r	..	I 3940.89	100	..	I 4514.19	60	2
I 3684.48	200 W	..	I 3941.73	200 wn	..	I 4517.11	300	6
I 3690.72	60	10	I 3945.33	200	15	I 4519.29	40	..
I 3693.11	80	15	I 3952.33	40	4	I 4527.93	100	2 n
I 3693.48	35	10	I 3952.92	100	75	I 4530.96	1000 w	8
I 3702.24	200	..	I 3957.93	100 r	..	I 4533.99	500	8
I 3704.06	300 r	35	I 3960.99	60	10	I 4540.78	30	..
I 3707.47	30	..	I 3969.12	100 w	6	I 4543.81	500 W	..
I 3708.82	100	..	I 3972.53	100	6	I 4545.24	50	..
I 3711.65	35	..	I 3973.15	150 w	6	I 4549.66	600	..
I 3712.18	40	8	I 3974.73	100	10	I 4552.44	25	..
I 3726.66	30	..	I 3975.32	30	5	I 4553.33	25	..
I 3730.48	200 r	..	I 3978.65	100	..	I 4561.94	25	..
I 3732.40	200 r	..	I 3979.52	150 w	12	I 4564.17	35	1
I 3733.49	150	..	I 3987.11	80	..	I 4565.59	800 W	12

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COBALT (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 4566.61	100	2 n	I 5122.77	150	..	I 5436.99	25	..
I 4570.02	300	..	I 5124.77	25 n	..	I 5444.57	400 w	..
I 4579.36	25	..	I 5125.69	100 w	..	I 5452.30	25	..
I 4580.14	300	3	I 5126.19	200	..	I 5454.55	300 w	..
I 4581.60	1000 w	10	I 5133.45	50 w	..	I 5469.30	125	..
I 4588.70	100	1	I 5145.51	80 w	..	I 5470.46	50	..
I 4594.63	400	..	I 5146.74	400 w	..	I 5477.08	40	..
I 4596.90	400	..	I 5149.79	100	..	I 5483.34	500 w	..
I 4601.16	30	..	I 5154.05	200 W	..	I 5483.96	150 w	..
I 4614.01	60	..	I 5156.34	300 w	..	I 5489.65	150 w	..
I 4620.82	25	..	I 5158.43	40	..	I 5523.29	300 w	..
I 4622.70	30	..	I 5158.84	40	..	I 5524.98	25 w	..
I 4623.04	150	..	I 5165.16	30	..	I 5530.77	500	..
I 4625.78	200	..	I 5176.08	500 r	..	I 5545.93	25 n	..
I 4628.94	125	..	5183.61	35	..	I 5590.73	500	..
I 4629.38	600 W	5	I 5192.35	100 w	..	5594.46	40	..
I 4644.32	70	..	5210.06	100	..	5598.48	50	..
I 4654.85	25	..	I 5210.84	50	..	I 5647.22	600 w	..
I 4657.39	100	35	I 5211.82	100	..	I 5659.11	25	..
I 4663.41	700 W	..	I 5212.71	300 w	..	I 5915.54	200 w	..
I 4682.38	500	..	I 5222.48	50	..	I 5935.39	150	..
I 4685.86	30	..	I 5230.22	300 r	..	I 5946.49	70	..
I 4693.21	500	25	5235.21	100 w	..	I 5991.88	900 r	..
I 4698.38	300	8	I 5247.93	500 w	..	I 6000.67	80	..
I 4699.19	25	..	I 5249.99	200 w	..	I 6006.35	50 n	..
I 4718.48	50	..	I 5254.65	200 w	..	I 6007.67	50 n	..
4721.41	8	100 n	I 5257.62	400 w	..	I 6013.58	30	..
I 4727.94	300	..	I 5265.82	25	..	6016.64	40	..
I 4732.06	40	..	I 5266.30	100	..	6021.79	50	..
I 4734.83	150	..	I 5266.49	500 w	..	I 6049.09	50 n	..
4737.77	150	1	I 5268.51	500 w	..	I 6082.43	300 W	..
I 4746.11	100	..	I 5276.19	400 w	..	I 6086.65	80	..
I 4749.68	500	100 n	I 5280.65	500 w	..	I 6093.13	200	..
I 4754.36	200	2	I 5283.49	125 w	..	I 6107.93	25	..
I 4756.72	100	..	I 5301.06	700 w	..	I 6116.98	80	..
I 4767.14	100	..	I 5312.66	400 w	..	6122.22	40	..
I 4768.08	300	10	I 5316.78	300 w	..	I 6122.65	125	..
I 4771.11	500 w	..	I 5325.28	300 w	..	6162.17	60	..
I 4776.32	300	..	I 5325.95	25	..	I 6188.99	200 w	..
I 4778.25	100	..	I 5331.47	500 w	80	I 6211.19	25	..
I 4780.01	500 w	500	I 5332.67	200 w	..	I 6230.97	200 w	..
I 4781.43	400	2 n	I 5333.65	100	..	I 6232.44	25	..
I 4785.07	50	..	I 5334.84	70	..	I 6249.51	125	..
I 4792.86	600 W	5	I 5336.17	50	..	I 6257.58	70	..
I 4795.85	100	..	I 5339.53	100 w	..	I 6273.03	70 w	..
I 4796.37	100	..	I 5341.33	300 w	..	I 6275.13	25	..
I 4813.48	1000 W	6	I 5342.71	800 w	..	I 6276.63	40	..
I 4813.98	100	2	I 5343.39	600 w	..	I 6282.63	300 w	..
I 4840.27	700 w	150	I 5347.49	80	..	6311.28	30 n	..
I 4843.46	300	..	I 5349.09	80	..	I 6313.05	50	..
I 4867.88	800 W	100	I 5352.05	500 w	..	I 6314.53	50	..
I 4899.52	400 W	..	I 5353.48	500 w	..	I 6320.41	80	..
I 4904.17	80	..	I 5358.92	40 w	..	6347.83	125	..
I 4928.28	200 W	..	I 5359.18	300 w	..	I 6351.42	25	..
4934.06	25	..	I 5362.77	500 w	..	I 6395.19	125	..
I 4953.19	50	..	5368.89	30	..	I 6417.82	200 r	..
I 4966.59	100	..	I 5369.58	500 w	..	I 6429.91	50	..
I 4971.96	150	..	I 5381.10	150	..	I 6430.34	30 n	..
I 4979.93	60	..	I 5381.75	150	..	6439.17	80	..
I 4988.04	500 r	..	I 5390.46	25	..	I 6444.69	25	..
I 5094.94	190	..	I 5401.98	100 w	..	I 6450.24	1000	..
I 5108.89	200 w	..	I 5407.51	100	..	I 6451.14	70 w	..
I 5113.23	100	..	I 5408.12	30	..	I 6454.99	200 w	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COBALT (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
6462.58	60	..	I 7094.53	40	..	I 8043.33	80 n	..
I 6463.01	25 n	..	7102.55	25	..	I 8056.06	80 n	..
6474.57	25 w	..	I 7113.56	150 l	..	I 8066.49	60	..
I 6477.88	80	..	7122.25	50	..	I 8080.23	60	..
I 6490.34	70	..	I 7124.47	50	..	I 8093.96	80 n	..
6493.74	25	..	I 7134.32	200	..	I 8116.41	80	..
I 6551.44	80 w	..	I 7154.71	200	..	I 8137.08	80	..
I 6563.42	200 w	5	I 7159.18	250	..	I 8140.43	40	..
I 6595.90	150	..	I 7193.60	200 w	..	8150.19	50	..
I 6617.12	30	..	I 7250.12	80	..	I 8152.11	60	..
I 6617.53	30	..	I 7285.28	200	..	I 8160.65	40	..
6623.79	70 W	..	I 7315.73	25	..	I 8193.03	125	..
I 6632.44	150	..	I 7353.47	25	..	I 8208.66	80	..
I 6635.12	25 n	..	I 7354.59	150	..	I 8269.38	80 n	..
I 6678.81	125	..	I 7388.70	200	..	I 8283.48	50 n	..
6684.08	30	..	I 7417.38	300 W	..	I 8296.85	50 n	..
I 6684.87	30	..	I 7437.16	30	..	I 8299.95	60 n	..
6707.86	200 Wn	..	I 7457.36	200 W	..	I 8342.63	50 Wn	..
I 6756.57	25	..	I 7533.48	40	..	I 8372.84	80 n	..
I 6758.10	25	..	I 7553.99	200	..	I 8378.39	50	..
6767.60	35 n	..	I 7590.57	35	..	I 8379.47	35	..
6771.06	200 n	..	I 7610.24	35	..	I 8489.50	30	..
I 6784.85	25	..	I 7712.68	80	..	I 8574.57	50	..
I 6808.94	25 n	..	I 7734.23	40	..	I 8575.35	50	..
I 6814.94	150 r	..	I 7838.17	80	..	I 8586.74	30	..
I 6846.97	25	..	I 7840.05	40	..	I 8589.73	50	..
6858.38	25	..	I 7855.85	40 n	..	I 8661.09	60	..
I 6872.40	200 w	..	I 7869.90	80	..	I 8744.37	30	..
6908.08	30	..	I 7871.39	80	..	I 9037.91	60	..
I 6937.81	150	..	I 7908.71	80 n	..	I 9095.37	50	..
I 6997.22	200 w	..	I 7926.55	80 n	..	I 9344.92	30 n	..
I 7004.81	150	..	I 7957.76	40 n	..	I 9356.98	200	..
I 7016.61	300 W	..	I 7960.55	25 n	..	I 9544.53	300	..
I 7027.81	200 W	..	I 7966.08	40	..	I 9597.89	300	..
I 7032.52	25	..	I 7987.38	80	..	I 9746.05	50	..
I 7052.89	300 W	..	I 8007.27	80 n	..	I 9764.53	25	..
I 7054.04	200 W	..	I 8022.13	40	..	9785.39	40	..
I 7055.88	25	..	I 8024.73	40	..	I 9890.92	30	..
I 7084.99	500 W	..	I 8029.26	80	..			

COLUMBIUM

2005.03	5	25	2131.18	12	40	2290.38	..	25 w
2010.00	5	25	2137.05	5	30	2295.68	15	30
2011.99	4	25	2137.54	5	40	2302.68	15	30
2017.28	3	25	2155.62	5	25	2309.23	10 l	30 l
2025.31	10	30	2160.27	5	50	2313.32	..	30 w
2029.32	10	50	2175.84	5	25	2334.81	3	25 w
2032.46	..	25 w	2176.76	8	30	2340.04	8	30
2037.94	3	25	2203.63	15	40	2362.05	..	25 w
2043.16	3	25	2206.01	..	25 w	2369.95	5	25
2043.52	2	25	2224.67	5	30 nl	2372.72	2	50
2049.87	2	40	2229.72	30	20	2376.40	8	60
2057.05	4	35	2242.58	5	50 nl	2387.52	10	25 wn
2060.27	..	25	2252.21	5	35	2388.27	5	25 w
2064.21	2	30	2265.59	..	50 Wn	2398.48	10	30
2082.89	6	25	2273.56	15	25	2404.89	5	50
2107.26	10	25	2274.13	12	300	2405.34	5 w	50 w
2109.42	15	50	2274.20	2	80	2405.85	5 w	50 w
2125.21	15	40	2281.51	..	25	2410.27	4 w	25 w
2126.54	15	50	2283.00	10	25 l	2412.46	5	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COLUMBIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2412.80	..	40 n	2580.28	2	100	2753.01	5	50 n
2413.94	..	300	2583.99	10	800 wn	2753.14	2	80
2414.48	..	100	2586.10	..	40 wn	2754.52	10 w	100
2416.17	5	25	2587.40	..	30	2757.26	3	50
2416.99	8	200	2590.94	15	800	2757.51	2	30
2418.69	5	500	2593.76	2 n	100	2758.78	1	100 w
2421.91	..	80	2594.74	3	80	2768.13	10	100
2426.79	..	40	2598.88	..	150	2769.57	2	30
2431.68	1 w	40 w	2601.29	4	200	2780.24	30	200 r
2432.32	2 w	40 w	2604.75	2	40	2791.74	3	100
2433.79	3	100	2605.02	1	40	2793.05	10 w	100
2435.95	3	50	2605.07	1	40	2797.69	10	200
2437.41	4	100	2613.85	3	30 n	2810.81	3	100
2441.86	3 w	25 w	2613.93	1	30	2816.68	2	50
2442.14	3	80	2614.76	..	30	2827.08	8	50
2442.68	1	50 w	2616.22	2	30	2829.75	3	50
2445.83	..	100	2620.45	3	200	2830.57	1	30
2447.97	2	30	2628.67	..	30 wn	2835.12	5 d	100
2451.87	3	100	2632.52	4 w	300 n	2841.15	10	100
2456.99	1	200	2633.16	..	200	2842.65	10	100
2458.09	2	50	2641.06	2	30	2846.28	10	50
2460.40	..	200 W	2642.24	5	300	2849.56	2 w	100 w
2462.05	1	100	2646.26	8	200 wn	2859.04	1	50
2468.74	..	50	2651.12	3	200	2861.09	10	100
2469.41	1	80	2656.08	8	200	2865.61	5	30
2472.38	4 d	25	2658.03	..	200	2868.52	15	300
2474.81	2	30 n	2659.05	3 n	30	2875.39	50 r	300
2475.89	..	25 n	2660.03	2	30	2876.95	40 W	500 W
2477.38	5	200	2665.25	3	300	2879.49	25	2
2479.94	3	50	2666.59	5	50	2880.71	4 w	50
2483.88	3	80	2667.76	3	30	2883.18	100	800 r
2484.93	2	25	2671.93	20	200	2888.83	10	100
2488.75	..	40	2673.57	10	500	2893.07	..	100 W
2498.25	1	25	2675.94	10	100	2897.81	15	150
2499.75	..	200	2677.66	2	50	2899.24	20	500
2501.40	..	150	2680.06	4	80	2900.67	..	100 wn
2502.49	3	50	2686.39	2	300	2908.24	20 r	200
2508.54	..	25	2691.77	10	100	2910.59	10	100
2511.00	3	100	2697.06	10	500	2911.74	8	100
2511.97	..	50 n	2698.86	5	200	2917.05	10 w	100 r
2521.40	3	100	2702.20	10	100	2927.81	200	800 r
2525.81	3	80	2702.52	8	80	2931.47	3	50
2527.92	2	50	2704.26	2 w	50	2932.13	..	50
2530.97	2	100	2707.83	3	80	2932.66	1 n	80
2531.25	1	80	2715.34	2	100	2936.66	..	30
2533.19	2	80	2715.88	2	100	2941.54	50	300
2534.44	1	40	2716.31	3	30	2945.88	2	100
2540.61	2	150	2716.62	10	200	2946.90	3	30
2541.42	3	80	2721.98	10	200	2950.88	150	200
2544.80	5	300	2723.66	2	200	2972.57	40	100
2545.64	1	150	2730.32	2	200	2974.10	5	200
2548.63	2	80	2733.26	30	50	2977.68	1	300
2551.38	5	100	2733.46	3	40	2978.94	1	50
2553.49	1	30	2733.74	2	50	2979.87	2	30
2555.32	1	30	2734.35	5	80	2980.72	3	50
2555.63	2	80	2735.95	..	40	2982.11	10 w	80
2556.94	5	200	2737.09	5	100	2985.05	2 n	50
2557.94	..	100 n	2739.24	..	50	2990.26	5	200
2562.41	4	100	2740.18	3	50	2991.95	1	100
2564.07	1	30	2745.30	5 w	30 w	2993.96	..	50
2566.07	2	30	2745.73	3	50	2994.73	100	300
2571.33	4	100	2746.10	..	50 n	3002.21	5 W	30
2574.84	2	100	2750.58	2	30	3005.77	1	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COLUMBIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3008.41	..	50	3263.37	3	500	3412.93	5	150
3022.74	5 w	100	3273.89	20 r	100 W	3413.21	1	40
3024.74	10 w	200	3283.46	2	100	3415.97	50	50
3028.44	50	200	3287.59	25	2	3420.63	5	50
3032.77	3	300	3291.06	10	100	3421.16	10 w	50 w
3034.95	1	100 w	3292.02	3	100	3422.85	1	30
3035.02	2	30	3294.36	2	100	3425.42	30 r	300
3039.81	5	300	3296.01	20	40	3425.85	50 r	30
3044.76	2	30	3297.05	3	50	3426.57	5	200
3048.20	1	50	3297.66	1	30	3427.45	30 r	30
3049.52	..	150	3301.49	1	100	3432.70	10	100
3053.64	1	30	3303.32	1	30	3436.96	20 r	50
3055.52	2	100	3304.72	1	30	3438.42	1	50 wn
3064.53	5 w	200	3305.61	1	100	3439.92	4	50
3065.26	10	200	3312.60	40	50	3440.59	15	80
3066.10	2	30	3319.58	4	50	3441.65	2	40
3071.56	10	50	3320.81	3	100	3444.28	1 n	50
3076.87	10 w	50	3323.89	1	50	3445.68	50	80
3080.35	8	100	3324.66	4	50	3448.22	3 n	50
II 3094.18	100	1000	3335.24	1 w	30 w	3448.67	1	30
3097.12	3 w	100 w	3335.42	30	40	3450.76	2	50
3127.53	10 w	50	3335.67	..	30 w	3451.64	1	30
3130.79	100	100	3341.60	3	50	3452.35	5	200
3145.40	10	100	3341.97	100 r	50	3453.97	..	100
3150.41	1	50	3346.29	..	40	3454.71	3	50
3152.16	2	50	3346.75	5	80	3454.91	3	80
3152.78	2	30	3348.28	1 n	50	3459.70	30	20
3153.37	1	30 n	3348.78	1	30	3463.03	5	30
3154.81	3 w	200 w	3349.06	80	100	3463.81	30	50
3171.79	..	25 n	3349.35	5	100	3465.86	30	40
3173.20	2	100	3349.52	80	5 n	3468.13	..	50
3175.85	5	50	3358.42	100	100	3470.25	3 n	100
3180.29	5	200	3360.90	3	50	3473.02	30	30
3184.22	5	150	3362.17	..	100	3474.67	100	4
3189.28	10 w	300 r	3365.58	5	50	3478.69	30	15
3191.10	100 w	300 w	3365.94	1	30	3478.78	2	50
3191.43	3	200	3369.16	5	50	3479.56	5	200
3194.27	2 w	150 w	3370.16	..	80	3482.95	2	100
II 3194.98	30	300	3370.61	3	30	3484.05	10	100
3198.22	1	50	3372.56	10 n	200	3488.83	2	30
3203.35	8	50	3374.09	..	30 n	3489.09	5	50
3204.97	10	150	3379.30	1	100	3491.03	30	50
3206.34	10	300	3380.94	..	200	3497.81	30	15
3207.33	5	30	3382.41	5	40 n	3498.63	30	50
3208.58	3 w	100 w	3386.24	5	100	3499.95	5	50
3215.59	50	200	3388.94	1	80	3500.74	..	30 n
3217.02	2 w	200 w	3390.63	30	50	3501.34	3	30
3222.07	5	30	3392.34	20 r	30	3510.26	15	200
3223.32	10	100	3394.97	2	50	3511.16	50	1
3225.48	150 w	800 wr	3395.72	1	30	3514.04	..	50
3229.56	5	50	3396.37	2	150	3515.42	20	300
3230.24	2	30	3397.32	..	50	3517.67	2	200
3236.40	10	200	3398.25	15	40	3522.36	..	50 W
3237.68	2	50	3399.40	20	30	3525.23	15 w	30 w
3238.02	20	200	3401.23	2	40	3528.48	3	50
3244.51	2 n	30	3402.02	..	50	3528.90	2	40
3247.47	50 w	100 w	3403.01	20 w	80 w	3533.66	20	30
3248.93	5	50	3405.41	80	50	3535.30	300	500
3250.27	5 n	100	3406.13	30	30	3537.47	30	30
3254.07	20	300	3406.95	1	30	3537.62	2	30
3254.88	1	50	3407.30	..	30	3540.96	15	500
3260.56	15	300	3408.68	5	50	3541.25	50	5
3261.69	1	50	3409.19	10	100	3542.56	5	30 d

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COLUMBIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3550.45	40	30	3818.86	8	300	4286.99	15	30
3554.12	..	30	3824.88	30	50	4292.48	30	50
3559.60	2	100	3831.84	5	300	4296.16	10	30
3563.50	30	30	3845.90	10	30	4299.60	20	30
3567.10	5	30 w	3855.50	..	50 n	4300.99	30	30
3567.99	2	50	3858.95	20	50	4311.26	30	100
3568.51	10	50	3865.02	..	200 n	4321.49	..	30
3575.85	50	80	3867.92	30	20	4326.33	30	5
3580.27	100	300	3875.76	10	50	4337.56	10	30
3584.97	30	50	3877.56	50	20	4359.85	50	50
3589.11	50	30	3879.35	5	300	4367.97	2	50 n
3589.36	100	100	3883.14	30	30	4368.43	15	30
3591.20	2	50	3885.44	50	100	4377.96	10	30
3593.97	80	50	3885.68	15	30	4410.21	15	30
3602.56	30	30	3891.30	50	100	4437.22	40	50
3615.50	30	30	3894.03	15	30	4471.29	20	30
3619.51	5	200	3895.90	10	30	4492.96	1	50 n
3619.73	3	300	3898.28	3	200	4523.41	30	30
3628.18	1	50	3900.53	30	10	4527.65	1	30
3629.47	..	30	3914.70	30	100	4546.82	15	30
3633.31	3	30	3919.72	2	100	4564.53	20	30
3636.96	20 W	30 W	3920.20	30	100	4573.07	30	50
3637.83	20	30	3920.76	1	50 n	4579.45	5 n	30 n
3651.19	10	400	3936.02	5	200	4581.62	30	50
3659.61	15	500	3937.44	30	30	4606.77	50	50
3660.37	20	30	3938.55	..	100 n	4630.11	30	20
3664.69	30	30	3943.67	20	50	4648.95	50	20
3687.97	20 w	300 w	3949.45	1	50	4663.83	30	20
3695.90	4	200	3952.37	3	50	4666.24	30	15
3696.68	2	50	3964.28	1	50	4672.09	150	100
3697.85	50	50	3966.25	10	30	4675.37	50 w	30 w
3699.93	15 w	30 w	3967.37	..	50 n	4706.14	50	50
3703.16	20	30	3976.51	..	80 n	4708.29	50	30
3704.14	30	30	4000.60	2	50	4715.83	3	50 n
3707.92	3 W	100 W	4012.17	..	100	4733.89	30	30
3709.25	5	30	4016.08	5	30	4749.70	100	50
3713.01	100	80 n	4032.52	30	50	4810.60	100	10
3716.21	30 W	10 w	4039.53	30	50	4816.38	50	50
3717.07	8	1000	I 4058.94	1000 w	400 w	4848.37	150	100
3719.63	..	50 w	I 4079.73	500 w	200 w	4965.37	100	15
3720.46	5	100 n	I 4100.92	300 w	200 w	4967.78	150	50
3722.57	..	60 n	4104.17	3	30	4975.14	30	3
3723.44	1	30	4119.28	2	200	4988.97	150	10
3725.22	30 w	10 w	I 4123.81	200	125	5000.95	30	5
3726.24	30	100	4129.93	15	30	5017.75	80	10
3739.79	100	200	I 4137.09	100	60	5026.36	50	8
3740.72	3	50	4139.71	50	50	5039.04	200	30
3742.39	30	50	4152.58	100	300	5058.01	50	10
3744.00	30	30	4156.68	5	100	5065.25	80	10
3746.91	20	80	4163.66	60	40	5078.96	300	50
3759.55	40	50	4164.66	30	50	5095.30	50	30
3765.08	25 w	10 w	4168.13	100	80	5100.16	100	15
3777.67	20	30	4184.44	20	50	5110.91	30	2
3781.38	5	200	4185.54	1	30	5120.30	50	10
3787.06	30	30	4190.88	20	30	5134.75	200	15
3790.15	100 r	50 r	4214.67	..	100	5147.54	30	5
3791.21	80	80	4214.73	40	..	5152.63	100	10
3798.12	50	80	4217.94	50	50	5160.33	200	15
3802.92	50	50	4229.15	50	100	5164.38	150	20
3803.88	30	20	4252.97	30	50	5180.31	150	15
3804.74	20	50	4253.69	25	40	5186.98	50	10
3810.49	30	50	4255.44	30	50	5189.20	80	12
3815.51	20	30	4270.69	30	50	5193.07	100	20

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COLUMBIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
5195.84	30	10	5900.62	200	200	7353.16	60	10
5219.09	100	10	5997.93	50	5	7382.50	150	30
5232.81	50	10	6251.76	30	10	7515.93	40	10
5247.38	30	2	6430.46	80	10	7574.58	100	20
5271.53	200	50	6433.22	30	4	7726.68	60	..
5276.19	200	50	6544.61	80	10	7873.41	25	..
5318.60	100	12	6614.15	25	8	7885.31	60	..
5334.87	50	10	6660.84	300	80	7938.89	30	..
5344.17	400	200	6677.33	200	50	8135.20	80	..
5350.74	150	50	6701.20	100	15	8240.00	50	..
5437.27	30	10	6723.62	100	30	8320.93	500	..
5504.58	30 w	3 n	6739.88	80	15	8346.08	60	..
5523.57	30	10	6828.11	150	30	8439.77	25	..
5551.35	30	10	6876.36	80	12	8475.98	150	..
5576.15	80	5	6886.33	30	8	8526.99	50	..
5642.11	80	20	6902.89	60	10	8560.54	30	..
5664.71	100 r	30 r	6908.07	40	8	8575.87	30	..
5665.63	100	30	6918.32	80	10	8697.55	40	..
5671.02	200	10	699C.32	100	15	8815.56	100	..
5753.06	..	30 n	7023.48	30	8	8905.78	30	..
5760.34	30	30	7046.81	200	40	9141.31	50	..
5776.07	30	3	7098.94	60	10	9323.54	40	..
5787.54	80	15	7102.01	30	8	9595.06	60	..
5838.64	200	100	7126.17	35	8	9626.88	100	..
5866.47	50	15	7159.43	100	15	9631.11	50	..
5874.70	30	5	7252.35	40	6	9676.75	50	..
						9912.26	25	..

COPPER

II 2012.96	..	20	I 2138.51	25 wn	..	II 2230.95	..	15
II 2015.57	..	50	II 2146.98	..	15	II 2231.57	..	15
II 2016.88	2	20	II 2148.97	15	25	I 2236.28	30	..
I 2024.33	50 r	6	II 2151.80	..	30	I 2238.45	40	..
II 2025.47	8	30	II 2161.31	..	40	II 2242.61	25	50 n
II 2027.18	..	15	I 2165.09	60 r	25	I 2244.26	25	9
II 2029.94	3	15 wn	I 2169.53	30	..	II 2246.99	30	500
II 2031.02	2	35	I 2171.76	30	..	II 2249.06	..	25
II 2035.84	12	30	II 2174.97	3	40	2255.08	1	30
II 2037.12	12	30	I 2178.94	30 r	12	I 2260.53	25	6
II 2043.79	15	35	II 2179.40	12	35	I 2263.08	30	10
II 2054.41	3 r	20 r	I 2181.72	50 r	15	II 2263.78	..	25
II 2054.97	15	35	II 2189.62	12	40	2265.46	..	15
II 2062.49	..	25	II 2192.26	25	500 n	II 2276.25	10	30
II 2066.32	..	20	II 2195.77	..	30	II 2278.44	..	20
II 2078.65	1	40	I 2199.58	50 r	20	II 2286.73	..	25
I 2079.46	15 n	..	I 2199.75	20 r	5 n	II 2290.99	..	25
II 2085.30	2	25	II 2210.26	20	40	I 2293.84	40 wn	10
II 2087.92	..	30	2212.83	..	20	II 2294.36	3	25
II 2093.61	2	20	I 2214.58	50 r	5 n	II 2299.44	..	15
II 2098.41	..	35	II 2215.10	..	15	I 2303.12	30	20
II 2104.78	8	25	I 2215.65	30	..	II 2309.61	..	18
I 2105.11	15	..	II 2218.10	25	40	I 2319.56	20	..
I, II 2112.09	15	40	II 2218.50	..	(25)	II 2336.20	3	20
II 2117.30	2	20	2218.62	2 r	15	2346.13	2	25
II 2122.97	15	50	II 2224.78	..	25	II 2348.82	15 d	20
II 2125.10	..	20	I 2225.70	150	20	II 2355.15	..	25
II 2126.03	15	35	II 2226.86	..	30	II 2356.65	5	25
I 2130.76	25	3	I 2227.77	40 r	25 r	2368.17	2	15
II 2134.35	30	40	II 2228.86	9	40	II 2369.89	20	30
II 2135.98	25	500 w	I, II 2230.08	30 r	20	2376.27	..	25

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COPPER (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2376.38	3	30	I 3073.80	70	20	I 3524.24	40	10
II 2384.84	..	15	I 3088.13	30	7	I 3527.48	50	10
2391.72	..	20	I 3093.99	150	50	I 3530.39	50	20
II 2400.11	5	100	I 3099.93	60	10	I 3533.75	50	15
II 2403.33	100	300	3108.45	15	1 n	I 3544.96	35	6
I 2406.66	150	50	I 3108.60	20	5	I 3594.02	15	2
II 2424.44	4	200	I 3116.35	50	12	I 3598.01	40 wn	..
I 2441.64	200	100	I 3120.43	25	3	I 3599.14	60	30
2444.44	..	20	I 3126.11	80	20	I 3602.03	50	25 W
II 2468.58	5	70	I 3128.70	70	15	I 3609.31	25	5
II 2473.33	5	20	I 3140.31	50	12	I 3610.81	25	6
2482.34	..	20	I 3142.44	60	15	I 3613.76	60	7
II 2485.79	5	50	I 3146.82	100	20	I 3614.22	50	6
II 2489.65	3	50	I 3149.51	50	2	I 3620.35	30	5
I 2492.15	200 r	50	I 3156.63	50	15	I 3621.24	20	5
II 2506.27	..	500 r	I 3169.68	50	20	I 3624.24	30 W	3 wn
II 2526.59	..	200	I 3194.09	70	60	I 3629.79	15	2
II 2526.73	..	50	I 3208.23	25	15	I 3632.56	25	3
II 2529.30	..	600	I 3223.43	20	10	I 3635.92	50	7
II 2544.80	..	700 r	I 3224.66	25	10	I 3641.69	60	5
II 2571.74	..	150	I 3231.17	15	10	I 3645.23	20	5
II 2590.53	1 n	250	I 3235.71	15	7	I 3655.86	20	7
I 2592.63	1000	50	I 3243.16	15	15	I 3665.73	20	5
II 2598.81	..	200	I 3247.54	5000 r	2000 r	I 3671.95	20	3
II 2600.27	1 n	200	I 3266.02	20	15	3676.88	25 wn	1 n
2609.31	..	30	I 3268.28	15	10	II 3686.55	..	25
I 2618.37	500 w	100	I 3273.96	3000 r	1500 r	I 3700.54	20	7
II 2666.29	..	20	I 3279.82	25	30	I 3712.01	20	4 n
II 2689.30	..	300	I 3282.72	25	15 W	I 3741.24	50	2
II 2700.96	20	400	I 3290.54	25	25	I 3743.36	40	40
II 2703.18	10	200	3301.23	..	15	I 3759.49	20	2 n
II 2713.50	50	300 w	I 3307.95	60	30	I 3771.90	30	5
2715.52	20 w	..	I 3317.22	60	20	I 3800.50	20	2 n
II 2718.77	40	300 w	I 3319.68	60	20	I 3805.30	20	2 n
I 2720.20	18	..	I 3329.64	60	10	I 3825.05	40	3
II 2721.67	..	150	3335.21	60	15	I 3860.46	30	7
I 2723.95	50	1 n	I 3337.84	70	50	I 3861.75	50	2
II 2745.28	30	30	I 3349.29	70	40	I 3925.27	50	2 n
I 2745.45	8	150	I 3354.47	30	10 n	I 4003.04	40	1 n
I 2766.37	500	25	I 3365.35	70	30	I 4022.66	400	25
I 2768.88	25	1 n	3370.45	..	15	II 4043.50	..	25
II 2769.67	5 n	400	I 3375.67	25	5	I 4050.66	30	..
I 2782.59	20	1 n	I 3381.12	15	5 n	I 4062.70	500 w	20
I 2783.55	18	..	I 3381.42	20	7	I 4063.29	30 w	7
I 2824.37	1000	300	I 3395.48	30	7	I 4073.27	15	..
II 2837.55	..	250	I 3396.32	30	3	I 4075.59	40	..
I 2858.22	30	2 n	I 3402.24	45	10	I 4080.55	30 w	..
I 2858.73	30	2 n	I 3413.34	20	7	I 4104.23	30	1 n
II 2877.69	5	20	I 3420.17	15	3 n	I 4121.74	20	..
II 2884.38	..	30	I 3450.33	150	30	I 4123.29	30 w	1 n
I 2961.16	350	300	3454.69	40	10 n	I 4177.76	60 w	1
2991.75	15	..	I 3457.85	50	15	I 4242.26	20	..
I 2997.36	300	30	I 3459.43	25	2 n	I 4248.96	80	15
I 2998.38	20	2 n	I 3472.14	20	5	I 4259.43	25 wn	2 wn
I 3010.84	250	30	I 3475.99	25	10	I 4275.13	80	30
I 3012.00	50	6	I 3483.76	60	25	I 4378.20	200 w	30 w
I 3021.56	25	5	I 3487.57	30	5	I 4415.60	40 w	..
I 3022.61	30	3	I 3488.86	30	5	I 4480.36	200	20
I 3024.99	30	3	I 3498.06	20	5	II 4505.99	1	50
I 3036.10	200	50	I 3500.32	20	2 n	I 4507.5	50 w	30 wn
I 3044.03	20	1 n	I 3512.12	50	30	I 4509.39	150	30
I 3063.41	300	50	I 3517.04	20	3 n	I 4530.82	200	50
I 3068.91	15	..	I 3520.03	30	10	I 4539.69	100 W	80 W

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

COPPER (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 4555.92	2	70	II 5897.99	..	25	I 7039.37	15	..
I 4586.95	250 w	80 w	II 5941.17	..	50	II 7255.83	..	20
II 4649.27	..	60	II 5988.30	..	25	II 7326.02	..	15
I 4651.13	250	40	II 6000.10	..	40	II 7331.74	..	15
II 4674.76	200	30 W	II 6080.32	..	30	II 7399.89	..	20
II 4681.99	..	20	II 6114.47	..	20	II 7404.34	..	100
I 4697.49	60 w	5 w	6119.55	25	..	II 7438.15	..	15
I 4704.70	200	50	I 6127.73	80	..	II 7562.01	..	25
II 4812.94	..	15	I 6147.31	20	..	I 7570.09	50	..
II 4909.73	..	25	II 6150.42	..	20	II 7579.02	..	30
II 4931.65	..	25	II 6154.24	..	30	II 7652.36	..	30
II 4953.73	..	15	II 6172.02	..	20	II 7664.70	5	70
II 5006.79	..	30	II 6186.86	..	20	II 7738.68	..	30
II 5009.83	..	20	II 6188.69	..	20	II 7778.74	..	30
II 5012.61	..	20	II 6204.27	..	15	II 7805.19	..	25
I 5016.61	15	..	II 6208.46	..	15	II 7807.66	..	70
II 5021.28	..	20	II 6216.91	..	60	II 7825.66	..	50
II 5051.78	..	60	II 6219.82	..	30	II 7845.03	..	25
II 5058.90	..	30	I 6223.66	15	..	II 7895.83	..	20
II 5060.63	..	30	II 6261.83	..	40	II 7902.57	..	25
II 5065.45	..	40	I 6268.30	40	..	I 7933.13	150	..
II 5067.08	..	30	II 6273.33	..	60	II 7944.42	1	25
II 5072.29	..	20	II 6300.99	..	40	II 7988.17	..	60
II 5083.99	..	15	II 6305.96	..	15	II 8088.58	..	20
II 5088.26	..	30	II 6311.29	..	30	I 8092.63	400 W	..
II 5093.79	..	20	II 6312.83	..	20	II 8095.55	..	40
I 5105.54	500	..	I 6325.45	20	..	II 8192.28	..	30
I 5111.91	15	..	II 6357.45	..	15	II 8277.60	..	50
II 5120.74	..	20	II 6377.84	..	20	II 8283.21	..	60
II 5124.46	..	20	II 6414.62	..	20	II 8503.46	..	15
I 5153.23	600	..	II 6423.90	..	30	II 8511.04	..	40
II 5183.36	..	20	II 6441.70	..	40	II 9205.40	..	20
II 5207.13	..	20	II 6470.15	..	50	II 9735.94	..	15
I 5218.20	700	..	I 6474.20	15	..	II 9813.35	..	20
I 5220.07	100	..	II 6481.46	..	15	II 9837.94	..	25
II 5269.99	..	30	II 6484.46	..	20	II 9861.41	..	50
II 5276.52	..	15	II 6494.04	..	30	II 9864.26	..	40
I 5292.52	50	..	I 6565.54	15	..	II 9868.20	..	15
II 5641.30	..	20	I 6599.68	25	..	II 9881.57	..	15
II 5682.42	..	20	II 6621.61	20	..	II 9916.52	..	30
I 5700.24	350	..	I 6672.23	15	..	II 9918.05	..	15
II 5721.78	..	20	I 6741.42	50	..	II 9925.67	..	20
I 5782.13	1000	..	I 6905.94	40	..	II 9939.05	..	20 d
II 5806.00	..	25	I 6920.06	100	..	II 9960.46	..	15

DYSPROSIUM

2634.81	40	20	3128.41	40	10	3235.90	35 s	8
3026.16	30	4	3135.37	100	50	3251.26	100	100
3029.83	30	4	3140.64	40	20	3256.25	25	5
3043.14	30	10	3141.13	50	20	3280.10	70	5
3049.13	25	4	3156.52	50	20	3308.89	25	..
3060.65	30	10	3162.82	80	60	3312.73	50	5
3062.62	25	10	3169.98	100	50	3316.32	50	4
3071.92	25	4	3177.88	30	5	3317.12	35	4
3073.54	30	8	3186.37	25	10	3319.89	150	9
3078.68	25	..	3187.68	25	10	3339.51	25	4
3103.25	30	1	3193.31	25	5	3340.01	80	4
3103.84	30	10	3206.40	40	5	3341.88	30	..
3109.77	40	20	3215.19	40	10	3353.59	35	5
3120.18	25	10	3216.63	25	15	3368.12	60	5

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

DYSPROSIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3385.03	25	■	3584.43	50	20	3931.54	200	..
3393.58	100	10	3585.07	300	100	3932.23	30	..
3407.80	150	9	3585.78	150	100	3942.54	30	5
3413.79	40	9	3590.67	30	20	3944.69	300	150
3414.83	35	5	3591.42	200	100	3946.94	30	..
3425.06	40	5	3591.82	80	20	3950.40	50	..
3429.44	50	5	3592.12	80	30	3954.57	40	..
3432.58	25	5	3595.05	200	100	3957.80	70	..
3434.37	80	30	3596.07	50	20	3968.39	300	..
3438.95	25	9	3600.34	20	30	3978.57	200	15
3440.94	25	5	3606.13	200	100	3979.48	30	..
3441.45	50	5	3612.79	25	10	3981.94	150	100
3445.58	80	8	3614.08	30	10	3983.66	150	8
3447.00	50	8	3618.52	80	10	3984.23	80	..
3449.90	40	5	3619.96	25	5	3991.33	40	..
3454.33	100	10	3620.18	80	20	3996.70	200	80
3456.01	40 W	..	3629.44	100	50	4000.45	400	300
3456.57	50	30	3633.26	25	..	4045.98	150	12
3460.97	100	3	3645.42	300	100	4050.58	30	15
3468.43	50	3	3648.81	50	30	4073.11	80	15
3473.70	80	40	3672.31	100	100	4077.97	150 r	100
3477.07	90	30	3673.15	25	5	4103.31	50	50
3494.50	100	5	3674.09	100	50	4103.88	30	4
3497.84	30	3	3676.56	6	30	4111.35	30	12
3498.67	50	50	3694.75	20	30	4143.10	40	8
3504.52	90	3	3698.17	10	30	4146.07	40	4
3505.46	70	2	3747.83	60	20	4167.97	50	12
3506.82	80	..	3753.51	50	20	4186.81	100 w	12
3517.27	70	4	3753.76	80	10	4131.63	40	2
3531.71	100	100	3757.37	200	50	4194.83	50	12
3534.96	125	..	3788.45	100	40	4201.32	30 w	..
3536.02	125	10	3806.28	25	80	4211.72	200	15
3538.52	150	40	3816.77	100	50	4215.17	50	8
3542.33	90	20	3836.51	100	40	4218.09	50	8
3544.21	25	10 n	3841.32	100	..	4221.10	60	8
3546.84	50	10	3846.36	25	..	4225.15	40	8
3550.23	200	100	3853.04	100	..	4239.87	50	4
3551.16	25	1	3866.59	25	..	4245.92	25	4
3560.15	40	20	3868.46	50	..	4247.36	30	4
3563.15	200	100	3868.81	60	..	4256.32	25	8
3563.70	50	30	3869.43	25	..	4291.93	25	..
3564.24	25	10	3869.87	100	..	4294.94	25	15
3568.99	100	..	3872.12	300	150	4308.62	100	12
3569.67	40	10	3873.99	100	..	4358.46	25	4
3573.84	80	80	3879.05	25	2	4394.98	25	4
3574.16	200	100	3882.00	25	..	4409.38	30	8
3576.25	300	..	3898.54	100	..	4589.38	70	15
3576.87	200	50	3901.34	25	..	4612.27	50	10
3577.99	150	50	3914.88	50	..	4731.85	30	10
3580.04	80	30	3915.60	80	..	7662.35	25	..
3582.03	25	10	3923.39	30	..			

ERBIUM

2128.07	..	250 w	2670.25	25	3	3187.78	25	12
2185.71	30	..	2833.06	25	..	3220.73	25	5
2191.24	..	200 W	2859.81	25	10	3223.31	25	5
2314.43	3	40	2904.47	25	5	3230.58	25	15
2327.36	..	150	2911.42	30	15	3249.34	25	8
2396.38	..	30	3095.88	25	8	3264.78	25	5

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

ERBIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3273.08	25	15	3630.24	25	6	4527.78	40	9
3289.36	25	8	3645.40	25 s	12	4643.69	50	15
3312.42	25	15	3664.44	40	20 n	4674.85	50	15
3323.20	25	4	3668.49	25	3	4781.02	35	2
3329.66	25	3	3683.47	25	..	4820.34	25	2
3332.70	25	2	3694.19	25 d	15	4831.16	25	..
3346.03	30	10	3729.53	25	7	4839.85	35	..
3364.09	25	7	3777.09	25	10 n	4845.65	50	..
3372.75	35	20	3787.27	25 d	5 d	4852.68	45	..
3374.17	25	5	3808.15	25	4	4854.86	40 s	..
3385.09	25 d	15 d	3835.26	25 d	2 d	4872.10	25	3
3391.99	30	12	3836.50	40	10	4883.67	30 n	..
3393.57	25	10	3880.66	25 wd	6 wd	4900.11	30	20
3398.94	40 wd	7 wd	3892.69	25	2	4935.50	35	..
3433.13	25	2	3896.23	30	15	5042.04	60	..
3434.37	25	8	3898.53	30	10	5127.40	25	..
3443.70	25	2	3906.32	25	12	5133.83	40	..
3456.00	25 d	10 d	3950.35	30	10 n	5164.76	30	..
3471.71	25	8	3973.04	25	..	5188.89	30	..
3476.30	30	7	3987.95	100 r	20	5218.25	30	..
3479.42	25	10	3996.69	25	..	5229.32	30	..
3480.44	25	8	4000.45	35	6	5255.95	50	..
3484.83	30 d	7 d	4007.97	35	7	5279.33	30	..
3485.86	25	6	4050.57	25	1	5302.30	30	..
3492.54	25 d	2 d	4057.82	30	..	5343.93	30	..
3496.86	25	20	4142.96	30	15	5344.51	30	..
3504.52	25	4 n	4180.87	25 w	..	5395.87	50	..
3515.58	25 w	5 w	4211.72	30	5	5414.64	50	..
3523.98	25	8	4230.20	25	..	5422.80	30	..
3531.71	40	25	4301.60	25	2	5454.27	30	..
3547.51	25 l	1 n	4308.63	30	3	5456.62	30	..
3549.85	25	20 s	4374.92	40 wn	25 wn	5485.93	30	..
3553.20	25	15	4384.70	30	5	5739.19	30	..
3584.52	25	15 n	4409.36	35	2	5757.62	30	..
3590.35	25	..	4419.61	25	4	5762.79	30	..
3599.83	30 w	20 s	4422.47	30	20	5826.79	50	..
3600.74	30 w	20 w	4449.70	30	1	5855.29	30	..
3616.57	30	20	4505.94	40	5	5881.14	30	..
3620.18	50	3	4518.64	40 w	1 n	5886.46	30	..
3620.94	25	15	4527.24	50	10	5902.09	30	..
3628.70	25	12 n						

EUROPIUM

2564.18	20	60	II 2729.39	100 d	60	2925.03	150 l	100
2580.60	25 w	..	2781.89	100 w	100 w	2947.30	30	..
2635.46	30	30 n	2802.86	150 w	..	2952.68	200 w	150
2638.76	300	200	II 2811.75	50	..	2959.48	30	..
2641.26	100 w	60	2813.95	300 w	300 wn	2960.23	150 W	..
2668.33	300 w	400	2816.18	50 w	50	2986.92	25	..
2673.41	125	50	2820.77	200 W	200 W	2991.34	80	40
2678.28	150	100	2828.69	200 W	150	3006.27	30	..
II 2685.65	150	100	II 2859.67	40	..	3022.15	25	10
2692.02	200	200	2862.57	100 W	70	3040.77	25 w	..
II 2701.12	60 n	60 n	2887.88	30	30	3054.93	400 w	3
2701.89	300 W	200	2892.54	40 w	30 n	3077.35	30	20
2705.26	50 l	..	2893.03	40	..	3097.46	200 w	5
2716.97	300	300	2893.85	150	100	3098.17	25 d	5
2723.92	30	..	2906.68	300 W	300	3111.43	200	..
2727.78	300 l	500	2909.01	40	..	3130.74	100 W	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

EUROPIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3149.88	40 w	20 w	3930.44	100 W	...	4692.63	60 w	2
3173.60	35	1	II 3930.50	100 r	400 r	4698.14	300	2
3210.57	80	...	3943.08	50	15	4704.60	30 w	...
3212.81	200	20	3949.12	25 w	1	4709.82	30 W	2
3213.75	100	20 n	3949.59	50 W	...	4713.61	400	2
3241.40	25	1 n	3955.75	50 W	...	4717.22	60 W	2
3247.53	50 W	5	3961.14	50 W	...	4718.61	60 W	2
3280.68	1000 r	...	3964.89	40 wd	...	4724.06	30	...
3301.95	25	2	3967.13	25 W	...	4728.15	40	...
3308.02	20	30	3971.90	100 rwn	...	4736.61	60	...
3313.32	35	40	I 3971.99	1000 rwn	...	4739.17	80	...
3321.86	30	5	3978.45	30 W	...	4740.52	500	2
3334.33	50	5	4002.56	30	2	4755.94	60 w	...
3350.43	30	...	4003.71	18	25	4758.73	60 W	2
3369.05	40	5	II 4011.68	25	...	4762.91	60	2
3391.99	40	5	4012.82	20	25	4777.70	40	...
3396.58	100	10	4017.58	25 W	25	4867.60	30	3
3414.77	40	...	4036.11	50 W	...	4900.84	25	2
3425.02	50	4	4059.38	25	...	4911.41	30	6
3435.20	35	2	II 4129.74	150 r	50 r	4938.31	250 W	...
3440.99	40	25	II 4205.05	200 r	50	5013.14	125	1
3445.17	40	2	4235.60	400 r	...	5022.90	125	...
3454.76	40 W	2	4281.92	25	2	5029.48	500 w	...
3457.05	25	2	4322.57	60	...	5029.55	30	1
3457.57	25	1	4325.53	30 w	...	5033.54	60	2
3461.38	25	2	4329.36	100 W	2	5067.95	35	...
3466.42	30	2	4329.97	100 w	1	5096.41	30	...
3481.61	45 W	2	4331.18	80	...	5114.36	150	...
3505.30	25 w	5 w	4337.68	100 W	2	5124.77	60	...
3511.07	30 w	2	4345.90	80 W	1	5129.08	200	...
3511.85	25 w	1	4354.79	100 w	2	5133.48	150	...
3521.09	50	4 n	I 4355.10	150	20	5160.07	200	...
3603.20	100 w	50	4370.46	60 W	2	5166.72	125	...
3606.71	50	...	I 4383.16	100 W	20	5199.85	500	...
3611.58	40	5	4387.88	200	...	5200.92	300	...
3616.15	40	10	4417.25	60 w	...	5206.43	40	...
3622.56	20 n	50	4435.53	2000	...	5213.37	150	...
3629.80	40	50 n	4435.60	400 r	100	5215.09	1000	...
3632.17	30	10	4464.56	30	...	5217.02	125	...
3660.60	30 d	...	4464.97	80	10	5223.48	700	...
3674.67	25	...	4471.99	30 w	2	5233.89	30	...
3678.27	50	...	II 4485.15	40	2	5236.12	25	...
3687.79	40 w	50 w	4522.58	500	...	5239.22	80	...
II 3688.44	1000 W	500 W	I 4522.60	200 r	200	5242.68	30	...
3693.82	25 w	1	4526.69	100	...	5248.61	80	...
3710.88	35 l	30 n	4586.44	30 w	...	5249.11	60	...
3713.46	50	2	4594.02	500 r	200	5263.04	30	...
I 3714.91	40	2	4597.33	40 W	...	5266.40	1000	...
3719.17	30	...	4611.52	50 w	...	5271.95	2000	...
3722.61	40 W	10	4616.49	30 w	...	5272.48	400	...
3724.99	250	50	4625.30	50 w	...	5275.66	30	...
3732.21	30 W	...	4627.12	(300 r)	...	5282.82	1000	...
3742.23	25 W	...	4627.22	50	15	5285.46	40	...
3770.23	15 W	25 W	4644.24	50	...	5285.73	40	...
3774.08	50 W	10 W	4653.48	25 w	...	5287.23	125	...
3781.39	25 W	30 W	4656.73	50	1	5289.25	125	...
3785.47	25 W	10 Wn	4660.37	50	1	5291.25	200	...
II 3799.01	100 wn	...	4661.87	80 r	20	5293.68	50 w	...
II 3819.66	500 wd	500 wd	4661.88	100	...	5294.60	300	...
3861.18	30 w	30 w	4665.07	30 W	...	5302.72	30	...
3865.56	30 W	...	4671.18	30	1	5303.87	300	...
3884.76	50 W	5 Wn	4685.25	60 W	...	5350.40	60 n	...
II 3907.11	1000 rW	500 r	4688.23	100	2	5351.67	150	...

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

EUROPIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
5352.82	80	..	5963.76	60	..	6692.98	40	..
5355.08	200	..	5966.07	1000	..	6693.97	500	..
5356.72	40	..	5967.16	2000 s	..	6710.50	25 W	..
5357.61	1000	..	5971.69	40	..	6744.96	100	..
5360.81	150	..	5972.78	300	..	6782.59	100	..
5361.59	300	..	5992.86	1000	..	6787.52	30 W	..
5376.91	200	..	6004.41	300	..	6802.79	500	..
5392.91	150	..	6005.68	60	..	6816.11	150 W	..
5402.79	1000	..	6012.21	300 W	..	6834.41	30 W	..
5405.31	40	..	6012.56	400	..	6841.05	50 W	..
5411.84	80	..	6015.58	150	..	6844.98	40 W	..
5421.08	125	..	6018.19	1000	..	6864.55	1000 W	..
5426.93	200	..	6023.16	200	..	6898.27	30 W	..
5443.56	125	..	6029.01	500	..	6903.71	200 W	..
5451.53	1000 #	..	6044.67	200	..	6914.82	40 W	..
5452.96	1000 s	..	II 6049.50	1000	..	7040.18	800	..
5472.33	1000 s	..	6057.36	600	..	7074.56	60	..
5488.65	500	..	6075.59	300	..	7077.09	800	..
5495.17	125	..	6077.37	100 W	..	7106.48	600 W	..
5510.55	300 s	..	6083.87	500	..	7164.67	50 W	..
5526.62	60	..	6099.38	600	..	7175.50	200 W	..
5533.24	30	..	6107.47	30	..	I 7194.85	700	..
5536.13	30	..	6108.13	150	..	I 7217.60	700	..
5542.54	80	..	6118.78	400 W	..	7224.72	150 W	..
5547.45	1000	..	6124.68	150	..	7258.74	100 W	..
5570.36	1000	..	I 6173.05	600	..	7262.80	200 W	..
5577.13	1000	..	6178.75	120	..	7281.57	50 W	..
5579.65	200 s	..	6188.10	500 W	..	7297.57	30 W	..
5580.04	300	..	6195.06	300	..	II 7301.16	700	..
5586.25	300	..	6233.74	100	..	7310.33	30 W	..
5586.77	200	..	6250.46	70	..	7313.64	60 W	..
5592.26	25	..	6262.28	600	..	7336.28	300 W	..
5599.81	40	..	6266.95	120	..	7356.65	30 W	..
5605.85	40	..	6288.34	300	..	7362.25	50 W	..
5618.81	125	..	6291.34	250	..	7369.69	200 W	..
5622.45	200 s	..	6299.76	500 W	..	I 7370.27	700	..
5632.56	200 s	..	II 6303.39	700	..	7389.15	40 W	..
5645.80	1000	..	6313.79	25 W	..	7404.41	30 W	..
5673.84	200	..	6335.78	200	..	7426.57	500	..
5681.05	40	..	6350.04	600 W	..	7436.59	100 W	..
5684.27	125	..	6355.88	200	..	7470.53	30 W	..
5730.89	300	..	6369.24	300	..	7528.70	200	..
5738.99	300	..	6382.74	200	..	7583.91	400	..
5765.20	2000	..	6383.86	350	..	7742.58	400	..
5783.71	150 s	..	6400.93	700 W	..	7746.20	600	..
5792.72	30	..	6406.11	100	..	7803.22	30	..
5800.27	200	..	6410.10	500 W	..	7887.98	300	..
II 5818.74	1000	..	6411.34	500	..	8209.84	200	..
5820.00	30	..	6428.28	200	..	8226.82	100	..
5820.91	30	..	I 6437.69	700	..	8464.75	50	..
5831.05	2000 W	..	6439.97	40	..	8542.12	100	..
5845.76	30	..	6457.99	500	..	8642.69	300	..
5860.96	30	..	6470.75	30 W	..	8727.78	40	..
II 5872.97	300	..	6483.07	30	..	8790.87	40	..
5891.27	200	..	6493.90	40	..	8876.34	100	..
5895.29	25	..	6501.53	300	..	8917.65	60	..
5902.76	30	..	6519.60	500	..	8934.41	50	..
5909.95	30	..	6522.76	25	..	9018.00	50	..
5915.76	200 l	..	6567.87	600	..	9024.5	60	1
5926.53	80	..	6593.82	400	..	9058.0	80	..
5942.73	30	..	6603.60	80	..	9083.2	30	..
5953.50	30	..	6645.15	1000	..	9085.3	50	..
5953.83	40	..	6685.27	80	..	9898.30	40	..
5954.27	30	..						

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

FLUORINE

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 3059.96	..	60	bh 5771.9	100	..	bh 6417.7	100	..
II 3202.74	..	200	bh 5774.8	100	..	bh 6419.0	50	..
II 3501.42	..	200	bh 5777.6	100	..	bh 6499.0	80	..
II 3502.95	..	60	bh 5779.4	200	..	bh 6502.2	80	..
II 3503.09	..	400	bh 5780.5	50	..	bh 6505.5	100	..
II 3505.61	..	600	bh 5782.1	150	..	bh 6508.7	200	..
II 3541.76	..	100	bh 5784.8	100	..	bh 6512.0	300	..
II 3541.94	..	60	bh 5787.6	100	..	bh 6514.2	80	..
3577.23	..	60	bh 5790.3	100	..	bh 6517.5	100	..
3602.85	..	60 d	bh 5793.1	100	..	bh 6520.8	100	..
II 3640.89	..	100	bh 5795.9	100	..	bh 6524.2	150	..
II 3641.98	..	60	bh 5798.9	80	..	bh 6527.6	200	..
II 3704.51	..	60	bh 5801.8	80	..	I 6569.69	..	50
II 3847.09	..	800	bh 5804.7	80	..	bh 6610.5	50	..
II 3849.99	..	600	bh 5807.7	80	..	bh 6613.6	80	..
II 3851.67	..	200	bh 5810.6	50	..	bh 6616.6	100	..
II 4024.73	..	500	bh 5813.7	50	..	bh 6619.8	150	..
II 4025.01	..	150	bh 5816.7	50	..	bh 6622.9	200	..
II 4025.49	..	300	bh 5831.1	50	..	bh 6626.1	200	..
II 4083.92	..	40	bh 5831.5	50	..	bh 6629.4	200	..
II 4103.08	..	150	bh 5832.0	50	..	bh 6632.7	300	..
II 4103.52	..	300	bh 5832.6	50	..	bh 6642.0	50	..
II 4103.72	..	50	bh 6034.8	50	..	bh 6645.4	80	..
II 4103.87	..	50	bh 6036.9	50	..	bh 6648.7	100	..
II 4109.17	..	100	bh 6050.8	50	..	bh 6652.1	100	..
II 4116.55	..	50	bh 6056.9	50	..	bh 6655.6	100	..
II 4119.22	..	50	bh 6058.6	80	..	I 6690.47	..	60
II 4207.16	..	50	bh 6060.4	100	..	I 6708.28	..	40
II 4246.16	..	300 n	bh 6062.3	150	..	6773.97	..	100
II 4275.21	..	100 n	bh 6064.4	200	..	I 6795.52	..	60
II 4277.51	..	40 n	I 6239.64	..	300	I 6834.26	..	300
II 4299.18	..	150	bh 6290.7	50	..	I 6856.02	..	1000
II 4446.51	..	40 n	bh 6291.6	50	..	I 6870.22	..	150
II 4446.71	..	150 n	bh 6292.5	50	..	I 6902.46	..	500
II 4447.18	..	200 n	bh 6293.4	80	..	I 6909.82	..	150
II 4859.37	..	50	bh 6295.4	80	..	I 6966.35	..	70
bh 4950.8	100	..	bh 6296.5	100	..	I 7037.45	..	200
bh 4952.6	80	..	bh 6297.5	100	..	I 7127.99	..	150
bh 4954.3	50	..	bh 6298.7	100	..	I 7202.37	..	125
bh 4992.1	50	..	bh 6299.8	100	..	7309.03	..	50
bh 5000.6	80	..	bh 6300.9	150	..	I 7311.02	..	125
bh 5003.6	50	..	bh 6302.2	150	..	I 7314.31	..	40
bh 5291.0	200	..	bh 6303.5	150	..	I 7331.95	..	200
bh 5292.9	150	..	bh 6304.8	150	..	I 7398.68	..	400
bh 5296.8	100	..	bh 6306.1	100	..	I 7425.64	..	150
bh 5298.6	100	..	I 6348.50	..	200	I 7482.72	..	80
bh 5302.7	100	..	bh 6411.8	50	..	I 7489.14	..	50
bh 5304.4	100	..	bh 6412.9	80	..	I 7552.24	..	40
bh 5308.7	80	..	I 6413.66	..	150	I 7573.41	..	40
bh 5310.3	80	..	bh 6414.1	100	..	I 7607.17	..	45
bh 5314.7	50	..	bh 6415.3	100	..	I 7754.70	..	60
bh 5316.2	80	..	bh 6416.5	100	..	I 7800.22	..	50

GADOLINIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2781.40	30	40	3010.14	100	100	3100.51	100	80
2796.94	70	80	3027.61	100	60	3145.01	50	30
2809.72	60	80	3032.85	100	100	3331.39	100	80
2840.24	50	60	3034.06	100	60	3350.48	150	180
2881.58	40	..	3068.65	50	50	3358.63	100	100
2999.06	40	30	3082.00	100	60	3362.24	150	180

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

GADOLINIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3392.53	40	25	I 3934.80	100	50	4262.09	150	10
3407.60	100 r	100	3938.98	20	40	4266.60	50	..
3416.96	50	30	3942.64	60	30	4267.02	40	40
3418.73	50	25	3943.25	40	40	4268.74	40	40
3422.47	80	100	3945.54	200 W	150	4274.17	100	..
3432.99	50	40	3952.01	100	60	4280.50	200	100
3439.21	60	35	3953.37	100	50	4285.83	60	20
3439.78	50	50	3957.68	300 W	200	4286.12	60	20
3439.99	70	50	3963.66	50	60	4289.90	40	100
3450.38	100	100	I 3969.00	40	..	4296.08	200	4
3451.24	50	40	3969.26	200	..	4296.29	40	40
3463.98	100	125	3974.07	100	80	4297.18	100	4
3467.28	100	100	I 3979.34	100	30	4304.90	100	100
3468.99	150	150	3983.03	40	40	4306.35	200	80
3473.23	50	40	3987.22	100	100	4310.99	100	..
3481.36	150	150	3987.84	50	25	4313.85	200	80
3481.82	80	60	3996.32	100	100	4314.40	100	20
3491.97	50	25	4001.24	80	3	4316.06	150	60
3494.42	70	60	4009.21	50	2	4316.27	40	..
3505.52	60	60	4037.34	100	30	4320.53	60	20
3545.79	125	125	4037.91	100	30	4321.11	50	20
3549.36	125	125	4047.85	150 l	50	4321.21	40	..
3558.52	100 r	50	4049.44	80	20	4322.19	50	25
3584.96	100	100	4049.90	100	60	4324.07	100	..
3592.70	50	70	4053.30	100	80	I 4325.69	500 r	250
3604.88	50	12	I 4053.65	100	40	4327.10	500 r	100
3608.76	100	125	I 4054.73	80	20	4329.58	100	100
3629.52	40	60	I 4058.23	100	60	4330.62	100	..
3646.20	200 w	150	4059.88	50	20	4337.51	50	50
3654.64	200 w	200	4065.64	50 l	50 n	4341.29	200	125
3656.16	200 w	200	4070.29	80	..	4342.19	200	200
3662.27	200 w	200	4070.40	40	10	4344.30	50	..
3664.62	200 w	200	4073.21	80	80	4346.46	150	60
3671.22	150 w	100	4073.77	100	50	4346.63	50	20
3674.06	100 W	30	4085.65	100	80	4347.32	100	100
3684.12	200 W	150	4087.71	80	100	4360.93	200	..
3686.34	150 W	200	I 4090.42	100	20	4369.17	50	20
3687.76	200 w	200	I 4092.71	100	40	4369.77	250	150
3697.74	200 w	200 w	4098.91	100	100	4370.19	40	..
3699.75	200 W	250	4130.38	200	10	4373.84	200	80
3712.71	200 W	250	4131.48	50	50	4378.57	40	..
3713.58	100 W	80	4137.08	20	40	4380.64	100	125
3716.37	150 w	125	4162.74	50	..	4382.06	40	..
3717.49	100 w	50	4170.11	50	50	4383.14	30	40
3719.46	40	40	4175.54	50	..	4387.68	150	..
3722.03	50	30	4183.62	35	..	4389.88	40	40 n
3725.49	50	50	4184.26	150	150	4389.99	30	80
3730.86	100 W	100	4190.15	100 W	..	4390.95	100	100
3739.76	100	50	I 4190.78	100	40	4392.07	100	100
3740.05	50	50	4191.08	100	..	4397.52	100	5
3769.45	50	40	I 4191.62	40	15	4401.85	200	100
3770.70	50	60	4197.70	40	50	4403.14	100	100
3782.28	25	50	4212.02	150	50	4406.67	70	200
3796.39	150 w	150	4215.02	200	150	4408.26	100	150
3812.02	200 r	200 n	4217.19	100	100	4411.16	100	50
3813.98	100 w	60	4225.85	150	50	4414.16	100	60
3836.51	100 wn	60	4227.14	50	20	4414.73	100	50
3852.50	100	8	4238.78	200	200	4419.04	200	200
3894.71	150 W	80	4243.84	60	100	4421.24	100	8
3902.40	100	80	4246.55	150	3	4422.41	100	40
3905.65	50	50	4251.74	300	10	4426.15	50	2
3907.12	100 W	100	4253.37	50	4	4430.63	150	40
3916.59	150 w	100	4253.62	50	50	4431.77	60	1

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

GADOLINIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4436.22	30	100	4791.60	150	..	6645.18	150	..
4438.27	40	100	4799.87	25	60	6681.22	100	..
4446.48	80	2	4800.11	30	80	6718.14	40	..
4449.95	4	40	4801.08	200	200	6727.84	50	..
4466.55	200	150	4802.58	100	40 n	6730.76	100	..
4467.09	50	..	4803.55	100	40	6752.68	300	..
4471.30	50	..	4805.82	200	80	6753.90	100	..
4474.14	150	150	4807.46	100	40	6783.35	40	..
4476.14	100	..	4816.84	50	20	6786.32	125	..
4478.81	80	..	4821.71	150	80	6816.47	40	..
4481.07	70	100	4834.24	125	25	6820.91	50	..
4483.34	80	125	4835.27	100	10	6828.25	150	..
4486.36	25	80	4848.11	60	10	6846.60	500	..
4486.91	100	15	4856.19	80	..	6857.12	200	..
4497.13	150	80	4856.74	80	..	6887.62	35	..
4498.29	100	..	4859.23	50	..	6900.68	60	..
4506.22	100	50	4861.80	100	..	6916.57	200	..
4506.35	80	5	4862.61	100	2	6985.88	200	..
4506.94	50	20	4865.04	400	10	6991.93	150	..
4514.52	60	10	4866.41	100	..	6996.78	200	..
4519.66	150	100	4870.05	200	10	7006.16	80	..
4520.08	50	3	4871.52	100	..	7037.25	50	..
4522.84	50	4	4873.35	200	2	7118.91	40	..
4537.82	150	100	4875.97	100	10	7122.59	50	..
4540.02	80	200	4881.08	60	..	7147.36	50	..
4542.03	50	50	4881.38	50	..	7168.41	500	..
4548.01	50	50	4881.94	100	20	7172.29	50	..
4583.09	40	2	4883.20	100	..	7189.59	80	..
4597.92	25	40	4889.20	60	..	7194.87	50	..
4601.05	40	6	4894.32	200	4	7201.42	40	..
4614.50	50	25	4915.84	40	..	7228.05	40	..
4680.06	50	25	4930.71	80	..	7233.44	80	..
4683.34	100	50	4938.62	150	2	7252.72	80	..
4694.34	50	8	4942.57	100	..	7262.67	80	..
4697.49	100	4	4958.79	125	4	7291.35	60	..
4702.32	50	100	4961.50	100	..	7301.23	150	..
4703.14	50	20	4965.06	100	10 n	7313.28	150	..
4709.78	100	25	4969.16	100	..	7324.89	80	..
4712.82	25	40	5010.83	50	..	7327.09	40	..
4719.05	50	20	5015.06	100 W	..	7370.28	80	..
4723.73	100	200	5050.87	50	..	7373.83	40	..
4726.74	40	100	5125.54	50	..	7376.42	40	..
4728.47	150	100	6004.57	35	8	7377.59	40	..
4732.61	300	300	6305.14	100	..	7380.30	40	..
4734.44	100	40	6380.97	100	..	7385.91	40	..
4735.76	150	150	6382.19	60	..	7394.91	40	..
4738.13	50	50 n	6422.41	50	..	7405.76	40	..
4743.65	300	300	6462.58	50	..	7417.99	50	..
4758.71	35	..	6480.11	40	..	7426.56	80	..
4760.75	40	40	6538.14	50	..	7430.20	40	..
4767.25	100	25	6591.60	40	..	7441.89	200	..
4781.93	200	50	6634.35	150	..	7464.38	200	..
4784.64	100	50	6640.09	40	..	7489.47	40	..
4786.81	40	2						

GALLIUM

II 2091.34	..	(40)	I 2534.83	..	(20)	2659.87	5	12
2450.07	10	10	I 2607.47	..	(15)	I 2665.05	..	(40)
I 2482.76	..	(15)	I 2624.82	..	(25)	I 2691.29	..	(25)
2500.17	12	10 r	I 2632.66	..	(40)	II 2700.47	..	(70)

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

GALLIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2719.65	5	15	I 3872.56	30	..	5992.34	..	10
II 2780.15	..	(40)	II 3924.39	..	25 W	II 6334.2	..	(100)
I 2874.24	10	15 r	I 4032.98	1000 r	500 r	6396.61	..	20
I 2943.64	10	20 r	I 4172.06	2000 r	1000 r	6414.01	..	15
2944.17	10	15 r	II 5218.21	..	(10)	II 6419.4	..	(25)
3004.06	..	15	5360.09	2	12	II 6456.3	..	(15)
3375.30	..	12	II 5416.8	..	(10)	II 7198.7	..	(60)
3730.04	..	20	5844.22	..	12	II 7793.0	..	(10)

GERMANIUM

2041.69	5 r	150 r	2709.63	30	20	4260.80	20	10 n
2043.76	4 r	70 n	2740.43	10	10	I 4685.84	20	..
2065.20	4 r	50	2754.59	30	20	II 4741.94	..	50
2068.65	5 r	200 r	II 2845.48	..	12	II 4814.80	..	200
2198.70	10 r	2 n	I 3039.06	1000	1000	II 4824.20	..	10
2417.37	10	12	3067.01	60	40	II 5131.7	..	100
I 2497.96	8	10	I 3124.82	200	80	II 5178.58	..	100
2556.30	20	2	3255.34	..	100 Wn	II 5893.46	..	100
2592.54	20	15	I 3269.49	300	300	II 6021.14	..	25
I 2651.18	40	20	4179.04	..	25 wn	II 6336.31	..	10
I 2651.57	30	20	I 4226.57	200	50	II 6484.32	..	15
2691.34	25	15						

GOLD

I 2012.00	15	18	2687.63	..	15	I 3204.74	50	30
2110.80	..	60	I 2688.71	2	20	I, II 3230.64	15	80
2125.34	..	30	I 2700.89	20	25	I 3308.31	50	15
I 2176.33	15	..	II 2732.01	..	30	I 3320.15	20	5
II 2188.98	..	15	I, II 2748.26	40	80	3349.40	15	5
2201.35	..	30	2780.83	..	20	I 3355.14	25	..
2215.76	..	15	II 2795.53	..	15	I 3553.57	20	10
2222.56	..	15	2802.19	..	200	I 3565.93	20	15
II 2229.03	..	50	II 2805.32	..	30	3580.08	20	15
II 2231.31	..	20	2819.95	..	150	I 3586.74	20	15
2242.71	..	30	2822.72	..	80	3591.99	15	5
2246.43	..	15	2825.45	10	40	3594.15	25	6
II 2246.68	..	18	2838.03	..	80	I 3598.08	35	10
II 2283.32	..	15	II 2847.09	..	25	3607.54	..	20
II 2291.52	..	15	2856.91	..	20	3614.00	..	20
II 2304.81	..	30	I 2883.45	15	20	II 3633.24	1	15
2314.64	..	15	I 2891.96	8	20	3682.86	20	10 n
II 2352.65	25	..	2893.42	..	30	3706.82	..	15 n
I, II 2364.56	20	8	I, II 2905.90	10	30	I 3795.90	20	3 n
2364.89	..	15 n	2907.06	..	25	II 3804.00	25	150
I 2376.24	25	3	II 2913.54	..	50	3816.13	20	40
I 2387.75	30	10	II 2918.37	..	25	II 3825.65	20	30
I 2404.81	20	4	I, II 2932.19	8	40	3829.38	25	20
I 2427.95	400 r	100	2954.39	..	50	3836.48	30	30
II 2477.71	..	15	II 2982.11	..	15	3871.35	25	20
2480.28	..	15 n	II 2990.28	..	50	3874.67	5	15
2503.32	..	30	II 2994.99	..	100	II 3880.20	..	20
I 2510.49	25	15	3014.23	5	15	3883.35	..	20
I 2544.19	30	8	I 3029.20	25	30	I 3897.89	30	25
I, II 2590.04	30	50	3033.18	25	30 n	I 3909.38	10	15
I 2641.49	5	20	I 3122.78	500 n	5	I 3914.72	15	3
I 2675.95	250 r	100	I 3194.71	25	20	3959.11	8	20

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

GOLD (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 4016.05	10	15	4587.89	..	15	I 5726.82	35	10
I 4040.94	50	40	I 4607.34	30	15	I 5837.40	400 n	10
II 4052.81	..	60	4607.50	..	15 r	I 5862.94	30	5
I 4065.08	50	30	I 4792.60	200 W	60	I 5956.98	35	8
II 4076.33	4	25 w	I 4811.62	50	15	5962.72	35	3
I 4084.12	25	12	I 5064.61	40	10	II 6022.74	15	5
I 4241.77	40	30	I 5147.39	40	5	I 6160.1	20	..
II 4259.89	..	15	I 5230.26	40	15	I 6278.18	700	20
I 4315.09	40	18	I 5261.82	40	3	I 6652.6	15	..
I 4437.27	50	10	I 5655.77	35	5	I 7510.75	20	..
I 4488.25	40	301	I 5721.26	15	..			

HAFNIUM

II 2028.18	25	15	II 2447.25	25	50	II 2789.73	20	30
II 2083.80	40	30	II 2453.34	12	25	II 2808.00	25	30
II 2088.77	50	50	II 2460.49	20	50	II 2813.86	25	30
II 2089.95	30	30	2461.72	..	30	II 2814.47	25	40
II 2090.83	40	40	II 2464.19	30	100	II 2814.76	15	35
II 2096.18	100	150	II 2469.18	20	50	II 2820.22	40	100
II 2107.47	60	60	II 2473.91	15	25	II 2822.68	30	90
II 2123.68	40	40	II 2478.56	100	300 wn	II 2829.32	15	30
II 2124.59	50	80	2495.17	..	60	2833.28	25	4
II 2129.10	60	100	II 2496.99	30	40	2845.28	25	5
II 2139.24	30	40	II 2512.69	25	50	II 2849.21	30	100
II 2156.44	25	25	II 2513.03	25	70	2850.96	25	5
II 2170.22	20	30	2515.16	1	40	II 2851.21	25	50
II 2175.36	25	30	II 2515.48	20	30	II 2852.01	20	50
II 2178.90	60	80	II 2516.88	35	100	II 2860.31	15	30
II 2190.22	30	30	II 2531.19	25	50	II 2861.01	40	90
II 2212.45	25	30	II 2551.40	25 d	125 d	II 2861.70	50	125
II 2254.01	60	80	II 2559.19	20	40	2866.37	50	12
II 2255.15	40	60	2560.74	..	25	II 2869.82	25	20
II 2266.52	30	40	II 2563.61	20	35	II 2876.33	30	100
II 2266.83	60	80	II 2571.67	30	80	2887.13	25	3
II 2273.15	40	60	II 2573.90	25	100	2889.62	30	10
II 2277.16	150	150	II 2576.82	5	60	I 2898.26	50	12
II 2284.60	20	30	II 2578.14	25	30	II 2898.71	25	50
II 2291.64	30	40	II 2582.54	25	35	I 2904.41	30	6
II 2298.34	25	50	II 2606.37	25	50	2904.75	30	6
II 2321.14	50	60	II 2607.03	30	80	II 2909.91	30	20
II 2322.47	60	60	II 2613.60	20	80	I 2916.48	50	15
II 2323.25	40	60	II 2622.74	30	80	2918.58	30	8
II 2324.50	20	40	II 2638.71	40	100	II 2919.59	40	80
II 2324.89	40	80	II 2641.41	40	125	2924.61	25	2
II 2332.97	40	50	II 2647.29	40	125	II 2929.63	30	50
II 2337.33	30	30	II 2651.16	15	40	II 2937.79	50	100
II 2343.32	60	80	II 2657.84	20	25	I 2940.77	60	12
II 2347.44	80	125	II 2661.87	25	40	2958.02	30	5
II 2351.21	100	150	II 2665.97	20	35	II 2961.80	20	30
II 2380.30	30	60	II 2683.35	15	100	2964.88	50	10
II 2381.00	20	40	2687.22	..	25	2966.93	25	4
II 2393.18	20	40	II 2706.73	10	50	II 2967.23	20	25
II 2393.36	50	80	II 2712.42	25	50	II 2968.81	30	30
II 2393.83	80	100	II 2738.76	40	100	II 2975.88	80	100
II 2405.42	25	50	II 2751.81	25	80	II 2977.59	30	25
II 2406.44	12	25	2753.61	..	60	2980.81	50	10
II 2410.14	25	50	II 2756.91	15	40	2982.72	30	1
II 2417.69	25	40	2761.63	25	3	II 3000.10	40	30
II 2425.97	15	25	II 2773.36	25	60	3005.56	50	8
II 2433.57	15	50	II 2774.02	25	50	II 3012.90	80	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

HAFNIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3016.78	25	10	II 3569.04	20	50	4859.24	30	5
3018.31	60	10	3616.89	25	10	II 4904.52	12	25
II 3024.76	18	25	II 3644.35	25	50	II 4934.45	40	50
II 3025.29	30	30	II 3661.05	10	25	4975.25	25	4
II 3031.16	70	90	II 3665.35	20	25	II 4999.68	30	40
II 3046.08	25	25	II 3666.77	25	4	II 5040.82	100	150
3050.76	50	10	3672.27	25	3	II 5057.03	20	30
3057.02	70	10	3682.24	25	30	II 5079.65	40	60
3063.78	25	1	II 3698.39	10	25	5181.86	25	10
II 3064.68	10	30	II 3699.72	20	25	II 5187.75	20	30
3067.41	30	10	II 3701.15	15	40	II 5247.10	40	60
I 3072.88	80	18	II 3705.40	15	25	II 5260.44	30	40
3074.10	25	1	II 3719.28	15	30	II 5264.95	50	80
3074.79	30	4	II 3737.88	15	25	II 5298.06	80	100
II 3080.66	30	100	II 3762.51	2	25	II 5311.60	100	150
3080.84	25	5	II 3766.92	5	25	II 5324.26	20	30
3096.76	25	1	II 3797.92	25	25	II 5346.30	10	40
II 3101.40	60	90	3831.13	25	25	II 5444.07	20	30
II 3109.12	50	100	II 3877.10	4	30	II 5524.35	40	50
II 3110.87	30	40	II 3880.82	20	30	5550.60	30	5
3119.98	25	1	II 3979.40	6	40	5552.12	40	5
3131.81	40	10	4047.96	8	25	5719.18	40	10
II 3134.72	80	125	II 4093.16	25	20	II 5767.18	15	30
3137.51	30	10	4174.34	25	6	II 5809.56	20	30
II 3139.65	25	20	4294.79	25	2	II 5842.23	50	80
II 3140.76	25	25	II 4336.66	30	60 n	II 6248.95	80	100
II 3145.32	50	20	II 4350.51	20	40	6257.00	10	30
II 3162.61	40	30	4356.33	30	4	II 6531.66	2	30
3168.39	30	2	II 4367.90	25	20	II 6542.80	3	50
3172.94	30	8	II 4370.97	30	40	II 6557.91	10	100
II 3176.86	30	30	II 4417.35	25	50	II 6567.39	6	60
II 3193.53	25	25	4417.91	25	1	II 6584.53	4	40
II 3194.19	40	40	II 4422.74	15	25	II 6644.60	100	200
II 3199.99	20	30	4438.04	30	2	II 6647.06	30	100
II 3217.30	30	15	4457.34	25	2	II 6719.40	2	50
II 3220.61	25	35	4461.18	25	2	II 6754.61	60	100
II 3253.70	30	30	II 4486.13	25	30	6789.27	50	100
II 3255.28	20	30	II 4533.15	20	40	6818.94	100	200
II 3279.98	25	25	4540.93	50	2	6826.56	10	25
3312.86	30	10	4565.94	40	6	6850.07	20	60
II 3317.99	25	18	II 4599.44	10	25	II 6855.29	7	50
3332.73	40	10	II 4605.77	20	30	6858.70	15	50
II 3352.05	30	50	4608.09	25	4	6911.40	15	50
3358.91	25	2	II 4613.74	12	25 wn	II 6935.16	5	50
3378.93	25 r	20	4620.86	50	4	II 6980.91	100	200
II 3389.83	30	40	II 4622.70	20	60	II 7021.23	3	30
II 3394.59	20	25	4655.19	50	4	II 7030.33	30	150
II 3394.98	20	50	II 4664.12	50	100	7061.90	10	30
II 3399.79	60	100	4688.39	30	4	7063.83	40	100
II 3407.76	20	25	4699.01	30	4	7119.52	15	50
II 3410.17	25	60	II 4699.71	20	25	7131.81	150	250
II 3438.23	25	25	II 4719.10	30	40	7237.10	100	200
3472.49	25	10	4773.71	25	4	7240.87	70	150
II 3478.99	30	40	4782.74	40	5	II 7277.67	5	50
II 3505.23	20	50	4800.50	50	6	7320.05	15	25
II 3535.54	15	50	II 4817.21	15	40	II 7328.64	3	30
II 3552.70	20	35	4818.87	25	4	7624.40	30	...
II 3561.66	20	35	4837.23	35	4	II 7663.09	2	30

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

HELIUM

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 2252.71	..	10	I 3705.00	..	30	I 5015.67	..	100
II 2306.22	..	20	I 3732.86	..	10	I 5047.74	..	15
II 2385.42	..	30	I 3819.61	..	50	II 5411.55	..	50
II 2511.22	..	50	I 3867.48	..	15	I 5875.62	..	1000
I 2723.19	..	10	I 3888.65	..	1000	I 5875.87	..	10
II 2733.32	..	100	I 3964.73	..	50	II 6560.13	..	100
I 2763.80	..	20	I 4009.27	..	10	I 6678.15	..	100
I 2829.07	..	40	I 4026.19	..	70	I 7065.19	..	70
I 2945.10	..	100	I 4120.81	..	25	I 7065.70	..	10
I 3187.74	..	200	I 4143.76	..	15	I 7281.35	..	30
II 3203.14	..	100	I 4387.93	..	30	I 7816.16	..	12
I 3354.55	..	10	I 4437.55	..	10	I 9463.66	..	60
I 3447.59	..	15	I 4471.48	..	100	I 9516.70	..	30
I 3587.25	..	10	II 4685.75	..	300	I 9526.17	..	10
I 3613.64	..	30	I 4713.14	..	40	I 9702.76	..	10
I 3634.23	..	15	I 4921.93	..	50			

HOLMIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2431.03	..	20	3281.98	12	15	3837.45	15	6 n
2433.00	..	20	3289.38	10	20	3854.05	10	20
2439.33	..	20	3338.76	12	20	3861.68	40	20
2442.76	..	20	3343.56	20	20	3888.95	40	20
2452.69	..	20	3372.79	12	15	3891.02	200	40
2511.12	..	20	3398.98	40	60	3905.55	15	8
2597.51	..	20	3410.25	20	15	3905.78	30	6
2636.50	..	70	3414.92	30	30	3955.74	15	4
2677.95	..	20	3416.46	30	40	3998.28	40	6
2681.18	..	20	3421.64	20	20	4040.84	150	30
2774.70	..	300	3425.35	40	40	4045.43	200	80
2812.87	..	20	3428.13	40	40	4053.92	400	200
2814.74	10	20	3429.19	10	15	4101.09	40	40
2824.19	20	3	3453.13	30	20	4103.84	400	400
2826.63	3	20 n	3456.00	60	60	4108.63	100	40
2828.14	..	20 n	3461.96	20	20	4120.20	50	25
2831.60	..	70	3474.25	40	20	4125.65	20	15
2845.64	..	70 n	3484.73	40	30	4127.16	150	60
2847.50	..	40	3494.77	30	40	4136.24	40	25
2849.10	10	20	3515.58	40	40	4152.54	30	30
2867.82	..	40 n	3531.74	10	20	4152.75	30	40
2880.27	20	10	3545.97	20	20	4163.03	100	100
2880.99	20	10	3556.76	15	40	4173.23	50	..
2894.99	20	10	3574.78	10	20	4194.34	30	15
2897.36	..	20 n	3598.77	40	30	4254.43	100	20
2909.42	40	10	3626.70	20	15	4264.07	15	8
2928.79	..	100	3627.18	15	15	4350.73	40	15
2936.77	..	1000 r	3662.27	20	10	5468.46	20	..
2944.50	10	20	3674.77	8	15	5498.57	20	..
2945.83	3	70 n	3685.16	6	15	5553.14	30	..
2949.19	..	20	3692.65	10	15	5560.94	20	..
2953.11	20	10	3694.24	10	20	5568.52	100	..
2973.00	20	..	3748.17	60	40	5640.62	100	..
2979.63	20	40	3753.75	20	10 n	5659.58	20	..
3166.62	10	15	3757.26	40	30	5674.70	200	..
3171.71	10	15	3796.73	20	40	5681.41	20	..
3181.52	8	40	3810.70	20	40	5682.12	30	..
3278.15	10	15	3813.24	15	8 n	5691.47	200	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

HOLMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
5706.88	50	..	5892.56	50	..	5973.52	125	..
5751.12	30	..	5921.76	200	..	5982.90	200	..
5839.47	30	..	5933.71	200	..	6305.36	20	..
5860.28	200	..	5948.03	200	..	6550.97	20	..
5870.85	20	..	5955.98	100	..	6604.94	20	..
5882.99	200	..						

HYDROGEN, FIRST SPECTRUM*

Wave length	Geissler tube	Wave length	Geissler tube	Wave length	Geissler tube
3656.6	..	3673.7	..	3770.06	..
3657.6	..	3676.34	..	3797.91	..
3658.0	..	3679.35	..	3835.40	..
3660.3	..	3682.82	..	3889.06	..
3661.2	..	3686.83	..	3970.07	..
3662.2	..	3691.55	..	4101.74	..
3663.4	..	3697.15	..	4340.47	..
3664.6	..	3703.86	..	4861.33 p	..
3666.1	..	3711.98	..	6562.73	..
3667.7	..	3721.95	..	6562.85 p	..
3669.42	..	3734.37	..	9500.	..
3671.34	..	3750.15	..		

HYDROGEN, SECOND SPECTRUM*

3990.03	4	4849.32	5	5888.16	6
3991.9	4	4873.03	5	5931.4	7
4062.49	6	4928.7	9	5938.62	7
4069.65	6	4934.27	6	5949.91	7
4087.75	4	4973.26	6	5975.44	9
4171.29	5	5013.05	6	5982.55	7
4177.07	6	5055.07	6	6018.30	9
4205.10	7	5084.84	5	6027.98	6
4212.51	6	5113.18	5	6031.9	10
4412.25	5	5196.38	5	6070.00	7
4447.56	5	5266.04	5	6079.80	9
4460.96	6	5303.16	7	6090.93	6
4490.45	6	5336.51	5	6095.98	6
4498.10	6	5366.0	5	6121.78	10
4568.11	7	5388.2	7	6127.3	6
4572.72	6	5419.90	6	6135.35	8
4580.03	7	5434.84	5	6182.98	6
4582.60	6	5481.09	5	6199.38	6
4625.3	5	5505.5	5	6224.81	9
4627.96	6	5537.45	6	6238.37	7
4631.88	9	5688.20	6	6299.40	6
4634.0	9	5731.90	6	6327.04	8
4662.77	5	5736.86	7	6935.8	10
4683.78	6	5775.0	6	6940.4	10
4719.01	6	5812.58	9	6962.6	10
4723.00	6	5836.0	7	7072.	10
4797.74	5				

* Intensity scale 1-10.

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

INDIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2334.57	..	(50 n)	II 4627.38	..	(150)	II 5555.43	..	(70)
I 2389.54	50 r	..	II 4638.10	..	(200)	II 5556.04	..	(100)
II 2447.90	..	(80)	II 4638.24	..	(125)	II 5576.75	..	(300)
II 2488.95	..	(60)	4638.86	3	70	II 5576.91	..	(150)
II 2498.59	..	(50)	II 4644.54	..	(125)	II 5577.04	..	(100)
II 2499.60	..	(80)	II 4644.65	..	(60)	II 5636.66	..	(150)
II 2554.40	..	(50)	II 4655.41	..	(45)	II 5636.75	..	(300)
II 2554.48	..	(50)	II 4655.52	..	(45)	5644.86	..	70
I 2560.23	150 r	50 r	II 4655.66	..	(50)	II 5708.31	..	(100)
I 2601.76	50 r	15 wn	II 4655.79	..	(100)	II 5708.52	..	(100)
II 2668.68	..	(50)	II 4681.11	..	(200)	II 5708.69	..	(70)
II 2683.12	..	(50)	4682.00	..	250 W	I 5709.75	50 wn	..
I 2710.26	800 r	200 rn	II 4685.22	..	(100)	II 5722.04	..	(70)
I 2713.93	200 r	125 wn	II 4907.15	..	(50)	I 5728.27	50	..
II 2749.70	..	(50)	II 4924.93	..	(80 n)	II 5852.83	..	(100)
I 2753.88	300 r	300 r	II 5043.55	..	(50)	II 5853.11	..	(150)
I 2775.35	80	30	II 5044.14	..	(50)	II 5853.43	..	(300)
I 2836.92	80	80	II 5109.36	..	(300 w)	II 5903.04	..	(70)
II 2865.68	..	(50)	II 5115.91	..	(100)	II 5903.14	..	(100)
I 2932.62	500	300	II 5116.75	..	(70)	II 5903.24	..	(100)
II 2941.05	..	(80)	II 5117.37	..	(50)	II 5903.37	..	(100)
I 2957.01	50	25	II 5117.41	..	(300)	II 5903.47	..	(70)
3008.31	..	500 W	II 5120.85	..	(100)	II 5903.63	..	(500)
I 3039.36	1000 r	500 r	II 5120.96	..	(150)	II 5903.75	..	(150)
II 3138.56	..	(50)	II 5121.10	..	(400)	II 5914.68	..	(70)
II 3138.64	..	(50)	II 5121.34	..	(50)	II 5914.83	..	(50)
II 3146.81	..	(50)	II 5129.94	..	(70)	II 5915.45	..	(50)
II 3155.77	..	(200)	II 5175.29	..	(400)	II 5915.63	..	(50)
II 3158.40	..	(100)	II 5175.42	..	(300)	II 5915.97	..	(100)
I 3256.09	1500 r	600 r	II 5175.56	..	(150)	II 5918.65	..	(70)
I 3258.56	500 r	300 r	II 5184.44	..	(300)	II 5918.78	..	(50)
II 3438.34	..	(50)	II 5184.66	..	(70)	II 6095.85	..	(50)
II 3795.21	..	(50)	II 5309.03	..	(70)	II 6095.96	..	(80)
II 3801.5	..	(50)	II 5309.40	..	(70)	II 6108.65	..	(50)
II 3889.78	..	(100)	II 5309.83	..	(100)	II 6108.99	..	(60)
II 4013.93	..	(80)	II 5402.94	..	(50)	II 6129.70	..	(60)
II 4016.24	..	(50)	II 5411.41	..	(300)	II 6132.74	..	(50)
II 4021.66	..	(50)	II 5418.48	..	(50)	II 6137.19	..	(50)
4024.83	..	100 wn	II 5418.73	..	(150 n)	II 6143.23	..	(80)
II 4027.79	..	(50 n)	II 5436.01	..	(50)	II 6161.15	..	(60)
II 4056.75	..	(50)	II 5436.28	..	(100)	II 6224.27	..	(60)
II 4056.94	..	(500)	II 5436.93	..	(150)	II 6468.89	..	(50)
II 4057.07	..	(100)	II 5437.40	..	(50)	II 6468.99	..	(80)
4057.87	80	10	II 5497.55	..	(70)	II 6540.96	..	(60)
4072.40	..	200 wn	II 5497.64	..	(50)	II 6541.22	..	(50)
I 4101.77	2000 r	1000 r	II 5507.33	..	(70)	II 6751.88	..	(60)
II 4205.08	..	(50)	II 5510.88	..	(70)	II 6765.96	..	(50)
II 4213.10	..	(50)	II 5512.82	..	(150)	II 6766.33	..	(50)
II 4219.83	..	(50)	II 5512.92	..	(100)	II 6783.72	..	(100)
II 4227.16	..	(50 n)	II 5512.99	..	(70)	I 6847.77	60	..
II 4327.33	..	(80)	II 5513.06	..	(70)	II 6891.66	..	(60)
II 4330.02	..	(50)	II 5513.10	..	(50)	II 6900.37	50	..
II 4372.87	..	(80)	II 5519.36	..	(500)	II 7183.19	..	(80)
II 4500.95	..	(50)	II 5523.00	..	(50)	II 7183.96	..	(50)
I 4511.32	5000 r	4000 r	II 5523.29	..	(50)	II 7254.10	..	(50)
II 4578.08	..	(50)	II 5523.61	..	(50)	II 7276.41	..	(50)
II 4578.39	..	(60)	II 5523.86	..	(70)	II 7277.59	..	(60)
4612.13	..	150	II 5523.91	..	(100)	II 7303.75	..	(50)
II 4617.16	..	(200)	II 5535.94	..	(70)	II 7350.37	..	(50)
II 4620.05	..	(80)	II 5536.55	..	(70)	II 7351.49	..	(50)
II 4620.24	..	(200)	II 5537.03	..	(50)	II 7351.58	..	(50)

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IODINE

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
2023.80	..	100	3897.26	..	40	6007.51	..	50
2034.86	..	100	3931.01	..	400	6015.87	..	50
2049.45	..	150	3940.24	..	500	I 6024.13	..	300
2062.38	..	900	3994.98	..	35	I 6048.72	..	70
2081.29	..	40	II 4036.08	..	50	II 6068.95	..	50
2169.59	..	100	I 4050.09	..	35	II 6074.99	..	80
2229.97	..	400	4070.75	..	150	I 6082.46	..	1000
2250.03	..	100	4128.69	..	35	6084.80	..	40
2292.44	..	40	4220.96	..	80	6086.77	..	150
II 2331.54	..	40	I 4346.92	..	35	I 6125.53	..	100
II 2335.45	..	60	II 4408.96	..	250	II 6127.46	..	125
2342.38	..	150	II 4423.76	..	80	6132.94	..	50
2407.98	..	60	II 4428.22	..	35	I 6191.97	..	150
2419.16	..	60	II 4446.78	..	35	6195.51	..	100
2444.12	..	60	II 4452.88	..	700	I 6200.52	..	50
II 2461.13	..	60	4458.47	..	35 n	II 6204.87	..	70
II 2464.68	..	100	II 4473.44	..	80	I 6213.17	..	70
2491.61	..	40	II 4476.05	..	60	I 6213.91	..	70
2494.71	..	100	4499.58	..	35	6229.39	..	50
II 2499.32	..	60	4528.10	..	40	6232.85	..	50
II 2502.98	..	150	4621.89	..	35	6236.40	..	50
2526.88	..	40	4632.32	..	50	6257.49	..	40
II 2530.98	..	60	II 4632.43	..	35	6280.32	..	50
II 2533.62	..	100	I 4640.88	..	50	I 6294.08	..	300
2551.43	..	40	II 4666.52	..	250	I 6320.41	..	50
II 2559.72	..	40	II 4675.53	..	50	I 6320.60	..	100
2561.49	..	150	II 4676.94	..	80	6320.82	..	50
II 2564.40	..	70	I 4763.38	..	80	6330.45	..	50
II 2566.26	..	300	I 4862.31	..	700	6338.02	..	100
II 2582.81	..	400	I 4896.78	..	35	I 6338.97	..	100
II 2586.74	..	40	I 4917.03	..	100	6339.52	..	300
II 2588.68	..	40	II 4986.93	..	35	II 6339.97	..	100 n
II 2593.47	..	150	I 5119.28	..	500	6348.34	..	50
2625.00	..	40	II 5161.19	..	300	I 6359.19	..	60
2627.04	..	60	I 5204.20	..	50	I 6367.34	..	70
2635.30	..	60	I 5234.63	..	80	I 6371.76	..	100
2641.39	..	40	II 5245.70	..	80	6440.22	..	100
2674.80	..	60	I 5296.52	..	150	I 6444.51	..	100
2688.99	..	100	II 5338.19	..	300	6475.91	..	70
II 2698.32	..	50	5345.15	..	300	I 6488.18	..	150
2712.23	..	100	II 5369.87	..	40	6538.34	..	70
2730.13	..	50	5405.14	..	40	I 6566.48	..	400
2808.58	..	40	5405.65	..	40	6583.81	..	70
2836.92	..	40	II 5407.36	..	60	II 6585.19	..	70
2872.89	..	60	I 5427.10	..	50	I 6619.69	..	200
II 2878.64	..	400	I 5435.48	..	35	6661.16	..	100
2993.86	..	70	II 5435.84	..	125	6662.14	..	100
3055.37	..	350	II 5438.00	..	35	II 6665.97	..	70
3078.77	..	350	5464.61	..	900	I 6697.33	..	90
3081.66	..	100	5491.57	..	100	6698.53	..	50
3088.19	..	35	II 5496.92	..	900	I, II 6718.80	..	50
3149.46	..	35	II 5504.72	..	60	6727.00	..	70
3193.95	..	100	5522.05	..	35	6732.10	..	150
3288.35	..	35	5598.36	..	35	6736.60	..	50
3481.83	..	40	5600.31	..	50	6738.12	..	70
3561.18	..	40	II 5625.70	..	150	I 6739.50	..	50
II 3661.77	..	40 d	II 5678.06	..	80	I 6741.56	..	50
3686.55	..	70	II 5710.53	..	150	I 6773.56	..	50
3688.21	..	125	II 5738.29	..	50	I 6783.93	..	100
3724.81	..	50	II 5760.73	..	40	I 6789.32	..	50
I 3741.71	..	40	I 5764.33	..	100	I 6801.00	..	50
3742.13	..	40	I 5894.05	..	60	I 6812.19	..	50
I 3808.07	..	40	II 5950.26	..	50	II 6812.56	..	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IODINE (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 6902.13	..	150	7085.22	..	150	I 7300.30	..	50
II 6958.78	..	1000	I 7088.00	..	100	II 7351.36	..	60
7018.32	..	50	I 7102.65	..	50	I 7402.10	..	300
II 7018.94	..	50	7122.09	..	60	I 7411.25	..	50
II 7032.99	..	70	II 7138.99	..	70 n	7416.55	..	50
7042.24	..	70 n	I 7142.09	..	100	I 7469.04	..	500
I 7063.60	..	50	I 7236.80	..	150	I 7490.58	..	70

IRIDIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2005.86	3	35	2204.96	5	300	2384.81	4	80
2017.41	..	50	2208.09	40	3 wn	2386.89	50 l	15
2017.99	2 n	40	2208.72	..	40	2390.62	40	6
2021.51	..	50	2208.96	2	50	2391.18	50	..
2022.83	4	50	2212.32	..	50	2398.75	10	150
2023.97	40	..	I 2220.37	50	10	I 2431.94	50	50
2028.65	5	50	2221.07	2	100	I 2452.81	35	2
2039.79	8	40	2232.25	30	50	I 2455.61	35	5
2041.69	2	50	I 2233.37	9	100	I 2467.30	40	5
2044.19	10	100	2234.38	5	80	I 2475.12	100	10
2044.83	4	75	2237.09	..	100	I 2481.18	50	10
2051.16	10	50	2238.29	..	80	I 2502.98	100 w	5
2057.23	6	50	2242.68	50	300	I 2533.13	100	20
2063.03	..	80	2245.76	10	150	I 2534.46	100	10
2065.79	..	80	2246.90	10	100	I 2537.22	35	10
2066.21	..	40	2257.50	2	50	I 2542.02	35	10
2070.51	6	60	I 2258.51	15	50	I 2543.97	200 n	100
2076.76	2	40	2259.27	..	35	I 2546.03	100 n	20
2079.71	..	40	2260.65	3	40	I 2564.18	40	8
2080.64	2	60	2265.16	5	50	I 2577.26	60	15
2084.49	..	80	2271.39	..	40	I 2592.06	100	20
2088.82	50	50	2281.02	2	50	2599.40	40	..
2096.20	1	80	2289.39	5	40	I 2608.25	50	10
2097.10	4	50	2290.80	3	50	I 2611.29	80	10
2099.62	..	40	I 2295.08	40	5	I 2619.88	35	5
2100.96	2 n	50	I 2304.21	100	..	I 2639.71	100 n	15
2103.87	..	50	2314.11	2	40	I 2644.19	35	5
2109.38	3 n	50	2314.90	10	40	I 2661.98	150 n	15
2111.96	2	40	2315.15	2	40	I 2662.63	40	10
2117.72	10	50	2323.63	..	50 l	I 2664.79	200 n	50
2126.81	25	200	2324.11	..	35	I 2668.99	50	5
2130.45	5	80	2324.70	5	80	I 2669.91	60	10
2131.66	..	50	2326.05	6	50	I 2671.84	50	10
2132.56	3	80	2329.41	5	50	I 2673.61	40	10
2148.22	25	50	I 2333.84	40	10	I 2676.83	35	10
2151.62	2 w	80	2340.04	10	35	I 2694.23	150 n	50
2152.68	50	200	I 2343.18	40	10	I 2712.74	40	10
2158.05	50	50	2353.17	4	50 w	I 2849.72	40 n	20 n
2160.74	10	50	2355.52	10	50	I 2882.63	40	6
2169.42	2	50	2355.96	..	35	2936.62	40	..
2175.01	..	50	2356.55	40	5	I 2988.98	35	..
2178.98	10	50	2357.95	8	50	I 2990.62	35	3
2190.38	..	150	2360.73	40	25	I 2996.08	50	2
2194.27	..	40	2363.04	50	25	I 2999.54	35	1
2196.44	5	50	2368.04	25	125	I 3002.25	50	10
2197.50	5	100	I 2372.77	100	40	I 3003.63	60	30
2198.85	50	15	2381.82	8	50	I 3005.21	35	20

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRIDIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3011.69	35	1	I 3661.71	50	30	I 4268.10	200	15
I 3016.43	35	2 n	I 3664.62	60	15	4286.62	200	3
3017.31	35	2 n	I 3674.98	100	50	4301.60	200	10
3019.23	35	2 n	I 3687.08	40	4	4310.59	150	8
3020.01	35	1	I 3725.38	50	20	4311.50	300	10
I 3025.82	50	3	3728.03	60	10	4351.30	50	..
I 3029.36	60	3	I 3731.36	50	50	4352.56	50	2
I 3032.41	50	1	3734.77	100	30	4372.13	40 w	..
3037.75	40	2	3738.53	60	10	4377.01	100	4
I 3040.47	35	2	I 3747.20	100	60	4392.59	100	4
I 3047.16	50	20	I 3768.68	60	10	4399.47	400	100
I 3057.28	35	2	3770.73	40	5	4403.78	300	10
I 3068.89	40	20	I 3771.60	40	4	4411.18	40	2
I 3086.44	35	2	3790.53	50	..	4426.27	400 w	10
I 3088.04	50	2	3800.12	150	100	4450.18	60	3
I 3120.76	50	2	3833.88	50	..	4478.48	200	10
I 3121.78	35	1	3915.38	150	50	4491.36	40	2 w n
I 3133.32	40	2 n	I 3934.84	200	50	4492.16	35	2
I 3140.41	50 r	1	I 3946.27	50	15	4495.35	100	3
I 3159.15	50 r	2 n	I 3976.31	10	70	4496.03	40	2
I 3219.51	35	2	I 3992.12	150	60	4532.87	80	2
I 3220.78	100	30	4020.03	80	100	4545.68	200	4
I 3229.28	35	2	4033.76	100	25	4548.48	100	5
I 3241.52	100	50	4040.08	40	5	4550.77	80	..
I 3266.44	50	10	4092.61	60	20	4568.09	100	3
I 3334.16	40	3	4100.15	100	3 n	4570.02	50	2
I 3448.97	60	10	4115.78	100	30	4616.39	200	5
I 3513.64	100 n	100	4117.60	50	3	4640.08	40	2 w n
I 3515.95	35	15	4155.70	80	5	4656.18	60	..
I 3522.03	..	50	4166.04	150	10	4728.86	150	3
I 3558.99	50	50	I 4172.56	150	12	4778.16	50	3
I 3573.72	8	100	4182.47	50	6	I 5449.50	35	2
I 3617.21	50	15	4183.21	40	4	6110.67	35	..
I 3628.67	100	30	4197.54	40	2	I 6830.01	50	..
I 3635.49	35	4 n	4217.76	40	3	I 6929.88	50	..
I 3636.20	50	25	4259.11	200	10	I 7183.71	40	..
3653.19	15	50	I 4265.30	60	2			

IRON

2017.07	2	10	2156.47	20	..	I 2186.89	6	12
2020.52	2	100	I 2157.79	10	4	I 2187.19	50 r	10
I 2100.79	15	2	I 2158.48	12	8	II 2187.69	..	12
I 2102.35	15	3	I 2159.89	12	2	II 2189.03	1	20
I 2108.95	10	2	II 2161.16	..	12	2190.77	20	2
I 2109.11	..	10	I, II 2162.02	5	25	I 2191.20	10	2
2125.01	30	..	2162.24	10 n	..	I 2191.84	100 r	12
2130.96	20	..	2163.37	12	..	I 2196.04	80 r	30
2132.01	12	3	II 2164.32	2	12	2199.57	10	..
2135.96	10	5	2165.86	20 n	1 n	I 2200.72	35	8
2141.47	10	..	I 2166.77	100 r	35	I 2201.12	10	..
2144.45	25	..	II 2167.88	..	10	II 2211.10	..	12
I 2145.19	12	2	2170.54	10	..	I 2213.65	2	35
2146.04	1	10	I 2171.29	10	3	II 2217.06	..	10
2149.17	10	..	II 2172.97	3	10	II 2219.89	2	20
II 2150.62	..	15	I 2175.45	8	25	II 2220.37	2	35
I 2151.10	8	10	I 2178.09	100 r	20	II 2221.16	..	25
2151.70	20	..	2183.83	..	12	2221.83	12	..
I 2153.00	10	1	2183.98	20	..	II 2222.45	..	10
2154.46	15	..	2186.48	50 r	80	II 2223.49	..	25

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2224.46	1	12	I 2292.52	15	2	II 2385.01	8	15
I 2228.17	10	6	II 2293.76	..	10	II 2388.62	25	30
II 2232.08	2	12	2293.85	10	6	I 2389.97	15	..
II 2233.91	..	35	I 2294.41	15	2	II 2391.47	8	20
2236.31	10	..	II 2294.61	15	5	II 2395.62	50	100 Wn
2237.90	..	12	I 2296.92	15	2	II 2399.24	20	30
2238.63	..	10	I 2297.79	35 r	6	II 2400.34	4	25
2240.63	20	3 n	II 2298.23	5	25	II 2402.60	10	20
2243.15	..	10 n	I 2299.22	15	4	II 2404.43	25	40
II 2244.39	..	10	I 2300.14	15	3	II 2404.88	50	100 wn
II 2245.50	..	50	2301.17	10	..	II 2406.66	50	1 wn
I 2245.65	12	..	I 2301.68	15	..	2407.23	20	2
II 2246.91	..	20	II 2303.35	..	15	II 2407.95	..	20
II 2247.69	..	50	2303.42	10	..	I 2408.04	10	..
I 2248.86	35	..	I 2303.58	10	3	II 2410.52	50	70 n
II 2249.17	10	50	I 2304.73	10	20	II 2411.07	35	70 n
II 2250.17	5	15	I 2306.17	10	..	II 2413.31	60	100 n
I 2250.78	10	..	2306.38	10	3	II 2415.06	1	50
II 2250.93	5	20	2307.31	..	25	II 2416.46	1	40 n
I 2251.87	12	70	2308.76	..	15	II 2417.87	10	100
II 2253.12	12	30	I 2308.99	20	5	II 2418.44	1	10 n
II 2254.08	..	10 n	II 2311.22	..	20	II 2422.68	3	70
II 2255.15	..	12	2311.29	..	35	II 2423.21	2	40
II 2255.76	..	20	II 2312.03	..	15	II 2424.14	25	70
I 2255.86	20	..	I 2313.10	25	3	II 2424.58	1	20
II 2256.43	..	10	II 2317.37	..	10 n	II 2425.36	..	20
II 2256.90	..	15 n	2318.17	10 w	..	II 2425.68	1	40
2259.51	25	..	I 2320.36	25	5	II 2425.93	..	10
II 2259.59	..	20	2322.95	..	10 wn	II 2428.29	1	10
II 2260.08	9	15	II 2327.39	10	25	II 2428.36	3	15
2260.60	10	..	II 2331.31	10	6	II 2428.79	1	15
II 2260.85	12	12	II 2332.80	15	40	II 2429.38	..	15
II 2262.68	6	12	II 2336.86	..	20 n	II 2430.07	15	70
II 2263.23	..	30	II 2338.00	15	35	2431.02	20	3 n
I 2264.39	35	5	2339.58	10 wn	..	II 2432.27	25	70
II 2264.59	..	20	II 2343.49	10	50	2432.87	5	40
I 2265.05	10	..	II 2343.96	5	10	II 2433.50	2	15
II 2265.99	4	10	II 2344.28	6	20	II 2434.24	3	10 n
I 2266.90	15	..	2345.07	20 n	..	2434.73	6	30
I 2267.47	15	..	II 2345.34	..	20	II 2434.94	6	20
II 2267.59	2	35	II 2348.10	5	20	II 2436.22	..	10
II 2268.14	..	12	II 2348.30	5	20	2436.34	25	..
II 2268.85	..	10	II 2354.47	5	15	II 2436.63	4	25 n
I 2269.10	12	..	II 2354.89	10	10	I 2438.18	30	4
I 2270.86	10	..	II 2357.01	..	10	II 2439.30	15	100
I 2271.78	35	..	II 2359.10	15	20	2439.74	20	12
I 2272.07	15	3	II 2360.00	10	8	2440.11	25	8
I 2272.82	20	..	II 2360.29	10	8	II 2440.42	1	40
I 2274.09	15	15	II 2362.02	8	15	2442.57	70	10
2275.19	10	..	2363.94	10 w	..	I 2443.87	40	4
I 2276.02	20	10	II 2364.83	15	30	II 2444.51	25	60
I 2277.10	15	..	II 2366.59	10	20	II 2445.56	15	40
I 2277.67	25	..	II 2368.59	15	25	II 2445.78	2	15
I 2279.92	15	40	II 2369.96	3	15 n	II 2446.10	3	35
I 2280.22	15	..	II 2372.63	10	..	II 2446.46	3	40
I 2283.65	10	..	II 2373.73	6	15	II 2447.20	1	30
I 2284.08	25	20	II 2375.19	..	15	II 2447.32	1	15
I 2287.25	20	6	II 2376.45	3	50 n	I 2447.71	70	100
I 2289.03	25	..	II 2379.27	12	15	II 2447.75	..	80
I 2290.06	10	..	II 2380.76	12	15	II 2449.96	1	30
I 2290.54	15	..	II 2382.04	40 r	100 r	II 2450.20	1	15
I 2291.12	15	..	II 2383.24	8	12	2450.44	15	..
I 2291.62	10	2	2384.39	20	5	II 2451.21	..	15

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2453.47	20	3	I 2487.06	25	10	II 2525.39	20	60
II 2453.80	1	10	I 2488.15	600 r	100 r	II 2526.07	3	20
II 2454.58	..	80	2488.95	10	1	II 2526.29	10	60
2455.56	15 n	..	II 2489.49	1	40	II 2527.10	1	60
II 2455.90	..	25 n	I 2489.75	200 r	2	I 2526.43	200 r	50
II 2456.64	..	15	II 2489.82	1	50	II 2527.69	1	30
II 2456.82	..	20	I 2490.64	200 r	10	2529.08	..	70
2457.59	70	30	II 2490.73	1	10	I 2529.13	80 r	5
II 2458.78	7	60	II 2490.86	..	15	2529.31	10	..
2458.96	..	10	I 2491.15	150 r	10	II 2529.55	15	100
II 2460.45	1	15 n	II 2491.39	..	30	I 2529.83	50 r	2
2460.60	15	..	2491.98	10	..	II 2530.11	2	30
2461.06	20	..	II 2492.34	..	30	2530.69	25	70
II 2461.28	5	50	II 2493.18	10	100	2532.53	10	..
II 2461.86	15	70	II 2493.26	10	100	II 2533.63	8	50
I 2462.18	50 r	3	I 2493.99	20	1	2533.80	12	..
I 2462.64	200 r	50	I 2494.25	10	..	II 2534.42	7	50
II 2463.28	6	60	I 2495.86	25	35	II 2535.48	..	20
I 2463.73	15	7	2496.53	40	15	I 2535.60	1000	..
II 2464.01	5	80	2496.99	20	1	II 2536.82	10	4
II 2464.90	4	50	2497.30	..	15	II 2538.20	2	35
I 2465.15	70	..	II 2497.82	15	50	II 2538.50	2	10
II 2465.20	..	50	I 2498.89	20	70	II 2538.81	15	30
2465.45	15	..	2500.93	12	40	2538.99	10	20
II 2465.91	7	100	I 2501.13	100 r	25	I 2539.36	15	..
II 2466.68	1	10	I 2501.69	20	4	2539.98	3	20 n
II 2466.82	1	30	II 2502.39	3	60	II 2540.66	6	30
I 2467.73	10	2	II 2503.32	5	50	I 2540.97	100 r	10
II 2468.29	1	30	II 2503.56	2	20	II 2541.10	1	15
2468.88	40	15	2503.65	80	..	2542.10	40	8
2469.51	2	40	II 2503.87	8	70	II 2542.73	1	40
II 2470.41	1	40	2505.01	10	1	II 2543.38	5	50
II 2470.66	8	50	II 2505.22	2	25	2543.65	700	..
I 2470.97	25	1	2505.49	10	1	2543.92	40	20
II 2472.07	..	25	2505.63	12	..	2544.71	100	5
I 2472.34	30	5	II 2506.09	2	70	II 2544.97	2	10
II 2472.43	..	15	2506.57	10	..	II 2545.22	4	25
I 2472.88	300 r	25	II 2507.01	1	10	I 2545.98	100 r	30
I 2472.91	1000	..	2507.90	40	6	II 2546.66	1	30
II 2474.76	..	60	2508.33	..	20 n	2546.87	40	1
2474.81	40	50	2508.75	20	1	II 2547.33	1	35
II 2475.55	..	10 n	II 2509.12	1	50	2548.08	50	..
2476.03	20 n	..	I 2510.83	300 r	50	II 2548.33	..	10
II 2476.27	..	35	II 2511.76	25	100	2548.74	..	12
I 2476.65	15	25	2512.10	..	30	II 2549.08	3	30
II 2477.34	1	40	2512.36	12	1	II 2549.39	1	10
II 2478.12	..	20	II 2512.52	..	40	II 2549.46	1	15
II 2478.57	4	40	II 2514.91	1	25	I 2549.61	70 r	2
II 2479.78	200 r	30	2515.10	..	30	II 2550.02	15	40
II 2480.16	10	80	I 2516.57	10	1	2550.51	25	..
II 2481.05	..	40	II 2517.12	10	60	II 2550.68	3	30
II 2481.57	..	15	I 2517.66	20	12	2551.09	25	1
II 2482.11	3	50	I 2518.10	200 r	50	2552.61	15	2
II 2482.65	1	50	II 2519.05	..	70	2552.77	20	..
I 2483.27	500 rn	50	2519.63	30	20	2553.18	10	20
II 2483.72	..	25	2520.88	80	..	II 2553.73	..	15
I 2484.19	100 r	5	II 2521.09	2	20	II 2555.07	20	20
II 2484.24	..	20	2521.81	1	60	2555.22	10	..
II 2484.56	..	10 n	II 2522.20	1	10	II 2555.44	2	35
2485.98	10	1	I 2522.85	300 r	50	2556.30	15	1
II 2486.34	..	80	2523.66	15	10	2556.86	20	1
2486.37	40	..	I 2524.29	100 r	50	II 2557.08	..	10
2486.69	30	3	2525.02	20	1	II 2557.50	1	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2558.48	10	20	I 2599.57	1000	..	I 2641.65	100	60
II 2559.24	..	20	2600.10	10	..	II 2642.01	..	20
II 2559.77	3	30	2600.20	10	..	I 2644.00	150	150
II 2559.93	2	15	2603.56	20	3	II 2645.08	..	20
II 2560.27	10	80	2604.76	20	1	I 2645.43	50	10
I 2560.56	15	..	2604.87	18	..	II 2646.22	..	10
I 2561.85	15	..	2605.04	..	80	I 2647.56	100	70
II 2562.10	2	25	II 2605.30	..	50	II 2649.46	..	70
I 2562.23	15	..	II 2605.41	..	40	II 2650.49	..	150 n
II 2562.53	50	150	I 2605.65	80	10	I 2651.71	60	60
2563.40	5	25 n	2605.90	..	20	II 2652.57	1	40
II 2563.47	70	125	2606.31	10	..	2656.15	70	40
I, II 2563.83	2	10	II 2606.50	..	80	I 2656.80	50	25
I 2564.55	15	..	I 2606.82	200	30	II 2657.92	..	20
2566.21	2	40	II 2607.09	300	400	II 2658.25	..	80
2566.29	3	10	2608.58	100	10	2658.47	20	2
2566.41	1	15	II 2608.85	..	20	2658.93	10	2
II 2566.62	3	15	II 2609.13	..	20	I 2660.40	40	15
II 2566.91	60	150	2609.22	10	1	I 2661.20	10	7
2567.87	12	..	II 2609.44	..	10	2661.31	12	10
II 2568.40	..	80	II 2609.87	..	40	I 2662.06	70	40
I 2568.86	20	10	I 2610.75	40	4	2662.31	25	10
II 2568.88	..	25	II 2611.07	20	80	II 2662.56	2 n	15 n
I 2569.60	20	1	II 2611.87	500	500	2663.78	10 n	3 n
I 2569.74	10	12	I 2612.77	50	10	2664.04	15	5
II 2569.76	..	60	2613.19	15	..	2664.26	..	10
2570.52	10	5	2613.24	10	2	II 2664.66	20	300
II 2570.84	70	100	II 2613.82	400	400	I 2666.40	70	10
II 2571.55	..	15	I 2614.49	40	5	II 2666.63	5	80
2572.97	1	15	II 2614.87	..	10	I 2666.82	80	15
II 2573.21	..	40	2615.42	25	10	I 2666.97	30	10
II 2574.37	50	150	II 2617.62	300	400	I 2667.92	50	20
2575.74	80	10	I 2618.02	150	60	2669.50	50	25
I 2576.69	40	5	I 2618.71	70	25	2669.93	..	25
II 2576.86	2	70	II 2619.08	5	150	II 2670.38	..	10
II 2577.92	30	100	II 2620.17	..	40	2670.80	10	4
I 2579.27	12	6 n	II 2620.41	70	40	II 2671.40	..	25 wn
II 2579.41	1	10	II 2620.69	3	80	II 2672.15	1 Wn	25 wn
2579.84	10	1	II 2621.67	200	400	II 2672.51	..	15 wn
I 2580.06	10	..	2623.12	..	30	I 2673.21	30	15
II 2580.71	..	10	I 2623.37	25	10	2675.28	30	15
2581.11	1	25	I 2623.53	100	80	2676.11	15 w	7 w
2581.46	12	..	II 2623.73	..	20	2676.88	2	25
2582.30	50	..	2625.49	1	60	2678.05	20	10
II 2582.58	25	80	II 2625.67	300	60	I 2679.06	200	200
2583.75	250	..	II 2626.50	3	80	2680.16	20	8
I 2584.54	100	30	2627.14	1	10	I 2680.45	70	35
II 2585.88	70	100	II 2628.29	400	400	II 2680.79	..	12
II 2587.95	..	50	I, II 2629.59	60	150	II 2681.03	..	20
2587.99	40	..	II 2630.07	10	100	2681.59	50	25
II 2588.79	1	20	II 2631.05	200	125	2682.21	30	15
II 2590.54	2	35	II 2631.32	150	60	2682.52	..	40
2591.26	20	..	II 2631.61	10	50	2682.99	..	40
II 2591.54	50	100	I 2632.24	100	60	2683.95	15	8
2592.29	12	..	I 2632.60	80	40	2684.07	30	15
2592.78	20	100	2632.99	10	..	II 2684.75	3	400
2593.52	25	..	2633.19	..	80	II 2686.39	..	10
II 2593.73	15	70	2635.39	..	20	2686.75	50	6
2594.04	20	2	I 2635.81	300	200	2687.80	20	10
I 2594.15	20	2	I 2636.48	50	20	I 2689.21	150	150
II 2598.37	700	1000 n	II 2637.64	2	200	I 2689.83	40	40
2598.85	20	..	II 2639.55	1	100	2689.88	10	..
II 2599.40	1000	1000 n	II 2641.13	..	20	I 2690.07	30	30

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2691.73	..	35	II 2732.00	..	40	II 2762.44	..	10
I 2692.25	20	4	II 2732.45	8	20	2762.68	50	1
II 2692.60	..	300	2732.94	..	40	I 2762.78	25	10
I 2692.65	20	..	I 2733.58	300	200	I 2763.11	100	70
II 2692.84	15	20	I 2734.00	40	25	II 2763.91	1	25
II 2693.86	..	30	I 2734.27	50	25	2764.33	70	40
2694.54	100	35	I 2734.62	20	8	II 2764.78	..	20
2695.04	30	20	I 2735.47	125	100	2766.66	15	6
2695.53	40	30	I 2735.61	20	10	I 2766.91	90	40
2695.66	20	12	2736.78	10 n	2 n	II 2767.50	10	400 wn
2695.99	80	50	I 2737.31	300 r	150	I 2767.52	300	..
2696.28	90	50	II 2737.63	..	10	2768.11	35	8
I 2697.02	50	25	2737.64	10	..	2768.44	25	5
II 2697.31	2	15	2737.83	25	10	II 2768.93	40	100
II 2697.46	3	50	I 2738.21	10	2	II 2769.14	1	15
2698.16	35	6	II 2739.55	200	300 n	2769.30	90	10
I 2699.11	100	60	2741.11	10	3	II 2769.35	1	20
2701.91	20	5	II 2741.40	..	70	I 2769.67	60	20
2702.45	15	10	I 2742.02	35	15	II 2770.51	..	50
II 2703.99	30	400	I 2742.26	25	25	2770.70	20	7
II 2704.58	5	10	I 2742.41	50	50	II 2771.18	..	50
2706.01	60	40	II 2743.20	80	150	2771.89	12	6
I 2706.58	150	150	2743.56	50	15	I 2772.11	300	300
II 2707.13	..	70	I 2744.07	150	8	2772.33	50	10
2707.45	20	6	I 2744.53	70	50	2772.51	30	20
2708.57	80	50	2745.08	10	1	2772.83	15	4
II 2709.06	3	100	II 2746.16	..	10	2773.24	90	40
2709.99	40	10	II 2746.48	150	300 wn	2773.90	10	5
I 2710.55	80	35	II 2746.98	200	300 wn	II 2774.69	..	50
2711.46	12	3	I 2747.56	30	5	I 2774.73	80	10
I 2711.65	100	50	II 2749.18	40	40	II 2776.17	..	40
II 2711.84	4	100	II 2749.32	30	30	2776.40	100	30
II 2712.39	2	100	II 2749.48	15	20	II 2776.92	..	25 n
2714.06	20	3	I 2750.14	300 n	100	2778.07	30	10
II 2714.41	200	400	I 2750.72	15	..	I 2778.22	100	80
I 2714.87	40	15	2750.88	60	20	2778.84	70	40
I 2715.32	12	5	II 2751.12	..	70	II 2779.30	25	300
II 2716.22	20	150	2751.37	15	..	II 2779.91	..	40
2717.37	15	5	2751.81	15	5	II 2780.04	..	20
2717.79	50	25	2752.09	1	20	2780.54	10	2
I 2718.43	80	60	II 2752.16	..	10	2780.70	30	15
I 2719.02	500 r	300 r	2753.10	25	..	2780.89	10	3
2719.42	20	12	II 2753.29	25	150 n	I 2781.83	90	60
2720.20	35	25	I 2753.69	70	25	2782.05	12	6
I 2720.90	700 r	..	I 2754.04	90	35	II 2783.70	20	400
II 2721.82	..	30	2754.43	70	20	2784.01	12	3
II 2722.04	20	70	II 2754.91	..	18	2784.35	15	6
2722.74	..	80	2754.95	25	..	II 2785.21	..	40 n
I 2723.58	300	200	2755.18	15	..	2786.78	15	7
2724.68	10	2	II 2755.74	300	100	II 2787.26	..	10 n
II 2724.88	15	25	I 2756.26	300	100	I 2787.93	25	15
I 2724.96	25	15	I 2756.33	300	100	I 2788.10	150	150
I 2725.61	15	5	II 2756.51	10	7	I 2789.48	60	30
2726.05	100	80	II 2757.02	10	30	2789.80	50	25
2726.24	25	12	I 2757.32	100	60	II 2790.56	..	35
II 2726.51	..	15	2757.86	25	10	2791.01	..	10
II 2727.38	1 n	40	2758.51	2	25 n	2791.46	40	20
II 2727.54	150	150	II 2759.33	2	12	2791.79	60	40
2728.02	100	40	I 2759.82	100	60	2792.40	50	25
2728.82	50	15	2760.90	15	8	II 2793.89	8	150
I 2728.97	15	5	I 2761.78	200	..	2794.16	10	..
II 2730.74	80	150	II 2761.81	50	200	I 2794.70	50	30
I 2730.98	70	15	I 2762.03	100	60	..	..	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2795.01	50	35	I 2843.63	125	100	2889.88	20	15
I 2795.54	90	60	I 2843.98	300	300	2889.99	15	8
2795.85	15 W	10	2845.54	125	7	2891.71	15	10
II 2796.65	..	20	I 2845.59	125	7	2891.91	25	10
I 2796.87	15	3	I 2846.82	20	12	2892.48	100	40
I 2797.77	150	80	II 2848.05	..	70	II 2892.83	2	20
II 2797.91	..	20	II 2848.12	..	10	I 2893.76	15	8
2799.15	50	10	I 2848.72	60	30	I 2893.88	25	20
II 2799.29	1	100	II 2849.61	..	50	2894.50	150	150
II 2799.72	..	10	I 2851.80	200	150	II 2894.78	..	80
2800.46	50	10	2852.13	150	80	I 2895.03	125	70
2803.12	35	15	II 2853.20	..	10	II 2895.21	..	80
I 2803.17	15	..	I 2853.69	15	7	II 2897.26	..	200
2803.62	50	20	2853.77	15	7	2898.35	100	30
II 2804.02	..	15	II 2855.67	2	200	2899.41	125	100
I 2804.52	300	200	II 2856.14	1	40	I 2901.38	100	80
2804.86	20	15	II 2856.93	..	15 n	2901.91	125	40
II 2805.31	..	15	II 2857.17	..	30	II 2902.47	1	35
II 2805.79	..	50	II 2857.41	..	10	2904.16	15	8
2806.07	15	5	2857.81	12	2	II 2906.12	..	40
I 2806.98	200	200	2857.99	12	2	2906.42	60	25
I 2807.24	15	8	II 2858.34	3	200	I 2907.52	100	80
2808.32	100	40	I 2858.90	100	30	II 2907.86	2	20
II 2809.81	1	100 n	II 2861.19	1	30	2908.86	80	40
2810.26	40	15	I 2862.50	100	50	2909.50	70	35
II 2811.27	..	40	I 2863.43	100	80	2910.92	10	4
2812.05	15	10	I 2863.86	125	100	I 2912.16	150	150
II 2812.49	2	25	II 2864.37	..	10	2914.20	10	5
I 2813.29	400	400	II 2864.97	..	50	I 2914.31	50	25
II 2813.61	5	60	I 2866.63	125	80	II 2917.09	..	20
2815.02	15	8	2867.31	60	30	II 2917.47	2	25
I 2815.51	40	25	2867.56	60	30	2918.03	125	100
II 2817.11	..	20 n	2868.21	15	8	2918.36	40	25
I 2817.51	100	60	II 2868.45	80	40	2918.82	15	8
2819.29	10	..	II 2868.87	5	60	2919.21	15	10
2820.81	20	15	I 2869.31	300	70	2919.85	80	35
I 2823.28	200	300	2869.83	10	5	I 2920.69	150	80
2825.56	150	150	II 2870.60	..	15	2920.99	12	7
I 2825.69	70	60	II 2871.06	..	40	II 2922.02	..	50
II 2826.03	..	25	II 2871.13	..	20	I 2922.38	10	4
2826.50	10	8	I 2872.34	150	50	2922.62	50	25
II 2827.43	..	25	II 2872.38	2	20	2923.29	50	35
2827.60	15	12	II 2873.40	..	300	2923.44	30	12
I 2827.89	70	50	2873.53	15	1	2923.85	100	70
II 2828.63	..	80	I 2874.17	300	200	2925.36	70	50
2828.81	100	60	2874.88	60	20	2925.79	15	6
2830.96	10	..	I 2875.30	125	50	I 2925.90	15	10
II 2831.56	1	500	II 2875.35	..	70	II 2926.59	150	400
I 2832.44	300	200	2876.01	15	..	2927.55	20	12
2833.40	10	8	2876.80	..	100	I 2928.10	10	4
2834.75	15	10	I 2877.30	200	125	I 2929.01	150	100
I 2835.46	100	100	II 2879.24	..	25	2929.12	10	10
I 2835.95	15	10	I 2880.58	15	5	I 2929.62	50	10
II 2836.19	3	10	II 2880.76	15	50	2931.43	10	3
II 2836.51	3	12	II 2880.83	1	25	2931.60	..	15
II 2836.72	..	20	II 2883.70	..	300	2931.81	10	6
II 2837.30	..	25	2883.73	30	..	II 2936.02	5	10
I 2838.12	150	150	II 2884.78	..	25 n	I 2936.90	700 r	500 r
II 2839.53	4	25	II 2885.93	..	70	2937.81	300	150
II 2839.82	..	10 n	I 2886.32	50	15	I 2939.08	80	20
2840.42	125	20	II 2887.31	3	20	II 2939.51	3	30
II 2840.65	..	70	2887.81	80	60	2940.59	200	80
II 2840.76	..	35	II 2888.09	..	80	I 2941.34	600	300

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2942.63	10	5	2991.64	100	80	3066.48	60	40
2943.57	12	6	I 2994.42	1000 r	600 r	I 3067.24	300	300
II 2944.40	70	600	2996.39	90	50	3067.94	15	10
2945.05	100	30	II 2997.30	...	60	I 3068.17	150	150
2945.70	10	5	I 2999.51	500	300	3073.98	40	25
2947.36	30	20	II 3000.06	...	10	3074.15	40	25
II 2947.66	10	100	I 3000.45	100	80	3074.44	40	25
I 2947.88	600 r	200	I 3000.95	800 r	300 r	I 3075.72	400	400
2948.43	80	70	II 3002.65	20	150	II 3077.17	1	300
I 2948.73	10	7	I 3003.03	200	100	3077.64	60	25
I 2948.95	10	4	3004.12	18	10	3078.02	100	80
2949.70	10	5	3005.31	70	40	I 3078.43	80	50
2950.24	700	300	I 3007.14	100	80	II 3078.70	4	15 n
2951.56	10	4	I 3007.28	80	60	3079.98	30	20
2953.49	100	50	I 3008.14	600 r	400 r	3080.11	30	15
II 2953.78	5	80	3009.09	80	60	I 3083.74	500	500
I 2953.94	400 r	150	I 3009.57	500	400	II 3089.39	...	10
2954.65	100	70	3011.48	125	125	3090.21	30	15
I 2956.70	25 n	8 n	3012.45	50	30	I 3091.58	300	200
I 2957.36	300	300	I 3014.17	70	35	3092.78	50	30
2959.34	60	25	3015.91	70	50	3093.36	70	40
II 2959.60	...	60	I 3016.18	200	150	I 3093.81	50	40
2959.68	150	10	I 3017.63	150	150	3093.88	40	30
2959.99	150	80	I 3018.98	150	150	I 3094.90	30	15
2960.30	60	30	I 3020.49	300 r	300 r	3095.27	10	6
2960.55	10	5	I 3020.64	1000 r	600 r	II 3096.30	2	30
II 2961.28	3	40	I 3021.07	700 r	300 r	3096.84	30	20
II 2964.63	8	150	I 3024.03	300	200	3097.81	20 n	10 n
II 2965.04	4	50	3025.28	50	30	I 3098.19	70	60
I 2965.25	400	150	3025.64	100	100	I 3099.90	60	60
2965.81	25	15	I 3025.84	400 r	300 r	I 3099.97	40	40
I 2966.90	1000 r	600 r	I 3026.46	200	200	I 3100.30	100	100
2968.48	30	20	I 3029.23	80	60	I 3100.67	100	100
I 2969.36	80	80	3030.15	300	300	3102.87	30	20
I 2969.48	60	60	3031.21	150	150	II 3105.17	...	60
II 2969.93	...	15	I 3031.64	200	200	II 3105.55	1	30
I 2970.10	400	200	3033.10	40	20	II 3106.56	1	30
II 2970.51	30	100	I 3034.54	70	40	3107.98	20	10
II 2970.68	...	10	3035.74	100	60	3110.28	40	30
I 2972.28	100	40	I 3037.39	700 r	400 r	3110.84	20	10
I 2973.13	500 r	400 r	3039.32	20	15	3111.82	10	6
I 2973.24	500 r	400 r	I 3040.43	400	400	3112.08	30	20
2974.78	10	6	I 3041.64	80	80	3113.59	25	10
II 2975.94	3	40	I 3041.74	100	80	II 3114.29	...	80
2976.13	100	60	I 3042.02	125	100	II 3114.68	...	10
I 2976.55	15	10	I 3042.66	300	200	II 3116.59	...	150
II 2979.09	...	30	II 3044.84	...	12	I 3116.63	150	...
II 2979.35	20	100	3045.08	150	100	3117.64	20	10
2980.54	100	70	3045.59	10	7	3119.49	100	80
II 2980.96	...	10	I 3047.60	800 r	500 r	3120.43	100	80
I 2981.45	300	200	3048.45	100	8	3120.87	80	50
I 2981.85	100	50	3049.36	25	8	3122.30	70	20
II 2982.06	...	90	3053.07	100	80	3123.35	10	4
II 2982.23	5	10	I 3053.44	80	50	3124.89	15	7
I 2983.57	1000 r	400 r	I 3055.26	200	150	I 3125.65	400	300
I, II 2984.83	200 r	400	3055.71	10	6	3126.17	150	70
II 2985.55	80	300	II 3056.80	4	25	3128.90	10	5
I 2986.46	100	60	I 3057.45	400	400	3129.10	15	8
II 2986.61	...	30	I 3059.09	600 r	400	I 3129.33	100	60
2986.65	15	...	I 3060.99	50	35	II 3131.72	...	35
I 2987.29	300	200	II 3062.23	2	400	3132.51	70	40
I 2988.47	60	30	3063.93	40	30	II 3133.05	...	35
2990.39	150	100	II 3065.31	...	60	I 3134.11	200	125

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 3135.36	1	100	II 3180.16	10	15	3228.90	80	40
3135.45	10	3	I 3180.23	300	300	I 3229.12	80	50
3136.50	60	40	I 3180.75	100	100	3229.59	10	5
3138.52	10	5	3181.52	80	70	3229.87	10	10
I 3139.66	15	8	3181.85	15	15	3229.99	20	20
3139.91	70	40	3181.91	15	15	I 3230.21	100	80
3140.39	100	80	3182.06	80	80	I 3230.97	300	200
I 3142.45	125	100	3182.97	125	70	II 3231.71	..	30
3142.88	80	70	II 3183.11	7	50	II 3232.79	..	50
3143.24	60	30	I 3184.62	60	40	3233.05	100	60
3143.99	200	150	I 3184.90	200	150	I 3233.97	300	150
I 3144.49	150	100	II 3185.32	..	25	I 3234.61	200	125
II 3144.76	..	50	II 3186.74	20	300	I 3236.22	300	200
3145.06	40	25	II 3187.29	..	60	II 3237.40	..	10
3147.29	20	10	3188.03	4	10	II 3237.82	1	100
3147.60	10	5	I 3188.57	150	100	I 3239.44	400	300
3147.79	40	15	I 3188.82	150	100	3243.11	50	20
3148.41	100	40	3190.02	30	10	3243.40	70	20
3150.30	60	30	I 3190.65	50	25	II 3243.72	..	60
3151.35	300	150	3190.82	40	20	I 3244.19	300	200
I 3151.87	40	15	3191.11	20	8	I 3245.98	200	150
I 3153.21	100	80	I 3191.66	200	150	3246.48	40	25
3153.37	15	15	II 3192.06	..	10	I 3246.96	100	70
3153.75	40	15	I 3192.41	12	6	II 3247.17	..	10
II 3154.21	400	..	I 3192.80	150	8	3247.21	10	10
3154.50	20	5	I 3193.23	100	70	I 3247.28	20	10
3155.30	50	35	I 3193.30	20	15	I 3248.21	200	150
3156.27	125	100	I, II 3193.80	10	50	3249.19	70	35
I 3157.04	150	100	3194.43	100	70	II 3249.66	..	10
3157.45	10	5	3194.60	60	20	3250.39	20	6
I 3157.89	100	100	II 3196.08	10	150	I 3250.63	60	40
I 3157.98	10	6	3196.13	100	..	I 3251.23	300	150
3160.20	70	50	I 3196.93	500	300	3252.44	90	40
3160.34	40	20	I 3196.99	150	..	3252.93	80	50
I 3160.66	150	125	3197.52	10	8	3253.60	100	80
I 3161.37	80	60	I 3199.52	300	200	3253.95	20	8
I 3161.95	200	150	I 3200.47	150	150	3254.36	200	150
I 3162.33	70	50	I 3200.78	25	15	3254.73	15	6
II 3162.80	1	100	3202.56	40	20	II 3255.89	20	100
II 3163.10	1	10	I 3205.40	300	200	3256.70	20	7
3163.87	40	25	I 3207.09	80	50	I 3257.24	25	12
I 3164.30	20	10	3208.47	100	80	I 3257.59	100	100
I 3165.01	100	60	3209.30	200	125	II 3258.77	..	150
I 3165.86	100	80	I 3210.24	150	100	II 3259.05	1	200
3166.44	100	80	II 3210.45	5	50	I 3259.99	150	100
II 3167.86	2	100	I 3210.83	150	100	3260.26	20	15
3167.92	100	30	3211.49	80	40	3261.33	25	7
3168.15	10	3	I 3211.68	80	50	3262.01	30	15
3168.86	30	15	3211.88	10	10	3262.28	50	25
II 3170.35	10	50	I 3211.99	70	50	I 3263.37	30	15
I 3171.35	100	80	II 3213.31	50	300	I 3264.51	80	60
I 3171.66	30	10	I 3214.04	400	200	I 3265.05	200	150
I 3172.07	100	100	II 3214.40	100	50	I 3265.62	300	300
3173.41	20	10	3215.42	10	4	II 3266.94	..	15
3173.61	20	20	I 3215.94	300	150	I 3268.24	125	100
3173.69	20	20	I 3217.38	200	125	3269.23	20	6
I 3175.45	200	200	I 3219.58	200	125	I 3271.00	300	300
3175.99	12	5	I 3219.81	100	80	3271.49	15	7
I 3176.36	20	10	I 3222.07	200	100	I 3271.68	25	15
II 3177.53	5	300	I 3225.79	300	150	3274.45	80	60
I 3178.01	300	150	I 3227.06	30	10	I 3276.47	100	50
3178.55	10	6	II 3227.75	200	300	II 3276.61	..	10
3178.97	30	15	I 3228.25	100	80	II 3277.35	40	200

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3278.73	100	60	3356.69	15	1	I 3451.62	15	4
3280.26	150	150	I 3359.49	15	3	I 3451.92	100	60
II 3281.30	15	100	3359.81	10	2	I 3452.28	150	8
3282.89	80	80	3366.79	50	25	3453.02	30	15
I 3284.59	200	125	3366.87	50	15	3458.31	60	25
II 3285.41	60	40	3367.16	10	3	3459.43	10	3
I 3286.02	30	15	3369.55	300	200	I 3459.92	80	50
I 3286.75	500	400	3370.79	300	200	I 3462.36	10	3
3288.65	15	6	I 3372.08	40	7	I 3465.86	500	400
3288.97	30	15	3378.68	150	80	I 3466.50	30	70
II 3289.35	..	40	I 3379.02	80	50	3466.89	10	4
3289.44	10	4	3380.11	200	25	II 3468.68	10	20
3290.72	15	7	I 3382.41	50	10	I 3468.85	30	12
I 3290.99	125	80	I 3383.70	100	70	3469.01	18	1
3292.02	150	125	I 3383.98	200	100	I 3469.83	35	10
I 3292.59	300	150	3387.41	35	8	I 3471.27	40	15
3293.14	10	5	I 3389.75	15	4	I 3471.34	40	15
II 3295.82	4	30	3392.01	20	6	3473.31	10	2
3296.47	12	6	I 3392.31	125	80	3474.44	10	6
II 3297.89	4	15	I 3392.66	300	200	I 3475.45	400	300
I 3298.13	200	150	3394.59	150	80	I 3476.70	300	200
3301.22	15	7	I 3396.98	125	25	3477.86	20	4
3303.57	70	10	I 3397.64	10	2	3478.63	20	6
I 3305.97	400	300	I 3399.34	200	200	I 3483.01	50	10
I 3306.35	200	150	I 3401.52	150	90	I 3485.34	100	50
3307.23	80	60	3402.26	150	150	3489.67	20	15
3310.34	100	80	I 3404.30	25	25	I 3490.57	400	300
3310.49	50	40	I 3404.36	100	50	II 3493.47	40	80
3314.45	15	6	3406.44	30	10	I 3495.29	100	60
3314.74	200	200	I 3406.80	100	60	I 3497.11	200	100
I 3317.12	100	80	I 3407.46	400	400	I 3497.84	200	200
3319.25	70	50	3409.20	40	4	3500.57	50	20
I 3320.65	20	10	3410.18	30	20	I 3504.86	10	5
3320.78	30	12	I 3410.90	10	2	3505.06	10	10
3322.48	150	100	3411.36	80	30	I 3506.50	50	30
II 3323.07	..	100	I 3413.13	400	300	3508.48	40	20
3323.74	150	150	I 3415.53	60	20	I 3508.53	20	10
I 3324.54	100	80	I 3417.84	150	100	I 3509.87	15	4
I 3325.46	100	80	I 3418.51	150	100	I 3510.45	15	8
I 3327.49	15	7	3422.49	40	10	I 3513.06	10	2
3328.87	150	100	I 3422.66	100	50	I 3513.82	400	300
3329.53	35	6	I 3424.29	200	150	3516.42	40	15
I 3331.61	125	70	3425.01	70	40	3516.56	30	4
3331.78	40	10	I 3426.39	80	20	I 3518.88	10	2
I 3334.22	150 n	100 n	I 3426.64	80	60	3520.85	10	4
3335.77	125	100	I 3427.12	50	50	I 3521.26	300	200
3336.25	40	30	I 3428.20	50	50	I 3521.84	50	20
3337.67	125	100	I 3431.81	50	20	I 3522.28	50	30
3338.64	70	25	3433.04	50	1 n	I 3522.89	10	3
I 3339.19	80	50	II 3436.11	5	15	3523.31	10	4
I 3339.58	10	5	3437.05	80	15	3524.07	50	40
I 3340.57	125	100	3437.95	15	7	I 3524.24	60	50
3341.90	100	80	3438.31	10	3 n	I 3526.04	80	50
I 3342.22	40	40	3439.87	15	7	I 3526.17	50	25
3342.29	20	20	I 3440.61	500	300	3526.38	20	10
I 3346.94	30	15	I 3440.99	300	200	I 3526.46	20	10
I 3347.93	150	100	I 3442.36	50	15	I 3526.68	80	50
I 3351.52	70	60	I 3442.68	30	5	I 3527.80	100	80
3351.74	80	60	I 3443.88	400	200	3529.82	125	80
I 3353.27	10	5	I 3445.15	300	150	I 3530.39	50	25
3354.06	40	40	3445.77	10	3	3533.01	50	75
3355.23	100	100	I 3447.28	100	60	I 3533.20	50	50
I 3356.40	35	8	I 3450.33	150	80	I 3536.19	40	10

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3536.56	300	200	I 3592.69	12	2	3644.80	20	6
I 3537.49	25	8	I 3594.64	125	100	I 3645.08	20	8
I 3537.73	25	15	I 3595.31	20	7	I 3645.49	15	7
I 3537.90	50	25	3596.20	15	5	3645.82	80	60
I 3540.12	100	60	3597.06	40	10	I 3647.43	20	15
I 3540.71	10	4	3599.15	10	5	I 3647.84	500	400
I 3541.09	200	200	3599.62	40	30	I 3649.30	60	25
I 3542.08	150	100	I 3602.08	20	5	I 3649.51	100	100
3543.39	10	2	3602.47	10	5	I 3650.03	70	30
3543.67	60	30	I 3602.53	50	30	I 3650.28	70	50
3544.63	50	6	I 3603.21	150	80	I 3651.10	10	3
I 3545.64	90	70	I 3603.82	20	12	I 3651.47	300	200
I 3547.20	25	8	3604.38	10	1	I 3653.76	25	10
I 3548.02	10	7	I 3605.21	12	2	I 3655.47	25	25
I 3549.87	15	5	I 3605.46	300	150	3655.67	15	2 n
3552.12	10	6	I 3606.68	200	150	3656.23	15	5
I 3552.83	80	50	I 3608.15	15	25	I 3657.14	20	7
3553.74	100	100	I 3608.86	500	400	I 3657.90	20	4
I 3554.12	50	20	I 3610.16	100	90	I 3659.52	125	80
I 3554.93	400	300	I 3610.70	10	3	I 3661.37	10	1
I 3556.88	300	150	I 3612.07	80	50	3662.85	30	5
3557.30	15	..	I 3612.94	20	4	I 3663.46	25	7
I 3558.52	400	300	3613.45	10	2	I 3664.54	35	8
3559.51	50	25	3614.12	10	3	3664.69	12	3
3560.70	50	15	3614.56	15	6	I 3666.25	20	7
I 3564.12	15	2	3615.20	10	1	3667.26	80	25
3564.53	30	15	I 3615.66	10	2	I 3667.99	60	10
I 3565.38	400	300	I 3616.57	30	7	I 3668.21	15	4
I 3565.59	10	4	3617.32	25	15	I 3669.16	50	30
I 3567.04	50	15	3617.79	125	80	I 3669.52	200	150
I 3567.38	10	2	I 3618.77	400	400	I 3670.03	100	..
I 3568.42	20	4	3619.39	12	1	3670.07	200	200
3568.82	15	7	3620.47	15	2	I 3670.81	20	6
I 3568.98	50	35	I 3621.46	125	100	3673.09	10	4
I 3570.10	300	300	I 3622.00	125	100	3674.41	12	5
3570.26	50	15	I 3623.19	100	80	3674.77	40	25
I 3571.23	40	6	I 3623.45	15	5	I 3676.31	200	100
I 3571.99	100	80	I 3623.77	35	7	I 3676.88	10	2
3573.40	50	20	I 3624.31	10	2	3677.31	40	30
3573.84	20	15	3624.81	12	2	3677.63	80	60
3573.89	40	30	I 3625.15	70	35	I 3678.86	100	50
I 3575.12	15	5	3627.04	10	3	I 3679.91	500	300
I 3575.25	10	5	I 3628.09	10	3	3680.80	12	7
3575.37	40	30	I 3630.35	40	15	I 3682.21	400	300
I 3575.98	80	25	I 3631.10	25	10	I 3683.06	200	100
3576.76	80	40	I 3631.46	500	300	I 3684.11	300	200
I 3578.38	40	5	3632.04	50	50	I 3686.00	150	125
I 3581.19	1000 r	600 r	3632.56	30	25	3686.26	10	4
3582.20	30	30	I 3632.98	12	8	I 3687.10	15	7
3583.34	50	15	3633.08	10	3	I 3687.46	400	300
I 3584.66	100	60	I 3634.33	15	5	I 3687.66	15	15
3584.96	30	25	3634.69	20	2	3688.48	40	8
I 3585.32	150	100	I 3635.20	12	2	I 3689.46	200	150
I 3585.71	125	80	I 3636.19	40	10	3690.46	15	6
3586.11	80	80	3636.23	15	10	3690.73	80	60
I 3586.99	200	150	I 3636.99	20	10	3693.03	15	7
I 3587.42	10	5	I 3637.25	12	5	I 3694.01	400	300
I 3587.76	50	25	I 3637.87	20	7	3695.05	200	150
I 3588.62	35	10	I 3638.30	100	80	I 3697.43	100	60
I 3588.91	10	4	I 3640.39	300	200	3698.60	40	20
I 3589.11	70	30	3642.81	20	..	I 3699.14	15	3
I 3589.46	50	30	3643.11	30	5	I 3701.09	300	200
I 3591.34	12	3	I 3643.63	20	8	3702.03	50	30

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3702.49	20	7	3773.70	40	10	I 3840.44	400	300
I 3703.56	30	25	I 3774.83	100	40	I 3841.05	500	400
I 3703.70	12	7	3776.46	125	70	3843.26	125	100
3703.82	15	10	3777.06	12	7	3844.28	10	1
I 3704.46	125	100	I 3777.45	20	10	3845.17	100	60
I 3705.57	700	500	3778.51	60	25	3845.70	10	6
I 3707.05	150	100	I 3778.70	10	4	3846.00	10	1
I 3707.82	80	50	I 3779.45	100	70	3846.41	50	75
I 3707.92	80	60	I 3781.19	40	12	I 3846.80	125	100
I 3709.25	600	400	3781.93	12	5	I 3849.97	500	400
I 3711.22	80	50	I 3782.46	10	2	I 3850.82	200	75
3711.41	50	25	3785.71	10	4	I 3852.57	150	100
I 3715.91	80	50	3785.95	125	80	I 3856.37	500	300
I 3716.45	150	100	I 3786.18	100	60	I 3859.22	100	100
I 3718.41	80	50	I 3786.68	125	50	I 3859.91	1000 r	600
I 3719.93	1000 r	700	3787.17	25	15	3861.34	80	50
I 3721.51	10	4	I 3787.88	500	300	I 3863.74	60	30
3721.92	15	10	3789.18	80	50	I 3865.53	600	400
I 3722.56	500	400	I 3790.09	200	100	I 3867.22	150	100
I 3724.38	200	150	I 3790.76	10	3	I 3867.92	30	8
3725.49	15	8	I 3792.16	40	20	I 3869.56	100	80
I 3726.92	100	70	I 3792.83	10	3	I 3871.75	100	60
I 3727.09	30	10	I 3793.48	10	5	I 3872.50	300	300
I 3727.62	200	150	I 3793.88	25	10	I 3873.76	125	80
I 3728.67	18	10	3794.34	80	50	3876.04	40	15
3730.39	70	40	I 3795.00	500	400	I 3878.02	400	300
3730.95	50	30	3797.52	300	200	I 3878.57	300 r	300
3731.38	40	20	3798.51	400	300	I 3878.68	30	..
3732.40	200	150	I 3799.55	400	300	3878.74	10	10
I 3733.32	400	300	3801.68	50	25	3883.29	70	40
I 3734.87	1000 r	600	I 3801.98	25	5	3884.36	80	35
I 3735.33	30	20	3802.28	25	10	I 3885.51	100	60
I 3737.13	1000 r	600	I 3804.01	40	10	I 3886.28	600	400
3738.31	100	100	3805.34	400	300	3888.82	40	15
I 3739.13	10	5	3806.22	40	20	3890.24	15	..
3739.53	80	35	I 3806.70	200	150	3890.84	60	30
3740.25	70	35	I 3807.54	150	100	3891.93	100	70
I 3742.62	50	25	I 3808.73	100	70	I 3893.39	100	8
I 3743.36	200	150	3809.57	15	5	I 3893.91	10	4
3743.48	4	10	3810.76	70	25	I 3895.66	400	300
I 3744.10	40	20	I 3811.89	15	10	I 3897.45	10	5
I 3745.56	500	500	I 3812.96	400	300	3897.89	100	60
I 3745.90	150	100	3813.63	35	15	I 3898.01	80	50
3746.93	40	25	3813.89	50	25	I 3899.04	20	8
I 3748.26	500	200	I 3814.52	80	40	I 3899.71	500	300
I 3648.97	35	20	3814.78	10	5	I 3900.52	60	3 d
I 3749.49	1000 r	700	I 3815.84	700	700	I 3902.95	500	400
I 3752.42	12	4	I 3816.34	25	20	I 3903.90	100	80
I 3753.61	150	100	3817.65	50	15	I 3906.48	300	200
I 3754.50	2 n	10	I 3820.43	800	600	3906.75	10	10
3756.07	15	8	3821.18	100	100	3907.47	15	6
3756.94	80	10	I 3821.84	50	30	3907.94	100	60
3757.45	15	10	I 3824.44	150	100	I 3909.67	20	5
I 3758.23	700	700	I 3825.88	500	400	I 3909.83	40	12
I 3760.05	150	100	I 3827.82	200	200	I 3910.84	30	10
3760.53	100	70	3829.46	15	8	I 3913.63	100	25
I 3761.41	20	8	I 3830.76	10	3	I 3914.28	15	3
I 3763.79	500	400	I 3830.86	12	4	3916.73	100	80
3765.54	200	150	I 3833.31	100	60	I 3917.18	150	70
I 3767.19	500	400	I 3834.22	400	400	I 3918.32	20	10
I 3768.03	15	8	3836.33	100	60	3918.42	15	10
I 3769.99	80	30	I 3837.14	25	6	I 3918.65	60	40
I 3770.30	35	12	3839.26	100	75	I 3919.07	15	7

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3920.26	500	300	I 3997.40	300	150	I 4098.19	100	40
I 3922.91	600	400	I 3998.05	150	100	I 4100.17	10	1
I 3925.20	15	3	4000.45	35	10	I 4100.74	80	30
I 3925.65	80	50	I 4001.67	80	50	I 4101.27	40	10
I 3925.95	50	30	4003.77	30	80	I 4104.13	100	25
I 3927.92	500	300	4004.84	10	7	I 4106.44	10	2
I 3928.08	15	15	I 4005.25	250	200	I 4107.49	120	100
3929.12	10	5	4006.31	60	35	I 4109.07	12	2
3929.21	15	8	4006.63	20	15	I 4109.81	120	100
I 3930.30	600	400	I 4007.27	80	50	I 4112.97	70	10
I 3931.12	35	15	I 4009.72	120	100	I 4114.45	80	50
I 3932.63	80	40	I 4013.79	80	40	4114.96	10	2
I 3933.60	200	200	4013.82	200	..	I 4118.55	200	100
I 3935.31	40	8	4014.53	200	100	I 4120.21	80	35
I 3935.81	100	8	I 4016.43	15	4	I 4121.81	100	40
I 3937.33	80	35	I 4017.15	80	50	I 4122.51	70	30
I 3940.88	150	80	I 4018.27	50	7	4123.74	80	20
I 3941.28	60	10	I 4021.87	200	100	4125.62	80	30
I 3942.44	100	70	I 4024.74	120	30	I 4125.88	25	15
I 3943.35	40	8	I 4029.64	80	25	I 4126.19	80	60
I 3944.90	15	8	I 4030.19	20	4	I 4127.61	100	80
3945.13	30	10	I 4030.49	120	60	I 4127.80	25	15
I 3947.00	50	20	4031.96	80	50	I 4130.04	20	3
I 3947.53	70	20	I 4032.63	80	15	I 4132.06	300	200
I 3948.11	125	50	4040.64	20	7	I 4133.86	50	7
3948.78	150	100	I 4043.90	25	7	I 4134.42	10	3
I 3949.96	150	100	I 4044.61	70	35	I 4134.68	150	100
3951.17	150	125	I 4045.81	400	300	4137.00	100	80
I 3952.60	80	50	I 4049.33	10	2	I 4139.92	40	30
I 3953.15	80	40	4049.87	30	3	I 4141.87	15	5
I 3955.35	25	5	4051.91	10	2	I 4143.42	200	100
3955.96	10	5	I 4054.83	25	5	I 4143.87	400	250
3956.46	100	100	I 4054.88	25	5	I 4146.07	15	3
I 3956.68	150	150	I 4055.04	40	10	I 4147.67	200	100
3957.03	50	15	I 4057.35	20	3	I 4149.37	100	35
3960.28	30	6	4058.23	80	25	I 4150.26	50	2
I 3961.14	25	7	I 4058.76	40	10	I 4152.17	70	5
I 3963.11	125	50	4059.72	15	8	I 4153.91	120	100
I 3964.52	80	25	I 4062.44	120	100	I 4154.50	100	80
I 3965.51	10	3	I 4063.28	10	10	I 4154.81	100	8
I 3966.07	100	70	I 4063.60	400	300	I 4156.80	100	80
I 3966.63	80	40	I 4065.39	15	6	I 4157.79	150	80
3967.42	125	100	4066.59	40	20	I 4158.80	100	25
I 3967.97	60	15	I 4066.98	100	80	I 4161.08	10	..
I 3969.26	600	400	I 4067.27	80	70	4161.49	15	..
3970.39	50	30	I 4067.98	150	100	I 4163.68	12	1
I 3971.33	200	125	I 4070.78	50	20	4165.42	12	2
3973.65	40	10	I 4071.74	300	200	4167.96	10	2
I 3974.40	10	1	I 4073.77	80	20	4168.95	10	1
3976.61	8	35	I 4074.79	80	40	I 4170.91	80	40
I 3976.86	30	10	I 4076.64	80	50	4172.13	80	50
I 3977.74	300	150	I 4078.36	80	40	I 4172.75	60	10
I 3981.77	150	100	I 4079.84	80	40	I 4173.32	25	5
I 3983.96	200	125	I 4080.22	60	10	I 4173.93	50	5
3985.39	125	40	I 4082.12	10	2	I 4174.92	100	25
I 3986.17	125	8	I 4083.55	10	2	I 4175.64	100	80
3989.01	15 wn	1 wn	I 4083.78	15	2	I 4176.57	100	50
3989.86	30	5	I 4084.50	120	80	I 4177.60	100	25
3990.38	70	25	I 4085.01	80	30	II 4178.87	10	10
I 3994.12	25	10	I 4085.32	100	70	I 4181.76	200	150
3995.20	10	..	I 4087.10	50	5	I 4182.39	80	30
I 3995.99	60	20	I 4089.22	10	2	I 4184.89	100	80
3996.97	40	20	I 4095.98	80	40	I 4187.04	250	200

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 4187.80	200	150	4285.44	125	50	I 4450.31	12	2
I 4191.44	200	100	I 4286.99	10	1	I 4454.38	200	80
I 4191.68	20	6	I 4288.15	50	6	I 4455.03	20	1
I 4195.34	150	100	4290.38	35	5	I 4458.11	30	1
I 4195.62	25	3	I 4290.87	20	2	I 4459.12	400	200
I 4196.21	100	50	I 4291.47	125	20	I 4461.65	300	125
I 4198.31	250	150	I 4292.29	15	...	I 4464.78	35	3
I 4198.64	10	2	I 4294.13	700	400	I 4466.55	500	300
I 4199.10	300	200	I 4298.04	100	400	I 4469.38	200	100
I 4200.93	80	20	I 4299.24	500	400	4472.72	10	1
I 4202.03	400	300	I 4302.19	50	10	I 4476.02	500	300
4202.76	10	4	II 4303.17	12	15	I 4479.62	15	2
I 4203.57	10	1	I 4305.45	100	50	I 4480.14	10	2
I 4203.99	200	120	I 4307.91	1000 r	800 r	I 4482.17	150	70
I 4205.55	50	6	4309.04	40	20	I 4482.26	150	70
I 4206.70	125	25	I 4309.38	125	70	I 4482.75	20	2
I 4207.13	80	40	I 4315.09	500	300	I 4484.22	125	40
4208.61	100	50	4321.80	20	4	I 4485.68	50	2
I 4210.35	300	200	I 4325.76	1000	700	I 4489.74	100	12
4213.65	100	60	I 4326.76	10	4	I 4490.09	40	10
I 4215.42	60	15	4327.10	100	50	I 4490.76	40	1
I 4216.19	200	100	4330.15	10	2	I 4494.57	400	150
I 4217.55	200	100	I 4337.05	400	150	II 4508.28	40	30
I 4219.36	250	200	4343.26	20	3	II 4515.34	10	10
4220.35	80	40	4343.70	12	2	I 4517.53	30	3
I 4222.22	200	200	4346.56	50	10	II 4520.24	40	30
I 4224.18	200	80	I 4351.55	30	5	II 4522.63	60	50
I 4224.52	60	15	II 4351.76	30	30	I 4525.15	100	50
I 4225.46	80	20	I 4352.74	300	150	I 4526.42	10	1
I 4225.96	80	30	I 4358.50	70	20	I 4528.62	600	200
I 4226.43	80	25	I 4367.58	100	50	4529.68	10	2
I 4227.43	300	250	I 4367.91	60	70	I 4531.15	125	...
I 4229.76	20	2	I 4369.77	200	100	4547.85	200	100
I 4232.73	10	1	I 4373.57	50	3	II 4549.47	100	100
II 4233.17	100	100	I 4375.93	500	200	4550.79	50	...
I 4233.61	250	150	4382.77	10	10	4552.55	10	1
I 4235.94	300	200	I 4383.55	1000	800	II 4555.89	12	12
I 4238.04	80	15	II 4385.38	4	10	I 4556.12	150	35
II 4238.82	200	100	I 4387.90	150	35	I 4560.10	20	...
4239.73	30	10	I 4388.41	125	50	I 4568.78	10	1
I 4239.85	40	15	I 4389.25	35	2	I 4574.72	12	1
4240.37	30	5	I 4390.95	100	35	I 4581.52	60	2
4243.37	10	3	I 4395.29	80	...	II 4583.85	150	150
I 4245.26	80	40	4400.35	20	1	4587.14	12	2
4246.09	80	30	I 4401.30	60	15	I 4592.65	200	50
I 4247.43	200	100	I 4404.75	1000	700	4595.36	15	2
I 4248.23	150	40	I 4407.72	100	50	I 4596.06	10	2
I 4250.13	250	150	I 4408.42	125	60	I 4598.13	50	4
I 4250.79	400	250	4410.71	20	...	I 4602.01	20	2
I 4258.32	60	4	I 4415.12	600	400	I 4602.94	300	100
I 4258.61	12	2	I 4422.57	300	125	I 4607.65	50	5
I 4260.00	15	5	I 4427.31	500	200	I 4611.29	200	25
I 4260.48	400	300	I 4430.21	10	1	I 4613.22	30	2
I 4264.21	35	4	I 4430.62	200	8	I 4618.76	10	1
I 4264.74	12	2	I 4433.22	150	20	I 4619.30	100	8
I 4266.97	70	30	I 4433.79	30	2	I 4625.05	100	12
4267.83	125	60	I 4435.15	70	3	I 4630.13	10	2
4268.76	30	10	I 4436.93	15	2	I 4632.92	76	4
I 4271.16	400	300	I 4438.35	10	1	I 4635.85	12	1
I 4271.76	1000	700	I 4442.34	400	200	I 4637.52	100	10
I 4273.87	10	2	I 4443.20	200	100	I 4638.02	80	10
I 4276.68	10	1	I 4446.84	10	10	I 4643.47	35	2
I 4282.41	600	300	I 4447.72	200	100	I 4647.44	125	40

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 4654.50	20	3	I 4957.31	100	20	I 5133.68	200 n	1 n
I 4654.62	10	2	I 4957.61	300	150	II 5136.79	3	100
I 4667.46	150	20	4962.56	10 n	..	I 5137.39	200 n	..
I 4668.14	125	10	I 4966.16	300	1	I 5139.26	125	..
I 4669.18	15	2	4969.93	50	..	I 5139.48	200	40
I 4673.17	20	2	4970.50	20	..	I 5141.75	100	100 n
I 4678.85	150	100	I 4973.11	100	..	I 5142.54	100 n	..
I 4691.41	80	10	I 4978.61	80	..	I 5142.94	125	..
4704.96	10	1	4982.51	200	..	I 5145.10	10	..
I 4707.28	100	12	I 4983.26	100 n	..	I 5148.05	20	..
4708.96	50	50	I 4983.85	200 n	..	I 5148.26	35	..
I 4709.10	20	2	I 4985.26	100	..	I 5150.84	150	..
I 4710.29	20	2	I 4985.56	100	..	I 5151.91	70	..
4714.07	50	50	I 4988.96	100 n	..	5159.05	35 n	..
I 4727.41	10	..	I 4991.28	80	..	I 5162.29	300 n	..
I 4728.56	20	1	I 4994.13	200	..	5164.61	70 n	..
I 4729.70	25	25	4995.63	3	60	I 5165.42	50	..
I 4733.60	15	1	4997.80	20	300	I 5166.30	125	..
4735.85	10	1	I 5001.87	300	40	I 5167.49	700	150
I 4736.78	125	50	I 5002.81	20	..	I 5168.90	80	..
I 4741.53	12	1	5004.79	3	100	II 5169.03	2	200 n
4747.48	30	25 n	5005.72	200	..	I 5171.60	300	60 n
I 4772.82	10	4	I 5006.13	300	5	5180.06	10	..
I 4786.81	150	..	I 5007.29	25 n	..	I 5184.29	20	..
I 4788.75	40	..	5016.85	50	..	I 5191.47	400	35
I 4789.65	100	..	I 5012.07	300	..	I 5192.36	400	50
I 4791.25	200	200 r	I 5014.96	500	..	I 5194.95	200	15
4800.66	15	..	II 5018.44	80	50	I 5195.48	100 n	..
4821.05	200 n	200 n	I 5022.25	150	..	5196.10	25 n	..
I 4859.75	150	40	5023.48	10	300	II 5197.59	..	10
I 4871.32	200	100	I 5027.14	60	..	I 5198.71	80	..
I 4872.15	100	30	5027.21	60	..	5198.84	10	..
I 4878.22	80	4	5028.14	100	..	I 5202.34	300	10
I 4889.01	2 wn	50 n	II 5030.78	1	125	I 5204.58	125	..
I 4890.77	100	15	I 5039.26	100	2 n	I 5208.60	200	8
I 4891.50	70	15	I 5041.08	125	..	I 5215.18	200	5
I 4903.32	500	2	I 5041.76	300	..	I 5216.28	300	10
I 4905.18	10	..	I 5044.22	25	..	I 5217.40	150	3
I 4907.74	25	..	I 5048.45	50	..	I 5225.53	60	..
I 4909.39	50	..	I 5049.82	400	1	I 5226.87	200	15
I 4910.03	100	..	I 5051.64	200	..	I 5227.19	400	60
I 4910.33	15	..	I 5065.02	25 n	..	5228.41	15 n	6 n
I 4910.57	15	..	5065.20	15	..	I 5229.87	200	15 n
I 4911.80	10	..	I 5068.79	400	200	I 5232.94	800	150
I 4918.99	300	50	5070.96	1	70	I 5235.39	35	..
I 4920.50	500	125	5073.56	..	20 n	5242.49	125	5
4923.72	5	100	I 5074.76	80	..	I 5243.79	20	..
II 4923.92	30	50	I 5078.99	20 n	..	I 5247.06	50	10
I 4924.78	100	..	I 5079.24	100	..	I 5250.21	30	..
I 4925.29	1000 r	50 r	I 5079.75	100	..	I 5250.65	150	..
4927.45	50	6	I 5083.34	200	..	5251.97	12	..
4927.87	20	..	5086.76	2	100	I 5253.48	70	..
I 4930.33	25	..	I 5090.79	40 n	..	I 5254.96	50	..
4933.35	50	30	I 5096.99	35 n	..	I 5263.33	300	..
4933.63	2	70	I 5098.71	200	..	I 5266.58	500	40
I 4934.02	40	..	I 5102.20	80	..	I 5269.54	800	200
I 4938.18	100	..	5106.44	25	..	I 5270.36	400	80
I 4938.82	300	1	I 5107.45	100	..	I 5273.17	80	4
I 4939.24	10 n	..	I 5110.41	300	..	I 5273.38	50	4
I 4939.69	150	2	I 5123.72	200	..	II 5275.99	2	15
I 4946.40	5	40	I 5125.13	100 n	..	5280.36	15	..
4946.64	1	50	I 5127.36	100	..	I 5281.80	300	20
I 4950.10	..	10	I 5131.47	125	..	I 5283.63	400	40

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 5284.09	..	70 n	I 5525.55	40	2	I 6003.03	30	15
5287.92	100	20	I 5534.66	20	..	I 6007.97	10 n	16 n
5288.53	30	..	II 5534.86	..	10	I 6008.58	18	10
I 5290.85	15	..	5535.41	50	..	6013.50	100	..
5298.78	12	..	5538.57	50	..	I 6016.65	100	..
I 5302.31	300	..	5539.28	30	..	I 6020.18	8	10 n
II 5303.42	25	25	5543.18	25	..	I 6021.83	300	..
I 5307.36	125	..	I 5543.93	10	..	I 6024.06	20	20 n
II 5316.61	..	150	I 5546.49	40	..	6027.06	6	12
I 5322.05	30	..	I 5554.89	100	..	I 6056.00	10	10 n
I 5324.18	400	70	I 5562.71	15 n	..	I 6065.49	50	30
I 5328.05	400	100	I 5563.60	100	5	I 6102.18	15	20 n
I 5328.53	150	35	I 5565.70	70	..	6103.33	..	40
5329.99	15	..	I 5567.40	30	..	I 6136.62	100	..
I 5339.94	200	30	I 5569.62	300	15	I 6137.00	10	..
I 5341.03	200	15	I 5572.85	300	25	I 6137.70	100	..
I 5343.47	12 n	..	I 5576.11	150	..	I 6141.76	10	..
I 5353.39	60	2	5584.76	25	2	6157.73	15	..
II 5362.86	..	15	I 5586.76	400	50	I 6170.50	15	..
5364.88	200 n	10 n	5594.66	10	..	I 6173.34	18	..
5365.40	40	..	I 5598.29	20	..	I 6191.56	100	20 n
5367.46	200 n	15 n	I 5602.96	45	35	I 6200.33	15	..
5369.96	150 n	20 n	I 5615.30	4	12	I 6213.44	20	..
I 5371.49	700	..	I 5615.65	400	300	I 6219.29	40	5
I 5373.71	15	..	I 5618.64	10	8	I 6230.73	60	50
5379.58	35	..	I 5624.55	150	125	I 6246.33	20	20 n
5383.37	400 n	40	5633.96	20	10	I 6252.56	60	25 n
I 5389.46	60	..	I 5638.27	40	20	I 6254.26	10	..
I 5391.47	25	..	I 5641.46	15	8	I 6265.14	12 n	5 n
I 5393.18	150	10	I 5655.50	10	5	I 6297.80	10 n	15 n
I 5397.13	400	50	I 5658.54	30	2	I 6301.52	50	50 n
I 5398.28	70	..	I 5658.83	100	80	I 6302.51	15 n	15 n
I 5400.50	125	..	I 5662.52	50	50	I 6318.02	40	25 n
5403.82	30	..	5686.52	10	8	I 6335.33	50	20 n
I 5404.15	300	35	I 5701.56	50	25	I 6336.84	60	35 n
I 5405.78	400	70	I 5705.98	15	10	I 6355.04	15 n	8 n
I 5409.13	10 n	..	I 5709.38	100 n	..	6380.75	25 n	8 n
I 5410.91	200	10	I 5717.84	10	2	I 6393.60	100	80 n
I 5415.21	500	20	I 5731.77	10	3	I 6400.02	200	150 n
5424.08	400	20	I 5753.14	40	20	I 6408.03	50	30 n
I 5429.70	500	40	I 5763.01	80	35	I 6411.66	100	80 n
I 5434.53	300	35	I 5775.09	12	2	I 6419.98	18 n	15 n
I 5445.04	150	..	I 5806.73	10	5 n	I 6421.35	60	40 n
I 5446.92	300	35	5816.38	15 d	10 n	I 6340.85	100	80
5449.78	10	..	5833.64	2	10	II 6446.43	..	20
I 5455.43	50	..	I 5859.61	15	12	I 6462.73	20	7 n
I 5455.61	300	30	I 5862.36	35	35	I 6481.87	12 n	80 wn
5457.65	18	2	5869.76	10	..	I 6494.98	400	150
I 5462.97	50	..	5875.37	15 n	..	6496.46	10	..
I 5463.28	100	..	I 5883.85	15	10	II 6516.05	..	20
I 5466.41	25	..	5905.68	12	8 n	I 6518.37	10 n	7 n
I 5473.92	100	..	5912.83	10	..	I 6546.24	150	50
5474.92	100	..	I 5914.16	50	25 n	I 6569.22	50	25 n
5476.29	12	..	I 5916.26	25	4	I 6575.02	12 n	15 n
I 5476.58	80	..	5927.81	10	..	I 6592.92	150	80
I 5480.87	10	..	I 5930.19	30	10 n	I 6593.88	30	18
I 5483.12	15	..	I 5934.68	15	12 n	I 6597.61	10	..
I 5487.14	50	5	I 5956.71	12	..	I 6609.12	25	12 n
I 5487.77	10 n	..	5975.36	10	10	I 6633.77	60 n	25 Wn
I 5497.52	150	5	I 5983.70	35	12 n	I 6663.45	70	25 n
I 5501.47	150	..	I 5984.80	50	20 n	I 6677.99	250	150
I 5506.78	150	10	I 5987.05	25 n	12 n	I 6705.12	12 n	12 wn
5514.63	50	10	5999.95	10 n	..	6726.78	15	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

IRON (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 6750.16	50	18 n	I 7306.61	25	12 n	I 8365.64	15	..
I 6752.73	9	12 wn	7307.96	30	..	I 8387.78	35	1
I 6810.25	15	18 n	II 7307.97	..	25 n	I 8468.41	20	..
6820.38	10	7 n	I 7311.10	60	25 n	I 8514.07	10	..
I 6828.61	18	25 n	II 7320.70	25	18 n	I 8611.81	10	..
I 6841.35	50	50 n	I 7351.56	18	7 n	I 8661.91	100	..
I 6843.67	30	35 n	7376.46	..	10 wn	I 8674.75	50	..
I 6855.18	60	80 n	7386.40	40	25 n	I 8688.63	150	..
I 6858.16	15	15 n	I 7389.42	100	80 n	I 8710.29	20 n	..
I 6885.77	10 n	8 n	7401.69	10	..	I 8713.19	10	..
I 6916.70	35	5 wn	I 7411.18	100	..	I 8757.19	50	..
I 6945.21	60	20 n	7418.67	10	..	I 8764.00	100	..
I 6951.26	10 n	..	I 7440.98	18 n	..	I 8790.62	10 n	..
I 6978.85	60	12 n	I 7445.78	150	..	I 8793.38	125	..
I 6999.90	25	..	II 7462.38	3	20	I 8804.62	10	..
I 7016.44	100	25 n	I 7476.30	12 n	..	I 8824.23	200	..
I 7023.00	40	30 n	I 7491.68	20	..	I 8838.43	30	..
I 7024.65	15	8 wn	I 7495.09	200	..	I 8866.96	150	..
I 7038.25	7	20 n	I 7507.28	40	..	I 8919.95	10	..
7067.44	..	10 n	I 7511.04	20	1	I 8945.20	20	..
I 7068.41	40	30	I 7531.17	80	..	I 8975.41	15	..
I 7090.40	50	25 n	I 7586.04	10	..	I 8999.56	100	..
I 7130.94	100	80 n	I 7653.76	80	..	I 9012.10	30	..
7132.99	15	10 n	I 7661.22	10	..	I 9024.47	15	..
I 7142.52	12 n	8 n	I 7664.30	15	..	I 9088.33	40	..
I 7145.32	15 n	10 n	I 7710.39	10	..	I 9089.41	30	..
I 7155.64	10 n	..	II 7711.73	25	15	I 9118.89	20	..
I 7164.47	200	100 n	I 7748.28	25	..	I 9258.31	20	..
I 7176.89	10 n	..	I 7780.59	25	..	I 9259.06	15	..
I 7187.34	500	300	I 7832.22	30	1	I 9350.44	10	..
I 7207.41	300	300	I 7937.17	40	1	I 9401.14	10 n	..
7219.69	12	18 n	I 7945.88	30	2	I 9414.14	20 n	..
I 7221.23	10	8 n	I 7998.97	35	1	I 9443.98	10 n	..
II 7222.39	..	15 n	I 8028.34	100	..	I 9513.24	10 n	..
I 7223.67	20	..	I 8046.07	25	1	I 9569.96	40 n	..
II 7224.51	..	12	I 8085.20	20	1 n	I 9626.56	30 n	..
I 7239.88	25	20 n	I 8198.95	20	..	I 9653.14	20	..
I 7244.86	18	..	I 8207.77	100	..	I 9738.62	200	..
I 7254.65	10 n	8 wn	I 8232.35	10	..	I 9753.13	10	..
I 7261.54	18 n	10 n	I 8248.15	10	..	I 9763.45	15	..
7264.99	..	10	8264.27	20	..	I 9763.91	15	..
7284.85	15	15 n	I 8327.06	40	2	I 9800.33	20	..
I 7288.76	30	20 n	I 8331.94	20	..	I 9861.79	30	..
I 7293.07	100	50 n	I 8339.43	18	..	I 9889.08	40	..

KRYPTON

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
2353.68	..	50	II 3200.40	..	50 n	I 3665.33	..	80
II 2464.77	..	109 n	II 3405.16	..	80 wnl	3669.01	..	150 nl
II 2592.48	..	60	II 3446.51	..	50 wn	I 3679.56	..	50
II 2712.40	..	80 n	II 3460.09	..	50	I 3679.61	..	50
2733.26	..	50	II 3503.25	..	50 wnl	II 3680.37	..	100 wnl
2795.81	..	80 n	II 3535.35	..	50 nl	II 3686.15	..	80 wnl
II 2816.46	..	60	II 3589.65	..	70 wnl	II 3718.02	..	360 nl
II 2833.00	..	100	II 3607.88	..	100 wnl	II 3718.63	..	200 nl
II 2967.25	..	80 wn	II 3631.87	..	200 nl	II 3721.35	..	150 nl
II 3150.93	..	80 n	II 3653.97	..	250 nl	II 3741.69	..	200 nl

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

KRYPTON (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 3744.80	..	150 ns	II 4481.85	..	50 wnl	I 5580.39	..	80
II 3754.24	..	80	II 4489.88	..	400 nl	II 5633.02	..	100 n
I 3773.42	..	50	I 4502.36	..	600	I 5649.56	..	100
II 3778.09	..	500 nl	II 4523.14	..	400 nl	I 5672.45	..	50
II 3783.13	..	500 nl	II 4556.61	..	200 nl	II 5681.89	..	400
II 3844.45	..	50 wnl	II 4577.20	..	800	II 5690.35	..	200 wns
II 3875.44	..	150 wnl	II 4582.85	..	300 nl	II 5752.98	..	60
II 3894.71	..	60 wnl	II 4592.80	..	150 wnl	II 5771.41	..	100
II 3906.25	..	150 nl	II 4598.49	..	50 nl	I 5832.86	..	100
II 3912.59	..	70	II 4604.02	..	60 nl	I 5866.75	..	50
II 3917.64	..	50 wnl	II 4610.65	..	60 nl	I 5870.92	..	3000
II 3920.14	..	200 nl	II 4615.28	..	500	I 5879.90	..	50
II 3954.78	..	90 wnl	II 4619.15	..	1000	II 5992.22	..	200
II 3994.83	..	100	II 4633.88	..	800	I 5993.85	..	60
II 3997.95	..	100 wnl	II 4658.87	..	2000	I 6012.16	..	50
II 4044.67	..	80	II 4680.41	..	500	I 6056.13	..	60
II 4050.42	..	50 wnl	II 4691.28	..	100	II 6168.80	..	50
II 4057.01	..	300 ns	II 4694.44	..	200 nl	II 6303.66	..	100
II 4065.11	..	300	II 4695.66	..	50 nl	II 6416.61	..	60 ns
II 4088.33	..	500	II 4739.00	..	3000	II 6420.18	..	300
II 4098.72	..	250	II 4752.02	..	100 nl	I 6421.03	..	100
II 4109.23	..	100 ns	II 4762.43	..	300	I 6456.29	..	200
4137.96	..	50 wn	II 4765.74	..	1000	II 6470.89	..	50
4139.11	..	100 wnl	II 4796.33	..	60 nl	II 6510.95	..	100
II 4145.12	..	250	II 4811.76	..	300	II 6570.07	..	150
II 4185.12	..	50	II 4825.18	..	300	I 6699.23	..	60
II 4236.64	..	100 nl	II 4832.07	..	800	II 6763.61	..	100
II 4250.58	..	150	II 4846.60	..	700	II 6764.43	..	80
II 4252.67	..	50 ns	II 4857.20	..	150	II 6771.22	..	50
II 4254.85	..	100 nl	II 4915.94	..	100 nl	I 6813.10	..	50
4259.44	..	80 ns	II 4945.59	..	300	I 6904.68	..	100
II 4268.57	..	60 wnl	II 4948.50	..	50 nl	II 7073.97	..	60
II 4268.81	..	100 wnl	II 4960.25	..	100 nl	II 7139.99	..	60
I 4273.97	..	1000	II 4978.89	..	100 nl	II 7213.13	..	250
II 4282.97	..	100	II 4982.83	..	50 nl	I 7224.10	..	100
II 4292.92	..	600	II 5013.29	..	100	I 7287.26	..	80
I, II 4300.49	..	200	II 5021.88	..	100	II 7289.78	..	400 n
II 4317.81	..	500 wnl	II 5022.40	..	200	II 7407.02	..	400 n
II 4318.55	..	400	II 5033.85	..	100 wnl	I 7425.54	..	60
II 4319.58	..	1000	II 5046.31	..	80 wnl	II 7435.78	..	200 n
II 4322.98	..	150 wnl	II 5086.52	..	250 nl	I 7486.86	..	100
II 4331.24	..	80 wn	II 5125.73	..	400 wnl	II 7524.46	..	300 n
II 4333.34	..	50 wn	II 5143.05	..	600 nl	I 7587.41	..	1000
I 4351.36	..	100	II 5166.80	..	80	I 7601.54	..	5000
II 4355.48	..	3000	II 5186.99	..	60 wns	II 7641.16	..	150
I 4362.64	..	500	II 5200.22	..	60 wns	I 7685.25	..	1000
II 4369.69	..	200	II 5208.32	..	500	I 7694.54	..	1000
I 4376.12	..	800	II 5229.52	..	60	II 7735.69	..	200 n
II 4381.52	..	100 n	II 5276.50	..	100 n	I 7746.83	..	150
II 4385.27	..	50 wnl	II 5308.66	..	200	7781.97	..	100 n
II 4386.54	..	300 nl	II 5322.77	..	60 nl	I 7806.52	..	50
I 4399.97	..	200	II 5333.41	..	500 n	I 7854.82	..	800
II 4400.87	..	100 nl	II 5346.76	..	60 nl	I 7913.42	..	200
I 4410.37	..	50	II 5446.34	..	80	I 7928.60	..	150
I 4418.76	..	50	II 5468.17	..	200 ns	I 7982.41	..	100
II 4422.70	..	100 ns	I 5490.94	..	50	II 7993.22	..	50 n
I 4425.19	..	100	II 5499.54	..	50	I 8059.50	..	1000
II 4431.67	..	500	I 5500.71	..	50	I 8104.02	..	500
II 4436.81	..	600	II 5522.94	..	60	I 8104.36	..	5000
II 4453.21	..	50 wns	II 5552.99	..	100 wns	I 8112.90	..	5000
I 4453.92	..	600	I 5562.23	..	500	I 8132.98	..	60
I 4463.69	..	800	II 5568.65	..	100	I 8190.05	..	3000
II 4475.00	..	800 ns	I 5570.29	..	2000	I 8195.07	..	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

KRYPTON (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 8218.40	..	80	I 8928.69	..	2000	II 9577.52	..	125
I 8263.24	..	2000	I 8977.99	..	50	9605.80	..	125 W _n
I 8272.35	..	100	II 9238.48	..	125	9619.61	..	100 W _n
8281.05	..	1000	II 9293.82	..	100 W _l	II 9663.34	..	50
I 8298.11	..	5000	II 9320.99	..	70 n	I 9704.22	..	50
I 8412.43	..	100	I 9352.23	..	100	9711.60	..	50 W _n
I 8508.87	..	3000	II 9361.95	..	80	I 9743.11	..	50
I 8560.89	..	50	I 9362.03	..	100	I 9751.76	..	2000
I 8764.11	..	150	II 9402.82	..	50 W _s	9803.14	..	125
I 8774.05	..	50	II 9470.93	..	50 W _n	I 9856.24	..	500
I 8776.75	..	5000						

LANTHANUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2187.87	3	40	I 3641.52	25	4	II 4067.39	150	80
2216.11	2	25	II 3645.41	100	60	II 4077.34	600	400
II 2265.76	2 n	30	I 3649.51	40	8	I 4079.18	25	3
2297.78	2 n	150	II 3650.17	100	60	II 4086.71	500	500
2379.42	..	60	II 3662.07	60	40	I 4089.61	40	5
2476.75	..	30 n	I 3672.02	25	3	II 4099.54	100	100
II 2487.59	..	40	I 3704.53	25	4	I 4104.88	40	2
II 2519.21	..	50	II 3705.82	50	80 n	II 4123.23	500	500
II 2560.37	..	50	II 3713.54	200	60	4133.33	15	25
II 2610.33	10	150	II 3714.86	60	40	II 4141.74	200	200
II 2672.91	3	30	II 3715.52	100	50	I 4143.94	25	15 n
II 2695.46	3	35	II 3725.05	25	15	II 4151.95	200	300
II 2791.51	2	25	II 3759.08	400	150	II 4152.77	40	50
II 2798.55	2	40 nl	II 3780.67	50	50	I 4160.26	40	50
II 2808.39	10 d	150	II 3790.82	400	300	I 4187.32	50	40
II 2840.50	3	25 nl	II 3794.77	400	200	II 4192.36	50	50
II 2855.90	3	50 nl	II 3840.71	50	70	II 4196.55	200	150
II 2880.64	4	40	II 3845.99	40	50	II 4204.04	200	25
II 2885.14	5	50	II 3849.01	200	150	II 4217.55	200	100
II 2893.07	6	60	II 3854.91	..	40	II 4230.95	150	50
II 2950.49	3	50	II 3864.49	100	150	II 4238.38	500	300
II 3104.59	200	50	II 3871.63	200	15	II 4249.99	100	50
I 3109.44	25	2	II 3886.37	400	200	I 4256.91	50	..
II 3142.76	150	50	II 3898.60	30	5	II 4263.58	150	150
3171.69	2 n	1000 wn	II 3916.04	400	400	II 4269.49	150	150
II 3193.02	15	60	II 3921.53	400	200	I 4271.16	30	..
II 3245.12	400	300	I 3927.56	40	..	II 4275.64	40	500
II 3249.35	300	80	II 3929.22	400	300	II 4280.26	50	30
II 3265.67	300	200	II 3936.22	100	50	II 4286.97	400	300
II 3303.11	400	150	II 3949.11	1000	800	II 4296.05	200	200
II 3337.49	800	300 wn	I 3953.68	30	..	II 4300.43	25	20
II 3342.22	80	5	II 3988.52	1000	800	I 4306.00	30	..
II 3344.56	300	200 wn	II 3995.75	600	300	II 4315.90	50	3 n
II 3376.33	100	50	I 4015.39	100	2 n	II 4322.50	150	150
II 3380.91	200	100 n	II 4023.59	50	15	II 4333.73	800	500
II 3411.76	5	25 nl	II 4025.88	50	50	II 4334.96	40	50
II 3452.18	50	40	II 4031.69	400	300	I 4340.73	50	3
II 3453.17	50	40	I 4037.21	50	3 n	II 4354.40	80	100
II 3512.92	50	15	II 4042.91	400	300	I 4354.80	40	3
3517.11	..	25 n	II 4050.08	60	60	II 4364.67	50	50
I 3574.43	30	8	I 4060.32	80	5	bh 4372.0	40	..
II 3628.82	80	40 n	I 4064.78	40	3	bh 4375.8	30	..
II 3637.15	50	40	I 4065.58	30	2	II 4378.10	40	30

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

LANTHANUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 4383.45	10	50	II 4946.47	100	50	II 5610.53	2	40
bh 4418.1	25	..	I 4949.77	200	..	bh 5626.0	100	..
bh 4418.2	50	..	II 4952.07	50	40	bh 5628.6	100	..
I 4427.57	30	50	II 4970.39	125	100	I 5631.21	50	..
bh 4428.1	30	..	II 4986.83	150	100	I 5648.25	150	..
bh 4428.2	40	..	II 4991.28	100	80	bh 5652.3	50	..
II 4429.90	200	300	I 4993.88	80	..	bh 5654.8	50	..
II 4432.95	25	5	II 4996.82	25	30	I 5657.73	50	..
bh 4438.0	30	..	II 4999.47	400	300	II 5671.55	10	100
bh 4443.0	25	..	II 5014.45	2	30 nl	I 5696.19	50	..
II 4455.79	40	25	I 5046.88	80	..	II 5712.40	20	40
II 4522.37	200	400	I 5050.57	80	4	I 5720.02	25	..
II 4525.30	100	100	I 5056.46	80	..	I 5740.66	100	1
II 4526.11	100	150	I 5067.90	30	..	I 5744.41	80	..
II 4530.56	15	25	I 5106.23	100	10	I 5761.84	60	..
II 4540.71	4	25	II 5114.57	150	200	II 5769.07	30	60
I 4541.79	30	5	II 5122.99	150	200	I 5769.35	70	..
II 4558.46	100	200	I 5145.42	100	10	I 5770.01	25	..
II 4559.29	100	150	II 5156.74	40	40	I 5789.25	125	..
I 4567.91	100	25	II 5157.43	40	100	I 5791.34	200	..
I 4570.03	80	25	I 5158.69	50	..	II 5797.59	80	150
II 4574.87	300	300	II 5163.61	25	40	II 5805.78	60	120
II 4580.06	80	100	II 5173.85	20	25 n	II 5808.33	25	60
II 4605.78	100	100	I 5177.31	150	30	I 5821.99	40	..
II 4613.39	100	100	II 5183.42	300	400	I 5829.73	25	..
II 4619.88	150	200	I 5183.92	25	..	I 5855.59	30	..
II 4645.28	25	40	II 5188.23	50	500	II 5863.71	40	80
II 4647.51	10	50	II 5204.15	50	300	bh 5866.4	40	..
II 4655.50	150	300	I 5211.87	300 r	5	bh 5869.5	50	..
II 4662.51	150	200	I 5234.27	200 r	8 W	II 5880.65	30	50
II 4663.76	100	200	I 5253.46	100	5	bh 5893.6	60	..
II 4668.91	200 r	300 r	II 5259.39	40	50	I 5894.85	25	..
II 4671.83	100	150	I 5271.20	100	20	bh 5896.7	80	..
II 4691.18	10	25	II 5290.84	60	100	II 5901.95	2	40
II 4692.50	200	300	II 5301.98	300 r	200	I 5917.63	25	..
II 4699.63	200 r	200 r	II 5302.62	50	150	bh 5920.8	50	..
II 4703.28	200 r	300 r	II 5303.56	100	125	II 5927.71	..	30
I 4708.19	25	2	I 5304.03	25	..	I 5930.63	150	..
II 4712.93	100 r	150	II 5340.67	80	100	I 5930.67	100	..
II 4716.44	100	200	I 5357.87	40	..	II 5973.53	15	120
II 4717.59	15	25	II 5377.09	30	200	I 6007.38	70	..
II 4719.95	200 r	300	II 5380.99	50	100	I 6038.61	50	..
II 4728.42	400 r	300	II 5381.92	15	100	II 6100.38	30	15
II 4740.28	150	300	bh 5407.7	30	..	I 6107.28	25	..
II 4743.08	300 r	300	bh 5433.0	30	..	I 6108.49	70	..
II 4748.73	100	200	I 5455.15	200	1	I 6111.72	50	..
I 4750.41	40	40	II 5458.69	5	50	II 6126.09	20	25
I 4766.89	100	10	II 5464.38	25	30	I 6127.06	25	..
I 4770.43	25	5	II 5480.74	5	40	II 6129.55	40	25
II 4804.04	150	150	II 5482.27	25	50	I 6134.39	70 r	..
II 4809.01	150	150	5501.34	200	50	I 6142.98	50	..
II 4824.07	150	150	I 5503.81	100	..	I 6165.70	100	..
II 4826.89	15	30	I 5506.00	50	..	II 6188.09	8	50
I 4839.52	40	10	I 5510.34	200	..	II 6203.51	8	25
II 4840.00	35	10	I 5517.34	30	..	I 6234.85	25	..
II 4850.58	25	20	II 5535.67	50	100	I 6238.59	25	..
II 4860.91	100	100	I 5541.26	50 W	..	I 6249.93	300	..
I 4878.85	20	30	I 5568.47	40	..	II 6262.30	125	150
II 4899.92	400	200	I 5588.34	40	..	I 6266.03	80	..
I 4901.86	50	..	bh 5599.9	50	..	II 6273.76	5	50
II 4920.97	500	400	bh 5600.0	100	..	I 6293.56	30	..
II 4921.78	500	400	bh 5602.4	100	..	II 6296.10	50	150
II 4934.82	150	100	bh 5602.5	200	..	II 6310.93	10	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

LANTHANUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 6315.82	4	25	I 6661.40	70	..	II 7282.34	70	125
II 6320.39	70	100	II 6671.38	10	25	I 7334.17	100	..
I 6325.92	30	..	I 6692.87	50	..	I 7345.31	125	..
II 6390.48	70	100	I 6709.50	150	..	I 8247.44	40	..
I 6394.23	150	..	II 6714.09	4	40	I 8324.69	80	..
II 6399.05	15	200	II 6718.67	3	30	I 8346.53	70	..
I 6410.99	100	..	I 6748.12	25	..	I 8476.48	25	..
II 6443.05	8	25 n	I 6753.02	100	..	I 8545.44	35	..
II 6446.60	15	100	II 6774.23	100	120	I 8672.11	25 w	..
I 6454.53	125	..	II 6813.64	5	25	I 8674.43	50 W	..
I 6455.99	100	..	I 6823.75	50	..	I 8748.38	25	..
I 6468.43	25	..	II 6834.02	25	10	I 8825.82	25 w	..
I 6485.55	50	..	I 6917.22	25	..	I 8957.73	25	..
II 6498.19	25	125	I 6925.21	100	..	I 9079.08	50	..
II 6526.99	125	100	I 6934.99	50	..	I 9412.64	80	..
I 6543.15	125	..	II 6958.08	25	50	I 9438.29	100	..
I 6578.51	100	..	I 7023.67	100 n	..	I 9461.79	50	..
I 6593.47	25	..	I 7032.03	40	..	I 9542.09	40	..
I 6600.17	40	..	I 7045.96	125	..	I 9633.72	40	..
I 6608.26	50	..	II 7066.21	400	150	9640.81	30	..
I 6616.58	125	..	I 7068.36	100	..	I 9737.09	100	..
II 6642.79	10	25	II 7104.7	50	2	I 9881.24	100	..
I 6644.41	40	..	I 7158.05	125	..	I 9920.82	150	..
I 6650.80	100	..	I 7161.25	100	..			

LEAD

2059.63	500 w _r	..	2864.51	..	60	3832.83	..	50
2061.74	8 r	40	2873.32	100 r	60	3841.62	..	60
2088.43	30 r	40 W	II 2948.72	..	125	I 3854.05	..	100
2115.02	30 r	8 w	II 3016.4	..	25	II 3909.17	..	40
I 2169.99	1000 r	1000 r	I 3043.90	..	100	I 3951.94	..	50 n
2175.58	40 w	..	I 3089.09	..	30	II 3971.3	..	(30)
2187.85	50	3	II 3117.7	..	(100)	I 4057.82	2000 r	300 r
II 2203.50	50 w	5000 r	II 3125.6	..	(50)	I 4272.63	..	30
2218.08	50	40	I 3137.83	..	100	4571.35	..	30
2237.43	50 w	30 w	I 3176.54	..	100	II 5042.5	..	(200)
2246.89	30 r	100 r	3220.54	50 n	5	II 5049.3	..	(35)
2253.95	40	5	3232.35	30	..	II 5070.7	..	(40)
2332.43	60	30	3240.19	30 n	..	II 5074.6	..	(40)
2388.77	40	18	I 3242.86	..	40	II 5111.9	..	(40)
2393.79	2500	1000	II 3261.0	..	(50)	II 5155.8	..	(25)
2399.58	35	12	3262.35	20 n	5 n	II 5163.8	..	(25)
2401.95	50	40	3276.19	..	60	II 5367.3	..	(40)
2411.73	75	15	3297.64	..	30	II 5372.1	..	(40)
2443.84	100 w	15	II 3451.7	..	(80)	II 5472.4	..	(25)
2446.18	150 w	15	I 3455.49	..	70	I 5523.5	..	25
2476.38	150 wn	25	II 3463.6	..	(50)	II 5544.6	..	(40)
II 2526.62	..	(100)	3483.39	..	30	II 5608.8	..	(40)
2562.28	..	100	bh 3485.7	30	..	II 5767.9	..	(40)
II 2576.55	..	(100)	3572.73	200	20	II 5876.7	..	(40)
2577.26	100 wn	40	I 3589.92	..	40	6001.88	40 nl	3 n
2613.65	50 r	5	3593.12	..	30	II 6009.7	..	(40)
2614.18	200 r	80	I 3639.58	300	50 n	6011.98	25 nl	..
II 2628.26	50	10	3671.39	..	70	II 6041.4	..	(35 d)
2650.4	100	80	3671.50	50	7	II 6075.8	..	(200)
2663.17	300 wn	40	I 3683.47	300	50	II 6081.5	..	(200)
2802.00	250 rn	100 n	I, II 3689.31	..	40	II 6160.0	..	(50)
2823.19	150 r	40	3739.95	150	60 n	II 6181.9	..	(30)
I 2833.07	500 r	80 r	II 3746.9	..	(30)	II 6229.7	..	(50)
2864.26	..	60	II 3786.00	..	40	II 6311.5	..	(40)

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

LEAD (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 6345.0	..	(25)	II 7050.7	..	(40)	II 8395.6	..	(100)
II 6518.2	..	(35)	II 7193.6	..	(100)	II 8545.0	..	(30)
II 6527.8	..	(25)	7229.11	50	..	II 8710.1	..	(30)
II 6569.4	..	(25)	II 7558.7	..	(100)	II 9050.7	..	(100)
II 6660.0	..	(500)	II 7632.2	..	(100)	II 9063.7	..	(100)
II 6790.8	..	(50)	8272.84	200 wl	..	9604.06	50 Wl	..
II 7013.2	..	(50)	II 8335.0	..	(25)	9674.56	100 Wl	..

LITHIUM

I 2425.68	30 w	..	I 3232.61	1000 r	500	I 4602.86	800	..
I 2475.29	100 w	5	I 3718.7	30	..	I 4971.99	500	..
I 2562.54	150	15	I 3794.72	60	..	I 6103.64	2000 r	300
II 2741.19	..	30	I 3915.0	200 wn	..	I 6240.1	300	..
I 2741.31	200	..	I 3985.79	100	..	I 6707.84	3000 r	200
2899.66	..	60	I 4132.29	400 wn	..	I 8126.52	1000	..
2988.5	..	15	I 4273.28	200 r	100 n			

LUTECIUM

2065.42	..	30 n	2989.27	50	4	4295.95	30	3
2104.40	..	40	3020.54	..	100	4309.57	25	2
2191.37	6	60	3056.72	50	100	4341.98	3	30 nl
2195.54	30	100	3057.90	3	150 n	4430.48	30	2
2236.17	..	150 n	3077.60	100	200	4450.81	40	2
2297.41	15	100	3081.47	80	8	4518.57	300	40
2381.69	..	30 n	3104.98	..	25 nl	4645.47	25 n	2
2392.19	30	100	3118.43	40	5	4648.21	25 n	2
2399.14	10	50	3171.36	40	5	4648.85	25 n	..
2419.21	8	40	3191.80	3	60 nl	4658.02	100	15
2469.27	10	40	3198.12	40	80	4785.42	100	200
2481.72	20	100	3254.31	50	150	4839.62	50	100
2563.52	1	80 n	3278.97	50	5	4904.88	60	5
2571.23	30	100	3281.74	60	5	4942.34	40	3
2578.79	40	125	3312.11	100	10	4994.13	250	400
2613.40	30	100	3359.56	150	15	5001.14	100	..
2615.42	100	250	3376.50	100	10	5135.09	200	20
2619.26	30	100	3385.50	30	4	5349.12	25	2
2657.80	50	150	3396.82	30	1	5402.57	150	10
2685.08	50 n	3	3397.07	50	20 r	5421.90	50	5
2701.71	40	150	3472.48	50	150	5437.88	30	3
2728.95	40	2	3507.39	100	150	5476.69	500	1000
2738.17	2	25 nl	3507.47	30	..	5736.55	150	15
2754.17	40	125	3508.42	30	3	5775.40	50	5
2772.58	5	150 n	3554.43	50	150	5800.59	30	2
2796.63	25	100	3567.84	100	7	5983.59	30	60
2821.23	2	50 nl	3623.99	20	40	5983.80	20	40
2834.35	5	40 n	3636.25	25	3	5984.15	20	40
2845.13	30 n	2	3647.77	100	5	5997.13	50	5
2847.51	40	125	3841.18	100	8	6004.52	400	40
2885.14	40 n	3	3876.63	50	100	6055.03	150 d	10
2894.84	60	200	3968.46	50	..	6159.94	50	200
2900.30	50	150	4054.45	25	3	6199.66	40	125
2911.39	100	300	4124.73	200	10	6221.87	500	1000
2951.69	20	80	4154.08	40	3	6228.14	10	40
2955.78	2	60 nl	4184.25	100	200	6235.36	25	100
2963.32	50	150	4277.50	30	3	6242.34	40	200
2969.82	30	100	4281.03	40	4	6345.35	60	4

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

LUTECIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
6441.14	40	..	6793.77	40	2	8178.16	40	..
6463.12	400	800	6917.31	50	..	8382.08	30	..
6477.67	30	2	7031.24	50	..	8459.19	150	..
6523.18	80	5	7096.34	30	..	8478.50	50	..
6611.28	30	..	7125.84	125	..	8508.08	100	..
6611.58	25	..	7237.98	40	..	8610.98	125	..
6611.71	100	150	7815.91	25	..	9696.03	30	..
6677.14	40	1	7911.62	30	..	9914.92	100	..

MAGNESIUM

II 2329.58	12	..	I 2846.75	18	4	I 3838.26	300	200
II 2449.57	20	..	I 2848.42	20	..	I 3844.97	2	10
I 2632.88	10	4	I 2851.65	25	..	II 3848.24	10	10
I 2649.02	12	..	I 2852.13	300 r	100 r	I 3848.77	2	12
II 2660.75	40	6	2915.52	20	12	I 3878.57	10	..
II 2660.82	40	6	II 2928.75	25	100	3892.12	3	12
I 2668.11	10 n	..	II 2936.54	20	..	I 3895.66	..	15
I 2669.54	12	..	I 2936.89	12	..	I 3904.03	2	12
I 2672.45	20	..	I 2938.54	25	..	I 3938.42	10 w	3
I 2693.71	10	..	I 2942.11	20	2 n	I 3986.73	15 w	3
I 2695.21	10	..	II 2967.87	10	..	I 4057.63	10 w	..
I 2698.14	12	..	II 2971.70	10	..	I 4351.91	15	2
I 2732.08	12	3	3073.99	8	10	II 4390.58	10	..
I 2733.57	25	..	I 3091.08	80	10	4481.16	..	50
I 2736.53	30	3	I 3092.99	125	20	II 4481.33	100	..
2776.69	30	20	I 3096.90	150	25	I 4571.15	20	2
2778.29	25	20	II 3104.71	15	..	bh 5007.3	12	..
2779.83	40	50	II 3104.80	15	..	I 5167.34	100 wn	50
2781.42	20	8	I 3229.37	25	..	I 5172.70	200 wn	100 wn
2782.97	15	15	I 3329.93	80	8	I 5183.62	500 wn	300
II 2790.79	40	80	I 3332.15	100	25	I 5528.46	60	30
II 2795.53	150	300	I 3336.68	125	60	II 6347.06	10	2
II 2798.06	30	80	I 3829.35	100 w	150	I 6545.44	10	2
II 2802.69	150	300	I 3832.31	250	200	I 8806.79	100	..

MANGANESE

2003.82	50 r	25	2315.68	..	25	2437.91	..	25 wn
2012.12	..	30	2318.92	..	30	2452.53	3 n	100 wn
2092.13	30 r	20	2320.45	..	60	2453.17	..	40 wn
2093.39	30 r	18	2328.67	..	25	2458.69	..	80 wn
2097.54	18	30	2328.85	..	30	2460.88	25	3
2106.04	40 r	..	2332.14	..	25	2461.01	25	5
2109.58	40 r	12	2333.26	2	25	2466.21	..	50
2175.56	..	40	2334.94	..	25	2466.42	..	40
2184.88	8	30	2340.59	..	30	2472.89	125	100
2191.39	25	10	2358.45	8	25	2488.14	150	12
2213.82	60 r	10	2361.76	2 n	30	2490.64	125	3
2220.54	..	40 w	2366.91	..	40	2491.16	100	2
2229.97	..	60	II 2373.37	4	50	2518.15	..	40
2231.66	..	70	2374.30	..	30	2520.58	..	25 d
2269.87	2 n	70	2384.05	40	3	2527.44	150	12
2298.95	20 s	40	2387.02	2 n	35	2529.13	80	5 d
2304.99	40	60	2427.41	..	50 wn	2534.15	..	25 d
2308.18	..	25	2427.75	..	50 wn	II 2534.21	..	25
2310.96	25	..	2427.98	..	50 wn	2535.64	..	80
2312.69	..	40	2437.42	..	40 wn	2538.05	..	25

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

MANGANESE (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2541.11	..	80	2674.43	2	25	2937.92	25 Wn	..
2542.92	1	100	2675.51	..	25	2939.30	50	..
2543.45	4	100	2677.85	..	40	2940.39	40 Wn	..
2545.16	..	25	2679.16	..	40	2940.48	40 Wn	..
2548.74	8	150	2681.23	..	50	2941.04	25	1
2551.88	1	100 d	2683.82	..	25	2949.20	100	30
2553.26	..	50	2684.55	2	80	3007.65	40	40
2556.57	10	80 n	2685.94	12 n	100 w	3011.16	25	25
2556.89	3	40	2687.41	25	80 r	3011.37	25	25
2557.54	1	50	2688.25	3	100 n	3016.45	25	25
2558.59	..	80	2689.80	..	40	3022.75	50	25
2559.41	2	50	2690.98	..	25 w	3031.06	8	25
2559.66	..	40 d	2692.66	150	..	3040.60	50	25
2563.65	25	50 wn	2694.09	8	50	3041.22	25	25
2565.22	2	80	2695.36	100 r	50	3042.73	25 r	25
2570.94	..	80	2698.97	..	40	3043.36	40	40
2572.76	200	50	2701.70	150	40 n	3044.57	100 wn	40
2575.51	150	1	2703.99	100 wn	25	3045.59	40	20
II 2576.10	300 r	2000 r	2705.73	25	25 n	3045.81	25	12
2578.91	..	25 wn	2707.53	10	50 n	3047.03	60	60
2579.67	125	1	2708.45	15	50 n	3048.86	25	..
2582.96	..	50	2709.96	..	25	3054.36	75	40
2584.31	150 w	15	2710.33	12	40 n	3062.12	75	20
2588.96	..	80	2710.62	..	25 n	3066.02	75	..
2589.71	10	50 n	2711.58	2	125 n	3070.27	100	25
2592.94	150	3	2713.33	300 Wn	..	3073.13	75	20
II 2593.73	200 r	1000 r	2716.79	1	40	3079.63	125	40
2595.65	..	25	2722.08	1	50 n	3081.33	75	25
2595.76	200	25	2724.45	2	80	3082.05	50	..
2596.83	..	50 r	2725.92	..	50	3097.06	75 w	40
2598.90	5	100 wd	2726.14	300 Wn	..	3100.30	60	60
2602.72	..	80	2728.61	..	50	3101.56	50	50
2603.72	5	50	2738.86	25	..	3110.68	35	35
II 2605.69	100 r	500 r	2760.93	80	..	3115.46	50	25
2610.20	15	100 n	2771.43	25	..	3120.34	50	..
2616.51	..	60	2776.23	80	..	3142.67	50	..
2618.14	50	100 n	2778.56	60	..	3148.18	150	40
2618.91	40	12	2779.99	25	..	3161.04	150	50
2619.51	125	10	2782.73	50	..	3178.49	150	50
2619.98	50	12	2794.82	1000 r	5	3206.91	60	..
2622.90	200	15	2798.27	800 r	80	3212.88	100	100
2624.04	25 l	60	2801.06	600 r	60	3216.95	75	75
2624.80	25	12	2806.14	25	..	3224.76	75	40
2625.58	..	100 n	2809.11	25	..	3226.03	40	20
2626.64	125	5	2813.47	30	1	3228.09	100	100
2629.55	..	35	2815.02	25	75	3230.72	75	75
2630.57	100	15	2817.97	50	1	3233.97	75 wn	..
2632.35	12	80 n	2818.77	25	..	3235.00	30 n	..
2635.60	..	60	2821.45	40	..	3236.78	75	75
2638.17	25	80 n	2828.76	50 wn	..	3237.41	30 n	..
2639.83	12	80 n	2830.79	50	..	3240.40	60	30
2648.04	..	25	2858.66	50	..	3240.62	60	30
2648.94	1	50	2872.58	30	..	3243.78	100	75
2650.99	..	150	2882.90	25	..	3247.54	125	..
2652.48	3	100	2900.55	50	..	3248.52	100	100
2659.08	..	25	2902.20	50	..	3251.13	50	25
2662.54	..	50	2907.22	50	..	3252.95	75	50
2664.03	..	25	2914.60	150 Wn	..	3254.04	50	25
2666.77	8	50 n	2925.57	150 Wn	1 Wn	3256.14	75	50
2667.00	5	50 n	2928.68	25	..	3258.41	75	40
2671.80	..	50	2930.25	25	..	3260.23	75	50
2672.59	15	125 n	2933.06	80	15	3264.71	75	50
2673.37	..	50	2934.02	25	..	3267.79	40	40

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

MANGANESE (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3268.72	30	30	3809.48	150	...	4135.04	50	30
3270.35	30	30	3809.59	150	150	4137.26	40	5
3278.55	60	30	3816.75	60	50	4141.06	50	30
3280.76	60	30	3823.51	75 n	75	4147.53	40	20
3296.88	60	30	3823.89	50 n	50	4148.80	50	30
3298.22	50	25 n	3829.68	60	60	4155.52	40	5
3303.28	40	...	3833.86	75	75	4157.02	40	2 d
3311.90	75	...	3834.36	75 r	75	4176.60	100	40
3313.22	50	...	3839.78	100	125	4189.99	80	40
3314.42	30 n	...	3841.08	50	50	4201.76	40	20
3314.90	35	...	3843.98	75	100	4211.75	30	20
3317.30	100	30 n	3853.47	25	20	4220.61	60	20
3320.69	60	30 n	3856.53	15	30	4235.14	80	...
3330.67	75	...	3889.45	25	50	4235.29	80	100
3343.73	30	...	3894.71	40	40	4239.72	100	50
II 3441.99	75	75	3898.36	30	...	4257.66	100	40
II 3460.33	60	500	3899.33	12	25	4265.92	100	50
II 3474.13	12	400	3918.31	40	50	4281.10	100	50
II 3482.91	50	250	3926.47	40	50 l	4284.08	80	20
3488.68	50	200	3929.24	30	30	4300.20	60	5
II 3495.84	25	150	3929.65	12	25	4305.66	50	...
II 3496.81	10	30	3936.76	25	50	4312.55	100	20
II 3497.54	15	150	3942.85	75	75	4321.16	60	5
3531.85	40 r	30 r	3951.96	40	50	4323.40	50	...
3531.99	50 n	8	3952.84	60	75	4326.76	80	30
3532.12	50 n	30	3975.89	40	50	4337.42	80	...
3547.80	40 n	15	3977.08	50	100	4343.97	100	30
3548.03	40 n	15	3982.17	12	25	4359.80	25	...
3548.20	40 n	40	3982.58	20	30	4365.24	25	5
3569.49	25 n	8	3982.91	20	30	4368.88	50	...
3577.88	50	25	3985.24	75	100	4370.87	30	...
3586.54	50 n	40	3986.83	40	75	4374.95	150	20
3595.12	50	25	3987.10	30	60	4381.70	80	20
3607.54	75	40	3991.60	20	25	4382.63	80 n	...
3608.49	60	40	3992.49	40	75	4388.08	60	...
3610.30	60	40	3997.21	12	25	4389.75	50	...
3619.28	75	50	4018.10	80	60	4408.08	60	5
3623.79	75	40	4026.43	50	40	4410.49	50	...
3629.74	100	30	I 4030.75	500 r	20	4411.88	100	20
3641.39	50	50 n	I 4033.07	400 r	20	4414.88	150	60
3660.40	75	75	I 4034.49	250 r	20	4419.78	100	20
3669.84	30	30	4035.73	50	60	4436.35	80	50
3670.52	25	15	4041.36	100	50	4447.15	60	...
3676.96	60	100	4048.75	60	60	4451.59	125	100
3682.09	25	40	4055.54	80	80	4453.00	50	20
3892.81	50	50	4057.95	80	20	4455.01	25	10
3693.67	50	60	4058.93	80	60	4455.32	25	15
3696.57	100	50	4061.74	80	30	4455.82	25	15
3701.73	60	30	4063.53	100	60	4458.26	25	20
3706.08	75	...	4068.00	50	20	4461.08	30	25
3718.93	75	100	4070.28	80	30	4462.02	40	60
3728.89	75	100	4075.25	25	5	4464.68	60	50
3731.93	75	100	4079.24	50	40	4470.14	80	40
3736.90	25	25	4079.42	50	40	4472.79	100	25
3746.62	25	25	4082.94	80	60	4479.40	60	...
3750.76	60	30	4083.63	80	60	4490.08	100	25
3763.38	20 s	20	4089.94	80	20	4491.65	50	5
3763.80	40	25	4092.39	30	20	4496.63	40	5
3776.53	25	25	4102.96	100	20	4498.90	150	40
3790.21	100	125	4105.36	50	20	4502.22	125	40
3799.26	50	50	4110.90	80 r	40	4503.87	60	5
3800.55	60	60	4113.24	40	20	4523.39	50	...
3806.72	50 n	20	4131.12	50	40	4529.79	50	...

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

MANGANESE (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4534.46	30	..	5117.94	30	..	6887.75	30	..
4538.46	40	..	5150.80	40	..	6942.52	100 n	..
4542.44	80	5	5196.59	30	..	6989.81	80	..
4544.41	60	5	5255.32	50	..	7069.84	60	..
4548.58	80	5	II 5295.29	..	(30)	7151.28	30 n	..
4575.41	50	..	II 5296.97	..	(40)	7184.25	40	..
4579.67	50	..	II 5299.28	..	(50)	7247.82	40	..
4581.83	125	..	II 5302.32	..	(60)	7283.81	400 n	..
4586.11	30 l	..	5341.06	200	100	7302.89	300 n	..
4605.36	150	15	5377.63	40	..	I 7326.51	500	..
4607.62	50	..	5394.67	50	..	I 7680.20	200	..
4626.54	80	15	5399.49	40	..	I 7712.42	100 n	..
4627.74	50	..	5407.42	60	..	I 7733.24	60 nl	..
4642.81	50	..	5413.69	30	..	I 7764.72	200 n	..
4645.03	40	..	5420.36	60	..	8212.43	50 n	..
4658.78	25	..	5432.55	40	..	8380.77	25	..
4671.69	100	5	5457.47	25	..	I 8654.63	40 n	..
4701.16	100	5	5470.64	50	..	I 8670.92	60 wl	..
4709.71	150	15	5481.40	50	..	I 8672.06	80 w	..
4727.48	150	20	5505.87	40	..	I 8673.97	100 w	..
4739.11	150	15	5516.77	50	..	I 8699.13	100 w	..
4754.04	400	60	5537.76	40	..	I 8701.05	150 w	..
4761.53	60	15	6013.50	100 n	5	I 8703.76	200 w	..
4762.38	100	40	6016.64	80 n	5	I 8734.60	30	..
4765.86	60	25	6021.80	80 n	5	I 8737.32	150 w	..
4766.43	80	30	II 6122.44	..	(80)	I 8740.93	500 W	..
4774.09	50	..	II 6125.85	..	(50)	I 8929.72	50 n	..
4783.42	400	60	II 6128.72	..	(40)	I 9084.29	30	..
4797.70	25	..	II 6130.79	..	(30)	I 9114.02	40	..
4823.52	400	80	6384.67	25	..	I 9172.09	100	..
4838.24	50	..	6413.95	25	..	I 9243.29	150	..
4840.15	50	..	6440.97	60	..	I 9336.47	40 n	..
4844.31	80	5	6491.71	100	..	I 9429.58	30 n	..
4854.81	30	5	6605.53	30 n	..	I 9444.90	40	..
4862.05	40	5	6691.58	25	..	I 9608.56	100	..
4934.15	25	5	6833.92	40	..	I 9676.50	40	..
4965.88	50	2						

MERCURY

2022.19	..	(30)	I 2655.12	80	40	I 3023.48	60	10 n
II 2026.97	..	(100)	I 2698.85	25	30	I 3027.50	25	15
II 2052.93	..	(100)	I 2699.50	25	(5)	3035.10	..	(30)
II 2148.00	..	(60)	II 2705.36	..	(30)	II 3090.66	..	(200)
II 2224.71	..	(30)	I 2752.77	100 r	50	II 3116.24	..	(100)
II 2252.78	..	(50)	2752.84	40	10 n	I 3125.66	200	150
II 2260.26	..	(200)	2761.97	..	(40)	I 3131.55	400	300
II 2262.23	..	(100)	II 2814.93	..	(200)	I 3131.83	200	100
II 2345.55	10	30	II 2847.67	..	(300)	II 3191.03	..	(100)
II 2407.35	..	(25 n)	I 2847.83	15	100	II 3252.21	..	(30)
II 2414.13	..	(25 n)	I 2893.59	40	50	II 3264.06	..	(200)
2480.62	..	(40)	II 2909.36	..	(25)	II 3277.87	..	(50)
I 2482.01	30	5	II 2916.27	..	(30)	I 3341.48	100	100
I 2482.72	25	10	I 2925.41	60	50	II 3385.25	..	(200)
I 2483.83	30	5 n	II 2947.08	..	(25)	3390.06	..	50 wn
I 2534.77	30	30	II 2955.13	..	(100)	II 3451.69	..	(200)
I 2536.52	2000 r	1000 r	2967.28	100 w	100	3473.01	..	(30)
2552.87	..	(25)	2975.19	..	(50)	3492.77	..	(50)
2574.86	..	(25)	3004.47	..	(30)	II 3493.85	..	(100)
I 2652.04	100	60	II 3006.57	..	(50)	II 3524.19	..	(100)
I 2653.68	80	40	I 3021.50	80	40	3532.63	..	(200)

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

MERCURY (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3543.08	..	40	4103.87	..	(50)	II 5128.45	..	(150)
II 3549.42	..	(200)	II 4115.41	..	(50)	5146.26	..	(30)
3578.75	..	(40)	II 4120.6	..	(50)	5204.78	..	(40)
II 3604.09	..	(50)	4124.07	..	(30)	5210.79	..	(60)
II 3605.80	..	(200)	4140.38	..	(200)	II 5222.81	..	(80)
3606.92	..	(30)	4156.68	..	(50)	I 5354.05	..	(30 wn)
3613.61	..	(40)	4178.02	..	(50 n)	II 5425.25	..	(200)
3618.53	..	(50)	4180.95	..	(100)	I 5460.74	..	(2000)
3630.65	..	(100)	4206.10	..	(30)	I 5675.86	..	(80)
3638.34	..	(100)	4212.22	..	(30)	II 5677.17	..	(300)
3644.32	..	(40)	II 4212.53	..	(50)	I 5769.59	600	200
I 3650.15	200	500	4216.72	..	(50 n)	I 5789.66	..	(500)
I 3654.83	..	(200)	4227.29	..	(100)	I 5790.65	..	(1000)
I 3662.88	50	400	4227.87	..	(70)	I 5803.65	..	(70)
I 3663.28	500	400	4261.88	..	(70)	I 5859.38	..	(30)
I 3680.01	..	(40)	I 4339.23	150	20	II 5871.73	..	(40)
3774.52	..	(30)	I 4347.50	200	50	5890.16	..	(40)
II 3776.26	..	(30)	I 4358.35	3000 w	500	II 6089.79	..	(25)
II 3806.38	..	(200)	4376.19	..	(50)	6100.36	..	(25)
3826.61	..	(30)	II 4398.62	..	(300)	II 6149.50	..	(200)
3839.26	..	(50)	4402.06	..	(50)	II 6291.26	..	(50)
3845.15	..	(30)	II 4404.86	..	(50)	II 6394.94	..	(25)
3874.98	..	(30 n)	II 4425.22	..	(30)	6418.95	..	(25)
I 3906.41	25	15	4454.33	..	(30)	II 6715.2	..	(25)
II 3914.29	..	(100)	II 4455.49	..	(30)	I 6716.17	..	(80)
II 3918.92	..	(200)	4487.48	..	(300)	I 6888.74	..	(25)
3925.65	..	(100)	II 4492.81	..	(30)	I 6907.16	..	(125)
3942.24	..	(100)	II 4552.89	..	(30)	II 6938.1	..	(25)
3942.59	..	(100)	4630.14	..	(30)	I 7081.88	..	(125)
3945.09	..	(100)	II 4660.28	..	(200)	I 7091.99	..	(100)
3948.29	..	(100)	II 4704.63	..	(200)	7301.68	..	(25)
3960.24	..	(30)	II 4762.22	..	(100)	II 7346.37	..	(1000)
3968.03	..	(50)	4797.01	..	(300)	I 7371.71	..	(80)
II 3983.98	..	(400)	4825.62	..	(70)	II 7418.1	..	(40)
4006.27	..	(30)	II 4855.72	..	(100)	I 7454.33	..	(50)
I 4046.56	200	300	I 4916.04	..	(50)	I 7978.70	..	(70)
I 4077.81	150	150	4980.57	..	(70)			

MOLYBDENUM

2015.11	12	40	2481.81	50 n	..	2636.67	25	150
2020.30	20	50 r	2506.19	..	40 n	2638.76	20	125
2273.26	..	100	2524.81	40 n	..	2640.99	40 n	40 wn
2294.96	..	50	2533.45	30	125	2644.35	30	60
2304.25	7	50	2540.45	40 n	1	2646.49	25	100
2332.12	8	80	2555.42	3	50	2653.35	25	150
2340.47	30	50	2564.34	3	40	2655.03	50 n	8
2341.59	9	60	2567.05	40 n	3	2658.11	40	5
2359.73	..	40	2572.34	60 n	10	2660.58	25	125
2401.93	10	40	2578.90	2	60	2671.83	1	100
2407.13	3	40	2591.97	40	1	2672.84	15	100
2410.09	..	60 n	2593.70	20	40	2673.27	1	100
2419.01	3	40	2602.80	25	100	2681.36	10	100
2420.18	1	40	2607.37	50 n	5	2683.23	20	150
2422.18	2	60	2609.22	..	40 wn	2684.14	40	150
2423.99	6	40	2613.08	40 n	20	2687.99	30	100
2435.96	10	50 n	2619.34	20	40	2692.61	2	40
2437.74	10	80 W	2621.07	40 n	1	2695.22	5	40
2457.77	10	60	2628.74	40	2	2696.83	1	40
2471.97	50 n	2	2629.85	50	6	2701.42	20	100
2477.57	2	50	2630.73	5	40	2704.93	1	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

MOLYBDENUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2712.35	1	40	3023.30	5	100	3289.01	40	30
2713.51	20	40	3025.00	50	4	3290.82	40	100
2717.35	20	100	3041.70	40	5	3292.31	10	300
2726.97	10	100	3046.80	50	2	3297.68	1	60
2729.68	15	60	3047.31	50	4	3305.56	40	30
2730.20	2	60	3052.32	10	50	3307.43	..	50
2738.60	1	40	3055.32	50	5	3312.94	1	50
2750.03	2	50	3061.59	50	3	3313.62	5	50
2751.47	50	5	3064.28	80	10	3320.90	3	80
2756.07	10	50 n	3067.64	10	50	3323.95	40	25
2761.53	40	20	3070.89	40	3	3325.23	..	40
2763.62	25	50 n	3074.37	60	15	3325.67	50	25
2769.76	10	100	3077.66	20	125	3327.30	40	20
2774.39	30	50 n	3079.88	40	3	3329.21	2	100
2775.40	80	100 n	3080.41	60	6	3332.52	..	80
2780.04	60	100 n	3082.22	4	40	3344.75	50	40
2784.99	100	200	3085.61	125	25	3346.40	2	50
2787.83	40	4	3087.82	30	200	3347.02	40	4
2807.75	60	80 n	3089.71	40	5	3358.12	60 W	30
II 2816.15	200	300 n	3092.07	30	100	3363.78	40	30
2826.54	40	5	3094.66	150	25	3367.97	2	100
2827.74	8	40	3100.87	40	2	3402.81	5 d	100
2834.39	20	40	3101.34	80	10	3434.79	50	12
2835.33	20	40	3112.12	40	10	3435.40	..	60 n
2842.15	2	40	3116.09	1	60	3446.08	1	40 n
II 2848.23	125	200 n	3121.99	5	150	3524.65	5	50 n
2849.38	50	5	3132.59	1000 r	300 r	3537.09	..	50
2850.67	1	40	3136.41	..	40	3544.62	40 n	2
2853.23	25	100 n	3136.46	1	40	3614.25	50 d	30
2863.81	30	100 n	3144.61	3	45	3623.70	..	50
2864.31	40	2	3151.63	2	40	3635.14	100 n	10
2864.66	40	3	3152.82	6	80	3651.11	2	50
II 2871.51	100	100 n	3155.64	..	50	3664.81	20	40
2872.88	2	50	3158.16	300 r	30 r	3688.31	4	150
2874.85	2	60	3170.35	1000 r	25 r	3692.64	3	150
2879.05	15	100 n	3172.74	3	50	3694.94	40	30
2888.15	1	40	3175.05	2	60	3702.55	10	150
II 2890.99	30	50 n	3176.33	..	50	3713.96	..	40
2894.45	50	80 n	3187.59	1	50	3720.25	10	40
2900.79	2	40	3192.10	3	50	3744.37	20	80
2903.07	20	100 n	3193.97	1000 r	50 r	3746.41	..	40 w
II 2909.12	25	40 n	3195.96	12	50	3748.13	1	50
2911.91	30	50 n	3208.83	150 r	60	3751.20	6	40 d
2913.81	1	50 w	3214.44	20	50	3755.54	1	50
2926.22	..	40	3216.07	..	50	3782.07	..	100
2927.54	3	40	3222.90	..	40	3783.18	..	40
2930.50	25	50 n	3228.21	40	25	3786.36	2	125
2934.30	30	50 n	3229.71	..	50	I 3798.25	1000 r	1000 r
2940.10	2	40	3233.14	50	30	3828.87	40	30
2941.22	2	40	3237.07	40	25	3833.75	80	25
2944.82	2	50 n	3238.40	..	40	3837.29	..	100 w
2946.01	20	40	3240.71	3	60	3857.20	..	60
2963.79	10	40	3250.75	2	100	I 3864.11	1000 r	500 r
2965.27	8	40	3253.78	1 d	50 d	3871.45	..	50
2971.91	2	40	3254.68	8	50	I 3902.96	1000 r	500 r
2972.61	20	50	3255.25	..	40	3915.44	6	50
2986.16	4	50	3256.21	40	25	3941.48	5	150
3002.21	40	3	3266.89	..	40	3961.50	5	500
3004.46	5	40	3270.90	50	25	3968.75	8	50
3013.76	100 n	5	3271.67	..	60	4013.21	1	40
3014.16	5	50	3276.34	2	40	4062.07	80	80
3018.55	1	100	3278.88	1	50	4081.44	50	50
3021.62	..	40	3284.62	..	40	4084.38	40	40

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

MOLYBDENUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4107.47	30	40	4576.50	40	40	5533.05	200	100
4119.63	5	50	4595.16	40	40	5570.45	200	100
4120.10	25	50	4609.88	40	40	5632.47	100	50
4122.39	15	50	4626.47	100	80	5650.13	90	50
4125.62	..	50	4627.47	80	80	5689.14	80 l	40
4128.28	50	25	4662.76	40	40	5705.72	40	40
4128.83	40	40	4707.25	125	125	5722.73	80	60
4143.55	100	100	4717.92	50	50	5751.40	125	100
4148.94	40	25	4731.44	100	100	5791.85	100	60
4185.82	40	40	4758.50	40	40	5848.86	50 n	..
4188.32	100	80	4760.19	125	125	5849.73	70 n	10 n
4192.29	..	40	4764.42	50	50	5851.52	40 n	20 n
4209.65	4	80	4776.34	40	40	5858.27	200	200
4232.59	125	100	4782.94	40	40	5869.33	50	..
4241.80	4	80	4792.74	40	30	5888.33	150	100
4250.69	5	125	4796.52	40	40	5889.98	50 n	..
4251.87	60	60	4811.06	50	50	5893.38	70 n	15
4279.02	8	100	4819.25	80	60	5926.36	70 n	20
4284.60	125 n	80 n	4830.51	125	100	5928.88	100 n	..
4288.64	80	100	4868.00	50	40	6030.66	300	125
4292.13	100	80	4903.81	80	30	6101.87	40	4
4293.21	125	100	4941.66	40	25	6357.21	40	10
4311.65	2	40	4950.62	80	30	6424.37	100	20
4326.14	50	40	4957.54	60	25	6471.20	50	4
4326.74	50	50	4977.69	50	3	6619.13	300	15
4350.34	50	40	4979.11	100	30	6650.37	80	6
4358.32	..	40	4999.91	50	25	6707.85	300 W	..
4363.64	5	200	5059.88	40	20	6733.98	100	4
4369.04	40	25	5097.52	40	20	6746.27	50	3
4377.76	5	200	5172.94	70 n	25 n	6828.98	50	..
4381.64	150	150	5174.18	70 n	25 n	6914.01	40	..
4423.62	40	40	5200.17	40	20	7109.87	80	..
4433.50	4	125	5238.20	80 n	30 n	7134.08	40	..
4434.95	80	80	5240.88	80 n	40 n	7242.50	80	..
4442.20	40	30	5242.81	50 n	20 n	7245.85	60	..
4449.74	40	40	5259.04	60	20	7287.62	40	..
4457.36	50	50	5280.86	50	25	7391.36	50	..
4474.56	125	125	5360.56	100 n	70 n	7485.74	100	..
4474.65	80	..	5364.28	70 n	25 n	7720.77	50	..
4491.28	40	30	5473.37	50	25	8328.44	100	..
4519.59	..	40	5506.49	200 r	100	8389.32	150	..
4536.50	40	80						

NEODYMIUM

2993.18	40	2	3824.79	40	30	3865.98	35	30
3134.90	40	30	3826.91	40 w	25 w	3905.89	40	30
3382.81	200	10	3828.17	50	40	3918.05	40	6
3555.72	100	15	3829.41	50	40	3920.96	40	15
3563.40	50	10	3829.63	40	30	3927.11	80	50 s
3590.35	400 W	300 W	3831.03	60 d	30	3934.82	60	30
3661.34	40	25	3833.03	60	30	3941.51	60	30
3735.60	10	50	3836.11	40	15	3951.15	40	30
3769.64	100	20	3836.54	80	100	3953.52	60	60
3778.14	40	40	3838.33	40	25	3957.46	60	40 s
3787.16	60 d	50	3838.72	50	25	3973.27	40	25
3801.37	60	40	3842.99	30	40	3975.20	40	30
3805.36	50	30	3847.85	60	50	3976.84	40	30
3817.67	40	40	3848.31	40	..	3979.48	40	30
3820.43	..	40	3852.38	60	50	3990.10	40	20
3821.77	50 w	40 w	3853.48	40	20	3991.74	60	40

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

NEODYMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3994.68	80	40	4542.05	50	5	4896.93	60	..
3998.69	40	15	4542.60	50	5	4901.85	35	..
4012.25	80	40	4559.67	40	..	4913.42	60	..
4040.80	40	40	4560.42	50	3	4920.69	60	..
4061.08	40	30	4563.22	50	4	4924.53	80	..
4123.88	40	20	4586.61	50	..	4944.83	50	..
4175.61	40	10	4621.94	40	..	4954.78	50	..
4232.38	40	15	4634.23	50	..	4959.13	35	..
4247.37	50	20	4641.10	80	..	4989.94	35	..
4256.48	40	20	4646.40	50	..	5130.60	40	2
4267.49	..	200 wn	4646.69	60	4	5191.45	40	..
4303.57	100	40	4649.67	40	..	5192.62	40	..
4325.77	100	30	4674.59	50	10	5234.19	50	..
4338.70	40	15	4680.73	50	1	5249.58	60	2
4358.17	50	20	4683.44	50	..	5255.51	50	3
4368.63	50	15	4684.04	40	..	5293.17	60	4
4385.66	40	20	4706.54	50	5	5319.82	60	2
4400.83	50	20	4706.96	40	..	5594.42	150	5
4411.05	50	20	4717.08	40	..	5620.54	200	5
4412.26	40	15	4719.03	50	..	5669.77	40	..
4424.34	50	50	4731.78	40	..	5688.52	150	..
4446.39	100	50	4749.75	40	..	5706.21	40	..
4451.57	100	50	4789.43	40	..	5708.28	60	..
4451.98	50	20	4811.34	60	60	5718.12	35	1
4462.98	60	20	4820.34	40	..	5740.86	35	..
4501.81	50	8	4825.48	100	8	5742.09	40	..
4506.58	50	3	4859.03	60	60	5804.02	100	..
4511.82	50	10	4866.73	35	..	6244.08	35	..
4516.35	40	3	4883.81	60	..	6310.49	50	..
4529.93	40	..	4891.06	40	..	6385.20	100	..
4541.27	50	4						

NEON

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
2595.21	..	50	I 2980.92	..	50	I 3351.74	..	25
I 2613.59	..	30	I 2982.66	..	250	II 3355.05	..	40
I 2616.62	..	25	I 2992.44	..	150	II 3367.20	..	25
I 2635.98	..	25	II 3001.65	..	25	I 3369.81	..	500
2645.51	..	50	I 3012.13	..	50	I 3369.91	..	700
I 2645.70	..	35	I 3012.95	..	50	I 3375.65	..	50
I 2647.42	..	150	I, II 3017.35	..	50	II 3388.46	..	25
I 2648.56	..	25	I 3030.31	..	50	I 3417.90	..	500
2651.01	..	50	II 3047.57	..	25	I 3418.01	..	50
I 2675.24	..	150	I 3057.39	..	250	I 3423.91	..	50
I 2675.64	..	150	I 3063.69	..	150	I 3447.70	..	150
II 2792.05	..	25	I 3076.97	..	150	I 3450.76	..	50
I 2795.10	..	35	I 3078.87	..	75	I 3454.19	..	75
I 2872.66	..	35	I 3079.17	..	75	I 3460.52	..	75
I 2911.46	..	25	I 3126.19	..	150	I 3464.34	..	75
I 2913.17	..	150	I 3147.70	..	25	I 3466.58	..	150
I 2932.72	..	75	I 3148.60	..	75	I 3472.57	..	500
I 2947.30	..	150	I 3153.40	..	50	II 3481.96	..	25
II 2955.73	..	40	I 3167.57	..	50	I 3498.06	..	75
I 2974.71	..	250	II 3218.21	..	75	I 3501.22	..	150
I 2975.52	..	35	II 3297.74	..	40	I 3510.72	..	50
I 2979.81	..	50	II 3323.75	..	40	I 3515.19	..	150
I 2980.64	..	40	II 3334.87	..	250	I 3520.47	..	1000

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

NEON (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 3542.90	..	40	II 4397.94	..	100	I 4593.24	..	50
II 3568.53	..	25	II 4409.30	..	150	I 4595.25	..	50
I 3593.53	..	500	II 4413.20	..	50	I 4609.36	..	30
I 3593.64	..	250	I, II 4416.82	..	50	I 4609.91	..	150
I 3600.17	..	75	II 4421.38	..	30	I 4614.39	..	100
I 3609.18	..	50	I 4421.56	..	50	II 4615.98	..	50
I 3633.66	..	75	I 4422.52	..	300	I 4617.84	..	70
II 3664.11	..	250	I 4424.80	..	300	I 4628.31	..	150
I 3682.24	..	75	I 4425.40	..	150	I 4628.46	..	30
I 3685.74	..	75	I 4427.75	..	30	I 4636.12	..	70
II 3694.20	..	250	II 4428.54	..	100	I 4636.63	..	70
II 3701.22	..	40	II 4430.90	..	50	I 4636.97	..	50
II 3709.64	..	40	I 4433.72	..	70	I 4639.59	..	30
II 3713.08	..	250	II 4439.30	..	30	I 4640.44	..	70
II 3727.08	..	125	II 4442.67	..	30	I 4644.83	..	40
II 3734.94	..	40	I 4444.98	..	30	I 4645.42	..	300
I 3754.22	..	50	II 4446.46	..	30	I 4649.90	..	70
II 3766.29	..	75	II 4456.95	..	70	I 4652.10	..	30
II 3777.16	..	75	I 4460.17	..	100	I 4653.70	..	50
II 3818.44	..	25	I 4465.65	..	50	I 4656.39	..	300
II 3829.77	..	40	I 4466.81	..	70	I 4661.10	..	150
I 4042.64	..	50	II 4468.91	..	70	I 4663.09	..	40
II 4062.90	..	30	II 4471.52	..	30	I 4666.65	..	50
I 4064.04	..	50	I 4475.66	..	100	I 4667.36	..	100
I 4068.83	..	30	I 4483.19	..	150	I 4669.02	..	50
I 4069.24	..	30	I 4488.09	..	300	I 4670.88	..	70
II 4080.15	..	50	I 4491.77	..	80	I 4678.22	..	300
II 4098.77	..	50	I 4491.84	..	50	I 4678.60	..	50
I 4128.07	..	30	I 4492.41	..	30	I 4679.13	..	150
I 4131.05	..	70	I 4493.70	..	50	I 4680.36	..	100
II 4133.65	..	30	I 4500.18	..	50	I 4681.20	..	50
II 4150.67	..	30	II 4508.21	..	30	I 4683.76	..	30
I 4164.80	..	50	II 4511.37	..	50	I 4687.67	..	100
I 4166.09	..	30	I 4514.89	..	70	I 4702.53	..	150
I 4174.37	..	70	I 4515.41	..	30	I 4704.39	..	1500
I 4175.22	..	60	I 4516.94	..	50	I 4708.85	..	1200
I 4175.49	..	40	I, II 4517.74	..	100	I, II 4710.06	..	1000
I 4198.10	..	70	II 4522.66	..	50	I 4710.48	..	30
II 4217.15	..	30	I 4525.76	..	30	I 4712.06	..	1000
II 4219.76	..	100	I 4526.18	..	50	I 4713.13	..	100
II 4231.60	..	50	I 4529.48	..	30	I 4714.34	..	70
I 4233.86	..	30	II 4535.47	..	30	I 4715.13	..	30
II 4250.68	..	50	I 4536.31	..	150	I 4715.25	..	30
II 4257.82	..	30	I 4537.68	..	300	I 4715.34	..	1500
I 4268.01	..	70	I 4537.75	..	1000	I 4717.61	..	70
I 4269.72	..	70	I 4538.31	..	300	I 4721.54	..	70
I 4270.23	..	50	I 4539.17	..	50	I 4725.14	..	70
I 4274.66	..	50	I 4540.38	..	50	I 4749.57	..	300
I 4275.56	..	70	I 4544.50	..	50	I 4750.69	..	30
II 4290.40	..	100	I 4552.60	..	30	I 4751.80	..	30
I 4303.25	..	30	II 4553.16	..	50	I 4752.73	..	1000
I 4306.24	..	70	I 4554.82	..	40	I 4754.44	..	100
I 4314.69	..	30	I 4555.39	..	30	I 4758.73	..	150
I 4334.12	..	70	I 4565.89	..	60	I 4780.34	..	50
I 4336.22	..	50	I 4566.83	..	40	I 4780.88	..	30
I 4362.69	..	30	II 4569.01	..	70	I 4788.93	..	300
I 4363.52	..	70	I 4573.56	..	50	I 4789.60	..	100
II 4369.77	..	70	I 4573.76	..	30	I 4790.22	..	50
I 4372.16	..	30	I 4575.06	..	300	I 4790.73	..	30
II 4379.50	..	100	II 4580.35	..	30	I 4810.06	..	150
I 4381.22	..	30	I 4582.03	..	150	I 4810.63	..	100
II 4391.94	..	150	I 4582.45	..	150	I 4814.34	..	50
I 4395.56	..	50	II 4588.13	..	30	I 4817.64	..	300

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

NEON (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 4818.79	..	150	I 5191.33	..	35	I 5811.42	..	300
I 4819.94	..	70	5193.13	..	150	I 5816.64	..	50
I 4821.92	..	300	I 5193.22	..	150	I 5820.15	..	500
I 4823.17	..	100	I 5203.89	..	150	I 5828.91	..	75
I 4823.37	..	50	I 5208.86	..	70	I 5852.49	..	2000
I 4825.53	..	50	I 5210.57	..	50	I 5868.42	..	75
I 4827.34	..	1000	I 5214.34	..	35	I 5872.15	..	75
I 4827.59	..	300	I 5222.35	..	50	5872.83	..	35
I 4837.31	..	500	I 5234.03	..	50	I 5881.89	..	1000
I 4842.94	..	50	I 5274.04	..	40	I 5902.46	..	50
I 4849.53	..	30	I 5280.07	..	50	I 5906.43	..	50
I 4851.50	..	60	I 5298.19	..	150	I 5913.63	..	250
I 4852.65	..	100	I 5304.76	..	70	I 5918.91	..	250
I 4863.08	..	100	I 5314.78	..	30	I 5922.71	..	25
I 4864.35	..	30	I 5316.81	..	25	I 5934.46	..	75
I 4865.50	..	100	I 5326.40	..	75	I 5939.32	..	50
I 4866.48	..	80	I 5330.78	..	600	I 5944.83	..	500
I 4867.01	..	70	I 5333.32	..	50	I 5961.63	..	70
I 4868.27	..	70	I 5341.09	..	1000	I 5965.47	..	500
I 4884.91	..	1000	I 5343.28	..	600	I 5966.17	..	35
I 4885.08	..	100	I 5349.21	..	150	I 5974.63	..	500
I 4892.09	..	500	I 5355.18	..	150	I 5975.53	..	600
I 4897.92	..	70	I 5355.42	..	150	I 5987.91	..	150
I 4899.01	..	50	I 5360.01	..	150	I 5991.67	..	75
I 4928.23	..	70	I 5360.44	..	35	I 6000.95	..	100
I 4830.94	..	50	I 5362.25	..	25	I 6029.99	..	1000
I 4939.04	..	100	I 5366.22	..	25	I 6046.16	..	50
I 4944.99	..	100	I 5372.31	..	75	I 6064.55	..	50
I 4955.38	..	150	I 5374.97	..	50	I 6074.34	..	1000
I 4957.03	..	1000	I 5383.26	..	25	I 6096.16	..	300
I 4957.12	..	150	I 5400.56	..	2000	I 6128.45	..	100
I 4973.54	..	100	I 5412.65	..	250	I 6142.51	..	100
I 4974.76	..	50	I 5418.55	..	150	I 6143.06	..	1000
I 4994.93	..	150	I 5420.15	..	50	I 6150.30	..	100
I 5005.16	..	500	I 5433.65	..	250	6154.09	..	70 w
I 5005.33	..	50	I 5448.51	..	150	I 6156.14	..	50
I 5011.00	..	25	I 5494.41	..	50	I 6163.59	..	1000
I 5022.87	..	25	I 5507.34	..	25	I 6174.89	..	70
I 5031.35	..	250	I 5533.68	..	75	I 6175.29	..	50
I 5035.99	..	35	I 5538.64	..	50	I 6182.15	..	150
I 5037.75	..	500	I 5559.09	..	35	I 6189.08	..	70
I 5052.93	..	25	I 5562.44	..	150	I 6193.08	..	50
I 5074.20	..	35	I 5562.77	..	500	I 6205.79	..	100
I 5076.58	..	35	I 5563.05	..	75	I 6213.88	..	150
I 5080.38	..	150	I 5576.05	..	35	I 6217.28	..	1000
I 5083.97	..	25	I 5589.38	..	50	I 6225.74	..	50
I 5099.04	..	25	I 5652.57	..	75	I 6246.73	..	100
I 5104.70	..	35	I 5656.03	..	75	I 6258.80	..	100
I 5113.67	..	75	I 5656.66	..	500	I 6266.49	..	1000
I 5116.50	..	150	I 5662.55	..	75	I 6273.01	..	70
I 5117.01	..	35	I 5684.65	..	25	I 6276.04	..	50
I 5120.51	..	25	I 5689.82	..	150	I 6293.77	..	100
I 5122.26	..	150	I 5715.34	..	35	I 6304.79	..	100
I 5122.34	..	150	I 5718.90	..	150	I 6313.69	..	150
I 5144.94	..	500	I 5719.22	..	500	I 6328.17	..	300
I 5145.01	..	500	I 5719.53	..	75	I 6330.90	..	150
I 5145.12	..	35	I 5748.30	..	500	I 6334.43	..	1000
I 5150.08	..	35	I 5748.65	..	70	I 6351.87	..	100
I 5151.96	..	75	I 5760.58	..	70	I 6365.01	..	100
I 5154.42	..	50	I 5764.42	..	700	I 6382.99	..	1000
I 5156.66	..	50	I 5770.31	..	50	I 6401.08	..	100
I 5158.89	..	50	I 5804.10	..	75	I 6402.25	..	2000
I 5188.61	..	150	I 5804.45	..	500	I 6409.75	..	150

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

NEON (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 6421.71	..	100	I 8128.93	..	60	I 8780.62	..	1000
I 6444.72	..	150	I 8136.41	..	300	I 8782.01	..	50
I 6506.53	..	1000	I 8248.70	..	30	I 8783.75	..	1000
I 6532.88	..	100	I 8259.38	..	150	I 8792.51	..	30
I 6598.95	..	1000	I 8266.08	..	200	I 8830.92	..	50
I 6602.91	..	100	I 8267.11	..	80	I 8853.87	..	700
I 6652.09	..	150	I 8300.33	..	600	I 8865.33	..	100
I 6666.89	..	100	I 8301.54	..	150	I 8865.76	..	500
I 6678.28	..	500	I 8365.75	..	150	I 8919.50	..	300
I 6717.04	..	70	I 8376.41	..	200	I 8988.58	..	200
I 6738.06	..	70	I 8377.61	..	800	I 9148.68	..	600
I 6929.47	..	1000	I 8417.18	..	100	I 9201.76	..	600
I 7024.05	..	500	I 8418.43	..	400	I 9220.05	..	400
I 7032.41	..	1000	I 8463.37	..	150	I 9221.59	..	200
I 7051.29	..	70	I 8484.45	..	80	I 9226.67	..	200
I 7059.11	..	200	I 8495.36	..	500	I 9275.53	..	100
I 7138.70	..	30	I 8544.70	..	60	I 9300.85	..	600
I 7173.94	..	1000	I 8571.36	..	100	I 9310.58	..	150
I 7245.16	..	1000	I 8582.91	..	60	I 9313.98	..	300
I 7304.82	..	30	I 8591.26	..	400	I 9326.52	..	600
I 7438.90	..	300	I 8634.65	..	600	I 9373.28	..	200
I 7472.42	..	50	I 8635.31	..	50	I 9425.38	..	500
I 7488.87	..	500	I 8647.05	..	300	I 9432.94	..	40
I 7535.77	..	300	I 8654.38	..	2000	I 9459.21	..	300
I 7544.05	..	100	I 8654.51	..	400	I 9486.68	..	500
I 7839.08	..	30	I 8679.49	..	500	I 9534.17	..	500
I 7927.13	..	40	I 8681.92	..	500	I 9547.40	..	300
I 7937.01	..	70	I 8704.15	..	200	I 9665.42	..	1000
I 7943.18	..	200	I 8771.70	..	400	I 9900.58	..	40
I 8082.46	..	200	I 8778.75	..	150	I 9902.31	..	30
I 8118.55	..	100						

NICKEL

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2004.29	..	30	II 2125.90	4	25	II 2278.77	12	25
II 2019.04	2	30	II 2126.80	2	25 w	II 2287.08	100	500
II 2020.97	..	30	II 2128.57	5	30	I, II 2302.99	10 s	35
II 2029.19	..	25	II 2161.22	10	30	I 2310.96	50 r	10 s
II 2032.30	2	25	II 2165.56	20	40 r	I 2312.34	30 W	6
II 2053.29	3	25	II 2174.67	12	30	II 2316.04	15	25 W
II 2054.32	..	25	II 2175.16	15	25	I 2317.16	30 r	12
II 2066.41	2	25	II 2180.47	4	40	I 2320.03	30 r	5 l
II 2080.85	3	35	II 2185.50	4	30	I 2325.79	30 r	9
I 2082.86	25	2	II 2188.05	4	25	II 2336.58	..	150
II 2084.86	..	25	II 2201.41	10	30	II 2336.68	..	30
I 2088.98	30 d	..	II 2206.70	20	30 n	II 2375.42	10	30
II 2090.10	3	25	II 2216.47	20	40 wn	II 2387.76	6	30
II 2095.73	25	2	II 2220.40	10	25	I 2401.84	40 r	10
II 2097.10	4	35	II 2222.94	15	25 w	II 2405.17	..	80
II 2103.38	..	25	II 2224.87	15	25	II 2413.05	..	50
II 2107.96	2	45	I 2244.53	40	..	II 2416.14	40	250 n
II 2111.72	25	9	II 2253.86	100	300	I 2423.33	25	4
II 2113.51	3	45	I 2259.57	300 w	..	II 2433.57	..	80
I 2124.11	30	..	II 2264.46	150	400	I 2434.41	40 w	..
I 2124.81	25	3	II 2270.21	100	400	I 2436.67	30 l	20
II 2125.11	4	25	II 2277.28	5	25	II 2437.89	40 w	200

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

NICKEL (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2450.99	100 n	30	II 2825.24	..	125	I 3361.56	500 W	20
I 2453.99	40 W	8	I 2834.55	40	15	I 3362.81	100	..
II 2455.53	..	40	I 2838.96	25	..	I 3365.77	400 w	12
I 2466.96	40 W	..	II 2842.42	..	150	I 3366.17	400 W	12
II 2473.15	80	500	II 2863.70	..	250	I 3366.81	60	1
I 2476.87	40 W	2	II 2864.15	..	300 wn	I 3367.89	80	..
II 2484.33	..	50 wn	I 2907.46	40	..	I 3369.57	500 r	100
I 2489.51	40	6	I 2943.91	50 r	20	I 3371.99	400	10
2490.70	40	..	I 2981.65	80 r	20	I 3374.22	400	6
II 2505.84	..	50	I 2984.13	50 r	10	I 3376.33	25	..
II 2510.87	50 n	250 n	I 2992.59	80 r	10	I 3380.57	600 r	100
I 2524.22	50 r	..	I 2994.46	125 r	10	I 3380.88	200	12
II 2525.39	..	300 Wn	I 3002.49	1000 r	100	I 3391.05	400	40
I 2432.08	30	..	I 3003.63	500 r	80	I 3392.99	600 r	..
2535.97	25	..	I 3012.00	800 r	125 W	I 3401.17	40	1
II 2539.10	..	250 w	I 3019.14	200 r	30	I 3403.43	40	..
I 2540.02	40	1	I 3031.87	200	..	II 3407.30	..	25
II 2545.90	20	900 n	I 3037.93	800 r	100	I 3409.58	300	..
II 2547.19	..	100	I 3045.00	200	10	I 3413.48	500	15
II 2549.56	..	150	I 3050.82	1000 r	..	I 3413.94	300	10
II 2551.03	..	80	I 3054.32	400 r	100	I 3414.76	1000 r	50 wn
II 2555.11	..	1000 n	I 3057.64	400 r	125	I 3420.74	30	3
II 2557.87	..	80	I 3064.62	200 r	50	I 3421.34	30	8
II 2560.30	..	500 n	I 3080.75	200	60	I 3423.71	600 r	25
I 2561.42	40	..	II 3087.08	..	150	I 3433.56	800 r	50 wn
II 2565.37	..	150 wn	I 3097.12	200	50	I 3437.28	600 r	40
II 2566.08	..	600 n	I 3099.11	200	50	I 3446.26	1000 r	50 n
II 2583.99	..	200	I 3101.55	1000 r	150	I 3452.89	600 r	50
II 2587.25	..	50	I 3101.88	400 r	150	I 3458.47	500 r	50 n
II 2588.31	..	80	I 3105.47	200	35	I 3461.65	500 r	50 n
II 2601.13	..	2000 n	I 3107.71	25	..	I 3467.50	300	15
II 2605.35	..	250 n	I 3114.12	300	50	I 3469.49	300	20
II 2606.39	..	600 n	I 3129.31	125	..	I 3472.54	800 r	40
II 2610.09	..	900 n	I 3134.11	1000 r	150	I 3483.77	500 r	30
II 2611.65	..	125	I 3145.72	200	3	I 3485.89	150	30
II 2615.19	..	900 n	I 3181.7	50	1 n	I 3492.96	1000 r	100 n
II 2626.56	..	500 n	I 3183.25	25	..	I 3500.85	500 wn	80
II 2630.28	..	150 w	I 3184.37	150	3	I 3502.59	100	..
II 2631.52	..	100 wn	I 3195.57	125	..	I 3507.69	100	12
II 2632.89	..	2000 wn	I 3197.11	300	..	I 3510.34	900 r	50 n
II 2647.06	..	500 wn	3200.42	30	..	I 3513.93	200	40 n
II 2648.72	..	80	I 3202.14	25	..	I 3515.05	1000 r	50 n
II 2655.47	..	400 wn	I 3221.27	35	..	I 3518.63	90	8
II 2655.91	..	500 Wn	I 3221.65	300	4	I 3519.77	500 n	30
II 2665.25	..	125	I 3225.02	300	6	I 3523.44	100	..
II 2670.33	..	80	I 3226.98	100	..	I 3524.54	1000 r	100 wn
II 2679.24	..	500 wn	I 3232.96	300 r	35	I 3527.98	200	15
II 2684.41	..	600 wn	I 3234.65	300	15	I 3530.59	30	..
II 2690.64	1	250 n	I 3243.06	400 r	15	I 3548.18	400	25
I 2696.49	2	50	I 3248.46	150	2	I 3551.53	50	12
II 2708.79	..	500	I 3249.44	30	..	I 3553.48	50	10
II 2742.99	..	500	I 3250.74	125	1	I 3561.75	70	12
I 2746.75	125	50	I 3271.12	125	1	I 3566.37	2000 r	100 wn
II 2759.02	..	500 wn	I 3282.70	100	..	I 3571.87	1000 r	40 n
II 2760.67	..	40	I 3282.83	25	1	II 3576.76	2	40 n
II 2768.78	..	250 wn	I 3286.95	100	1	I 3587.93	200	12
II 2775.33	..	250 wn	I 3304.95	25	..	I 3597.70	1000 r	50 n
I 2798.65	125	..	I 3310.20	50	..	I 3602.28	150	15
2802.27	50	15	I 3312.32	70	2	I 3606.85	100 r	..
I 2805.08	50	15	I 3315.66	400 r	20	I 3609.31	200	15
II 2805.67	..	200 n	I 3320.26	400 w	15	I 3610.46	1000 r	..
II 2808.36	..	40	I 3322.31	400	10	I 3612.74	400	50 n
I 2821.29	125	125	I 3359.11	60	..	I 3619.39	2000 r	150 n

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

NICKEL (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3624.73	150	15	I 4712.07	30	..	I 5084.08	300 w	2
I 3634.94	50	10	I 4714.42	1000	8	I 5094.42	25	..
I 3661.95	50	6	I 4715.78	200	2	I 5096.87	50	..
I 3664.09	300	30	I 4731.81	100	2	I 5099.32	80	..
I 3669.24	150	10	I 4732.46	100	..	I 5099.95	150 w	..
I 3670.43	150	20	I 4752.12	30	..	I 5102.97	40	..
I 3674.15	200	50 r	I 4752.43	150	..	I 5115.40	80	5 wh
I 3688.41	150	15	I 4754.77	100	..	I 5125.21	50	..
I 3693.93	50	..	I 4756.52	250	3	I 5129.38	80	..
I 3722.48	200	20	I 4762.63	150	1 n	I 5137.07	150	1
I 3730.75	25	..	I 4763.95	150	1	I 5139.25	50	..
I 3736.81	300	15	I 4786.29	25	..	I 5142.77	100	..
I 3739.23	100	10	I 4786.54	300 W	2	I 5146.48	150	1
I 3749.04	50	5	I 4806.99	150 W	1	I 5155.14	50	..
II 3769.45	2	50 n	I 4808.86	25	..	I 5155.76	80	1
I 3775.57	500 n	40 n	I 4821.14	25	2	I 5168.66	70	..
I 3778.06	25	5	I 4829.03	300 w	2 n	I 5176.56	70	2
I 3783.53	500	40 n	I 4831.18	200	2	I 5184.58	50	..
I 3792.34	25	5	I 4832.70	70	..	I 5235.35	30	2
I 3793.61	50	..	I 4838.65	150	4	I 5353.41	40	..
I 3807.14	800 W	40 n	I 4852.56	150	..	I 5371.35	30	..
3831.69	300	10	I 4865.41	400 w	1	I 5411.23	40	2
I 3832.87	25	..	I 4857.38	100	..	I 5424.65	30	..
3858.80	800 r	70 n	I 4863.93	30	..	I 5435.87	50	..
I 3889.67	30	10 n	I 4866.27	300 w	1	I 5476.91	400 w	8
I 3970.50	40 w	..	I 4870.84	100	..	I 5578.73	50	..
I 3972.17	100	6	I 4873.44	200	2 n	I 5587.86	50	..
I 3973.56	800	10	I 4874.81	25	..	I 5592.28	150 r	1
I 3974.65	40 n	..	I 4886.99	30	..	I 5593.73	40	2 n
I 3984.14	30 wn	..	I 4904.41	400 W	1	I 5614.79	50	..
I 3993.95	30 n	..	I 4912.03	100	..	I 5625.33	30	..
II 4067.05	..	30	I 4913.97	200	..	I 5641.88	25	..
I 4195.53	30	..	I 4918.36	200 W	1	I 5682.20	50	..
I 4200.46	40	..	I 4918.71	40	..	I 5694.99	40	..
I 4201.72	30	..	I 4925.58	100	..	I 5709.58	100 w	(1)
I 4284.68	25	10	I 4935.83	150	1	I 5711.90	50	..
I 4288.00	150	..	I 4937.34	400 w	..	I 5715.09	50	..
I 4295.89	100	2 n	I 4945.46	90	..	I 5748.34	40	..
I 4325.61	70	..	I 4953.20	150	..	I 5754.67	150 w	..
I 4331.64	200	12	I 4971.35	100	..	I 5760.85	50	..
I 4359.58	100	10	I 4976.34	40	..	I 5805.23	50	..
I 4384.54	25	1	I 4980.16	500 W	1	I 5857.75	50	..
I 4401.55	1000 W	30	I 4984.13	500 W	1	I 6086.29	100	..
I 4410.52	25	4	I 4996.85	80	..	I 6108.12	200	..
I 4436.98	25	5	I 4998.23	150	..	I 6111.06	25	..
I 4459.04	400	20	I 5000.33	150 w	..	I 6116.18	150	..
I 4462.46	150	20	I 5010.04	25	..	I 6163.42	100	..
I 4519.99	25	..	I 5010.96	50	..	I 6175.42	300	..
I 4546.93	50	2	I 5012.46	70	2 n	I 6176.81	400 w	..
I 4547.23	30	..	I 5014.24	25	..	I 6186.74	30	..
I 4592.53	200	2	I 5017.59	100 w	1	I 6191.19	500	1
I 4600.37	200	..	I 5018.29	70 w	..	I 6223.99	30	..
I 4604.99	300	10 n	I 5035.37	300 w	5	I 6256.36	600 w	10
I 4606.23	100	..	I 5035.96	70 w	..	I 6314.67	300	..
I 4648.66	400 w	3	I 5038.60	50	..	I 6327.60	25	..
I 4655.66	40	..	I 5041.08	30	..	I 6339.15	50	..
I 4666.99	50	..	I 5042.19	80	..	I 6482.81	35	..
I 4667.77	100	..	I 5048.85	80	2 n	I 6586.32	40	..
I 4686.22	200	1	I 5051.53	50	..	I 6643.64	300 w	..
I 4698.41	30	..	I 5079.96	30	..	I 6767.78	300	..
I 4701.34	100	..	I 5080.52	200 w	3	I 6772.36	200	..
I 4701.54	150	..	I 5081.11	150 w	2	I 6813.60	30	..
I 4703.81	200	..	I 5082.35	100 w	..			

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

NICKEL (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 6842.07	60	..	I 7182.00	200	..	I 7522.78	40	..
I 6876.71	25	..	I 7197.03	200	..	I 7525.14	30	..
I 6914.57	300	..	I 7261.93	300	..	I 7555.60	40	..
I 6955.06	80	..	I 7291.48	100	..	I 7574.08	30	..
I 7001.57	30	..	I 7327.67	25	..	I 7617.00	60	..
I 7024.86	50	..	I 7381.94	40	..	I 7714.32	60	..
I 7030.06	100	..	I 7385.24	150	..	I 7715.63	40	..
I 7034.42	30	..	I 7386.21	100	..	I 7727.66	80	..
I 7062.97	35	..	I 7393.63	600	..	I 7788.95	60	..
I 7110.91	100	..	I 7409.39	400	..	I 7797.62	80	..
I 7122.24	1000 W	..	I 7414.51	200	..	I 7917.48	30	..
I 7167.01	35	..	I 7422.30	600	..	I 9520.06	50	..

NITROGEN

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 2095.47	..	50	II 4788.13	..	25	I 5999.47	..	90
II 2286.73	..	25	II 4803.27	..	30	I 6008.48	..	800
2308.55	..	35	I 4935.03	..	250	6075.83	..	30
2308.90	..	35	II 4994.36	..	30	II 6167.82	..	50
II 2496.88	..	25	II 5001.13	..	150	II 6173.40	..	30
II 2522.27	..	25	II 5001.47	..	200	II 6242.52	..	70
II 2590.91	..	25	II 5005.14	..	500	II 6284.30	..	30
II 2709.82	..	50	II 5007.32	..	150	II 6340.67	..	50
II 2799.20	..	25	II 5010.62	..	100	II 6357.00	..	30
II 2823.67	..	25	II 5016.39	..	70	II 6379.63	..	70
2879.73	..	25 n	II 5025.66	..	100	I 6420.47	..	30
2885.25	..	50 n	II 5045.10	..	200	I 6437.01	..	30
2892.86	..	25 n	II 5073.60	..	30	6440.95	..	25
II 3006.86	..	50	II 5175.89	..	30	I 6441.70	..	70
II 3437.16	..	35	II 5179.50	..	70	I 6457.93	..	25
3650.19	..	70	II 5320.75	..	50	I 6468.32	..	30
I 3822.07	..	35	I 5328.70	..	70	II 6482.07	..	300
I 3830.39	..	150	II 5351.21	..	30	I 6482.74	..	500
II 3838.39	..	25	I 5356.77	..	50	I 6483.75	..	30
II 3919.00	..	35	I 5378.45	..	30	I 6484.88	..	500
II 3955.85	..	35	II 5462.62	..	30	I 6491.28	..	25
II 3994.99	..	300	II 5480.10	..	30	I 6499.52	..	25
I 4099.94	..	150	II 5495.70	..	70	II 6610.58	..	100
I 4109.98	..	1000	II 5530.27	..	50	I 6622.53	..	30
I 4114.00	..	30	II 5535.39	..	70	I 6637.01	..	50
I 4137.63	..	50	II 5543.49	..	30	I 6644.96	..	500
I 4143.65	..	30	II 5551.95	..	30	I 6653.41	..	70
I 4151.46	..	1000	I 5560.37	..	200	I 6706.20	..	50
I 4214.73	..	25	5563.84	..	30 n	6708.81	..	50
I 4223.04	..	25	I 5564.37	..	200	I 6723.12	..	500
4236.98	..	30 n	I 5616.54	..	60	I 6733.48	..	100
II 4241.80	..	100 n	I 5623.20	..	40	I 6741.29	..	30
4305.46	..	30	II 5666.64	..	300	I 6752.40	..	50
4358.27	..	250	II 5676.02	..	100	I 6758.60	..	50
II 4432.71	..	30 n	II 5679.56	..	500	II 6942.9	..	30
II 4447.03	..	300	II 5686.21	..	100	I 6945.22	..	40
4492.40	..	40	II 5710.76	..	100	II 7139.8	..	30
4494.67	..	25	II 5747.29	..	50	I 7423.88	..	50
4530.37	..	25	I 5752.64	..	30	I 7442.56	..	100
II 4601.49	..	100	II 5767.43	..	30	I 7468.79	..	200
II 4607.17	..	50	I 5829.53	..	60	I 8216.46	..	35
II 4609.60	..	30	II 5927.82	..	50	9045.1*	150	..
II 4613.89	..	30	II 5931.79	..	150	I 9060.6	..	125
II 4621.40	..	50	II 5941.67	..	200	I 9386.5	..	70
II 4630.55	..	300	II 5952.39	..	30	I 9392.5	..	120
II 4643.11	..	100						

* Also listed for carbon.

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

OSMIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2045.36	50	20	2872.40	50	8	I 3156.25	500 r	15 wn
2117.96	80	20	2874.95	50	15	3156.77	100	3
2119.79	125	30	I 2909.06	500 r	400	3157.24	100	2
2127.97	5	50	2912.33	50	50	3161.44	80	12
2137.11	100	30	2919.79	100	15	3161.73	100	10
2156.31	50	3	3003.48	60	12	3164.61	60	12
2158.53	50	25	3013.07	150	20	3166.51	200	20
2159.52	60	...	3015.65	100	15	3168.28	100	15
2159.98	60	5	3017.25	100	25	3173.20	100	15
2161.00	50	1	I 3018.04	300 r	50	3173.93	80	30
2164.85	25	50	3019.37	100	20	3178.06	150	20
2167.75	50	10	I 3030.69	500	40	3178.24	80	10
2188.97	50	...	3032.81	50	15	3181.88	100	12
2194.39	40	100	3040.90	200	100	3182.57	100	15
2205.74	20	50	3042.74	20	50	3185.33	150	12
2206.27	25	50	3043.50	100	15	3186.98	100	15
2231.16	12	50	3043.64	60	12	3187.33	80	12
2255.85	125	2	3044.41	50	10	3189.46	125	15
2260.11	25	50	3044.91	100	12	3194.23	125	15
2261.73	25 l	50 l	3049.46	80	15	3194.69	50	10
2270.17	60	15	3050.39	100	50	3195.08	100	12
2272.54	4 w	25	3051.17	80	15	3213.31	50	40
2279.11	100	50	3054.97	50	10	3223.86	100	8
2282.26	I 0	125	3055.21	80	15	3227.28	125	12
2283.67	50	15	I 3058.66	500 r	500	3229.21	125	5
2336.80	50	80	3060.30	100	30	3231.42	150	12
2362.77	50	12	3062.19	100	30	I 3232.05	500 r	20
2367.35	50	80	3066.12	50	10	3232.54	150	10
2369.24	50	12	3069.94	125	15	3234.20	150	12
2371.18	50	15	3074.08	125	20	3234.73	100	10
2377.03	50	30	3074.96	125	20	3238.63	100	20
2377.61	50	15	3077.06	100	12	3241.04	80	20
2396.77	100	12	3077.44	80	8	3252.01	50	15
2423.07	25	80	3077.72	100	30	3254.91	60	12
2424.97	50	8	3078.11	125	15	3256.92	80	12
2461.42	50	10	3078.38	125	15	3260.30	60	10
I 2488.55	50 w	15	3084.60	60	10	I 3262.29	500 r	50
2492.37	50 r	8 r	3086.27	50	10	3262.75	100	20
2513.25	50	8	3087.75	50	10	3264.69	100 n	10
2542.51	50	8	3088.27	60	12	I 3267.94	400 r	30
2580.03	15	100 w	3090.08	100	15	3269.21	200	20
2581.96	80 s	5	3090.30	100	12	3275.20	200	15
2590.75	75	8 l	3090.49	80	15	3277.97	80	8
2613.06	50	10	3093.59	125	15	3290.26	200	20
I 2637.13	150	30	3101.53	125	20	I 3301.56	500 r	50
2644.11	75	10	3104.98	200 d	15 d	3306.23	80	12
2658.60	50	10	3105.99	150	20	3310.91	200	30
2689.82	50	10	3108.98	125	15	3315.42	50	15
2699.59	50	8	3109.38	125	20	3324.33	50 d	15 d
2706.70	50	8	3111.09	100	20	3327.42	80	15
2714.64	50 r	10	3114.81	50	12	I 3336.15	200 r	50
2720.04	75	15	3116.47	50	15	3351.73	50	12
2721.86	75	10	3118.12	80	15	3357.97	100	15
2732.80	75	15	3118.33	150	20	3361.15	80	20
2761.42	50	10	3124.94	150 n	10 wn	3364.12	100	12
2796.73	100	15	3129.23	60	15	3370.20	50	10
2804.07	80	20	3131.11	125	30	I 3370.59	300 r	30
2806.91	100 w	1	3140.31	60	12	3378.68	50	10
2814.20	50	25	3140.94	50	12	3384.00	80	5
I 2838.63	100 r	100	3145.96	60	10	I 3387.84	100	15
2844.40	50	25	3152.07	80	15	I 3401.86	200	20
2850.76	75	25	3152.67	150	18	I 3402.51	200	15
2860.96	100	25	3153.61	125	20	3427.67	80	15

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

OSMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3444.46	50	12	I 3790.14	80	30	4189.91	60	3
3445.55	80	15	3790.73	100	20	4195.14	100 s	1
3449.20	100	20	I 3793.91	125	300	4202.06	100	4
3455.03	50	15	3800.44	50	15	4211.85	150	50
3458.38	200	12	3827.14	50	20	I 4260.85	200	200
3459.01	100	10	I 3836.06	150	20	I 4293.95	60	6
3465.42	60	12	3840.30	150	20	4311.40	150	9
3478.53	100	15	3843.66	80	12	4328.68	60	4
3487.46	50	15	I 3849.94	125	20	4365.67	60	4
3498.54	80	15	3853.41	100	15	4370.66	50	3
3501.16	100	15	I 3857.09	150	15	4394.86	150	6
3504.66	300	20	I 3865.47	125	200	4402.74	50	3
3518.72	200	30	I 3876.77	300	50	I 4420.47	400 r	100
3523.64	150	30	3878.57	50	12	4436.32	80	3
3525.03	80	20	3881.86	125	20	4447.35	200	3
I 3528.60	400 r	50	3900.39	50	12	4479.81	80 l	1
3530.06	100	20	3901.71	150	20	4484.76	100	1
I 3532.80	100	20	3928.54	50	10	4488.60	60	..
3542.71	150	10	3929.99	80	12	4524.87	80	2
I 3559.79	150	0	3938.59	125	20	4529.67	80	2
I 3560.85	150 r	100	3939.57	50	12	4537.61	50	..
3562.34	50	20	3949.78	50	10	4539.92	100	2
3569.77	100	30	3960.51	50	15	4548.66	100	5
3587.31	60	15	3961.02	125	20	4550.41	150	10
I 3598.11	300	30	I 3963.63	500	50	4551.30	150	8
3601.83	60	20	3964.96	60	12	4595.04	80	4
3604.47	15	100	3969.67	100	100	4597.16	100	4
I 3616.57	150	20	3975.44	50	12	4616.78	150	6
3619.43	60	25	I 3977.23	300	40	4631.83	100	5
I 3610.33	200	40	3988.18	50	12	4663.82	100	5
3648.81	100	10	3996.80	50	10	4692.06	80	3
3654.41	100	15	3998.93	80	12	4743.89	60	..
I 3656.90	150	30	4003.48	50	6	4793.99	300	6
I 3670.89	200	20	4004.02	50	6	4815.96	60	..
3689.06	200	30	4018.26	60	4	4865.60	80	1
3703.25	100	30	4037.84	80 l	4	4899.21	60	..
3706.56	50	15	4041.92	100 l	6	4912.60	80	..
3712.84	50	12	4066.69	100	100	5039.12	50	..
3713.73	100	20	4074.68	80	6	5149.74	80	..
I 3720.13	80	40	4088.44	100 n	3	5376.79	50	..
3732.85	200 r	5 n	4091.82	100	12	5416.34	80	..
3746.47	100	20	4100.30	60	3	5416.69	50	..
I 3752.52	400 r	100	4112.02	150	9	5443.31	50	..
3766.30	100	20	4128.96	60	3	5523.53	100	..
3768.14	80	15	4135.78	200	50	5584.44	50	..
3774.40	60	15	4137.84	100	3	5731.93	80	..
3774.62	60	12	4158.78	50	1	5780.81	50	..
3776.25	50	15	4172.57	60	3	5800.60	50	..
3776.99	150	20	4173.23	100	6	5857.76	80	..
I 3782.19	400 r	200	4175.63	100	4	5995.99	50	..

OXYGEN

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 2293.33	..	50	2493.75	..	50	II 3134.79	..	100 l
II 2300.36	..	70	2517.41	..	50	II 3287.57	..	70 l
II 2433.53	..	250	II 2575.30	..	100	II 3390.26	..	100
II 2445.55	..	300	II 2733.40	..	150	II 3470.77	..	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

OXYGEN (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 3692.44	..	50	II 4369.28	..	50	I 5435.16	..	70
II 3727.30	..	50	II 4395.95	..	80	I 5435.76	..	100
II 3749.47	..	125	II 4414.89	..	300	I 5436.83	..	200
I 3823.47	..	125	II 4416.97	..	150	I 5512.70	..	70 n
II 3911.95	..	150	II 4443.04	..	50	I 5554.94	..	100 n
I 3947.33	..	300	II 4448.20	..	70	I 5750.42	..	70
I 3947.51	..	50	II 4452.41	..	70	5950.60	..	70
I, II 3954.38	..	100	II 4465.45	..	50	I 5958.53	..	100 n
II 3973.27	..	125	II 4467.83	..	50	I 6046.34	..	150
II 4069.63	..	60	II 4590.94	..	300	I 6155.99	..	150
II 4069.90	..	125	II 4596.13	..	150	I 6156.78	..	300
II 4072.16	..	300	II 4609.39	..	60 n	I 6158.20	..	1000
II 4075.87	..	800	II 4638.86	..	70	6261.31	..	70
II 4078.85	..	70	II 4641.83	..	150	6366.28	..	50
II 4085.12	..	70	II 4649.15	..	300	6374.29	..	70
II 4089.27	..	60 n	II 4650.85	..	70	I 6453.69	..	100
II 4092.94	..	80	II 4655.36	..	50	I 6454.55	..	150
II 4097.24	..	70	II 4661.65	..	125	I 6456.07	..	500
II 4103.01	..	50	II 4676.25	..	125	II 6640.90	..	70
II 4104.73	..	50	II 4699.21	..	100	I 6654.12	..	50
II 4105.00	..	125	II 4705.32	..	300	II 6721.21	..	300
II 4112.02	..	50	II 4710.00	..	60	II 6721.35	..	70
II 4119.22	..	300	II 4751.34	..	50	I 6727.87	..	70
II 4120.27	..	50	I 4772.89	..	50	II 6895.29	..	70
II 4121.46	..	50	I 4773.76	..	70	II 6906.54	..	50
II 4132.82	..	100	I 4803.00	..	50	I 7002.22	..	50
II 4153.31	..	200	II 4906.80	..	50	I 7157.36	..	70
II 4169.23	..	50	II 4924.50	..	60	I 7476.47	..	70
II 4185.45	..	150	II 4941.02	..	50	I 7771.93	..	1000
II 4189.79	..	500	II 4942.97	..	100	I 7774.14	..	300
4222.78	..	50	I 4967.40	..	50	I 7775.43	..	100
4233.32	..	100	I 4967.86	..	80	I 7947.57	..	1000
II 4253.74	..	50	I 4968.76	..	100	I 7950.82	..	100
II 4253.98	..	100 n	I 5019.34	..	50	I 7952.18	..	50
II 4275.47	..	50 n	I 5020.13	..	70	7995.09	..	50
II 4303.78	..	60 n	I 5146.06	..	70	I 8221.83	..	2000
II 4317.16	..	150	II 5206.61	..	60	I 8227.68	..	1000
II 4319.65	..	150	I 5275.08	..	50	I 8230.02	..	1000
II 4336.85	..	70	I 5299.00	..	70	I 8233.08	..	1000
II 4345.57	..	125	I 5328.98	..	100	I 8235.41	..	50
II 4347.43	..	70	I 5329.59	..	150	I 8426.33	..	50
II 4349.43	..	300	I 5330.66	..	500	I 8446.38	..	2000
II 4366.91	..	100	5408.59	..	50	8819.60	..	70
I 4368.30	..	1000						

PALLADIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2001.49	..	40	II 2231.59	10	60	II 2372.15	5	50
2003.80	..	40	II 2270.11	..	(40)	2382.57	..	40 n
II 2045.62	..	100	2270.21	..	40 wn	II 2383.40	..	50 wn
II 2137.24	..	40	II 2296.51	20	60	II 2385.01	..	50 wn
II 2162.27	3	40	II 2302.01	..	60	II 2388.29	2	40
II 2198.24	..	40	II 2307.50	..	50	II 2406.34	..	60
II 2202.35	..	40	II 2331.41	..	40	II 2406.74	1	150
II 2212.14	5	50	II 2351.34	10	60	II 2408.74	..	100
II 2214.04	..	40	II 2357.63	3	40	II 2413.39	..	40
II 2218.16	..	40	2367.96	10	60	II 2414.73	..	150

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

PALLADIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2418.73	..	50	II 2658.72	20	300	II 3272.56	..	60 n
II 2424.48	..	100	II 2661.14	..	100	I 3287.25	300 w	25
II 2426.87	..	50	II 2679.58	..	100	I 3302.13	1000 wn	200 n
II 2433.10	..	50	II 2684.76	..	100	II 3327.23	..	50 n
II 2435.32	..	50	II 2687.66	..	150	I 3373.00	800 r	500 wn
II 2446.18	..	100	II 2688.55	..	200	I 3380.67	150 w	2 n
II 2446.71	..	50	II 2698.55	..	200	I 3404.58	2000 r	1000 r
I 2447.91	200 r	100	2714.32	..	150	I 3421.24	2000 r	1000 r
II 2448.16	..	100	II 2714.90	..	200	I 3433.45	1000 n	500 n
II 2469.25	..	150	II 2727.89	..	200	I 3441.40	800 n	2 n
II 2470.01	..	150	II 2731.61	..	(50)	II 3451.35	..	400 n
II 2471.15	..	150	II 2742.60	..	100	I 3460.77	300 r	600 n
II 2472.51	..	150	II 2763.09	300 r	30 r	II 3468.54	..	50 n
I 2476.42	300 r	50	II 2837.12	..	(40)	I 3481.15	500 r	2 n
II 2489.61	..	75	II 2839.89	..	100	I 3489.77	150 W	35
II 2496.69	..	100	II 2841.03	..	100	I 3516.94	1000 r	500 r
II 2498.78	4	150 n	II 2854.58	4	500 n	I 3553.08	100 r	15 wn
II 2508.92	..	(50)	II 2857.73	..	100	3566.63	60	..
II 2514.48	..	200	II 2893.09	..	100	I 3571.15	40 n	40 n
II 2534.60	..	100	I 2922.49	200	25	I 3609.55	1000 r	700 r
II 2537.17	..	100	II 2954.39	..	60 n	I 3634.69	2000 r	1000 r
II 2537.97	..	100	II 2980.65	..	200 r	I 3690.34	300 n	1000 w
II 2539.36	..	50 wn	II 2999.55	..	100 n	I 3718.91	300	200
II 2544.83	..	200	I 3002.65	100 r	60	I 3799.19	200 W	150
II 2550.66	..	150	I 3009.78	50 r	10	I 3832.29	150	150
II 2551.85	..	100 n	II 3018.50	..	50 n	I 3894.26	200 W	200 W
II 2561.02	..	200	I 3027.91	150	200 n	I 3958.64	500 w	200
II 2565.51	2	200	II 3032.20	2	100 n	I 4087.34	500	100
II 2569.55	20	150	3050.08	..	100 n	I 4140.83	100 r	..
II 2575.49	..	100	II 3052.15	..	150 n	I 4169.84	200	50
II 2576.40	..	100	II 3059.43	..	150 w	I 4212.95	500 W	300 W
II 2577.10	3	150	I 3065.31	10	100	I 4473.59	60	6
II 2583.85	..	200	I 3066.10	150	2	I 4788.17	200 n	4 n
II 2584.13	..	75	I 3114.04	400 w	500 w	4817.51	40	8
I 2593.27	3	100	I 3142.81	300	100	I 5110.81	100	2
II 2595.97	3	150	II 3155.59	..	40	I 5117.01	50	4
II 2602.76	20	200	II 3161.95	..	100 n	I 5163.84	300	8
II 2609.86	..	200	II 3170.26	..	50 wn	I 5234.86	50	2
II 2613.43	..	100	II 3210.45	..	60 n	I 5295.63	200	10
II 2628.25	..	200	I 3218.97	300	8	I 5395.24	50	2
II 2635.94	50	300	I 3242.70	2000 wn	600 r	I 5542.80	100	2
II 2637.07	..	100	II 3243.13	..	60 n	I 5547.02	50	2
II 2640.18	..	70	I 3251.64	200	500	I 5619.44	50	2
II 2642.17	..	100	I 3258.78	300	200 n	I 5670.07	100	..
II 2649.47	..	200	II 3267.35	..	200 n	I 5695.09	50	..
II 2657.56	..	200						

PHOSPHORUS

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 2496.00	..	50	3162.34	..	50	II 3308.85	..	100 w
II 2497.33	..	100	3163.87	..	50	3364.43	..	100
II 2500.92	..	50	3171.84	..	50	3371.10	..	70
I 2534.01	50	20	II 3175.14	..	70	II 3372.70	..	50
I 2535.65	100	30	3184.82	..	50	II 3377.52	..	50 n
I 2553.28	80	20	3186.24	..	50	3378.76	..	50
I 2554.93	60	20	3219.30	..	100 w	3395.35	..	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

PHOSPHORUS (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 3404.33	..	50	4057.39	..	50	4675.78	..	70
3406.93	..	50	4059.27	..	100	II 4678.94	..	100 l
3413.51	..	70	4080.04	..	150	II 4700.79	..	50 l
II 3419.24	..	100	II 4109.19	..	70	4724.25	..	75
II 3424.87	..	100	II 4117.09	..	50	4727.46	..	100
II 3426.19	..	50	II 4127.49	..	70	II 4792.06	..	70 l
II 3470.82	..	50	4143.84	..	50	4854.69	..	70
II 3472.87	..	70	4178.36	..	300 w	II 4864.38	..	50 l
3474.14	..	70	4222.15	300	150 w	4872.33	..	50
3485.00	..	50	4246.88	70	150 w	4876.98	..	50 l
3488.77	..	70	4249.57	..	100	II 4927.16	..	50 l
II 3490.44	..	70	II 4288.52	..	50	II 4943.41	..	150 l
II 3502.99	..	70	4385.33	..	100 l	II 4954.32	..	70 l
II 3507.36	..	100 w	4400.99	..	50 l	II 4969.64	..	150 l
3516.15	..	70	4414.28	..	100	5040.74	..	70 l
II 3518.60	..	50 n	II 4414.60	..	70	5141.49	..	50
II 3530.24	..	70	4420.64	..	70	II 5152.20	..	50
II 3556.48	..	100	4428.15	..	70	5156.72	..	50
II 3566.42	..	70	4443.87	..	50	5176.38	..	70
3577.60	..	50 d	II 4452.44	..	150 l	II 5191.40	..	100
3583.60	..	50	4462.94	..	70	5235.52	..	70
3617.09	..	100 w	II 4463.70	..	70	II 5253.48	..	300 w
II 3631.40	..	50	II 4467.97	..	50	II 5296.09	..	300 w
3653.38	..	100 w	II 4475.26	..	150 l	5303.21	..	50
3659.26	..	50	4479.74	..	70	II 5316.07	..	150 w
II 3664.19	..	100 w	4485.29	..	50	5344.72	..	150 w
3668.59	..	50	II 4499.17	..	150 l	II 5345.81	..	50
II 3676.26	..	100 w	II 4522.92	..	50	5386.87	..	150 w
II 3706.05	..	150 w	4523.73	..	50	II 5409.65	..	150 w
II 3715.85	..	50	II 4530.78	..	150 l	II 5425.92	..	150 w
II 3717.62	..	70	4540.20	..	70	5437.28	..	70
II 3728.66	..	50 d	4541.12	..	70	II 5450.65	..	100 l
3733.26	..	50	4546.03	..	70	5460.85	..	100
3744.21	..	70	4548.40	..	50	II 5483.55	..	70 l
II 3768.70	..	50	II 4554.80	..	100	II 5499.71	..	150
3802.07	..	100	II 4558.03	..	100 l	II 5507.13	..	70 l
II 3827.44	..	150 l	II 4565.21	..	100 l	II 5541.18	..	50
3885.17	..	150 l	II 4587.90	..	300 w	5544.49	..	50
3895.02	..	100	II 4589.78	..	300 w	II 5583.33	..	70 l
3904.78	..	100	II 4601.96	..	300 w	II 5588.25	..	70 l
3914.26	..	100 l	II 4622.70	..	50 n	II 6024.14	..	50
3922.71	..	50	II 4626.60	..	70	II 6043.05	..	150
3933.37	..	50	II 4628.70	..	50	I 9525.78	100	..
3951.50	..	70	4637.16	..	50	I 9593.54	70	..
3957.62	..	100	4641.72	..	50	I 9734.74	50	..
3997.16	..	70	4649.05	..	50	I 9750.77	70	..
II 4019.45	..	50	II 4658.11	..	100 l	I 9796.79	100	..
II 4044.49	..	150 w						

PLATINUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2036.46	15	40	I 2401.87	300	30	I 2418.06	300	50
I, II 2144.23	35	100	I 2403.09	400	50	II 2424.87	50	100
I 2165.17	1000 r	25	II 2405.73	..	100 wn	I 2428.03	100	10
2180.31	150	15	II 2410.33	..	50	I 2428.20	100	20
I 2292.39	400	100	I 2413.04	60	10	I 2429.10	100	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

PLATINUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2434.46	20	40	I 2719.04	1000 w	100 w	I 3240.20	40	6
I 2436.69	300	20	I 2729.91	500	50	3250.35	40	8
I 2440.06	800 w	100 wn	I 2733.96	1000 n	200 n	I 3251.98	100	1
II 2442.63	20	40	I 2734.50	100	10	3290.22	150	10
II 2450.44	25	50	I 2738.48	100	5	I 3301.86	300	250 W
I 2450.97	400	10	II 2743.49	6	40 n	I 3315.05	200	10
2467.44	800 r	100	I 2747.61	150	2	I 3323.79	150	10
II 2467.59	5	100	I 2753.86	100	4	I 3343.90	100	80
I 2471.01	100	20	I 2754.92	200	5 n	I 3408.12	250 W	60
2483.37	40	2	I 2769.84	50	2	I 3427.92	50	6
I 2487.17	600 r	20	I 2771.67	500	15	3483.42	70	10
I 2490.12	300	20	I 2773.24	50	5	I 3485.27	150	200 r
I 2495.82	40	10	I 2773.99	50	2	I 3628.11	300 W	20
I 2498.50	400	50	II 2774.78	10	100 wn	I 3638.79	250	10
I 2504.04	60	5	I 2793.27	100	5	I 3643.17	60	8
2505.93	150	10	II 2794.21	10	100 wn	I 3663.09	50	2
I 2508.50	300	20	II 2799.99	20	80 n	I 3671.99	80	10
II 2513.88	6	50	I 2803.24	400	5	I 3674.04	80	4
I 2514.07	150	10 n	2818.25	70	4	I 3699.91	80	5
I 2515.03	150	20	II 2822.27	10	60 n	3818.69	40	10
I 2515.58	500	20	I 2830.29	1000 r	600 r	I 3900.73	40	3
I 2529.41	80	..	I 2834.71	80	5	I 3922.96	100	20 r
I 2536.49	100	10	II 2860.68	30	150 n	I 3925.34	60	3
I 2539.20	400	20	II 2865.05	20	80 n	I 3948.39	60	5
I 2549.46	80	10	II 2875.85	20	80 n	I 3966.36	80	40
I 2552.25	150	20	II 2877.52	40	200 n	I 3996.57	50	..
II 2568.59	1	40	I 2888.20	50	..	I 4118.69	400	10
II 2572.62	15	50	I 2893.86	500	25	I 4164.56	100	80
2596.00	200	20	I 2897.87	400	15	I 4192.43	100	2
I 2603.14	300	20	I 2905.90	100	15	I 4288.06	75	1 n
II 2616.75	10	60	I 2912.26	300	25	I 4327.06	80	4
I 2619.57	300	5	I 2913.54	300	25	I 4391.83	50	3
II 2625.33	35	60	I 2919.34	150	40	I 4442.55	800	25
I 2627.39	40	5	I 2921.38	100	6	I 4498.76	100	5 n
I 2628.03	1000 w	100	I 2929.79	800 r	200 w	I 4520.90	40	2 n
I 2639.35	500	50	I 2997.97	1000 r	200 r	I 4552.42	60	10
I 2645.37	40	5	II 3001.17	3	50 w	5044.04	60	1
I 2646.89	1000 n	100	I 3002.27	200	30	5059.48	60	3
I 2650.86	700	100	3017.88	60	10	5227.66	80	2
I 2658.17	100	10	II 3031.22	10	40 n	5301.02	150	10
I 2658.70	40	5	I 3036.45	200	10	5368.99	50	1
I 2659.45	2000 r	500 r	I 3042.64	200 r	250 r	5390.79	50	2
2674.57	200	10	I 3064.71	2000 r	300 r	5475.77	60	2
I 2677.15	800 w	200 w	I 3071.94	60	15	5478.49	50	2
II 2679.13	6	50	I 3139.39	300	80	5840.12	80	..
II 2692.24	4	40	3141.66	150	5 n	5844.84	40	2
I 2698.43	500	50	I 3156.56	150	50	6326.58	50	..
I 2702.40	1000	300	I 3200.71	100	40	6523.45	80	..
I 2705.89	1000 wn	200 wn	I 3204.04	250	100	6710.42	50	..
2713.13	200	10	I 3230.29	100	6	6760.02	100	..
II 2717.62	4	40	I 3233.42	40	10	I 7113.73	80	..

POLONIUM

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
2450.0	..	10	2558.1	..	20			

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

POTASSIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2036.9	..	(40)	2836.2	..	(10)	II 3966.69	..	(30)
2054.9	..	(18)	I 2992.21	15 r	..	II 3972.55	..	(30)
2077.9	..	(80)	2993.4	..	(10)	II 3991.77	..	(15)
2082.1	..	(10)	I 3034.82	30 n	..	II 3995.10	..	30
2085.2	..	(20)	II 3062.18	..	(20)	II 4001.20	..	(40)
2089.8	..	(40)	II 3075.00	..	(10)	II 4012.10	..	(20)
2097.65	..	(10)	I 3102.03	50 r	..	II 4017.51	..	(15)
2100.0	..	(10)	I 3102.25	20 r	..	II 4024.92	..	(15)
2110.05	..	(10)	II 3105.00	..	(30)	II 4039.69	..	(15)
2114.2	..	(10)	II 3169.80	..	(10)	II 4042.59	..	(30)
2122.0	..	(23)	II 3190.07	..	(20)	I 4044.14	800	400
2127.25	..	(20)	I 3217.02	100 r	20 n	I 4047.20	400	200
2128.9	..	(20)	I 3217.50	50 r	25	II 4065.21	..	(15)
2130.75	..	(20)	II 3220.60	..	(15)	II 4093.70	..	(20)
2132.8	..	(10)	II 3258.81	..	(10)	II 4112.07	..	(15)
2137.56	..	(30)	II 3290.65	..	(10 n)	II 4114.95	..	(30)
2144.5	..	(18)	II 3301.60	..	(10)	II 4134.72	..	(40)
2149.42	..	(10)	3345.32	..	(30)	II 4149.17	..	(20)
2155.3	..	(20)	3373.60	..	(30)	II 4186.23	..	(60)
2175.12	..	(10)	II 3380.62	..	(30)	II 4209.50	..	(15)
2177.92	..	(10)	II 3384.86	..	(30)	II 4222.97	..	(40)
2186.93	..	(40)	II 3392.63	..	(10)	II 4225.60	..	(40)
II 2190.0	..	(40)	II 3404.24	..	(30)	II 4263.31	..	(40)
2196.7	..	(10)	II 3440.05	..	(40)	II 4284.85	..	(10)
II 2210.53	..	(20)	I 3446.72	150 r	100 r	II 4288.65	..	(15)
2213.1	..	(20)	I 3447.70	100 r	75 r	II 4304.94	..	(40)
2217.23	..	(10)	II 3481.11	..	(30)	II 4309.08	..	(40)
2221.58	..	(30)	II 3529.53	..	(10)	4332.02	..	(10)
2240.89	..	(40)	II 3530.71	..	(40)	II 4339.98	..	(20)
2250.92	..	(30)	II 3562.15	..	(15)	II 4362.96	..	(20)
II 2255.29	..	(10)	II 3608.87	..	(10)	II 4388.13	..	(40)
2260.32	..	(30)	II 3618.43	..	(20)	II 4423.72	..	(10)
2260.6	..	(30)	3626.42	..	(15)	II 4466.66	..	(20)
2262.1	..	(10)	II 3637.00	..	(10)	II 4505.34	..	(30)
2265.04	..	(30)	II 3668.63	..	(10)	II 4595.61	..	(40)
2270.9	..	(30)	II 3676.05	..	(10)	II 4608.42	..	(40)
2280.05	..	(10)	II 3681.52	..	(30)	II 4659.32	..	(40)
2300.9	..	(10)	II 3716.59	..	(20)	II 4744.92	..	(15)
2306.58	..	(10)	II 3721.34	..	(20)	II 4829.21	..	(100)
2315.22	..	(20)	II 3739.12	..	(20)	I 4869.70	10	..
2319.15	..	(30)	II 3744.40	..	(20)	II 4938.75	..	(10)
2324.33	..	(10)	II 3756.63	..	(10)	II 4943.24	..	(30)
2340.15	..	(10)	II 3767.37	..	(30)	I 4950.82	10	..
II 2342.30	..	(10)	II 3783.19	..	(30)	I 4956.04	10	..
2348.3	..	(20)	II 3800.14	..	(30)	I 4965.04	15	..
2350.2	..	(10)	II 3816.55	..	(30)	II 5005.34	..	(15)
II 2358.70	..	(50)	II 3817.54	..	(40)	II 5056.18	..	(60)
2370.25	..	(30)	II 3821.30	..	(10)	I 5084.21	20 l	..
2379.5	..	(18)	II 3844.02	..	(10)	I 5097.14	25 n	..
2393.4	..	(10)	II 3861.41	..	(10)	I 5099.18	25 l	..
2402.0	..	(10)	II 3873.75	..	(20)	I 5112.20	30 l	..
2410.4	..	(10)	II 3878.62	..	(15)	II 5310.21	..	(25)
2436.6	..	(20)	II 3883.36	..	(10)	I 5323.23	40 l	..
2446.0	..	(20)	II 3897.87	..	(60)	I 5339.67	40 l	..
2470.4	..	(10)	II 3899.24	..	(10)	I 5342.97	30 l	..
2474.2	..	(10)	II 3900.11	..	(10)	I 5359.52	40 l	..
2538.6	..	(10)	II 2933.05	..	(20)	II 5470.06	..	(40)
II 2550.02	..	(20)	II 3926.34	..	(20)	II 5536.01	..	(10)
2662.4	..	(10)	3934.46	..	(20)	II 5642.67	..	(25)
2736.0	..	(20)	II 3942.50	..	(30)	II 5772.32	..	(15)
2803.8	..	(30)	II 3955.21	..	(30)	I 5782.60	60	..
II 2808.99	..	(10)	II 3956.10	..	(10)	I 5801.96	50 n	20
II 2819.26	..	(10)	II 3959.78	..	(10)	I 5812.52	30	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

POTASSIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 5832.09	50	..	II 6307.24	..	(40)	I 7698.98	5000 r	200
6050.	..	(12)	II 6427.69	..	(20)	I 9591.8	50 Wl	..
6119.95	..	(10)	6911.30	300	..	I 9950.5	20 n	..
6120.22	..	(60)	I 6938.98	500	..	I 9955.2	10 n	..
II 6246.46	..	(30)	I 7664.91	9000 r	400			

PRASEODYMIUM

2230.37	..	40	3826.29	80 d	50 d	4008.71	150	50
2297.77	..	100	3830.72	100	60	4015.39	50	30
2445.52	..	40	3842.36	80	40	4020.99	40	30
3101.27	40	2	3844.56	50	10	4025.54	40	25
3121.57	50	4	3846.60	70 d	30	4031.75	50	30
3245.46	40	4	3850.83	50	15	4033.86	50	35
3499.09	40	3	3851.62	200 w	150 w	4039.36	50	20
3544.00	40 r	10 r	3852.80	100	50	4044.82	50	35
3615.16	40	4	3854.90	80 w	30	4051.15	50	30
3630.97	50	20	3865.46	200 r	125 r	4054.84	50	40
3641.62	50	5	3876.18	80	30	4056.54	100	60
3646.30	50	15	3877.22	125 w	80 w	4062.82	150	50
3660.37	40	20	3879.21	100	80	4068.80	40	15
3668.83	100	40	3880.47	80	60	4079.79	50	35
3685.26	60	8	3885.19	100 w	40 w	4081.02	50	25
3687.04	60 d	20 d	3889.33	150	70	4081.90	75	30
3687.20	50 d	15 d	3902.47	60	40	4087.21	50	3
3689.40	40	10	3908.03	100	50	4094.97	50	12
3694.69	40	4 n	3908.43	100	60	4100.75	200	50
3699.51	40	10	3912.90	150	80	4113.89	30 w	70 w
3714.06	50	20	3913.56	80	30	4118.48	250 d	50 d
3729.11	40	7	3915.47	40	20	4141.26	150	50
3733.03	40 d	20	3918.86	100	30	4143.14	200	50
3734.41	40	30	3924.14	100	15	4164.19	200	50
3739.19	80	30	3925.46	125	100	4171.82	75	40
3741.01	40	15	3927.45	80	35	4172.27	75	40
3751.00	40	30	3929.26	40	30	4179.42	200	40
3752.29	40 d	30 d	3935.82	125	50	4189.52	100	50
3761.87	150	100	3937.03	50	8	4191.61	40	25
3764.81	100	50	3938.31	40	30	4206.74	50	50
3768.93	50	30	3940.15	80	15	4211.86	50 d	25 d
3771.77	40 d	20 d	3947.63	125 d	60 d	4222.98	125	40
3772.85	80 d	20	3949.44	150	100	4225.33	50	40
3774.06	100	50	3953.52	150	100	4241.02	50	12
3778.75	40	20	3960.60	50	25 n	4247.66	60	35
3781.64	100 d	50 d	3962.44	60	50	4251.49	40 w	15 w
3783.86	100 d	30 d	3964.26	60	50	4263.80	50	5 w
3785.50	50	20	3964.82	125 d	80 d	4272.27	50	35
3788.93	50 d	25 d	3965.26	100	50	4280.10	60	30
3792.52	100	8	3966.57	100 d	70 d	4282.44	75	40
3793.79	40 d	30 d	3967.13	40 d	25 d	4297.76	50	40
3794.38	50 d	25 d	3971.16	100	60	4302.10	60	5 w
3796.92	40 d	20 d	3971.69	60	40	4303.59	100	60
3799.68	50	25	3972.16	125	80	4305.76	150	90
3800.30	100	50	3976.29	50	10	4311.10	50	10 w
3803.11	50 d	20	3982.06	125	100	4316.06	50	8
3804.85	25 w	50 w	3986.17	40	15	4317.84	40	5 w
3809.16	80	40	3989.72	200	125	4323.55	100	35
3816.17	40	40	3994.83	300	25	4328.42	50	15
3818.28	125	100	3997.05	100	40	4328.98	50	10
3821.82	50	50	3999.19	50 d	40 d	4329.41	50	20
3823.18	125	25	4000.19	50	25	4330.44	50	3 w

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

PRASEODYMIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4333.15	40	10	4487.82	40	3 w	4822.98	125	10 w
4333.91	150	100	4488.17	40	10	4826.65	40 wn	..
4334.62	40	6 w	4496.43	200	125	4832.07	100 w	..
4335.75	80	20	4510.16	200	125	4837.04	80 w	..
4338.69	100	50	4517.59	40 w	15 w	4848.55	125 w	..
4342.81	40	5 w	4520.78	40	15	4859.04	40 w	..
4344.33	150 w	80 w	4534.15	150	80	4865.24	40	2
4347.49	100	40	4535.92	125	100	4877.82	50 w	5 w
4350.40	70	25	4548.54	60	30	4906.98	50	..
4351.85	80	60	4552.26	60	..	4914.03	60	..
4354.91	80	30	4563.13	100	40	4924.59	80	..
4359.11	70	25	4570.56	40	15	4936.00	50	..
4359.79	100	40	4576.32	50	15	4939.73	100	..
4362.98	50	20	4578.14	40 w	3 w	4940.30	50	..
4368.33	125	90	4612.07	60	15	4951.36	150	..
4371.61	125	40 w	4628.75	200	50 w	4956.64	40 w	..
4373.81	40	10	4632.28	40	1	4989.27	50	..
4374.41	50	15	4635.69	40	..	5018.58	50	1
4379.33	100 w	2	4639.55	60	2	5019.75	50	1
4380.32	50	20	4643.50	60 w	5 w	5026.97	80	1
4384.80	40	15	4646.06	50	8	5045.53	40	1
4396.12	80	50	4651.52	125	40 w	5110.38	80	2
4399.33	40	20	4664.65	100	15	5110.77	80	3
4403.60	100	40	4672.08	100	25 w	5129.52	100	..
4405.85	100	100	4684.94	125	10 w	5133.42	60	1
4408.84	125	100	4687.81	50	1	5135.12	50	2
4412.15	50	15	4695.77	60	2	5161.74	40	1
4413.76	90	40	4707.54	80	10 w	5173.90	100	4
4419.06	80	30	4707.94	50	10 w	5219.05	50	2
4419.67	100	50	4708.15	50	10 w	5220.11	80	3
4421.23	100	35 w	4709.52	40	1	5259.74	125	3
4424.59	90	35	4726.35	40 w	..	5285.63	40	1
4429.24	200	125	4728.63	40 w	6 w	5292.10	60 w	..
4431.89	40	5 w	4730.69	60	1	5292.63	50	2
4432.34	80	10 w	4734.18	100 w	8 w	5352.40	80	2
4438.16	50	20	4736.69	125	1	5381.26	60	2
4446.98	50	30 wn	4744.16	80	..	5509.15	50	2
4449.87	125	80	4744.92	100	10 w	5707.61	100 w	..
4450.21	40 w	20 w	4746.93	100	25 w	5779.29	50	..
4451.95	80	20	4755.98	50	2	5823.72	60 w	1
4454.38	60	15	4756.13	50 d	2 n	6017.80	40	2
4458.34	90	10 w	4757.94	100 w	5 w	6055.13	100 w	..
4465.98	90	30	4762.73	60	10	6161.19	50	2
4468.71	125	100	4765.22	80 w	5 w	6165.94	50	2
4477.26	125	30 w	4783.35	125	10 w	6359.04	40 w	..
4485.54	40	5 w	4801.15	40	3	6673.78	40	..

RADIUM

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
II 2169.9	..	125	II 2795.21	..	125	II 3851.90	..	25
II 2369.73	..	50	II 2813.76	..	400	II 3894.55	..	25
II 2460.55	..	50	II 2836.46	..	25	II 4194.09	..	80
II 2475.50	..	125	II 3033.44	..	150	II 4244.72	..	40
II 2586.61	..	50	I 3101.80	..	75	II 4340.64	..	1000
II 2643.73	..	125	II 3649.55	..	1000	II 4436.27	..	200
II 2708.96	..	200	II 3814.42	..	2000	II 4533.11	..	300

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RADIUM (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 4641.29	..	40	I 5505.50	..	25	I 6438.9	..	30
II 4682.28	..	800	I 5553.57	..	250	I 6446.20	..	1000
I 4699.28	..	40	I 5555.85	..	500	I 6487.32	..	1000
I 4825.91	..	800	I 5601.5	..	35	I 6532.08	..	30
I 4856.57	..	100	I 5616.66	..	250	6545.93	..	30
II 4859.41	..	100	I 5660.81	..	1000	6585.41	..	50
II 4927.53	..	100	II 5661.73	..	50	II 6593.34	..	500
I 5041.56	..	35	II 5728.83	..	25	I 6599.47	..	30
I 5081.03	..	50	5755.45	..	25	II 6719.32	..	500
5097.56	..	250	I 5778.28	..	35	I 6758.2	..	50
I 5205.93	..	250	I 5795.78	..	35	I 6903.1	..	30
5263.96	..	25	I 5811.58	..	35	I 6980.22	..	1000
I 5283.28	..	250	II 5813.63	..	500	II 7078.02	..	70
I 5320.29	..	250	5957.67	..	35	I 7118.50	..	1000
I 5399.80	..	250	I 6151.19	..	30	I 7141.21	..	2000
I 5400.23	..	500	I 6167.03	..	70	I 7225.16	..	1000
I 5406.81	..	500	I 6200.30	..	1000	I 7310.27	..	500
I 5482.13	..	100	II 6247.16	..	50	I 7838.12	..	100
I 5488.32	..	25	I 6336.90	..	500	II 8019.70	..	200
I 5501.98	..	250						

RADON

2756.3	..	25	3429.7	..	60	4604.40	..	200
2808.4	..	40	3479.5	..	30	I 4609.38	..	250
2812.1	..	25	3615.0	..	30	4625.48	..	500
2826.5	..	70	3621.0	..	250	4644.18	..	300
2830.6	..	70	3626.5	..	25	4680.83	..	500
2836.3	..	25	3634.8	..	250	4701.70	..	50
2838.5	..	70	3664.81	..	25	I 4721.76	..	150
2842.1	..	150	3679.0	..	30	I 4749.27	..	25
2868.7	..	70	3688.3	..	40	4768.59	..	100
2883.8	..	25	I 3739.89	..	25	4817.15	..	100
2887.2	..	125	I 3753.65	..	50	4829.2	..	35
2892.7	..	150	I 3917.20	..	25	4856.2	..	35
3006.8	..	300	3931.82	..	250	4891.1	..	35
3010.8	..	100	I 3941.72	..	25	4915.5	..	35
3032.5	..	40	I 3952.36	..	25	4950.0	..	35
3036.8	..	60	3957.15	..	25	4978.84	..	300
3037.7	..	40	3971.67	..	80	5044.8	..	35
3045.2	..	60	3981.68	..	150	5084.48	..	300
3054.3	..	250	4017.75	..	150	5582.4	..	200
3064.6	..	40	4045.3	..	35	5715.9	..	80
3068.9	..	100	4114.56	..	80	I 5722.58	..	30
3077.7	..	30	4166.43	..	500	5888.6	..	80
3100.19	..	50	4187.81	..	35	5894.4	..	30
3105.7	..	60	4203.23	..	200	I 5932.60	..	25
3106.7	..	30	I 4226.06	..	50	I 5951.57	..	25
3114.6	..	50	I 4307.76	..	400	I 6627.23	..	30
3169.7	..	30	I 4335.78	..	35	I 6751.81	..	40
3175.6	..	40	I 4349.60	..	5000	I 7055.42	..	400
3192.0	..	30	4371.53	..	30	I 7268.11	..	200
3196.9	..	30	4383.30	..	35	I 7291.00	..	40
3241.5	..	40	I 4435.05	..	200	I 7450.00	..	600
3254.5	..	30	I 4459.25	..	250	I 7809.82	..	100
3306.7	..	100	4507.83	..	80	I 8099.51	..	100
3312.8	..	100	I 4508.48	..	250	I 8270.96	..	100
3330.0	..	40	4546.8	..	35	I 8600.07	..	100
3356.5	..	40	I 4577.72	..	250	I 9327.02	..	50
3377.2	..	30						

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RHENIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2017.88	40	6	I 2647.12	100	..	I 3054.90	40	..
2023.66	10	50	2649.05	100	..	I 3058.79	50	..
2092.49	18	50	I 2651.90	100	..	I 3067.39	60	..
2097.16	40	10	2654.12	50	..	3069.94	125	..
2109.25	50	8	2663.63	150	..	3071.16	50	..
2112.28	6	40	2670.80	50	..	3072.96	40	..
2167.96	40	12	2671.84	60	..	I 3082.43	100 w	..
2176.23	40	8	I 2674.34	100	..	I 3084.21	40	..
2198.94	40	10	2683.56	50	..	3088.77	60	..
2214.27	100 W	100 W	2688.53	100	..	I 3093.65	60	..
2226.45	60	12	2690.26	50 n	..	3095.06	40	..
2238.64	40	4 n	I 2697.27	50	..	I 3100.67	100	..
2256.22	40	7	I 2715.47	100	..	I 3108.81	125	..
2275.25	300 r	300 r	I 2722.71	50	..	I 3110.86	100	..
2276.65	40	3	2732.21	40	..	3118.19	200	..
2301.82	..	40	2733.04	40 w	..	I 3121.37	100	..
2327.28	7	40	I 2733.05	40	..	I 3128.95	100 W	..
2335.75	40	9	2758.00	60 w	..	I 3151.63	150 w	..
2368.54	7	40	I 2763.31	40 w	..	I 3153.79	80	..
2381.14	40	7	2763.80	50	..	I 3158.31	200	..
2405.05	100	..	2766.40	50 w	..	I 3168.38	150 w	..
2405.60	80	..	I 2770.42	60	..	3177.71	80	..
2421.76	50	..	2781.45	40	..	I 3182.87	100	..
2431.53	50	..	I 2783.57	150 w	..	I 3184.75	150	..
2432.17	100 W	..	2790.94	40	..	I 3185.56	200	..
2441.48	40	..	2791.29	60	..	I 3192.37	40	..
2446.99	100 W	..	2807.87	50 w	..	I 3194.48	50 w	..
2449.71	40	..	2814.68	50	..	I 3200.04	50 w	..
2461.18	125	..	2816.33	40	..	3204.20	300	..
2461.86	80	..	I 2819.95	150 W	..	I 3211.76	40	..
2483.92	150	..	2834.06	100 r	..	3212.94	50	..
2485.81	50	..	2837.55	40	..	3227.46	40 w	..
2486.78	50 w	..	I 2840.35	40	..	3235.94	50	..
2487.23	50	..	I 2850.98	40	..	I 3252.26	40	..
2501.72	80	..	2867.20	40	..	I 3258.85	100	..
2502.38	60	..	I 2871.81	50	..	3259.55	100	..
2504.60	80	..	I 2875.29	80	..	3261.55	50	..
I 2508.99	125	..	2883.45	60	..	3268.08	40	..
2516.12	125	..	I 2887.67	125	..	I 3268.48	40	..
I 2520.01	50	..	2891.88	40	..	I 3296.70	80	..
2521.59	100 r	..	I 2896.02	125 w	..	I 3296.99	60	..
2534.80	100 w	..	I 2902.48	125 W	..	I 3301.60	50	..
2545.49	60	..	I 2905.58	50	..	I 3303.75	40	..
2552.03	80	..	2909.82	40	..	I 3313.95	40	..
2556.51	100	..	I 2924.60	40 W	..	I 3322.48	150	..
2558.05	60	..	2927.40	125 w	..	I 3335.37	100	..
2564.19	50	..	2930.62	50	..	I 3338.17	150	..
2573.77	60	..	I 2943.14	60	..	I 3342.26	200	..
2586.79	100	..	I 2965.12	100	..	I 3344.35	150	..
2587.14	40 w	..	I 2965.76	150 w	..	I 3346.20	100	..
2592.87	50 w	..	I 2968.05	40	..	I 3353.21	40	..
I 2594.85	40	..	I 2976.29	50 w	..	3355.29	60 n	..
I 2595.24	60	..	2978.16	40	..	I 3359.20	40	..
2599.86	80	..	2980.83	40	..	I 3362.75	40	..
2603.87	100	..	I 2988.48	40	..	3379.05	50	..
2614.56	60	..	I 2992.37	100	..	I 3379.72	80	..
2620.02	60	..	I 2999.59	125	..	3390.24	40	..
2620.35	50	..	3001.13	40	..	I 3399.30	200 w	..
2623.31	50 w	..	I 3004.14	40	..	I 3404.72	100	..
2631.58	80	..	I 3006.43	40	..	I 3405.89	150	..
2633.62	40	..	I 3016.02	80 W	..	3408.68	100	..
I 2636.64	125	..	3016.49	100	..	I 3417.80	40 r	..
2642.76	125	..	I 3030.45	100	..	I 3419.40	80	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RHENIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3420.76	40	..	I 3962.48	100	..	5278.24	100	..
I 3424.60	300 W	..	I 4023.35	40 w	..	5317.28	40 w	..
I 3427.62	50	..	I 4029.64	80	..	5321.26	40	..
I 3437.72	100	..	I 4033.31	40	..	5327.46	100	..
3441.26	40	..	I 4110.90	40	..	5331.90	80	..
3449.37	100 r	..	I 4121.63	50	..	5369.81	40	..
I 3451.81	100	..	I 4133.41	200	..	5377.04	300 W	..
I 3453.50	40	..	I 4136.45	150 w	..	5532.66	100	..
I 3460.47	1000 W	..	I 4144.36	125 w	..	5563.21	150 w	..
I 3464.72	100	..	I 4149.97	40 w	..	5584.75	40 w	..
I 3467.95	100 w	..	4170.39	40	..	5667.90	100	..
I 3480.38	50	..	I 4182.98	150 r	..	5740.30	50 w	..
I 3480.85	50	..	I 4194.67	40	..	5752.95	200 w	..
3482.24	40	..	I 4221.08	100	..	5776.84	300 w	..
I 3503.06	80	..	I 4227.46	200 W	..	5815.87	50 w	..
I 3512.29	50	..	I 4257.59	125 w	..	5834.33	200	..
3516.65	60	..	4291.18	100 w	..	5852.02	40 w	..
3517.33	50	..	I 4315.71	40 w	..	5943.24	100	..
I 3537.47	80 w	..	I 4332.26	50	..	6145.80	50 w	..
I 3549.89	40	..	I 4358.69	80	..	I 6146.82	50	..
3551.31	40 w	..	4367.58	80	..	I 6217.99	40 w	..
I 3558.95	50 w	..	4391.33	60 w	..	I 6229.44	40 w	..
3568.23	40	..	4392.49	100	..	I 6243.22	50 w	..
I 3579.13	50	..	4394.38	100 r	..	I 6307.72	100 w	..
3580.13	80	..	4406.40	60	..	I 6321.89	100 w	..
I 3580.97	40 w	..	4415.82	40	..	I 6350.75	100 r	..
I 3583.02	100 w	..	4440.44	40	..	I 6511.48	60	..
3610.49	40	..	4454.67	100	..	I 6577.15	50 W	..
I 3617.08	50	..	4467.94	50	..	I 6592.54	60 w	..
I 3637.84	50	..	4477.99	40 w	..	I 6605.19	100 W	..
I 3642.99	100	..	4478.39	40 w	..	6652.40	80 W	..
I 3651.97	40	..	4507.03	40 w	..	6751.22	50	..
I 3689.52	100 W	..	4513.30	300	..	6752.03	50	..
I 3691.50	100 w	..	4516.63	80	..	6813.42	200 w	..
3697.70	150 w	..	4519.74	40 d	..	I 6829.96	200 w	..
I 3703.24	40	..	4522.72	100	..	I 6971.53	150	..
I 3709.94	40	..	4523.88	40	..	I 7006.65	100	..
I 3717.29	150 W	..	4529.93	40 w	..	I 7024.13	125	..
I 3725.77	40 n	..	4605.73	50	..	I 7228.03	40	..
I 3735.33	40	..	4614.70	50	..	I 7246.67	300	..
I 3740.10	50 W	..	4625.98	40	..	I 7273.84	150	..
I 3745.44	40 W	..	4630.84	50	..	7292.67	300	..
I 3777.66	40	..	4695.01	40	..	7352.03	50	..
I 3787.53	80	..	4705.03	40 w	..	I 7578.72	200 w	..
3795.80	40 W	..	4727.62	40	..	I 7611.90	100	..
I 3796.60	60	..	4748.38	50 w	..	I 7620.25	200 wl	..
I 3797.59	40	..	4791.42	200 w	..	I 7640.93	400 wl	..
I 3817.56	40	..	I 4889.17	2000 w	..	I 7869.60	100 wl	..
I 3834.23	50	..	4923.93	150	..	I 7898.47	40	..
I 3836.32	40	..	4946.74	100	..	I 7912.94	400 wl	..
I 3843.45	50	..	I 4985.99	40 W	..	I 7980.75	300 wl	..
I 3869.92	40	..	5058.56	40	..	I 8417.14	300	..
I 3875.25	40	..	5096.50	100	..	I 8527.73	300 Wl	..
I 3876.89	60	..	5104.63	50 w	..	I 8675.65	50 Wl	..
I 3917.27	100 w	..	5120.32	40	..	8786.77	40 Wl	..
3920.88	40 W	..	5126.69	50 w	..	9383.74	40	..
I 3929.84	100	..	5178.91	100 W	..	9710.52	50	..
I 3936.90	40	..	5270.98	200 W	..	I 9949.90	200 W	..
I 3945.91	40	..	5275.53	500 w	..	I 9955.45	60 W	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RHODIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2013.74	..	100	2377.81	..	50	2609.17	3	200
2017.45	..	80	2382.89	50	5	I 2622.57	50	25
2023.74	..	70	2383.40	50	10	2625.40	2	200 Wn
2036.70	..	80	2386.14	80	8	I 2625.88	60	25
2037.60	..	50	2390.62	10	50 w	2628.12	1	150
2040.19	2	100	2396.55	2	200	2630.33	2	50
2048.65	..	200	2405.22	1	50	2638.74	2	100
2051.25	2	100	I 2407.88	60	5	2639.25	2	100
2059.16	..	50	2410.69	2	50	I 2652.66	100	25
2064.17	3	100	2411.94	2	50	2657.32	..	70
2076.83	..	100	2415.84	100	200	2659.11	..	100
2085.58	..	100	2420.98	30	100	2674.44	1	200 w
2089.48	..	80	2427.34	2	50	2676.25	1	100
2091.07	..	100	2438.79	2	100	I 2680.63	60	10
2096.05	..	80	2443.71	4	100	2681.60	..	100
2097.83	3 n	200	2444.06	2	100	2683.56	1	200
2098.09	15	300	I 2444.27	100 w	3	2684.21	2	150
2100.52	2	100	2447.85	4	200 w	2689.62	1	100
2100.76	50	..	2448.28	2	100	2691.12	1	60
2102.45	..	50	2455.70	15	200 W	2700.59	2	80
2104.89	..	100	2456.18	5	150	I 2703.73	150	25
2111.69	..	150	2458.90	50	300	2705.63	100	300 wn
2112.70	3	80	2461.04	80	200 wn	I 2707.23	100	4
2113.70	..	70	2463.44	2	150	I 2709.52	50	2
2116.87	3 w	50	2466.15	1	100	I 2714.41	150	5
2118.50	2 w	200	2467.23	..	50	I 2715.04	50	2
2139.43	..	100	I 2470.39	70	5	2715.31	50	500 wn
2163.18	..	50	I 2471.47	70	8	I 2716.82	50	3
2167.32	..	80	2471.77	3	100	I 2717.51	100	5
2187.58	..	50 l	2482.73	2	100	2717.98	..	50
2199.96	..	50	I 2483.33	100 r	5	I 2718.54	150	20
2203.55	15	50 w	2485.82	2	50	2720.14	100	6
2205.02	..	100	2487.47	100	8	I 2720.52	50	2
2206.35	..	80	2490.77	100	1000 wn	I 2728.94	200	200
2226.53	50	..	2491.85	2	400 n	I 2736.76	100	3
2237.71	..	100	I 2492.30	100	10	2737.40	30	400 wn
2240.00	..	50	2495.95	2	50	2739.92	10	300
2246.38	..	50	2501.27	50 r	50	2747.63	1	100
2261.75	2	100	2503.84	2	150	I 2752.84	50	2
2263.43	5	200	2505.10	2	200	2761.26	1	50
2264.14	50	25	2510.65	5	200 wn	2764.83	15 r	125
2276.21	..	50	I 2515.75	60	10	2766.54	5	150
2276.96	20	150	2517.52	..	150	I 2767.73	100	4
2284.08	..	200	2520.53	10	1000 wn	2768.23	50	4
2290.03	25	500	2534.57	2 w	100 w	I 2771.51	100	8
2294.12	1	50	2537.04	15	100	2775.77	5	125
2295.12	5	50	2537.73	4	50	I 2778.05	100	3
2298.26	..	150	2542.16	1	50	2778.15	2	100
2305.95	..	100 wn	2543.94	15	100 r	I 2779.54	100	6
2312.65	2	100	2545.35	8	150	2781.80	1	150
2321.86	..	80	2545.69	50	10	I 2783.03	150	10
2322.58	50	10	I 2555.36	100	60	I 2791.16	100	1 n
I 2333.31	8	125	2557.20	1	100	I 2796.63	100	1
2334.77	25 l	500	2557.92	1	50	I 2826.67	100	50 d
2336.84	1	125	2559.90	5	700	I 2827.31	50	..
2346.44	2	100	2561.92	..	50	I 2834.12	70	30
2349.68	3	125	2568.83	2	100	I 2836.69	60	..
2350.35	..	50	2569.07	3	125	I 2856.16	60	30 n
2357.43	2	50 wn	2581.69	1	150	I 2862.93	150	60
2359.18	15	100	2587.29	2	100	2864.40	70	10
2359.57	..	50	2592.16	..	80	2871.35	100	10 n
2366.88	3	50	2597.07	3	150	2873.62	60	10
2368.34	50	1	2603.32	..	100	I 2878.65	50	10

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RHODIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2882.37	80	10	3451.15	50	2	I 4135.27	300	150
I 2889.11	80	1 n	I 3455.22	300	12	4154.37	60	1
I 2889.84	70	30	I 3455.42	50	2	I 4196.50	100	50
I 2899.95	70	30	I 3457.07	100	4	I 4211.14	15	200
I 2907.21	100	30	I 3457.93	125	10	I 4288.71	400	100
2910.17	50	12	I 3462.04	1000	150	I 4373.04	60	10
I 2912.62	50	20	I 3469.62	100	10	I 4374.80	1000 W	500
I 2915.42	80	40	I 3470.66	500	125	I 4379.92	60	25
I 2924.02	100	..	I 3472.25	100	8	I 4528.72	500 r	60
2929.11	100	10	I 3474.78	700	125	I 4569.00	100	25
I 2931.94	80	20	I 3478.91	500	100	I 4675.03	100	50
I 2968.66	125	30	I 3494.44	50	3	I 4842.43	50	..
I 2977.68	125	30	I 3498.73	500	60	4843.99	100	60
I 2986.20	150	60	I 3502.52	1000	150	4851.63	80	30
I 2986.99	80	20	I 3507.32	500	125	I 4963.71	100	..
I 3023.91	100	2	I 3511.78	50	3	I 5090.63	150	1
I 3028.43	80	..	I 3513.10	50	3	I 5155.54	150	1
3067.30	80	1	I 3525.66	50	2	5158.69	80	1
I 3083.96	150	2	I 3528.02	1000 w	150	5175.97	200	1
I 3114.91	100	2	I 3538.14	100	10	I 5184.19	100	1
I 3121.75	150	..	I 3538.26	50	4	5193.14	200	3
I 3123.70	150	2	I 3541.91	50	10	I 5237.16	100	2
I 3130.79	60	2	I 3543.95	150	40	I 5269.27	50	1
I 3137.71	100	..	I 3549.54	150	50	I 5292.14	80	1
3151.36	80	2	I 3570.18	400 r	150	I 5354.40	300	5
3152.60	80	3	I 3583.10	200	125	I 5379.09	100	3
3155.77	150	2	I 3596.19	200	50	I 5381.48	100	..
I 3179.73	50	..	I 3597.15	200	100	I 5390.44	125	3
I 3185.59	100	20	I 3612.47	200	50	5404.73	50	1
I 3189.05	100	20	I 3626.59	150	60	5424.07	100	2
I 3191.19	300	50	I 3639.51	125	70	5535.04	80	1
I 3194.55	50	10 n	I 3657.99	500 W	200 W	I 5544.58	50	1
I 3197.13	50	10	I 3666.21	70	30	I 5599.42	300 w	3
I 3214.32	70	20	I 3690.70	125	50	I 5686.38	100	1
I 3217.88	60	20	I 3692.36	500 nd	150 wd	I 5806.91	100	1
I 3218.28	60	..	I 3700.91	150 d	150 d	I 5831.58	80	1
I 3237.66	60	20	I 3713.02	100	100 r	I 5983.60	200	2
I 3263.14	200	40	I 3735.28	70	2	6102.72	100	..
I 3271.61	200	60	I 3737.12	50	1	I 6319.53	50	..
I 3283.57	150	..	3737.27	50	10	I 6414.72	50	..
I 3289.14	150	50	I 3748.22	200	100	I 6752.35	150	..
3289.64	50 r	5	I 3765.08	100	70	6965.67	200	..
I 3294.28	60	25	3788.47	50	25	I 6979.15	25	..
I 3300.46	100	20	I 3793.22	200	60	I 7101.64	60	..
I 3323.09	1000	200	I 3799.31	25	100	I 7104.45	80	..
I 3331.09	50	10	I 3805.92	25	50	I 7268.18	125	..
I 3338.54	200	50	I 3806.76	50	50	I 7270.82	200	..
I 3344.20	100	20	I 3818.19	50	25	I 7271.94	80	..
I 3359.89	100	50	I 3822.26	100	100	I 7442.39	100	..
I 3362.18	100	20	I 3828.45	100	60	I 7475.74	100	..
I 3368.37	300	50	I 3833.89	25	50	I 7495.24	100	..
I 3372.25	300	200	I 3856.51	50	20	I 7772.90	100	..
I 3396.85	1000 w	500	I 3872.39	50	3	I 7791.61	100	..
I 3399.70	500	60	I 3934.23	100	2	7824.91	200	..
I 3406.55	50	8	I 3942.72	60	25	I 7830.05	80	..
3412.27	300	60	I 3958.86	200	100	I 7846.50	50	..
3434.89	1000 r	200 r	I 4082.78	100	50	I 8029.91	150	..
3440.53	2	100	I 4119.68	100	25	I 8036.11	100	..
I 3447.74	50	5	I 4121.68	150	50	I 8045.40	125	..
I 3450.29	100	10	I 4128.87	300	150	I 8136.20	50	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RUBIDIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2217.12	..	(100)	3492.76	..	(300)	I 6159.62	400	..
2254.24	..	(70)	3511.19	..	(60)	II 6199.09	..	100
2291.76	..	(80)	II 3521.44	..	(200)	I 6206.31	800	100
2304.14	..	(125)	II 3531.60	..	(100)	I 6298.33	1000	150
2312.45	..	(100)	II 3541.22	..	(100)	I 6299.22	300	50
2333.38	..	(80)	I 3587.08	200	40	6310.04	..	50
2337.05	..	(125)	I 3591.59	80	20	II 6458.35	..	400
2345.35	..	(100)	II 3940.57	..	(200)	6498.31	..	50
2349.80	..	(80)	I 4201.85	2000 r	500	II 6555.62	..	100
2364.28	..	(150)	I 4215.56	1000 r	300	6560.84	..	150
2365.08	..	(70)	4242.6	..	(150)	II 6775.06	..	200
2365.97	..	(80)	4348.3	..	(80)	II 6805.65	..	50
2373.22	..	(70)	II 4622.45	..	50	II 7042.45	..	150
2380.44	..	(125)	II 4776.41	..	(100)	I 7279.99	400	50
2381.30	..	(100)	II 5152.09	..	100	II 7316.50	..	(50)
2807.63	..	(70)	I 5362.60	50	..	I 7408.17	500	..
2956.12	..	(70)	I 5431.53	100	..	I 7618.93	1000	..
3198.77	..	(60)	II 5522.79	..	100	I 7757.65	1000	..
3286.47	..	(60)	I 5578.78	150	..	I 7759.43	400	..
II 3321.54	..	(60)	II 5635.99	..	100	I 7800.23	9000 r	..
II 3340.60	..	(60)	I 5648.10	400	..	I 7925.26	100	..
3347.00	..	(60)	I 5653.74	200	..	I 7925.54	70	..
I 3348.72	100	..	II 5699.16	..	100	I 7947.60	5000 r	..
I 3350.89	150	..	I 5724.45	600	..	I 8271.41	200	..
II 3434.26	..	(60)	I 5724.95	50	..	I 8271.71	100	..
3439.34	..	(200)	I 6070.75	600	50	I 8868.51	70	..
II 3461.57	..	(200)						

RUTHENIUM

2238.33	50	..	2402.72	100	150 r	2507.01	60	80
2241.07	60	..	2407.92	60	50	I 2508.27	50	2
2253.64	50	..	2420.82	60	2	2508.67	..	50
2255.52	80	3	2422.57	50	1 n	2509.07	50	20
2272.09	100	3	2422.92	60	8	2512.81	80	2
2278.19	80	..	2429.60	60	..	2513.32	50	80
2279.57	100	10	2432.93	60	..	2515.28	60	2
2285.38	80	1	2434.88	50	..	2517.32	60	80
2287.68	60	1	2454.92	60	5	2517.62	50	..
I 2291.18	60	1	2455.53	80	100 r	2518.40	3	50
2299.29	50	..	2456.44	60	50	2519.21	20	80
2300.37	50	..	2456.57	60	50	2521.61	60	1
2302.54	80	3	2458.62	60	2	2524.86	10	80
2320.70	50	..	2462.94	60	..	2526.83	50	20
2322.01	60	2	2464.70	50	4	2528.04	..	60
2340.69	60	4	2474.04	50	1 Wn	2528.88	60	2
2342.72	60	10	2475.41	100	3	I 2533.24	50	..
2342.85	60	40	2476.31	50	..	2534.00	4	80
2348.33	50	..	2476.88	60	2	2535.59	..	100
2349.34	60	4	2478.93	80	60	2539.72	12	100
2351.33	60	4	I 2481.11	12	80	2540.30	10	100
2357.91	60	100	2489.91	60	..	2541.28	50	..
2370.17	60	..	2493.69	20	80	2543.25	50	150
2375.27	80	5	2494.02	80	..	2544.22	60	6
2375.63	50	80	2494.48	50	60	2547.67	5	80
2381.99	50	150	2495.69	80	35	2549.18	5	150
2387.90	60	3	2497.68	50	1 n	2549.58	50	3
2392.42	80	6	2498.42	60	40	2549.79	3	100
2393.25	80	1	2498.57	60	40	2551.98	10	150
2393.97	50	..	2499.78	50	4	2556.31	50	..
2396.71	60	80	2501.48	60	1	2557.13	5	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RUTHENIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2558.53	50	1	2636.82	..	50	2717.86	..	50
2560.26	60	5	2638.51	60	4	I 2719.51	100	30
2563.15	50	1	2639.12	60	5	2719.72	12	50
2564.58	50	2	2639.87	50	..	I 2721.56	60	5
2565.18	50	..	2640.33	60	5	I 2722.65	60	1
2565.70	4	50	2641.62	..	100	2723.10	..	50
2566.23	..	50	2642.79	..	150	2724.06	60	4
I 2568.77	60	8	I 2642.96	150	..	2724.87	..	100
2570.97	50	..	2644.61	8	100	2725.47	80	200
2571.08	6	100	2646.02	20	150	2726.97	60	10
2573.54	5	50	2647.31	50	5	2728.83	60	..
2576.08	..	50	2648.78	30	150	2729.45	60	..
2579.02	12	80	2650.40	50	..	I 2730.33	60	2
2580.80	50	3	I 2651.29	60	5	I 2730.93	80	5
2581.14	60	2	2651.84	100	9	2731.90	50	..
2584.14	50	3	2653.95	..	80	2733.59	80	4
2585.73	50	..	2656.25	20	150	2734.35	80	200
2589.41	..	60	2657.19	..	50	2735.72	60	60
2589.57	60	3	I 2659.61	80	12	2736.48	12	80
2590.97	12	100	2661.17	20	100	2736.81	30	60
2591.12	50	..	2661.61	80	150	2737.59	..	50
2591.24	..	50	2661.86	50	..	2737.79	..	60
2592.02	60	6	I 2664.76	60	5	2738.89	60	2
2594.85	60	4	2667.39	10	150	I 2739.22	60	5
2595.80	..	100	2667.79	..	80	2742.35	4	50
2597.15	..	50 n	2667.97	50	..	2743.53	50	50
2598.77	4	50	2669.42	..	100	2743.94	50	100
2602.25	..	100	2673.01	8	50	2744.45	30	50
2604.12	..	80	2673.48	50	3	2745.25	12	150
2605.35	50	4	2673.60	50	3	2745.83	50	80
2605.86	50	3	2674.19	..	50	2746.07	50	8
I 2609.06	80	12	2675.52	..	50	2747.97	50	100
2610.08	..	60	2676.19	8	100	2749.68	50	10
2611.05	50	5	2676.35	50	3	2750.35	50	..
2611.51	3	80	2678.76	100	300	2752.10	..	60
2612.07	100	30	2680.54	5	50	2752.45	50	..
2612.51	..	80	I 2686.29	80	12	2752.77	50	150
2614.07	60	3	2687.07	..	50	2753.44	50	50
2614.59	50	4	2687.50	12	100	I 2754.61	50	1
2615.09	60	100	2688.11	8	100	2757.81	50	..
2617.07	..	50	2689.90	50	..	2762.31	50	3
2617.79	50	4	2692.06	8	200	2763.42	50	15
2619.35	..	60	2693.29	80	2 n	2764.72	50	1
2619.67	50	5	I 2700.15	..	100	2765.13	..	80
2620.61	50	5	2700.48	50	..	2765.44	50	150
2623.83	50	..	2700.99	..	50	2765.87	..	50
2626.21	50	..	2701.34	60	8	2766.55	..	100
2626.35	20	50	I 2702.83	80	8	2768.93	60	200
2626.47	50	..	2703.80	60	3	2770.30	60	3
2627.65	60	1	2704.57	..	100	2770.70	60	..
2628.73	..	100	2707.29	..	60	2771.07	..	100
2630.02	..	50	2707.97	50	3	2772.45	..	150
2630.23	50	1 n	2709.20	60	8	2772.61	50	..
2631.09	..	50	2710.23	50	100	2774.48	60	2
2631.57	60	3	2712.41	80	300	2775.18	50	..
2632.13	50	2	2713.07	..	80	2775.63	50	150
2632.50	50	1	2713.19	60	2	I 2775.91	50	..
2632.71	..	80	2713.58	..	100	2777.39	..	50
2633.46	50	1 n	2713.74	60	2 n	2777.50	5	50
2633.80	..	80	2715.78	50	..	2778.38	..	150
2635.86	30	100	2716.12	..	100	2778.99	50	50
2636.54	8	100	2716.58	..	80	I 2782.21	50	1
2636.67	60	..	2717.40	50	100	2784.53	60	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RUTHENIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2785.65	60	200	2919.61	80	12	3048.49	50	5
2787.83	60	150	2927.54	50	200	I 3048.78	60	9
2788.71	..	50	2933.24	20	150	3049.17	2	70
2792.33	10	100	2935.52	10	80	I 3054.94	70	12
2792.64	50	1	I 2940.36	50	3	3056.86	12	150
2799.91	..	50	2942.25	30	100	3059.17	50	..
2802.81	50	150	2943.92	50	5	3060.23	20	50
2803.50	50	4	2945.10	6	50	3060.49	8	50
2804.88	..	60	2945.67	60	300	3064.84	70	60
2806.74	50	100	I 2946.99	60	12	3068.26	60	8
2808.23	50	..	I 2949.50	80	12	I 3073.34	50	5
I 2810.03	50	12	I 2952.50	60	2	3073.51	10	80
I 2810.55	50	200	I 2954.49	100	20	I 3076.78	50	3
2813.30	..	75	2955.36	50	1	I 3080.90	50	6
2813.71	50	125	I 2958.00	60	5	3081.38	4	50
I 2817.09	50	4	2961.53	5	50	I 3083.15	50	3
I 2818.36	50	12	2961.69	60	3	3086.07	60	6
I 2818.95	50	3	2963.40	60	150	I 3089.14	60	12
2821.42	5	100	I 2963.71	60	5	I 3089.80	60	5
2822.03	50	5	I 2965.16	80	20	3090.23	50	6
2822.55	30	150	2965.55	60	200	3091.87	50	5
2823.18	20	80	I 2968.95	60	6	3093.90	30	100
2825.06	..	60	2973.99	50	5	3094.39	50	3
2825.46	..	80	2976.59	60	200	3094.56	6	50
2826.22	..	80	2976.92	60	5	3096.57	70	60
2826.68	..	100	2977.23	50	80	I 3099.28	70	60
I 2829.16	50	8	2977.48	30	60	I 3100.84	70	50
2831.84	10	50	2978.64	50	150	3103.41	3	50
2833.78	..	80	2979.96	60	80	3105.28	50	40
2840.54	60	8	2980.96	10	50	I 3105.41	50	1
2841.12	..	125	2981.93	60	3	I 3106.84	50	3
2841.68	50	200	I 2988.95	250	100	3107.58	10	50
2844.71	..	150	2991.62	50	100	I 3107.71	60	5
2848.58	50	3	I 2993.27	60	9	I 3110.55	60	6
2849.29	3	100	I 2994.96	80	40	I 3111.91	50	5
I 2854.07	60	35	2995.99	4	50	3112.68	50	3
2854.72	2	60	2996.89	60	5	I 3113.40	50	..
2856.55	..	50	2998.35	80	8	I 3118.07	50	50
2857.78	4	60	2998.89	50	100	3118.68	50	3
I 2860.02	60	12	2999.81	8	50	I 3124.17	60	8
I 2861.41	60	35	I 3001.64	60	5	3124.61	50	2
2862.88	6	60	3004.60	50	2	I 3125.96	70	12
2863.32	30	80	3005.13	..	60	3126.61	12	50
I 2866.64	60	25	3006.59	70	15	3127.91	10	100
2870.55	..	50	3008.26	50	3	3129.60	50	1
2871.64	50	5	3008.80	50	5	I 3129.84	60	4
2873.31	4	60	I 3012.92	60	4	3132.88	60	5
2874.98	80	50	I 3013.36	60	5	I 3134.80	10	100
2879.06	..	60	3015.41	8	50	3135.80	10	80
2879.75	50	12	3017.24	100	50	3136.55	60	6
2882.12	30	200	3017.81	10	60	3140.48	50	..
2886.54	60	50	I 3020.88	60	40	I 3140.97	60	6
2897.71	6	60	3027.79	12	50	3143.65	20	80
2898.22	..	60	I 3033.45	70	10	3144.26	60	8
2900.42	..	50	I 3034.06	60	5	I 3147.21	50	3
I 2905.65	50	12	I 3035.47	60	4	3147.45	6	80
2909.74	..	150	3036.47	50	150	3150.69	60	60
2913.17	50	3	I 3037.96	50	5	3153.82	60	12
2913.97	..	50	I 3038.18	80	5	I 3156.82	50	..
2914.30	50	..	I 3040.31	60	10	I 3158.89	60	12
I 2916.25	100	25	3042.47	70	12	I 3159.92	70	25
2917.77	60	2	I 3042.83	60	5	3163.18	12	100
2918.50	..	60	I 3045.71	60	12	3164.95	3	70

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RUTHENIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3167.47	5	100	3341.09	50	5	I 3509.72	50	2
3168.52	100	25 r	3341.66	70	50	I 3514.49	70	40
3174.13	50	3	I 3344.53	60	6	3519.63	70	30
3175.15	20	100	3345.32	60	5	3520.13	60	40
3176.29	50	3	I 3347.61	60	6	I 3528.68	60	12
3177.05	60	200	3348.01	50	3	3531.39	60	9
3179.26	50	50 r	I 3348.70	50	2	3532.81	60	12
I 3186.04	80	25	I 3351.93	50	4	3535.83	60	12
I 3188.34	60	50	3353.65	50	4	3536.57	50	..
I 3189.98	50	50	I 3359.09	70	20	I 3537.95	70	25
3195.15	..	100	I 3362.00	60	8	I 3539.37	60	15
3196.59	50	2	3362.33	50	5 n	3541.63	60	10
3201.26	2	100	I 3368.45	100	60	3570.59	12	60
I 3223.27	60	35	3369.28	12	60	3587.20	5	70
I 3226.37	50	12	I 3371.86	70	18	I 3589.21	60	100
I 3228.53	50	150	I 3373.98	60	4	I 3593.02	60	150
I 3232.75	50	4	I 3374.65	80	18	I 3596.17	30	100
3234.43	3	50	3378.02	60	12	3599.76	12	100
3238.53	100	45	I 3379.60	60	18	3634.93	50	100
I 3238.77	50	1	I 3380.17	60	15	3657.55	..	50
I 3239.60	50	5	3385.14	60	35	I 3661.35	60	100
I 3241.23	60	12	I 3385.71	50	4	3663.37	5	60
3242.16	80	..	I 3388.71	80	20	3669.49	50	70
3243.50	70	12	I 3389.50	60	18	3690.03	5	100
I 3254.54	50	9	3391.89	50	6	I 3696.59	50	15
3254.71	50	9	3392.54	100	40	3700.99	50	20
3256.33	50	3	3399.37	60	3	3726.10	12	60
I 3258.04	50	8	I 3401.74	100	50	I 3726.93	100	150
3258.97	10	60	3405.88	50	2	I 3728.03	100	150
I 3259.67	60	9	3406.59	50	3	I 3730.43	12	70
I 3260.35	100	50	3409.28	100	40	I 3742.28	70	100
I 3266.44	50	9	3411.64	80	20	3742.78	50	50
I 3268.21	60	12	I 3412.80	50	5	3753.54	30	60
3268.79	4	60	I 3414.64	50	5	I 3755.93	30	60
I 3273.08	60	20	3416.18	50	4	I 3760.03	20	50
I 3274.71	60	25	I 3417.35	1	70	3767.35	50	50
I 3294.11	60	200	3420.08	60	8	I 3777.59	60	50
I 3296.11	50	10	3428.31	100	100	3781.18	50	40
I 3296.65	50	5	3429.54	60	25	I 3786.05	70	100
3297.26	50	4	I 3430.77	70	45	I 3790.51	70	150
I 3297.95	50	6	I 3432.21	50	12	I 3798.90	70	100
I 3298.41	50	25 r	3432.74	70	40	I 3799.35	70 r	100
I 3299.33	50	4	I 3433.26	60	25	3808.68	50	30
I 3301.59	70	40	I 3435.19	60	20	3817.27	50	60
3303.99	60	8	I 3436.74	300 r	150	I 3819.03	50	30
I 3304.82	50	3	I 3438.37	70	35	3822.09	50	25
I 3306.17	60	12	I 3440.20	100	30	3831.79	60	50
I 3307.98	50	..	3446.07	50	6	3835.05	50	6
I 3315.05	50	12	3446.49	50	..	3839.69	50	30
I 3315.23	60	25	3448.95	70	20	I 3850.43	50	10
I 3316.39	80	..	I 3452.90	60	6	3856.46	50	8
3316.91	5	50	I 3456.62	60	8	3857.55	50	25
I 3317.89	50	12	I 3463.14	60	4	3862.65	2	60
3318.82	50	8	3467.05	50	3	I 3867.84	60	35
I 3324.99	60	12	3472.23	60	9	I 3892.21	50	40
3327.71	50	6	I 3473.75	70	35	I 3901.24	50	12
3332.05	60	10	I 3481.30	70	35	3909.07	30	50
3332.64	60	5	3483.16	50	8	3923.46	60	100
I 3335.69	70	12	I 3483.29	60	10	I 3925.92	60	100
3336.64	50	4	I 3494.25	50	8	3931.75	50	70
I 3337.82	60	8	3495.97	60	10	3933.68	5	200
3339.55	100	60	I 3498.94	500 r	200	3945.57	50	100
3339.78	10	70	3509.20	10	100	3964.90	50	40

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

RUTHENIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3968.46	12	200	I 4342.07	60	40	5093.83	60	..
I 3978.44	60	70	4361.21	40	50	I 5136.55	125	..
I 3979.42	60	60	I 4372.21	125	100	I 5147.24	60	..
I 3984.86	60	70	I 4385.39	125	40	I 5155.14	125	..
3987.79	3	50	I 4385.65	125	50	I 5171.03	150	..
I 4022.16	40	100	I 4390.43	150 r	80	I 5195.02	100	..
I 4023.83	25	60	I 4397.80	150	..	I 5284.08	100	..
4039.21	25	50	I 4410.03	150	80	5304.86	60	..
I 4051.40	125	200	I 4421.46	60	..	I 5309.27	125	..
I 4052.19	25	50	I 4428.46	125	..	5334.70	60	..
I 4054.05	40	100	I 4439.76	125	50	5335.93	100	..
I 4064.46	20	60	I 4449.34	125	100	5361.77	100	..
4068.37	40	60	I 4460.03	150	80	5401.04	125	..
I 4076.73	60	25	I 4473.93	100	..	5454.82	100	..
4080.60	125	300	4480.45	60	..	I 5484.32	60	..
I 4085.43	40	50	I 4498.14	125	40	5510.71	100	..
I 4097.79	25	125	I 4516.89	100	..	I 5559.75	60	..
I 4101.74	20	60	I 4517.82	60	..	I 5636.23	100	..
I 4112.74	125	200	I 4530.85	60	..	I 5699.05	125	..
4113.38	40	50	I 4554.51	1000 r	200	6663.14	100	..
I 4144.16	150	200	I 4584.44	150 r	80	6990.00	300	..
I 4145.74	125	150	I 4591.10	60	..	6824.09	200	..
I 4146.77	100	70	I 4592.52	100	..	6911.48	100	..
I 4148.37	60	15	I 4599.08	100	..	6923.23	300	..
I 4161.66	25	50	I 4635.69	125	..	6982.01	200	..
I 4167.51	100	150	4645.09	100	30	I 7027.98	250	..
4196.87	60	50	4647.61	125	..	7235.92	200	..
I 4197.58	100	100	I 4654.31	125	..	7393.93	150	..
I 4198.87	60	100	I 4681.79	100	..	7468.91	150	..
I 4199.90	150	300	I 4684.02	100	..	7475.40	50	..
I 4206.02	100	40	I 4709.48	150	80	7485.79	150	..
I 4212.06	125	80	I 4731.33	60	..	7499.75	200	..
4214.44	100	40	I 4757.84	125	..	I 7559.61	100	..
I 4217.27	100	20	I 4869.15	125	..	7771.88	100	..
I 4220.67	60	..	I 4903.05	60	..	7774.14	100	..
I 4230.31	60	..	I 4938.43	60	..	7775.41	60	..
I 4241.05	100	20	I 4980.35	60	..	I 7791.86	100	..
I 4243.06	100	40	5057.29	60	..	I 7847.80	100	..
I 4297.71	60	50	I 5057.33	100	..	7881.49	100	..
I 4307.59	20	50						

SAMARIUM

3183.92	60	40	II 3418.51	50	10	II 3710.87	100 r	7
II 3207.18	50	9	3445.62	150 r	10 r	II 3712.76	100	100
3211.75	100	15	II 3568.26	40	50	II 3718.88	100	5
II 3215.24	50	15	II 3592.59	40	50	3719.45	50	10
3218.60	100	25	II 3609.48	60	100	3721.84	100	50
II 3230.54	100	30	II 3621.22	60	10	II 3726.80	100 r	3
3236.63	100	40	II 3626.99	50	40	II 3728.47	100	100
II 3239.64	100	25	II 3634.27	100	25	II 3731.26	50	10
II 3241.14	50	10	II 3649.51	100	30	II 3735.97	50	8
II 3250.36	50	10	II 3661.35	100	50	II 3743.86	50	25
II 3253.93	50	8	II 3662.25	50	50	II 3770.73	25	50
II 3254.38	100	15	II 3670.82	100	50	3771.35	50 d	2
II 3276.74	50	10	II 3674.05	50	10	3778.13	40	100
3298.10	60	60	3687.88	50	..	3783.81	50 d	10 d
II 3306.37	100	40	II 3692.22	90	40	II 3787.20	100	35
II 3321.18	50	15	II 3693.99	100	150	II 3830.30	50	10
3327.90	50	20	II 3700.59	50	30	3836.51	50	25
II 3382.41	100	40	3700.93	50	4	3848.81	150 d	10
II 3402.46	50	10	II 3708.66	50	25	3854.20	300 wn	25

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

SAMARIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3875.17	50	10	II 4378.23	100	100	II 4719.84	125	..
3877.47	50	8	II 4384.29	50	50	II 4726.03	100	..
II 3885.28	50	50	II 4390.86	150	150	4728.44	150	..
II 3891.18	50	8	4401.17	50	30	II 4741.73	80	..
II 3896.97	50	50	II 4403.36	50	50	II 4745.67	250	..
3903.41	60	60	II 4409.24	100	100	4750.72	60	..
II 3922.38	60	60	II 4417.58	80	80	II 4755.37	100	..
II 3928.27	60	60	II 4420.53	200	200	4760.26	150	..
II 3933.59	200	200 n	II 4421.14	150	150	II 4774.14	100	..
II 3941.87	50	40	II 4424.34	300	300	II 4777.84	100	..
II 3948.11	50	50	II 4433.88	200	200	II 4781.84	60	..
3959.53	50	40	II 4434.32	200	200	4783.10	150	..
3962.99	50	40	4444.26	100	100	4785.87	100	..
II 3966.05	60	50	II 4452.71	200	200	4789.96	50	..
II 3971.39	50	30	II 4454.63	100	100	II 4791.58	150	..
II 3979.19	50	50	II 4458.51	150	200	II 4798.87	50 r	..
II 3983.14	100	60	II 4467.34	200	200	II 4815.81	125	80
II 4007.49	50	25	4470.89	60	60	II 4829.58	200	..
II 4035.10	50	3	II 4472.42	100	100	II 4833.33	80	..
II 4084.40	80	..	II 4473.01	150	150	II 4834.63	100	..
II 4106.60	100	5	4478.66	100	100	II 4836.67	50	..
II 4118.55	50	60	II 4499.48	100	100	II 4837.65	100	..
II 4210.34	50	20	II 4511.83	100	100	4841.70	100	..
II 4220.65	100	100	4515.10	100	..	II 4844.21	150	..
II 4223.71	50	20	II 4519.63	150	80	II 4847.77	150	..
II 4234.57	60	40	4522.54	60	..	4848.33	100	..
II 4236.74	60	50	II 4523.91	100	50	II 4854.37	125	..
II 4237.66	60	50	4532.44	60	..	II 4859.57	80	..
II 4244.70	100	80	II 4537.95	50	25	II 4869.98	125	..
II 4249.54	50	40	4542.05	50	..	4883.78	60	..
II 4251.79	200	200	II 4543.94	100	50	4883.98	80	..
II 4256.40	150	150	II 4552.66	80	40	II 4893.34	150	..
II 4258.56	50	40	II 4554.44	60	..	II 4894.30	60	..
II 4262.68	200	150	II 4560.42	50	..	II 4900.74	100	..
II 4265.07	60	25	II 4566.20	100	50	4904.98	60	..
II 4279.66	100	100	II 4577.69	100	50	4910.41	150	..
II 4279.95	50	40	II 4584.83	60	50	II 4913.26	150	..
II 4280.78	200	200	II 4591.83	100	..	4918.98	125	..
4281.00	50	30	II 4593.53	50	50	II 4920.37	125	..
II 4285.48	200	200	II 4595.30	100	60	II 4936.02	80	..
II 4286.64	100	60	II 4604.18	60	..	II 4938.10	125	..
II 4292.18	100	60	4611.26	50	..	4946.31	60	..
4296.75	100	50	II 4615.69	50	40	II 4948.63	125	..
II 4304.94	100	100	II 4642.23	100	40	II 4952.37	125	..
II 4309.00	200	150	II 4646.68	50	..	II 4953.05	50	..
II 4318.93	300	300	4663.55	60	..	II 4961.94	100	..
4319.53	50	15	II 4669.65	50	40	II 4964.56	80	..
II 4323.28	125	100	II 4674.59	80	40	II 4972.17	80	..
II 4329.02	300	300	II 4676.91	100	50	4975.99	80	..
4330.01	80	15	4681.56	50	..	II 4981.71	50	..
II 4334.15	200	200	II 4687.18	100	..	II 4989.44	60	..
4336.13	100	30	4688.73	50	..	II 4992.03	80	..
II 4345.85	100	100	II 4693.63	50	..	II 5016.61	80	..
II 4347.80	150	60	II 4699.34	50	..	II 5023.51	60	..
II 4350.46	150	150	II 4704.41	200	..	II 5028.44	200	..
4352.10	125	100	II 4710.65	50	..	5036.21	50	..
II 4360.71	100	60	II 4713.07	100	..	5044.28	150	..
II 4362.03	150	150	II 4714.63	50	..	II 5052.75	150	2
4362.91	60	25	II 4715.27	100	..	II 5057.75	100	1
II 4363.45	60	50	4716.11	150	..	II 5069.44	150	1
II 4368.03	60	60	4717.09	80	..	5071.19	100	..
II 4373.46	50	50	II 4717.74	100	..	II 5100.20	50	..
II 4374.97	200	200	II 4718.35	100	..	5100.30	60	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

SAMARIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 5103.08	150	..	II 5831.01	80	..	II 6617.61	50 d	..
II 5104.47	125	1	II 5831.77	40 r	..	II 6623.88	50 d	..
II 5112.29	125	1	II 5836.36	100 d	..	II 6630.61	50 d	..
II 5116.68	100	1	5867.79	50	..	II 6632.28	100	..
5117.16	80	1	5897.38	100	..	II 6637.17	60 d	..
5122.14	80	..	5919.33	60	..	II 6649.02	50	..
5124.83	50	..	II 5932.89	50	..	II 6651.61	80 d	..
5154.27	125 d	1	II 5938.84	50 d	..	II 6656.19	100	..
II 5155.02	125	1	II 5965.71	125	..	II 6667.22	50 d	..
II 5166.05	125 d	..	II 5994.65	60	..	I 6671.48	50	..
5169.60	50 d	..	II 5997.32	60	..	6679.1	80	..
5172.74	80	1	6001.68	50	..	II 6679.24	80	..
5175.42	60	1	II 6011.24	60	20	II 6681.53	60 d	..
5178.06	100 d	..	II 6017.39	50 d	..	II 6687.79	80 d	..
5200.59	200	1	6044.99	60	..	II 6693.55	100 d	..
II 5202.73	50	..	6084.13	50	..	II 6707.45	50 d	..
5228.78	60	..	II 6123.60	50 d	..	II 6712.62	50	..
5234.17	50 d	..	II 6149.10	60	..	II 6731.84	500 d	..
5251.89	150	..	II 6181.05	50 d	..	II 6734.06	400 d	..
5271.40	150	..	II 6182.89	60 d	..	II 6734.81	400 d	..
II 5272.81	50 d	..	6192.64	50	..	6735.34	100 d	..
5282.91	100	..	II 6237.66	50	..	II 6754.68	50	..
5302.91	50	..	II 6246.76	80	..	II 6756.94	50	..
II 5312.21	100	..	II 6256.66	80	..	II 6766.52	50 d	..
5320.60	100	..	II 6267.28	150	..	II 6778.61	200 d	..
5321.87	50 d	4	II 6289.93	60	..	II 6781.17	50 d	..
5341.29	80	..	II 6291.82	100 d	..	II 6790.03	300 d	..
5364.36	50	..	II 6300.19	50	..	II 6794.20	200	..
5368.36	80	..	II 6301.12	50	..	II 6829.81	100	..
5387.98	50	3	II 6307.06	60	..	II 6844.71	150 d	..
5405.24	80	..	6321.74	60	..	II 6846.54	100 d	..
5416.05	100	..	6325.58	50 d	..	II 6854.50	60 d	..
5453.02	100	..	II 6327.47	100	..	II 6856.03	300 d	..
5466.73	80	..	6353.49	50	5	I 6860.93	800 d	..
5493.72	80	..	6357.19	50	1	II 6861.06	500 d	..
5498.21	80	..	II 6368.28	50 d	..	II 6862.82	100 d	..
5512.10	80	..	II 6389.87	100	..	II 6872.42	100 d	..
5516.14	200	..	II 6390.84	100	..	II 6909.81	50 d	..
II 5537.07	50	..	II 6417.51	100 d	..	II 6930.41	50 d	..
5548.95	80	..	II 6426.62	100 d	..	II 6941.56	50	..
5550.40	125	..	6428.31	50 d	..	II 6950.51	100	..
5573.43	80	..	II 6431.03	50 d	..	II 6955.27	400 d	..
5574.91	50	..	II 6431.96	50	..	II 7020.41	500	..
II 5600.85	200	..	II 6470.46	60 d	..	I 7026.64	100	..
II 5603.19	100 d	..	II 6472.34	150 d	..	II 7039.22	500 n	..
5621.80	60	..	II 6484.52	100	..	II 7042.23	400 n	..
5626.01	60	..	II 6487.62	60	..	II 7051.52	400 nd	..
5637.27	80	..	II 6490.75	60 d	..	7074.67	50	..
5659.86	60	..	II 6498.67	100 d	..	II 7082.37	400 n	..
5686.73	50	20	6526.64	50	..	I 7088.30	60	..
5719.12	60	20	6529.70	50	..	I 7091.22	60	..
5732.95	100	..	II 6542.76	200	..	I 7095.51	100	..
5740.88	80	..	II 6549.77	100 d	..	I 7096.37	60	..
5741.19	60	..	6562.94	50 d	..	I 7104.57	150	..
II 5759.50	60	..	II 6569.31	500 d	..	I 7106.24	80	..
5773.77	100	..	II 6570.67	200 d	..	7115.96	50	..
5778.33	50	..	II 6574.38	100	..	7119.81	60	..
5779.25	50	..	II 6585.21	150 d	..	I 7131.80	80	..
5781.89	100	..	6588.92	100	..	7136.01	50	..
II 5786.99	200	..	II 6589.73	400 d	..	II 7149.60	150	..
5800.50	80	..	II 6601.83	150 d	..	I 7213.82	60	..
5802.82	80	..	II 6604.56	200 d	..	II 7218.09	50	..
5814.87	60	..	II 6614.82	50 d	..	II 7240.90	200	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

SAMARIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 7279.25	100	..	II 7749.30	200	..	8065.16	150	..
7290.23	80	..	II 7755.20	125 d	..	II 8068.46	800	..
I 7332.65	100	..	I 7755.32	80	..	II 8070.37	50 d	..
7338.04	50	..	I 7794.50	100	..	8090.80	60	..
I 7347.30	100	..	I 7801.54	150	..	8091.15	80	..
7364.10	50	..	7812.75	60 d	..	II 8117.16	150 d	..
I 7371.51	50	..	II 7820.15	150 d	..	II 8125.12	125 d	..
II 7376.69	60	..	7831.40	60 d	..	II 8161.90	200 d	..
7405.00	50	..	II 7835.08	400 d	..	8184.43	50 d	..
7444.56	150	..	II 7837.27	400	..	II 8195.50	200 d	..
I 7445.41	100	..	II 7844.82	60 d	..	8203.98	80	..
7070.76	100	..	I 7859.53	100	..	8206.30	80 d	..
II 7502.39	50 d	..	II 7863.65	100 d	..	8208.25	60	..
II 7541.42	100 d	..	II 7880.07	100 d	..	II 8218.76	300	..
7544.74	50	..	I 7895.96	200	..	8230.33	100	..
7562.94	50 d	..	7913.49	60	..	II 8240.98	150	..
II 7570.95	150 d	..	II 7914.96	200 d	..	II 8289.26	125 d	..
7572.29	80 d	..	I 7919.44	80	..	II 8300.88	80 d	..
II 7578.09	60 d	..	II 7928.14	800	..	8301.34	100	..
II 7585.77	60 d	..	7931.15	50	..	II 8305.79	500 d	..
I 7607.74	80	..	I 7931.92	200	..	8315.45	150	..
II 7637.94	60 d	..	II 7937.09	100 d	..	II 8348.68	150 d	..
II 7645.09	200 d	..	7940.31	150	..	8383.71	150 d	..
7645.82	80	..	II 7948.12	100 d	..	II 8387.77	100 d	..
II 7648.02	100 d	..	7968.32	50	..	II 8432.64	200 d	..
II 7655.78	50 d	..	II 8001.61	200 d	..	II 8473.54	100 d	..
II 7667.20	50 d	..	II 8014.92	200 d	..	II 8485.99	400 d	..
7672.49	50	..	8016.17	80	..	II 8510.90	200 d	..
II 7678.79	60 d	..	II 8025.12	400	..	II 8543.22	150 d	..
7695.78	100	..	II 8026.32	500 d	..	II 8617.03	50 d	..
II 7712.04	60 d	..	II 8032.03	200 d	..	II 8708.43	60 d	..
II 7728.56	200 d	..	II 8048.70	400	..	II 8717.89	50 d	..
7736.26	150 d	..						

SCANDIUM

II 2552.36	25	40	II 3651.80	50	45	II 4670.40	100	300 wn
II 2560.23	10	30	3787.15	30	10	I 4728.77	50	25
2699.10	3	25	3828.18	30	30	I 4729.23	100	50 n
II 2822.13	50	20	3836.52	25	25	I 4734.09	100	60 n
II 2826.66	10	25	II 3843.00	25	20	I 4737.64	100	60 n
II 3045.71	15	25	I 3907.48	125	25	I 4741.02	100	60 n
II 3065.11	12 d	25	I 3911.81	150	30	I 4743.81	100	60 n
I 3269.90	30	12	I 3933.38	60	60	I 4753.15	80	40
I 3273.62	35	12	I 3996.61	40	10	I 4779.35	80	40
II 3353.73	50	60	I 4020.40	50	20	bh 4858.1	30	..
II 3359.68	50	25	I 4023.22	60	..	II 5031.02	50	200 n
II 3361.27	25	9	I 4023.69	100	25	I 5081.55	100	100
II 3361.93	25	9	I 4047.79	25	10	I 5083.71	100	80
II 3368.95	50	20	I 4082.40	25	10	I 5085.55	80	70
II 3372.15	7	150	II 4246.83	80	500	I 5086.95	60	25
II 3535.73	15	30	II 4314.08	50	150	I 5087.15	40	20
II 3558.54	15	40	II 4320.74	50	40	I 5099.23	100 r	80
II 3567.70	15	40	II 4325.01	50	40	II 5239.82	30	125
II 3572.52	30	50	II 4354.61	60	10	I 5349.29	30	..
II 3576.34	18	45	II 4374.45	100	25	I 5356.10	40	..
II 3580.93	12	40	II 4384.81	25	10	I 5481.99	60	..
II 3613.84	40	70	II 4400.35	150	30	I 5484.62	60	..
II 3630.74	50	70	II 4415.56	100	25	I 5514.21	60	..
II 3642.78	60	50	II 4431.37	50	3	I 5520.50	80	..
II 3645.31	50	50	bh 4536.6	40	..	II 5526.81	100	300 wn

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

SCANDIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 5657.87	30	..	hh 6072.7	100	..	II 6279.76	10	25
I 5671.80	300 W	..	hh 6079.3	100	..	I 6305.67	80	60
I 5686.83	200	..	hh 6101.9	30	..	II 6309.90	5	25
I 5700.23	400 r	..	hh 6109.9	40	..	I 6413.35	10	25
I 5711.75	100	..	hh 6116.0	40	..	hh 6446.2	30	..
hh 6017.1	40	..	I 6210.68	20	25	6835.03	25	..
hh 6036.2	200	..	I 6239.78	3 n	30	I 7711.17	50	..
hh 6064.3	80	..	II 6245.63	6	30	I 7800.44	40	..

SELENIUM

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 2039.85	..	1000	II 4401.02	..	100	II 6055.96	..	1000
I 2062.79	..	800	II 4406.58	..	70	II 6065.83	..	80
I 2074.79	..	100	II 4432.33	..	60	II 6101.96	..	200
I 2164.16	..	100	II 4434.92	..	40	II 6123.49	..	60
I 2413.52	..	125	II 4446.02	..	200	II 6135.04	..	70
2496.05	..	100	II 4449.15	..	300	I 6138.46	..	60
I 2547.98	..	60	II 4467.60	..	300	I 6177.71	..	80
2591.41	..	150	II 4516.25	..	70	I 6242.21	..	80
II 3038.66	..	60	II 4563.95	..	200	I 6266.23	..	200
II 3041.31	..	60	II 4599.96	..	70	I 6269.15	..	80
II 3134.42	..	70	II 4604.34	..	300	I 6283.16	..	200
II 3141.13	..	100	II 4618.77	..	100	I 6283.96	..	200
3935.36	..	60	I, II 4623.77	..	150	I 6284.47	..	300
4002.07	..	60	4636.65	..	150	I 6303.42	..	1000
II 4003.08	..	60	II 4648.44	..	800	I 6325.57	..	500
II 4007.90	..	150	I 4664.20	..	150	II 6422.90	..	125
I 4011.88	..	200	I, II 4664.98	..	150	I 6444.25	..	100
I 4012.96	..	150	I 4667.80	..	70	II 6483.06	..	200
I 4014.77	..	70	I 4730.78	..	1000	II 6488.34	..	100
II 4018.52	..	70	I 4739.03	..	800	II 6490.48	..	500
II 4030.07	..	150	II 4740.97	..	600	6534.44	..	125
II 4062.06	..	70	I 4742.25	..	500	II 6534.95	..	300
II 4070.16	..	500	II 4763.65	..	800	I 6679.43	..	70
II 4091.95	..	70	II 4840.63	..	800	I 6699.56	..	125
II 4097.91	..	60	II 4844.96	..	800	I, II 6721.37	..	60
II 4108.83	..	800	I 4886.99	..	70	I 6746.43	..	200
II 4126.57	..	150	II 4975.66	..	300	I 6768.50	..	80
II 4129.15	..	200	II 4992.75	..	300	I 6805.24	..	200
4132.76	..	200	II 5068.65	..	250	I 6815.28	..	70
II 4136.28	..	100	II 5096.57	..	350	I 6830.89	..	100
4152.34	..	80	II 5142.14	..	500	I 6831.27	..	400
II 4159.75	..	70	II 5175.98	..	600	I 6990.65	..	300
II 4175.32	..	800	II 5227.51	..	600	I 6991.77	..	200
II 4180.94	..	800	II 5253.63	..	100	I 7010.92	..	500
II 4195.51	..	100	II 5271.22	..	150	I 7012.75	..	200
II 4211.83	..	200	II 5305.35	..	500	I 7013.85	..	400
II 4212.58	..	200	I 5365.47	..	125	I 7062.06	..	1000
4215.02	..	150	I 5369.91	..	175	I 7063.79	..	70
II 4248.00	..	100	I 5374.14	..	150	I 7299.51	..	200
II 4280.36	..	150	II 5401.01	..	75	I 7328.97	..	300
II 4282.10	..	100	II 5522.42	..	750	I 7370.82	..	80
II 4320.39	..	100	II 5566.93	..	500	I 7380.34	..	60
4322.19	..	60	II 5591.16	..	500	I 7383.88	..	100
I 4328.70	..	200	II 5623.13	..	300	II 7391.90	..	125
I, II 4330.28	..	200	II 5842.68	..	60	I, II 7426.81	..	100
I 4339.59	..	200	II 5866.27	..	75	I 7429.27	..	200
II 4382.87	..	800	I 5962.01	..	100			

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

SILICON

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2058.13	15	..	I 4102.95	12	10	I 7165.62	100 n	..
I 2082.01	15	..	4128.11	..	20 w	I 7184.89	10	..
I 2084.47	20	..	4130.96	..	25 w	I 7226.20	10	..
I 2122.99	10	..	4552.50	..	40	I 7235.32	10	..
I 2124.15	200 r	50	4567.66	..	30	I 7235.86	10	..
I 2163.78	10 w	..	4574.66	..	20	I 7250.69	40	..
2192.22	..	(10)	4828.84	..	12	I 7275.28	50	..
I 2207.98	18	15	I 5645.66	20	..	I 7289.25	200	..
I 2210.91	30	30	I 5665.60	20	..	I 7290.21	10	..
I 2211.75	12	12	I 5684.52	30	..	I 7373.02	10 w	..
I 2216.68	40	40	I 5690.47	25	..	I 7405.85	300	..
I 2218.08	10	15	I 5701.14	15	..	I 7409.11	100	..
2287.06	..	(10)	I 5708.44	40	2 n	I 7415.37	15	..
I 2289.61	10	..	I 5754.25	40	..	I 7416.00	200	..
I 2303.02	10	6	I 5772.26	30	..	I 7423.54	500	..
2356.35	..	(10)	I 5780.45	15	..	I 7424.63	20	..
I 2435.16	150	80	I 5793.13	18	..	I 7680.35	100 w	..
I 2438.78	30	20	I 5797.91	25	..	7913.47	10 n	..
I 2443.38	15	15	I 5948.58	50	5	7918.38	200	..
I 2452.14	20	20	I 6145.08	10 n	..	7930.23	..	(150)
I 2506.90	300	200	I 6145.22	15 n	..	I 7932.20	300 w	..
I 2514.33	300	200	I 6155.22	20 n	..	7943.94	500 w	..
I 2516.12	500	500	I 6155.32	50 n	..	7970.26	10 n	..
2517.45	..	10	I 6156.00	10 n	..	8093.32	25 n	..
I 2519.21	300	300	I 6243.86	10 n	..	I 8230.67	15	..
I 2524.12	400	400	I 6244.56	10 n	..	I 8444.00	15 w	..
I 2528.52	400	500	I 6244.74	12 n	..	I 8501.50	20 w	..
I 2532.38	30	40	I 6254.25	25 n	..	I 8502.38	30 w	..
2559.20	..	(15)	I 6254.55	15 nl	..	I 8556.64	100 n	..
I 2568.64	15	10	6347.01	2	50	8648.89	100 nl	..
I 2577.13	10	..	6371.09	2	30	8728.38	10 w	..
I 2631.31	60	50	6976.53	25 n	..	I 8742.60	100	..
I 2881.58	500	400	I 7003.58	50 n	..	I 8752.17	200	..
I 2970.35	20	20	I 7005.84	50 n	..	8892.97	25 w	..
I 2987.65	100	100	I 7017.68	10 n	..	8949.33	15 w	..
I 3905.53	20	15 W	I 7034.96	50 n	..	I 9413.59	100	..

SILVER

II 2000.68	..	30	II 2205.95	..	50 wn	II 2321.55	..	25 w
II 2015.90	..	25	II 2208.50	..	25 wn	II 2324.68	15	100 wn
II 2033.93	..	25	II 2219.70	..	15 n	II 2325.05	4	25 wn
I 2061.17	25	10 n	II 2226.11	..	20 n	II 2331.37	18	150 wn
II 2065.91	4	80	II 2229.52	..	25 wn	II 2357.92	15	100 n
I 2069.83	10	3	2238.41	..	10	II 2358.86	..	100 W n
II 2075.61	..	10 wn	II 2240.38	..	20 n	II 2362.18	..	80 w
II 2113.83	20	150 wn	2241.34	..	10	II 2364.00	..	100 W n
II 2120.45	5	80	II 2241.81	..	10 n	II 2365.67	..	20 n
I 2120.91	..	15	II 2243.44	..	15 n	2375.06	300 wn	300 wn
II 2125.52	..	25 wn	II 2246.41	25	300 ns	II 2383.21	..	25
II 2129.12	..	10	II 2248.74	15	150 wn	II 2386.33	..	25 n
II 2145.61	8	150	II 2253.46	..	50 wn	II 2390.54	..	60 n
2161.94	..	15	II 2275.26	..	50 wn	II 2392.96	..	25 n
II 2166.50	5	100 w	II 2277.41	..	25 wn	II 2402.57	..	30 wn
II 2170.86	..	30 n	II 2279.98	10	125 n	II 2409.02	..	10 n
II 2171.70	..	10	2286.46	..	12	II 2411.35	25	150 n
II 2186.77	10	100	II 2296.04	..	20 W n	II 2411.59	..	(20)
2191.86	..	10	2309.64	150 n	200 n	II 2413.18	50	300 n
II 2202.10	..	50 wn	II 2312.41	25 wn	50 w	II 2420.07	..	100 nw
II 2203.66	..	20 n	II 2317.03	15	100	II 2422.59	..	10 wn
II 2204.40	..	10 n	II 2320.25	15	150 w	II 2428.20	1	40 wn

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

SILVER (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2429.64	..	150 wn	II 2712.06	3	200 n	I 3508.09	10	1
II 2436.57	..	20 wn	2721.77	20	25	3538.27	10	2
II 2437.80	60	500 wn	II 2743.9C	..	50	3542.61	30	5
II 2444.21	..	80 w	II 2756.51	5	200	I 3624.71	25 n	..
II 2446.32	..	25 wn	II 2767.52	30	200	I 3682.47	50	4
II 2447.93	30	200 wn	II 2786.49	10	10 n	3683.32	..	10
II 2453.33	..	125 n	2795.53	10	10	I 3709.25	10	3
II 2460.31	..	80 wn	II 2799.66	20	100 n	I 3810.86	100 wn	10 n
II 2462.24	5	80 n	II 2801.93	..	10 w	I 3840.80	20	3 n
II 2472.92	..	25 n	II 2815.54	3	80 wn	3933.62	80	80
II 2473.80	20	150 n	2824.37	150 wn	200 w	3942.95	5 n	10 n
II 2477.28	..	150 wn	II 2873.65	3	100 wn	3961.3	15	5
II 2480.41	..	15 n	II 2882.20	..	10 n	3968.22	100	60
II 2485.77	1	10 n	II 2896.49	2	150 wn	I 3981.64	30	20
II 2504.08	..	50 n	II 2902.07	5	200 wn	3985.19	2	20
II 2506.60	15	50 n	II 2920.04	..	100 wn	4005.32	10	2
II 2535.07	..	(10)	II 2929.35	20	40	4045.82	10	2
II 2535.31	10	25	II 2934.23	10	200 n	I 4055.26	800 r	500 r
II 2553.41	2	10	II 2938.55	200	200 wn	4085.87	..	25
2562.91	..	10	3C12.93	..	10	I 4210.94	200 n	30 n
II 2564.42	..	15 wn	3099.12	10	8	I 4212.68	150 n	20 n
II 2567.16	..	15 wn	3130.01	25 n	15 n	4311.07	5	25 l
2575.74	10 n	3 n	3179.24	2	15 n	4385.06	..	12
II 2580.74	1	150 wn	3180.71	2 n	15	4395.93	10	30
II 2595.63	..	40 wn	II 3184.15	..	20	4396.32	100	..
II 2598.68	10	10 n	II 3223.51	1	25 n	I 4476.08	40	8
II 2606.16	10	200 wn	3233.15	..	10	I 4668.48	200	70
II 2614.59	..	300 wn	3244.95	..	10 n	4874.18	30	..
II 2617.01	..	(10 n)	3247.55	15	15	4888.28	9	20
II 2625.67	6	15 n	3267.35	..	12	5123.68	4	30
2628.58	1	25	II 3269.82	..	10	I 5209.07	1500 r	1000 r
II 2656.66	1 n	15 n	I 3280.68	2000 r	1000 r	5434.2	2	10 n
II 2656.92	..	20 n	3352.08	..	10 n	I 5465.49	1000 r	500 r
II 2660.46	30	150	3382.89	1000 r	700 r	I 5471.55	500 n	100
II 2681.38	..	100 wn	3469.21	10	8	I 5545.94	30 l	..
II 2688.35	..	10 wn	3475.78	..	20	I 7687.78	20	..
II 2711.21	1 n	300 wn	3501.68	8 n	20 n			

SODIUM

II 2493.15	..	(40)	II 2974.99	15	(60)	I 3302.35	600 r	300 r
II 2531.55	6	(60)	II 2979.66	35	(40)	I 3302.99	300 r	150 r
II 2611.81	..	(80)	II 2984.43	20	(80)	II 3533.01	50	(200)
II 2660.99	..	(80)	II 3015.40	..	(60)	II 3631.27	12	(100)
II 2671.83	12	(60)	II 3029.07	..	(60)	II 3711.07	8	(60)
II 2678.09	6	(40)	II 3037.07	8	(40)	I 4494.27	60	..
I 2680.33	60 r	10	II 3045.59	..	(40)	I 4497.72	70	..
I 2680.44	40 r	..	II 3053.66	8	(60)	I 4664.86	80	..
II 2809.51	8	(40)	II 3056.16	35	(60)	I 4668.60	200	100
II 2841.72	20	(80)	II 3074.33	8	(60)	I 4982.84	200 wn	100
I 2852.83	100 r	20	II 3078.31	12	(60)	I 5149.09	400	..
I 2853.03	80 r	15	II 3092.73	50	(200)	I 5153.64	600	..
II 2859.48	2	(40)	II 3129.37	35	(60)	I 5670.18	100 wn	..
II 2871.27	6	(40)	II 3135.48	12	(40)	I 5675.70	150 wn	..
II 2881.14	8	(60)	II 3149.27	12	(40)	I 5682.66	80	..
II 2893.95	8	(60)	II 3163.73	35	(60)	I 5688.22	300	..
II 2904.91	20	(80)	II 3179.05	6	(40)	I 5889.95	9000 r	1000 r
II 2917.52	8	(40)	II 3189.78	35	(60)	I 5895.92	5000 r	500 r
II 2919.05	6	(40)	II 3212.19	35	(60)	I 6154.23	500	100
II 2937.72	6	(40)	II 3257.96	35	(60)	I 6160.76	500	100
II 2947.44	6	(40)	II 3274.22	15	(40)	I 8183.27	500 r	..
II 2951.23	40	(100)	II 3285.75	40	(100)	I 8194.81	1000 r	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

STRONTIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2165.96	25 r	15	I 4305.45	40	..	5486.12	40	8
I 2569.47	25 r	5	I 4319.05	25 n	..	5504.17	60	25
I 2931.83	30	8	I 4319.12	50	20	5521.83	50	10
I 3301.74	100	10	I 4337.66	30 n	..	5540.05	20	30
I 3307.53	200	10 s	I 4337.89	150	50	I 5543.36	30	5
I 3322.23	100	8	4406.85	50 n	..	I 6345.75	25	4
I 3329.99	100	10	I 4438.04	25	..	I 6363.94	25	4
I 3351.25	300	15	I 4607.33	1000 r	50 r	6369.96	25	5
I 3366.33	100	10	I 4722.28	30	..	I 6380.75	30	8
II 3380.71	150	200	I 4741.92	30	..	I 6386.50	35	10
II 3464.45	200	200	I 4784.32	30	..	I 6388.24	35	10
II 3474.89	80	50	I 4811.88	40	..	6408.47	50	20
I 3499.67	50	..	I 4832.07	200	8	6503.99	35	20
bh 3503.8	30	..	I 4872.49	25	..	I 6546.79	25	5
I 3548.08	50	..	4876.32	200	60	I 6550.25	100	10
I 3629.14	30	..	I 4891.98	40	..	I 6617.26	150	..
I 3653.27	30	8	I 4962.26	40	..	I 6643.54	100	..
I 3705.90	30	10	I 5156.07	80	18	I 6791.05	200	..
I 3780.46	30	..	5222.20	70	8	I 6878.38	500	..
I 3807.38	50	..	5225.11	70	8	I 6892.59	100	..
I 3865.46	50	..	5229.27	70	8	I 7070.10	1000	..
I 3969.26	30	..	5238.55	90	15	I 7167.24	100 nl	..
I 4030.38	40	..	5256.90	90	25	I 7232.27	50 nl	..
II 4077.71	400 r	500 W	I 5329.82	40	2	I 7309.41	200	..
I 4161.80	30	..	5450.84	30	..	I 7621.50	100	..
II 4215.52	300 r	400 W	5480.84	100 n	30	I 7673.06	200 ns	..

SULFUR

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
2089.90	..	300	II 4463.58	..	200	5606.10	..	700
2098.14	..	300	4464.42	..	100	5639.98	..	500
3497.34	..	100	II 4483.42	..	100	5640.36	..	500
II 3616.92	..	60	II 4524.95	..	150	5659.93	..	600
II 3669.05	..	60	4549.55	..	80	I 6052.63	..	125
3867.56	..	150	II 4552.38	..	200	6286.35	..	300
II 3923.48	..	200	II 4656.74	..	80	6287.06	..	1000
II 3933.29	..	80	II 4716.23	..	600	6305.51	..	1000
II 3998.79	..	60	II 4815.51	..	800	6312.68	..	1000
II 4028.79	..	200	II 4924.08	..	60	6384.89	..	300
II 4032.81	..	125	II 4925.32	..	100	6397.30	..	300
II 4142.29	..	150	4993.51	..	150	6398.05	..	300
II 4145.10	..	250	5428.69	..	250	6413.71	..	500
II 4153.10	..	600	5432.83	..	600	6455.36	..	70
II 4162.70	..	600	5453.88	..	750	6538.57	..	60
4174.30	..	150	5473.63	..	750	I 6748.79	..	80
II 4189.71	..	250	5564.93	..	150	I 6757.10	..	150
II 4267.80	..	60	5578.86	..	70	7040.92	..	70
II 4294.43	..	80						

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

SULFUR (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 7244.77	..	80	8585.60	..	200	9437.11	..	150
7281.04	..	70	I 8680.45	..	200	9633.78	..	70
7578.96	..	70	I 8694.71	..	200	9649.94	..	250
7629.82	..	200	I 8874.53	..	150	9672.34	..	200
I 7679.60	..	70	I 8882.47	..	70	9680.80	..	200
I 7686.13	..	150	I 8884.23	..	150	9693.68	..	200
I 7696.73	..	200	I 9035.92	..	100	9697.33	..	150
I 7923.95	..	300	I 9212.91	..	200	9739.74	..	150
I 7931.63	..	200	I 9228.11	..	200	9741.93	..	70
7967.43	..	200	I 9237.49	..	200	9932.26	..	150
8314.73	..	200	9413.46	..	150	9949.84	..	150
I 8452.18	..	70	9421.93	..	150	9958.90	..	150

TANTALUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2101.85	3	40	2544.80	40	..	2615.66	50	1
2146.87	10	40	2546.80	80	..	2624.12	60	..
2193.88	15	40	2549.38	100	..	2625.46	40	..
2217.82	8	40	2551.07	150	..	2632.27	15	80
2330.79	..	60	2551.19	150	..	2633.79	10 wn	80 wn
2364.24	10	40	2551.73	100	4 n	2635.93	50 n	..
2381.13	15	40	2554.62	50	100	2636.67	70	1
2381.52	8	40	2554.91	50 n	50 n	2636.90	100	3
2387.06	20	50	2555.05	50	..	2643.89	50	..
2396.30	80	..	2557.71	50	100	2644.60	20 W	50 W
2406.55	60	..	2559.43	100	2	2645.10	80	30 n
2416.89	100	150	2560.68	70	..	2646.22	50	2
2417.86	20 W	40	2562.10	100	..	2646.37	125	2
2421.85	8	40	2563.33	50	..	2646.77	50 n	50
2427.64	150	1	2563.70	80	..	2647.47	200	10
2429.71	20 l	40	2569.13	40	40 n	2651.22	..	80
2432.70	300 r	400	2573.54	125	1	2651.48	50	..
2436.51	10 n	40	2573.79	100	1	2653.27	200	15
2438.64	40	4	2574.38	80	..	2656.61	200 r	2
2443.94	50	..	2575.47	80	..	2658.86	25	50
2444.67	50	200	2577.37	80 d	150 d	2661.34	200	10
2454.21	50	..	2577.78	90	1	2661.89	60	..
2454.48	60	..	2579.05	3 n	100 n	2664.23	10 n	100 n
2458.68	40	..	2579.62	80	..	2665.60	80 d	40 n
2460.55	50	..	2580.16	150	..	2668.07	80	..
2465.26	60	..	2584.03	80 w	200	2668.62	1	100
2470.90	60	40	2584.60	40	..	2675.90	150	200
2472.13	80	..	2593.08	150	1	2680.06	30	50
2474.62	150	1	2593.66	80 d	100	2680.66	30	40
2478.22	60	..	2595.26	50	2	2681.87	50	..
2482.58	50	50	2595.59	40 d	50 n	2684.28	150	2
2488.40	60	..	2596.45	80	150	2691.31	150	..
2488.70	200	150	2598.21	2 s	50	2692.39	100	1
2504.45	200	1	2599.40	100	30	2694.76	50	..
2507.45	150	1	2600.14	80	..	2696.81	125	1
2511.69	2 d	100 d	2601.05	50	5 wn	2698.30	15	3
2512.04	5	800	2602.38	40	..	2702.80	40 d	30 wn
2512.65	100	..	2603.57	5	300	2703.06	60	..
2519.78	50	..	2607.84	20 n	150	2704.31	50	..
2526.02	100	80	2608.63	125	4	2706.69	50	1
2526.35	100	..	2608.99	80	1	2709.27	40	150
2526.45	150	..	2611.34	100	..	2710.13	200	3
2526.66	50	..	2612.61	50	40	2714.67	200	8
2532.12	80	100	2614.17	200 wn	..	2717.18	100	..
2535.60	50 n	..	2615.25	40	..	2718.38	80	..
2536.23	100 W	..	2615.46	50	1	2720.76	150	1

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TANTALUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2721.83	50	...	2844.25	400 r	50	2957.60	100	30
2725.42	20 w	100	2844.46	200	200 l	2963.06	40	10
2727.43	50	150	2844.76	150	30	2963.32	300	100
2727.78	200	40	2845.35	150	10	2963.91	50	10
2732.06	40	3	2846.75	150 ns	10 n	2965.13	40	800
2732.92	100 W	5	2848.06	150	15	2965.54	150	50
2736.25	300 s	8 s	2848.52	300	50	2965.92	30	80
2739.26	2	80	2849.82	15 Ws	50 W	2969.47	150	80
2740.21	100	10 n	2850.49	200	100	2969.90	50 n	10 n
2746.68	100	5	2850.98	400	150	2975.56	200	50
2747.25	50	5	2852.35	5	100 l	2976.10	40 l	5 n
2748.78	400	50	2857.28	60	5	2976.26	2 wn	150
2749.83	200	50	2858.43	100	300	2976.76	3 n	40
2752.29	150	8	2862.02	40	10	2978.18	...	150 l
2752.49	300	300	2864.50	125	30	2978.75	200 r	30
2758.31	200	40	2867.41	5 n	150	2986.81	20 d	100
2761.55	80	...	2868.65	150	40	2988.58	40	20
2761.68	200	150	2871.42	200	50	2989.05	40 W	5 n
2762.05	1	40 l	2873.36	200 W	40 n	2989.50	200	15
2763.37	25 d	60 d	2873.56	150	50 l	2991.25	50	10
2766.12	40 n	20	2874.17	150	15	3010.84	5	70
2770.78	50 wn	1	2876.11	50 r	5	3011.12	100 W	25
2771.83	3 n	100	2877.69	15	80 n	3011.88	100 w	15
2774.88	100	3	2878.95	40 r	3	3012.54	125	100 l
2775.11	100 W	80	2879.52	50 s	10 n	3025.16	70	15
2775.35	80	15	2879.74	150	10	3027.51	125	35 w
2775.88	200	30	2880.02	150	50	3028.78	50	7
2779.10	150 w	5 n	2882.33	3	80	3037.50	8 n	100
2781.37	50	4	2889.38	40	5	3040.98	50	7 w
2784.97	50	100	2891.04	150 W	30 n	3042.06	5	100
2787.69	400 r	40	2891.84	500 W	100	3045.96	150	50 w
2788.30	150	3	2892.00	80 n	10	3048.86	100	15
2790.71	150	10	2895.10	125	15	3049.56	150	30
2791.37	25	150	2896.44	2 n	50	3052.53	...	70 l
2791.67	100	10	2899.04	200	15	3056.61	1 wn	70 l
2796.34	400	80	2900.36	200	40	3057.12	25 w	125
2796.56	150	...	2900.75	3 n	100 l	3058.64	50	3
2797.76	100 d	100 d	2901.05	100	3	3060.29	125	35 W
2798.40	150	...	2902.05	1000 w	200	3063.56	70	15
2800.57	150 W	40 n	2904.07	300 w	40	3069.24	150	70
2802.07	300	80	2905.24	80	100	3077.24	150 w	50 w
2806.30	300	50	2905.74	40	3	3078.23	50	5
2806.58	200	50	2908.91	150	10	3079.95	50 w	5 n
2810.92	200 W	40 W	2914.12	200	30	3081.85	50	5
2811.72	1	150	2915.34	150 w	50	3085.53	70	18
2814.31	50 r	50	2915.49	150	40	3087.76	5 wn	70
2814.80	125	5	2918.96	2	50	3092.44	50	15
2815.01	150	15	2925.19	100	5	3093.87	50	15
2815.12	100	4	2925.26	100 W	40 ws	3095.39	70 w	18 w
2817.10	80 d	100	2925.66	100	4	3101.03	...	100 W
2817.50	80 l	10	2926.46	100	10	3103.25	70	15
2819.37	100	5	2932.69	400	80 w	3110.81	...	70 w
2824.81	60 W	5 n	2933.55	400	150	3112.92	1	50 l
2826.18	60	5	2934.85	40	4	3113.90	50	35 w
2827.18	200	10	2935.43	50	3	3115.86	50	18 w
2827.55	3 d	100 d	2939.28	200	40 n	3117.44	70	10
2828.58	75	100	2940.06	100 l	40 w	3124.97	50	20
2833.64	300 w	40 w	2940.21	150	50	3127.76	18 w	100
2836.62	80 r	2	2942.14	150	40	3129.55	50	7
2838.24	2	150	2946.91	150	10	3129.95	50	8
2840.39	2	50	2951.92	400 wl	200	3130.58	100 W	35
2842.81	200	50	2952.99	30 n	100 n	3132.64	250 w	25
2843.51	3	80	2956.84	1 n	100 l	3135.89	35	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TANTALUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3137.44	3	50	3317.93	200	25 W	4067.23	40	10 n
3141.38	1 n	50 l	3318.53	70	3	4067.91	100	40
3142.95	10	50	3318.84	125	35	4085.80	5	80 W
3147.37	70	50	3325.74	50	3	4123.17	50 r	4 w
3148.03	50	7	3331.01	18	200 w	4129.38	200	40
3150.85	50 w	35 w	3332.41	50	3	4136.20	80	30
3157.95	3 r	50	3337.80	100	18 s	4147.89	40	30
3162.72	70	7	3339.91	15	70	4175.21	100	40 n
3163.13	70 r	35	3358.53	70	25 W	4176.99	15	40
3163.82	40	5	3361.64	125 W	50 W	4181.15	40	25
3168.18	...	70	3366.66	50	15 w	4205.88	100	30
3170.29	250 w	35	3371.54	70	20	4206.40	50	20
3172.87	50	25 n	3376.49	15 n	70	4268.25	50	15 n
3173.59	70	10	3379.51	18 r	50 r	4271.51	40	5 wn
3176.29	70	18	3406.66	70 w	18 s	4286.38	80	20 n
3180.95	100	35	3406.93	70	15	4302.98	125 W	40 W
3182.57	70 r	18	3414.14	18 W	100 W	4355.14	80	10 n
3184.55	70	18	3419.75	50 w	5 n	4360.83	40 s	5
3191.16	50	5	3430.94	50	70	4378.82	40	2
3192.25	70	18 w	3436.00	70 w	18 w	4386.07	50	15
3194.84	1 n	40	3437.37	7	300 wn	4398.45	40	10
3198.67	125	18	3439.00	...	70 W	4402.50	100	20 n
3198.94	...	70 l	3440.24	18	50	4415.74	40	10
3199.22	...	70 l	3446.91	2 W	150 W	4441.03	60	2 n
3201.98	40	7	3463.77	50	...	4441.68	100 l	2 n
3206.39	70	15	3480.52	70	200 ws	4480.93	200 w	10 n
3207.85	70	15	3497.85	70	5	4494.97	50	2
3216.92	100 w	18 w	3503.87	70	10 n	4496.50	100	2
3221.31	70	15 s	3504.98	70	2	4509.29	60	2
3223.83	200 W	50 W	3511.04	100	35 w	4510.98	200 W	50 W
3227.32	70 l	10	3527.60	50	2 n	4511.50	300	40 W
3229.24	300 w	70 w	3565.63	...	50 l	4521.09	200	10 n
3229.88	35 n	50	3566.72	50	5 l	4527.49	150	5
3230.85	200	18 w	3573.44	15	70 w	4530.85	300	50
3234.69	70	10	3584.21	50	7 n	4547.15	150	2
3237.85	70	7 n	3595.64	70	5	4551.95	400	8
3239.99	200	18 w	3607.41	70	35	4553.69	200 l	2
3242.05	125	15	3625.24	70 r	2 n	4556.35	200	5
3242.83	125	10	3626.62	125	18	4565.85	200	15
3245.28	70	2	3642.06	125	18	4566.86	100	2 n
3246.90	35 n	...	3731.02	50	3	4573.29	200	2 n
3248.52	100	3 n	3763.44	12	60	4574.31	300	20
3250.36	70	3	3784.25	150	50 w	4580.69	200 W	10
3256.77	100	1	3792.01	50	10	4583.17	150	10
3259.87	50	3	3796.21	...	50	4601.42	60	100 wn
3260.18	125	18 w	3833.74	40	200	4602.19	100	2
3263.76	70	2	3889.46	...	40 W	4604.85	200 W	...
3269.14	70 r	7 l	3894.67	...	40 n	4619.51	300	10
3271.19	70 wn	18 w	3922.42	5	50	4622.96	50	1
3273.13	70	3 n	3922.78	100	15	4633.06	150	3 n
3274.95	200	35 W	3922.91	100	10 n	4661.12	300	5 n
3275.68	70	35	3970.10	100	40	4669.14	300	15
3275.94	50	1 n	3973.18	1	400 W	4678.02	40	2
3279.29	50 r	3	3979.28	50 n	3 n	4681.87	200	50
3287.26	50	...	3981.01	2	40	4684.87	100	2
3292.48	70	3	3996.17	100	30 n	4685.27	80	2
3293.93	70	10	4026.94	40	30	4688.84	40	...
3295.33	125 W	20 w	4029.94	50	5	4691.90	400	5 n
3299.77	70	10	4033.07	100	10	4693.35	150	3
3302.76	50	1 n	4040.87	50	5 n	4701.32	150	2 n
3304.37	70	15	4041.06	40	4 n	4706.09	200	2
3309.78	70	5	4061.40	50	30	4722.88	200	...
3311.16	300 w	70 w	4064.63	40	5	4730.12	100	5

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TANTALUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4740.16	100 r	100	5518.91	100 W	..	6428.60	40	..
4756.51	150	10	5548.32	60	..	6430.79	150	..
4780.93	50	200 l	5584.02	60	..	6444.61	40	..
4812.75	150	5	5598.75	60	..	6450.36	200	..
4819.53	100	..	5620.68	80 w	..	6455.83	40	..
4825.43	150	..	5645.91	80	..	6485.37	500	..
4832.18	100	..	5664.90	60	..	6502.43	40	..
4846.45	100	2	5688.25	100 w	..	6505.52	100	..
4852.17	80	2	5699.24	80 w	..	6514.39	200	..
4871.70	50 w	1	5704.31	40	..	6516.10	200	..
4883.95	150	3	5706.28	50	..	6561.60	40	..
4904.59	80 W	2	5746.71	60 l	..	6574.84	200	..
4907.73	50	1	5755.81	40	..	6611.95	300	..
4914.95	50	1	5766.56	80 w	..	6621.30	200	..
4920.11	150 W	3	5767.91	100 w	..	6673.73	200	..
4921.27	50	2	5776.77	80	..	6675.53	400	..
4923.47	60 W	1	5780.02	60	..	6684.00	40	..
4926.00	60	2	5780.71	80	..	6740.73	80	..
4936.42	100 s	..	5811.10	100	..	6771.74	100	..
4937.63	40	2	5816.51	40 w	..	6774.25	100 w	..
4968.53	60 W	1	5849.68	80 w	..	6788.99	50	..
4969.69	40 l	1	5849.95	60 w	..	6810.46	40	..
4976.20	40	1	5865.87	40 w	..	6813.25	200	..
5012.52	60	..	5866.61	60	..	6866.23	200	..
5037.37	60	..	5877.35	100	..	6875.27	200	..
5043.32	60	..	5882.29	80	..	6900.55	80	..
5067.87	60	..	5901.91	80	..	6902.10	150	..
5076.37	50	..	5918.95	80 s	..	6927.38	150	..
5087.37	60	..	5931.05	40 s	..	6928.54	150	..
5090.71	60	..	5931.68	40	..	6951.26	100	..
5115.84	80	..	5939.76	80 l	..	6953.88	50	..
5136.47	60	40	5944.02	80	..	6966.13	150	..
5141.62	40	..	5957.23	200 W	..	6995.39	200	..
5156.56	80 W	..	6009.89	40	..	7005.07	50	..
5161.81	80 w	..	6015.89	40	..	7006.96	100	..
5163.65	40	..	6020.72	300 r	..	7025.03	80	..
5212.74	60	..	6045.39	200 l	..	7039.07	40	..
5218.45	40 l	..	6047.25	150 l	..	7081.30	50	..
5218.66	40	..	6053.64	150 l	..	7125.72	80	..
5230.80	60 w	..	6090.82	50 w	..	7148.63	150	..
5244.77	40 w	..	6101.57	150	..	7172.90	150	..
5279.82	60 w	..	6140.07	40 l	..	7250.27	80	..
5295.01	40	..	6144.56	50	..	7296.32	40	..
5328.38	40	..	6152.54	60	..	7301.74	200	..
5336.13	40	..	6154.50	200	..	7346.41	100	..
5341.05	150 w	80	6158.84	80 w	..	7352.86	150	..
5342.25	80	..	6189.66	50	..	7356.96	100	..
5349.09	80	..	6249.79	100	..	7369.09	100	..
5354.68	80 r	..	6256.68	300	..	7407.89	150	..
5388.51	40 W	..	6266.37	50 W	..	7440.17	40	..
5389.30	100 W	..	6268.70	200	..	7467.75	40	..
5395.99	80 w	..	6281.33	50	..	7485.90	300	..
5402.51	80	30	6309.58	100	..	7814.03	50	..
5404.95	80	..	6325.08	100	..	7842.76	50	..
5419.13	80 r	..	6332.91	50	..	7882.37	150	..
5431.66	60 w	..	6341.17	50	..	7950.19	50	..
5435.27	80	..	6346.02	40	..	8026.50	50	..
5461.29	80	..	6356.14	100	..	8248.95	50	..
5475.54	40	..	6360.84	100	..	8264.85	40	..
5490.11	60	..	6373.05	50	..	8281.62	50	..
5494.78	50	..	6389.45	100	..	8447.62	70	..
5499.44	60 s	..						

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TELLURIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2001.59	600	..	4048.89	..	(70)	4885.22	..	(100)
2039.79	300	..	4073.57	..	(300)	4893.58	..	(70)
2070.9	150	..	4169.77	..	(100)	4894.94	..	(150)
I 2081.03	400	..	4179.24	..	(70)	4904.43	..	(100)
2107.20	100	..	4220.42	..	(100)	5449.82	..	(75)
2107.63	100	..	4251.15	..	(70)	5576.40	..	(100)
I 2142.75	600	..	4261.08	..	(300)	5649.30	..	(250)
I 2147.19	..	(150)	4273.40	..	(70)	5708.07	..	(250)
I 2159.79	100	..	4285.84	..	(70)	5741.66	..	(70)
2166.88	100	..	4293.35	..	(70)	5755.87	..	(250)
I 2208.83	200	(2)	4294.25	..	(70)	5765.25	..	(70)
I 2383.25	500	300	4364.02	..	(400)	5851.09	..	(75)
I 2385.76	600	(300)	4377.10	..	(70)	5936.21	..	(75)
2403.00	..	(100)	4396.00	..	(100)	5974.70	..	(250)
2426.39	..	(100)	4398.45	..	(70)	5985.64	..	(75)
2469.62	..	(300)	4401.89	..	(100)	5993.12	..	(75)
2499.75	..	(300)	4421.14	..	(70)	5993.94	..	(75)
2537.80	..	(300)	4434.96	..	(70)	6014.49	..	(100)
2564.58	..	(150)	4478.73	..	(800)	6047.44	..	(100)
2635.55	..	(350)	4494.47	..	(100)	6136.81	..	(70)
2793.24	..	(300)	4545.97	..	(70)	6153.89	..	(70)
2858.29	2	(100)	4557.84	..	(300)	6166.84	..	(100)
2868.86	..	(100)	4569.71	..	(70)	6202.29	..	(70)
2895.49	..	(300 n)	4602.37	..	(800)	6230.80	..	(300)
2942.16	..	(100 n)	4641.19	..	(70)	6245.61	..	(150)
2949.52	..	(100)	4654.38	..	(800)	6266.21	..	(70)
2967.21	..	(300)	4664.34	..	(800)	6293.61	..	(100)
2975.91	..	(100)	4665.33	..	(70)	6367.10	..	(70)
3017.51	..	(350)	4686.95	..	(300)	6412.15	..	(70)
3023.29	..	(100)	4706.53	..	(70)	6422.96	..	(70)
3047.00	..	(350)	4711.16	..	(70)	6437.06	..	(1000)
3073.53	..	(100)	4731.27	..	(70)	6487.09	..	(70)
3218.44	..	(100)	4766.03	..	(150)	6537.01	..	(100)
3251.37	..	(150)	4784.85	..	(70)	6648.52	..	(100)
3306.99	..	(150)	4796.10	..	(70)	6676.01	..	(70)
3329.25	..	(100)	4831.29	..	(800)	I 6843.94	..	(70)
3585.34	..	(350)	4864.10	..	(800)	6930.51	..	(70)
4006.50	..	(100)	4866.22	..	(800)	7038.95	..	(70)

TERBIUM

2540.12	3	50	3372.72	50		3561.74	200	200
2571.78	..	40	3413.76	50	30	3568.51	50	50
2619.61	..	40	3420.34	50	15	3579.20	50	50
2658.91	..	500	3446.40	50		3585.03	15	50
2800.51	10	40	3454.06	80	30	3596.38	50	15
2885.14	..	70	3457.03	50	8	3600.44	8	50
2891.41	3	500	3468.03	50	15	3611.33	50	8
2956.21	10	40	3472.79	50	15	3615.66	50	15
3078.86	30	80	3500.27	50		3625.54	50	15
3147.04	50	3	3500.84	70	15	3628.20	100	15
3218.93	50	50	3507.45	50	8	3638.46	80	50
3219.95	50	50	3509.17	200	200	3641.66	70	30
3252.34	50	30	3510.10	50	8	3645.38	50	15
3274.24	70	..	3519.76	50	15	3647.75	50	..
3281.40	50	15	3523.66	30	50	3650.40	50	100
3293.07	50	100	3525.61	50	8	3654.88	70	30
3294.04	50	3	3531.70	15	50	3658.88	100	100
3324.40	70	50	3540.24	50	50	3663.12	50	15
3339.00	50	8	3543.86	50	15	3664.64	50	8
3349.42	30	50	3546.52	50	8	3676.35	100	200

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TERBIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3677.89	70	8	4002.18	40 w	2	4493.08	100	..
3682.26	50	30	4002.58	50	5	4511.52	40	..
3691.15	50	50	4005.55	100 d	125	4563.68	50	..
3694.75	50	8	4019.12	40	5	4578.69	70	..
3702.85	50	200	4024.07	40 W	1	4641.98	40	..
3703.92	70	100	4031.64	50	3	4645.26	60 W	..
3711.74	200	30	4033.04	125	5	4658.38	40	..
3755.24	50	100	4052.86	40 w	2	4702.42	80	..
3765.14	70	100	4061.57	40	2	4752.52	100	80
3767.50	75	8	4066.21	40	3	5065.79	40	..
3776.49	100	100	4100.90	50 d	2	5089.12	40	..
3806.85	50	50	4144.45	80	10	5228.12	40	..
3840.26	50	..	4178.97	50 d	2 n	5262.11	40	..
3842.49	40	50	4200.99	40	4	5319.23	40	..
3848.75	100	200	4226.44	50	..	5354.88	40	..
3874.18	200	200	4276.75	50 w	2 n	5369.72	40	..
3899.19	200	100	4278.51	200	100	5375.97	40	..
3901.35	50	8	4318.85	150	30	5470.34	40	..
3919.54	40	15	4325.83	100	..	5514.54	50	..
3922.74	50	8	4326.48	150	4	5516.24	50	..
3925.45	150	200	4332.13	40	2	5524.12	40	..
3935.25	50	8	4336.50	40	..	5685.76	40	..
3939.60	200	200	4338.45	100	3	5747.58	60	..
3946.87	150	50	4340.63	40	2	5785.18	40	..
3957.97	60 d	15	4342.50	50 w	..	5803.15	40	..
3958.36	100 w	15	4353.19	50	..	5851.07	40	..
3976.82	150	200	4356.84	60	..	5967.32	40	..
3981.88	80	200	4409.51	40 w	..	..	..	..

THALLIUM

2066.8	..	30	I 2608.99	80 r	10	II 3381.00	..	(20)
I 2168.61	30 r	..	I 2609.77	30 r	..	II 3460.48	..	(20 d)
I 2207.00	30 r	3	II 2675.76	..	(30)	I 3519.24	2000 r	1000 r
I 2237.85	60 r	3	II 2676.03	..	(30)	I 3529.43	1000	800
II 2292.97	..	(20)	II 2705.55	..	(20)	II 3540.05	..	(20)
II 2297.88	..	35	I 2709.23	400 r	200 r	3558.52	15	7
II 2298.08	..	40	I 2710.67	30 r	10	II 3560.77	..	(25)
II 2298.16	..	20	I 2767.87	400 r	300 r	II 3793.95	..	(25)
2298.95	30	150	II 2780.25	..	(20)	II 3869.19	..	(18)
I 2315.98	60 r	..	II 2801.81	..	(25)	4223.05	..	(25)
I 2379.69	100 r	200 r	I 2826.16	200 r	100 r	II 4274.98	..	(100)
2380.34	20	60	II 2833.31	..	(25)	II 4306.80	..	(40)
II 2451.94	..	30	II 2849.80	..	(200)	II 4340.53	..	(20)
2452.70	..	100	I 2895.41	30 s	15 s	II 4490.77	..	(25)
II 2468.95	..	15	I 2918.32	400 r	200 r	II 4737.05	..	(40)
II 2469.07	..	20	I 2921.52	200 r	100 r	II 4981.35	..	(15)
2469.76	..	30	I 2945.04	50 l	25 l	II 5078.54	10	30 w
II 2477.40	..	(20)	II 2948.73	..	(30)	I 5109.47	15	..
2502.3	..	20	II 3029.01	..	(15)	II 5152.14	..	50 w
II 2507.39	..	(20)	II 3091.61	..	25	I 5350.46	5000 r	2000 r
II 2507.70	..	(30)	II 3091.66	..	50	I 5488.79	15	..
I 2517.41	30 r	..	II 3187.74	..	(50)	I 5527.90	30	..
II 2530.67	..	(100)	I 3229.75	2000	800	I 5583.98	15	..
II 2530.82	..	(60)	II 3261.60	70	300 r	II 5949.04	20	15 wn
II 2530.88	..	(80)	II 3291.01	..	(40)	II 5949.57	..	35
2531.6	..	100	II 3319.91	..	(35)	II 6111.50	..	(20)
I 2552.53	80 r	1	II 3321.17	..	(25)	II 6154.03	..	(20)
I 2580.14	100 r	80 r	II 3332.30	..	(25)	II 6167.38	..	(20)
I 2585.59	30 r	2	II 3369.15	..	(40)	II 6179.98	..	(100)

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

THALLIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 6239.46	..	15	II 6966.43	..	40	II 9130.	..	(60)
I 6549.77	300	50 nl	II 7073.9	..	(20)	I 9136.1	20	..
II 6552.63	200	(10)	II 8445.8	..	(15)	I 9170.7	20	..
I 6713.69	100	40	II 8632.9	..	(15)	I 9512.4	30	..
II 6950.5	..	30	II 8664.1	..	(30)			

THORIUM

2301.22	..	30	2982.05	150	5	3245.76	12	15
2324.70	..	15	2985.25	15	12	3256.27	10	15
2363.09	..	15	2988.23	15	20	3262.67	12	15
2391.52	..	15 wn	2991.06	15	10	3273.88	10	15
2413.49	5	20	2993.80	12	15	3287.74	12	15
2427.99	3	25	3000.92	30 d	10	3290.59	..	40 n
2431.74	2	30	3002.39	15	12	3300.49	..	30 n
2463.69	..	25	3006.93	12	15	3304.24	15	3
2473.98	..	15	3008.49	15	12	3310.25	8	15
2475.33	..	15	3009.72	15	10	3313.65	4	50 n
2501.12	..	20 n	3015.72	15	10	3325.13	10	15
2512.74	..	15 d	3025.43	20 d	5	3334.60	10	15
2545.10	..	20	3026.58	15	15	3337.87	12	15
2545.34	15	4	3034.07	15	15	3339.56	..	20 n
2547.90	15	10	3035.11	15	15	3377.43	..	20 n
2549.51	..	15	3045.57	12	15	3392.04	10	15
2554.73	..	15 d	3046.95	12	20	3402.70	10	15
2555.20	..	15	3049.09	20	20	3469.93	12	15
2564.36	..	20 wn	3060.18	12	15	3479.18	15	10
2565.60	10	15	3061.70	12	15	3493.53	30	15
2566.59	15 s	10 n	3063.03	25 d	25 d	3538.75	..	50
2567.83	..	20	3067.73	12	20	3635.37	15	10
2571.61	..	25	3078.83	10	25 n	3700.77	15	10
2576.69	15	5	3080.22	12	15	3702.87	10	20
2589.06	20	10	3083.35	12	15 n	3706.77	15	10
2597.05	20	5	3088.47	20	20	3711.31	30	20
2600.63	..	15	3090.10	15	10	3712.54	15	8
2600.88	15	4	3097.96	1	50 n	3717.83	20	10
2641.49	15	10	3102.66	15	12	3718.17	15	10
2658.67	15	10	3105.75	15	20	3718.66	20 n	8
2680.96	..	25	3107.03	15	15	3719.44	30	10
2684.29	15	15	3108.30	15	20	3720.31	15	10
2686.16	..	40 d	3110.02	15	15	3721.83	40	30
2692.42	20	20	3111.83	20 d	8 d	3722.19	35	25
2703.96	15	15	3112.35	..	20 n	3724.74	30	20
2708.18	10	20	3119.48	15	15	3726.73	30	20
2752.17	15	12	3122.96	20	20	3727.90	15	5
2768.85	15	15	3124.39	12	15	3730.38	15	3
2824.68	..	25 d	3139.31	10	15	3738.85	20	20
2832.32	18	25	3146.04	12	15	3739.79	20	5
2837.30	15	10	3148.04	3	40 n	3740.85	40	20
2870.41	18	20	3150.46	12	15	3741.19	80	80
2885.04	12	15	3154.73	15	15	3742.25	20	10
2887.82	18	18	3175.73	12	15	3742.92	20	8
2896.71	..	20 Wd	3180.20	15	15	3744.74	15	10
2898.93	..	25 wn	3208.02	18	10	3745.98	15	20
2899.72	15	12	3216.62	3	20 n	3747.55	30	30
2917.39	25 d	6	3221.29	15	40 n	3750.15	20	5
2925.05	10 s	15 n	3225.36	12	15	3752.57	40	50
2932.52	..	25 wn	3228.97	12	15	3754.04	20 w	5 w
2976.02	15	10	3230.87	15	12	3754.60	20	10
2978.64	1	100 n	3232.12	3	25 n	3756.32	50 r	20 r
2980.34	15	10	3238.12	12	15	3759.31	20	10

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

THORIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3670.28	20	5	3904.09	20	20	4381.86	30	30
3761.10	15	8	3905.19	30	30	4391.11	50	40
3762.88	20	20	3912.28	15	15	4416.24	15	8
3763.33	15	8	3913.01	15	15	4432.97	25	15
3765.25	20	10	3915.21	15 n	1 n	4439.13	20	15
3767.90	20	15	3916.73	15	10	4440.58	15	6
3771.38	30 w	20 w	3927.18	15	10	4440.87	20	10
3773.76	20	20	3927.42	15	10	4465.34	30 s	15
3775.32	20	5	3929.67	30	20	4480.82	25	10
3775.94	20	10	3932.23	15	10	4487.50	20	10
3777.12	40	20	3937.04	15	10	4488.68	25	12
3777.91	15	10	3937.93	15	10	4510.53	30	20
3778.78	15	10	3938.73	15 w	10 w	4537.07	20	8
3779.81	20	10	3945.51	20	15	4593.64	..	50 wn
3780.51	20	10	3946.15	20	20	4631.76	15	10
3780.85	20	5	3948.97	30	30	4651.56	30	15
3780.97	15	3	3950.39	30	30	4694.09	15	10
3781.69	20	10	3951.52	20	20	4740.52	20	15
3783.02	20	20	3960.34	10	15	4752.41	20	12
3783.30	20	15	3972.16	15	8	4863.18	20	10
3783.82	15	5	3976.42	15	20	4872.93	20	..
3785.65	15	15	3981.11	20	20	4882.46	5	20 wn
3786.88	15	15	3988.01	50	30	4919.81	50	20
3787.19	40 w	20 w	3994.55	30	10	4921.61	20	..
3789.12	20	20	3996.07	15	10	4987.14	15	4
3793.49	20 w	8	4003.32	15	15	5017.25	50	10
3793.79	20	8	4005.55	20 w	30 w	5028.61	40 W	10 wn
3795.39	20	10	4007.03	20	20	5049.81	30 w	5
3795.75	20 w	10 w	4011.75	15	15	5198.83	15	..
3803.08	15	15	4012.50	15	15	5247.65	20 d	3
3805.82	20	15	4022.09	20	15	5277.50	15 d	3
3811.38	20	10	4025.61	20	20	5325.14	15 d	3
3813.06	15	20	4036.57	15	15	5390.46	18	5
3814.59	15	15	4041.21	20	10	5415.43	20 d	3
3817.37	20	10	4050.89	15 n	5	5425.68	15 d	3
3817.73	15	15	4069.21	40	30	5435.90	15	2
3820.81	20	20	4085.04	15	15	5539.90	18 d	4
3821.43	15	15	4094.75	15	15	5548.16	15 s	..
3823.08	20 w	10 w	4100.83	18	18	5707.09	20	5
3824.35	20 w	20 w	4108.43	15	15	5720.18	18 d	..
3824.76	20 d	10	4116.72	12	15	5815.43	18 d	2
3829.41	40 w	20 w	4140.24	15 s	15 s	5989.03	20	5
3833.04	20 w	10 w	4165.47	20 w	10 w	6112.82	15	3
3834.61	15 w	10 w	4208.89	15	15	6120.55	15	3
3836.50	50 w	50 w	4247.99	15	12	6261.06	15	2
3839.70	15	15	4273.36	20	15	6274.11	25	3
3841.96	20	20	4277.32	20	12	6279.17	20	2
3845.02	20 w	10 w	4281.07	20	10	6342.86	15	..
3854.55	20	20	4281.42	15	10	6457.28	15	..
3863.39	20	20	4282.04	30	25	6462.65	30 s	..
3872.73	30	20	4309.99	15	12	6531.35	15	..
3884.83	20	15	4327.14	15	7	6989.66	20	..
3900.89	30	30	4374.79	15	10	7168.89	15	..
3903.09	15	5						

THULIUM

2338.36	2	50	2480.13	60	20	2552.49	..	50
2357.04	3	80	2489.46	2	100	2561.65	60	30
2361.23	1	60	2509.08	80	40	2588.27	40	80
2406.63	2	60	2519.80	1	50	2607.05	50	30

H. EMISSION SPECTRA 2000-10,000 Å (Continued)

THULIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2624.34	80	40	3266.63	70	50	3996.52	200	40
2679.57	30	50	3267.41	50	40	4094.18	300	30
2721.19	60	100	3269.00	40	150	4105.84	300	30
2744.09	20	50	3291.00	125	80	4138.36	80	8
2785.08	60	30	3302.45	125	80	4187.62	300	30
2794.60	60	20	3309.80	80	60	4199.92	100	20
2797.27	60	100	3310.59	60	20	4203.73	250	25
2827.02	20	50	3316.87	60	20	4242.15	500	100
2827.92	50	100	3354.86	30	50	4359.93	300	30
2869.22	100	300	3362.61	250	200	4386.42	200	10
2890.93	60	15	3374.51	60	30	4481.27	400	50
2918.27	25	50	3397.50	100	50	4519.58	50	1
2925.65	20	60	3399.95	50	40	4522.57	200	300
2926.75	80	60	3425.08	200	300	4529.37	80	5
2935.99	80	300	3425.63	100	50	4555.26	25	50
2951.26	30	150	3429.97	100	100	4556.67	35	70
2959.65	20	60	3431.20	50	50	4561.84	50	10
2965.87	50	100	3441.51	150	80	4599.00	80	80
2981.49	60	100	3453.66	150	80	4615.93	200	300
2986.52	50	150	3462.20	250	200	4626.31	50	20
2990.54	80	30	3535.52	80	25	4626.55	50	3
3015.29	125	100	3536.21	40	60	4634.24	80	10
3026.07	60	30	3536.57	60	20	4677.85	50	2
3042.35	50	..	3565.90	40	50	4681.92	50	2
3050.73	50	150	3566.47	60	20	4733.32	80	5
3054.05	30	60	3608.77	100	20	4831.21	50	80
3056.06	40 d	100	3643.65	60	40	4957.19	50	5
3073.08	60	150	3668.08	80	20	5009.76	50	50
3073.50	25	60	3678.86	50	40	5034.21	100	100
3073.85	15	50	3700.26	150	80	5307.11	100	20
3087.02	30	60	3701.36	150	80	5631.41	80	10
3093.12	30	60	3717.92	100	10	5675.83	100	100
3096.97	15	50	3725.06	60	15	5764.29	50	..
3098.59	80	60	3734.13	150	50	5895.63	80	20
3099.61	10	50	3744.07	100	10	6181.41	40	50
3131.26	400	500	3751.82	50	5	6430.95	15	60
3133.89	200	200	3761.33	250	150	6460.28	400	80
3144.89	25	60	3761.92	200	120	6604.97	300	60
3151.03	200	200	3795.76	250	150	6657.73	70	10
3157.34	200	150	3817.40	60	15	6721.37	60	20
3168.19	25	60	3838.20	80	60	6779.77	300	50
3172.82	200	200	3848.02	400	250	6844.27	250	30
3173.58	50	100	3883.13	100	10	6845.76	200	20
3210.57	40	50	3883.43	150	30	7481.09	100	..
3212.01	50	40	3887.35	80	8	7490.22	100	..
3235.45	80	40	3900.79	80	50	7558.36	200	..
3236.80	100	80	3916.47	80	8	7731.57	150	..
3240.23	100	80	3929.58	70	50	7856.10	60	..
3241.53	150	125	3949.27	50	5	7927.52	50	..
3249.84	10	50	3958.10	200	40	7930.85	100	..
3258.04	125	60	3995.58	100	..	8017.90	200	..
3261.66	30	100						

TIN

2039.5	..	200	2199.34	30	60 r	2268.91	100 r	100 r
2113.90	25 r	5 r	II 2209.66	25 w	60 r	2286.68	60	40
I 2148.74	50 r	20	2231.72	30	60	2317.23	100 r	100 r
II 2152.22	..	(100)	II 2246.05	100 r	100 r	2334.81	100 r	100 r
2152.5	30	..	2251.15	25	50	2354.84	150 r	150 r
2194.49	30 r	60	2265.98	..	(40)	2408.15	30	30

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TiN (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2419.49	..	(40)	3032.77	50	20	6149.67	15	50
2421.69	150 r	200 r	I 3034.12	200 wn	150 wn	6154.60	12	25
2429.49	200 r	250 r	3141.81	20	30	II 6453.58	6	300 wnn
2445.01	..	(50)	I 3175.02	500 n	400 nr	6462.36	4	300 wn
II 2449.79	..	25	3218.68	18	50	6563.24	..	50 W
II 2483.40	125	125	I 3262.33	400 n	300 n	II 6844.20	..	(50 nl)
II 2486.99	..	(30)	II 3283.21	..	(50)	II 7191.40	..	(40)
2495.72	100	100	II 3283.51	..	100 n	II 7741.80	..	(30)
2504.59	..	(30)	3330.59	100 n	100 n	I 7754.96	100	..
2523.91	60	60	II 3351.97	..	(60)	8030.5	100 nl	..
2531.11	40	15 W	3352.43	..	100 n	8039.3	40 nl	..
2546.55	100	100	3399.04	..	25 Wn	I 8100.3	49 nl	..
2558.05	30	6	3655.78	30	25 n	I 8114.10	200	..
2571.59	100	125	3800.99	200 n	150 n	8121.0	30 nl	..
2594.42	60	80	4511.30	200	..	8349.35	30 n	..
2661.25	100	80	I 4524.74	500 wn	50	I 8357.04	80	..
2706.51	200 r	150 r	4585.64	..	25 wn	8422.72	300 nl	..
2779.82	80	100	II 5561.95	..	(40)	I 8552.60	500	..
2785.03	60	60	II 5588.92	2 n	(50)	8681.7	50 Wn	..
2787.93	50	50	5631.68	50	200	I 9018.9	30 Wn	..
2813.58	50	50	II 5799.18	2 n	(30)	9410.86	50 Wl	..
I 2839.99	300 r	300 r	5925.48	8	25	I 9415.37	80 nl	..
2850.62	80	100 wn	5970.30	10	30	9616.40	150 n	..
I 2863.33	300 r	300 r	6037.70	12	50	9741.4	100 nd	..
2913.54	100 wn	125 wn	6054.90	12	30	9805.38	300 Wl	..
II 2919.82	..	(30)	6068.94	12	25	9850.52	500 l	..
I 3009.15	300 n	200 n	..	..	..	..	..	..

TITANIUM

II 2154.70	3	60	II 2780.56	..	60 wn	II 2926.75	..	50 wn
II 2450.44	10	100	II 2786.00	..	60 wn	II 2931.26	..	150 wn
II 2478.65	..	50	II 2788.02	..	70 nd	II 2936.17	..	100 wn
II 2524.64	15	60	II 2800.61	..	150 wn	II 2938.70	..	100 wn
II 2525.60	35	125	I 2802.50	100	15	I, II 2941.99	100	150
II 2531.25	30	125	II 2805.01	..	200 wn	II 2943.13	..	60 wn
II 2534.62	25	80	II 2810.3C	6	150	II 2945.47	..	100 wn
II 2535.87	20	60	II 2817.87	10	200	I 2948.25	100	30
I 2555.99	15	80	II 2820.00	..	70 wn	II 2954.76	..	150 wn
II 2571.03	20	70	II 2821.42	..	70 wn	I 2956.13	125	25
I 2599.91	70	10	II 2827.21	..	80 wn	II 2958.99	..	150 wn
I 2605.15	100	12	II 2828.15	2	200 n	..	..	50 wn
I 2611.28	80	15	II 2828.9	..	150 wn	II 2979.20	..	100 wn
I 2632.42	50	7	II 2832.16	25	100	II 2990.16	..	80 wn
II 2635.63	..	50 wn	II 2836.64	..	100 wn	2995.75	10 n	70 wn
II 2638.70	..	100 wn	II 2839.80	..	100 wn	II 3017.19	15	200
I 2641.10	150	20	II 2841.94	40	125	II 3022.82	..	150 wn
II 2642.15	..	150 wn	II 2846.09	..	70 wn	II 3023.86	..	100 wn
I 2644.26	100	12	II 2851.10	20	80	II 3029.73	12	150
II 2646.11	..	200 wn	II 2856.24	..	100 wn	II 3043.85	3	50
I 2669.60	60	1	2857.81	..	70 wn	3045.08	2	50 wn
I 2679.93	100	12	2861.99	..	100 wn	II 3046.68	10	60
2698.52	..	200 n	2870.04	..	100 wn	II 3056.74	12	70
II 2716.25	5	70	II 2877.44	30	100	II 3058.09	12	70
I 2733.26	60	15	II 2884.11	35	125	II 3071.24	12	70
I 2739.81	50	3	2888.63	..	70 wn	II 3072.11	25	125
II 2746.71	..	150 wn	2890.61	..	50 wn	II 3072.97	35	200 r
II 2751.70	..	200 wn	II 2891.07	20	50	II 3075.22	40	300 r
II 2752.88	..	50 wn	2906.68	..	100 wn	II 3078.64	60	500 r
I 2758.07	70	4	2913.33	..	50 wn	II 3088.02	70	500 r
II 2764.82	15	70	2916.10	..	50 wn	II 3089.40	12	100

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TITANIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 3090.05	..	100 wn	II 3321.70	15	125	I 3708.65	50	3
II 3097.19	20	150	II 3322.94	80	300 r	I 3709.96	80	25
II 3103.80	20	200	II 3326.76	15	125	I 3717.40	80	50
II 3105.08	12	100	II 3329.46	80	200 r	II 3721.64	60	125
II 3106.23	25	150	II 3332.11	40	125	I 3722.57	100	60
3110.67	10	100	II 3335.19	60	150	I 3724.57	100	50
II 3112.05	7	70	II 3337.85	12	60	I 3725.16	150	60
II 3117.67	15	200	II 3340.34	80	100	I 3729.81	500	150
II 3119.80	4	150	I, II 3341.87	100	300 r	I 3741.06	150 r	40
II 3122.06	2	50	II 3343.77	60	70	II 3741.64	30	200
I, II 3128.64	12	70 wn	II 3346.73	60	60	I 3752.85	200	80
II 3130.80	25	100	II 3349.03	125	800 r	I 3753.63	80	35
II 3143.76	18	125	II 3349.41	100	40 r	II 3757.69	30	100
II 3148.04	25	150	I 3354.63	100	20	II 3759.29	100	400 r
II 3152.25	30	125	II 3361.21	100	600 r	II 3761.32	100	300 r
II 3154.19	20	100	I 3361.26	80 r	50 r	I 3771.65	70	30
II 3155.67	25	125	I, II 3366.18	20	50	I 3775.72	3000	1000 r
II 3161.20	30	125	I 3370.44	80	15	II 3776.06	8	60
II 3161.77	35	150	I 3371.45	100	15	I 3789.29	50	15
II 3162.57	50	200 r	II 3372.80	80	400 r	I 3868.40	50	8
3164.91	1	50	II 3380.28	25	150 r	I 3895.25	70	10
II 3168.52	70	300 r	II 3383.76	70	300 r	II 3900.54	30	50 n
II 3174.80	..	100	I 3385.95	80	25	I 3904.78	70	35
II 3181.84	..	50 wn	3387.84	60	125	3013.46	40	70
I 3186.45	150	80	II 3394.57	70	200	I 3914.33	50	10
II 3190.87	40	200 r	II 3402.42	15	90	3924.53	70	35
I 3191.99	100	20	II 3407.20	12	50	I 3929.87	70	35
I 3199.91	200	150	II 3416.96	7	50	I 3947.77	70	35
II 3202.54	25	200	II 3444.31	60	150	I 3948.67	80 n	40
II 3214.75	20	80	II 3452.47	12	100	I 3956.34	100	50
II 3217.06	47	150	II 3456.39	25	125	I 3958.21	150	100
II 3218.27	15	150	II 3461.50	80	125	I 3962.85	80	35
II 3222.84	20	150 r	II 3465.56	6	60	I 3964.27	80	40
II 3224.24	15	150	II 3477.18	60	100	I 3981.76	100	70
II 3228.60	30	100	II 3483.80	..	70 wn	I 3982.48	80	30
II 3229.19	30	60	II 3504.89	20	150	I 3989.76	150	100
II 3229.42	15	70	II 3510.84	40	125	I 3998.64	150	100
II 3232.28	30	100	II 3535.41	15	125	I 4003.81	50	70
II 3234.52	100	500 r	II 3596.05	50	125	I 4008.06	50	7
II 3236.57	70	300 r	I 3598.72	70	30	I 4008.93	80	35
II 3239.04	60	300 r	I 3610.16	100	70	I 4009.66	60	25
II 3239.66	25	80	II 3624.82	60	125	II 4012.39	35	50
II 3241.99	60	300 r	I 3635.46	200	100	I 4013.58	70 n	7 n
I, II 3248.60	25	200 r	II 3641.33	60	150	I 4015.38	70 n	10 n
II 3251.91	50	150	I 3642.67	300	125	I 4017.77	70 n	8
II 3252.91	60	200 r	I 3646.20	70	25	I 4021.83	100	20
II 3254.25	35	125	I 3652.95	150	50 l	I 4024.57	80	35
II 3263.69	10	70	I 3653.50	500	200	I 4026.54	70	10
II 3271.65	35	125	I 3654.59	100	40	II 4028.34	20	80
II 3272.08	25	100	I 3658.10	150	60	I 4030.51	80	18
II 3275.29	8	50	II 3659.76	50	150	I 4035.83	50	5
II 3276.77	12	70	I 3660.63	90	18	I 4055.02	80	30
II 3278.29	25	100	II 3662.24	40	100	I 4058.14	50	6
II 3278.92	40	150	I 3668.97	100	40	I 4060.26	60	25
II 3282.33	30	150	I 3671.67	150	70	I 4064.22	50	15
II 3287.65	40	200	II 3685.19	150	700 r	I 4065.10	80	35
I 3292.07	70	40	I 3689.91	100	40	I 4078.47	125	50
I 3299.41	50	35	I 3694.45	80	20	I 4082.46	60	25
I 3308.39	50	10	3700.08	60	5	I 4112.71	70	20
II 3308.81	35	100	I 3702.29	60	20	I 4127.54	70	15
I 3309.50	60	25	I 3704.29	70	25	I 4137.29	50	15
II 3315.32	12	100	II 3706.23	30	125	I 4159.64	60	15
II 3318.02	60	125	I 3707.53	100	10	II 4163.65	35	150

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TITANIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 4171.90	15	70	I 4465.81	100	40	I 4928.34	100	4
I 4180.87	100	20 n	II 4468.49	80	150	I 4938.29	70	2
I 4186.12	100	40	I 4471.24	100	40	I 4975.35	80	4
I 4203.46	50	10	I 4474.85	80	30	I 4978.20	70	3
I 4249.12	60 n	3 n	I 4479.70	70	35	I 4981.73	300	125
I 4256.04	80	15	I 4481.26	100	60	I 4989.15	100	4
I 4258.53	70	7	II 4488.32	10	125	I 4991.07	200	100
I 4261.6	70	8	I 4489.09	100	40	I 4997.10	50	4
I 4263.13	125	35	I 4496.15	60	60	I 4999.51	200	80
I 4270.14	50	3	II 4501.27	60	100	I 5001.01	80	2
I 4274.58	100	40	I 4512.74	100	60	I 5007.21	200	40
I 4276.43	50	20	I 4518.03	100	60	I 5009.65	50	2
I 4278.23	50	15	I 4522.80	100	70	I 5013.30	80	7
I 4281.38	80	20	I 4527.31	100	50	I 5014.24	100	30
I 4282.71	70	25	I 4533.24	150	40	I 5016.17	100	15
I 4286.01	100	40	II 4533.97	30	150	I 5020.03	100	80
I 4287.40	100	50	I 4534.78	100	40	I 5022.87	100	18
I 4289.07	125	50	I 4535.57	80	50	I 5024.84	100	15
II 4290.23	35	60	I 4544.69	150	60	I 5025.58	100	8
I 4290.94	70	30	I 4548.77	125	25	I 5035.91	125	30
II 4294.12	60	80	II 4549.63	100	200	I 5036.47	125	25
I 4295.76	100	40	I 4552.46	150	50	I 5038.40	100	20
I 4298.66	125	50	I 4555.49	125	60	I 5039.95	125	25
I 4299.23	70	20	I 4559.92	50	5	I 5052.87	50	3
I 4299.64	60	10	II 4563.77	100	200	I 5064.65	150	35
II 4300.05	40	100	II 4571.98	150	300	I 5065.99	50	2
I 4300.56	125	20	II 4589.95	40	100	I 5087.07	70	1
I 4301.09	150	50	I 4617.27	200	100	I 5113.44	80	2
II 4301.93	25	50	I 4623.09	125	40	I 5120.42	100	4
I 4305.92	300	150	I 4629.34	70	7	I 5145.47	100	4
II 4307.90	100	100	I 4639.37	80	18	I 5147.48	90	3
II 4312.87	35	100	I 4639.95	60	15	I 5152.20	90	2
I 4314.80	100	20	I 4645.19	100	10	I 5173.75	125	20
I 4318.64	100	50	I 4660.02	60	4	II 5188.70	80	100
I 4321.66	70	25	I 4656.47	150	70	I 5192.97	150	25
I 4325.13	100	40	I 4667.59	150	8	I 5210.39	200	35
I 4326.35	60	25	I 4675.12	50	5	I 5219.71	60	2
II 4337.92	70	125	I 4681.92	200	100	I 5223.64	50	1
II 4344.29	12	50	I 4691.34	125	25	I 5224.32	70	8
I 4360.49	60	15	I 4698.76	100	20	I 5224.95	90	6
II 4386.85	8	80	I 4710.19	100	25	II 5226.55	30	50 n
I 4393.92	60	12	I 4722.62	80	8	I 5238.58	50	100 n
II 4395.03	50	150	I 4731.17	50	6	I 5255.83	40	80
II 4399.77	40	100	I 4742.79	100	40	I 5265.98	70	3
I 4404.27	50	30	I 4758.12	125	60	I 5283.45	50	2
II 4411.08	7	100	I 4759.28	100	8	I 5295.79	50	1
I 4416.54	70	10	II 4779.95	10	100 n	I 5297.26	70	2
I 4417.28	80	20	I 4792.49	70	12	I 5351.08	50	60
II 4417.72	40	80	I 4799.80	80	15	I 5397.09	60	..
I 4421.76	60	15	II 4805.10	15	125	I 5409.61	50	1
I 4422.82	80	25	I 4805.43	70	4	I 5474.23	30	50
I 4426.05	80	25	I 4820.41	125	30	I 5477.71	70	2
I 4427.10	125	60	I 4840.87	125	25	I 5490.15	70	2
I 4434.00	100	50	I 4848.47	60	2	I 5503.90	60	3
I 4440.35	80	35	I 4856.01	100	10	I 5512.53	125	12
II 4443.80	80	125	I 4868.26	100	8	I 5514.35	70	10
I 4449.15	150	80	I 4870.14	100	18	I 5514.54	80	15
II 4450.49	12	50	I 4885.08	150	25	I 5565.49	80	2
I 4450.90	150	60	I 4899.91	150	20	I 5644.14	150	200
I 4453.32	150	70	II 4911.18	12	100	I 5648.58	80	60
I 4453.71	80	40	I 4913.62	125	15	I 5662.16	100	100
I 4455.33	150	80	I 4919.87	80	3	I 5675.44	90	125
I 4457.43	150	100	I 4921.77	100	5	I 5679.94	50	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TITANIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 5689.47	80	80	I 6261.10	300	100	8377.85	200	..
I 5702.67	60	40	I 6303.75	200	..	I 8382.54	300	..
I 5711.88	50	40	I 6312.24	80	..	I 8382.82	200	..
I 5715.13	70	60	I 6318.03	50	..	I 8396.87	200	..
I 5739.51	70	80	I 6336.10	80	..	I 8412.36	300	..
I 5762.27	70 n	50	I 6366.35	80	..	I 8426.52	200	..
I 5766.35	70 W	50	I 6546.28	80	..	I 8434.94	200	..
I 5774.05	70 W	50	I 6554.23	125	150	I 8435.70	150	..
I 5785.98	100 W	60	I 6556.07	150	..	I 8438.93	100	..
I 5804.26	100 n	50	I 6565.62	50	..	I 8450.89	70	..
I 5823.71	35	50	I 6599.11	100	..	I 8467.15	300	..
I 5866.46	300	400	6743.12	100	..	I 8468.50	300	..
I 5880.31	60	125	I 6861.47	50	..	I 8496.04	60	..
I 5899.32	150	150	I 7038.80	100	..	I 8518.05	60	..
I 5918.55	80	..	I 7209.44	150	..	I 8518.32	100	..
I 5922.12	100	100	I 7216.20	50	..	I 8539.38	60	..
5932.13	80	..	I 7244.86	150	..	I 8548.12	100	..
I 5937.82	60	..	I 7251.72	125	..	I 8569.77	50	..
I 5941.76	100	..	I 7299.71	50	..	I 8598.18	60	..
I 5953.17	150	250	I 7318.39	80	..	I 8675.39	150	..
I 5965.84	150	200	I 7344.72	200	..	I 8682.99	125	..
I 5978.56	125	150	7357.74	200	..	I 8692.33	100	..
I 5999.68	70	..	7364.11	150	..	I 8734.69	70	..
I 6064.63	80	20	I 7440.60	100	..	I 8766.64	70	..
I 6085.23	100	60	I 7489.61	150	..	I 9546.03	50	..
I 6091.17	125	25	I 7949.17	50	..	I 9599.51	50	..
I 6098.67	60	..	I 7978.88	100	..	I 9638.24	200	..
I 6126.21	150	60	I 8024.84	50	..	I 9647.40	80	..
I 6146.22	400	..	I 8068.24	50	..	I 9675.55	200	..
I 6215.28	100	50	I 8306.31	50	..	I 9705.59	100	..
I 6220.49	100	30	I 8307.41	60	..	I 9728.34	60	..
I 6221.41	80	..	I 8334.37	70	..	I 9743.55	50	..
I 6258.10	200	100	I 8353.15	50	..	I 9787.65	50	..
I 6258.70	300	250	I 8364.24	150	..			

TUNGSTEN

2008.07	12	25	2110.34	10	25	2239.78	..	18
2015.78	6	20	II 2116.94	8	15	2241.08	10	15
2016.40	4	20	II 2118.87	10	20	II 2245.21	10	20
2022.05	4	15	2135.04	..	20	II 2248.26	12	15
II 2026.08	7	25	II 2138.15	10	25	II 2248.75	20	25
II 2029.98	10	30	2152.14	3	20	2260.07	15	3
II 2035.89	8	20	2156.42	5	25	2263.53	7	25
2037.58	3	18	2160.91	..	30	II 2270.24	12	20
II 2054.68	9	20	2163.89	12	25	2277.58	20	10
II 2065.57	10	20	II 2166.32	10	30	II 2294.54	20	20
II 2071.21	10	25	2169.48	15	5	II 2303.83	10	15
2075.59	10	20	II 2173.54	10	15	2331.30	15	..
2078.35	6	25	2186.73	8	15	II 2337.74	8	20
2079.11	12	30	2194.52	10	15	2358.81	10	20
2088.19	12	30	II 2204.48	12	30	2360.43	15	5
2089.14	10	20	II 2206.59	10	15	2363.06	15	5
2092.08	..	25	2214.80	10	20	2364.22	5	15
2093.80	8	15	2215.34	6	15 w	2368.97	..	15
II 2094.75	10	18	II 2216.01	10	15	2370.04	5	25
2098.25	10	20	II 2219.72	15	4	II 2370.60	2	18
2098.60	10	20	II 2220.94	8	18	2382.99	15	3
2100.67	10	25	II 2225.89	10	18	II 2390.37	10	20
2105.76	6	20	I 2229.63	10	20	II 2392.93	8	15
2106.18	10	20	II 2237.06	10	15	II 2397.09	18	30

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TUNGSTEN (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2401.86	2 n	15	II 2489.23	10	20	2622.21	15	10 d
2402.44	15	20	II 2492.93	6	25	II 2623.11	2	20
2404.24	10	15	2495.26	20	5	2623.89	..	15 d
2405.26	10	15	II 2496.64	10	20	2624.47	1	15 s
2405.69	15	8	II 2497.48	10	15	2625.21	15	7
2407.78	1	15	2499.22	2	15	2633.13	15	12
2408.28	3	15	II 2499.69	10	15	II 2633.88	1	15
2409.23	..	15	2506.03	10	15	2634.58	1	20
2409.49	..	15	II 2509.96	1	15	II 2635.38	3	18
2410.44	..	20	II 2510.47	3	15	II 2637.57	6	15
II 2411.81	2	15	2513.45	..	15	II 2643.12	12	15
2414.81	..	25	2518.14	6	15	2643.29	2	20
2415.68	15	9	2519.88	15	2	2646.19	15	10 d
2417.60	..	15	2520.45	15	10	2647.74	10	20
2418.25	..	15	2521.32	15	2	II 2653.57	10	15
2419.34	2	20	II 2522.04	10	20	2656.54	15	5
2420.49	2	15	2528.91	3	15	II 2658.04	10	20
2423.28	..	15	2530.99	9	15	2662.83	15	10
2423.94	..	15	2534.15	2	15	II 2664.32	10	20
2424.22	20	7	II 2534.82	2	15	2666.08	..	15
2426.51	1	20	2537.14	1	15	II 2666.49	8	20
II 2435.01	3	30	2539.31	6	15	2667.67	..	15
2435.96	30	10	II 2539.90	2	20	II 2669.30	15	30 d
II 2440.43	2	15	2542.60	1	15	II 2670.39	3	15
2443.61	15	8	2545.34	15	9	2671.47	15	5
2444.06	18	9	2547.14	20	10	2673.59	7	20
2444.94	..	15	2553.16	12	15	II 2677.79	8	20
II 2446.39	10	30	2554.67	4	15	2678.88	20	10
2448.22	..	15	II 2554.86	15	10	2681.41	20	18
2448.39	15	5	II 2555.09	10	15	2685.05	2	15
II 2449.69	2 n	15	2559.49	3	15	2686.99	4 d	20
II 2451.48	15	20	2560.12	15	8	2687.37	15	3
2451.99	12	15	2563.16	8	30	II 2688.22	8 s	20
2454.71	15	10	2563.91	7	15	2690.71	..	15
2454.97	15	10	II 2567.61	7	15	2691.09	15	8
2456.53	15	5	2568.85	2	15	II 2694.38	9	18
2458.57	1	15	II 2569.25	15	25	2694.59	..	18
2459.29	18	10	II 2571.44	15	30	2695.67	20	12
II 2459.88	..	15	2573.53	15	..	2696.89	..	18
2462.79	15	10	2576.16	2	20	2697.51	15	3
2463.95	2	15	II 2576.36	2	15	II 2697.71	15	25
2464.31	15	2	2576.86	..	15	2699.59	15	10
II 2464.63	3	20	2577.02	15	4	2700.01	15	10
2465.20	12	20	2579.26	2	20	2700.31	..	15
2465.64	..	20 d	II 2579.54	8	25	II 2701.48	2	18
II 2466.52	12	20	II 2581.20	7	20	2702.11	8	25
2466.85	15	7	2584.38	15	10	II 2703.06	3 d	15
2468.41	..	20 r	II 2585.96	8	20	2703.46	2	20
II 2470.80	5 d	20	2586.94	75	30	II 2706.70	6	20
2471.74	1	15	II 2589.17	15 d	25	2707.02	6	15
2472.51	15	5	2594.54	4	15 l	2708.58	10	15
2474.15	20	10	2595.57	2	20	II 2709.57	6	15
2475.59	1	20	II 2596.86	1	15 s	II 2710.78	6 d	15
II 2477.80	15	30	II 2598.74	12	20	2712.69	1	20
2480.13	25	10	II 2601.43	2	15	II 2715.34	8	20
2480.95	20	3	2601.96	15	6	2715.49	20	8
2481.44	25	3	2602.51	10	25	II 2716.31	8	20
II 2484.00	2	15	II 2603.02	5	15	2717.17	4	15
2484.40	2	15	2612.19	10	15	II 2718.04	10	20
2484.73	20	6	2613.82	15	9	2718.90	25	20
2486.30	15	2 n	II 2615.44	6	20	2719.33	15	20 Ws
2487.49	15	5	2618.08	..	15	II 2720.40	4 d	18
2488.77	10	20	2620.23	12	15	2721.66	9 s	15

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TUNGSTEN (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
II 2722.81	8	25	2934.99	15	12	II 3358.60	10	40
2724.08	2	15	2936.67	10	20	II 3361.11	10	15
2724.35	20	10	II 2940.20	4	18	3366.72	..	15
II 2729.62	10	25 d	2944.39	30	20	II 3376.14	9	40
2729.94	1	15	2946.98	20	18	II 3379.02	4	15
2733.18	15	9	2950.44	..	20	3383.12	..	18
2734.77	10	20	II 2952.29	12 s	30	II 3401.89	7	40
2736.57	..	15	II 2987.29	8	15	3410.17	..	15
2737.37	..	20	II 3000.62	4	20	3416.62	7	20
2740.79	5	25	II 3002.28	1	15	3421.13	3 d	20
2742.47	5	25	II 3010.76	8 d	20	3424.45	2	15
2742.90	3	25	II 3021.99	15	20	II 3440.63	5	20
II 2745.03	2	25	II 3024.50	9	20 l	II 3449.87	6	25
2746.73	12	20	3024.92	15	12	3455.02	..	20
2752.24	2	20 l	3033.57	12	15	3460.42	..	15
II 2753.05	15	10 d	II 3036.66	8	20	3463.25	10	15
2760.74	8	20	II 3039.57	2	20	II 3463.51	8	25
II 2761.59	10	25	II 3051.29	10	30 l	3475.29	..	25
2762.34	20	10	II 3063.41	..	20	II 3486.13	5	20
II 2764.27	20	60	II 3063.97	2	20	II 3490.92	7	15
2766.32	..	20	II 3069.28	6	15	3495.25	12	20 l
II 2768.33	10	20 l	II 3071.72	8	15	II 3529.56	10	20
2768.98	18	10	3077.52	2	40 wn	3536.27	3	15
2769.74	15	10	3095.87	2	20	II 3549.05	5	25
2770.88	25	12	II 3100.74	2	20	II 3555.17	6	15
2772.48	10	60	II 3103.52	2	15	3570.65	15	15
2774.48	15	20 l	3111.12	9	15	II 3572.48	10	35
II 2776.50	12 d	25	II 3144.50	..	15	II 3592.42	9	35
2778.69	3	20	II 3149.85	10	15	3596.18	..	15
II 2780.28	10	20	3151.29	5	20	3611.85	..	20
II 2782.13	4	30	3152.47	10	15	II 3613.79	10	30
II 2785.63	3	20	3155.09	10	20	3617.52	35	20
II 2786.31	2 d	15	II 3160.02	9	30	3628.38	3	20 d
II 2790.42	2	15	3163.42	12	15 l	3628.93	..	15
II 2799.03	8	20	3169.93	10	15	3631.95	15	10
II 2801.05	6	15	3170.20	15	9	II 3641.41	12	40
II 2805.92	9 s	30	II 3175.94	8	20 l	II 3645.60	4	20
2808.51	..	20 l	II 3177.21	8 d	25	II 3646.52	10 l	35
2808.94	1	15	II 3178.02	8 d	20	II 3657.59	10	25
2812.25	3 d	20	3179.97	6 d	20	II 3657.88	5	15
2818.06	15	20	3187.13	..	20	3672.59	1	18
2819.05	2	15	II 3189.24	10	20	3682.09	25	20
II 2822.57	12	30	3197.56	..	20	3691.88	4 d	20 d
2829.82	15 l	10	3198.33	1	15	3694.51	10	20 l
2830.10	4	20 l	3201.58	7	20	3707.93	20	20
2831.38	25	10	II 3203.34	4	20	3708.51	3	35
2833.63	15	12	II 3206.41	6 d	15	3712.21	..	18
II 2834.21	..	30	3209.96	2	25	II 3716.08	9	18
2847.13	2	15	3215.26	..	15	3722.25	12	15
2848.03	15	12	II 3243.34	5	20	3741.71	12	20
2852.10	1 d	18 n	II 3251.22	10	18	3742.68	15 d	12 d
2853.49	12	15 n	3262.28	..	18	3745.56	..	25
2859.48	3	15	3300.82	15 l	12	3756.87	6	15
2866.06	15	10	3304.47	10 w	20	3757.92	15	20
II 2868.73	6	25	3308.34	3 d	25	3758.94	..	15
II 2886.89	3	20	3311.38	15 l	12	3760.13	15	10
2889.77	2	20	II 3317.40	1	15	3768.45	20	18
2896.45	15	25	3326.19	15	12	3773.70	20	18
2903.50	..	15	3331.67	15 l	12	3774.14	..	18
II 2904.07	3	18	II 3338.62	5	15	3780.77	20	18
2918.63	8	20	II 3342.46	10	30	3792.77	15	15
II 2924.98	2	15	II 3345.86	10	15 l	3803.68	..	15 w
2925.80	..	15 l	3348.29	2	15 l	3809.23	25	20

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TUNGSTEN (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3810.38	15	15	4316.81	15	7	4646.15	15	3
3817.48	18	15	4332.13	15	7	4657.44	50	12
3824.39	12	15	4335.57	2	15	4659.87	200	70
3835.05	15	20	4347.00	20	7	4661.97	15	2
3838.50	15	20	II 4348.12	50	40	4668.46	20	3
3846.21	20	20	4355.16	15	9	4676.63	20	2
3847.49	18	15	4361.81	20	9	4677.69	25	3
3859.98	15	30	4364.79	25	12	4679.04	15	2
3867.97	30	35	4372.53	25	10	4680.52	150	40
3881.39	20	20	4378.49	25	12	4683.54	20	10
3896.93	2	15	4384.86	25	15	4693.73	50	12
3897.91	12	15	4389.84	15	6	4698.63	15	1
3900.91	..	15	4394.08	20	9	4700.41	50	4
II 3935.44	7 d	20	4403.95	20	9	4702.47	15	5
3936.98	12	15	4408.28	25	12	4706.17	15	1
3980.64	12	15	4412.20	20	10	4711.19	15	3
3983.29	12	25	4415.07	15	6	4712.49	18	5
4001.89	..	15	4420.47	30	10	4720.40	15	3
I 4008.75	45	45	4425.91	15	6	4725.13	40	3
4015.22	25	30	4436.90	30	12	4729.65	30	15
4019.23	18	15	4438.29	15	7	4745.57	25	1 wn
4044.29	15	12	4441.81	20	10	4757.55	60	10
4045.60	12	15	4445.15	20	6	4757.78	15	1
4064.79	15	12	4449.01	20	6	4758.21	15	1
4070.61	15	12	4455.46	15	5	4773.91	30	2
4074.36	50	45	4456.11	15	5	4787.94	15	1
4081.30	2	25	4458.09	15	5	4788.43	15	1
4082.97	12	15	4460.50	25	7	4797.54	15	2
4095.70	12	15 w	4463.50	15	7	4799.92	50	10
4102.70	35	30	4466.35	20	10	4807.37	15	1
4109.76	20	20	4466.73	20	10	4835.02	15	..
4142.26	15	9	4481.28	15	6	4843.83	50	12
4145.16	15	8	4484.19	35	20	4854.09	30	..
4154.67	15	10	4493.97	15	7	4858.61	15	..
4157.04	3	25	4494.51	20	12	4878.28	30	..
4168.66	10	15	4495.31	20	6	4886.91	50	10
4170.53	15	7	4504.86	30	10	4888.39	20	..
4171.18	25	12	4512.91	30	10	4890.29	15	..
II 4175.59	7	25	4513.30	30	10	4892.44	25	..
4203.82	15	6	4529.76	15	4	4902.32	15	..
4204.41	20	10	4530.37	15	4	4910.74	30	..
4207.05	25	12	4534.71	15	5	4916.18	20	..
4219.38	25	15	4535.05	15	5	4931.56	30	..
4222.05	15	8	4536.66	15	6	4948.59	15	..
4226.91	15	3	4542.89	15	3	4953.09	25	..
4234.35	25	7	4543.51	25	10	4972.57	15	..
4241.45	30	10	4546.49	30	10	4977.24	15	..
4244.37	40	20	4551.85	35	10	4979.85	25	..
4258.53	15	5	4556.87	15	5	4982.60	40	5
4259.36	30	20	4563.59	15	5	4983.54	20	..
4263.31	25	15	4570.65	30	10	4984.17	15	..
4266.54	15	8	4586.85	30	5	4984.72	15	..
4269.39	40	30	4588.75	40	15	4986.94	40	1 n
4269.78	15	10	4592.42	20	10	4989.09	15	..
4274.55	20	12	4592.57	15	5	4994.10	30	..
4275.49	15	10	4599.96	50	10	5002.79	15	10
4276.75	15	10	4600.44	20	4	5006.16	40	7
4286.01	15	8	4609.91	50	10	5007.23	15	2
4294.10	20	10	4613.32	50	10	5013.46	15	..
I 4294.61	50	50	4620.55	20	7	5015.32	40	5
I 4302.11	60	60	4634.81	20	7	5039.03	15	1 n
4303.33	..	15	4641.80	20	6 w	5040.36	35	1 n
4306.87	20	15	4642.56	30	8	5053.30	60	10

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

TUNGSTEN (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
5054.61	25	3	5435.06	20	..	5851.56	25	..
5055.53	20	..	5456.59	18	..	5856.62	15	..
5069.15	50	3	5475.11	15	..	5864.63	20	..
5071.73	40	3	5477.80	25	20	5880.22	15	..
5105.48	15	..	5486.01	20	..	5902.66	20	..
5110.36	20	..	5487.78	15	..	5947.58	15	..
5130.11	15	..	5492.32	50	50	5965.86	25	..
5138.40	20	..	5500.51	15	15	5972.52	25	..
5145.77	18	..	5503.45	45	1	6012.81	30	3
5183.97	20	..	5514.70	50 w	8	6021.54	25	..
5192.72	30	..	5531.52	18	..	6081.48	25	1
5203.26	30	..	5533.26	25	..	6128.27	15	2
5204.51	40	..	5568.07	15	..	6153.73	15	1
5206.19	30	..	5631.26	15	..	6154.86	15	1
5212.79	20	5	5631.97	15	..	6203.51	15	1
5224.67	50	8	5642.04	15	..	6285.90	30	2
5242.99	25	1 n	5648.38	50 w	50 w	6292.03	30	2
5254.54	18	..	5674.42	30	..	6404.20	25	2
5255.42	20	..	5675.38	15	..	6708.18	20	..
5259.35	20	..	5697.82	35	..	8017.18	25	..
5263.21	15	..	5723.06	15	..	8055.60	20	..
5275.55	20	..	5735.09	50 W	25	8123.79	20	..
5318.87	20	..	5749.22	15	..	8338.01	15	..
5337.37	15	..	5793.07	20	..	8358.67	15	..
5348.95	30	..	5796.51	20	..	8585.06	50	..
5350.44	18	..	5804.87	25 w	12	8594.37	20	..
5351.90	20	..	5838.99	25	..	8613.26	15	..
5368.70	15	..	5845.26	18	..	8865.50	15	..
5388.20	15	..						

URANIUM

2158.61	..	20	2538.43	15	6	2698.06	20	50
2194.79	2	15	2556.19	15	12	2706.95	15 d	20 d
2219.28	15	2	2562.94	15	6	2713.49	..	15 wn
2237.44	..	15	2565.41	30	30	2730.07	2	15 n
2248.03	..	25	2572.65	..	15 n	2730.31	18	8
2273.36	..	15	2577.32	18	6	2731.27	15	8
2276.05	..	20	2587.07	6	15 n	2733.97	10	15
2282.78	..	25	2591.25	18	12	2741.75	18	6
2283.72	..	15	2593.57	18	6	2743.40	..	20 n
2306.91	..	25	2597.69	25	15	2746.16	25	6
2318.47	..	25	2608.20	25	6	2748.45	18	15
2324.80	2	20	2609.26	15	2	2751.93	2 d	20 n
2326.45	..	20	2628.93	15	10	2754.15	20	35
2349.60	..	15	2632.98	15	8	2762.85	15	20
2351.87	..	20	2633.03	5	15	2793.94	25	30
2377.87	2	15	2635.53	25	50	2795.23	18	12
2378.16	..	35	2641.93	18	8 n	2802.56	15	30
2397.32	..	20	2645.47	20	25	2807.05	18	30
2401.28	..	15	2649.07	15	15	2809.95	20	20
2403.42	..	30	2651.84	3	15 n	2811.34	35	30
2412.69	4	15	2654.58	15	6 n	2817.96	18	30
2423.70	15	4	2660.14	15	10	2819.83	6	25
2484.01	15	4	2664.15	18	20	2821.12	20	35
2484.22	10	15	2675.12	15	10	2824.28	25	30
2489.78	12	15	2675.88	15	10	2826.19	18	12 n
2500.86	18	12	2683.28	25	25	2828.90	18	20
2513.33	1	20	2684.04	15 r	10	2832.06	35	50
2518.97	15	6	2691.04	15	30	2833.82	15	25
2521.80	5	15	2695.49	12	30	2839.89	18	20

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

URANIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2842.09	15	12	3057.91	20 d	20 d	3516.85	6	15
2844.99	18	8	3062.54	12	15	3523.56	4	15
2847.34	15	4	3072.78	20	20	3528.69	6	15
2849.48	18	15	3073.81	15 r	10 r	3531.11	8	20
2852.75	15	15 n	3084.24	15	12	3531.64	15	1
2853.57	15	10	3088.99	20	15	3533.57	10	20
2858.90	35	25	3091.25	15 rd	12 rd	3540.46	6	15
2860.47	35	30	3093.01	20	20	3546.38	1	15
2860.80	15	12	3104.16	20	20	3550.82	12	20
2861.13	10	15	3111.62	15	15	3553.44	15	
2862.41	15	10	3115.93	8	15	3555.32	15	6
2864.28	18 n	12 n	3126.17	12	20	3561.80	12	30
2865.68	30	50	3129.73	8	15	3565.75	1	15 n
2870.97	18	20	3130.56		15	3566.60	30	10
2874.08	15	10	3139.56	25	25	3569.06	12	20
2875.20	18	12	3141.54	5	15	3577.08	15	3
2880.49	12	15	3147.09	12	15	3581.84	6	15
2882.74	18	20	3149.21	18 d	18 d	3582.02	6	15
2886.45	15	6 n	3153.12	12	15	3584.88	30	12
2887.25	25	25	3156.07	6	15	3590.32	5	15
2889.63	30	50	3157.86	10	15	3591.56	4	15
2894.14	12	15	3159.82	8	15	3594.95	8	15
2894.51	15	15	3165.28	6	18	3599.84	6	18
2906.80	15	30	3176.21	20	15	3608.96	18	10
2906.91	18 r	15 n	3177.33	15	18	3609.68	15	12
2908.27	12	30	3200.13	15	15	3620.08	15	2 n
2909.25	6	15	3229.50	18	25	3622.70	15	1
2914.25	18	25	3261.72	15	10	3623.05	12	15
2914.63	12	15	3263.11	25	8	3625.98	5	15 wn
2921.68	10	15	3265.81	25	18	3630.73	8	20
2925.57	15	25	3270.12	20	25	3633.29	8 d	15 d
2928.60	15	35	3288.21	25	20	3639.49	25	
2930.80	4	30 n	3293.59	30	5	3640.76	8	20
2932.61	10	25	3297.89	6	18	3640.95	8	20
2936.45	12	20	3300.68	15 n	8 n	3644.24	18	2
2941.92	15	30	3312.70	15 r		3645.03	8	15
2943.89	10	25	3322.12	18	12	3654.89	25	
2954.39	12	15	3341.66	12	15	3657.32	6	15
2954.77	10	15	3361.73	15	8	3659.16	15	1
2956.06	10	60	3371.29	8	15	3662.66	15 r	2
2960.94	15	25	3378.20	15	1	3667.97	15	8
2964.25	6	15	3386.13	6	15	3670.07	15	18
2966.12	15	25	3390.39	18	10	3672.58	8	15
2967.89	15	20	3398.99	15		3676.56	3	15
3009.42	15 d	2 d	3422.35	18 r	15 r	3678.75	6	15
3016.96	15	12	3423.05	12 d	15 d	3680.88	20	1
3019.29	8	15	3424.56	20	15	3682.04	6	15
3021.22	10	15	3429.03	18 r	2 n	3685.77	15	1
3024.38	25 r	20 r	3435.53	15 d		3693.70	4	18
3024.51	18	15	3436.78	12	15	3700.57	12	18
3025.03	12 n	20 n	3442.96	15		3701.52	10	25
3027.69	15	8	3486.30	5	15	3716.13	18	
3029.13	20	15	3488.81	8	15	3725.65	3	15
3031.99	15	15	3489.37	20	1	3729.82	8	15
3035.96	15	8	3490.24	12	20	3738.05	8	20
3037.91		20	3493.33	6	15	3748.68	15	25
3039.26	15	12	3494.84	6	15	3752.66	6	15
3043.79	15	8	3496.41	8	15	3760.88	10	15
3046.84	6	15	3499.33	6	15	3763.27	12	25
3047.57	15	20	3500.08	15	2	3765.34	18	1
3048.63	15	8	3505.07	8	15	3768.80	15	12
3051.14	15 r	10 r	3509.67	10	15	3769.53	4	18
3053.30		15	3514.61	18	5	3772.81	6	20

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

URANIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
3773.42	20	40	3914.27	10	18	4125.13	15	1
3779.05	8	15	3915.22	15	1	4128.34	18	20
3780.72	15	20	3915.88	20	30	4133.49	15	..
3782.84	25	40	3923.05	15	6	4136.81	15	■
3783.84	20	25	3924.27	15	15	4141.23	20	30
3785.35	..	15 n	3926.22	30	6	4146.61	15	..
3793.10	12	18	3928.83	15	..	4153.98	15	5
3793.28	20	12	3930.98	12	35	4155.41	12	18
3796.54	10	15	3931.49	25	6	4162.43	18	3 n
3796.84	12	15	3932.03	35	50	4169.05	20	2 n
3798.84	15	1	3935.38	15	18	4171.59	30	30
3801.15	20	..	3940.49	10	15	4172.97	10	15
3801.95	15	..	3942.83	20	8	4179.00	15	12
3808.94	20	..	3943.82	35	5	4204.37	15	10
3809.22	15	12	3944.13	8	15	4209.49	15	1
3809.92	15	2 n	3946.68	15	10	4210.45	10	15
3811.48	15	..	3952.95	15	..	4211.62	18	..
3811.62	15	..	3953.58	6	15	4213.88	20	4
3811.99	18	6	3954.66	20	30	4222.37	18	8
3812.58	15	4 n	3955.38	8	15	4228.76	18	12
3813.79	20	15	3957.81	10	15	4231.68	25	..
3814.07	25	15	3962.79	15	8	4232.04	15	15
3821.96	15	..	3966.57	20	30	4234.53	18	15
3825.03	15	..	3973.94	15	4	4241.67	40	50
3829.80	15	..	3978.80	8	18	4244.37	25	25
3831.46	25	25	3983.91	5	15	4246.26	30	2
3831.86	15	3 n	3985.79	25	30	4252.43	15	20
3833.02	20 r	15	3988.88	12	15	4266.33	15	..
3836.52	6	15	3990.42	18	20	4267.93	15	4
3837.27	15	..	3994.98	8	20 wn	4269.61	20	30
3839.63	30	2	3998.24	5	18	4273.97	12	15
3851.73	15	2	4002.34	10	18	4280.66	18	3
3854.23	20	..	4004.06	15	20	4282.03	30	30
3854.65	20	30	4005.70	25	3	4287.87	15	18
3859.58	20	30	4009.17	8	15	4288.84	20	2
3860.63	1	15 n	4017.72	25	25	4290.88	15	15
3863.40	5	20	4018.99	25	15	4293.30	18	5
3865.92	20	25	4026.02	25	25	4295.10	15	1
3871.04	30	1	4039.78	15	2	4297.11	18	18
3871.38	3 n	20 n	4042.75	40	10	4301.47	15	15
3874.04	15	15	4044.42	18	25	4304.14	15 r	1
3876.13	15	2	4047.61	18	3	4306.78	40 r	4
3879.55	18	..	4050.04	25	35	4313.15	20	1 n
3879.71	20	3	4051.91	20	25	4313.88	15	10
3881.46	30	20	4054.31	12	15	4316.49	15	1 n
3882.36	18	18	4062.55	12	18	4328.74	20	1
3883.33	10	18	4063.12	15	1	4341.69	50	50
3884.68	8 n	20	4067.76	12	20	4347.19	18	18
3887.45	20	..	4071.11	15	25	4355.74	10	20
3887.70	20	10	4077.79	15	6	4362.05	30	3
3890.36	35	30	4080.61	12	20	4362.26	15	18
3891.82	18	1	4088.25	25	18	4371.76	18	1
3892.68	20	30	4090.13	25	40	4372.57	15	18
3894.12	30	4	4095.75	18	25	4372.76	18	5
3895.27	12	20	4096.35	20	5	4382.34	18	5
3896.78	20	25	4099.27	20 r	1	4387.31	15	4
3897.06	8	18	4101.90	18	1	4393.59	40	6
3897.26	15	5	4103.12	18	1 n	4399.63	15	6
3901.55	15	..	4106.93	25	10	4413.14	15	4
3902.56	18	18	4116.10	25	35	4418.47	15	..
3904.30	8	15	4122.35	15	4	4426.68	18	15
3904.85	8	15	4123.96	20 r	1	4426.94	20	1
3911.67	18	18	4124.72	30	25	4427.65	12	15

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

URANIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
4433.89	15	12	4646.60	25	40	5620.79	30	1
4440.74	20	20	4663.75	18	3	5669.45	18	..
4462.33	15	18	4666.86	25	40	5723.63	15	1
4462.97	18	30	4669.31	8	15	5780.61	40	..
4465.13	20	25	4671.41	20	30	5798.55	35	1
4472.33	50	80	4685.72	10	18	5802.13	20	..
4477.71	20	25	4689.07	30	40	5836.05	30	..
4490.83	18	25	4702.05	8	18	5837.71	30	1
4510.32	20	30	4702.52	10	20	5845.27	20	..
4515.28	25	40	4722.73	40	50	5870.95	15	..
4516.72	15	1	4731.60	40	50	5915.40	125	..
4521.59	4	15	4755.73	8	15	5971.52	50	..
4538.19	25	40	4769.26	6	15	5976.34	50	..
4543.63	50	80	4772.70	6	18	5986.12	25	..
4545.58	20	25	4858.08	15	15	5997.33	25	..
4549.85	12	20	4885.13	18	..	6077.30	40	..
4551.98	15	1	4899.29	25	25	6171.87	30	..
4555.09	20	40	4910.34	15	1	6293.35	15	..
4557.80	3	15	4928.44	20	1	6359.30	30	..
4559.65	15	..	5008.22	30	25	6372.47	50	..
4567.69	20	40	5027.40	40	4	6379.64	15	..
4568.23	4 n	18	5160.33	18	20	6389.80	18	..
4569.91	25	40	5164.16	15	1	6392.78	20	..
4570.99	6	25	5184.59	12	15	6395.45	100	..
4573.69	30	40	5257.04	15	18	6449.17	100	..
4579.64	12	15	5278.18	12	15	6465.00	25	..
4581.72	8	18	5280.39	30	4	6503.59	15	..
4584.85	10	15	5308.54	25	3	6518.94	15	..
4601.13	18	25	5311.88	18	18	6555.01	15	..
4603.66	25	40	5475.72	20	18	6620.52	15	..
4605.15	12	25	5480.27	15	25	6826.93	25	..
4609.86	15	20	5481.22	30	25	7074.81	25	..
4611.44	12	25	5482.55	12	18	7128.91	20	..
4618.39	5	20	5492.97	60	50	7379.70	15	..
4620.22	25	12	5511.50	30	2	7425.50	18	..
4622.43	12	18	5527.85	25	40	7533.91	20	..
4627.08	30	60	5564.19	40	3	7784.13	20	..
4631.62	30	3	5570.68	15	15	7881.94	15	..
4641.66	10	15	5610.90	30	1	..	..	..

VANADIUM

II 2004.78	..	50	2222.70	..	100	2325.12	..	100
II 2014.19	2	50	2228.30	..	100	2328.93	..	100
2133.05	..	50	I 2229.74	12	80	2330.46	8	300
II 2134.12	30	125	2232.91	..	500	2331.29	..	50
II 2137.31	10	80	2240.62	..	100	2331.77	..	300
II 2138.16	8	50	2241.53	..	200	2333.60	..	50
II 2140.09	10	80	2285.45	..	100	2334.21	..	250
II 2141.98	10	80	2288.63	..	80	2335.49	3	50
II 2143.05	10	50	2290.54	..	50 wn	2336.10	2	50
II 2147.46	2	100	2292.85	..	250	2337.13	..	100
II 2151.82	..	50	2294.99	5	100	2337.32	..	80
2185.38	4	50	2297.85	..	100	I 2340.49	50	3
2201.67	..	50	2309.84	..	125	2342.14	4	125
2202.50	..	60	2311.35	..	150	2343.11	..	250
2209.22	..	50	2314.19	..	100	2346.34	..	125
2214.02	..	100	2318.07	..	250	2347.15	..	150
2216.03	2	100	2318.99	..	150	2349.81	3 w	150
2217.41	..	150	2323.83	..	300	2351.26	2	50
2218.43	..	125	I 2324.75	50	..	2351.54	..	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

VANADIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2352.18	5	200	2648.47	2	60	2830.40	10	60
2357.80	2 n	60	2649.36	2	100 n	2836.52	20	80
2358.74	..	300	I 2651.90	50	4	2845.24	18	80
2367.65	..	80	2655.68	10	100 n	2846.57	50	20 n
2371.07	..	500	I 2661.42	100	80	2847.57	15	150
2372.17	..	100	2663.25	12	100	2849.05	7	50
2373.06	..	200	2670.23	2	70	I 2852.87	60	7 n
2380.92	6	50	2672.00	50	300 r	2854.34	20	100 r
2382.47	..	100 w	2673.23	10	60	I 2855.22	50	1
2383.00	8	80	2677.80	70	300 r	I 2857.94	50	7 n
2385.82	..	100	2678.57	30	150 r	I 2859.97	50	10
2389.70	5	100	2679.32	70	300 r	2869.13	25	150 r
2393.57	..	500	2682.87	50	200 r	I 2870.55	50 r	20 r
2399.68	..	150	I 2683.09	35	150 r	2873.18	4	50
2404.18	1	90	2687.96	150	500 r	2877.69	15	100 r
2430.04	..	70	I 2688.71	35	100 r	II 2879.16	50	35
2444.97	2	60	2689.88	50	150 r	II 2880.03	25	150 r
2446.70	1	50	2690.24	50	200 r	II 2882.50	35	200 r
2447.61	..	70	2690.79	70	300 r	II 2884.78	40	200 r
2458.29	1	70	2694.74	2	70	2888.25	20	125 r
2465.28	2	100	I 2696.99	70	2	II 2889.62	40	150 r
2475.46	2	60	2697.74	100	50 r	II 2891.64	40	200 r
2475.87	..	60	2698.38	30	300	II 2892.44	30	150 r
2479.05	15	150	I 2698.73	70	15 n	II 2892.66	30	150 r
2479.52	15	150	2700.94	125	500 r	II 2893.32	50	300 r
2483.07	20	150	2702.19	80	300 r	II 2896.21	35	150 r
2503.02	7	100	2705.22	25	50	II 2903.08	35	150 r
2506.22	10	150	2706.17	100	400 r	II 2906.46	40	150 n
I 2506.90	50 r	35	2706.70	60	200 r	II 2907.47	40	150 n
2516.12	25	100	2707.86	70	150	II 2908.82	70 r	400 r
I 2519.62	125 r	50	2710.16	6	60	2910.02	35	150 r
II 2523.95	10	100	2711.74	50	150 r	II 2910.39	35	150 r
I 2526.21	150	150 r	2713.05	40	80	II 2911.06	30	200 r
2527.90	35	300 r	2714.20	60	100	I 2914.93	60	50 r
2528.47	50	150 r	2715.69	50	300 r	II 2919.99	10	70 r
2528.84	25	150 r	I 2722.56	100	40	II 2920.38	20	125 r
I 2530.18	100	70 r	2726.55	7	80	I 2923.62	50 r	150 r
II 2534.52	10	80	2728.64	50	400 r	II 2924.02	70 r	300 r
I 2545.98	50	10	I 2731.35	80	50	II 2924.64	60	200 r
II 2548.69	10	80	2739.71	50	80	II 2930.81	30	150 r
II 2549.28	20	150	2747.47	6	60	2932.32	12	80
I 2552.65	75 r	10	2753.40	50	200 r	II 2934.40	10	50 n
2554.22	..	50 wn	2760.70	25	100 n	I 2938.25	2	60
2555.91	2	80	2765.67	50	200 n	II 2941.37	40	300 r
I 2562.13	50	4	II 2766.45	40	100 n	II 2941.49	12	150 r
2571.06	4	70	2768.56	35	150 r	I 2942.35	80 r	20 n
I 2574.02	60	50	2771.40	6	50 n	II 2944.57	50	300 r
II 2574.52	9	80	2772.01	2	80 n	2948.07	2	70
2576.48	1	50	2774.28	25	100 r	2949.17	6	80
2583.01	..	50	2774.72	20	50 n	II 2950.35	25	100 r
2584.96	2	100	2775.76	12	70 n	II 2952.07	35	150 r
2593.05	..	50 n	II 2777.73	40 n	100 r	2955.58	1	60
2595.10	..	70 n	2778.58	..	60 n	I 2957.52	20	125 r
2615.40	..	50 wn	2781.45	4	125 n	I 2962.77	60	60 r
2616.25	4	70	2784.27	4	50 n	2972.25	2	50
2622.73	..	50 n	2797.02	12	80 n	2975.65	4	50
II 2628.74	4	50 n	2797.79	12	70 n	2976.20	6	50
2629.71	1	70 n	2798.76	25	80 n	I 2977.54	50	6
2630.67	30	150 n	2799.45	25	100 n	2981.20	4	60
2640.85	2	50	2810.27	50	50	2982.75	4	50
2644.35	12	100 n	2817.50	18	50	2983.55	10	60
2645.84	15	100	2822.44	4	70 n	2985.17	1	60
I 2647.71	50	10 n	2825.87	7	70 n	II 2988.02	10	80

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

VANADIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2990.95	50	5	3138.06	..	70	I 3365.55	125	80
2994.54	2 n	50	3139.74	15	150	I 3376.06	80	60
II 2995.99	5	70	3141.48	5	100	I 3377.62	60	30
II 3001.20	20	200 r	3142.47	15	100 r	3382.53	..	125
II 3003.46	8	70	3143.47	1	50	I 3384.60	60	40
3005.81	..	50	3144.70	1	60	I 3400.39	100	8
3006.50	..	50	II 3145.34	25	60	I 3402.57	60	25
II 3007.28	2	50	3146.23	2	70	3404.42	..	50 n
3008.50	..	50	3146.81	2	50	3451.04	..	60
3008.61	3	70	3148.74	..	50	3453.08	..	60
3012.01	2	50	3151.32	8 w	150 w	3457.15	2	150
3013.10	10	70	3155.41	5	100	3469.52	2	100
II 3014.82	10	100	3161.31	1	50	3470.26	..	70
II 3016.78	15	80	II 3164.83	10	100	3477.52	..	100
3022.57	2	50	3165.89	1	80	II 3479.84	20	80
II 3024.98	2	60	3167.44	5	150 r	I 3482.19	40	50
II 3028.04	2	50	3174.54	1	80	II 3485.92	8	70
II 3033.82	20	90 r	I 3183.41	200 r	100 r	II 3493.17	15	100
3042.26	6	80	I 3183.98	500 r	400 r	3497.03	..	150
I 3043.12	60	7	I 3185.40	500 r	400 r	II 3499.82	3	50
I 3043.55	60	40	II 3187.71	35	100 r	II 3504.44	60	200
3048.21	10	125 r	II 3188.51	35	100 r	I 3505.69	50	35
3048.89	10	50	II 3190.68	50	150 r	3507.54	..	50
3050.73	1	50	I 3193.92	100	20	3509.04	2	150
I 3052.19	50	5	I 3198.01	100 r	30 r	II 3520.02	5	50
II 3053.39	10	90 r	I 3202.38	100 r	20 r	3521.84	20	80
I 3053.65	90 r	..	I 3207.41	80 r	20	II 3524.71	10	60
3053.89	10	60 r	II 3208.35	10	100	II 3530.77	40	100
3055.94	..	50 w	I 3212.43	70	50	II 3538.24	10	100
I 3056.33	125 r	70 r	II 3214.75	20	100	I 3543.50	50	50
I 3060.46	150 r	100 r	I, II 3217.11	30	80 n	II 3545.20	40	300 r
3063.25	30	80 r	3226.92	1	50	I 3553.27	80	30
I 3066.37	400 r	125 r	3231.95	8	100	II 3560.60	10	50
3070.12	..	50	II 3237.87	30	100 n	II 3566.18	25	100
3072.71	70 r	40 r	I 3250.78	10	50	I 3577.87	50	40
I 3073.82	60	20 r	3251.87	10	50	3578.64	35 d	80 d
3081.25	5	50	I 3254.77	40	80 n	I 3580.82	50	50
I 3082.11	80 r	2 n	II 3263.32	..	50	I 3583.70	60	30
3083.21	2	50	II 3267.70	30	80 r	II 3589.76	80	600 r
I 3083.54	60	..	II 3271.12	25	50 r	II 3592.02	50	300 r
3092.72	100 r	50 r	II 3276.12	50	200 r	II 3593.33	30	300 r
II 3093.11	100 r	400 r	3281.11	3	50	I 3600.03	50	40
3094.20	20	125 r	3282.53	12	80	3604.38	..	50 n
3100.93	20	100	II 3289.39	10	70	I 3606.69	80	70
II 3102.30	70	300 r	3290.24	2	70	3618.93	..	100
3108.70	3	50	3293.15	..	50	3620.47	10	50
3109.37	1	70	3297.52	..	60	3621.21	15	80
II 3110.71	70	300 r	I 3298.14	50	15	3625.61	4	125
3113.57	7	100	II 3298.74	12	80	3627.71	4	50
II 3118.38	70	200 r	3301.65	..	80	I 3629.31	50	2
3120.73	12	80	3304.47	..	125	3632.12	..	70
II 3121.14	60	200 r	3308.48	..	80	3635.87	50	25 n
3122.89	12	300 r	3316.88	..	60	I 3639.02	70	60
3125.00	4	50	3317.91	..	80	I 3641.10	100 n	30 wn
II 3125.28	80	200 r	3318.91	..	60	I 3644.71	80	50
II 3126.21	60	100 r	3321.54	3	150	I 3648.97	80	50
3128.28	2	60	I 3329.85	100	40	I 3656.71	80	20 n
3128.69	3	70	3335.48	1 n	60	I 3661.38	10	150
II 3130.27	50	200 r	3337.85	2	150	I 3663.59	150	1 wn
3132.59	80 r	20	3345.90	..	125	I 3665.14	100	50 n
II 3133.33	50	200 r	3353.77	2	100	I 3667.74	80	25 n
3134.92	30	150 r	I 3356.35	125	60	3669.41	20 W	300
3136.51	20	200	3361.51	..	200	I 3671.20	100	70

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

VANADIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 3672.40	100	40 n	I 3858.68	50	15	I 5393.18	100	..
I 3673.40	150	80 n	I 3862.22	80	20	I 5401.93	100	100
I 3675.70	100	70	I 3864.86	100 r	50 r	I 5415.26	75	75
I 3676.68	300	150 n	II 3866.74	5	50	5434.17	50	50
I 3677.08	25	70	I 3867.60	70	35	I 5507.75	60	60
I 3680.11	125	50 n	I 3871.08	60	35	I 5592.41	50	50
I 3683.13	100	60	I 3875.07	70 r	50	I 5604.94	60	20
I 3686.26	100	100	I 3876.09	50	30	I 5624.60	100	..
I 3688.07	200	200 r	II 3878.71	35	100	I 5626.01	150	..
I 3690.28	200	125	I 3879.66	50	5	I 5627.64	200	80
I 3692.22	200 r	150 r	II 3884.84	4	70	I 5646.11	150	150
I 3694.62	60	5	I 3890.18	100	30	I 5657.44	150	60
I 3695.33	125	70 n	I 3892.86	60	35	I 5668.36	75	50
I 3695.86	150	100 r	I, II 3896.16	50	40	I 5670.85	150	70
3700.34	10	100	I 3900.17	50	2 n	5683.22	50	2
I 3703.58	200 r	100 r	I 3901.15	50	3 n	I 5698.52	300	300
I 3704.70	200 r	150 r	I 3906.75	50	20	I 5703.56	200	60
I 3705.03	100	70	3908.32	50	2 n	I 5706.98	200	..
I 3706.03	50	50	I 3909.89	50 w	30 w	I 5716.21	60	30
3708.72	100	60	I 3912.21	50	20	I 5727.03	150	150
3711.12	..	80	II 3914.33	25	70 wn	I 5727.66	75	..
I 3713.96	60	10	I 3922.43	80	40	I 5731.25	250	100
3715.47	70	400 r	I 3927.93	50	40	I 5737.06	100	100
II 3718.16	5	70	I 3930.02	50	20	I 5743.45	60	20
I 3721.99	70	20	I 3934.01	100	30	I 5750.65	50 W	..
II 3727.34	40	200	I 3937.53	50	20	I 5772.42	50	25
3728.34	20	150	I 3943.66	50	18	I 5776.68	50	25
I 3729.03	80	15	II 3951.97	35	50	I 5784.38	50	30
3732.76	70 r	500 r	I 3979.14	50	8	I 5786.16	75	..
I 3737.99	50	5	I 3988.83	70	35	I 5807.14	75	40
I 3738.76	100	7	I 3990.57	125	40	I 5817.06	50	..
I 3740.24	100	10	I 3992.80	60	20	I 5817.53	100 n	..
I 3741.50	80	8	I 3998.73	100	25	I 5830.72	100	80
3745.80	35	600	II 4002.94	6	80	I 5846.30	100	100 n
I 3747.98	50	4	II 4035.63	40	80	I 5924.57	250 W	..
3751.23	4	100	4053.59	..	70	5928.85	..	60 n
I 3751.78	50	2	4065.08	2	100	I 5978.91	100	..
I 3755.70	70	3	I 4067.74	50	15	I 5980.78	50	..
I 3759.32	50	2	I 4090.58	60	25	I 6039.73	100	10
I 3763.14	80	6 n	I 4111.78	100 Wr	100 Wr	I 6058.14	60	..
II 3770.97	30	60	I 4332.82	60	40	I 6077.36	300 n	2
I 3776.16	50	2	I 4341.01	60	30	I 6081.44	100	10
I 3778.68	60	4	I 4342.83	50	30	I 6090.22	60	15
I 3794.96	50 m	50 n	I 4379.24	200 r	200 r	I 6199.19	100	8
I 3799.91	60	50	I 4384.72	125 r	125 r	I 6213.87	50	3
I 3803.47	50	40	I 4389.97	80 r	60 r	I 6216.37	60	10
I 3807.50	80	50	I 4395.23	60 r	40 r	I 6224.50	50	5
I 3808.52	50	30	I 4400.57	60	40	I 6230.74	70	10
I 3809.60	70	40	I 4488.89	60 n	30 n	I 6251.82	70	8
I 3813.49	50	..	4564.59	..	150	I 6274.65	50	8
3815.39	1	150 n	4600.15	1	60 n	I 6285.16	50	10
I 3819.96	60	35	I 4670.49	60 r	40 r	I 6292.83	50	10
I 3821.49	50	30	I 5002.33	90	90	I 7338.92	50	..
I 3822.01	70	40	I 5014.62	125	125	I 8027.39	80 w	..
I 3835.56	50	12	5064.12	50	50	I 8093.45	80	..
I 3839.00	60	10	I 5128.43	75	75 n	I 8116.80	150	..
I 3843.51	50	15	I 5138.42	50	50 n	I 8161.07	150 w	..
I 3844.44	100	50 n	I 5139.53	50	50	I 8171.35	50	..
I 3847.33	100	70 n	I 5148.72	60	60	I 8186.71	80	..
I 3849.32	60	25	5176.77	60	50	I 8187.38	50	..
I 3851.17	50	15	I 5192.99	100	75 n	I 8198.87	60	..
I 3855.37	50 r	50 r	I 5240.87	50	50	I 8203.07	100	..
I 3855.84	200	200	I 5353.41	50	50	I 8241.61	60	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

VANADIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 8253.51	80	..	I 8919.80	100 w	..	I 9366.92	50	..
I 8255.88	70	..	I 8932.93	50 w	..	I 9435.58	80	..
I 8282.37	80	..	I 9046.71	50	..	I 9611.60	80	..
I 8342.03	50	..	I 9341.20	100	..	I 9614.68	50	..

XENON

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
2475.89	..	50	I 4524.88	..	400	II 4991.17	..	50 wnl
II 2864.73	..	100	II 4532.49	..	100	II 5012.83	..	50 n
II 2895.22	..	80 n	II 4540.89	..	200 nl	I 5028.28	..	200
II 2979.32	..	200	II 4545.23	..	200 wnl	II 5044.92	..	100
3017.43	..	50 n	II 4555.94	..	100 wnl	II 5080.62	..	500
II 3121.87	..	150	II 4577.06	..	100 wn	II 5122.42	..	150
II 3366.72	..	150 n	I 4582.75	..	300	II 5125.70	..	50
II 3461.26	..	50 n	II 4585.48	..	200 wnl	II 5178.82	..	50
II 3907.91	..	50 nl	II 4592.05	..	150 wnl	II 5188.11	..	100
I 3948.16	..	60	II 4603.03	..	300 n	II 5191.37	..	200
I 3950.92	..	125	II 4611.89	..	700	II 5192.10	..	50
I 3967.54	..	200	II 4615.06	..	50 nl	5247.75	..	50
II 4037.29	..	50	II 4615.50	..	100	II 5260.44	..	300
II 4037.59	..	100	II 4617.50	..	50	II 5261.95	..	200
II 4057.46	..	100 wnl	I 4624.28	..	1000	II 5268.31	..	50
I 4078.82	..	100	II 4651.94	..	100	II 5292.22	..	800
II 4089.89	..	50 n	II 4668.49	..	50	II 5309.27	..	150
I 4109.71	..	60	I 4671.23	..	2000	II 5313.87	..	500
I 4116.11	..	80	II 4672.20	..	50 nl	II 5339.38	..	500
II 4158.04	..	100 wnl	4676.46	..	100 wnl	II 5363.27	..	80
II 4180.10	..	500 n	I 4690.97	..	100	II 5368.07	..	100
4193.15	..	200 n	I 4697.02	..	300	II 5372.39	..	200
I 4193.53	..	150	II 4698.01	..	150 nl	I 5392.79	..	100
I 4203.69	..	50	II 4715.18	..	80	II 5419.15	..	1000
II 4208.48	..	200 n	II 4731.19	..	50 nl	II 5438.96	..	400
II 4209.47	..	100 n	I 4734.15	..	600	II 5445.52	..	80
II 4213.72	..	200 n	II 4769.05	..	100	II 5450.45	..	100
II 4215.60	..	100	II 4773.19	..	50	II 5460.39	..	200
II 4223.00	..	200 n	II 4779.18	..	50	II 5472.61	..	500
II 4238.25	..	200 n	II 4787.77	..	50	II 5531.07	..	300
II 4245.38	..	200 n	I 4792.62	..	150	I 5552.38	..	80
II 4251.57	..	50 wnl	I 4807.02	..	500	I 5566.61	..	100
II 4296.40	..	200 n	II 4818.02	..	100	5572.19	..	50
II 4310.51	..	200 n	II 4823.41	..	150 n	I 5581.78	..	50
II 4330.52	..	500 wnl	I 4829.71	..	400	II 5591.61	..	50 wn
4369.20	..	100 wn	I 4843.29	..	300	II 5616.67	..	150
II 4373.78	..	50 wnl	II 4844.33	..	1000	I 5618.88	..	80
I 4383.91	..	100	II 4862.54	..	400 nl	II 5659.38	..	150
I 4385.77	..	70	II 4876.50	..	200 nl	II 5667.56	..	300
II 4393.20	..	200 wn	II 4883.53	..	300 n	I 5695.75	..	100
4395.77	..	200 wnl	II 4884.15	..	50 wn	I 5696.48	..	80
II 4406.88	..	100 wnl	II 4887.30	..	150 n	II 5699.61	..	100
II 4414.84	..	150	II 4890.09	..	150 n	I 5715.72	..	70
II 4416.07	..	80 wnl	I 4916.51	..	500	II 5716.19	..	50 wn
4448.13	..	200 wn	II 4919.66	..	125	I 5716.25	..	80
4462.19	..	500 wnl	II 4921.48	..	500	II 5719.61	..	100
II 4480.86	..	200 wnl	I 4923.15	..	500	II 5726.91	..	200
I 4500.98	..	500	4971.71	..	100 wnl	II 5751.03	..	200
II 4521.86	..	50 nl	II 4972.71	..	200 n	II 5758.65	..	150
II 4524.21	..	100	II 4988.77	..	150 n	II 5776.39	..	150

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

XENON (Continued)

Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube	Wave length	Arc	Discharge tube
I 5814.50	..	60	I 6554.20	..	50 nl	I 7881.32	..	100
II 5815.96	..	50	6595.01	..	400	I 7887.39	..	300
I 5823.89	..	300	I 6595.56	..	100	7942.54	..	50
I 5824.80	..	150	II 6597.25	..	200	I 7967.34	..	500
II 5835.5	..	50 wn	II 6598.84	..	50	7981.1	..	50 nw
I 5875.02	..	100	II 6620.02	..	100	7992.34	..	50 wn
II 5893.29	..	150	I 6632.46	..	50	8008.45	..	150 n
I 5894.99	..	100	I 6666.96	..	60	I 8029.67	..	100
II 5905.13	..	100	I 6668.92	..	150	8031.64	..	50 n
II 5917.44	..	50	II 6694.32	..	200	8038.26	..	50 n
I 5931.24	..	80	II 6702.25	..	50	I 8057.26	..	200
I 5934.17	..	100	I 6728.01	..	200	I 8061.34	..	150
II 5945.53	..	200	I 6777.57	..	50	I 8101.98	..	100
II 5958.03	..	50	II 6788.71	..	80	8151.80	..	60
II 5971.13	..	150	II 6790.37	..	50	I 8171.02	..	100
II 5976.46	..	800	II 6805.74	..	400	I 8206.34	..	700
II 6008.92	..	100	I 6827.31	..	200	I 8231.63	..	5000
II 6036.20	..	500	I 6846.61	..	60	I 8266.52	..	500
II 6051.15	..	700	I 6848.82	..	50	I 8280.12	..	5000
II 6093.56	..	150	I 6866.84	..	50	8297.55	..	50 n
II 6097.59	..	600	I 6872.11	..	700	I 8346.82	..	2000
II 6101.43	..	200	I 6882.15	..	300	II 8347.24	..	50
II 6115.08	..	50	II 6910.22	..	50	I 8347.45	..	60
II 6146.45	..	50	I 6925.53	..	100	I 8409.19	..	2000
I 6163.66	..	90	I 6935.62	..	50	I 8576.01	..	200
I 6163.93	..	80	6942.11	..	400 wn	I 8624.24	..	80
I 6178.30	..	150	I 6976.18	..	100	I 8648.54	..	200
I 6179.66	..	125	II 6990.88	..	700	I 8692.20	..	100
I 6182.42	..	300	II 7082.15	..	100	I 8696.86	..	200
II 6194.07	..	250	I 7119.60	..	500	I 8737.37	..	300
I 6198.26	..	100	7147.50	..	50 wns	I 8758.20	..	100
I 6200.89	..	60	II 7149.03	..	150	I 8819.41	..	5000
6206.16	..	100	II 7164.83	..	300	I 8862.32	..	300
I 6261.21	..	50	I 7257.94	..	60	I 8908.73	..	200
II 6270.82	..	250	II 7284.34	..	50	I 8930.83	..	200
II 6277.54	..	200	I 7285.30	..	60	I 8952.25	..	1000
II 6284.41	..	50	II 7301.80	..	100	I 8952.78	..	50
I 6286.01	..	100	I 7316.27	..	70	I 8981.05	..	100
I 6292.65	..	50	I 7321.45	..	80	I 8987.57	..	200
II 6300.86	..	125	I 7336.48	..	50	I 9032.18	..	50
I 6318.06	..	500	II 7339.30	..	150	I 9045.45	..	400
II 6343.96	..	200	I 7386.00	..	100	I 9096.13	..	50
II 6356.35	..	300	I 7393.79	..	150	I 9162.65	..	500
II 6375.28	..	80	II 7548.45	..	150	I 9167.52	..	100
II 6397.99	..	50	I 7584.68	..	200	I 9374.76	..	100
I 6469.70	..	300	II 7618.57	..	50	I 9412.01	..	60
I 6472.84	..	150	I 7642.02	..	500	I 9445.34	..	80
I 6487.76	..	125	I 7643.91	..	100	I 9513.38	..	200
I 6498.72	..	100	II 7670.66	..	100	I 9685.32	..	150
I 6504.18	..	200 n	I 7783.66	..	50	I 9718.16	..	100
II 6512.83	..	150	II 7787.04	..	50	I 9799.70	..	2000
II 6528.65	..	100	I 7802.65	..	100	I 9923.20	..	2000
I 6533.16	..	100						

YTTERBIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2098.40	..	50 n	2126.72	40	200	2185.69	60	100
2102.72	20	200	2154.16	..	80 n	2224.45	20	40
2109.60	..	100 n	2155.51	..	40	2257.01	4	40
2116.65	50	250	2161.60	100	250	2265.65	3	50

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

YTTERBIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2282.99	5	50	3426.04	40	15	5211.60	40	2
2305.33	8	100	3428.46	25	80	5240.50	10	40
2314.48	4	50	3431.12	40	15	5244.11	50	5
2337.95	2	40	3438.72	4	80	5257.49	15	100
2512.06	10	50	3438.84	20	100	5277.07	200	6
2552.15	10	40	3446.88	10	50	5279.55	15	100
2555.31	..	50 n	3454.07	40	250	5300.94	6	60
2567.63	5	150	3458.28	12	100	5307.12	40	..
2579.58	5	200	3464.37	200 r	50 r	5335.16	150	400
2581.12	20	100	3476.30	80	10	5345.67	20	100
2599.15	2	50	3478.84	40	300	5345.83	10	50
2621.12	2	100	3485.76	20	40	5347.20	40	200
2638.09	1	60	3507.83	12	60	5351.32	50	3
2642.55	3	80	3520.29	10	70	5352.96	100	250
2644.32	5	40	3560.33	20	50	5358.64	15	100
2651.71	2	60	3560.73	8	100	5426.91	2	60
2652.23	2	60	3606.47	15	60	5432.73	5	100
2653.75	50	200	3611.31	12	50	5449.29	20	100
2665.03	10	60	3619.81	30	100	5478.52	10	50
2666.08	5	150	3669.71	50	80	5481.94	50	2
2666.97	5	150	3675.09	50	200	5505.50	40	2
2672.65	20	80	3690.58	10	50	5539.06	200	5
2677.37	..	40	3694.20	500 r	1000 r	5556.48	1500	50
2750.48	20	150	3722.29	7	60	5588.47	30	100
2776.27	6	40	3724.21	15	50	5651.99	50	80
2803.48	..	40	3847.86	40 w	..	5720.01	300	8
2818.75	..	80	3887.31	6	40	5730.02	4	60
2830.98	2	40	3900.86	50	10	5771.67	30	50
2851.12	10	50	3904.83	12	150	5819.43	7	100
2867.04	4	40	3987.99	1000 r	500 r	5834.01	60 n	1
2891.38	50 n	100	3990.89	60	20	5837.16	50	150
2906.34	..	40	4077.27	30	100	5897.22	7	100 n
2911.52	5	40	4089.68	50	7	5898.80	3	50 n
2914.21	10	60	4135.10	15	50	5935.06	3	40
2915.27	10	40	4180.83	10	100	5946.02	4	100
2919.35	15	90	4218.57	3	50	5991.50	50	150
2945.90	10	60	4316.97	20	40	6007.42	4	80 n
2970.56	150	150	4370.81	15	40	6152.57	60	80
2983.98	10	70	4439.21	45	10	6246.97	40	60
2994.80	10	80	4515.15	45	100	6260.80	4	50
3002.61	15	150	4553.56	20	60	6274.79	100	150
3005.76	10	100	4576.20	90	10	6355.40	2	50 n
3017.56	3	40	4582.36	80	6	6400.40	200 n	4 n
3029.55	1	40 n	4590.83	40	..	6417.97	125	3
3031.11	100 n	30	4598.37	25	70	6432.73	30	40
3042.65	5	50	4726.07	45	200	6463.15	10	100
3107.90	10	60	4781.88	50	5	6474.74	5	50
3201.16	4	40	4786.60	50	200	6489.10	800	40
3275.81	12	100	4820.24	15	60	6492.74	3	50
3289.37	500 r	1000 r	4836.95	18	100	6643.54	50	..
3289.85	1000	..	4935.50	200	10	6667.85	1000	20
3304.56	15	40	4937.23	6	80	6727.62	30	60
3304.76	12	40	5009.52	20	50	6768.70	80	2
3305.73	30	125	5074.34	200	5	6799.61	1000	50
3333.07	20	60	5076.76	50	1	7350.09	40	..
3343.06	6	40	5104.43	1	50	7527.56	80	..
3375.48	30	100	5135.98	6	50	7699.49	2000	..
3391.10	10	40	5147.03	3	50	9760.37	100	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

YTTRIUM

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
2243.06	25	35 w	3800.03	25	5	II 5087.42	50	100
II 2422.18	20	30	II 3818.34	30	50	II 5119.12	7	20
II 2460.62	10	30 n	II 3832.89	30	80	II 5123.21	10	30
I 2490.42	20	3	II 3878.29	15	15	II 5200.41	60	150
II 2734.97	5	15	II 3930.67	20	25	II 5205.72	50	80
II 2785.23	7	20	II 3950.36	60	100	I 5240.81	20	..
II 2785.59	5	18	3968.43	10	30	II 5402.78	30	50
II 2800.10	10	20	II 3982.59	60	100	I 5438.23	20	2
I, II 2813.65	7 d	20 n	I 4047.63	50	10	I 5466.47	150	20
II 2834.57	2	18	4076.35	30	8	II 5473.40	10	20
II 2840.96	7	18	I 4077.37	50	40	II 5480.75	10	15
II 2854.42	10	18	I 4083.71	50	10	II 5497.40	20	40
II 2856.29	8	15	I 4102.38	150	30	II 5509.90	30	40
II 2858.08	7	15	II 4124.91	7	18	II 5521.70	4	40
I 2886.46	15	6	I 4128.30	150	30	I 5527.54	100	15
2919.05	18	6	I 4142.84	100	25	II 5544.61	10	80
II 2930.14	8	20	I 4167.51	50	10	I 5577.42	15	2
2945.95	2	100	I 4174.13	100	8	I 5581.87	100	10
I 2948.40	20	5 n	II 4177.55	50	50	I 5630.12	80	..
II 2956.04	7	15 n	II 4204.70	15	15	I 5644.68	15	2
2980.54	8	30	I 4220.64	15	7	II 5662.92	20	400
II 3026.47	7	20	4226.73	5	15	I 5706.72	15	1
II 3036.59	10	40	II 4235.73	3	20	II 5728.88	3	25
II 3053.27	10 n	20 n	I 4235.94	60	30	bh 5730.1	15	..
II 3055.22	8	50	I 4251.20	25	8	bh 5746.9	20	..
II 3086.86	12	50	II 4279.3	3	15	bh 5764.2	20	..
II 3093.77	9 d	15 d	I 4302.29	30	8	bh 5800.0	15	..
II 3128.79	10	40	II 4309.63	50	50	bh 5818.6	15	..
II 3129.93	8	50	I 4348.79	100	..	bh 5939.1	100	..
II 3135.17	10	18	II 4358.73	60	50	bh 5956.4	80	..
II 3173.05	20	70	I 4366.03	20	..	bh 5973.0	600	..
II 3179.42	20	30	II 4374.93	150	150	bh 5987.6	300	..
II 3195.61	30	50	II 4398.01	150	100	bh 6003.6	200	..
II 3200.27	30	40	I 4422.59	60	60	bh 6019.9	150	..
II 3203.32	30	50	I 4505.95	50	50	bh 6030.6	100	..
II 3216.68	40	70	I 4527.23	40	50	bh 6053.8	50	..
II 3242.28	60	100	I 4527.79	25	40	bh 6072.8	15	..
3289.85	15	10	I 4643.69	50	100	bh 6089.4	30	..
II 3308.47	10	20	bh 4650.2	15	..	bh 6096.8	30	..
II 3327.87	60	60	I 4658.32	8	15	bh 6107.8	15	..
II 3330.88	4	30	I 4674.85	80	100	bh 6114.7	20	..
II 3362.00	12	25	II 4682.32	60	100	bh 6132.1	200	..
3372.77	15	3	I 4728.53	60	4	bh 6148.4	100	..
II 3448.81	18	18	I 4760.97	50	25	bh 6165.1	80	..
II 3496.08	20	35	II 4786.58	15	25	bh 6182.2	60	..
II 3549.01	12	50	I 4786.88	15	15	bh 6199.8	50	..
I 3571.43	15	2	bh 4817.4	20	..	bh 6218.0	40	..
I 3576.05	15	2	bh 4818.2	30	..	bh 6236.7	30	..
II 3584.51	20	15	II 4823.31	15	10	bh 6275.0	15	..
3587.75	15	2	4829.35	3	15 n	I 6435.00	150	50
I 3592.91	80	25	I 4839.87	20	25	bh 6501.2	15	..
II 3600.73	100	300	I 4845.67	30	30	bh 6518.3	15	..
II 3601.92	18	60	I 4852.69	30	15	I 6538.60	50	10
II 3611.05	40	60	II 4854.87	100	150	II 6613.74	15	12
II 3628.71	40	50	I 4859.85	50	5	I 6650.62	15	4
II 3633.12	50	100	II 4883.69	20	300	I 6687.60	50	10
II 3664.61	100	100	II 4900.12	20	300	6699.26	18	4
II 3668.49	7	20	I 4906.11	6	20	I 6713.19	15	4
II 3696.62	6	20 n	I 4908.99	4	15	I 6793.70	70	15
II 3710.29	80	150	I 4921.89	10	30	II 6795.40	12	20
II 3747.55	12	15	4950.66	3	15	I 6845.24	15	5
II 3774.33	12	100	II 4982.14	8	50	II 6896.01	5	15
II 3788.70	30	30	bh 5025.3	20	..	I 6950.27	20	10

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

YTTRIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 6979.85	15	6	I 7346.46	40	4	I 9231.58	80	..
I 7191.65	20	5	II 7450.30	15	10	I 9494.81	60	..
II 7264.18	15	20	II 7881.90	25	10			

ZINC

2012.62	..	(250)	I 2600.94	10 wn	..	3639.53	20	(5)
II 2024.66	..	(25)	I 2608.56	200	50	II 3683.47	20	(15)
II 2025.51	200	200	I 2608.64	300	100	3739.99	20	..
II 2040.00	..	(250)	II 2614.30	..	(10)	II 3793.91	10	..
II 2057.51	..	(20)	I 2670.53	200	4	II 3806.37	3	15
II 2061.91	100	100	2682.84	..	10	II 3840.34	3	(50)
II 2063.61	2	20	I 2684.16	300	6	II 3842.26	..	(15)
2077.14	..	(10)	I 2712.49	300	8	I 3883.34	50	2 n
II 2085.53	..	(20)	II 2738.43	..	(10)	I 3965.43	15	..
2136.46	..	(10)	I 2751.39	10 n	..	II 3989.23	..	(100)
I 2138.56	800 r	500	I 2756.45	200	100	II 4057.71	80	..
II 2148.15	..	(50)	2758.86	..	(10)	I 4113.21	10	..
II 2210.87	..	50	I 2770.86	300	25	I 4292.88	25	25
II 2253.06	..	(10)	I 2770.98	300	150	I 4298.33	25	25
II 2265.51	..	(10)	I 2781.23	25	5 n	4300.81	..	(25)
II 2266.00	..	(250)	II 2782.83	..	(20)	I 4629.81	35	..
2312.72	10	..	I 2800.87	400	300	I 4680.14	300 w	200 n
II 2390.78	..	25	I 2801.06	100	20	I 4722.16	400 w	300 n
2393.81	15 n	..	II 2801.79	..	(25)	I 4810.53	400 w	300 n
II 2428.86	..	(10)	II 2804.69	..	(10)	II 4911.66	15	(25)
II 2435.52	..	10	2826.13	3	(10)	II 4924.04	15	(30)
2439.42	..	(25)	2832.95	..	(25)	I 5069.58	15	..
I 2449.72	10	..	II 2882.15	..	(25)	I 5181.99	200	2
I 2463.47	20	2	II 2902.26	..	(50)	II 5585.21	12	(1)
I 2469.38	12 r	..	I 3018.35	125	40	I 5777.11	10	15
I 2479.74	30	..	I 3035.78	200	100	II 5894.35	3	(30)
I 2491.48	100	50	I 3072.06	200	125	II 6021.26	3	(15)
I 2493.32	25	..	I 3075.90	150	50	II 6102.54	6	(20)
II 2502.00	20	400 w	II 3172.18	..	(12)	II 6111.56	8	(10)
I 2515.81	150 w	20	II 3196.29	..	(15)	II 6214.59	3	(12)
I 2530.09	10 l	..	I 3282.33	500 r	300	I 6362.35	1000 Wn	500
I 2542.32	40 n	..	II 3299.39	..	(15)	I 6479.15	10	..
II 2557.96	10	300	I 3302.59	800	300	II 6482.98	4	(15)
I 2562.61	10 n	..	3302.94	700 r	300 r	II 6483.27	..	(30)
II 2564.45	..	(25)	II 3305.96	..	(20)	I 6928.32	15	..
II 2568.08	50 n	10	I 3345.02	800	300	II 7478.79	..	(50)
I 2569.87	100 n	5	I 3345.57	500	100	II 7588.48	..	(50)
II 2570.72	..	10 r	I 3345.93	150	50	II 7612.90	..	(20)
2575.60	..	(10)	II 3381.04	..	(20)	II 7732.50	..	(50)
I 2582.44	100	..	3624.07	10	3	II 7757.86	..	(30)
I 2582.49	300	40	3631.93	15	(1)	I 7799.36	10	..

ZIRCONIUM

I 2248.05	40	..	II 2542.10	100	50	II 2726.49	50	50
2285.23	100	..	II 2550.74	100	50	II 2732.72	40	30
II 2291.11	80	15	II 2567.64	100	100	II 2734.85	40	40
II 2294.04	50	10	II 2568.87	100	200	II 2752.21	40	40
II 2295.48	40	8	II 2571.39	300 r	400 r	I 2798.27	100	..
2303.14	100	..	II 2678.63	80	100	I 2814.90	70	1
2331.57	..	100 w	II 2700.13	50	50	I 2837.23	100	..
II 2449.85	50	20	II 2711.51	40	20	II 2844.58	50	50
I 2539.65	50	..	II 2722.61	50	50	I 2848.52	100	..

II. EMISSION SPECTRA 2000-10,000 Å (Continued)

ZIRCONIUM (Continued)

Wave length	Arc	Spark	Wave length	Arc	Spark	Wave length	Arc	Spark
I 2875.98	70	1	II 3843.02	40	40	I 4688.45	50	..
I 2985.39	50	3	I 3864.33	50	20	I 4710.07	60	..
I 3011.75	100	4	I 3890.32	150	6	bh 4736.9	60	..
II 3020.47	50	30	I 3891.38	100	5	I 4739.48	100	..
I 3029.51	60	5	I 3900.52	100	..	I 4772.31	100	..
II 3236.58	20	40	II 3914.34	70	8	I 4784.92	40	..
I 3254.28	40	40	I 3921.79	100	4	I 4815.63	40	..
II 3273.05	50	80	I, II 3929.53	100	6	bh 5437.0	40	..
II 3279.26	50	50	II 3958.22	500	150	bh 5456.5	40	..
II 3306.28	80	80	3961.59	500	8	bh 5551.7	60	..
II 3326.80	100	100	I 3968.26	100	4	bh 5553.1	60	..
II 3356.09	50	40	I 3975.29	50	1	bh 5610.1	60	..
II 3357.26	50	40	II 3991.13	100	60	bh 5629.0	80	..
II 3387.87	100	100	I 4027.20	100	4	bh 5629.5	100	..
II 3388.30	50	40	I 4028.95	40	1	bh 5658.1	50	..
II 3391.97	300	400	II 4029.68	40	15	I 5664.51	50	..
II 3399.35	100	40	I 4035.89	40	2	I 5680.90	50	..
II 3404.83	40	35	I 4055.03	100	5	bh 5718.1	150	..
II 3410.25	50	50	I 4064.15	100	6	bh 5724.1	70	..
II 3430.53	50	50	I 4072.70	100	3	bh 5748.1	100	..
II 3438.23	250	200	I 4081.21	150	7	bh 5778.5	60	..
I 3447.36	150 w	3	II 4149.20	100	100	I 5797.74	50	..
II 3463.02	18	40	II 4161.21	40	30	bh 5860.1	80	..
II 3479.39	60	80	I 4166.36	50	4	I 5879.80	60	..
II 3481.15	50	80	I 4183.32	40	1	bh 5908.5	60	..
II 3496.21	100	100	I 4201.46	50	3	I 6121.91	60	..
II 3505.67	40	30	I 4213.86	40	3	I 6124.84	40	..
I 3509.32	40	5	I 4227.76	150	8	I 127.44	500	..
I 3519.60	100	10	I 4239.31	100	5	I 6134.55	300	..
I 3547.68	200	12	I 4240.34	100	1	I 6140.46	40	..
II 3551.95	30	40	I 4241.20	100	2	I 6143.20	300	..
II 3556.60	15	50	I 4241.69	100	2	I 6299.66	50	..
II 3572.47	60	80	I 4256.04	60	..	I 6313.02	200	..
I 3575.79	100	5	I 4268.02	40	1	I 6470.21	40	..
I 3601.19	400	15	I 4290.21	40	20	I 6489.64	50	..
II 3611.89	15	40	I 4294.79	40	1	I 6762.38	50	..
II 3613.10	40	40	I 4302.89	100	1	I 6769.16	50	..
II 3614.77	40	80	I 4341.13	50	4	I 6953.84	80	..
I 3623.86	40	7	I 4347.89	40	5	I 6966.44	40	..
II 3636.45	200	30	II 4457.43	40	7	I 6990.84	50	..
I 3663.65	100	10	bh 4471.5	40	..	I 7097.70	100	..
II 3671.27	40	30	I 4575.51	50	..	I 7102.91	80	..
II 3674.72	100	40	bh 4619.8	80	..	I 7103.72	50	..
II 3698.17	50	80	bh 4637.8	100	..	I 7111.68	40	..
II 3709.26	50	30	bh 4640.6	150	..	I 7169.09	150	..
II 3751.59	25	40	bh 4644.7	40	..	I 8070.08	100	..
I 3780.54	40	15	I 4687.80	125	..	I 8132.99	80	..
3825.27	40	60						

Infrared above 10,000 Angstroms

Intensities are shown by the numbers 1 to 10 except where otherwise indicated.
Characteristics of lines are indicated by symbols as follows: 2, 3, 4, etc. unresolved line of 2, 3, or 4 components.

I, II, III, etc. classes of spectra emitted by the neutral, ionized, or doubly ionized atom respectively.

- b widened, not sharp
- c complex, hyperfine structure
- d double
- h hazy
- H very hazy
- l shaded or displaced to longer wave lengths
- r narrow, self reversed
- v violet, shaded or displaced to shorter wave lengths
- w wide, hyperfine structure
- W very wide, hyperfine structure

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III. EMISSION SPECTRA ABOVE 10,000 Å (Continued)

BARIUM (Cont.)		CALCIUM		CHROMIUM (12) (Cont.)	
Wave length	Arc	Wave length	Arc	Wave length	Arc
26221.	2	I 10345.	10	King's Intensity Scale	
27751.	3	I 12822.	5 (')	10647.66	12
I 29224.	5	I 13038.	3	10667.53	15
29791.	4	I 16145.	2	10672.17	18
30469.	2	I 16162.	2	10801.37	12
I 30687.	2	I 16200.	3	10816.91	8
I 30934.	3	16433.	1	10821.62	12
BERYLLIUM		I 19311.	4	10905.83	25
10283.	5	I 19453.	5	10929.90	10
10674.	4	I 19507.	3	10957.19	12
12141.	7	I 19777.	6	11015.63	30
12329.	4	19817.	1	11157.03	25
12355.	6	I 19857.	4	11310.69	12
13227.	6	I 19865.	4	11331.88	10
14904.	3	I 19918.	1	11339.16	15
15006. }	3	I 19936.	3	11390.63	15
15013. }	3	I 19947.	1	11397.96	12
15393. }	6	I 22610.	1	11472.93	10
15400. }	6	I 22625.	3	11484.50	15
15951.	2	I 22656.	4	11610.48	15
16794.	2	CARBON (17)		1-10 Intensity Scale.	
17571.	2	King's Intensity Scale		13462.	2
21560.	3	Wave length	Intensity	15680.	3
21897.	2 (2)	10683.18	25	15861.	3
22239.	2	10685.44	10	18479.	3
23097. }	6	10691.36	50	18584.	3
23110. }	6	10707.44	8	18654.	3
BISMUTH		10729.59	8	18717.	2
10106.	2	CESIUM		25460.	2
10302.	2	Wave length		25490.	1
10540.	1	Arc		25560.	1
11073.	1	I 10026.	10	25584.	2
11556.	1	I 10124.	10	25665.	1
11711.	10	I 13589.	8	25709.	1
11995.	1	I 13605.	..	25785.	1
12167.	4	I 14695.	10	25816.	1
12691.	3	I 29317.	8	25850.	2
14332.	3	I 30103.	6	25902.	1
25554.	1	I 30963.	4	26232.	2
CADMIUM		I 34893.	7	COBALT	
I 10394.6	10	I 36128.	2	10020.7	..
I 11268.	4	I 39180.	1	10189.2	..
I 11630.	2	I 42202.	4	10206.1	..
I 13979.	10	I 68070.	2	10210.8	..
I 14327.	10	69310.	2	10213.3	..
I 14354.	8	71110.	1	10236.4	..
I 14473.	8	I 71930.	1	10272.9	..
I 14849.	2	74250.	1	10284.6	..
I 15154.	10	CHROMIUM (12)		10366.6	..
15258.	7	King's Intensity Scale		11275.5	..
I 15711.	7	10080.32	15	11293.5	..
I 16402.	2	10486.24	20	11340.8	..
I 16432.	6	10509.96	10	11453.4	..
I 16482.	6			11634.	2
I 39086.	..			11895.	1
				14062.	4
				14559.	2

III. EMISSION SPECTRA ABOVE 10,000 Å (Continued)

COBALT (Cont.)		HELIUM (4), (5) (Cont.) King's Intensity Scale		IRON (Cont.) King's Intensity Scale (13) (Cont.)	
Wave length	Arc	Wave length	Geissler tube	Wave length	Intensity
14611.	4				
14681.	2	11044.95	40	11607.57	12
14958.	3	11969.07	20	11689.98	8
15210.	2	I 20581.	20	11973.01	8
16133.	5	I 40540.	..		
16257.	5				
16388.	3				
16447.	2				
16574.	3				
17005.	5				
17080.	3				
18176.	3				
18274.	2				
19779.	3				
COLUMBIUM (9) King's Intensity Scale		HYDROGEN		KRYPTON (4), (7), (8) King's Intensity Scale	
10003.85	30 c				
10042.54	10 c				
10067.4	20 c,d?				
10181.33	10 c				
10203.44	8 c				
10419.54	10 c				
10563.7	10 c				
COPPER (11)		IRON		Wave length	Geissler tube
King's Intensity Scale		Wave length	Arc		
10146.78	50 b	10063.	2	10017.97	20 H _v
10172.00	20	10144.	3	10042.27	20 H _l
		11641.	3	10065.96	10
		11884.	5	10077.66	10
		11975.	8	10120.96	30
		12034.	3	10147.68	10
		13594.	5	10167.61	10 H
		13899.	5	10221.46	1000
		14237.	4	10296.93	80
		14288.	4	10360.37	100
		14402.	10	10361.15	100
		14513.	8	10374.44	10
		14558.	4	10389.28	8 h
		14711.	2	10428.40	10
		14828.	2	10592.97	30
		15054.	2	10593.01	100
		15213.	4	10608.43	20
		15296.	4	10626.70	8
		15396.	3	10699.33	20
		15625.	3	10874.84	20
		15771.	4	10874.92	100
		15815.	3	11187.13	40
		15821.	3	11257.74	80
		16166.	2	11259.16	50
		16317.	2	11457.52	80
		25987.	3	11792.47	10
		26229.	2	11819.43	100
				11997.15	10
				12204.54	10
HELIUM (4), (5) King's Intensity Scale		King's Intensity Scale (13)		LANTHANUM (1) King's Intensity Scale	
Wave length	Geissler tube	Wave length	Intensity	Wave length	Arc
10027.73	40			10005.73	50
10031.16	15			10141.20	10
10138.50	10			10154.74	40
10311.32	40			10184.60	20
10667.60	30			10274.85	10
10829.081	500			10281.34	10
10830.250	1500			10294.68	10 d
10830.341	2500			10349.08	40
10912.92	100			10357.70	20
10916.98	50				
11012.97	30				

III. EMISSION SPECTRA ABOVE 10,000 Å (Continued)

LANTHANUM (1) (Cont.) King's Intensity Scale		MANGANESE (Cont.) 1-10 Intensity Scale		NEON (4), (7) (Cont.) King's Intensity Scale	
Wave length	Arc	Wave length	Arc	Wave length	Geissler tube
10450.82	20	11378.	2	11160.29	10
10461.69	15	11614.	4	11177.59	300
10522.09	10	11782.	6	11390.53	110
10612.56	10	12307.?		11409.24	100
		I 12900.	8	11522.82	150
		12976.	4	11525.11	90
		I 13294.	5	11536.41	50
		I 13318.	3	11601.62	25
		13416.	8	11614.18	80
		13500.	10	11688.08	10
		I 13626.	10	11766.87	60
		13685.	8	11789.11	50
		I 13864.	10	11789.93	10
		I 13997.	10	11984.99	10
		14970.	3	12066.38	15
		15218.	8		
		15263.	10		
		15965.	10		
		17336.	8		
		17608.	2		
				NICKEL	
				Wave length	Arc
				10195.	5
				10301.	3
				10330.	3
				10378.	4
				10980.	5
				11198.	4
				11591.	3
				13553.	2
				13722.	5
				13829.	3
				13969.	2
				14102.	2
				14874	3
				16313.	2
				16363.	10
				16409.?	5
				16495.	2
				16868.	2
				16990.	6
				17986.	2
				18040.	2
				OXYGEN	
		Wave length	Geissler tube	I 11287.	4
				I 11294.	2
				I 11300.	2
				I 13163.	1
				POTASSIUM (2) King's Intensity Scale	
				10480.3	3 H
				10487.7	1 H
				11022.3	10 H, W
				11690.17	10
				11769.41	3
				11773.05	15 r
				MANGANESE (3) King's Intensity Scale	
10052.9	20 h				
10212.34	8 h				

III. EMISSION SPECTRA ABOVE 10,000 Å (Continued)

POTASSIUM (Cont.) 1-10 Intensity Scale		SILICON (16) King's Intensity Scale		STRONTIUM (2)	
Wave length	Arc	Wave length	Arc	Wave length	Arc
I 11028.0	10	10288.83	25	King's Intensity Scale	
I 11689.76	10	10371.23	50	10036.59	300
I 11771.73	10	10585.12	100	10327.29	1000
I 12434.3	10	10603.38	60	10914.83	200
I 12523.0	9	10627.81	20 b	1-10 Intensity Scale	
I 15165.8	10	10660.98	50	I 11242.	10
I 27065.6	2	10689.52	20 b	17137.	..
I 27215.0	1	10694.14	50 b	17170.	..
I 31395.	8	10727.21	75 b	17446.	..
I 31596.8	4	10749.40	60	I 20262.	10
I 36372.7	1	10786.86	50	20705.	..
I 36626.4	3	10827.09	100	20767.	..
I 37075.6	3	10844.02	25 b	I 26024.	6
I 37354.3	4	10869.54	125	26714.	..
I 37370.7	1	10885.16	10 b	26806.	..
I 40115.5	6	10979.27	35	I 26915.	6
I 62030.	2	11018.00	70	26947.	..
I 62360.	2	11187.74	20 b	I 27356.	6
I 64310.	1	11290.01	10 b	28516.	..
I 64610.	1	11984.20	20	28964.	..
I 74260.	1	11991.57	10	I 29225.	6
I 84520.	1	12031.49	25	I 30110.	5
I 85100.	1			30482.	..
RHENIUM (3) King's Intensity Scale		SILVER		I 30665.	..
10064.02	10 c, W	I 12551.		THALLIUM	
10128.78	15	I 16819.	3	I 10292.	6
10169.85	100 c, W	I 17415.	1	I 10492.	5
10175.68	20 w	I 18307.	1	I 10496.	8
10206.32	20	I 18382.	1	I 11482.	5
10332.57	10 c, W	39889.	5	I 11513.	10
10339.44	10 c, W	39951.	8	I 11594.	8
RUBIDIUM (2) King's Intensity Scale		SODIUM (2) King's Intensity Scale		11691.	1
10055.2	30 H, v	10745.9	4	I 12492.	2
10076.1	500 H, l	10748.7	2	12728.	2
10284.8	4 H, l	11381.62	6	I 12736.	10
10305.3	2 H, l	11403.96	10	I 13014.	10
1-10 Intensity Scale		1-10 Intensity Scale		I 14515.	10
I 10082.	10	Wave length		I 14593.	1
I 13237.	10	Arc		I 14598.	3
I 13444.	10	Spark		I 16123.	10
I 13667.	10	I 18459.5	10	I 16340.	10
I 14754.	10	I 40449.	8 r	20486.	1
I 15290.	10	I 74430.	1 r	21397.	1
I 38511.	3	I 90480.	..	I 21803.	3
I 39827.	3	I 90850.	..	27024.	1
I 39898.	6			I 27889.	4
I 46190.	1			I 33393.	1
I 46960.	8			I 35680.	1
I 52313.	2			I 35950.	2
I 64360.	2			I 38131.	5
I 65670.	2			I 39215.	2
72690.	2			I 39246.	2
I 74280.	3			39286.	6
				I 51058.	2
				I 55590.	1
				I 70230.	1
				I 71170.	1

III. EMISSION SPECTRA ABOVE 10,000 Å (Continued)

TIN		TITANIUM (14) (Cont.)		XENON (4), (6) (Cont.) King's Intensity Scale	
Wave length	Arc	Wave length	Intensity	Wave length	Geissler tube
10458.	1	11246.88	8	11162.67	10
10808.	1	11403.89	8	11175.5	1
10896.	4	VANADIUM (10) King's Intensity Scale		11214.89	5
11194.	7			11289.10	10
11279.	10	Wave length	Arc	11309.56	5
11457.	6			11415.04	15
11618.	6	11491.22		15	
11672.	2	11537.4		1	
11740.	9	Wave length	Arc	11614.08	25
11827.	4			11742.26	50
11853.	4	10203.45	10	11793.56	10
11934.	10	10848.0	20	11857.31	6
12983.	5	10993.4	15	11857.86	2
13022.	2	11107.7	10	11874.36	1
TITANIUM (14) King's Intensity Scale		XENON (4), (6) King's Intensity Scale		11912.10	2
				11951.1	1
Wave length	Intensity	Wave length	Geissler tube	11953.00	3
				12084.80	3
10120.90	10	10023.72	50	12235.24	5
10145.48	8	10060.96	10	12257.81	1
10396.85	25	10084.79	20	12623.40	5
10460.07	10	10107.34	80	ZINC	
10496.14	30	10125.47	20		
10553.02	8	10188.36	10	Wave length	Arc
10584.66	25	10251.07	20	I 10970.	4
10607.78	10	10484.83	8	I 10979.	4
10661.61	20	10515.15	10	I 11054.2	10
10677.04	10	10527.84	40	I 13053.2	10
10689.52	15	10549.76	20	I 13150.4	10
10726.33	18	10706.78	150	I 13197.5	10
10732.89	8	10758.86	100	I 13781.4	2
10774.92	12	10838.34	1000	I 13786.1	4
10896.10	8	10895.32	200	I 14038.5	10
11243.90	10	11085.25	250	I 15679.7	4
		11127.20	100	I 16485.7	4
		11130.81	8	I 16503.9	4
		11141.09	50	16504.0	4

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SPARK SPECTRUM OF AIR

INTERNATIONAL ÅNGSTRÖMS

Wave length	In-tensity	Ele-ment	Wave length	In-tensity	Ele-ment	Wave length	In-tensity	Ele-ment
2 287.9	1	N	3 727.34	4	O	4 145.90	3	N
2 318.5	1	O	3 729.3	1	O	4 153.5	3	
2 382.1	2	....	3 749.51	5	O	4 169.36	1	O
2 395.62	1	....	3 754.5	1	O	4 176.2	2	O
2 399.	1	....	3 759.8	1	O	4 185.5	4	O
2 404.9	2	....	3 770.9	1	N	4 189.8	6	O
2 406.9	1	....	3 804.0	1	N	4 199.3	0	O
2 433.6	1	O	3 830.7	1	N	4 206.7	2	N
2 445.5	1	O	3 839.1	2	N	4 211.1	1	N
2 507.2	2	....	3 842.8	1	N	4 223.3	1	N
2 514.5	1	....	3 845.1	0	N	4 228.	2	N
2 599.5	2	....	3 848.04	1	O	4 236.8	3	N
2 739.8	1	....	3 850.6	1	N	4 241.75	3	N
2 746.7	1	....	3 851.2	1	O	4 253.7	2	O
2 749.	1	....	3 856.7	1	O	4 266.4	2	
2 755.9	2	....	3 864.6	1	O	4 275.9	1	N
2 795.5	1	....	3 882.3	2	O	4 303.7	1	O
2 858.3	1	....	3 893.3	1	N	4 317.11	3	O
2 927.5	1	....	3 907.6	1	N	4 319.62	3	O
3 007.	1	O	3 909.1	1	N	4 325.7	1	O
3 047.0	1	....	3 912.1	3	O	4 327.5	1	O
3 059.15	2	....	3 919.10	6	N	4 328.5	1	O
3 130.1	1	....	3 933.6	9	?	4 331.04	1	O
3 135.3	1	O	3 940.2	1	N	4 331.9	1	O
3 139.3	2	O	3 945.1	1	O	4 336.8	2	O
3 158.7	1	....	3 947.45	1	O	4 345.54	3	O
3 265.2	1	O	3 954.4	1	N	4 347.44	2	O
3 288.9	1	....	3 955.9	4	N	4 348.0	2	O
3 301.9	1	....	3 968.4	1	A(?)	4 349.40	4	O
3 312.5	1	O	3 973.30	4	O	4 351.3	2	O
3 318.8	1	....	3 982.76	2	O	4 361.6	0	O
3 320.7	2	O	3 995.1	10	O	4 366.87	3	O
3 325.	1	O	4 014.0	1	N	4 369.2	1	O
3 329.5	2	N	4 025.7	1	N	4 371.4	1	N
3 331.8	2	N	4 034.9	2	N	4 379.6	1	N
3 344.8	1	....	4 041.3	3	N	4 392.4	0	N(?)
3 354.08	1	O	4 057.8	1	N	4 396.0	1	O
3 365.8	1	O	4 063.2	1	N	4 401.2	1	O
3 367.3	1	N	4 069.90	8	O	4 414.9	6	O
3 370.9	1	N	4 072.25	8	O	4 417.0	5	O
3 374.0	2	N	4 075.93	8	O	4 425.9	1	O
3 377.2	2	O	4 078.9	2	O	4 430.1	1	N
3 390.3	2	O	4 085.20	2	O	4 432.4	2	N
3 408.3	2	O	4 089.1	1	O	4 434.0	0	N
3 437.32	3	N	4 093.00	2	O	4 443.3	1	O
3 450.9	1	....	4 097.2	3	N	4 447.04	6	O
3 471.2	2	....	4 103.3	2	N	4 452.4	2	O
3 491.9	2	....	4 105.00	3	O	4 460.1	1	O
3 514.8	1	....	4 110.84	2	O	4 465.4	2	O
3 560.6	1	....	4 112.09	1	O	4 467.8	2	O
3 570.3	1	....	4 114.0	0	O	4 469.4	1	O
3 577.2	1	....	4 119.3	4	O	4 477.7	1	O
3 589.0	1	....	4 120.5	2	O	4 507.62	2	N
3 594.6	1	....	4 121.5	2	O	4 514.8	2	N
3 609.8	1	....	4 124.1	2	O	4 529.9	2	N
3 639.6	3	....	4 129.5	1	O	4 544.8	1	N
3 702.9	1	....	4 132.88	2	O	4 552.5	2	N
3 707.3	1	O	4 133.70	2	N	4 590.93	3	O
3 709.2	1	O	4 142.2	1	O	4 596.12	3	O
3 712.7	2	O	4 143.7	1	O	4 601.48	4	N

SPARK SPECTRUM OF AIR (Continued)

INTERNATIONAL ÅNGSTRÖMS

Wave length	In-tensity	Ele-ment	Wave length	In-tensity	Ele-ment	Wave length	In-tensity	Ele-ment
4 607.14	4	N	5 016.4	2	N	5 952.4	4	N
4 609.4	1	N	5 022.9	1	N	6 158.1	0	N
4 613.84	3	N	5 025.7	2	N	6 171.0	2	O
4 621.39	4	N	5 032.	0	N	6 284.3	1	O
4 630.53	10	N	5 045.1	2	N	6 341.5	0	O
4 634.0	1	N	5 061.8	0	N	6 358.1	0	N
4 638.8	2	O	5 073.5	0	N	6 370.7	0	N
4 640.5	1	O	5 136.	0	N	6 379.3	2	N
4 641.8	3	N	5 143.6	0	O	6 456.	0	N
4 643.1	4	O	5 150.	0	N	6 482.0	5	O
4 649.1	4	O	5 160.1	0	O	6 563.2	3	N
4 650.8	2	O	5 172.	1	N	6 610.4	6	H
4 654.5	1	O	5 173.4	1	N	6 640.7	0	N
4 661.6	5	O	5 175.9	2	N	6 654.8	2	N
4 674.9	1	O	5 179.4	1	N	6 721.2	1	N
4 676.2	3	O	5 183.2	0	O	6 811.9	0	N
4 697.6	0	N(?)	5 185.1	0	N	6 864.	0	N
4 699.2	3	O	5 190.6	1	N	6 887.6	1	N
4 703.1	0	O	5 206.5	1	N	6 950.	0	N
4 705.1	1	O	5 250.6	1	N(?)	6 965.9	1	A
4 705.4	3	O	5 263.	0	N	7 067.6	0	A
4 709.9	2	O	5 281.7	0	N	7 157.4	9	O(?)
4 718.4	2	O	5 320.5	1	N	7 384.5	1	A
4 735.7	1	N	5 325.1	0	O	7 424.0	8	N
4 751.2	1	O	5 328.6	0	N	7 432.9	0	N
4 764.6	1	N	5 338.7	1	N	7 442.7	10	N
4 774.2	1	N	5 341.2	1	N	7 458.7	0	N
4 779.8	2	N	5 351.2	0	N	7 468.7	10	N
4 781.2	0	N(?)	5 356.4	0	N	7 479.	0	O
4 788.2	4	N	5 411.5	1	N	7 505.8	0	A
4 793.7	2	N	5 432.1	0	N(?)	7 515.2	0	A
4 803.3	5	N	5 452.1	1	N	7 635.7	1	A
4 805.9	1	N	5 454.1	1	N	7 772.1	10	O
4 810.3	2	N	5 462.8	1	N	7 774.3	7	O
4 847.7	1	N(?)	5 478.1	0	N	7 775.6	6	O
4 856.8	1	O	5 480.1	1	N	7 947.8	4	O
4 860.3	1	O	5 495.7	2	N	7 951.1	3	O
4 871.6	0	O	5 526.2	2	N	7 952.3	2	O
4 879.7	1	O	5 530.2	3	N	8 185.3	4	N
4 890.9	0	O	5 535.2	5	N	8 188.4	4	N
4 895.3	1	O	5 543.4	3	N	8 200.7	1	N
4 906.8	1	O	5 552.0	2	N	8 211.1	2	N
4 924.6	2	O	5 566.	0	N	8 216.7	7	N
4 934.8	1	N	5 592.3	0	O	8 223.5	4	N
4 941.0	1	N	5 645.6	1	N	8 230.2	0	O
4 942.5	1	N	5 666.6	5	N	8 242.8	4	O
4 943.9	1	O	5 675.9	3	N	8 446.8	5	N
4 955.	1	O	5 679.5	10	N	8 594.	0	N
4 964.7	0	N	5 686.2	3	N	8 630.0	0	N
4 987.4	1	N	5 710.7	2	N	8 680.6	2	N
4 991.3	1	N	5 730.6	2	N	8 683.7	1	N
4 994.4	3	N	5 747.5	1	N	8 686.4	0	N
5 001.4	6	N	5 767.4	2	N	8 692.	0	N
5 005.2	6	N	5 927.8	4	N	8 703.8	0	N
5 007.4	3	N	5 931.8	7	N	8 712.0	0	N
5 010.6	2	N	5 940.5	1	N	8 719.2	0	N
5 013.9	0	....	5 941.6	10	N			

STANDARD WAVE LENGTHS

Primary Standard

Wave length of the red cadmium line in air, 760 mm. pressure 15°C., measures of Benoit, Fabry and Perot 1907.

6438.4696 Ångström units

Secondary Standards

Lines of the Iron Arc

Selected lines from list by Ch. Fabry: *International Critical Tables*, 1929.
Wave lengths in international Ångströms, atmospheric pressure, 15°C.

Wave-length	Wave-length	Wave-length	Wave-length	Wave-length
3370.789	3935.816	4592.655	5232.948	6065.489
3399.337	3977.744	4602.945	5266.564	6137.697
3485.343	4021.870	4647.437	5371.493	6191.563
3513.821	4076.638	4691.414	5405.779	6230.729
3556.882	4118.549	4707.282	5434.527	6265.141
3606.682	4134.680	4736.782	5455.613	6318.023
3640.392	4147.673	4789.654	5497.520	6335.338
3676.314	4191.436	4878.219	5506.783	6393.606
3677.630	4233.609	4903.318	5569.626	6430.852
3724.381	4282.406	4919.001	5586.763	6494.985
3753.615	4315.087	5001.872	5615.652	6546.245
3805.346	4375.933	5012.072	5658.825	6592.920
3843.261	4427.313	5049.825	5709.396	6677.994
3850.820	4466.556	5083.343	5763.013	6750.157
3865.527	4494.568	5110.414	5857.759 Ni	
3906.482	4531.152	5167.491	5892.882 Ni	
3907.937	4547.851	5192.353	6027.058	

Iron, Wave Lengths in the Ultraviolet Spectrum

The following table presents the results of interferometer measurements made by Meggers and Humphreys and reported in the Jour. Research of B. of S. 18, 543, 1937. The standard iron arc was used as a source and the wave lengths in air at 15°C. and 76 mm are given in international Ångströms.

$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$
2100.795	2163.368	2240.627	2287.632
2102.349	2163.860	2245.651	2291.122
2108.955	2164.547	2248.858	2292.5227
2110.233	2165.861	2249.177	2293.8454
2112.966	2172.581	2253.1251	2294.4059
2115.168	2173.212	2255.861	2296.9247
2130.962	2176.837	2259.511	2297.785
2132.015	2180.866	2260.079	2299.2180
2135.957	2183.979	2264.3894	2300.1397
2138.589	2186.890	2265.053	2301.6818
2139.695	2187.192	2270.8601	2303.4225
2141.715	2191.202	2271.781	2303.579
2145.188	2196.040	2272.0670	2308.9971
2147.787	2200.7227	2274.0085	2313.1022
2150.182	2201.117	2276.0247	2320.3561
2151.099	2207.068	2277.098	2327.3940
2153.004	2210.686	2279.922	2331.3067
2154.458	2211.234	2283.653	2332.7972
2157.792	2228.1704	2284.087	2338.0052
2161.577	2231.211	2287.2477	2344.2802

STANDARD WAVE LENGTHS (Continued)
Iron, Wave Lengths in the Ultraviolet Spectrum
(Continued)

$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$
2354.8888	2584.5349	2863.864	3191.6583
2359.1039	2585.8753	2869.3075	3196.9288
2359.997	2598.3689	2874.1722	3200.4741
2360.294	2611.8725	2877.3005	3205.3992
2362.019	2613.8240	2894.5050	3215.9398
2364.8269	2617.6160	2895.0352	3217.3796
2366.592	2621.6690	2899.4156	3222.0682
2368.595	2625.6663	2912.1581	3225.7883
2370.497	2628.2923	2920.6906	3236.2226
2371.4285	2635.8082	2929.0081	3239.4362
2374.517	2643.9972	2941.3430	3244.1887
2375.193	2647.5576	2953.9400	3254.3628
2379.2756	2651.7059	2957.3654	3257.5937
2380.7591	2662.0563	2959.9924	3271.0014
2384.386	2673.2127	2965.2551	3280.2613
2388.6270	2679.0608	2981.4448	3284.5892
2389.9713	2689.2117	2987.2919	3286.7538
2399.2396	2699.1060	2990.3923	3298.1328
2404.430	2706.5812	2999.5123	3305.971
2406.6593	2711.6548	3003.0311	3306.356
2410.5172	2714.413	3009.5698	3314.7421
2411.0663	2718.4352	3015.9129	3323.7374
2413.3087	2723.5770	3024.0330	3328.8669
2431.025	2727.540	3030.1491	3337.6655
2438.1811	2735.473	3037.3891	3340.5659
2442.5674	2739.5467	3040.4281	3347.9262
2443.8707	2746.4833	3047.6059	3355.2285
2447.7086	2746.9823	3055.2631	3370.7845
2453.4746	2749.325	3057.4452	3380.1111
2457.5956	2755.7366	3059.0874	3383.9808
2465.1479	2763.1078	3067.2433	3396.9772
2468.8782	2767.5208	3075.7204	3399.3343
2474.8131	2778.2205	3083.7419	3401.5196
2487.0643	2781.8347	3091.5777	3407.4608
2496.5324	2797.7751	3116.6329	3413.1335
2507.8987	2804.5200	3125.653	3427.1207
2519.6279	2806.9840	3134.1113	3443.8774
2530.6938	2813.2861	3143.9896	3445.1506
2542.1007	2823.2753	3157.0388	3465.8622
2551.0936	2832.4350	3160.6582	3476.7035
2562.5348	2838.1193	3175.4465	3485.3415
2575.7442	2845.5945	3178.0137	3490.5746
2576.1033	2851.7970	3184.8948	3497.8418

Iron, Wave Lengths in the Infrared

From interferometer measurements by Meggers, Jour. Research of B. of S. 14, 33, 1935. The integrated light from the iron arc was used as a source. Wave lengths in air at 15°C and 760 mm are given as well as the intensity.

$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity
7164.469	250	7418.674	5	7583.796	50
7187.341	800	7445.776	200	7586.044	150
7207.406	500	7495.088	400	7620.538	25
7389.425	80	7511.045	800	7661.223	30
7401.689	4	7531.171	60	7664.302	80
7411.178	100	7568.925	30	7710.390	25

STANDARD WAVE LENGTHS (Continued)

Iron, Wave Lengths in the Infrared (Continued)

$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity
7748.281	125	8387.781	1200	9089.413	30
7780.586	300	8439.603	20	9118.888	25
7832.224	400	8468.413	300	9147.800	2 <i>n</i>
7912.866	6	8514.075	150	9210.030	6
7937.166	700	8526.685	8	9258.30	10 <i>n</i>
7945.878	600	8582.267	15	9350.46	6
7994.473	20	8611.807	40	9359.420	3
7998.972	700	8621.612	10	9362.370	4
8028.341	50	8661.908	600	9372.900	6
8046.073	600	8674.751	60	9430.08	3
8080.668	10 <i>n</i>	8688.633	1500	9513.24	8 <i>n</i>
8085.200	500	8757.192	25	9569.960	15 <i>n</i>
8096.874	10	8764.000	20 <i>n</i>	9626.562	12 <i>n</i>
8198.951	80	8793.376	25 <i>n</i>	9653.143	15
8207.767	40	8804.624	.....	9738.624	100
8220.406	1500	8824.227	250	9753.129	10
8232.347	50	8838.433	30	9763.450	10
8239.130	8	8866.961	60	9763.913	12
8248.151	30	8945.204	10 <i>n</i>	9800.335	8 <i>n</i>
8293.527	20	8975.408	10	9861.793	12
8327.063	1200	8999.561	200	9889.082	15
8331.941	200	9012.098	10	10065.080	30
8339.431	80	9079.599	4	10145.601	40
8360.822	8	9088.326	50	10216.351	50
8365.642	25				

Helium

Merrill, Bulletin 14, Bureau of Standards 1917.

λ_{air}	λ_{air}	λ_{air}	λ_{air}
2945.104	3888.646	4387.928	5047.736
3187.743	3964.727	4471.479	5875.620
3613.641	4026.189	4713.143	6678.149
3705.003	4120.812	4921.928	7065.188
3819.606	4143.759	5015.675	7281.349

From Meggers and Humphreys, Jour. Research of B. of S. **13**, 293, 1934.

$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$
10829.081	10830.250	10830.341	.....

Neon

From Meggers and Humphreys, Jour. Research of B. of S. **13**, 293, 1934. The source was an "end on" Geissler tube. Values are given for the wave length in air at 15°C and 760 mm pressure, and referred to the primary standard (Cd 6438.4696 Å) and also to the red lines of neon. For complex lines the value for the principal component is given.

$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.	$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.	$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.
4334.125	4395.556	.....	4425.400	.....
4363.524	4422.519	.....	4433.721	.....
4381.220	4424.800	.....	4460.175	.....

STANDARD WAVE LENGTHS (Continued)

Neon (Continued)

$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.	$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.	$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.
4466.807	4957.0334	.....	5965.474	.....
4475.656	4957.122	.....	5974.628	.....
4483.190	4994.930	.....		5975.5343
4488.0928	5005.160	.....	5987.9069	.....
4500.182	5011.003	.....		6029.9968
4517.736	5022.870	.....		6074.3376
4525.764	5031.3484	.....		6096.1630
4537.751	5037.7505	.....	6128.4513	6128.4502
4540.376	5074.200	.....		6143.0627
4552.598	5080.383	.....		6163.5937
4565.888	5104.705	.....	6182.146	.....
4573.759	5113.675	.....		6217.2812
4575.060	5116.503	5116.501		6266.4952
4582.035	5122.257	.....		6304.7893
4582.450	5144.9376	.....		6334.4276
4609.910	5151.963	.....		6382.9914
4614.391	5154.422	.....	6402.247	6402.248
4617.837	5156.664	.....		6506.5277
4628.309	5188.612	.....		6532.8824
4636.125	5193.130	.....		6598.9528
4636.634	5193.224	.....		6678.2766
4645.416	5203.8950	.....		6717.0430
4649.904	5208.863	.....		6929.4679
4656.3923	5210.573	.....	7024.0508	.....
4661.104	5222.351	.....	7032.4134	7032.4125
4670.884	5234.028	.....	7059.109	7059.108
4678.218	5298.190	.....	7173.9389	7173.9390
4679.135	5304.756	.....	7245.1668	7245.1668
4687.671	5326.396	.....	7438.8990	7438.8988
4704.395	5330.7766	5330.778	7488.8722	7488.8717
4708.854	5341.091	5341.093	7535.7750	7535.774
4715.344	5343.284	.....	7544.046	.....
4725.145	5355.422	.....	7943.1802	7943.1802
4749.572	5360.012	.....	8082.4580	8082.4585
4752.7313	5374.975	.....	8118.5495	8118.549
4758.728	5400.5619	5400.5620	8136.4060	8136.4058
4780.338	5433.649	.....	8259.380	.....
4788.9258	5448.508	.....	8266.076	8266.077
4790.218	5562.769	.....	8300.3258	8300.3257
4800.111	5656.6585	.....	8377.6068	8377.6070
4810.0625	5662.547	.....	8418.4274	8418.4275
4817.636	5689.8164	5689.817	8495.3600	8495.3604
4821.924	5719.2254	5719.224	8591.2584	8591.2585
4827.338	5748.299	5748.298	8634.6480	8634.649
4827.587	5764.418	5764.4182	8654.3835	8654.383
4837.3118	5804.4488	5804.450	8679.491	.....
4852.655	5820.1548	5820.1553	8681.920	.....
4863.074	5852.4878	8780.6223	8780.6220
4865.505	5872.828	.....	8783.755	8783.755
4866.476	5881.8950	8853.867	8853.864
4884.915	5902.464	5902.4634	8865.759	.....
4892.090	5906.429	.....	9486.680	.....
4928.235	5913.633	.....	9535.167	.....
4939.041	5944.8340	9665.424	.....
4944.987

STANDARD WAVE LENGTHS (Continued)

Neon_I, Ultraviolet Lines

From Humphreys, Jour. Research of B. of S. **20**, 17, 1938. The source was an "end on" Geissler tube. Values are given for the wave length in dry air at 15°C and 760 mm of Hg pressure and referred to the Krypton secondary standards.

$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$
3369.8086	3450.7653	3501.2165	3609.1793
3369.9081	3454.1952	3510.7214	3633.6646
3375.6498	3460.5245	3515.1908	3682.2428
3417.9036	3464.3389	3520.4717	3685.7359
3418.0066	3466.5786	3593.5259	3701.2250
3423.9127	3472.5711	3593.6398	3754.2160
3447.7029	3498.0644	3600.1693	

Argon

From Meggers and Humphreys, Jour. Research of B. of S. **13**, 293, 1934.

$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.	$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.	$\lambda_{\text{air A}}$ Ne Std.	$\lambda_{\text{air A}}$ Cd Std.
3948.977	.....	4887.9465	.....	7030.262	.....
4044.4173	.....	5162.2845	.....	7067.2170	7067.2177
4054.5250	.....	5187.7458	.....	7147.0406	7147.0412
4158.5896	4158.5895	5221.270	.....	7272.9357	7272.9356
4164.1788	4164.1789	5252.786	.....	7372.117	.....
4181.8826	4181.8825	5421.346	.....	7383.9800	7383.9800
.....	4190.7098	5451.650	.....	7503.8676	7503.8667
.....	4191.0270	5495.8720	.....	7514.6510	7514.653
4198.316	4198.3160	5506.112	.....	7635.1053	7635.1055
4200.674	4200.6738	5558.702	.....	7723.7597	7723.761
4251.1842	.....	5572.548	.....	7724.2064	7724.206
4259.3603	4259.3607	5606.732	.....	7891.075	.....
4266.2853	4266.2855	5650.7034	.....	7948.1754	7948.1756
4272.1680	4272.1678	5739.517	.....	8006.1556	8006.155
4300.0995	4300.1000	5834.263	.....	8014.7856	8014.785
4333.5595	4333.5601	5860.315	.....	8053.307	.....
4335.3370	4335.3363	5888.592	.....	8103.6922	8103.6922
4345.1666	.....	5912.084	.....	8115.3115	8115.3095
4363.7936	.....	5928.805	.....	8264.5209	8264.5210
4423.9936	.....	6032.124	.....	8408.208	8408.207
4510.7322	4510.7324	6043.230	.....	8424.647	8424.646
4522.3216	.....	6052.721	.....	8521.4407	8521.4406
4589.2884	.....	6059.373	.....	8667.9430	8667.9435
4596.0964	.....	6105.645	.....	9122.9660	9122.9664
4628.4398	.....	6170.183	.....	9224.498	9224.498
4702.3151	.....	6173.106	.....	9354.218	.....
4752.9381	.....	6416.315	.....	9657.7841	.....
4768.6716	.....	6752.832	.....	9784.5010	.....
4876.2596	.....	6965.4302	6965.4304	10470.051	.....

STANDARD WAVE LENGTHS (Continued)

Argon_I

From Humphreys, Jour. Research of B. of S. **20**, 17, 1938. The source was an "end on" Geissler tube. Values are given for the wave length in dry air at 15°C and 760 mm of Hg pressure, referred to the Krypton secondary standards.

$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$
3319.3446	3690.8957	4158.5906	4272.1690
3373.481	3770.3688	4164.1800	4300.1011
3393.7517	3781.3609	4181.8838	4333.5612
3461.0780	3834.6785	4190.7127	4335.3380
3554.3061	3894.6602	4191.0296	4345.1682
3567.6565	3947.5043	4198.3170	4510.7333
3606.5224	3948.9788	4200.6751	4522.3238
3632.6837	4044.4182	4251.1852	4596.0970
3634.4605	4045.9658	4259.3618	4628.4410
3649.8324	4054.5254	4266.2867	4702.3164

Krypton

Meggers, Journal Optical Society of America, 1921.

$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$
4273.9696	4362.6422	4502.354	6456.290
4282.967	4376.122	4807.065	7587.414
4318.552	4399.969	5562.224	7601.544
4319.580	4453.9174	5570.2872	
4355.478	4463.690	5870.9137	

Krypton_I

From Humphreys, Jour. Research of B. of S. **20**, 17, 1938. The source was the "end on" Geissler tube. Values are given for the wave length in air at 15°C and 760 mm of Hg pressure.

$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$	$\lambda_{\text{air A}}$
3424.9433	3615.4755	3796.8839	4184.4726
3431.7217	3628.1570	3800.5437	4263.2881
3434.1423	3632.4896	3812.2155	4302.4455
3495.9900	3665.3259	3837.7028	4410.3685
3502.5537	3668.7363	3837.8162	4416.8838
3503.8981	3679.5609	3845.9778	4418.7626
3511.8963	3679.6111	3982.1699	4425.1908
3522.6747	3698.0452	3991.0797	4550.2985
3539.5416	3773.4241	3991.2581	4812.6367
3540.9538			

Titanium, Vacuum Arc Spectrum

From the measurements by Kiess, Jour. Research of B. of S. **1**, 75, 1928. Wave lengths in air at 15°C. 760 mm.

$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity
2941.995	60 r	3075.225	40	3130.804	15
2948.255	60 r	3078.645	45	3148.033	12
2956.133	70 R	3088.027	60	3161.755	20

STANDARD WAVE LENGTHS (Continued)

Titanium, Vacuum Arc Spectrum (Continued)

$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity
3168.519	30	3694.445	10	4282.702	12
3186.451	60 <i>r</i>	3717.393	20	4286.006	25
3190.801	20	3722.568	15	4287.405	22
3191.994	80 <i>R</i>	3724.570	20	4289.068	25
3199.915	100 <i>R</i>	3725.155	20	4294.101	8
3202.535	12	3729.806	50 <i>r</i>	4295.751	22
3214.240	12	3741.059	60 <i>r</i>	4298.664	40
3217.056	15	3752.860	80 <i>r</i>	4305.910	60
3222.843	15	3759.291	40	4307.900	12
3229.397	10	3761.320	40	4312.861	7
3234.517	60	3771.652	25	4314.801	25
3236.573	50	3786.043	20	4318.631	10 <i>n</i>
3239.037	40	3798.276	6	4321.655	8 <i>n</i>
3241.984	40	3866.446	15 <i>n</i>	4325.134	9 <i>n</i>
3261.596	25	3875.262	20 <i>n</i>	4337.916	10
3287.657	10	3895.243	30 <i>n</i>	4346.104	5
3292.078	20	3900.546	50	4360.487	4
3314.422	10	3904.785	40 <i>n</i>	4369.682	5 <i>n</i>
3318.024	8	3913.464	40	4372.383	3
3322.936	20	3914.334	35	4393.925	8
3326.762	5	3921.423	30	4395.031	25
3329.455	20	3924.527	50	4399.767	5
3332.111	8	3929.875	40	4417.274	15
3335.192	20	3947.770	40	4421.754	6
3340.344	15	3948.670	60	4422.823	10
3341.875	50 <i>r</i>	3956.336	60	4426.054	10
3349.399	40	3958.206	80	4427.098	40
3354.634	60 <i>r</i>	3962.851	35	4430.366	7
3358.271	10	3964.269	35	4434.003	15
3361.213	40	3981.761	70 <i>R</i>	4436.586	4
3370.436	40 <i>r</i>	3989.758	80 <i>R</i>	4440.345	10
3371.447	80 <i>R</i>	3998.635	100 <i>R</i>	4443.802	25
3377.577	30 <i>r</i>	4008.926	35	4449.143	30
3380.278	15	4013.587	12 <i>n</i>	4450.896	25
3383.761	40	4015.377	12 <i>n</i>	4453.312	30
3385.944	40 <i>r</i>	4017.771	15 <i>n</i>	4453.708	20
3387.834	15	4024.573	35	4455.321	30
3394.574	15	4026.539	25 <i>n</i>	4457.428	40
3444.306	15	4030.512	25 <i>n</i>	4465.807	20
3461.496	20	4035.828	10	4468.493	25
3477.181	15	4055.011	20	4471.238	20
3480.525	12	4058.139	7	4474.852	8
3491.053	8	4060.263	20	4481.261	30
3504.890	8	4065.094	15	4482.688	10
3510.840	10	4078.471	30	4489.089	20
3535.408	10	4082.456	20	4496.146	20
3547.020	15	4099.166	8	4501.270	25
3596.048	10	4112.708	20	4503.762	4 <i>n</i>
3598.714	15	4122.143	10	4512.734	40
3610.154	12	4127.531	15	4518.022	50
3624.826	8	4137.284	10 <i>n</i>	4522.798	40
3635.462	80 <i>r</i>	4150.963	10	4527.305	35
3641.330	10	4159.634	9	4533.238	80
3642.675	80 <i>r</i>	4163.644	8	4544.688	30
3646.198	12	4171.897	5	4548.764	35
3653.497	100 <i>r</i>	4186.119	25	4549.622	25
3654.592	15	4237.889	7	4552.453	35
3658.097	20	4249.114	5 <i>n</i>	4555.486	30
3660.631	12	4256.025	8 <i>n</i>	4559.920	6
3668.965	15	4258.523	4 <i>n</i>	4563.761	15
3671.672	20	4263.134	15	4571.971	15
3685.192	40	4274.584	15	4599.226	5
3689.916	15	4281.371	10	4617.269	30

STANDARD WAVE LENGTHS (Continued)

Titanium, Vacuum Arc Spectrum (Continued)

$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity	$\lambda_{\text{air A}}$	Intensity
4623.098	25	5014.185	25	5512.529	25
4629.335	15	5014.277	25	5565.476	9
4645.193	12	5016.162	20	5644.137	18
4656.468	25	5020.028	25	5648.570	5
4667.585	25	5022.871	25	5662.154	12
4675.118	10	5024.842	20	5675.413	9
4681.908	30	5025.570	18	5689.465	10
4691.336	20	5035.908	25	5715.123	9
4698.766	20	5036.468	25	5739.464	9
4710.186	18	5038.400	25	5766.330	4 n
4715.295	4	5039.959	22	5774.037	5 n
4731.172	9	5052.879	8	5785.979	5 n
4742.791	20	5062.112	7	5804.265	5 n
4758.120	25	5064.654	25	5866.453	35
4759.272	25	5087.055	8	5899.295	25
4778.259	10	5113.448	10	5903.317	5
4792.482	10	5120.420	12	5918.548	10
4799.797	12	5145.465	12	5922.112	18
4805.416	12	5147.483	10	5937.806	6
4820.410	20	5173.742	30	5941.755	12
4840.874	25	5192.971	35	5953.162	30
4856.012	20	5210.386	40	5965.828	30
4868.264	18	5224.301	15	5978.543	25
4870.129	20	5224.928	8	5999.668	8
4885.082	20	5265.967	10	6064.631	9
4899.910	20	5283.441	8	6085.228	20
4913.616	20	5295.781	4	6091.175	20
4919.867	10	5297.236	6	6126.217	20
4921.768	12	5298.429	4	6258.103	40
4928.342	12	5369.635	4	6258.706	50
4938.283	8	5389.996	3	6261.101	35
4975.344	10	5397.093	4	6303.754	10
4978.191	10	5409.609	6	6312.240	10
4981.732	60	5429.139	6	6336.104	8
4991.067	50	5477.695	8	6366.354	8
4997.099	8	5481.426	6	6546.276	20
4999.504	45	5488.210	5	6554.226	30
5007.209	40	5490.151	12	6556.066	25
5009.652	7	5503.897	8	6743.124	10

Xenon

Meggors, Journal Optical Society of America, 1921

λ_{air}	λ_{air}	λ_{air}
4500.978	4624.275	4807.019
4524.680	4671.225	4829.705
4582.746	4697.020	4844.333
4603.028	4734.154	4923.246

STANDARD WAVE LENGTHS (Continued)

Wave Lengths in the Vacuum Ultraviolet

J. C. Boyce, Rev. Med. Phys. 13, 34, (1941)

Copper (Shenstone, 1936)

λA	Inten- sity	P.E. in .001 A	λA	Inten- sity	P.E. in .001 A	λA	Inten- sity	P.E. in .001 A
685.139	8	2	1065.781	20	1	1393.126	10	2
685.396	2	2	1066.133	20	2	1399.355	3	2
724.487	15	2	1069.193	50	2	1402.776	15	2
735.519	20	2	1088.393	20	2	1442.136	15	2
736.031	25	2	1106.446	3	2	1444.131	2	2
810.997	15	2	1109.742	1	2	1473.976	25	2
813.882	20	2	1185.899	2	2	1496.686	35	4
826.995	30	2	1214.553	1	2	1517.630	20	2
866.440	5	2	1219.332	1	2	1519.491	50	2
876.719	20	2	1241.961	2	1	1535.004	25	2
883.837	5	2	1248.790	5	2	1540.391	30	2
884.824	5	2	1250.045	10	2	1541.701	75	2
911.654	1	2	1265.504	15	1	1558.344	30	2
912.022	0	2	1266.308	10	1	1565.925	40	2
992.951	25	1	1274.069	3	2	1566.411	40	2
1001.010	8	1	1274.463	3	2	1569.216	10	2
1004.053	30	1	1275.570	30	2	1590.164	40	3
1008.568	30	1	1281.458	8	4	1593.557	60	3
1011.433	2	1	1297.549	2	2	1598.402	40	3
1012.595	25	1	1298.394	15	2	1602.387	40	3
1018.705	50	1	1299.267	10	2	1604.848	20	3
1019.652	15	1	1308.296	30	2	1606.834	40	3
1022.100	5	1	1309.463	15	2	1608.638	25	3
1027.830	50	1	1314.147	15	2	1610.298	15	3
1028.326	25	1	1314.335	30	2	1617.914	20	3
1031.764	8	1	1325.511	3	2	1621.426	60	3
1035.160	8	1	1326.394	10	2	1649.457	25	3
1036.468	60	1	1350.592	15	2	1656.326	20	3
1039.345	60	2	1351.837	25	2	1660.005	20	3
1044.742	80	1	1355.304	15	2	1663.003	30	3
1049.363	20	2	1359.010	20	2	1944.586	25	4
1049.754	50	1	1359.935	5	2	1970.489	15	4
1054.690	60	1	1362.598	20	2	1979.947	50	4
1055.795	40	2	1363.501	5	2	1989.849	30	4
1058.796	40	2	1370.558	2	2	2000.339	60	4
1059.094	60	1	1371.840	20	2			

STANDARD WAVE LENGTHS (Continued)

Iron (Green, 1939)

Intensities			Intensities			Intensities		
λA	Schüler tube	Spark	λA	Schüler tube	Spark	λA	Schüler tube	Spark
1550.273	1	..	1637.398	15	2	1702.044	25	25
1559.084	20	2	1640.150	12	2	1709.551	0	..
1563.788	25	2	1643.576	15	2	1712.998	20	25
1566.821	20	1	1652.482	0	..	1718.100	2	..
1568.017	8	..	1654.476	5	1	1720.611	20	20
1569.674	12	..	1658.771	15	2	1724.962	8	1
1570.244	20	1	1659.479	20	10	1726.391	12	8
1572.754	1	..	1663.220	15	2	1815.411	0	1
1573.826	5	..	1670.990	1	..	1818.516	2	1
1574.769	0	..	1674.254	2	1	1826.994	1	1
1574.921	20	1	1676.854	1	..	1833.073	0	..
1577.167	1	..	1685.952	5	1	1842.283	0	..
1584.949	15	..	1686.454	8	1	1848.771	12	2
1612.805	20	8	1691.272	8	1	1851.526	1	..
1623.090	8	1	1693.475	0	..	1859.744	15	10
1625.520	20	8	1693.935	0	..	1898.535	10	2
1632.665	1	..	1696.794	8	..	1903.384	1	..
1633.906	15	2	1699.195	2	..	1904.785	15	5
						2001.025	30	30

Hydrogen

(Paschen, 1929)

Helium

(He II) (Paschen, 1929)

λA	λA	λA	λA	λA
923.148	949.739	234.3452	949.326	1084.940
926.222	972.532	237.3297	958.696	1215.129
930.745	1025.717	243.0244	972.109	1640.409
937.799	1215.664	256.3145	992.361	
		303.7788	1025.270	

Carbon, Nitrogen, Oxygen (More and Rieke, 1936)

El.	λA	Int.	El.	λA	Int.	El.	λA	Int.
O II	832.764	0	N I	1176.502	1	C II	1335.703	18d
O II	833.332	1	N I	1199.550	7	N I	1494.670	4
O II	834.467	2	N I	1200.218	6	C I	1560.313	8d
O I	990.205	4d	N I	1200.707	5	C I	1560.702	15d
O I	990.794	3	O I	1217.643	2	C I	1656.271	8d
O I	999.493	2	O I	1302.174	8	C I	1656.994	15d
N II	1083.996	2	O I	1304.858	8	C I	1657.388	5d
N II	1084.582	3	O I	1306.023	6	C I	1657.908	8d
N I	1134.168	3	C I	1328.820	3	C I	1658.135	8d
N I	1134.417	3	C I	1329.099	5			
N I	1134.979	4	C II	1334.534	15d			

PERSISTENT LINES OF THE ELEMENTS

Spectra of the neutral atom, the singly ionized atom, and the doubly ionized atom are indicated by I, II, and III, respectively. The most sensitive lines are indicated by an asterisk (*). The symbol "D" preceding the intensity indicates the discharge-tube spectrum. Wave lengths are given in International Ångström units.

Wave lengths and intensities of lines between 2000 and 9999 Ångströms have been given according to the M.I.T. Wavelength Tables.

ARRANGED BY ELEMENTS

Element	Wave length	Intensity		Element	Wave length	Intensity	
		Arc	Spark			Arc	Spark
A I	*1048.26			Ba II	2304.235	60	80
	1066.70				2335.269	60	100
	6965.430				3891.785	18	25
	7067.217	....	D 400		4130.664	50	60
	7503.867	....	D 700		*4554.042	1000	200
Ag I	8115.311	....	D 5000	Be I	4934.086	400	400
	*3280.683	2000	1000		*2348.610	2000	50
	3382.891	1000	700		2650.781	25	
	5209.067	1500	1000		3321.013	50	
	5465.487	1000	500		3321.086	100	
Ag II	2246.412	25	300	Be II	3321.343	1000	30
	*2437.791	60	500		*3130.416	200	200
Al I	3082.155	800	800	Bi I	3131.072	200	150
	3092.713	1000	1000		2061.70	300	100
	3944.032	2000	1000		2276.578	100	40
	*3961.527	3000	2000		2780.521	200	100
Al II	1671.0			Bi II	2809.625	200	100
	1856.00				2897.975	500	500
	1858.13				2938.298	300	300
	1862.48				2989.029	250	100
	2631.553	....	40		*3067.716	3000	2000
	*2669.166	3	100		4722.552	1000	100
	2816.179	10	100		1909.41		
	6231.76	....	30		1540.8		
	6243.36	....	100		1633.8		
	1854.67			Br II	*4704.86	....	D 250
Al III	1862.90				4785.50	....	D 400
	1889.9				4816.71	....	D 300
As I	*1890.5			C I	*2478.573	400	D 400
	1936.9				1334.54		
	1972.0			C II	1335.72		
	2288.12	250	5		2836.710	....	200
	2349.84	250	18	C III	2837.602	....	40
	2369.67	40			4267.02	....	350
	2370.77	50	3		4267.27	....	500
	2456.53	100	8		2296.89	....	200
	2780.197	75	75		*4226.728	500	50
	2860.452	50	50		4425.441	100	
	2898.71	25	40		4434.960	150	
	*2427.95	400	100		4454.781	200	
	2675.95	250	100		4455.880		
	2802.19	....	200		4456.62		
B I	2496.778	300	300	Ca II	3158.869	100	300
	*2497.733	500	400		3179.332	100	400
B II	1362.46			Cb I	*3933.666	600	600
	3451.41	5	30		3968.468	500	500
Ba I	3452.33			Cb II	*4058.938	1000	400
	3071.591	100	50		4079.729	500	200
	5424.616	100	30		4100.923	300	200
	5519.115	200	60		4123.810	200	125
	*5535.551	1000	200		4137.095	100	60
	5777.665	500	100		*3094.183	100	1000

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY ELEMENTS (Continued)

Element	Wave length	Intensity		Element	Wave length	Intensity	
		Arc	Spark			Arc	Spark
Cb II	3130.786	100	100	Dy I	4077.974	150	100
	3163.402	15	8		4167.966	50	12
	3194.977	30	300		4211.719	200	15
Cd I	3225.479	150	800	Er I	3499.104	18	15
	*2288.018	1500	300		3692.652	20	12
	3261.057	300	300		3906.316	25	12
	3403.653	800	500	Eu I	*4594.02		
	3466.201	1000	500	Eu II	4129.737	150	50
	3610.510	1000	500		*4205.046	200	50
Cd II	6438.4696	2000	1000	F I	6856.02		D 1000
	*2144.382	50	200		6902.46		D 500
	2265.017	25	300	Fe I	3581.20		
	2312.84	1	200		*3719.935	1000	700
	2573.09	3	150		3737.133	1000	600
	2748.58	5	200		3745.564	500	500
Ce II	4012.388	60	20		3745.903	150	100
	4040.762	70	5		3748.264	500	200
Cl I	4165.606	40	6	Fe II	*2382.039	40	100
	*4186.599	80	25		2395.625	50	100
	1379.6				2404.882	50	100
	1396.5				2410.517	50	70
Cl II	4794.54	....	D 250		2413.309	60	100
	4810.06	....	D 200	Ga I	2874.244	10	15
	4819.46	....	D 200		2943.637	10	20
Co I	*3453.505	3000	200		4032.982	1000	500
	3465.800	2000	25	Gd I	*4172.056	2000	1000
	3529.813	1000	30		3646.196	200	150
Co II	*2286.156	40	300	Ge I	3768.405	20	20
	2307.857	25	50		*2651.178	40	20
	2363.787	25	50		2651.575	30	20
	2378.622	25	50		2709.626	30	20
	2388.918	10	35		3039.064	1000	1000
	2519.822	40	200		3269.494	300	300
	3405.120	2000	150		4226.570	200	50
	*4254.346	5000	1000	H I	1215.7		
Cr I	4274.803	4000	800		4861.327	....	D 500
	4289.721	3000	800		6562.79	....	D 3000
	5204.518	400	100	He I	584.4		
	5206.039	500	200		*3888.646	....	D 1000
	5208.436	500	100		5875.618	....	D 1000
Cr II	*2835.633	100	400	He II	303.8		
	2843.252	125	400		1640.5		
	2849.838	80	150		4685.75	....	D 300
	2855.676	60	200	Hf I	2898.259	50	12
	2860.934	60	100		2904.408	30	6
	4555.355	2000	100		2916.481	50	15
Cs I	4593.177	1000	50		2940.772	60	12
	*8521.10	5000			3072.877	80	18
	8943.50	2000			4093.161	25	20
	*3247.540	5000	2000	Hf II	2513.028	25	70
Cu I	3273.962	3000	1500		2516.881	35	100
	5105.541	500			*2641.406	40	125
	5153.235	600			2773.357	25	60
	5218.202	700			2820.224	40	100
Cu II	*2135.976	25	500		3134.718	80	125
	2192.260	25	500	Hg I	*1849.68		
	2246.995	30	500		2536.519	2000	1000
Dy I	4000.454	400	300		3650.146	200	500
	4045.983	150	12		3654.833	....	D 200

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY ELEMENTS (Continued)

Element	Wave length	Intensity		Element	Wave length	Intensity	
		Arc	Spark			Arc	Spark
Hg I	3663.276	500	400	Mn II	*2576.104	300	2000
	4046.561	200	300		2593.729	200	1000
	4358.35	3000	500		2605.688	100	500
	5460.740	....	D 2000	Mo I	*3798.252	1000	1000
Hg II	1649.8				3864.110	1000	500
	1942.3				3902.963	1000	500
Ho I	3748.17	60	40	Mo II	*2816.154	200	300
	3891.02	200	40		2848.232	125	200
Ho II	2936.77	....	1000		2871.508	100	100
	1782.9				2890.994	30	50
I I	2062.38	....	D 900	N I	2909.116	25	40
	5161.188	....	D 300		1199.5		
In I	5464.61	....	D 900		1200.2		
	3039.356	1000	500		1200.7		
	3256.090	1500	600	N II	*4099.94	....	D 150
	3258.564	500	300		4109.98	....	D 1000
	4101.773	2000	1000		5666.64	....	D 300
Ir I	*4511.323	5000	4000		5676.02	....	D 100
	2543.97			N III	5679.56	....	D 500
	2849.725	40	20		989.8		
	2924.792	25	15		991.6		
	*3220.780	100	30	Na I	4097.31	....	D 100
K I	3437.015	20	15		4103.37	....	D 80
	3513.645	100	100		3302.323	600	300
	4044.140	800	400		3302.988	300	150
	4047.201	400	200		5682.657	80	
	*7664.907	9000			5688.224	300	
Kr I	7698.979	5000			*5889.953	9000	1000
	5570.2895	....	D 2000	Nd I	5895.923	5000	500
	5870.9158	....	D 3000		3951.154	40	30
La I	5455.146	200	1		4177.321	15	25
	5930.648	250		Ne I	*4303.573	100	40
La II	*6249.929	300			735.95		
	*3949.106	1000	800		743.73		
	4077.340	600	400		5400.562	....	D 2000
Li I	4123.228	500	500		5832.488		
	3232.61	1000	500		5852.488	....	D 2000
	4603.00	800			6402.246	....	D 2000
Lu I	6103.642	2000	300	Ni I	*3414.765	1000	50
	*6707.844	3000	200		3492.956	1000	100
Lu II	4518.57	300	40		3515.054	1000	50
	*2615.43				3524.541	1000	100
Mg I	2894.84	60	200	Ni II	2216.47		
	2911.39	100	300		2253.86	100	300
	3397.07	50	20		2264.457	150	400
	3472.48	50	150		2270.213	100	400
	3554.43	50	150	O I	*2287.084	100	500
Mg II	*2852.129	300	100		1302.27		
	3829.350	100	150		1304.96		
	3832.306	250	200		1306.12		
	3838.258	300	200		*7771.928	....	D 1000
	5167.343	100	50		7774.138	....	D 300
Mn I	5172.699	200	100	Os I	7775.433	....	D 100
	5183.618	500	300		*2909.061	500	400
	*2795.53	150	300		3058.66	500	500
Mn II	2802.695	150	300		3262.290	500	50
	*4030.755	500	20		3267.945	400	30
	4033.073	400	20		3301.56		
	4034.490	250	20		3752.54		

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY ELEMENTS (Continued)

Element	Wave length	Intensity		Element	Wave length	Intensity	
		Arc	Spark			Arc	Spark
Os I	3782.20			Ru I	*3498.942	500	200
	4420.468	400	100		3596.179	30	100
P I	1774.8			Ru II	2678.758	100	300
	1782.7				2692.065	8	200
	1787.5				2712.410	80	300
	2136.8				2945.668	60	300
	2149.8				2965.546	60	200
	2534.01	50	D 20		2976.586	60	200
	2535.65	100	D 30	S I	1807.4		
	2536.38				1820.5		
	2553.28	80	D 20		1826.4		
	2554.02				4694.13	....	D 500
	2554.93	60	D 20		4695.45	....	D 30
Pb I	2169.994	1000	1000		4696.25	....	D 15
	2614.178	200	80		9212.91	....	D 200
	2833.069	500	80		9228.11	....	D 200
	3639.580	300	50		9237.49	....	D 200
	3683.471	300	50	Sb I	*2068.38	300	3
	*4057.820	2000	300		2175.890	300	40
Pb II	1682.4				2311.469	150	50
	*2203.505	50	5000		2528.535	300	200
	5608.8	....	D 40		2598.062	200	100
Pd I	*3404.580	2000	1000		2877.915	250	150
	3421.24	2000	1000		3232.499	150	250
	3516.943	1000	500		3267.502	150	150
	3609.548	1000	700	Sc I	3907.476	125	25
	3634.695	2000	1000		*3911.810	150	30
Pd II	*2296.53				4020.399	50	20
	2488.921	10	30		4023.688	100	25
	2498.784	4	150		5671.80		
	2505.739	3	30	Sc II	*3613.836	40	70
	2658.722	20	300		3630.740	50	70
	2854.581	4	500		3642.785	60	50
Pr I	4062.817	150	50	Se I	*1960.2		
Pr II	*4179.422	200	40		2039.851	....	D 1000
	4189.518	100	50		2062.788	....	D 800
	4225.327	50	40		4730.78	....	D 1000
Pt I	2659.454	2000	500		4739.03	....	D 800
	2830.295	1000	600		4742.25	....	D 500
	2929.794	800	200	Si I	2506.899	300	200
	2997.967	1000	200		2516.123	500	500
	*3064.712	2000	300		2528.516	400	500
Ra I	*4825.91	....	D 800		*2881.578	500	400
Ra II	*3814.42	....	D 2000		3905.528	20	15
	4682.28	....	D 800	Si II	1526.83		
Rb I	4201.851	2000	500		*1533.55		
	4215.556	1000	300	Sm I	*4296.75		
	*7800.227	9000		Sm II	3568.27		
	7947.60	5000			4390.865	150	150
Re I	*3460.47	1000			*4424.342	300	300
	4889.17	2000			4434.321	200	200
Rh I	3323.092	1000	200	Sn I	*2839.989	300	300
	3396.85	1000	500		2863.327	300	300
	*3434.893	1000	200		3009.147	300	200
	3657.987	500	200		3034.121	200	150
	3692.357	500	150		3175.019	500	400
Rn I	7055.42	....	D 400		3262.328	400	300
	7450.00	....	D 600		4524.741	500	50
Ru I	3436.737	300	150	Sn III	*2152.22		

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY ELEMENTS (Continued)

Element	Wave length	Intensity		Element	Wave length	Intensity	
		Arc	Spark			Arc	Spark
Sr I	*4607.331	1000	50	V I	4389.974	80	60
	4832.075	200	8	V II	*3093.108	100	400
	4872.493	25			3102.299	70	300
	4962.263	40			3110.706	70	300
Sr II	3380.711	150	200		3118.383	70	200
	3464.57	200	200		3125.284	80	200
	3474.887	80	50	W I	4008.753	45	45
	*4077.714	400	500		4294.614	50	50
Ta I	4215.524	300	400		*4302.108	60	60
	4305.447	40		W II	*2204.49		
	*3311.162	300	70		2397.091	18	30
	3318.840	125	35		2589.167	15	25
Tb I	3406.664	70	18		3215.560	10	9
	3509.17	200	200		3613.790	10	30
	3561.74	200	200	Xe I	1295.8		
	3848.75	100	200		1469.9		
Te I	3874.18	200	200		4500.977	....	D 500
	*2142.75	60			4624.276	....	D 1000
	2383.25	500	D 300		4671.226	....	D 2000
	2385.76	600	D 300	Y I	4643.695	50	100
Th I	2530.70	....	D 30		*4674.848	80	100
	2769.67	....	D 30		5466.47		
	3538.75	....	50	Y II	3242.280	60	100
	3601.040	8	10		3600.734	100	300
Th II	4019.137	8	8		3633.123	50	100
	3290.59	....	40		*3710.290	80	150
	3635.463	200	100		3774.332	12	100
	3642.675	300	125		3788.697	30	30
Ti I	3653.496	500	200	Yb I	3289.37	500	1000
	*4981.733	300	125		*3987.994	1000	500
	4991.066	200	100	Yb II	*3694.203	500	1000
	4999.510	200	80	Zn I	*2138.56	800	500
Ti II	5007.213	200	40		3282.333	500	300
	5014.25				3302.588	800	300
	*3349.035	125	800		3345.020	800	300
	3361.213	100	600		4680.138	300	200
Tl I	3372.800	80	400		4722.159	400	300
	3383.761	70	300		4810.534	400	300
	2767.87	400	300	Zn II	6362.347	1000	500
	2918.32	400	200		*2025.51	200	200
Tm I	3229.75	2000	800		2061.91	100	100
	3519.24	2000	1000		2502.001	20	400
	3775.72	3000	1000		2557.958	10	300
	*5350.46	5000	2000	Zr I	3519.605	100	10
Tm II	3462.21	200	100		3547.682	200	12
	3761.333	250	150		*3601.193	400	15
	3761.917	200	120		4687.803	125	
	*3848.02				4710.075	60	
U I	3552.172	8	12		4739.478	100	
	3672.579	8	15		4772.312	100	
	4241.669	40	50		4815.62		
	3183.406	200	100	Zr II	*3391.975	300	400
V I	3183.982	500	400		3438.230	250	200
	3185.396	500	400		3496.210	100	100
	*4379.238	200	200		3572.473	60	80
	4384.722	125	125				

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY WAVE LENGTHS

Wave length	Element	Intensity		Wave length	Element	Intensity	
		Arc	Spark			Arc	Spark
303.8	He II			*2138.56	Zn I	800	500
584.4	He I			*2142.75	Te I	60	
735.95	Ne I			*2144.382	Cd II	50	200
743.73	Ne I			2149.8	P I		
989.8	N III			*2152.22	Sn II		
991.6	N III			2169.994	Pb I	1000	1000
*1048.26	A I			2175.890	Sb I	300	40
1066.70	A I			2192.260	Cu II	25	500
1199.5	N I			*2203.505	Pb II	50	5000
1200.2	N I			*2204.49	W II		
1200.7	N I			2216.47	Ni II		
1215.7	H I			2246.412	Ag II	25	300
1295.8	Xe I			2246.995	Cu II	30	500
1302.27	O I			2253.86	Ni II	100	300
1304.96	O I			2264.457	Ni II	150	400
1306.12	O I			2265.017	Cd II	25	300
1334.54	C II			2270.213	Ni II	100	400
1335.72	C II			2276.578	Bi I	100	40
1362.46	B II			*2286.156	Co II	40	300
1379.6	Cl I			*2287.084	Ni II	100	500
1396.5	Cl I			*2288.018	Cd I	1500	300
1469.9	Xe I			2288.12	As I	250	5
1526.83	Si II			*2296.53	Pd II		
*1533.55	Si II			2296.89	C III	...	200
1540.8	Br I			2304.235	Ba II	60	80
1633.8	Br I			2307.857	Co II	25	50
1640.5	He II			2311.469	Sb I	150	50
1649.8	Hg II			2312.84	Cd II	1	200
1671.0	Al II			2335.269	Ba II	60	100
1682.4	Pb II			*2348.610	Be I	2000	50
1774.8	P I			2349.84	As I	250	18
1782.7	P I			2363.787	Co II	25	50
1782.9	I I			2369.67	As I	40	
1787.5	P I			2370.77	As I	50	3
1807.4	S I			2378.622	Co II	25	50
1820.5	S I			*2382.039	Fe II	40	100
1826.4	S I			2383.25	Te I	500	D 300
*1849.6	Hg I			2385.76	Te I	600	D 300
1854.67	Al III			2388.918	Co II	10	35
1856.00	Al II			2395.625	Fe II	50	100
1858.13	Al II			2397.091	W II	18	30
1862.48	Al II			2404.882	Fe II	50	100
1862.90	Al III			2410.517	Fe II	50	70
1889.9	As I			2413.309	Fe II	60	100
*1890.5	As I			*2427.95	Au I	400	100
1909.41	Bi II			*2437.791	Ag II	60	500
1936.9	As I			2456.53	As I	100	8
1942.3	Hg II			*2478.573	C I	400	D 400
*1960.2	Se I			2488.921	Pd II	10	30
1972.0	As I			2496.778	B I	300	300
*2025.51	Zn II	200	200	*2497.733	B I	500	400
2039.851	Se I	...	D 1000	2498.784	Pd II	4	150
2061.70	Bi I	300	100	2502.001	Zn II	20	400
2061.91	Zn II	100	100	2505.739	Pd II	3	30
2062.38	I I	...	D 900	2506.899	Si I	300	200
2062.788	Se I	...	D 800	2513.028	Hf II	25	70
*2068.38	Sb I	300	3	2516.123	Si I	500	500
*2135.976	Cu II	25	500	2516.881	Hf II	35	100
2136.8	P I			2519.822	Co II	40	200

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY WAVE LENGTHS (Continued)

Wave length	Element	Intensity		Wave length	Element	Intensity	
		Arc	Spark			Arc	Spark
2528.516	Si I	400	500	2860.452	As I	50	50
2528.535	Sb I	300	200	2860.934	Cr II	60	100
2530.70	Te I	....	D 30	2863.327	Sn I	300	300
2534.01	P I	50	D 20	2871.508	Mo II	100	100
2535.65	P I	100	D 30	2874.244	Ga I	10	15
2536.38	P I			2877.915	Sb I	250	150
2536.519	Hg I	2000	1000	*2881.578	Si I	500	400
2543.97	Ir I			2890.994	Mo II	30	50
2553.28	P I	80	D 20	2894.84	Lu II	60	200
2554.02	P I			2897.975	Bi I	500	500
2554.93	P I	60	D 20	2898.259	Hf I	50	12
2557.958	Zn II	10	300	2898.71	As I	25	40
2573.09	Cd II	3	150	2904.408	Hf I	30	6
*2576.104	Mn II	300	2000	*2909.061	Os I	500	400
2589.167	W II	15	25	2909.116	Mo II	25	40
2593.729	Mn II	200	1000	2911.39	Lu II	100	300
2598.062	Sb I	200	100	2916.481	Hf I	50	15
2605.688	Mn II	100	500	2918.32	Tl I	400	200
2614.178	Pb I	200	80	2924.792	Ir I	25	15
*2615.43	Lu II			2929.794	Pt I	800	200
2631.553	Al II	....	40	2936.77	Ho II	....	1000
*2641.406	Hf II	40	125	2938.298	Bi I	300	300
2650.781	Be I	25		2940.772	Hf I	60	12
*2651.178	Ge I	40	20	2943.637	Ga I	10	20
2651.575	Ge I	30	20	2945.668	Ru II	60	300
2658.722	Pd II	20	300	2965.546	Ru II	60	200
2659.454	Pt I	2000	500	2976.586	Ru II	60	200
*2669.166	Al II	3	100	2989.029	Bi I	250	100
2675.95	Au I	250	100	2997.967	Pt I	1000	200
2678.758	Ru II	100	300	3009.147	Sn I	300	200
2692.065	Ru II	8	200	3034.121	Sn I	200	150
2709.626	Ge I	30	20	3039.064	Ge I	1000	1000
2712.410	Ru II	80	300	3039.356	In I	1000	500
2748.58	Cd II	5	200	3058.66	Os I	500	500
2767.87	Tl I	400	300	*3064.712	Pt I	2000	300
2769.67	Te I	....	D 30	*3067.716	Bi I	3000	2000
2773.357	Hf II	25	60	3071.591	Ba I	100	50
2780.197	As I	75	75	3072.877	Hf I	80	18
2780.521	Bi I	200	100	3082.155	Al I	800	800
*2795.53	Mg II	150	300	3092.713	Al I	1000	1000
2802.19	Au I	....	200	*3093.108	V II	100	400
2802.695	Mg II	150	300	*3094.183	Cb II	100	1000
2809.625	Bi I	200	100	3102.299	V II	70	300
*2816.154	Mo II	200	300	3110.706	V II	70	300
2816.179	Al II	10	100	3118.383	V II	70	200
2820.224	Hf II	40	100	3125.284	V II	80	200
2830.295	Pt I	1000	600	*3130.416	Be II	200	200
2833.069	Pb I	500	80	3130.786	Cb II	100	100
*2835.633	Cr II	100	400	3131.072	Be II	200	150
2836.710	C II	....	200	3134.718	Hf II	80	125
2837.602	C II	....	40	3158.869	Ca II	100	300
*2839.989	Sn I	300	300	3163.402	Cb II	15	8
2843.252	Cr II	125	400	3175.019	Sn I	500	400
2848.232	Mo II	125	200	3179.332	Ca II	100	400
2849.725	Ir I	40	20	3183.406	V I	200	100
2849.838	Cr II	80	150	3183.982	V I	500	400
*2852.129	Mg I	300	100	3185.396	V I	500	400
2854.581	Pd II	4	500	3194.977	Cb II	30	300
2855.676	Cr II	60	200	3215.560	W I	10	9

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY WAVE LENGTHS (Continued)

Wave length	Element	Intensity		Wave length	Element	Intensity	
		Arc	Spark			Arc	Spark
*3220.780	Ir I	100	30	3474.887	Sr II	80	50
3225.479	Cb II	150	800	3492.956	Ni I	1000	100
3229.75	Tl I	2000	800	3496.210	Zr II	100	100
3232.499	Sb I	150	250	*3498.942	Ru I	500	200
3232.61	Li I	1000	500	3499.104	Er I	18	15
3242.280	Y II	60	100	3509.17	Tb I	200	200
*3247.540	Cu I	5000	2000	3513.645	Ir I	100	100
3256.090	In I	1500	600	3515.054	Ni I	1000	50
3258.564	In I	500	300	3516.943	Pd I	1000	500
3261.057	Cd I	300	300	3519.24	Tl I	2000	1000
3262.290	Os I	500	50	3519.605	Zr I	100	10
3262.328	Sn I	400	300	3524.541	Ni I	1000	100
3267.502	Sb I	150	150	3529.813	Co I	1000	30
3267.945	Os I	400	30	3538.75	Th I	...	50
3269.494	Ge I	300	300	3547.682	Zr I	200	12
3273.962	Cu I	3000	1500	3552.172	U I	8	12
*3280.683	Ag I	2000	1000	3554.43	Lu II	50	150
3282.333	Zn I	500	300	3561.74	Tb I	200	200
3289.37	Yb I	500	1000	3568.27	Sm II		
3290.59	Th II	....	40	3572.473	Zr II	60	80
3301.56	Os I			3581.20	Fe I		
3302.323	Na I	600	300	3596.179	Ru I	30	100
3302.588	Zn I	800	300	3600.734	Y II	100	300
3302.988	Na I	300	150	3601.040	Th I	8	10
*3311.162	Ta I	300	70	*3601.193	Zr I	400	15
3318.840	Ta I	125	35	3609.548	Pd I	1000	700
3321.013	Be I	50		3610.510	Cd I	1000	500
3321.086	Be I	100		3613.790	W II	10	30
3321.343	Be I	1000	30	*3613.836	Sc II	40	70
3323.092	Rh I	1000	200	3630.740	Sc II	50	70
3345.020	Zn I	800	300	3633.123	Y II	50	100
*3349.035	Ti II	125	800	3634.695	Pd I	2000	1000
3361.213	Ti II	100	600	3635.463	Ti I	200	100
3372.800	Ti II	80	400	3639.580	Pb I	300	50
3380.711	Sr II	150	200	3642.675	Ti I	300	125
3382.891	Ag I	1000	700	3642.785	Sc II	60	50
3383.761	Ti II	70	300	3646.196	Gd I	200	150
*3391.975	Zr II	300	400	3650.146	Hg I	200	500
3396.85	Rh I	1000	500	3653.496	Ti I	500	200
3397.07	Lu II	50	20	3654.833	Hg I	...	200
3403.653	Cd I	800	500	3657.987	Rh I	500	200
*3404.580	Pd I	2000	1000	3663.276	Hg I	500	400
3405.120	Co I	2000	150	3672.579	U I	8	15
3406.664	Ta I	70	18	3683.471	Pb I	300	50
*3414.765	Ni I	1000	50	3692.357	Rh I	500	150
3421.24	Pd I	2000	1000	3692.652	Er I	20	12
*3434.893	Rh I	1000	200	*3694.203	Yb II	500	1000
3436.737	Ru I	300	150	*3710.290	Y II	80	150
3437.015	Ir I	20	15	*3719.935	Fe I	1000	700
3438.230	Zr II	250	200	3737.133	Fe I	1000	600
3451.41	B II	5	30	3745.564	Fe I	500	500
3452.33	B II			3745.903	Fe I	150	100
*3453.505	Co I	3000	200	3748.17	Ho I	60	40
*3460.47	Re I	1000		3748.264	Fe I	500	200
3462.21	Tm I	200	100	3752.54	Os I		
3464.57	Sr II	200	200	3761.333	Tm I	250	150
3465.800	Co I	2000	25	3761.917	Tm I	200	120
3466.201	Cd I	1000	500	3768.405	Gd I	20	20
3472.48	Lu II	50	150	3774.332	Y II	12	100

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY WAVE LENGTHS (Continued)

Wave length	Element	Intensity		Wave length	Element	Intensity	
		Arc	Spark			Arc	Spark
3775.72	Tl I	3000	1000	4130.664	Ba II	50	60
3782.20	Os I			4137.095	Cb I	100	60
3788.697	Y II	30	30	4165.606	Ce II	40	6
*3798.252	Mo I	1000	1000	4167.966	Dy I	50	12
*3814.42	Ra II	....	D 2000	*4172.056	Ga I	2000	1000
3829.350	Mg I	100	150	4177.321	Nd I	15	25
3832.306	Mg I	250	200	*4179.422	Pr II	200	40
3838.258	Mg I	300	200	*4186.599	Ce II	80	25
*3848.02	Tm II			4189.518	Pr II	100	50
3848.75	Tb I	100	200	4201.851	Rb I	2000	500
3864.110	Mo I	1000	500	*4205.046	Eu II	200	50
3874.18	Tb I	200	200	4211.719	Dy I	200	15
*3888.646	He I	....	D 1000	4215.524	Sr II	300	400
3891.02	Ho I	200	40	4215.556	Rb I	1000	300
3891.785	Ba II	18	25	4225.327	Pr II	50	40
3902.963	Mo I	1000	500	4226.570	Ge I	200	50
3905.528	Si I	20	15	*4226.728	Ca I	500	50
3906.316	Er I	25	12	4241.669	U I	40	50
3907.476	Sc I	125	25	*4254.346	Cr I	5000	1000
*3911.810	Sc I	150	30	4267.02	C II	....	350
*3933.666	Ca II	600	600	4267.27	C II	....	500
3944.032	Al I	2000	1000	4274.803	Cr I	4000	800
*3949.106	La II	1000	800	4289.721	Cr I	3000	800
3951.154	Nd I	40	30	4294.614	W I	50	50
*3961.527	Al I	3000	2000	*4296.75	Sm I		
3968.468	Ca II	500	500	*4302.108	W I	60	60
*3987.994	Yb I	1000	500	*4303.573	Nd I	100	40
4000.454	Dy I	400	300	4305.447	Sr II	40	
4008.753	W I	45	45	4358.35	Hg I	3000	500
4012.388	Ce II	60	20	*4379.238	V I	200	200
4019.137	Th I	8	8	4384.722	V I	125	125
4020.399	Sc I	50	20	4389.974	V I	80	60
4023.688	Sc I	100	25	4390.865	Sm II	150	150
*4030.755	Mn I	500	20	4420.468	Os I	400	100
4032.982	Ga I	1000	500	*4424.342	Sm II	300	300
4033.073	Mn I	400	20	4425.441	Ca I	100	
4034.490	Mn I	250	20	4434.321	Sm II	200	200
4040.762	Ce II	70	5	4434.960	Ca I	150	
4044.140	K I	800	400	4454.781	Ca I	200	
4045.983	Dy I	150	12	4455.880	Ca I		
4046.561	Hg I	200	300	4456.62	Ca I		
4047.201	K I	400	200	4500.977	Xe I	....	D 500
*4057.820	Pb I	2000	300	*4511.323	In I	5000	4000
*4058.938	Cb I	1000	400	4518.57	Lu I	300	40
4062.817	Pr I	150	50	4524.741	Sn I	500	50
4077.340	La II	600	400	*4554.042	Ba II	1000	200
*4077.714	Sr II	400	500	4555.355	Cs I	2000	100
4077.974	Dy I	150	100	4593.177	Cs I	1000	50
4079.729	Cb I	500	200	*4594.02	Eu I		
4093.161	Hf II	25	20	4603.00	Li I	800	
4097.31	N III	....	D 100	*4607.331	Sr I	1000	50
*4099.94	N I	....	D 150	4624.276	Xe I	....	D 1000
4100.923	Cb I	300	200	4643.695	Y I	50	100
4101.773	In I	2000	1000	4671.226	Xe I	....	D 2000
4103.37	N III	....	D 80	*4674.848	Y I	80	100
4109.98	N I	....	D 1000	4680.138	Zn I	300	200
4123.228	La II	500	500	4682.28	Ra II	....	D 800
4123.810	Cb I	200	125	4685.75	He II	....	D 300
4129.737	Eu II	150	50	4687.803	Zr I	125	

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY WAVE LENGTHS (Continued)

Wave length	Element	Intensity		Wave length	Element	Intensity	
		Arc	Spark			Arc	Spark
4694.13	S I	....	D 500	5466.47	Y I		
4695.45	S I	....	D 30	5519.115	Ba I	200	60
4696.25	S I	....	D 15	*5535.551	Ba I	1000	200
*4704.86	Br II	....	D 250	5570.2895	Kr I	....	D 2000
4710.075	Zr I	60		5608.8	Pb II	....	D 40
4722.159	Zn I	400	300	5666.64	N II	....	D 300
4722.552	Bi I	1000	100	5671.80	Se I	....
4730.78	Se I	....	D 1000	5676.02	N II	....	D 100
4739.03	Se I	....	D 800	5679.56	N II	....	D 500
4739.478	Zr I	100		5682.657	Na I	80	
4742.25	Se I	....	D 500	5688.224	Na I	300	
4772.312	Zr I	100		5777.665	Ba I	500	100
4785.50	Br II	....	D 400	5832.488	Ne I	....
4794.54	Cl II	....	D 250	5852.488	Ne I	....	D 2000
4810.06	Cl II	....	D 200	5870.9158	Kr I	....	D 3000
4810.534	Zn I	400	300	5875.618	He I	....	D 1000
4815.62	Zr I	....		*5889.953	Na I	9000	1000
4816.71	Br II	....	D 300	5895.923	Na I	5000	500
4819.46	Cl II	....	D 200	5930.648	La I	250	
*4825.91	Ra I	....	D 800	6103.642	Li I	2000	300
4832.075	Sr I	200	8	6231.76	Al II	....	30
4861.327	H I	....	D 500	6243.36	Al II	....	100
4872.493	Sr I	25		*6249.929	La I	300	
4889.17	Re I	2000		6362.347	Zn I	1000	500
4934.086	Ba II	400	400	6402.246	Ne I	....	D 2000
4962.263	Sr I	40		6438.4696	Cd I	2000	1000
*4981.733	Ti I	300	125	6562.79	H I	....	D 3000
4991.066	Ti I	200	100	*6707.844	Li I	3000	200
4999.510	Ti I	200	80	6856.02	F I	....	D 1000
5007.213	Ti I	200	40	6902.46	F I	....	D 500
5014.25	Ti I	....		6965.430	A I	....	D 400
5105.541	Cu I	500		7055.42	Rn I	....	D 400
5153.235	Cu I	600		7067.217	A I	....	D 400
5161.188	I II	....	D 300	7450.00	Rn I	....	D 600
5167.343	Mg I	100	50	7503.867	A I	....	D 700
5172.699	Mg I	200	100	*7664.907	K I	9000	
5183.618	Mg I	500	300	7698.979	K I	5000	
5204.518	Cr I	400	100	*7771.928	O I	....	D 1000
5206.039	Cr I	500	200	7774.138	O I	....	D 300
5208.436	Cr I	500	100	7775.433	O I	....	D 100
5209.067	Ag I	1500	1000	*7800.227	Rb I	9000	
5218.202	Cu I	700		7947.60	Rb I	5000	
*5350.46	Tl I	5000	2000	8115.311	A I	....	D 5000
5400.562	Ne I	....	D 2000	*8521.10	Cs I	5000	
5424.616	Ba I	100	30	8943.50	Cs I	2000	
5455.146	La I	200	1	9212.91	S I	....	D 200
5460.740	Hg I	....	D 2000	9228.11	S I	....	D 200
5464.61	I II	....	D 900	9237.49	S I	....	D 200
5465.487	Ag I	1000	500				

INDEX OF REFRACTION

Indices of refraction for elements, inorganic, metal-organic and organic compounds and minerals will be found in the tables of physical constants for the various classes of substances in the section Properties and Physical Constants.

Values for compounds not there listed and data subsequently collected are given below.

Indices not otherwise indicated are for sodium light, $\lambda = 589.3 \text{ m}\mu$. Other wave lengths are indicated by the value in millimicrons or symbol in parentheses which follows the index. Wave lengths are indicated as follows: He, $\lambda = 587.6 \text{ m}\mu$; Li, $\lambda = 670.8 \text{ m}\mu$; Hg, $\lambda = 579.1 \text{ m}\mu$; A, $\lambda = 759.4 \text{ m}\mu$; C, $\lambda = 656.3 \text{ m}\mu$; D, $\lambda = 589.3 \text{ m}\mu$; F, $\lambda = 486.1 \text{ m}\mu$.

Temperatures are understood to be 20°C for liquids, or ordinary room temperatures in the case of solids. Other temperatures appear as superior figures with the index.

Indices for the elements and inorganic compounds will be understood to be for the solid form except as indicated by the abbreviation liq.

ELEMENTS

See also under Physical Constants of Inorganic Compounds and Index of Refraction of Gases.

Name	Formula	Index
Bromine (liq.)	Br ₂	1.661 ¹⁵
Cadmium (liq.)	Cd	0.82 (579 m μ)
(sol.)		1.13
Chlorine (liq.)	Cl ₂	1.385
(gas)		1.000768
Hydrogen (liq.)	H ₂	1.0974 ^{-252.88(579 mμ)}
Iodine (sol.)	I ₂	3.34
(gas)		1.001920
Lead	Pb	2.6 (579 m μ)
Mercury (liq.)	Hg	1.6-1.9
Nitrogen (liq.)	N ₂	1.2053 ⁻¹⁹⁰
Oxygen (liq.)	O ₂	1.221 ⁻¹⁸¹
Phosphorus (yel.) (sol.)		2.1442 ²⁵
Selenium	Se ₈	3.00, 4.04
(amor.) (sol.)		2.92
Sodium (liq.)	Na	0.0045
(sol.)		4.22
Sulfur (liq.)	S ₈	1.929 ¹¹⁰
(amor.) (sol.)		1.998
(rhombic, α)		1.957, 2.0377, 2.2454
Tin (liq.)	Sn	2.1

INORGANIC COMPOUNDS

See also under Physical Constants of Inorganic Compounds.

Aluminum carbide	Al ₄ C ₃	2.7, 2.75 (700 m μ)
chloride	AlCl ₃ .6H ₂ O	1.560, 1.507
oxide	Al ₂ O ₃	1.665-1.680, 1.63-1.65
Alums. See under appropriate element.		
Ammonium antimonyl tartrate	2(NH ₄ .SbO ₂ .C ₄ H ₄ O ₆).H ₂ O	β 1.6229 (C)
orthoarsenate, di-H	NH ₄ H ₂ AsO ₄	1.5766, 1.5217
bromide	NH ₄ Br	1.7108
perchlorate	NH ₄ ClO ₄	1.4818, 1.4833, 1.4881
chloroplatinate	(NH ₄) ₂ PtCl ₆	1.8
fluoride	NH ₄ F	ω <1.328
acid	NH ₄ HF ₂	1.385, 1.390, 1.394
hydrogen malate (d)	NH ₄ C ₄ H ₅ O ₄	β 1.503
nitrate	NH ₄ NO ₃	1.413, 1.611(He), 1.637

INDEX OF REFRACTION (Continued)

INORGANIC COMPOUNDS (Continued)

Name	Formula	Index
Ammonium sulfate, acid.....	NH_4HSO_4	1.463, 1.473, 1.510
tartrate (<i>dl</i>).....	$(\text{NH}_4)_2\text{C}_4\text{H}_4\text{O}_6 \cdot 2\text{H}_2\text{O}$	β 1.564
thiocyanate.....	NH_4CNS	1.546, 1.685, 1.692
uranyl acetate.....	$\text{NH}_4\text{C}_2\text{H}_3\text{O}_2 \cdot \text{UO}_2(\text{C}_2\text{H}_3\text{O}_2)_2$	1.4808, 1.4933
Antimony bromide.....	SbBr_3	> 1.74+
iodide, tri.....	SbI_3	2.78 (Li), 2.36
Barium cadmium bromide.....	$\text{BaCdBr}_4 \cdot 4\text{H}_2\text{O}$	β 1.702
cadmium chloride.....	$\text{BaCdCl}_4 \cdot 4\text{H}_2\text{O}$	β 1.651
calcium propionate.....	$\text{BaCa}_2(\text{C}_3\text{H}_5\text{O}_2)_6$	1.4442
fluochloride.....	$\text{BaCl}_2 \cdot \text{BaF}_2$	1.640, 1.633
fluoride.....	BaF_2	1.475 also 1.4741
Barium oxide.....	BaO	1.980
orthophosphate, di.....	BaHPO_4	1.617, 1.63±, 1.635
propionate.....	$\text{Ba}(\text{C}_2\text{H}_5\text{CO}_2)_2 \cdot \text{H}_2\text{O}$	β 1.5175
sulfide, mono.....	BaS	2.155
Cadmium ammonium chloride.....	$\text{CdCl}_2 \cdot 4\text{NH}_4\text{Cl}$	1.6038, 1.6042
cesium sulfate.....	$\text{CdSO}_4 \cdot \text{Cs}_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$	1.498, 1.500, 1.506
fluoride.....	CdF_2	1.56
magnesium chloride.....	$(\text{CdCl}_2)_2 \cdot \text{MgCl}_2 \cdot 12\text{H}_2\text{O}$	1.49, 1.5331, 1.5769
oxide.....	CdO	2.49 (Li)
potassium chloride.....	$\text{CdCl}_2 \cdot 4\text{KCl}$	1.5906, 1.5907
" cyanide.....	$\text{Cd}(\text{CN})_2 \cdot 2\text{KCN}$	1.4213
rubidium sulfate.....	$\text{CdSO}_4 \cdot \text{Rb}_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$	1.4798, 1.4848, 1.4948
Calcium aluminate.....	$\text{Ca}_3\text{Al}_2\text{O}_6$	1.710
borate.....	$\text{CaO} \cdot \text{B}_2\text{O}_3$	1.540, 1.656, 1.682
carbide.....	CaC_2	> 1.75
copper acetate.....	$\text{CaCu}(\text{C}_2\text{H}_3\text{O}_2)_4 \cdot 6\text{H}_2\text{O}$	1.436, 1.478
cyanamide.....	CaCN_2	1.60, > 1.95
dithionate.....	$\text{CaS}_2\text{O}_6 \cdot 4\text{H}_2\text{O}$	1.5516, 1.5414
pyrophosphate.....	$\text{Ca}_2\text{P}_2\text{O}_7$	1.585, 1.60±, 1.605
platinocyanide.....	$\text{CaPt}(\text{CN})_4 \cdot 5\text{H}_2\text{O}$	1.623, 1.644, 1.767
strontium propionate.....	$\text{Ca}_2\text{Sr}(\text{C}_3\text{H}_5\text{O}_2)_6$	1.4871, 1.4956
sulfide (oldhamite).....	CaS	2.137
sulfite.....	$\text{CaSO}_3 \cdot 2\text{H}_2\text{O}$	1.590, 1.595, 1.628
thiosulfate.....	$\text{CaS}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$	1.545, 1.560, 1.605
Carbon dioxide (liq.).....	CO_2	1.195 ¹⁵
Cerium dithionate.....	$\text{Ce}_2(\text{S}_2\text{O}_6)_3 \cdot 15\text{H}_2\text{O}$	β 1.507
Cesium perchlorate.....	CsClO_4	1.4752, 1.4788, 1.4804
nitrate.....	CsNO_3	1.55, 1.56
selenate.....	Cs_2SeO_4	1.5989, 1.5999, 1.6003
thallium chloride.....	$\text{Cs}_2\text{Tl}_2\text{Cl}_9$	1.784, 1.774
Chromium cesium sulfate.....	$\text{CrCs}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	1.4810
oxide (ic).....	Cr_2O_3	2.5
potassium cyanide (ic).....	$\text{CrK}_3(\text{CN})_6$	1.5221, 1.5244, 1.5373
sulfate (ic).....	$\text{Cr}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$	1.564
thallium sulfate.....	$\text{CrTl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	1.5228
Cobalt acetate.....	$\text{Co}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 4\text{H}_2\text{O}$	β 1.542
aluminate (Thenard's Blue).....	$\text{Co}(\text{AlO}_2)_2$	> 1.78 (red), 1.74 (blue)
ammonium selenate.....	$\text{CoSeO}_4 \cdot (\text{NH}_4)_2\text{SeO}_4 \cdot 6\text{H}_2\text{O}$	1.5246, 1.5311, 1.5396
cesium sulfate.....	$\text{CoCs}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	1.5057, 1.5085, 1.5132
chloride (ous).....	$\text{CoCl}_2 \cdot 2\text{H}_2\text{O}$	< 1.625, < 1.671, > 1.67
potassium selenate.....	$\text{CoSeO}_4 \cdot \text{K}_2\text{SeO}_4 \cdot 6\text{H}_2\text{O}$	1.5135, 1.5195, 1.5358
rubidium sulfate.....	$\text{CoSO}_4 \cdot \text{Rb}_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$	1.4859, 1.4916, 1.5014
selenate.....	$\text{CoSeO}_4 \cdot 6\text{H}_2\text{O}$	β 1.5225, γ 1.5227
Copper ammonium selenate.....	$\text{CuSeO}_4 \cdot (\text{NH}_4)_2\text{SeO}_4 \cdot 6\text{H}_2\text{O}$	1.5213, 1.5355, 1.5395
ammonium sulfate.....	$\text{CuSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$	1.4910, 1.5007, 1.5054
cesium sulfate.....	$\text{CuSO}_4 \cdot \text{Cs}_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$	1.5048, 1.5061, 1.5153
chloride (ic).....	$\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$	1.644, 1.684, 1.742
formate.....	$\text{Cu}(\text{CHO}_2)_2 \cdot 4\text{H}_2\text{O}$	1.4133, 1.5423, 1.5571

INDEX OF REFRACTION (Continued)

INORGANIC COMPOUNDS (Continued)

Name	Formula	Index
Copper oxide (ous) (cuprite).....	Cu ₂ O	2.705
potassium chloride.....	CuCl ₂ .2KCl.2H ₂ O	1.6365, 1.6148
“ cyanide (ous).....	CuK ₃ (CN) ₄	1.5215
“ selenate.....	CuSeO ₄ .K ₂ SeO ₄ .6H ₂ O	1.5096, 1.5235, 1.5387
“ sulfate.....	CuSO ₄ .K ₂ SO ₄ .6H ₂ O	1.4836, 1.4864, 1.5020
strontium formate.....	Cu(HCO ₂) ₂ .2[Sr(HCO ₂) ₂] 8H ₂ O	1.4995, 1.5199, 1.5801
sulfate (ic).....	CuSO ₄	1.724, 1.733, 1.739
Cyanogen.....	C ₂ N ₂	1.3271 ¹ (lq.)
Germanium bromide, tetra.....	GeBr ₄	1.6269
Gold sodium chloride.....	AuNaCl ₄ .2H ₂ O	α1.545, γ1.75+
Hafnium oxychloride.....	HfOCl ₂ .8H ₂ O	1.557, 1.543
Ice.....	H ₂ O	1.3049, 1.3062 (A), 1.3091, 1.3104 (D), 1.3133, 1.3147 (F)
Iron ammonium chloride.....	Fe(NH ₄) ₂ Cl ₄	1.6439
ammonium selenate.....	FeSeO ₄ .(NH ₄) ₂ SeO ₄ .6H ₂ O	1.5201, 1.5260, 1.5356
cesium sulfate (ic).....	FeCs(SO ₄) ₂ .12H ₂ O	1.4839
“ (ous).....	FeSO ₄ .Cs ₂ SO ₄ .6H ₂ O	1.5003, 1.5035, 1.5094
rubidium sulfate.....	FeRb(SO ₄) ₂ .12H ₂ O	1.48234
sulfate (ic).....	Fe ₂ (SO ₄) ₃	1.802, 1.814, 1.818
thallium sulfate.....	FeTl(SO ₄) ₂ .12H ₂ O	1.52365
Lanthanum sulfate.....	La ₂ (SO ₄) ₃ .9H ₂ O	1.564, 1.569
Lead orthoarsenate, di-.....	PbHASO ₄	1.8903, 1.9097, 1.9765
nitrate.....	Pb(NO ₃) ₂	1.782
Lithium ammonium sulfate.....	LiNH ₄ SO ₄	β1.437 (Li)
ammonium tartrate (d).....	LiNH ₄ (C ₄ H ₄ O ₆).H ₂ O	β1.567, γ1.5673
“ (dl).....	LiNH ₄ (C ₄ H ₄ O ₆).H ₂ O	β1.5287
bromide.....	LiBr	1.784
chloride.....	LiCl	1.662
dithionate.....	Li ₂ S ₂ O ₆ .2H ₂ O	1.5487, 1.5602, 1.5788
oxide.....	Li ₂ O	1.644
potassium sulfate.....	LiKSO ₄	1.4723, 1.4717
“ tartrate.....	LiK(C ₄ H ₄ O ₆).H ₂ O	β1.5226 (red)
rubidium tartrate (d).....	LiRb(C ₄ H ₄ O ₆).H ₂ O	β1.552
sodium tartrate (dl).....	LiNa(C ₄ H ₄ O ₆).2H ₂ O	β1.4904
Magnesium ammonium selenate.....	MgSeO ₄ .(NH ₄) ₂ SeO ₄ .6H ₂ O	1.5070, 1.5093, 1.5169
ammonium sulfate.....	Mg(NH ₄) ₂ (SO ₄) ₂ .6H ₂ O	1.4716, 1.4730, 1.4786
orthoborate.....	3MgO.B ₂ O ₃	1.6527, 1.6537, 1.6748
cesium sulfate.....	MgCs ₂ (SO ₄) ₂ .6H ₂ O	1.4857, 1.4858, 1.4916
chlorostannate.....	MgSnCl ₆ .6H ₂ O	1.5885, 1.5970
fluosilicate.....	MgSiF ₆ .6H ₂ O	1.3439, 1.3602
platinocyanide.....	MgPt(CN) ₄ .7H ₂ O	1.5608, 1.91
Magnesium potassium selenate.....	MgK ₂ (SeO ₄) ₂ .6H ₂ O	1.4969, 1.4991, 1.5139
potassium sulfate.....	MgK ₂ (SO ₄) ₂ .6H ₂ O	1.4607, 1.4629, 1.4755
rubidium sulfate.....	MgRb ₂ (SO ₄) ₂ .6H ₂ O	1.4672, 1.4689, 1.4779
silicate.....	MgSiO ₃	1.651, 1.654 (calc.), 1.660
sulfide.....	MgS	2.271 also 2.268
Manganese borate.....	Mn ₃ B ₄ O ₉	1.617, 1.738, 1.776
cesium sulfate.....	MnCs ₂ (SO ₄) ₂ .6H ₂ O	1.4946, 1.4966, 1.5025
chloride.....	MnCl ₂ .4H ₂ O	1.555, 1.575, 1.607
rubidium sulfate.....	MnRb ₂ (SO ₄) ₂ .6H ₂ O	1.4767, 1.4807, 1.4907
sulfate (ous).....	MnSO ₄ .4H ₂ O	1.508, 1.518, 1.522
“.....	MnSO ₄ .5H ₂ O	1.495, 1.508, 1.514
Mercury chloride (ic).....	HgCl ₂	1.725, 1.859, 1.965
cyanide (ic).....	Hg(CN) ₂	1.645, 1.492
iodide (ic) (red).....	HgI ₂	2.748, 2.455
Nickel ammonium selenate.....	Ni(NH ₄) ₂ (SeO ₄) ₂ .6H ₂ O	1.5291, 1.5372, 1.5466
cesium sulfate.....	NiCs ₂ (SO ₄) ₂ .6H ₂ O	1.5087, 1.5129, 1.5162

INDEX OF REFRACTION (Continued)

INORGANIC COMPOUNDS (Continued)

Name	Formula	Index
Nickel chloride.....	$\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$	α 1.535, γ 1.61
fluoride, acid.....	$\text{NiF}_2 \cdot 5\text{HF} \cdot 6\text{H}_2\text{O}$	1.392, 1.408
potassium selenate.....	$\text{NiK}_2(\text{SeO}_4)_2 \cdot 6\text{H}_2\text{O}$	1.5199, 1.5248, 1.5339
rubidium sulfate.....	$\text{NiRb}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	1.4895, 1.4961, 1.5052
selenate.....	$\text{NiSeO}_4 \cdot 6\text{H}_2\text{O}$	1.5393, 1.5125
Platinum potassium dibromonitrite.....	$\text{PtK}_2(\text{NO}_2)_2\text{Br}_2 \cdot \text{H}_2\text{O}$	1.626, 1.6684, 1.757
Potassium carbonate.....	K_2CO_3	1.426, 1.531, 1.541
carbonate, acid.....	KHCO_3	1.380, 1.482, 1.578
perchlorate.....	KClO_4	1.4731, 1.4737, 1.4769
chloroplatinate.....	K_2PtCl_6	1.327 (577 $\text{m}\mu$)
chloroplatinite.....	K_2PtCl_4	1.64, 1.67
dichromate.....	$\text{K}_2\text{Cr}_2\text{O}_7$	1.7202, 1.7380, 1.8197
cyanide.....	KCN	1.410
fluoborate.....	KBF_4	1.3239, 1.3245, 1.3247
fluoride.....	KF	1.352 (1.361)
".....	$\text{KF} \cdot 2\text{H}_2\text{O}$	1.345, 1.352, 1.363
fluosilicate.....	K_2SiF_6	1.3391
periodate.....	KIO_4	1.6205, 1.6479
lithium ferrocyanide.....	$\text{K}_2\text{Li}_2\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$	1.5883, 1.6007, 1.6316
hypophosphate.....	$\text{K}_2\text{H}_2\text{P}_2\text{O}_6 \cdot 2\text{H}_2\text{O}$	1.4893, 1.5314, 1.5363
".....	$\text{K}_2\text{H}_2\text{P}_2\text{O}_6 \cdot 3\text{H}_2\text{O}$	1.4768, 1.4843, 1.4870
ruthenium cyanide.....	$\text{K}_4\text{Ru}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$	β 1.5837
silicate.....	K_2SiO_3	1.520, 1.521, 1.528
thiocyanate.....	KCNS	1.532, 1.660, 1.730
thionate, tetra-.....	$\text{K}_2\text{S}_4\text{O}_6$	1.5896, 1.6057, 1.6435
" penta-.....	$2\text{K}_2\text{S}_5\text{O}_6 \cdot 3\text{H}_2\text{O}$	1.565, 1.63, 1.655
Rhodium cesium sulfate.....	$\text{RhCs}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	1.5077
Rubidium perchlorate.....	RbClO_4	1.4692, 1.4701, 1.4731
chromate.....	Rb_2CrO_4	β 1.71, γ 1.72
dithionate.....	$\text{Rb}_2\text{S}_2\text{O}_6$	1.4574, 1.5078
fluoride.....	RbF	1.396
selenate.....	Rb_2SeO_4	1.5515, 1.5537, 1.5582
Ruthenium sodium nitrate.....	$\text{RuNa}_2(\text{NO}_2)_5 \cdot 2\text{H}_2\text{O}$	1.5889, 1.5943, 1.7163
Selenium oxide.....	SeO_2	> 1.76
Silver cyanide.....	AgCN	1.685, 1.94
nitrate.....	AgNO_3	1.729, 1.744, 1.783
phosphate.....	Ag_2HPO_4	1.8036, 1.7983
potassium cyanide.....	$\text{AgK}(\text{CN})_2$	1.625, 1.63
Sodium ammonium tartrate (d).....	$\text{NaNH}_4(\text{C}_4\text{H}_4\text{O}_6) \cdot 4\text{H}_2\text{O}$	1.495, 1.498, 1.499
ammonium tartrate (dl).....	$\text{NaNH}_4(\text{C}_4\text{H}_4\text{O}_6) \cdot \text{H}_2\text{O}$	β 1.473 (red)
orthoarsenate.....	$\text{NaH}_2\text{AsO}_4 \cdot \text{H}_2\text{O}$	1.5382, 1.5535, 1.5607
".....	$\text{NaH}_2\text{AsO}_4 \cdot 2\text{H}_2\text{O}$	1.4794, 1.5021, 1.5265
bromide.....	NaBr	1.6412
carbonate.....	Na_2CO_3	1.415, 1.535, 1.546
Sodium carbonate, acid.....	NaHCO_3	1.376, 1.500, 1.582
cyanide.....	NaCN	1.452
iodide.....	NaI	1.7745
molybdate.....	$3\text{Na}_2\text{O} \cdot 0.7\text{MoO}_3 \cdot 22\text{H}_2\text{O}$	β 1.627
nitrate.....	NaNO_3	1.5874, 1.3361
phosphate.....	$\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$	1.4401, 1.4629, 1.4815
".....	$\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$	1.4412, 1.4424, 1.4526
hypophosphate.....	$\text{Na}_3\text{HP}_2\text{O}_6 \cdot 9\text{H}_2\text{O}$	1.4653, 1.4738, 1.4804
silicate.....	$\text{Na}_2\text{Si}^{\text{IV}}\text{O}_3$	1.513, 1.520, 1.528
sulfate, acid.....	$\text{NaHSO}_4 \cdot \text{H}_2\text{O}$	1.43, 1.46, 1.47
sulfite.....	Na_2SO_3	1.565, 1.515
" acid.....	NaHSO_3	1.474, 1.526, 1.685
tartrate, acid (d).....	$\text{NaH}(\text{C}_4\text{H}_4\text{O}_6) \cdot \text{H}_2\text{O}$	β 1.533
thiocyanate.....	NaCNS	1.545, 1.625, 1.695

INDEX OF REFRACTION (Continued)

INORGANIC COMPOUNDS (Continued)

Name	Formula	Index
Sodium tungstate.....	$\text{Na}_2\text{WO}_4 \cdot 2\text{H}_2\text{O}$	1.5526, 1.5533, 1.5695
vanadate.....	$\text{Na}_3\text{VO}_4 \cdot 10\text{H}_2\text{O}$	1.5305; ω 1.5398, ϵ 1.5475
".....	$\text{Na}_3\text{VO}_4 \cdot 12\text{H}_2\text{O}$	1.5095, 1.5232
Strontium dichromate.....	$\text{SrCr}_2\text{O}_7 \cdot 3\text{H}_2\text{O}$	1.7146, 1.7174, 1.812
fluoride.....	SrF_2	1.442 (1.438)
oxide.....	SrO	1.870
orthophosphate, acid.....	SrHPO_4	1.608, 1.62 \pm , 1.625
sulfide, mono.....	SrS	2.107
Sulfur nitride.....	S_4N_4	α 1.908, β 2.046
Thallium chloride, mono.....	TlCl	2.247
iodide, mono.....	TlI	2.78
Tin iodide (ic).....	SnI_4	2.106
Uranyl potassium sulfate.....	$\text{UO}_2 \cdot \text{SO}_4 \cdot \text{K}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$	1.5144, 1.5266, 1.5705 (580 $m\mu$)
Vanadium ammonium sulfate....	$\text{VNH}_4(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	1.475
Zinc ammonium selenate.....	$\text{Zn}(\text{SeO}_4) \cdot (\text{NH}_4)_2\text{SeO}_4 \cdot 6\text{H}_2\text{O}$	1.5240, 1.5300, 1.5385
bromate.....	$\text{Zn}(\text{BrO}_3)_2 \cdot 6\text{H}_2\text{O}$	1.5452
cesium sulfate.....	$\text{ZnCs}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	1.5022, 1.5048, 1.5093
chloride.....	ZnCl_2	1.687, 1.713
fluosilicate.....	$\text{ZnSiF}_6 \cdot 6\text{H}_2\text{O}$	1.3824, 1.3956
potassium cyanide.....	$\text{ZnK}_2(\text{CN})_4$	1.4115
" selenate.....	$\text{ZnK}_2(\text{SeO}_4)_2 \cdot 6\text{H}_2\text{O}$	1.5121, 1.5181, 1.5335
" sulfate.....	$\text{ZnK}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	1.4775, 1.4833, 1.4969
rubidium sulfate.....	$\text{ZnRb}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$	1.4833, 1.4884, 1.4975
silicate.....	ZnSiO_3	1.616, 1.62 \pm , 1.623
Zirconium ammonium fluoride....	$\text{Zr}(\text{NH}_4)_3\text{F}_7$	1.433

ORGANIC COMPOUNDS

See also under Physical Constants of Organic Compounds.

Name	Index
Allontoin, solid.....	α 1.579, γ 1.660
Dimethyl thiophene (α , α'), liq.....	1.51693 ^{13.4} (He)
" (β , β'), liq.....	1.52217 ¹⁵ (He)
Ethyl carbylamine, liq.....	1.3659 ²⁴
Ethylidene cyanhydrin, liq.....	1.40582 ^{12.6}
Hexyl acetylene (n), liq.....	1.4208 ^{12.6}

MISCELLANEOUS

Albite glass.....	1.4890	Magdala red.....	1.90
Amber.....	1.546	Obsidian.....	1.482-1.496
Anorthite glass.....	1.5755	Paraffin.....	1.43295 ^{28.3} (C)
Asphalt.....	1.635	Quartz, fused.....	1.45640 (656 $m\mu$)
Bell metal.....	1.0052		1.45843 (589 $m\mu$)
Borax, amorphous, fused.....	1.4630		1.46190 (509 $m\mu$)
Canada balsam.....	1.530		1.47503 (361 $m\mu$)
Ebonite.....	1.66 (red)		1.49634 (275 $m\mu$)
Fuchsin.....	2.70		1.53386 (214 $m\mu$)
Gelatin, Nelson's No. 1.....	1.530		1.57464 (185 $m\mu$)
Gelatin, various.....	1.516-1.534	Resin, aloes.....	1.619 (red)
Gum Arabic.....	1.480 (1.514) (red)	colophony.....	1.548 (red)
Hoffman's violet.....	2.20	copal.....	1.528 (red)
Ivory.....	1.539, 1.541	mastic.....	1.535 (red)
		Peru balsam.....	1.593

MOLECULAR REFRACTION

The molecular refraction of a substance may be computed by the following relation,—

$$N = \frac{M(n^2 - 1)}{d(n^2 + 2)}$$

where N is the molecular refraction for a specified wave length and temperature, M , the molecular weight, d , the density and n the refractive index for the specified conditions.

LIQUIDS FOR INDEX BY IMMERSION METHOD

Liquid	N_D 24° C
Trimethylene chloride.....	1.446
Cineole.....	1.456
Hexahydrophenol.....	1.466
Decahydronaphthalene.....	1.477
Isoamylphthalate.....	1.486
Tetrachloroethane.....	1.492
Pentachloroethane.....	1.501
Trimethylene bromide.....	1.513
Chlorobenzene.....	1.523
Ethylene bromide + Chlorobenzene.....	1.533
<i>o</i> -Nitrotoluene.....	1.544
Xylidine.....	1.557
<i>o</i> -Toluidine.....	1.570
Aniline.....	1.584
Bromoform.....	1.595
Iodobenzene + Bromobenzene.....	1.603
Iodobenzene + Bromobenzene.....	1.613
Quinoline.....	1.622
α -Chloronaphthalene.....	1.633
α -Bromonaphthalene + α -Chloronaphthalene.....	1.640-1.650
α -Bromonaphthalene + α -Iodonaphthalene.....	1.660-1.690
Methylene iodide + Iodobenzene.....	1.700-1.730
Methylene iodide.....	1.738
Methylene iodide saturated with sulfur.....	1.78
Yellow phosphorus, sulfur and methylene iodide (8:1:1 by weight).....	2.06
Can be diluted with methylene iodide to cover range 1.74-2.06. For precautions in use, cf. West, Am. Mineral, 21, p. 245-9 (1936).	

HEAVY LIQUIDS FOR MINERAL SEPARATION

Liquid	Density
Tetrabromethane (sym.).....	2.964, 20°/4°
Can be diluted with carbon tetrachloride (1.595) or benzene (0.894).	
Methylene iodide.....	3.325, 20°/4°
Can be diluted with carbon tetrachloride or benzene.	
Thallium formate, aq.....	3.5
Can be diluted with water.	4.9
Thallium malonate-thallium formate, aq.....	
Can be diluted with water.	

For preparation and recovery of these liquids, cf. U. S. Bureau Mines, Rept. Inv. #2897 (1928).

INDEX OF REFRACTION OF WATER

Alcohol and Carbon Bisulfide*

For sodium light, $\lambda = .5893$

Temp. °C	Water, pure relative to air	Ethyl Alcohol 99.8 relative to air	Carbon Bisulfide relative to air
14	1.33348	.....	.....
15	1.33341	.....	1.62935
16	1.33333	1.36210	1.62858
18	1.33317	1.36129	1.62704
20	1.33299	1.36048	1.62546
22	1.33281	1.35967	1.62387
24	1.33262	1.35885	1.62226
26	1.33241	1.35803	1.62064
28	1.33219	1.35721	1.61902
30	1.33192	1.35639	1.61740
32	1.33164	1.35557	1.61577
34	1.33136	1.35474	1.61413
36	1.33107	1.35390	1.61247
38	1.33079	1.35306	1.61080
40	1.33051	1.35222	1.60914
42	1.33023	1.35138	1.60748
44	1.32992	1.35054	1.60582
46	1.32959	1.34969	.....
48	1.32927	1.34885	.....
50	1.32894	1.34800	.....
52	1.32860	1.34715	.....
54	1.32827	1.34629	.....
56	1.32792	1.34543	.....
58	1.32755	1.34456	.....
60	1.32718	1.34368	.....
62	1.32678	1.34279	.....
64	1.32636	1.34189	.....
66	1.32596	1.34096	.....
68	1.32555	1.34004	.....
70	1.32511	1.33912	.....
72	1.32466	1.33820	.....
74	1.32421	1.33728	.....
76	1.32376	1.33626	.....
78	1.32332	.....	.....
80	1.32287	.....	.....
82	1.32241	.....	.....
84	1.32195	.....	.....
86	1.32148	.....	.....
88	1.32100	.....	.....
90	1.32050	.....	.....
92	1.32000	.....	.....
94	1.31949	.....	.....
96	1.31897	.....	.....
98	1.31842	.....	.....
100	1.31783	.....	.....

ABSOLUTE INDEX FOR PURE WATER FOR SODIUM LIGHT

Temperature	Index	Temperature	Index
15° C.	1.33377	60° C.	1.32754
20	1.33335	65	1.32652
25	1.33287	70	1.32547
30	1.33228	75	1.32434
35	1.33157	80	1.32323
40	1.33087	85	1.32208
45	1.33011	90	1.32086
50	1.32930	95	1.31959
55	1.32846	100	1.31819

INDEX OF REFRACTION OF GLASS RELATIVE TO AIR

Variety.	Wave length in microns.							
	.361	.434	.486	.589 (Na)	.656	.768	1.20	2.00
Zinc crown.....	1.539	1.528	1.523	1.517	1.514	1.511	1.505	1.497
Higher dispersion crown	1.546	1.533	1.527	1.520	1.517	1.514	1.507	1.497
Light flint.....	1.614	1.594	1.585	1.575	1.571	1.567	1.559	1.549
Heavy flint.....	1.705	1.675	1.664	1.650	1.644	1.638	1.628	1.617
Heaviest flint.....	...	1.945	1.919	1.890	1.879	1.867	1.848	1.832

INDEX OF REFRACTION OF ROCK SALT, SYLVINE, CALCITE, FLUORITE AND QUARTZ (Compiled from data of Martens, Paschen, and others.)

Wave length.	Rock salt.	Sylvine, KCl.	Fluorite.	Calcsp., ordinary ray.	Calcsp., extraordinary ray.	Quartz, ordinary ray.	Quartz, extraordinary ray.
0.185	1.893	1.827	.....	.....	.....	1.676	1.690
0.198	.....	.....	1.496	.....	1.578	1.651	1.664
0.340	.....	.....	.....	1.701	1.506	1.567	1.577
0.589	1.544	1.490	1.434	1.658	1.486	1.544	1.553
0.760	.....	.....	1.431	1.650	1.483	1.539	1.548
0.884	1.534	1.481	1.430	.....	.....	.....	.....
1.179	1.530	1.478	1.428	.....	.....	.....	.....
1.229	.....	.....	.....	1.639	1.479	.....	.....
2.324	.....	.....	.....	.....	1.474	1.516	.....
2.357	1.526	1.475	1.421	.....	.....	.....	.....
3.536	1.523	1.473	1.414	.....	.....	.....	.....
5.893	1.516	1.469	1.387	.....	.....	.....	.....
8.840	1.502	1.461	1.331	.....	.....	.....	.....

INDEX OF REFRACTION OF GLASS

INDEX OF REFRACTION OF GLASS

Index of refraction of optical glass made at the Bureau of Standards.
Composition refers to the raw material combined, not to the finished glass.

Composition	Ordinary Crown	Borosilicate Crown	Barium flint	Light Barium flint	Light flint	Dense barium flint	Medium flint	Dense flint
(Composition percentage)								
SiO ₂	67.0	64.2	53.7	48.0	53.9	37.0	45.6	39.0
Na ₂ O.....	12.0	9.4	1.7	2.0	1.0	2.7	3.4	3.0
K ₂ O.....	5.0	8.3	8.3	6.1	7.6	5.0	4.1	4.0
B ₂ O ₃	3.5	11.0	2.7	4.0	.....	47.0	.....	.....
BaO.....	10.6	6.1	14.3	29.5	.....	7.7	.....	.....
ZnO.....	1.5	.....	2.5	10.0	.....	.....	.....	.....
As ₂ O ₃	0.4	0.4	.....	1.4	0.3	.....	.....	.....
CaO.....	.....	1.0	.....	.....	2.0	.....	3.0	4.0
PbO.....	.....	.....	16.7	.....	35.2	.....	44.0	49.0
Sb ₂ O ₃.....	.....	.....	.....	.....	.....	.....	.....	1.0
(Index of Refraction)								
Wave length, Å								
Hg 4046.8.....	1.53189	1.53817	1.58851	1.59137	1.60507	1.63675	1.65788	1.69005
Hg 4047.1.....	1.53147	1.53775	1.58791	1.59084	1.60430	1.63619	1.65692	1.68894
H 4340.7.....	1.52818	1.53468	1.58327	1.58698	1.59860	1.63189	1.64973	1.68079
Hg 4358.6.....	1.52798	1.53450	1.58299	1.58674	1.59826	1.63163	1.64931	1.68030
H 4861.5.....	1.52326	1.53008	1.57646	1.58121	1.59029	1.62548	1.63941	1.66911
Hg 4916.4.....	1.52283	1.52967	1.57587	1.58071	1.58958	1.62492	1.63854	1.66814
Hg 5461.0.....	1.51929	1.52633	1.57105	1.57657	1.58380	1.62033	1.63143	1.66016
Hg 5769.6.....	1.51771	1.52484	1.56894	1.57473	1.58128	1.61829	1.62834	1.65671
Hg 5790.5.....	1.51760	1.52475	1.56881	1.57460	1.58112	1.61817	1.62815	1.65650

INDEX OF REFRACTION OF GLASS (Continued)

Index of refraction of optical glass made at the Bureau of Standards.
Composition refers to the raw material combined, not to the finished glass.

(Index of Refraction) Continued

Wave Length, Å	Ordinary Crown	Borosilicate Crown	Barium flint	Light Barium flint	Light flint	Dense barium flint	Medium flint	Dense flint
Na 5893.2.....	1.51714	1.52430	1.56819	1.57406	1.58038	1.61756	1.62725	1.65548
Hg 6234.6.....	1.51573	1.52297	1.56634	1.57242	1.57818	1.61576	1.62458	1.65250
H 6563.0.....	1.51458	1.52188	1.56482	1.57107	1.57638	1.61427	1.62241	1.65007
Li 6708.2.....	1.51412	1.52145	1.56423	1.57054	1.57567	1.61369	1.62157	1.64913
K 7682.0.....	1.51160	1.51908	1.56100	1.56762	1.57183	1.61047	1.61701	1.64405
Dispersion								
n_D	1.51714	1.52430	1.56819	1.57406	1.58038	1.61756	1.62725	1.65548
$n_F - n_C$	0.00808	0.00820	0.01164	0.01014	0.01391	0.01121	0.01700	0.01904
$n_D - 1$	59.6	63.9	48.8	56.6	41.7	55.1	36.9	34.4
$n_F - n_C$								
$n_D - n_F$	0.00612	0.00578	0.00827	0.00715	0.00991	0.00792	0.01216	0.01363
$n_F - n_D'$	0.00492	0.00460	0.00681	0.00577	0.00831	0.00641	0.01032	0.01168
$n_D - n_C$	0.00256	0.00242	0.00337	0.00299	0.00400	0.00329	0.00484	0.00541

OPTICAL CONSTANTS OF METALS

The following table gives the refractive index n , the absorption index k , the angle of principle incidence ϕ , the angle of principle azimuth ψ and the percent of light reflected R .

The reduction of amplitude of the wave of the wave length λ after traveling any distance d in the medium is given by the ratio $1 : e^{\frac{2\pi dk}{\lambda}}$. $\bar{\phi}$ is the angle of incidence for which the phase change between the two rectangular components vibrating in and normal to the plane of incidence is 90° . $\bar{\psi}$ is the azimuth at which circularly polarized light results. These quantities are connected by the following relations

$$k = \tan 2\bar{\psi}(1 - \cot^2 \bar{\phi}), \quad n = \frac{\sin \bar{\phi} \tan \bar{\phi}}{(1+k^2)^{\frac{1}{2}}} (1 + \frac{1}{2} \cot^2 \bar{\phi})$$

Metal	λ	$\bar{\phi}$	$\bar{\psi}$	Computed				Authority
				n	k	nk	R	
	μ	$^\circ$	$^\circ$					
Aluminum.....	0.589	.....	.....	1.44	.....	5.32	83.	Drude
Antimony.....	.589	.....	.....	3.04	.....	4.94	70.	"
Bismuth (prism) white	.....	.....	.....	2.26	.....	.....	.....	Kundt, 1889
Bronze.....	.527	.....	.....	1.18	.....	.....	.....	Jamin
	.589	.....	.....	1.12	.....	.....	.....	"
Cadmium.....	.589	.....	.....	1.13	.....	5.01	85.	Drude
Chromium.....	.579	.....	.....	2.97	.....	4.85	70.	Wartenburg, 1910
Cobalt.....	0.231	64 31	29 39	1.10	1.30	1.43	32.	Minor
	.275	70 22	29 59	1.41	1.52	2.14	46.	"
	.500	77 5	31 53	1.93	1.93	3.72	66.	"
	.650	79 0	31 25	2.35	1.87	4.40	69.	Ingersoll
	1.00	81 45	29 6	3.63	1.58	5.73	73.	"
	1.50	83 21	26 18	5.22	1.29	6.73	75.	"
	2.25	83 48	26 5	5.65	1.27	7.18	76.	"
Columbium.....	.579	.....	.....	1.80	.....	2.11	41.	Wartenburg, 1910
Copper.....	.231	65 57	26 14	1.39	1.05	1.45	29.	Minor
	.347	65 6	28 16	1.19	1.23	1.47	32.	"
	.500	70 44	33 46	1.10	2.13	2.34	56.	"
	.650	74 16	41 30	0.44	7.4	3.26	86.	Ingersoll
	.870	78 40	42 30	0.35	11.0	3.85	91.	"
	1.75	84 4	42 30	0.83	11.4	9.46	96.	"
	2.25	85 13	42 30	1.03	11.4	11.7	97.	"
	4.00	87 20	42 30	1.87	11.4	21.3	.....	Först-Fréed
	5.50	88.00	41 50	3.16	9.0	28.4	.....	"
Gold.....	.257	.....	.....	0.92	.....	1.14	28.	Meier, 1903
Electrolytic....	.441	.....	.....	1.18	.....	1.85	42.	"
	.589	.....	.....	0.47	.....	2.83	82.	"
	1.00	81 45	44 00	0.24	28.0	6.7	.....	Först-Fréed
	2.00	85 30	43 56	0.47	26.7	12.5	.....	"
	3.00	87 05	43 50	0.80	24.5	19.6	.....	"
	5.00	88 15	43 25	1.81	18.1	33.	.....	"
Iodine.....	.589	.....	.....	3.34	.....	0.57	30.	Meier, 1903
Iridium.....	.579	.....	.....	2.13	.....	4.87	75.	Wartenburg, 1916
	1.00	82 10	29 15	3.85	1.60	6.2	.....	Först-Fréed
	2.00	83 10	29 40	4.30	1.66	7.1	.....	"
	3.00	81 40	30 40	3.33	1.79	6.0	.....	"
	5.00	79 00	32 20	2.27	2.03	4.6	.....	"
Iron.....	.257	.....	.....	1.01	0.88	.....	16.	Meier, 1903
	.441	.....	.....	1.28	1.37	.....	28.	"
	.589	.....	.....	1.51	1.63	.....	33.	"

OPTICAL CONSTANTS OF METALS

(Continued)

Metal	λ	ϕ	ψ	Computed				Authority
				n	k	nk	R	
	μ	° ,	° ,					
Lead.....	.589	.....	.....	2.01	.....	3.48	62.	Drude
Magnesium.....	.589	.....	.....	0.37	.....	4.42	93.	"
Manganese.....	.579	.....	.....	2.49	.....	3.89	64.	Wartenburg, 1910
Mercury (liq.)..	.326	.....	.....	0.68	.....	2.26	66.	Meier, 1903
	.441	.....	.....	1.01	.....	3.42	74.	"
	.589	.....	.....	1.62	.....	4.41	75.	"
	.668	.....	.....	1.72	.....	4.70	77.	"
Nickel.....	0.420	72 20	31 42	1.41	1.79	2.53	54.	Tool
	0.589	76 13	41 41	1.79	1.86	3.33	62.	Drude
	0.750	78 45	32 6	2.19	1.99	4.36	70.	Ingersoll
	1.00	80 33	32 2	2.63	2.00	5.26	74.	"
	2.25	84 21	33 30	3.95	2.33	9.20	85.	"
	.275	.....	.....	1.09	1.16	.....	24.	Meier, 1903
	.441	.....	.....	1.16	1.23	.....	25.	"
	.589	.....	.....	1.30	1.97	.....	43.	"
Platinum.....	1.00	75 30	37 00	1.14	3.25	3.7	.....	Försr-Fréed
	2.00	74 30	39 50	0.70	5.06	3.5	.....	"
	3.00	73 50	41 00	0.52	6.52	3.4	.....	"
	5.00	72 00	42 10	0.34	9.01	3.1	.....	"
Electrolytic....	.257	.....	.....	1.17	1.65	.....	37.	Meier, 1903
	.441	.....	.....	1.84	.....	3.16	58.	"
	.589	.....	.....	2.63	.....	3.54	59.	"
	.668	.....	.....	2.91	.....	3.66	59.	"
Potassium.....	.665	65 27	43 56	.066	26.8	.....	93.8	Duncan, 1913
	.589	62 58	43 42	.068	22.1	.....	92.	"
	.472	57 9	43 0	.070	14.3	.....	86.9	"
	.546	.....	.....	1.09	1.16	.....	24.	Morgan, 1922
Rhodium.....	.579	.....	.....	1.54	.....	4.67	78.	Wartenburg, 1910
Selenium.....	.400	.....	.....	2.94	2.31	.....	44.	Wood
	.490	.....	.....	3.12	1.49	.....	35.	"
	.589	.....	.....	2.93	0.45	.....	25.	"
	.760	.....	.....	2.60	0.06	.....	20.	"
Silicon, 95%....	pure	.....	.....	.....	.....	.....	.....	.....
	.579	75 38	.....	3.87	0.116	.....	35.7	Wartenburg, 1910
	.589	.....	.....	4.18	0.09	.....	38.	Ingersoll
	1.25	.....	.....	3.67	0.08	.....	33.	"
	2.25	.....	.....	3.53	0.08	.....	31.	"
99.75% pure...	0.589	76 45	.....	4.24	0.118	.....	37.8	Littleton, 1912
Silver.....	0.226	62 41	22 16	1.41	0.75	1.11	18.	Minor
	.293	63 14	18 56	1.57	0.62	0.97	17.	"
	.316	52 28	15 38	1.13	0.38	0.43	4.	"
	.332	52 13	7 2	0.41	1.61	0.65	32.	"
	.395	66 36	43 6	0.16	12.32	1.91	87.	"
	.500	72 31	43 29	0.17	17.1	2.94	93.	"
	.589	75 35	43 47	0.18	20.6	3.64	95.	"
	.750	79 26	44 6	0.17	30.7	5.16	97.	Ingersoll
	1.00	82 0	44 2	0.24	29.0	6.96	98.	"
	1.50	84 42	43 48	0.45	23.7	10.7	98.	"
	2.25	86 18	43 34	0.77	19.9	15.4	99.	"
	3.00	87 10	42 40	1.65	12.2	20.1	.....	Försr-Fréed
	4.50	88 20	41 10	4.49	7.42	33.3	.....	"
sodium.....	.665	72 11	44 29	0.051	55.0	.....	97.7	Duncan, 1913
	.589	68 51	44 29	.044	55.0	.....	97.1	"
	.546	68 48	44 20	.052	42.6	.....	96.5	"

OPTICAL CONSTANTS OF METALS

(Continued)

Metal	λ	ϕ	ψ	Computed				Authority
				n	k	nk	R	
	μ	° ,	° ,					
Sodium .....	.472	66 29	44 9	.057	33.3	.....	95.2	Duncan, 1913
	.435	66 0	44 6	.058	31.7	.....	94.8	"
(liq.) .....	.589	.....	.....	.004	.....	2.61	99.	Drude
(solid) .....	.546	.....	.....	.047	47.3	.....	96.9	Morgan, 1922
Sodium-Potassium								
17.3% K.....	.546	.....	.....	.081	27.2	.....	94.6	"
45. % K.....	.546	.....	.....	1.08	16.8	.....	90.4	"
66. % K.....	.546	.....	.....	.137	12.5	.....	87.0	"
74.2% K.....	.546	.....	.....	.124	12.8	.....	86.9	"
84.3% K.....	.546	.....	.....	.088	17.6	.....	90.2	"
Steel								
0.44% C.....	.589	77 15	.....	2.50	1.30	.....	57.4	Littleton, 1912
1.28% C.....	.589	77 22	.....	2.66	1.28	.....	57.5	"
3.5 % C.....	.589	77 35	.....	2.77	1.23	.....	57.0	"
	0.226	66 51	28 17	1.30	1.26	1.64	35.	Minor
	.257	68 35	28 45	1.38	1.35	1.86	40.	"
	.325	69 57	30 9	1.37	1.53	2.09	45.	"
	.500	75 47	29 2	2.09	1.50	3.14	57.	"
	.650	77 48	27 9	2.70	1.33	3.59	59.	Ingersoll
	1.50	81 48	28 51	3.71	1.55	5.75	73.	"
	2.25	83 22	30 36	4.14	1.79	7.41	80.	"
Tantalum.....	.579	.....	.....	2.05	.....	2.31	44.	Wartenburg
Tellurium								
axis horizontal	.590	.....	.....	3.07	.563	.....	34.	Van Dyke, 1922
axis vertical....	.590	.....	.....	2.68	.632	.....	30.	Van Dyke, 1922
Tin.....	.589	.....	.....	1.48	.....	5.25	82.	Drude
Tungsten.....	.579	76 0	.....	2.76	0.98	.....	48.6	Wartenburg
	.589	78 31	.....	3.46	0.94	.....	54.5	Littleton, 1912
Vanadium.....	.579	.....	.....	3.03	.....	3.51	58.	"
Zinc.....	.257	.....	.....	0.55	.....	0.61	20.	Meier, 1903
	.441	.....	.....	0.93	.....	3.19	73.	"
	.589	.....	.....	1.93	.....	4.66	74.	"
	.668	.....	.....	2.62	.....	5.08	73.	"

DISPERSION

The dispersion for various types of optical glass is shown in the following table. n_D = index of refraction for the D line (of the solar spectrum) and n_F and n_C the index for the F and C lines respectively ($n_F - n_C$) shows the dispersion for these two wave lengths.

Glass.	n_D	$(n_F - n_C)$
Light phosphate crown.....	1.5159	.00737
Barium-silicate crown.....	1.5399	.00909
High-dispersion crown.....	1.5262	.01026
Borate flint.....	1.5686	.01102
Extra light flint.....	1.5398	.01142
Heavy flint.....	1.7174	.02434
Heaviest flint.....	1.9626	.04882

INDEX OF REFRACTION, AQUEOUS SOLUTIONS

Substance	Density	Temp. °C	Index for $\lambda = .5893$ (Na)	Observer
Ammonium chloride.....	1.067	27.05	1.379	Willigen
Ammonium chloride.....	1.025	29.75	1.351	Willigen
Calcium chloride.....	1.398	25.65	1.443	Willigen
Calcium chloride.....	1.215	22.9	1.397	Willigen
Calcium chloride.....	1.143	25.8	1.374	Willigen
Hydrochloric acid.....	1.166	20.75	1.411	Willigen
Nitric acid.....	1.359	18.75	1.402	Willigen
Potash (caustic).....	1.416	11.0	1.403	Frauenhofer
Potassium chloride.....	Normal solution		1.343	Bender
Potassium chloride.....	Double normal		1.352	Bender
Potassium chloride.....	Triple normal		1.360	Bender
Soda (caustic).....	1.376	21.6	1.413	Willigen
Sodium chloride.....	1.189	18.07	1.378	Schutt
Sodium chloride.....	1.109	18.07	1.360	Schutt
Sodium chloride.....	1.035	18.07	1.342	Schutt
Sodium nitrate.....	1.358	22.8	1.385	Willigen
Sulfuric acid.....	1.811	18.3	1.437	Willigen
Sulfuric acid.....	1.632	18.3	1.425	Willigen
Sulfuric acid.....	1.221	18.3	1.370	Willigen
Sulfuric acid.....	1.028	18.3	1.339	Willigen
Zinc chloride.....	1.359	26.6	1.402	Willigen
Zinc chloride.....	1.209	26.4	1.375	Willigen

INDEX OF REFRACTION OF FUSED QUARTZ

λ $m\mu$, 15° C	n , 18° C	λ $m\mu$, 15° C	n , 18° C
185.467	1.57436	434.047	1.46690
193.583	1.55999	435.834	1.46675
202.55	1.54727	467.815	1.46435
214.439	1.53386	479.991	1.46355
219.462	1.52907	486.133	1.46318
226.503	1.52308	508.582	1.46191
231.288	1.51941	533.85	1.46067
250.329	1.50745	546.072	1.46013
257.304	1.50379	589.29	1.45845
274.867	1.49617	643.847	1.45674
303.412	1.48594	656.278	1.45640
340.365	1.47867	706.520	1.45517
396.848	1.47061	794.763	1.45340
404.656	1.46968		

INDEX OF REFRACTION, GASES

Values are relative to a vacuum and for a temp. of 0° C. and 760 mm. pressure.

(From Smithsonian Tables)

Substance	Kind of light	Indices of refraction	Observer
Acetone.....	<i>D</i>	1.001079-1.001100	Perreau
Air.....	<i>D</i>	1.0002926	
Ammonia.....	white	1.000381-1.000385	
Ammonia.....	<i>D</i>	1.000373-1.000379	Rayleigh
Argon.....	<i>D</i>	1.000281	
Benzene.....	<i>D</i>	1.001700-1.001823	
Bromine.....	<i>D</i>	1.001132	Mascart
Carbon dioxide.....	white	1.000449-1.000450	
dioxide.....	<i>D</i>	1.000448-1.000454	
disulphide.....	white	1.001500	Dulong
disulphide.....	<i>D</i>	1.001478-1.001485	
monoxide.....	white	1.000340	
monoxide.....	white	1.000335	Mascart
Chlorine.....	white	1.000772	
Chlorine.....	<i>D</i>	1.000773	
Chloroform.....	<i>D</i>	1.001436-1.001464	Dulong
Cyanogen.....	white	1.000834	
Cyanogen.....	<i>D</i>	1.000784-1.000825	
Ethyl alcohol.....	<i>D</i>	1.000871-1.000885	
ether.....	<i>D</i>	1.001521-1.001544	
Helium.....	<i>D</i>	1.000036	
Hydrochloric acid.....	white	1.000449	Mascart
Hydrochloric acid.....	<i>D</i>	1.000447	
Hydrogen.....	white	1.000138-1.000143	
Hydrogen.....	<i>D</i>	1.000132	Burton
sulphide.....	<i>D</i>	1.000644	
sulphide.....	<i>D</i>	1.000623	
Methane.....	white	1.000443	Dulong
Methane.....	<i>D</i>	1.000444	
Methyl alcohol.....	<i>D</i>	1.000549-1.000623	
Methyl ether.....	<i>D</i>	1.000891	Mascart
Nitric oxide.....	white	1.000303	
Nitric oxide.....	<i>D</i>	1.000297	
Nitrogen.....	white	1.000295-1.000300	
Nitrogen.....	<i>D</i>	1.000296-1.000298	
Nitrous oxide.....	white	1.000503-1.000507	
Nitrous oxide.....	<i>D</i>	1.000516	Mascart
Oxygen.....	white	1.000272-1.000280	
Oxygen.....	<i>D</i>	1.000271-1.000272	
Pentane.....	<i>D</i>	1.001711	Mascart
Sulphur dioxide.....	white	1.000665	
Sulphur dioxide.....	<i>D</i>	1.000686	
Water.....	white	1.000261	Jamin
Water.....	<i>D</i>	1.000249-1.000259	

COEFFICIENT OF TRANSPARENCY OF UVIOI GLASS FOR THE ULTRA-VIOLET

For a thickness of 1 mm.

Wave length, mi- crons.....	0.280	0.309	0.325	0.346	0.361	0.383	0.397
Uviol crown.....	0.56	0.95	0.990	0.996	0.999	1.000	1.000

REFLECTION OF LIGHT BY GLASS IN AIR

The table gives the percentage R of light reflected by one surface of glass having a refractive index of 1.55 relative to air. The angle of incidence is i , and the angle of refraction is r . The two components of the polarized light are marked \parallel and \perp according to the electric vector of the vibration. (Computed according to Fresnel's formula.)

i	r	\parallel	\perp	R
0	0° 0'	4.65	4.65	4.65
10	6° 26'	4.84	4.47	4.66
20	12° 45'	5.45	3.92	4.68
30	18° 49'	6.64	3.00	4.82
40	24° 30'	8.77	1.75	5.26
50	29° 37'	12.54	0.46	6.50
60	33° 58'	19.35	0.12	9.73
70	37° 19'	31.99	4.00	18.00
80	39° 27'	55.74	23.34	39.54
90	40° 11'	100.00	100.00	100.00

REFLECTION BY TRANSPARENT MEDIA IN AIR

FOR NORMAL INCIDENCE

The table gives the per cent of the normally incident light which is reflected by transparent media of various indices of refraction. n = index of refraction, R = reflected light, i = angle of incidence = 0.

(Computed from Fresnel's formula.)

n	R	n	R	n	R
1.0	0.00	1.7	6.72	2.4	17.0
1.1	0.23	1.8	8.16	2.5	18.4
1.2	0.83	1.9	9.63	2.6	19.8
1.3	1.70	2.0	11.11	2.7	21.1
1.4	2.78	2.1	12.6	2.8	22.5
1.5	4.00	2.2	14.1	2.9	23.8
1.6	5.33	2.3	15.5	3.0	25.0

COEFFICIENT OF TRANSPARENCY OF GLASS FOR THE INFRA-RED

Normal incidence, thickness 1 cm.

Wave length, microns . . .	0.7	1.1	1.7	2.3	2.7	3.1
Crown, borate	1.00	.55	.21	.025	.04	
borosilicate . . . . .		.74	.61	.33	.034	.021
Flint, light	1.00	.91	.82	.45	.083	.019
heavy	1.00	1.00	1.00	1.00	.45	.019

INDEX OF REFRACTION OF AQUEOUS SOLUTIONS OF SUCROSE (CANE SUGAR)

The table gives the index of refraction for $\lambda = 0.5893$ of aqueous sugar solutions at 20°C from 0–85% sugar. Corrections for temperatures other than 20° are given at the end of the table.

Per cent sugar		.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
00.	1.3	330	331	333	334	336	337	338	340	341	342
1.		344	345	347	348	350	351	353	355	356	357
2.		359	361	362	363	365	367	368	369	371	373
3.		374	375	377	378	380	381	382	384	385	387
4.		388	389	391	393	394	395	397	399	400	401
5.		403	405	406	407	409	411	412	413	415	417
6.		418	419	421	423	424	425	427	429	430	431
7.		433	435	436	437	439	441	442	443	445	447
8.		448	450	451	453	454	456	458	459	461	462
9.		464	465	467	469	470	471	473	475	476	477
10.		479	481	482	483	485	487	488	489	491	493
11.		494	496	497	499	500	502	504	505	507	508
12.		510	512	513	515	516	518	520	521	523	524
13.		526	527	529	531	532	533	535	537	538	539
14.		541	543	544	546	547	549	551	552	554	555
15.		557	559	560	562	563	565	567	568	570	571
16.		573	575	576	578	580	582	583	585	587	588
17.		590	592	593	595	596	598	600	601	603	604
18.		606	608	609	611	612	614	616	617	619	620
19.		622	624	625	627	629	631	632	634	636	637
20.		639	641	642	644	645	647	649	650	652	653
21.		655	657	658	660	662	663	665	667	669	670
22.		672	674	675	677	679	681	682	684	686	687
23.		689	691	692	694	696	698	699	701	703	704
24.		706	708	709	711	713	715	716	718	720	721
25.		723	725	726	728	730	731	733	735	737	738
26.		740	742	744	745	747	749	751	753	754	756
27.		758	760	761	763	765	767	768	770	772	773
28.		775	777	779	780	782	784	786	788	789	791
29.		793	795	797	798	800	802	804	806	807	809
30.		811	813	815	816	818	820	822	824	825	827
31.		829	831	833	834	836	838	840	842	843	845
32.		847	849	851	852	854	856	858	860	861	863
33.		865	867	869	870	872	874	876	878	879	881
34.		883	885	887	889	891	893	894	896	898	900
35.		902	904	906	907	909	911	913	915	916	918
36.		920	922	924	926	928	929	931	933	935	937
37.		939	941	943	945	947	949	950	952	954	956
38.		958	960	962	964	966	968	970	972	974	976
39.		978	980	982	984	986	987	989	991	993	995
40.		997	999	*001	*003	*005	*007	*008	*010	*012	*014
41.	1.4	016	018	020	022	024	026	028	030	032	034
42.		036	038	040	042	044	046	048	050	052	054
43.		056	058	060	062	064	066	068	070	072	074
44.		076	078	080	082	084	086	088	090	092	094
45.		096	098	100	102	104	107	109	111	113	115
46.		117	119	121	123	125	127	129	131	133	135
47.		137	139	141	143	145	147	150	152	154	156
48.		158	160	162	164	166	169	171	173	175	177
49.		179	181	183	185	187	189	192	194	196	198
50.		200	202	204	206	208	211	213	215	217	219
51.		221	223	225	227	229	231	234	236	238	240
52.		242	244	246	249	251	253	255	257	260	262
53.		264	266	268	270	272	275	277	279	281	283
54.		285	287	289	292	294	296	298	300	303	305
55.		307	309	311	313	316	318	320	322	325	327

INDEX OF REFRACTION OF AQUEOUS SOLUTIONS OF SUCROSE (CANE SUGAR) (Continued)

Per cent sugar		.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
55.	1.4	307	309	311	313	316	318	320	322	325	327
56.		329	331	333	336	338	340	342	344	347	349
57.		351	353	355	358	360	362	364	366	369	371
58.		373	375	378	380	382	385	387	389	391	394
59.		396	398	400	403	405	407	409	411	414	416
60.		418	420	423	425	427	429	432	434	436	439
61.		441	443	446	448	450	453	455	457	459	462
62.		464	466	468	471	473	475	477	479	482	484
63.		486	488	491	493	495	497	500	502	504	507
64.		509	511	514	516	518	521	523	525	527	530
65.		532	534	537	539	541	544	546	548	550	553
66.		558	561	563	565	567	570	572	574	577	579
67.		581	584	586	588	591	593	595	598	600	602
68.		605	607	609	612	614	616	619	621	623	625
69.		628	630	632	635	637	639	642	644	646	649
70.		651	653	656	658	661	663	666	668	671	673
71.		676	678	681	683	685	688	690	693	695	698
72.		700	703	705	708	710	713	715	717	720	722
73.		725	727	730	732	735	737	740	742	744	747
74.		749	752	754	757	759	762	764	767	769	772
75.		774	777	779	782	784	787	789	792	794	797
76.		799	802	804	807	810	812	815	817	820	822
77.		825	827	830	832	835	838	840	843	845	848
78.		850	853	855	858	860	863	865	868	871	873
79.		876	878	881	883	886	888	891	893	896	898
80.		901	904	906	909	912	914	917	919	922	925
81.		927	930	933	935	938	941	943	946	949	951
82.		954	956	959	962	964	967	970	972	975	978
83.		980	983	985	988	991	993	996	999	*001	*004
84.	1.5	007	009	012	015	017	020	022	025	028	030
85.		033									

TEMPERATURE CORRECTIONS

Below 20°C the correction should be subtracted from the per cent sugar.
Above 20°C the correction is to be added to the per cent sugar.

Temp. °C	Approximate per cent sugar										
	5	10	15	20	30	40	50	60	70	75	
15	0.25	0.27	0.31	0.31	0.34	0.35	0.36	0.37	0.36	0.36	
16	0.21	0.23	0.26	0.27	0.29	0.31	0.31	0.32	0.31	0.29	
17	0.16	0.18	0.20	0.20	0.22	0.23	0.23	0.23	0.20	0.17	
18	0.11	0.12	0.14	0.14	0.15	0.16	0.16	0.15	0.12	0.09	
19	0.06	0.07	0.08	0.08	0.08	0.09	0.09	0.08	0.07	0.05	
21	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	
22	0.12	0.14	0.14	0.14	0.14	0.14	0.15	0.14	0.14	0.14	
23	0.18	0.20	0.20	0.21	0.21	0.21	0.23	0.21	0.22	0.22	
24	0.24	0.26	0.26	0.27	0.28	0.28	0.30	0.28	0.29	0.29	
25	0.30	0.32	0.32	0.34	0.36	0.36	0.38	0.36	0.36	0.37	
26	0.36	0.39	0.39	0.41	0.43	0.43	0.46	0.44	0.43	0.44	
27	0.43	0.46	0.46	0.48	0.50	0.51	0.55	0.52	0.50	0.51	
28	0.50	0.53	0.53	0.55	0.58	0.59	0.63	0.60	0.57	0.59	
29	0.57	0.60	0.61	0.62	0.66	0.67	0.71	0.68	0.65	0.67	
30	0.64	0.67	0.70	0.71	0.74	0.75	0.80	0.76	0.73	0.75	

REFLECTION OF LIGHT BY METALS

The table gives the per cent of normally incident light which is reflected by the polished surface of various metals.

Wave length.	Anti-mony.	Bronze (68 Cu, 32 Sn).	Copper, commercial.	Gold, electrolytic.	Iron.	Magnesium, Mach's.	Magnesium.	Mercury, backed glass.
.251	....	.30	25.9	38.8	....	67.0		
.288	....	....	24.3	34.0	....	70.6		
.305	....	....	25.3	31.8	....	72.2		
.326	....	....	24.9	28.6	....	75.5		
.357	....	....	27.3	27.9	....	81.2		
.385	....	.53	28.6	27.1	....	83.9		
.420	....	....	32.7	29.3	....	83.3		
.450	....	....	37.0	33.1	....	83.4	....	72.8
.500	....	.63	43.7	47.0	.55	83.3	.72	70.9
.550	....	....	47.7	74.0	....	82.7	....	71.2
.600	.53	.64	71.8	84.4	.57	83.0	.73	69.9
.650	....	....	80.0	88.9	....	82.7	....	71.5
.700	....	....	83.1	92.3	.59	83.3	....	72.8
.800	....	....	88.6	94.9	....	84.3		
1.00	.55	.70	90.1	.....	.65	84.1	.74	
2.0	.60	.80	95.5	96.8	.78	86.7	.77	
3.0	.65	.86	97.1	.....	.84	87.4	.80	
4.0	.68	.88	97.3	96.9	.89	88.7	.83	
9.0	.72	.93	98.4	98.0	.94	90.6	.93	

Wave length.	Nickel, electrolytic.	Platinum, electrolytic.	Silver, chemically deposited.	Silver-backed glass.	Speculum metal.	Steel.	Tungsten.
.251	37.8	33.8	34.1	.....	29.9	32.9	
.288	42.7	38.8	21.2	.....	37.7	35.0	
.305	44.2	39.8	9.1	.....	41.7	37.2	
.326	45.2	41.4	14.6	.....	.....	40.3	
.357	48.8	43.4	74.5	.....	51.0	45.0	
.385	49.6	45.4	81.4	.....	53.1	47.8	
.420	56.6	51.8	86.6	.....	56.4	51.9	
.450	59.4	54.7	90.5	85.7	60.0	54.4	
.500	60.8	58.4	91.3	86.6	63.2	54.8	.49
.550	62.6	61.1	92.7	88.2	64.0	54.9	
.600	64.9	64.2	92.6	88.1	64.3	55.4	.51
.650	66.6	66.5	94.7	89.1	65.4	56.4	
.700	68.8	69.0	95.4	89.6	66.8	57.6	.54
.800	69.6	70.3	96.8	.....	.....	58.0	
1.00	72.0	72.9	97.0	.....	70.5	63.1	.62
2.0	83.5	80.6	97.8	.....	80.4	76.7	.85
3.0	88.7	88.8	98.1	.....	86.2	83.0	.90
4.0	91.1	91.5	98.5	.....	88.5	87.8	.93
9.0	95.6	95.4	98.7	.....	92.2	92.9	.95

REFLECTION OF LIGHT BY METALS

The table gives the percent of normally incident light which is reflected by the polished surface of various metals.

Coblentz, 1906, 1911

Wave length	Alum-inum	Cad-mium	Cobalt	Graph-ite	Irid-ium	Molyb-denum	Pallad-ium	Rhod-ium	Silicon
.5	..	..	..	22	..	46	..	76	34
.6	..	..	..	24	..	48	..	77	32
.8	..	..	..	25	..	52	..	81	29
1.0	71	72	67	27	78	58	72	84	28
2.0	82	87	72	35	87	82	81	91	28
4.0	92	96	81	48	94	90	88	92	28
7.0	96	98	93	54	95	93	94	94	28
10.0	98	98	97	59	96	94	97	95	28
12.0	98	99	97	..	96	95	97	..	..

Wave length	Tanta-lum	Telur-ium	Tin	Vanad-ium	Zinc	Wave length	Tung-sten*	Stellite*
.5	38	..	..	57	..	.15	....	.32
.6	45	49	..	58	..	.20	....	.42
.8	64	48	..	60	..	.30	....	.50
1.0	78	50	54	61	80	.50	.50	.64
2.0	90	52	61	69	92	.75	.52	.67
4.0	93	57	72	79	97	1.00	.576	.689
7.0	94	68	81	88	98	2.00	.900	.747
10.0	..	..	84	..	98	3.00	.943	.792
12.0	95	..	85	..	99	4.00	.948	.825
						5.00	.953	.848
						9.00	....	.880

*Coblentz, Emerson, 1917.

RELATIVE STIMULATION OF THE THREE PRIMARY COLOR SENSATIONS BY DIFFERENT WAVE LENGTHS

Wave length...	0.36 μ	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.54
Red.....	0.0	0.0	2.0	1.0	1.0	1.0	3.0	9.0	23.0	39.0
Green.....	0.0	0.0	0.0	0.0	0.0	2.0	7.0	23.0	6.10	87.0
Blue.....	0.0	10.5	29.0	52.0	76.0	78.0	68.0	46.0	16.0	7.0

Wave length...	0.56 μ	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74
Red.....	56.0	69.0	71.5	59.0	30.0	12.0	5.0	2.0	1.0	0.0
Green.....	86.0	67.0	37.0	10.0	2.5	1.0	0.0	0.0	0.0	0.0
Blue.....	4.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

REFLECTION OF LIGHT BY METALS (Continued)

Coblentz, Bulletin 379, Bureau of Standards 1920

Wave-length in $\mu - 0.001\text{mm.}$	Silver	Monel metal	Stellite	Zinc
0.45.....	88.0	56.5	63.5	54.0
0.50.....	90.0	57.8	65.8	55.0
0.55.....	91.5	59.0	68.3	56.0
0.60.....	92.7	60.2	70.1	57.5
0.65.....	93.5	61.8	71.0	60.0
0.70.....	94.1	63.7	71.8	61.0
0.75.....	94.7	65.6	72.4	61.5
0.80.....	95.1	67.2	73.0	61.5
0.90.....	96.0	70.0	73.5	55.5
0.95.....	96.3	71.1	....	51.0
1.00.....	96.5	72.3	74.0	49.0
1.05.....	96.7	73.0	....	53.5
1.10.....	96.9	73.6	....	62.5
1.20.....	97.2	74.8	74.5	74.7
1.40.....	97.4	77.0	75.0	85.8
1.50.....	97.6	78.2	75.3	88.4
1.75.....	97.8	81.2	76.0	92.0
2.00.....	97.9	83.8	76.8	94.0
2.50.....	98.0	87.0	78.6	95.3
3.00.....	98.0	88.7	80.0	95.5
3.50.....	98.0	89.5	81.4	95.8
4.00.....	98.0	91.0	82.8	96.2

TRANSMISSION FACTORS FOR "GROUND" GLASS

Luckiesh

	Side toward light	Transmission Factor	
		Narrow beam	Diffuse
Sand blasted.....	Rough	0.783	0.702
	Smooth	.739	.695
Etched, fine.....	Rough	.794	.709
	Smooth	.758	.704

COEFFICIENTS OF REFLECTION OF MAGNESIUM CARBONATE AND MAGNESIUM OXIDE

Frank Benford, 1947

$\lambda, \text{\AA}$	4500	5000	5500	6000	6500
MgCO ₃	0.967	0.977	0.983	0.987	0.989
MgO.....	0.980	0.986	0.991	0.994	0.995

DIFFUSE REFLECTING POWER

The diffuse reflecting power, or ratio of total luminous flux reflected to that received, measured for the various regions of the spectrum. The wave lengths given are those of maximum energy. — Coblentz, Bulletin, 196, Bureau of Standards 1912.

Material	Reflecting power %					
	0.54 μ	0.60	0.95	4.4	8.8	24.6
Lampblacks						
paint.....		3.2	3.4	3.2	3.8	4.4
paraffin-candle.....			0.97			
rosin.....			1.3	1.3		3.0
sperm candle.....			1.1	.9	1.3	4.6
camphor.....			1.3	1.2	1.6	5.7
acetylene.....			0.6	.8	1.2	2.1
Platinum black						
electrolytic.....			1.1	1.4	2.1	4.2
Pigments						
cobalt oxide, Co_2O_3		3.02	{ 3.92	13.9	{ 14.6	5.9
			{ 4.04		{ 11.8	
			2.49			
copper oxide, CuO			23.5	15.2		4.4
chromium oxide, Cr_2O_3	24.1	27.0	44.6	32.9	5.0	8.2
lead oxide, PbO		51.8		50.6	25.6	9.5
red iron oxide, Fe_2O_3		26.3	41.0	29.9	3.7	9.1
yttrium oxide, Y_2O_3		73.8		34.4	11.1	10.0
lead chromate, PbCrO_4	61.2	70.2		41.2	4.74	7.4
aluminum oxide, Al_2O_3		84.1	87.7	20.8	{ 2.34	6.5
					{ 1.64	
thorium oxide, ThO_2		86.0		46.9	7.11	10.0
zinc oxide, ZnO		82.2	86.4	8.5	{ 3.2	5.1
					{ 2.1	
magnesium oxide, MgO		86.3		16.0	2.5	9.1
calcium oxide, CaO		85.4		22.3	3.6	6.2
zirconium oxide, ZrO_2	82.2	85.8	84.1	23.2	5.1	5.4
		{ 86.8	{ 90.8	29.2	9.3	6.9
		{ 89.9	{ 92.8			
lead carbonate, PbCO_3			94.5		{ 13.2	
		85.2	89.4	10.8	4.1	8.8
Paints						
white lead No. 103.....		76.2	79.3			
" " " 102.....		74.3				
zinc lead white No. 107.....		69.6				
" oxide No. 104.....		68.1	72.1			
white lead 50 % } No. 209.....		70.8				
zinc oxide 50 % }						
Miscellaneous						
asphalt (pavement).....		14.8				
black felt.....		{ 13.9	{ 21.2			
		22.5	25.6			
black velvet.....		1.75		3.66	2.7	
bluestone (sandstone) SiO_2		18.4	8.1	17.6	11.0	
blue flannel.....		17.5				
Brick:						
light buff.....		48.4				
darker.....		40.0				
red brick.....		30.1			12.4	
darker & glazed.....		23.4				
Cotton cloth:						
diamine fast red 8 B L.....		43.8				
diamine fast black C B —.....		33.1				
columbia fast black R.....		28.7				
diamine aldehyde black.....		29.5				
sulphur black A W L —.....		2.43	2.57			

DIFFUSE REFLECTING POWER (Continued)

The diffuse reflecting power, or ratio of total luminous flux reflected to that received, measured for the various regions of the spectrum. The wave lengths given are those of maximum energy. — Coblenz, Bulletin, 196, Bureau of Standards 1912.

Material	Reflecting power %					
	0.54 μ	0.60	0.95	4.4	8.8	24.0
Woolen Cloth:						
lanacyl blue B N —.....		25.1				
salacine blue black A E —.....		14.6	17.8			
" black PB —.....		11.8	15.1			
Linen:						
starched, dull finish.....		81.2				
deep blue cloth (Navy Dept.)		17.0				
lighter shade.....		18.2				
Feldspar, KAlSi_3O_8			86.7	38.2	10.3	9.7
cleavage surface.....		39.4			14.6	
Granolith (pavement).....		16.9				
Green Leaf (tulip tree).....		21.9	38.0	5.6		
Indiana limestone, CaCO_3		42.9		20.3	5.0	
Quartz (powder, French Flint)						
SiO_2		81.0	41.5	7.9	9.0	
Slate (dark clay).....		6.7		13.4	20.0	
White marble CaCO_3 ground,						
unpolished.....		53.5		6.4	5.1	
cleavage, surface.....		40.8				
White paper.....		71.7	74.7	18.2	5.0	
two thicknesses.....		73.4				
White paper, (Bond).....		75.2				

DIFFUSED REFLECTION

Albedo

Giving the percent of diffused reflection of "white light" for various surfaces. *Sumpner, Zöllner and others.*

Material	Reflections	Material	Reflections
Wood, pine.....	40	Parchment	
Cardboard		1 sheet.....	22
yellow.....	30	2 sheets.....	35
white.....	60-70	Cloth	
Painted surface, ..		black.....	1
yellow.....	40	tracing.....	35
white washed... ..	50	white.....	60-70
Paper		Velvet	
tracing.....	22	black.....	0.4
ordinary white..	60-70	Loam, sandy.....	24
blotting.....	70-80	Earth, moist.....	8
chocolate color..	4	Marl, argillaceous.	16
brown.....	13		
blue.....	25		
yellow.....	25		

REFLECTION COEFFICIENTS

Coefficients of Reflection of Miscellaneous Surfaces for Monochromatic
Radiation in the Visible Spectrum
(J. L. Michaelson)

Material	Wave lengths (μ)			
	0.400	0.500	0.600	0.700
Carbon Black in Oil.....	0.003	0.003	0.003	0.003
Clay,				
Kaolin (treated).....	0.82	0.81	0.82	0.82
Kaolin (untreated).....	0.75	0.79	0.85	0.86
White Georgia.....	0.94	0.92	0.93	0.94
Magnesium oxide.....	0.97	0.98	0.98	0.98
Paint,				
Lithopone.....	0.95	0.98	0.98	0.98
MgCO ₃ -Vynal Acetate Lacquer.....	0.90	0.88	0.88	0.88
ZnO-Milk.....	0.74	0.84	0.85	0.86
Paper,				
Blotting.....	0.64	0.72	0.79	0.79
Calendered.....	0.64	0.69	0.73	0.76
Crepe, green.....	0.23	0.49	0.19	0.48
Crepe, red.....	0.03	0.02	0.21	0.69
Crepe, yellow.....	0.17	0.44	0.75	0.79
News Print Stock.....	0.38	0.61	0.63	0.78
Peach,				
Green.....	0.18	0.17	0.62	0.63
Ripe.....	0.10	0.10	0.41	0.42
Pear,				
Green.....	0.04	0.12	0.29	0.41
Ripe.....	0.08	0.19	0.46	0.53
Pigment,				
Chrome Yellow.....	0.05	0.13	0.70	0.77
French Ochre.....	0.06	0.14	0.50	0.56
Porcelain Enamel,				
Blue.....	0.44	0.10	0.05	0.23
Orange.....	0.09	0.09	0.59	0.69
Red.....	0.05	0.03	0.08	0.62
White.....	0.77	0.73	0.72	0.70
Yellow.....	0.11	0.46	0.62	0.62
Talcum, Italian.....	0.94	0.89	0.88	0.88
Wheat Flour.....	0.75	0.87	0.94	0.97

REFLECTION COEFFICIENTS OF SURFACES FOR "INCANDESCENT" LIGHT

Material	Nature of Surface	Coefficient	Authority
Aluminum, "Alzak".....	Diffusing	0.77-0.81	3
"Alzak".....	Specular	0.79-0.83	3
on Glass.....	First Surface	0.82-0.86	4
Polished.....	Specular	0.69	3
Black Paper.....	Diffusing	0.05-0.06	4
Chromium.....	Specular	0.62	4
Copper.....	Specular	0.63	4
Gold.....	Specular	0.75	1
Magnesium oxide.....	Diffusing	0.98	5
Nickel.....	Specular	0.62-0.64	1, 3
Platinum.....	Specular	0.62	1
Porcelain Enamel.....	Glossy	0.76-0.79	3
Porcelain Enamel.....	Ground	0.81	3
Porcelain Enamel.....	Matt.	0.72-0.76	3
Silver.....	Polished	0.93	1
Silvered Glass.....	Second Surface	0.88-0.93	3
Snow.....	Diffusing	0.93	2
Steel.....	Specular	0.55	1
Stellite.....	Specular	0.58-0.65	4

(1) Hagen and Rubens. (2) Nutting, Jones, and Elliot. (3) J. E. Bock.
(4) Frank Benford. (5) J. L. Michaelson.

EMISSION AND ABSORPTION

These data are the result of investigations made by the Bureau of Standards, the British National Physical Laboratory, General Electric Research Laboratories, and several eastern universities, and were collected by W. J. King of the General Electric Company.

Low Temperature Total Emissivities

Silver, highly polished..	0.02	Brass, polished.....	0.60
Platinum " " ..	0.05	Oxidized copper.....	0.60
Zinc " " ..	0.05	Oxidized steel.....	0.70
Aluminum, " " ..	0.08	Bronze paint.....	0.80
*Monel metal, polished.	0.09	Black gloss paint.....	0.90
Nickel " " ..	0.12	White lacquer.....	0.95
Copper " " ..	0.15	White vitreous enamel.	0.95
Stellite " " ..	0.18	Asbestos paper.....	0.95
Cast iron " " ..	0.25	Green paint.....	0.95
Monel metal, oxidized..	0.43	Gray paint.....	0.95
Aluminum paint.....	0.55	Lamp black.....	0.95

Coefficient of Absorption of Solar Radiation

Silver, highly polished..	0.07	Stellite, polished.....	0.30
Platinum " " ..	0.10	Light cream paint.....	0.35
Nickel " " ..	0.15	Monel metal, polished.	0.40
*Aluminum.....	0.15	Light yellow paint.....	0.45
Magnesium carbonate..	0.15	Light green paint.....	0.50
Zinc oxide.....	0.15	Aluminum paint.....	0.55
*Steel.....	0.20	Zinc, polished metal...	0.55
Copper.....	0.25	Gray paint.....	0.75
White lead paint.....	0.25	Black matte.....	0.97
Zinc oxide paint.....	0.30		

* Questionable because of scant or inconsistent data.

TOTAL EMISSIVITY

ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

Material	Temp. °C	Emissivity	Material	Temp. °C	Emissivity
Alloys			Iron, rusted.....	25	0.65
20Ni-25Cr-55Fe, oxidized..	200	0.90	wrought, dull.....	25	0.94
	500	0.97	oxidized.....	350	0.94
60Ni-12Cr-28Fe, oxidized..	270	0.89	Lead, unoxidized.....	100	0.05
	560	0.82	oxidized.....	200	0.63
80Ni-20Cr, oxidized.....	100	0.87	Mercury, unoxidized.....	25	0.10
	600	0.87		100	0.12
	1300	0.89	Molybdenum, unoxidized...	1000	0.13
Aluminum, unoxidized.....	25	0.022		1500	0.19
	100	0.028		2000	0.24
	500	0.060	Monel metal, oxidized.....	200	0.43
oxidized.....	200	0.11		600	0.43
	600	0.19	Nickel, unoxidized.....	25	0.045
Bismuth, unoxidized.....	25	0.048		100	0.06
	100	0.061		500	0.12
Brass, oxidized.....	200	0.61		1000	0.19
	600	0.59	oxidized.....	200	0.37
unoxidized.....	25	0.035		1200	0.85
	100	0.035	Platinum, unoxidized.....	25	0.037
Carbon, unoxidized.....	25	0.081		100	0.047
	100	0.081		500	0.096
	500	0.079		1000	0.152
Chromium, unoxidized.....	100	0.08		1500	0.191
Cobalt, unoxidized.....	500	0.13	Silica brick.....	1000	0.80
	1000	0.23		1100	0.85
Columbium, unoxidized.....	1500	0.19	Silver, unoxidized.....	100	0.02
	2000	0.24		500	0.035
Copper, unoxidized.....	100	0.02	Steel, unoxidized.....	100	0.08
	liquid	0.15		liquid	0.28
oxidized.....	200	0.6	oxidized.....	25	0.80
	1000	0.6		200	0.79
calorized.....	100	0.26		600	0.79
	500	0.26	Steel plate, rough.....	40	0.94
	200	0.18		400	0.97
calorized, oxidized...	600	0.19	calorized, oxidized.....	200	0.52
	1000	0.75		600	0.57
Fire brick.....	100	0.02	Tantalum, unoxidized.....	1500	0.21
Gold, unoxidized.....	500	0.03		2000	0.26
	100	0.37	Tin, unoxidized.....	25	0.043
Gold enamel.....	100	0.05		100	0.05
Iron, unoxidized.....	100	0.74	Tungsten, unoxidized.....	25	0.024
oxidized.....	500	0.84		100	0.032
	1200	0.89		500	0.071
cast, unoxidized.....	100	0.21		1000	0.15
	liquid	0.29		1500	0.23
cast, oxidized.....	200	0.64		2000	0.28
	600	0.78	Zinc, unoxidized.....	300	0.05
	40	0.95			
cast, strongly oxidized..	250	0.95			

SPECTRAL EMISSIVITY

Prepared by Roeser and Wensel, National Bureau of Standards
Spectral Emissivity of Materials, Surface Unoxidized for 0.65μ

Element	Solid	Liquid	Element	Solid	Liquid
Beryllium.....	0.61	0.61	Thorium.....	0.36	0.40
Carbon.....	0.80-0.93	....	Titanium.....	0.63	0.65
Chromium.....	0.34	0.39	Tungsten.....	0.43	
Cobalt.....	0.36	0.37	Uranium.....	0.54	0.34
Columbium.....	0.37	0.40	Vanadium.....	0.35	0.32
Copper.....	0.10	0.15	Yttrium.....	0.35	0.35
Erbium.....	0.55	0.38	Zirconium.....	0.32	0.30
Gold.....	0.14	0.22	Steel.....	0.35	0.37
Iridium.....	0.30	....	Cast Iron.....	0.37	0.40
Iron.....	0.35	0.37	Constantan.....	0.35	
Manganese.....	0.59	0.59	Monel.....	0.37	
Molybdenum.....	0.37	0.40	Chromel P (90Ni-10Cr).....	0.35	
Nickel.....	0.36	0.37	80Ni-20Cr.....	0.35	
Palladium.....	0.33	0.37	60Ni-24Fe-16Cr.....	0.36	
Platinum.....	0.30	0.38	Alumel (95Ni; Bal. Al, Mn, Si).....	0.37	
Rhodium.....	0.24	0.30	90Pt-10Rh.....	0.27	
Silver.....	0.07	0.07			
Tantalum.....	0.49	....		

Spectral Emissivity of Oxides

The emissivity of oxides and oxidized metals depends to a large extent upon the roughness of the surface. In general, higher values of emissivity are obtained on the rougher surfaces.

Material	Range of observed values	Probable value for oxide formed on smooth metal	Material	Range of observed values	Probable value for oxide formed on smooth metal
Aluminum oxide.....	0.22-0.40	0.30	Alumel (oxidized).....		0.87
Beryllium oxide.....	0.07-0.37	0.35	Cast Iron (oxidized).....		0.70
Cerium oxide.....	0.58-0.80	....	Chromel P (90Ni-10Cr) (oxidized).....		0.87
Chromium oxide.....	0.60-0.80	0.70	80Ni-20Cr (oxidized)...		0.90
Cobalt oxide.....	0.55-0.71	0.75	60Ni-24Fe-16Cr (oxidized).....		0.83
Columbium oxide.....	0.55-0.71	0.70	55Fe-37.5Cr-7.5 Al (oxidized).....		0.78
Copper oxide.....	0.60-0.80	0.70	70Fe-23Cr-5Al-2Co (oxidized).....		0.75
Iron oxide.....	0.63-0.98	0.70	Constantan (55Cu-45Ni) (oxidized).....		0.84
Magnesium oxide.....	0.10-0.43	0.20	Carbon Steel (oxidized).....		0.80
Nickel oxide.....	0.85-0.96	0.90	Stainless Steel (18-8) (oxidized).....		0.85
Thorium oxide.....	0.20-0.57	0.50	Porcelain.....	0.25-0.50	
Tin oxide.....	0.32-0.60	....		
Titanium oxide.....		0.50			
Uranium oxide.....		0.30			
Vanadium oxide.....		0.70			
Yttrium oxide.....		0.60			
Zirconium oxide.....	0.18-0.43	0.40			

PROPERTIES OF TUNGSTEN

JONES AND LANGMUIR, GENERAL ELECTRIC REVIEW

Temp. °K	Resis- tivity mi- crohm cm	Electron emission amp./cm ²	Evaporation g/cm ² sec	Vapor pressure dynes/cm ²	Ther- mal expan- sion per cent to at 293°	Atomic heat cal./g. atom./ °C.
300	5.65				.003	6.0
400	8.06				.044	6.0
500	10.56				.086	6.1
600	13.23				.130	6.1
700	16.09				.175	6.2
800	19.00				.222	6.2
900	21.94				.270	6.3
1000	24.93	1.07×10^{-15}	5.32×10^{-34}	1.98×10^{-29}	.320	6.4
1100	27.94	1.52×10^{-13}	2.17×10^{-30}	1.22×10^{-25}	.371	6.4
1200	30.98	9.73×10^{-12}	3.21×10^{-27}	1.87×10^{-22}	.424	6.5
1300	34.08	3.21×10^{-10}	1.35×10^{-24}	8.18×10^{-20}	.479	6.7
1400	37.19	6.62×10^{-9}	2.51×10^{-22}	1.62×10^{-17}	.535	6.8
1500	40.36	9.14×10^{-8}	2.37×10^{-20}	1.54×10^{-15}	.593	7.0
1600	43.55	9.27×10^{-7}	1.25×10^{-18}	8.43×10^{-14}	.652	7.1
1700	46.78	7.08×10^{-6}	4.17×10^{-17}	2.82×10^{-12}	.713	7.2
1800	50.05	4.47×10^{-5}	8.81×10^{-16}	6.31×10^{-11}	.775	7.4
1900	53.35	2.28×10^{-4}	1.41×10^{-14}	1.01×10^{-9}	.839	7.6
2000	56.67	1.00×10^{-3}	1.76×10^{-13}	1.33×10^{-8}	.904	7.7
2100	60.06	3.93×10^{-3}	1.66×10^{-12}	1.28×10^{-7}	.971	7.8
2200	63.48	1.33×10^{-2}	1.25×10^{-11}	9.88×10^{-7}	1.039	8.0
2300	66.91	4.07×10^{-2}	8.00×10^{-11}	6.47×10^{-6}	1.109	8.2
2400	70.39	1.16×10^{-1}	4.26×10^{-10}	3.52×10^{-5}	1.180	8.3
2500	73.91	2.98×10^{-1}	2.03×10^{-9}	1.71×10^{-4}	1.253	8.4
2600	77.49	7.16×10^{-1}	8.41×10^{-9}	7.24×10^{-4}	1.328	8.6
2700	81.04	1.63	3.19×10^{-8}	2.86×10^{-3}	1.404	8.7
2800	84.70	3.54	1.10×10^{-7}	9.84×10^{-3}	1.479	8.9
2900	88.33	7.31	3.30×10^{-7}	3.00×10^{-2}	1.561	9.0
3000	92.04	1.42×10	9.95×10^{-7}	9.20×10^{-2}	1.642	9.2
3100	95.76	2.64×10	2.60×10^{-6}	2.50×10^{-1}	1.724	9.4
3200	99.54	4.78×10	6.38×10^{-6}	6.13×10^{-1}	1.808	9.5
3300	103.3	8.44×10	1.56×10^{-5}	1.51	1.893	9.6
3400	107.2	1.42×10^2	3.47×10^{-5}	3.41	1.980	9.8
3500	111.1	2.33×10^2	7.54×10^{-5}	7.52	2.068	9.9
3600	115.0	3.73×10^2	1.51×10^{-4}	1.53×10	2.158	10.1
3655	117.1	4.79×10^2	2.28×10^{-4}	2.33×10	2.209	10.2

PROPERTIES OF TUNGSTEN

ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

Temp. °K	Normal bright- ness new candles per cm ²	Spectral emissivity		Color emis- sivity	Total emis- sivity	Bright- ness temp. 0.65μ	Color temp.
		0.65μ	0.467μ				
300	.....	0.472	0.505	.....	0.032		
400	.....				.042		
500	.....				.053		
600	.....				.064		
700	.....				.076		
800	.....				.088		
900	.....				.101		
1000	0.0001	.458	.486	.395	.114	966	1007
1100	0.001	.456	.484	.392	.128	1059	1108
1200	0.006	.454	.482	.390	.143	1151	1210
1300	0.029	.452	.480	.387	.158	1242	1312
1400	0.11	.450	.478	.385	.175	1332	1414
1500	0.33	.448	.476	.382	.192	1422	1516
1600	0.92	.446	.475	.380	.207	1511	1619
1700	2.3	.444	.473	.377	.222	1599	1722
1800	5.1	.442	.472	.374	.236	1687	1825
1900	10.4	.440	.470	.371	.249	1774	1928
2000	20.0	.438	.469	.368	.260	1861	2032
2100	36	.436	.467	.365	.270	1946	2136
2200	61	.434	.466	.362	.279	2031	2241
2300	101	.432	.464	.359	.288	2115	2345
2400	157	.430	.463	.356	.296	2198	2451
2500	240	.428	.462	.353	.303	2280	2556
2600	350	.426	.460	.349	.311	2362	2662
2700	500	.424	.459	.346	.318	2443	2769
2800	690	.422	.458	.343	.323	2523	2876
2900	950	.420	.456	.340	.329	2602	2984
3000	1260	.418	.455	.336	.334	2681	3092
3100	1650	.416	.454	.333	.337	2759	3200
3200	2100	.414	.452	.330	.341	2837	3310
3300	2700	.412	.451	.326	.344	2913	3420
3400	3400	.410	.450	.323	.348	2989	3530
3500	4200	.408	.449	.320	.351	3063	3642
3600	5200	.406	.447	.317	.354	3137	3754

PIGMENTS AND DYES

PIGMENTS AND DYES

The tables which follow give the fraction of incident light reflected by pigments or transmitted by dyes. The pigments were in dry powdered form and the dye solutions, except where indicated, in distilled water. Wave lengths are given in microns.

(Luckiesch, 1917)

Pigment	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
American vermilion.....	0.08	0.06	0.05	0.05	0.06	0.06	0.09	0.11	0.24	0.39	0.53	0.61	0.66	0.65
Venetian red.....	.05	.05	.05	.05	.05	.06	.07	.12	.19	.24	.28	.30	.32	.32
Tuscan red.....	.07	.07	.07	.08	.08	.08	.08	.12	.16	.18	.20	.22	.23	.24
Indian red.....	.08	.07	.07	.07	.07	.07	.07	.11	.15	.18	.20	.22	.23	.24
Burnt sienna.....	.04	.04	.04	.04	.05	.06	.09	.14	.18	.20	.21	.23	.24	.25
Raw sienna.....	.12	.13	.13	.13	.18	.26	.35	.43	.46	.46	.45	.44	.45	.43
Golden ochre.....	.22	.22	.23	.27	.40	.53	.63	.71	.75	.74	.73	.73	.73	.72
Chrome yellow, ochre.....	.08	.09	.07	.07	.10	.19	.30	.46	.60	.62	.66	.82	.81	.80
Yellow ochre.....	.20	.20	.21	.24	.32	.42	.53	.63	.64	.61	.60	.59	.59	.59
Chrome yellow (medium).....	.05	.05	.06	.08	.18	.48	.66	.75	.78	.79	.81	.81	.81	.81
Chrome yellow (light).....	.13	.13	.18	.30	.56	.82	.88	.89	.90	.89	.88	.87	.85	.84
Chrome green (light).....	.10	.10	.14	.23	.26	.23	.20	.17	.14	.11	.09	.08	.07	.06
Chrome green (medium).....	.07	.07	.10	.21	.21	.17	.13	.11	.09	.07	.06	.06	.06	.05
Cobalt blue.....	.59	.58	.49	.35	.23	.15	.11	.10	.10	.10	.11	.15	.20	.25
Ultramarine blue.....	.67	.54	.38	.21	.10	.06	.04	.03	.03	.04	.05	.07	.10	.17

PIGMENTS AND DYES (Continued)

PIGMENTS AND DYES (Continued)

Red Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Carmen ruby opt.	...	...	...	...	...	...	...	...	0.04	0.04	0.18	0.37	0.49	0.60
Amido naphthol red	...	...	...	...	...	...	...	0.04	0.04	.38	.75	.92	.96	.96
Cocchine	0.06	...	...	...	...	...	...	0.04	.56	.96	.98	.98	.98	.98
Erythrosine	.01	0.03	0.07	0.13	0.14	0.12	0.10	.53	.90	.95	.96	.96	.96	.96
Hematoxyline	...	...	...	...	...	...	.13	.25	.44	.54	.63	.73	.78	.82
"	...	...	...	...	...	...	...	.01	.02	.04	.09	.15	.21	.25
Alizarine red	...	.01	.02	.03	.04	.06	.11	.22	.39	.54	.65	.72	.77	.79
Acid rosolic (pure)	.04	.03	.01	...	...	...	.02	.38	.78	.88	.90	.91	.92	.92
Rapid filter red	...	...	...	...	...	.01	.10	.47	.86	.95	.96	.96	.96	.96
Aniline red fast extra A	...	...	...	...	...	.02	.12	.34	.55	.72	.84	.88	.90	.92
Pinatype red fast	...	...	...	...	...	...	...	...	.11	.35	.55	.65	.68	.69
Eosine (yellowish)	...	...	...	...	...	...	...	...	.06	.40	.63	.74	.82	.85
Eosine	...	...	...	...	...	...	...	...	.87	.93	.92	.92	.92	.92
Naphthalinrot in absolute alcohol	...	...	...	...	...	...	.01	.54	...	...	...	...	...	...
Rose bengal	.80	.70	.34	.06	.01	...	.14	...	.06	.28	.43	.50	.57	.61
Rose bengal	.01	...	...	...	...	...	...	.82	.96	.97	.98	.98	.98	.98
Cobalt ammonium sulphate	.60	.56	.48	.37	.38	.53	.70	.09	.57	.83	.89	.92	.94	.96
Cobalt nitrate	.69	.51	.40	.31	.32	.48	.67	.82	.87	.90	.90	.90	.90	.90

PIGMENTS AND DYES (Continued)

Yellow Dyes

Dye-Solution	.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Tartazine.....	0.07	0.52	0.75	0.86	0.91	0.95	0.96	0.97	0.98	0.98
Chrysoidin.....02	.23	.50	.71	.79	.79
Aurantia.....03	.23	.53	.82	.92	.96	.96	.96	.96
Aniline yellow phosphine.....02	.20	.43	.60	.67	.75	.81	.85	.86	.87
Fluorescein.....	0.15	0.01	....	....	.48	.91	.97	.98	.98	.98	.98	.98	.98	.98
Aniline yellow fast, S.....43	.84	.96	.96	.96	.96	.96	.96	.96	.96
Methyl orange, indicator.....	0.01	0.07	....	....	.01	.31	.70	.79	.80	.81	.81	.81
Auramin.....01	.39	.77	.83	.84	.86	.87	.88	.90	.92	.93	.93
Uranine.....	.15	.01	....	.01	.58	.96	.97	.97	.97	.97	.97	.97	.97	.97
Uranine naphthaline.....04	.53	.77	.82	.83	.84	.85	.86	.86	.87	.87
Orange B Naphthol.....01	.43	.88	.95	.96	.97	.97	.97	.97
Safranine.....03	.27	.64	.85	.93	.93
Martius gelb.....01	.43	.84	.91	.94	.95	.95	.95	.95	.95	.95
Naphthol yellow.....01	.18	.74	.91	.96	.97	.98	.98	.98	.98	.98	.98
Potassium bichromate, sat. sol.....10	.60	.84	.88	.88	.89	.89	.89	.89	.88
Cobalt chromate.....	.17	.36	.62	.82	.88	.90	.92	.93	.95	.96	.96	.96	.96	.95

PIGMENTS AND DYES (Continued)

PIGMENTS AND DYES (Continued)

Green Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Naphthol green.....	0.02	0.04	0.07	0.21	0.30	0.36	0.29	0.16	0.07	0.02	0.01	0.02	0.23	0.64
Brilliant green.....	.04	.39	.69	.52	.23	.04	.13	.02	.....	.....	.....	0.02	.....	.....
Filter blue green.....	.35	.49	.64	.70	.60	.37	.01	.....	.....	.....	.....	.....	.....	.....
Filter blue green.....	.06	.14	.23	.40	.26	.08	.....	.....	.....	.....	.....	.....	.12	.50
Malachite green.....	.....	.12	.20	.08	.01	.....	.....	.....	.....	.....	.....	.....	.02	.23
Malachite green.....	.....	.01	.04	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.10
Malachite green.....	.....	.....	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.30
Saurgrun.....	.03	.29	.57	.57	.39	.19	.04	.01	.....	.....	.....	.....	.04	.28
Methylengrün.....	.28	.31	.32	.26	.17	.07	.02	.01	.....	.....	.....	.....	.03	.14
Methylengrün.....	.14	.16	.17	.13	.06	.01	.....	.....	.....	.....	.....	.....	.02	.....
Aniline green naphthol B.....	.02	.06	.14	.24	.34	.40	.32	.14	.04	.01	.....	.....	.....	.....
Aniline green naphthol B.....	.....	.....	.02	.06	.10	.15	.09	.02	.....	.....	.....	.....	.....	.05
Neptune green.....	.....	.40	.63	.41	.13	.01	.....	.....	.....	.....	.....	.....	.....	.02
Neptune green.....	.....	.19	.36	.18	.02	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cupric chloride.....	.77	.84	.89	.92	.92	.89	.80	.67	.52	.36	.19	.06	.02	.....

PIGMENTS AND DYES (Continued)

Blue Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Turnbull's blue.....	0.58	0.60	0.56	0.51	0.38	0.28	0.18	0.09	0.05	0.03	0.01	.01	.01	.01
Victoria blau.....	.52	.23	.09	.01	.60	.46	.32	.20	.12	.07	.04	.03	.03	.03
Prussian blue (soluble).....	.66	.71	.76	.69	.05	.02	.01	.01	.01	.01	.03	.18	.37	.60
Wasser blau.....	.89	.75	.51	.26	.07	.01	.01	.01	.01	.02	.06	.10	.26	.48
Resorcine blue.....	.85	.66	.42	.17	.03	.01	.01	.01	.01	.02	.14	.41	.64	.72
Toluidin blau.....	.25	.18	.13	.03	.01	.01	.01	.01	.01	.02	.01	.04	.16	.40
Patent blue.....	.66	.31	.84	.76	.65	.46	.24	.08	.02	.01	.01	.06	.42	.78
".....	.83	.91	.84	.76	.65	.46	.24	.08	.02	.01	.01	.06	.42	.78
".....	.15	.25	.17	.05	.01	.01	.01	.01	.01	.01	.01	.01	.01	.12
Dianil.....	.77	.69	.59	.48	.35	.24	.15	.09	.05	.05	.07	.14	.29	.53
".....	.38	.30	.18	.10	.04	.01	.01	.01	.01	.01	.01	.01	.01	.12
Filter.....	.84	.79	.66	.44	.27	.17	.14	.19	.36	.56	.74	.81	.88	.92
".....	.35	.29	.18	.04	.01	.01	.01	.01	.02	.08	.23	.44	.62	.71
Aniline blue, methyl.....	.92	.88	.78	.52	.27	.09	.03	.02	.02	.04	.08	.16	.25	.45
".....	.44	.31	.13	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01

PIGMENTS AND DYES (Continued)

PIGMENTS AND DYES (Continued)

Purple Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Ethyl violet in gelatine (dry)...	0.97	0.87	0.67	0.28	0.04	....	.01	.03	.05	0.33	0.73	0.88	.91	
Ethyl violet in gelatine (wet)...	.83	.79	.45	.07	.01	....	.01	.22	.15	.42	.76	.91	.93	
Magenta	.21	.08	.02	.01	....	....	....	....	.73	.93	.97	.97	.97	
Gentian violet	.89	.83	.64	.44	.26	0.19	.15	.10	.07	.48	.81	.92	.95	
"	.11	.01	....	....	....	....	....	....	.13	.42	.75	.92	.94	
Rosazine	.50	.28	.02	....	....	....	....	.06	....	....	.01	.15	.48	.66
"	....	....	....	....	....	....	....	....	.55	.90	.98	.98	.98	.98
Iodine (dense)	....	....	....	....	....	....	....	....	.07	.07	.54	.90	.95	.95
Rhodamine B	.81	.71	.45	.13	.02	....	....	.23	....	....	.01	.03	.11	.23
Acid violet	.84	.76	.68	.50	.33	.26	.27	.34	.83	.96	.96	.96	.95	.94
"	.29	.08	.01	....	....	....	....	.01	.49	.70	.84	.96	.96	.96
Cyanine in alcohol	.07	.01	....	....	....	....	....	....	.09	.32	.63	.84	.94	.94
Xylene red	.39	.23	.01	....	....	....	....	.01	....	....	....	.01	.13	.23
"	....	....	....	....	....	....	....	....	.27	.79	.97	.97	.96	.96
Methyl violet B	.25	.04	....	....	....	....	....	....	.01	.31	.79	.96	.96	.95
"	....	....	....	....	....	....	....	....	....	....	.03	.26	.63	.89

TRANSMISSION OF COLORED GLASSES

If I_0 is the intensity of radiation entering a layer of some medium and I the intensity reaching the opposite surface, the ratio I/I_0 is called the transmittance. In practice the ratio of intensity of radiation passing through a glass sample to that incident on its surface is often measured and plotted as transmission. The transmission is the result of two factors, the transmittance of the glass and the losses by reflection. These losses amount to about 4% for each glass-air surface; the transmission of a sample is about 92% of its transmittance. Since the reflection losses differ slightly with different samples, the correction is often determined and applied when the transmission is measured. Values which are thus corrected are marked * at the head of the column.

In order to obtain the transmittance for thicknesses other than those listed it is convenient to transform the tabular values to terms of βt in the equation $I/I_0 = e^{\beta t}$ where t is the thickness (in millimeters) and β = constant for a particular sample. The base 10 is conveniently used in place of e so that βt becomes the common logarithm of the transmittance, or $\beta t = \log I/I_0$. Using the corrected value of the transmittance for a specific thickness, found in the table, the value of βt may be found, changed to the value for the new thickness and the transmittance for the second thickness computed.

For example: The tabular value of transmission for sample **CG 396** at $\lambda = .46\mu$ is given as 0.80 for a thickness of 2 mm. It is desired to find the transmittance for 5 mm.

The corrected value of the transmittance for 2 mm is 0.80/.92 or about 0.871. $\log .871 = 9.94002-10$. Writing this as a wholly negative number the equation becomes $\beta t = -.05998$. For $t = 5$ $\beta t = -.05998 \times 5/2 = -.14995$ or changing to the more familiar form gives 9.85005-10 which is the logarithm of the new transmittance which is found to be .708. The transmission will be $.92 \times .708$ or .651.

In order to identify the glasses listed, the manufacturer's number is given preceded by an abbreviation of the maker's name, as follows: **AO**, American Optical Co.; **BL**, Bausch & Lomb Optical Co.; **CE**, Chicago Eye Shield Co.; **CG**, Corning Glass Works. Data for Jena glasses are given separately in section II of the table.

This table has been compiled with the assistance of: Mr. H. P. Gage, Corning Glass Works; Mr. J. Liautaud, Chicago Eye Shield Co.; Mr. W. B. Rayton, Bausch & Lomb Optical Co.; Mr. A. J. Weinstein of the Fish-Shurman Corporation.

Abbreviations Used

abs., absorbing	lant., lantern	sext., sextant
bl., blue	lt., light	sig., signal
col., colorless	med., medium	tr., transmitting
didym., didymium	neut., neutral	u.v., ultra-violet
dk., dark	purp., purple	v., very
fl., fluorescent	pyrom., pyrometer	viol., violet
grn., green	rd., red	yel., yellow
ht., heat		

TRANSMISSION OF COLORED GLASSES

TRANSMISSION OF COLORED GLASSES SECTION I.—GLASSES OF AMERICAN MANUFACTURE

Wave-length μ	AO Crown 1.50 1.68 mm	BL Crookes 1 2 mm	BL Crookes 2 2 mm	BL Crookes 3 2 mm	BL Smoke A neut. 2 mm	BL Smoke B neut. 2 mm	BL Smoke C neut. 2 mm	CG 254 black ht. tr. 1 mm	CG 255 sext. red 1 mm	CG 241 Se red pyrom. 38 %
0.22	...	*	*	*	*	*	*	...	...	...
.24	...	...	...	...	...	...	...	...	...	...
.26	...	...	...	...	...	...	...	...	...	...
.28	...	...	...	...	...	...	...	...	...	...
.30	0	00	00	00	00	00	00	...	...	...
.32	56	00	00	00	00	00	00	...	...	...
.34	83	00	00	00	44	14	00	...	...	...
.36	89	06	22	20	83	60	32	...	...	...
.38	91	72	38	65	89	74	61	0	...	...
.40	92	86	80	74	90	76	64	07	...	...
.42	92	89	75	54	85	70	43	05	...	...
.44	92	44	77	46	82	54	28	015	...	...
.46	92	93	80	47	83	53	28	005	...	...
.48	92	94	82	51	84	55	33	005	...	...
.50	92	95	83	55	85	59	35	000	...	...
.52	92	96	85	57	85	59	34	005	...	...
.54	92	97	86	58	85	59	33	005	...	...
.56	92	97	84	57	85	60	33	015	...	...
.58	92	80	69	57	85	60	33	030	...	...
.60	92	99	85	58	85	59	32	040	...	...
.62	92	62	89	61	85	58	32	060	0	067
.64	92	1 00	90	63	85	60	33	070	090	508
.66	92	1 00	92	66	87	65	39	0	006	660
.68	92	1 00	94	73	90	73	52	012	120	667
.70	...	99	97	90	95	88	75	018	150	660
.72	...	...	92	85	93	75	74	200	200	...
1.0	...	98	92	85	93	75	74	724	860	...
1.5	...	95	89	87	91	82	74	845	920	...
2.0	...	94	89	83	90	81	72	920	915	...
2.5	...	89	82	80	88	80	74	818	915	...
3.0	...	55	53	53	59	61	56	672	743	...
3.5	...	31	25	33	35	33	31	549	670	...
4.0	...	26	34	32	31	28	28	325	390	...
4.5	...	23	20	21	22	22	23	030	...	...
5.0	...	11	09	09	10	12	10	...	...	...

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued)
SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	CG 242 Se red dark 100 %	CG 244 Se red lant. 225 %	CG 245 Se red traffic 300 %	CG 246 Se red lt. house 125 %	CG 346 amber A 2.5 mm	BL Kali- chrome A yellow 2 mm	BL Kali- chrome C yellow 2 mm	CG 348 yel. lant. Y 4	CG 351 yel. traffic Y 3	CG 338 yel. noviol C
0.22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.30	.....	.....	.....	.....	.....	.00	.00	.....	.....	.....
.32	.....	.....	.....	.....	.....	.00	.00	.....	.....	.....
.34	.....	.....	.....	.....	.....	.00	.00	.....	.....	.....
.36	.....	.....	.....	.....	.....	.00	.00	.....	.....	.....
.38	.....	.....	.....	.....	.....	.00	.00	0	.....	.....
.40	.....	.....	.....	.....	0	.21	.00	.0008	.....	.....
.42	.....	.....	.....	.....	.045	.50	.00	.0010	.....	.....
.44	.....	.....	.....	.....	.105	.65	.00	.0020	.....	.....
.46	.....	.....	.....	.....	.200	.74	.00	.0039	.....	.....
.48	.....	.....	.....	.....	.330	.81	.00	.0075	.....	.....
.50	.....	.....	.....	.....	.465	.85	.02	.0137	.....	.000
.52	.....	.....	.....	.....	.585	.90	.46	.0289	.....	.380
.54	.....	.....	.....	.....	.680	.93	.87	.0826	0	.765
.56	0	.....	.....	.....	.750	.94	.93	.157	.0003	.813
.58	.0001	.....	.....	.....	.795	.94	.97	.544	.289	.820
.60	.0005	.024	.148	.730	.835	.95	.98	.784	.844	.825
.62	.019	.680	.722	.828	.855	.96	.98	.882	.864	.825
.64	.630	.832	.844	.844	.865	.97	.97	.890	.874	.....
.66	.828	.855	.850	.850	.869	.97	.97	.893	.883	.....
.68	.847	.863	.....	.847	.879	.97	.97	.894	.889	.....
.70	.853	.862	.850	.835	.879	.97	.97	.894	.891	.....
.72	.854	.859	.....	.825	.900	.97	.97	.892	.891	.....
1.0	.605	.....	.....	.....	.....	.96	.87	.888	.890	.....
1.5	.703	.....	.....	.....	.....	.95	.89	.....	.....	.....
2.0	.805	.....	.....	.....	.....	.95	.90	.....	.....	.....
2.5	.730	.....	.....	.....	.....	.89	.85	.....	.....	.....
3.0	.330	.....	.....	.....	.....	.59	.60	.....	.....	.....
3.5	.275	.....	.....	.....	.....	.30	.34	.....	.....	.....
4.0	.230	.....	.....	.....	.....	.22	.27	.....	.....	.....
4.5	.023	.....	.....	.....	.....	.16	.17	.....	.....	.....
5.0	.....	.....	.....	.....	.....	.08	.10	.....	.....	.....

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

TRANSMISSION OF COLORED GLASSES (Continued)

Wave-length μ	CG 038 lt. yel. noviol A	CG 306 lt. yel. noviol O 2 mm	CG 330 sig. yel. 210 % 2.5 mm	CG 375 U yel. flor. 5 mm	BL Fieuzal A green 2 mm	BL Fieuzal B green 2 mm	BL Fieuzal C green 2 mm	BL Anti- glare green 2 mm	BL Green 19 green 2 mm	BL Ht. abs. green 2 mm
0.22	*	*	*	*	*	*
.24
.26
.28
.30
.32
.34
.36
.38
.40
.42
.44
.46
.48
.50
.52
.54
.56
.58
.60
.62
.64
.66
.68
.70
.72
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued)
SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	BL red free green 2 mm	CG 396 green 2 mm	CG 428 bl. grn. 2 mm	CG 440 sig. grn. 150% 5.78 mm	CG 401 sext. green 1 mm	CG 502 blue 2 mm	CG 503 dk. blue 2 mm	CG 556 sig. blue 100% 5 mm	CG 554 blue 101% 2.8 mm	CG 590 lt. bl. 4.6 mm
0.22	*									
24	...									
26	...									
28	...									
30	...	0	0					0		
32	00	020	004					060		
34	00	280	266					370		
36	00	530	652	0				650		
38	00	670	780	073				727		
40	00	735	830	237				780		417
42	04	760	845	366	0	631	766	780	700	650
44	10	785	860	480	0494	782	832	800	730	653
46	17	800	865	588	252	825	830	795	700	550
48	23	815	860	638	429	822	791	727	635	462
50	25	820	835	618	592	787	698	458	400	380
52	22	820	770	526	670	703	547	205	175	316
54	13	805	680	366	653	578	380	049	050	258
56	06	790	515	205	538	441	236	012	015	200
58	02	760	375	0952	397	281	105	022	030	205
60	01	720	255	0375	260	171	050	005	005	170
62	00	670	175	0134	161	088	018	0008	0	121
64	00	610	105	0051	107	038	005	0005	0	099
66	00	555	075	0019	0762	035	005	0003	0	080
68	00	495	050		0632	024	003	0003	0	082
70	00	430	040		0508	082	005	002	015	095
72	00	370	030		049	054	015	008	060	103
1.0	07	068			050	269	173	009	080	
1.5	10	172			180					
2.0	35	279			525					
2.5	54	400			780					
3.0	46				250					
3.5	29				150					
4.0	28				110					
4.5	20				0					
5.0	08									

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	BL Blue O blue 2 mm	BL Blue A blue 2 mm	BL Blue B blue 2 mm	BL Blue C blue 2 mm	CG 511 violet 2.15 mm	CG 557 lt. purp. 6.2 mm	CG 555 purp. 4.8 mm	CG 512 didym. 5 mm	CG 507 purp. 3 mm	CG 227 gold ruby 3 mm
0.22	*			*						
.24	.....			.....		
.26	.....			.....		
.28	.....			.....		
.30	.020	.11	.08	.11						
.32	.450	.68	.65	.60	0					
.34	.79	.88	.87	.87	.0018					
.36	.88	.94	.93	.97	.082				.212	
.38	.94	.97	.96	.98	.326	.795	.783		.552	
.40	.98	.98	.97	.98	.502	.861	.845		.728	
.42	1.00	.99	.98	.97	.462	.834	.786	.731	.726	.090
.44	1.00	.99	.98	.95	.326	.810	.705	.530	.490	100
.46	.99	.99	.98	.92	.138	.781	.589	.548	.225	105
.48	.99	.97	.93	.81	.014	.665	.318	.530	.092	100
.50	.99	.94	.83	.66	.0063	.497	.1015	.652	.045	.090
.52	.99	.91	.73	.52		.302	.0163	.601	.028	.055
.54	.98	.89	.69	.45		.185	.033	.790	.0299	.015
.56	.97	.88	.67	.43		.257	.0092	.811	.033	.005
.58	.96	.87	.64	.40		.160	.0017	.082	.050	.005
.60	.96	.86	.62	.37		.095	.0002	.184	.0727	.045
.62	.96	.85	.61	.35		.109	.0004	.184	.100	.185
.64	.96	.85	.60	.36		.0935	.0002	.849	.128	365
.66	.96	.87	.64	.39		.132	.0008	.851	.156	615
.68	.97	.91	.75	.52		.360	.035	.849	.177	615
.70	.98	.97	.93	.81		.710	.400	.736	.201	.695
.72	.....					.852	.795	.804	.230	.740
1.0	.99	.98	.99	.99				.845	.267	.740
1.5	.96	.95	.89	.83	0				.793	
2.0	.97	.94	.92	.87	100				.902	
2.5	.95	.87	.87	.91	.387				.863	
3.0	.81	.80	.85	.72	.320				.732	
3.5	.49	.33	.35	.41	.250				.155	
4.0	.39	.31	.31	.33	.305				.007	
4.5	.31	.21	.19	.29	.156				.015	
5.0	.11	.09	.12	.11	0				0	

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued) SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	CG G 984 B green	CG G 985 B blue	CG 585 bl. purp. tr. u.v. 1 mm	CG 597 rd. purp. tr. u.v. 1 mm	CG 587 rd. purp. tr. u.v. 2 mm	CG 586 violet tr. u.v. 5 mm	CG 584 red tr. u.v. 1 mm	CG 774 neut. pyrex. 2 mm	CG 970 neut. corex D 2 mm	CG 980 neut. corex A 2 mm
0.22	..	0	...	...	...	...	...	...	0	.0115
.24	0	.02	...	...	...	...	...	...	.0027	.237
.26	.38	.18	...	...	0	...	...	...	.039	.531
.28	.34	.46	0	...	0	...	...	0	.305	.753
.30	.12	.68	.153	.116	.039	0	.129	.120	.700	.840
.32	.36	.78	.650	.570	.342	.0004	.555	.610	.860	.879
.34	.73	.84	.860	.850	.640	.097	.791	.830	.902	.884
.36	.79	.86	.910	.913	.795	.290	.830	...	...	.885
.38	.75	.86	.925	.890	.700	.080	.714	.913	...	...
.40	.45	.81	.900	.714	.265	0	.115	.913	...	.887
.42	.11	.67	.840	.260	.045	...	0	...	...	.893
.44	.02	.41	.765	.065	.010	...	...	.913	...	...
.46	.01	.16	.620	.025	.010	...	...	...	...	.897
.48	.03	.04	.390	.025	.005	...	...	.917	...	...
.50	...	...	.199	.026	.000	...	...	...	...	.900
.52	...	...	.090	.026	.005	...	...	.918	...	...
.54	...	...	.053	.028	.005	...	...	...	...	.900
.56	...	...	.104	.027	.010	...	...	.918	...	...
.58	...	...	.029	.030	.005	...	...	.919	...	.900
.60	...	...	.014	.065	.000	...	...	...	...	...
.62	...	...	.020	.034	.000	...	...	...	...	.900
.64	...	...	.018	.045	.000	...	0	.919	...	...
.66	...	...	.033	.160	.005	...	.010	...	...	...
.68	...	...	.146	.350	.035	...	.080	.919	...	.900
.70	...	...	.505	.505	.255	...	.290	.919	...	...
.72	...	...	.760	.595	.520	...	.405	...	...	.900
1.0	...	...	.850	.450	...	...	...	.915	...	.900
1.5	...	...	.425	.610	...	...	...	.914	...	.898
2.0	...	...	.645	.415	...	...	...	.904	...	.857
2.5	...	...	.805	.450	...	...	...	...	...	.744
3.0	...	...	.595	.485	...	...	...	...	...	.018
3.5	...	...	.520	.393	...	...	...	...	...	.017
4.0	...	...	.580	.422	...	...	...	...	...	...
4.5	...	...	.310	...	...	...	...	...	...	...

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued) SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	Cg 986 rd. purp. corex A 3 mm	BL Weld. 3 yel. grn. 1 mm	BL Weld. 4 yel. grn. 1 mm	BL Weld. 5 yel. grn. 0.5 mm	BL Weld. 8 yel. grn. 0.5 mm	BL Weld. 12 yel. grn. 0.5 mm	CE Cescoweld no. 3 ht. abs.	CE Cescoweld no. 4 ht. abs.	CE Cescoweld no. 5 ht. abs.	CE Cescoweld no. 6 ht. abs.
0.22	....	*	*	*	*	*	...	...	...	...
.24	0	...	...	...	...	...	...	...	...	...
.26	.135	...	...	...	...	...	...	...	...	...
.28	.412	...	...	...	...	...	...	...	...	...
.30	.625	.00	.00	.00	.00	.00	...	...	...	...
.32	.793	.00	.00	.00	.00	.00	...	...	...	...
.34	.814	.00	.00	.00	.00	.00	...	...	...	...
.36	.797	.03	.03	.06	.11	.01	...	...	...	...
.38	.430	.06	.09	.13	.18	.01	...	...	...	...
.40	.075	.09	.12	.14	.21	.01	...	...	...	...
.42	.023	.10	.13	.14	.16	.02	...	...	...	...
.44	.000	.09	.14	.15	.15	.02	...	...	...	...
.46	.000	.13	.19	.21	.17	.03	...	...	...	...
.48	.000	.22	.27	.27	.20	.05	...	...	...	...
.50	.000	.31	.25	.25	.25	.07	...	...	...	...
.52	.000	.40	.42	.41	.29	.08	...	...	...	...
.54	.000	.46	.44	.45	.31	.09	...	...	...	...
.56	.000	.46	.43	.45	.32	.10	...	...	...	...
.58	.000	.43	.39	.43	.31	.09	...	...	...	...
.60	.001	.36	.31	.38	.27	.08	...	...	...	...
.62	.003	.29	.25	.31	.23	.07	...	...	...	...
.64	.010	.24	.20	.26	.20	.06	...	...	...	...
.66	.025	.19	.15	.21	.19	.05	...	...	...	...
.68	.128	.15	.12	.18	.17	.05	...	...	...	...
.70	.231	.12	.09	.16	.15	.04	...	...	...	...
.72	.240	..	..	..	..	..	...	...	...	...
1.0	.095	.07	.04	.09	.04	.03	...	...	...	...
1.5	.009	.03	.02	.04	.07	.02	...	...	...	...
2.0	.026	.07	.04	.10	.12	.04	...	...	...	...
2.5	.081	.11	.10	.15	.19	.07	...	...	...	...
3.0	0	.14	.11	.20	.22	.11	...	...	...	...
3.5	...	.16	.13	.14	.28	.14	...	...	...	...
4.0	...	.20	.17	.30	.33	.21	...	...	...	...
4.5	...	.21	.17	.37	.29	.26	...	...	...	...
5.0	...	.06	.05	.20	.15	.30	...	...	...	...

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION II.—JENA GLASSES*

Wave-length μ	UG 1 dk. viol. tr. u.v. 1 mm	UG 2 dk. viol. tr. u.v. 1 mm	UG 3 violet 1 mm	UG 4 dark violet 1 mm	BG 1 blue tr. u.v. 1 mm	BG 2 blue tr. u.v. 1 mm	BG 3 blue tr. u.v. 1 mm	BG 5 dk. blue abs. red 1 mm	BG 6 dk. blue 1 mm
.281	....	0.01	....	....	0.04	....	0.13	....	....
.302	0.17	.27	....	0.09	.40	0.04	.69	....	....
.312	.37	.50	0.04	.22	.64	.16	.77	....	....
.334	.69	.80	.55	.59	.93	.63	.92	....	....
.366	.85	.84	.91	.77	.97	.84	.96	0.09	0.06
.405	.08	.02	.85	.07	.97	.70	.86	.33	.34
.436	....	....	.50	.01	.86	.42	.63	.47	.48
.480	....	....	.17	.02	.44	.02	.10	.39	.33
.509	....	....	.12	.01	.14	....	.01	.19	.12
.546	....	....	.15	.02	.04	....	....	.06	.02
.578	....	....	.21	....	.05	....	....	.04	.02
.644	....	....	.35	....	.01	....	....	.01	.01
.700	.01	.12	.46	.21	.51	.32	.06	.13	.08
.775	.34	.30	.64	.52	.94	.84	.90	.13	.14
.85	.22	.19	.79	.39	.97	.83	.98	.10	.10
.95	.11	.12	.93	.39	.93	.74	.94	.12	.12
1.05	.07	.09	.97	.37	.86	.61	.81	.15	.15
1.15	.05	.07	.98	.32	.76	.50	.64	.19	.18
1.30	.04	.06	.99	.28	.58	.41	.39	.24	.23
1.45	.04	.06	.99	.27	.45	.38	.27	.29	.27
1.60	.03	.06	.99	.26	.40	.37	.19	.34	.31
1.80	.04	.06	.99	.25	.44	.38	.20	.42	.38
2.00	.04	.06	.99	.32	.50	.41	.28	.49	.46
2.40	.11	.11	.98	.51	.69	.51	.47	.68	.66
3.00	.17	.19	.86	.35	.55	.35	.49	.37	.36

* Data furnished by courtesy of the Fish-Schurman Corp., New York, Importers of Jena Glasses. All values are corrected for reflection losses.

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued)
SECTION II.—JENA GLASSES (Continued)

Wave-length μ	BG 7 dk. blue abs. red 1 mm	BG 9 blue-green 1 mm	BG 10 blue-green 1 mm	BG 11 lt blue (Nd) 1 mm	BG 12 blue abs. red 1 mm	BG 13 med. blue 1 mm	BG 14 bright blue 1 mm	BG 15 blue 1 mm	BG 16 blue 1 mm
.281	....	....	....	0.02	....	....	....	....	....
.302	....	....	....	.21	....	....	....	....	....
.312	....	0.01	....	.38	0.02	....	0.13	0.03	....
.334	0.02	.21	0.12	.80	.39	....	.71	.33	0.04
.366	.26	.67	.60	.95	.75	0.35	.92	.73	.57
.405	.51	.90	.78	.97	.86	.77	.98	.86	.80
.436	.70	.94	.84	.96	.85	.87	.98	.89	.84
.480	.79	.96	.88	.93	.48	.87	.98	.90	.86
.509	.73	.96	.88	.95	.12	.85	.96	.90	.86
.546	.50	.95	.87	.99	.02	.77	.90	.90	.84
.578	.26	.93	.86	.70	.01	.64	.75	.89	.81
.644	.03	.86	.74	1.00	....	.35	.46	.80	.68
.700	....	.74	.63	0.99	.04	.21	.30	.65	.54
.775	....	.56	.42	.90	.08	.14	.24	.47	.36
.85	.01	.46	.31	.92	.08	.14	.27	.36	.25
.95	.02	.38	.25	.98	.12	.19	.35	.28	.20
1.05	.04	.34	.24	.99	.18	.24	.45	.24	.18
1.15	.08	.33	.26	.99	.18	.30	.55	.24	.17
1.30	.15	.36	.31	.98	.16	.43	.69	.30	.21
1.45	.24	.42	.39	.97	.19	.52	.78	.41	.28
1.60	.35	.49	.47	.96	.22	.61	.84	.45	.38
1.80	.48	.56	.53	.97	.27	.73	.90	.49	.44
2.00	.58	.59	.55	.97	.53	.81	.93	.54	.44
2.40	.74	.64	.58	.93	.79	.88	.94	.61	.55
3.00	.56	.50	.46	.54	.55	.59	.63	.51	.44

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued)
SECTION II.—JENA GLASSES (Continued)

Wave-length μ	BG 17 col. abs. heat 1 mm	VG 2 yellow- green 1 mm	VG 3 green (Nd) 1 mm	GG 1 col. abs. u.v. 1 mm	GG 2 col. abs. u.v. 1 mm	GG 3 light yellow 1 mm	GG 4 light green 1 mm	GG 5 bright yellow 1 mm	GG 6 medium yellow 1 mm
.281	...	...	...	...	...	...	...	...	...
.302	0.03	...	...	0.02	...	0.03	...	0.01	0.02
.312	.11	...	...	.13	...	.05	...	.02	.05
.334	.46	...	0.01	.47	...	.09	0.03	.03	.11
.366	.89	...	.49	.86	0.64	.16	.01	.09	.14
.405	.97	...	.27	.98	.97	.21	.40	.14	.21
.436	.98	0.05	.06	.99	.99	.85	.67	.40	.36
.480	.98	.37	.02	1.00	1.00	.99	.92	.99	.73
.509	.98	.59	.38	1.00	1.00	1.00	.95	1.00	.98
.546	.98	.61	.06	1.00	1.00	1.00	.97	1.00	1.00
.578	.98	.44	.69	1.00	1.00	1.00	.96	1.00	1.00
.644	.97	.10	...	1.00	1.00	1.00	.94	1.00	1.00
.700	.93	.08	.85	1.00	1.00	1.00	.96	1.90	0.99
.775	.78	.07	.59	1.00	1.00	0.99	.99	0.96	.98
.85	.61	.06	.32	1.00	1.00	.98	.99	.99	.97
.95	.42	.09	.36	1.00	1.00	.98	.99	.98	.96
1.05	.32	.13	.22	1.00	1.00	.97	.99	.98	.95
1.15	.30	.18	.20	1.00	1.00	.97	.99	.98	.95
1.30	.33	.27	.39	1.00	1.00	.97	.99	.97	.95
1.45	.36	.37	.34	1.00	1.00	.98	.99	.97	.96
1.60	.43	.47	.22	1.00	1.00	.98	.99	.98	.96
1.80	.46	.57	.38	1.00	1.00	.98	.99	.98	.97
2.00	.42	.65	.47	1.00	0.99	.98	.99	.98	.97
2.40	.39	.75	.30	0.96	.98	.96	.98	.97	.94
3.00	.27	.54	.12	.50	.70	.62	.64	.62	.62

TRANSMISSION OF COLORED GLASSES (Continued)
SECTION II.—JENA GLASSES (Continued)

Wave-length μ	GG 7 medium yellow 1 mm	GG 8 greenish- yellow 1 mm	GG 9 greenish- yellow 1 mm	GG 10 dk. grn.- yellow 1 mm	GG 11 deep yellow 1 mm	GG 12 yellow, grn. fl. 1 mm	OG 1 yellow- orange 1 mm	OG 2 orange 1 mm	OG 3 red- orange 1 mm
.281	....	....	0.01	....	....	....	....	....	....
.302	....	....	0.01	....	....	....	....	....	....
.312	0.01	....	0.01	....	....	0.03	....	....	....
.334	.04	....	....	....	....	.74	....	....	....
.366	.05	....	....	....	....	....	....	....	....
.405	.12	0.05	.01	....	....	.53	....	....	....
.436	.16	.26	.14	0.09	0.01	.71	....	....	....
.480	.65	.75	.78	.59	.24	.90	....	....	....
.509	.99	.88	.88	.85	.97	.96	0.01	....	....
.546	.99	.99	.93	.97	.99	.99	.91	0.14	0.48
.578	1.00	.99	.92	.95	.99	1.00	.99	.94	1.00
.644	1.00	.92	.89	.83	.99	1.00	.99	.99	1.00
.700	1.00	.92	.91	.86	.99	1.00	.99	.99	1.00
.775	0.99	.98	.95	.96	.98	1.00	.99	.99	0.99
.85	.99	.98	.98	.99	.97	1.00	.99	.99	.99
.95	.98	.99	.99	.99	.96	1.00	.99	.99	.98
1.05	.98	1.00	.99	.99	.96	1.00	.99	.99	.98
1.15	.97	1.00	.99	1.00	.96	1.00	.99	.99	.98
1.30	.96	1.00	.99	1.00	.96	1.00	.99	.99	.98
1.45	.96	1.00	.99	0.99	.96	1.00	.99	.99	.98
1.60	.97	1.00	.99	.99	.96	0.99	.99	.99	.98
1.80	.98	.99	.99	.99	.97	.99	.98	.99	.98
2.00	.98	.99	.99	.99	.97	.99	.98	.99	.99
2.40	.95	.96	.97	.94	.95	.98	.97	.97	.97
3.00	.65	.68	.69	.44	.66	.67	.62	.60	.63

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued) SECTION II.—JENA GLASSES (Continued)

Wave-length μ	RG 1 bright red 1 mm	RG 2 pure red 1 mm	RG 3 dark red 1 mm	RG 4 dark red 1 mm	RG 5 dark red 1 mm	RG 6 blood color 1 mm	RG 7 infra-red 1 mm	RG 8 v. dk. red. 1 mm	RG 9 infra-red 1 mm
.281	...	...	...	...	...	...	...	...	...
.302	...	...	...	...	...	0.12	...	...	...
.312	...	...	...	...	...	.20	...	...	...
.334	...	...	...	...	...	.34	...	...	...
.366	...	...	...	...	...	.44	...	...	...
.405	...	...	...	...	...	...	...	...	...
.436	...	...	...	...	...	.49	...	...	...
.480	...	...	...	...	...	.50	...	...	...
.509	...	...	...	0.02	...	.44	...	...	...
.546	...	...	...	...	...	.31	...	...	...
.578	...	...	...	.05	...	...	...	...	...
.644	0.96	0.92	0.54	.10	0.02	.40	...	0.01	...
.700	.98	.98	.70	.55	.96	.93	0.02	.71	0.20
.775	.98	.98	.81	.82	.98	.98	.18	.99	0.98
.85	.98	.98	.88	.87	.98	.99	.41	.99	.97
.95	.98	.98	.92	.91	.98	.99	.74	.99	.92
1.05	.98	.98	.94	.93	.98	.99	.91	.99	.80
1.15	.98	.98	.95	.94	.99	.99	.96	.99	.62
1.30	.98	.98	.97	.96	.99	.99	.97	.99	.38
1.45	.98	.98	.97	.97	.99	.99	.98	.99	.25
1.60	.98	.98	.98	.98	.99	.99	.99	.99	.19
1.80	.98	.98	.98	.98	.99	.99	.99	.99	.20
2.00	.98	.98	.98	.99	.99	.99	.99	.99	.27
2.40	.96	.95	.94	.97	.97	.96	.99	.97	.45
3.00	.65	.65	.56	.67	.58	.63	.85	.58	...

TRANSMISSION OF COLORED GLASSES (Continued)

TRANSMISSION OF COLORED GLASSES (Continued)
SECTION II.—JENA GLASSES (Continued)

Wave-length μ	NG 1 v. dk. neut. 0.1 mm	NG 2 med. dk. neut. 0.1 mm	NG 3 dk. neut. 1 mm	NG 4 med. neut. 1 mm	NG 5 neut. 1 mm	NG 6 light neut. 1 mm	NG 7 blue-gray 1 mm
.281	....	0.05	....	....	....	....	....
.302	....	.30	....	....	....	....	....
.312	....	.36	....	....	....	....	....
.334	....	.46	....	....	0.02	0.07	0.01
.366	0.21	.47	0.02	0.07	.22	.53	.17
.405	.29	.45	.08	.18	.37	.89	.37
.436	.32	.46	.12	.23	.43	.92	.44
.480	.36	.50	.15	.29	.46	.89	.34
.509	.36	.52	.17	.30	.46	.89	.29
.546	.36	.56	.17	.31	.46	.89	.33
.578	.36	.58	.17	.31	.46	.89	.26
.644	.37	.62	.17	.30	.46	.87	.19
.700	.45	.77	.16	.28	.43	.86	.34
.775	.50	.80	.12	.21	.34	.85	.34
.85	.49	.80	.08	.17	.27	.86	.29
.95	.48	.81	.07	.14	.21	.87	.24
1.05	.50	.85	.07	.14	.19	.89	.21
1.15	.54	.85	.06	.16	.19	.91	.21
1.30	.59	.86	.09	.21	.22	.93	.21
1.45	.63	.88	.15	.26	.26	.95	.22
1.60	.67	.89	.20	.30	.31	.96	.26
1.80	.71	.90	.22	.34	.38	.96	.34
2.00	.73	.91	.26	.37	.43	.97	.40
2.40	.78	.93	.34	.39	.48	.96	.44
3.00	.72	.87	.20	.19	.21	.72	.25

TRANSMISSION OF WRATTEN FILTERS

Data condensed from Wratten Light Filters, published by Eastman Kodak Co., manufacturers of the filters.

The following pages give the percent transmission for the dyed gelatin only, unless otherwise indicated. Values for the transmission for wave lengths less than 0.40μ and greater than 0.70μ are computed from density curves while the values for the visible spectrum are taken directly from transmission tables. The values thus computed for the transmission in the ultraviolet and infrared are necessarily less accurate and are intended only as a general guide to the characteristics of the filters. These values are printed in italics.

In case the gelatin filters are cemented between sheets of glass the transmission at any wave length will be the product of the filter transmission and the transmission of glass for that wave length. See No. 00.

To save space the name, use and stability of the filters are indicated in the list below. The following abbreviations are used:

abs., absorbs	neut., neutral	sl., slightly
compl., complementary	ortho., orthochromatic	trans., transmits
exp., experimental	phot., photography	uns., unstable
ir., infrared	s., stable	uv., ultraviolet
m.s., moderately stable	sens., sensitive	v.s., very stable

No.	Name, use and stability	No.	Name, use and stability
	Colorless		
00	Two pieces of "B" glass cemented together, such as ordinarily used for mounting gelatin filters.	23	E red, contrast, m.s.
0	Plain gelatin, focusing, s.	23A	E red (light), exp. tricolor projection, m.s.
1	β -Naphtholdisulfonic acid, abs. uv., m.s.	23B	Two-color red, additive projection, m.s.
2	Aesculine, abs. uv., uns. (turns brown).	24	Projection red, additive tricolor projection, m.s.
2A	—, abs. uv., s.	24A	Projection red (light), projection, m.s.
	Yellow	25	A (tricolor red), contrast, m.s.
3	Aero No. 1, aerial phot., v.s.	26	Stereo red, for anaglyphs, m.s.
3N5	—, ortho., Aero No. 1 with neut. density, v.s.	27	Stage red, exp. tricolor, s.
4	Kodak color filter, ortho., v.s.	27A	Stage red (light), exp. tricolor, s.
5	Aero No. 2, aerial phot., v.s.	28	Ciné red, two-color taking, s.
5N5	—, ortho., Aero No. 2 with neut. density, v.s.	29	F, contrast, m.s. (darkens sl.).
6	K1, ortho., v.s.		Magenta and Violet
7	K1½, ortho., v.s.		Transmitting both red and blue
8	K2, ortho., v.s.	30	Rose bengal, absorption, uns.
9	K3, ortho., v.s.	30A	Q, absorption, m.s.
11	X1, ortho., v.s.	31	Minus green 1, absorption, sl. uns.
12	Minus blue, compl., v.s.	32	Minus green 3, compl., m.s.
13	X2, ortho., v.s.	33	Xylene red, absorption, s.
15	G, contrast, v.s.	34	D (light), absorption, sl. uns.
16	Flavazine T, contrast, v.s.	35	D, contrast, m.s.
17	Quinoline yellow, trans. uv., abs. violet, s.	36	Methyl violet B.B.R., absorption, m.s.
18A	Ultraviolet, trans. uv. and ir. only, s. Glass filter.		Blue and Blue Green
	Orange and Red		
21	Monobromofluoresceine, contrast, m.s.	38	Toluidine blue, absorption, v.s.
22	E2, contrast, m.s.	38A	Dark toluidine blue, absorption, v.s.
		39	Duplicating, contrast, s. Glass filter.

TRANSMISSION OF WRATTEN FILTERS (Continued)

No.	Name, use and stability	No.	Name, use and stability
40	Ciné green 1, two-color taking (tungsten source), m.s.	67	Filter blue green, absorption, s.
40A	Ciné green 2, two-color taking, m.s.	68	Fast green blue shade, absorption, s.
43	Minus red 2, absorption, sens. to heat.	69	Two-color blue green, additive projection, s.
44	Minus red 4, compl., m.s. (not sens. to heat).		Monochromatic
44A	Minus red 5, compl., m.s. (not sens. to heat).	70	α -(contrast R), deep red monochromat, m.s.
45	H, contrast, m.s. (darkens).	71A	β , orange red monochromat, m.s.
45A	Blue green, contrast, m.s. (darkens).	72	γ , orange yellow monochromat, m.s.
46	γ -Blue, contrast, m.s. (darkens).	73	δ , yellow green monochromat, s.
47	C5 projection blue, projection tricolor (standard tricolor), s.	74	ϵ , pure green monochromat, s.
47A	Stage blue, exp. tricolor, s.	75	η , blue green monochromat, m.s.
48	C2, absorption, s.	76	θ , violet monochromat, m.s.
48A	C3, absorption, s.	77	Mercury vapor monochromat, v.s. Cemented in glass.
49	C4, contrast, s.	77A	Mercury vapor monochromat, v.s. Cemented in glass.
49A	C4 (light), exp. tricolor, s.		Photometric
49B	C4 (dark), exp. tricolor, s.		Bluish, photometric, s.
49C	C4 (extra dark), exp. tricolor, s.	78	———, photometric, s.
50	L, contrast, m.s.	78AA	———, photometric, s.
	Green	78A	———, photometric, s.
51	Naphthol green 1, absorption, v.s.	78B	———, photometric, s.
52	Naphthol green 2, absorption, v.s.	78C	———, photometric, s.
53	Naphthol green 3, absorption, v.s.	79	———, photographic compensator, m.s.
54	Naphthol green 4, absorption, v.s.	80	———, kodachrome for photoflood, s.
55	Stereo green, viewing for anaglyphs, s.	86	Yellowish, photometric, m.s.
56	B3, absorption, s.	86A	———, photometric, m.s.
57	B2 (light), absorption, s.	86B	———, photometric, m.s.
57A	B2 (extra light), exp. tricolor, s.	86C	———, photometric, m.s.
58	B2, contrast, s.		Miscellaneous
58A	B2 (dark), s.	87	Extra dark infrared, absorption, v.s.
59	Projection green, tricolor for additive projection, s.	88	Infrared (R. W. Wood), absorption, v.s.
59A	Projection green (light), exp. tricolor, s.	88A	Infrared, absorption, v.s.
60	P, contrast, s.	89	Signaling red (light), absorption, s.
61	N, contrast, s.	89A	Signaling red (dark), absorption, s.
62	Mercury green, mercury monochromat, s.	90	Monochromatic viewing, s.
63	ϵ -Green, absorption, s.	91	Z (infrared), absorption, m.s.
64	Minus red 3 (light), absorption, s.	96	Neutral, m.s.
65	Minus red 3, absorption, s.	97	Dichroic, absorption, m.s.
65A	Minus red 3 (intermediate) absorption, s.	97A	Dichroic (light), absorption, m.s.
66	Rapid filter green, absorption, s.	97B	Dichroic (extra light), absorption, m.s.

TRANSMISSION OF FILTERS (Continued)

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	00	0	1	2	2A	3	3N5	4	5	5N5	6	7	8
0.24 μ	...	3	...	...	...	...	...	...	...	...	...	...	...
.26	...	3.2	...	...	...	...	...	...	...	...	...	...	...
.28	...	5.2	...	...	...	...	...	...	...	...	...	...	...
.30	...	43	...	...	...	...	...	...	...	...	...	...	...
.32	...	58	...	...	...	...	...	...	...	...	...	...	...
.34	2.5	69	...	...	...	...	...	...	...	...	...	...	...
.36	30	79	27	...	...	...	...	...	...	...	...	...	...
.38	65	83	78	4.0	...	...	...	...	...	...	...	...	...
.40	85	...	...	...	...	...	...	...	...	...	...	...	...
.42	92	85.0	85.0	30.0	54.3	...	...	...	...	...	...	...	...
.44	92	86.0	86.0	62.8	83.0	...	...	...	...	...	...	...	...
.46	92	87.0	87.0	79.5	86.0	...	...	...	...	...	...	...	...
.48	92	87.8	87.8	84.5	87.5	39.9	15.7	2.50	...	...	...	...	...
.50	92	88.5	88.5	86.5	87.5	82.2	33.9	70.4	...	...	...	...	...
.52	92	88.9	88.9	87.5	88.4	86.2	29.5	81.0	...	...	...	...	...
.54	92	89.3	89.3	88.3	89.1	87.5	27.0	85.5	...	...	...	...	...
.56	92	89.5	89.5	88.9	89.5	88.2	28.9	87.2	...	...	...	...	...
.58	92	89.7	89.7	89.3	89.7	89.2	32.4	88.0	...	...	...	...	...
.60	92	89.9	89.9	89.6	89.9	89.5	32.2	88.8	...	...	...	...	...
.62	92	90.0	90.0	89.8	90.0	89.7	32.3	89.3	...	...	...	...	...
.64	92	90.0	90.0	90.0	90.0	89.9	29.5	89.7	...	...	...	...	...
.66	92	90.0	90.0	90.0	90.0	90.0	28.8	89.9	...	...	...	...	...
.68	92	90.0	90.0	90.0	90.0	90.0	28.2	90.0	...	...	...	...	...
.70	92	90.0	90.0	90.0	90.0	90.0	28.2	90.0	...	...	...	...	...
.72	...	...	...	...	...	...	...	...	...	...	...	...	...
.74	...	...	...	...	...	...	...	...	...	...	...	...	...
.76	...	...	...	...	...	...	...	...	...	...	...	...	...
.78	...	...	...	...	...	...	...	...	...	...	...	...	...
.80	...	...	...	...	...	...	...	...	...	...	...	...	...
.82	...	...	...	...	...	...	...	...	...	...	...	...	...
.84	...	...	...	...	...	...	...	...	...	...	...	...	...
.86	...	...	...	...	...	...	...	...	...	...	...	...	...
.88	...	...	...	...	...	...	...	...	...	...	...	...	...
.90	92	...	...	...	...	...	...	...	...	...	...	...	...

TRANSMISSION OF FILTERS (Continued)

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	9	11	12	13	15	16	17	18A	21	22	23	23A	23B
0.24 μ	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	3	6	...	...	...	...	...	...	...	...	...	...
32	...	5	2.0	4	9	...	...	3.0	...	...	...	...	...
34	...	1	...	...	...	...	...	20	...	...	...	...	...
36	...	...	...	...	...	...	...	36	...	...	...	...	...
38	...	...	...	...	...	...	...	25	...	...	...	...	...
40	...	...	...	...	...	...	1.59	...	...	...	...	...	...
42	...	20	...	...	...	...	12	...	...	...	...	...	...
44	...	1.00	...	45	...	...	07	...	...	...	...	...	...
46	...	7.00	...	3.62	...	...	1.97	...	...	...	...	...	...
48	10.0	26.9	...	25.2	...	...	80.0	...	...	...	...	...	...
50	33.3	52.5	2.50	50.0	...	...	85.0	...	...	...	...	...	...
52	58.8	61.6	50.1	57.5	29.0	10	87.2	...	...	...	...	...	...
54	76.6	51.4	81.5	51.5	76.0	52.4	88.7	...	4.44	...	...	...	...
56	82.5	41.6	85.5	39.9	84.0	82.0	89.5	...	60.2	23.4	...	...	20.2
58	85.7	31.6	88.4	25.2	86.5	85.5	89.9	...	84.0	72.3	...	...	60.0
60	88.0	21.9	89.2	13.8	88.2	87.5	90.0	...	87.5	85.0	...	...	66.0
62	88.9	14.7	89.8	6.60	89.2	88.7	90.0	...	89.0	87.2	...	...	69.0
64	89.5	10.5	90.0	2.69	89.8	89.6	90.0	...	89.6	88.7	...	...	70.8
66	89.8	9.12	90.0	1.57	90.0	90.0	90.0	...	90.0	89.5	...	...	88.8
68	90.0	8.72	90.0	4.07	90.0	90.0	90.0	...	90.0	90.0	...	...	71.8
70	90.0	8.72	90.0	5.64	90.0	90.0	90.0	...	90.0	90.0	...	...	72.0
72	...	...	...	...	...	...	...	4.3	...	...	...	...	...
74	...	...	...	...	...	...	...	8.3	...	...	...	...	...
76	...	...	...	...	...	...	...	5.9	...	...	...	...	...
78	...	...	...	...	...	...	...	2.6	...	...	...	...	...
80	...	...	...	...	...	...	...	1.0	...	...	...	...	...
82	...	...	...	...	...	...	...	1.3	...	...	...	...	...
84	...	...	...	...	...	...	...	...	...	...	...	...	...
86	...	...	...	...	...	...	...	...	...	...	...	...	...
88	...	...	...	...	...	...	...	...	...	...	...	...	...
90	...	...	...	...	...	...	...	...	...	...	...	...	...

TRANSMISSION OF FILTERS (Continued)

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	24	24A	25	26	27	27A	28	29	30	30A	31	32	33
0.24 μ
.26
.28
.30
.32
.34
.36
.38
.40
.42
.44
.46
.48
.50
.52
.54
.56
.58
.60
.62
.64
.66
.68
.70
.72
.74
.76
.78
.80
.82
.84
.86
.88
.90

TRANSMISSION OF FILTERS (Continued)

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	34	35	36	38	38A	39	40	40A	43	44	44A	45	45A
0.24 μ
.26
.28
.30
.32
.34
.36
.38
.40
.42
.44
.46
.48
.50
.52
.54
.56
.58
.60
.62
.64
.66
.68
.70
.72
.74
.76
.78
.80
.82
.84
.86
.88
.90

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	46	47	47A	48	48A	49	49A	49B	49C	50	51	52	53
0.24 μ	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	.....	.....
.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.0	.....	.....
.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.1	.....	.....
.30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.9	.....	.....
.32	1	.....	.....	4	.....	.....	.....	.....	.....	.....	15	.....	.....
.34	2.7	.....	.....	1.2	.....	.....	.....	.....	.....	.....	26	.....	.....
.36	2.2	1.5	.....	2.3	3	.....	.....	.....	.....	.....	45	.....	.....
.38	3.5	10	3.0	6.0	5.0	3.9	9.1	1.7	.4	1.5	.....	1.3	.....
.40	2.09	25.1	12.3	2.69	8.31	5.76	12.0	2.29	.65	.46	55.1	1.83	.....
.42	2.50	49.0	28.2	3.32	15.5	9.75	16.5	3.99	1.42	.77	45.8	.80	.....
.44	13.8	48.0	31.6	19.1	25.5	20.0	36.2	10.0	6.03	8.71	36.1	.37	.....
.46	31.0	43.7	26.2	36.9	25.0	26.2	41.6	15.1	8.28	14.4	39.6	.80	.....
.48	28.7	30.3	13.5	26.2	12.0	10.4	27.6	3.99	1.97	1.97	49.4	5.24	.93
.50	10.7	12.5	3.30	9.10	2.23	.49	7.75	.10	.....	.....	60.1	14.4	5.25
.52	1.58	1.30	.10	.....	.....	.....	.18	.....	.....	.....	70.0	25.1	12.0
.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	75.6	31.6	18.9
.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	74.2	31.6	14.4
.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	71.0	18.2	6.45
.60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60.6	6.61	1.30
.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52.4	2.09	1.15
.64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45.8	.83	.....
.66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.2	.44	.....
.68	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37.8	.22	.....
.70	.....	.....	.....	.....	.....	.....	.31	.....	.....	.....	36.9	.....	.....
.72	.....	2.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.74	.....	11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.76	.....	31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.78	.....	55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.80	.....	72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.82	.....	83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.84	.....	89	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.86	.....	91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.88	.....	91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.90	.....	91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TRANSMISSION OF FILTERS (Continued)

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	54	55	56	57	57A	58	58A	59	59A	60	61	62	63
0.24 μ
.26
.28
.30
.32
.34
.36
.38
.40
.42
.44
.46
.48
.50
.52
.54
.56
.58
.60
.62
.64
.66
.68
.70
.72
.74
.76
.78
.80
.82
.84
.86
.88
.90

TRANSMISSION OF FILTERS (Continued)

TRANSMISSION OF WRATTEN FILTERS (Continued)

A	64	65	65A	66	67	68	69	70	71A	72	73	74	75
0.24 μ
.26
.28
.30
.32
.34
.36
.38
.40
.42
.44
.46
.48
.50
.52
.54
.56
.58
.60
.62
.64
.66
.68
.70
.72
.74
.76
.78
.80
.82
.84
.86
.88
.90

TRANSMISSION OF WRATTEN FILTERS (Continued)

TRANSMISSION OF FILTERS (Continued)

λ	73	77	77A	78	78AA	78A	78B	78C	79	80	86	86A	86P
0.24 μ	...	...	...	...	...	...	2	2.1	...	4.8	...	...	1.3
.26	...	...	...	...	...	1.1	1.8	16	...	10	...	1.9	4.2
.28	...	...	...	1	5	3.4	5.2	16	...	16	...	8.1	21
.30	...	...	...	4	2.0	7.9	13	16	...	22	...	11	29
.32	...	...	...	1.0	4.4	14	21	27	...	22	...	6.2	26
.34	...	...	...	3.0	8.1	24	34	38	...	31	...	3.2	21
.36	...	...	...	16	21	35	46	47	...	49	...	3.5	22
.38	1.9	...	...	32	41	48	54	58	15	68	...	...	...
40	2.29	...	...	43.5	51.3	55.0	60.6	66.0	23.4	72.6	...	10.0	34.7
.42	2.79	...	...	50.0	58.0	59.0	64.5	69.0	28.0	74.5	...	25.7	47.6
.44	9.15	...	...	49.0	58.0	59.5	64.5	70.0	29.9	75.5	...	37.3	55.0
.46	4.46	...	...	42.7	51.3	57.0	63.2	70.0	29.7	75.4	...	43.8	61.9
.48	...	...	...	33.0	40.7	52.5	60.0	69.5	26.8	72.5	...	48.5	66.8
.50	...	...	...	25.1	31.5	47.9	56.4	69.0	22.3	67.7	...	52.4	71.0
.52	...	...	...	17.8	24.0	43.8	52.8	66.0	17.8	64.0	...	57.6	74.5
.54	...	...	...	12.5	19.0	39.0	50.0	63.0	14.4	57.5	...	64.0	77.6
.56	...	...	...	12.5	15.9	35.5	47.9	59.5	11.5	52.0	...	70.5	80.5
.58	...	...	...	9.10	13.7	31.6	45.5	56.4	8.70	46.5	...	77.8	83.0
.60	...	...	...	7.00	12.3	28.8	43.8	54.8	6.40	40.6	...	82.7	85.0
.62	...	...	...	6.30	11.0	26.3	41.8	52.8	4.10	37.5	...	85.3	86.4
.64	...	...	...	4.90	12.3	26.3	41.8	52.8	3.00	35.5	...	86.8	87.5
.66	...	...	...	4.00	9.10	24.6	40.7	51.6	2.68	34.5	...	87.7	88.3
.68	...	...	...	3.60	7.43	22.9	39.8	51.7	2.82	34.5	...	88.0	88.9
.70	...	...	...	3.70	7.43	21.9	39.6	54.8	3.15	34.5	...	88.0	89.0
	.46	...	...	4.50	8.59	25.8	39.6	59.7	...	...	...	...	...

.72	8	...	...	10	...	...	...	...	...	...	...	...	...
.74	1.0	...	...	90	...	...	...	...	...	...	...	...	...
.76	1.4	...	...	59	...	...	...	...	...	...	...	...	...
.78	2.6	...	...	72	...	...	...	...	...	...	...	...	...
.80	7.9	...	...	74	...	...	...	...	...	...	...	...	...
.82	19	...	...	74	...	...	...	...	...	...	...	...	...
.84	34	...	...	74	...	...	...	...	...	...	...	...	...
.86	46	...	...	74	...	...	...	...	...	...	...	...	...
.88	56	...	...	74	...	...	...	...	...	...	...	...	...
.90	65	...	...	76	...	...	...	...	...	...	...	...	...

TRANSMISSION OF FILTERS (Continued)

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	86C	87	88	88A	89	89A	90	91	96	97	97A	97B
0.24 μ	...	...	...	...	...	...	...	...	...	...	...	...
.26	3.9	...	...	...	...	...	...	...	...	...	...	...
.28	9.6	...	...	...	...	...	...	...	...	...	...	...
.30	28	...	...	...	...	...	4	...	...	...	...	...
.32	41	...	...	...	...	...	1.0	...	1	...	...	...
.34	44	...	...	...	...	...	1.1	...	5	...	...	...
.36	36	...	...	...	...	...	7	...	2.2	...	...	...
.38	39	...	...	...	...	...	...	...	4.6	...	...	...
.40	52.4	...	...	...	...	...	...	...	6.72	...	...	...
.42	63.3	...	...	...	...	...	...	...	7.96	...	...	...
.44	71.9	...	...	...	...	...	...	...	8.12	...	...	...
.46	77.7	...	...	...	...	...	...	...	7.85	...	...	...
.48	80.5	...	...	...	...	...	...	...	7.43	...	...	...
.50	82.6	...	...	...	...	...	...	...	7.23	1.00	1.80	3.50
.52	84.2	...	...	...	...	...	...	...	7.23	1.00	1.59	3.50
.54	85.2	...	...	...	...	...	...	...	7.85	.16	.40	1.69
.56	86.1	...	...	...	...	...	...	...	7.85	...	...	.72
.58	86.8	...	...	...	...	...	12.5	...	8.12	...	.12	.67
.60	87.3	...	...	...	...	...	33.0	...	8.12	...	...	.31
.62	87.9	...	...	...	...	...	15.8	...	7.58	...	...	...
.64	88.3	...	...	...	...	...	6.70	...	7.08	...	...	...
.66	88.7	...	...	...	5.00	...	1.00	...	6.93	...	...	...
.68	89.0	...	...	...	33.0	.62	.64	...	6.93	...	.44	.59
.70	89.0	...	5.00	...	64.6	20.2	11.2	3.17	7.30	5.00	5.00	5.60
				...			57.6	14.4	7.85	41.5	20.2	26.9
.72	...	...	28	...	...	...	...	...	10	...	...	...
.74	...	1	69	38	...	...	...	...	11	...	...	...
.76	...	8.5	91	69	...	...	...	...	13	...	...	...
.78	...	21	91	72	...	...	...	...	16	...	...	...
.80	...	54	93	74	...	...	...	...	21	...	...	...
.82	...	68	94	76	...	...	...	...	28	...	...	...
.84	...	76	96	78	...	...	...	...	37	...	...	...
.86	...	81	96	79	...	...	...	...	45	...	...	...
.88	...	84	96	81	...	...	...	...	47	...	...	...
.90	...	85	96	83	...	...	...	...	49	...	...	...

TRANSMISSIBILITY FOR RADIATIONS

Ratio of the transmitted light to the incident light for a definite thickness of the substance, usually 1 cm.

GLASS.

Glass in general is opaque to the ultra-violet and infra-red. Uviol glass is transparent to the longer radiations of the ultra-violet.

Coefficient of transparency of glass for visible and ultra-violet radiations.

Wave length microns.	Normal incidence, thickness 1 cm.								
	0.309	0.330	0.347	0.357	0.361	0.375	0.384	0.388	0.396
Crown, ordinary..	...	...	...	...	...	.947			
Crown, borosili- cate.....	0.08	0.65	0.88	...	0.95	...	0.972	0.975	0.986
Flint, ordinary...	...	...	...	0.72	...	...	...	0.904	
Flint, heavy.....	...	...	0.01	...	0.16	...	0.58		

Wave length, microns.....	Normal incidence, thickness 1 cm.								
	0.400	0.415	0.419	0.425	0.434	0.455	0.500	0.580	0.677
Crown, ordinary..	0.964	...	0.952	...	0.960	0.981	...	0.986	0.990
Crown, borosili- cate.....	...	0.985	...	0.993	...	...	0.993		
Flint, ordinary...	...	0.959	...	...	...	...	1.00		
Flint, heavy.....	...	...	...	0.905					

QUARTZ

Quartz is very transparent to the ultra-violet and to the visible spectrum, but opaque for the infra-red beyond 7.0μ .

(Pflüger.)

Wave length, microns.....	0.19	0.20	0.21	0.22
Transmission for 1 mm.....	.67	.84	.92	.94

FLUORITE

Fluorite is very transparent to the ultra-violet, nearly to 0.10μ . Coefficient of transparency at $\lambda=186$ is found by Pflüger to be 0.80.

For the infra-red the values are given in a table below.

TRANSMISSIBILITY FOR RADIATORS (Continued)

ROCK SALT AND SYLVINE AND FLUORITE

TRANSPARENCY FOR THE INFRA-RED.

Thickness 1 cm.

Wave length, microns.	Rock salt	Sylvine KCl	Fluorite
8.	.....	.....	.844
9.	0.995	1.000	.543
10.	.995	.988	.164
12.	.993	.995	.010
14.	.931	.975	.000
16.	.661	.936	
18.	.275	.862	
19.	.096	.758	
20.7	.006	.585	
23.7	.000	.155	

PHOSPHORESCENCE BY CATHODE RAYS

SUBSTANCES LUMINOUS UNDER EXCITATION BY CATHODE RAYS

Substance (with calcium oxide)	Wave lengths of principal bands in microns (Urbain, 1909)
Dysprosium oxide.....	0.480, 0.489, 0.585, 0.675
Europium oxide.....	0.416-0.426, 0.469
Europium oxide.....	0.589-0.593, 0.613, 0.625
Neodymium oxide.....	0.392, 0.419-0.429, 0.458
Praesodymium oxide.....	0.488, 0.604, 0.606, 0.626, 0.634

One part	100 parts	Wave length	Color	Observer
Antimony oxide..	calcium oxide	0.560	yellow	Bruninghaus, 1910
Antimony trisulphide.....	calcium sulphide	0.569	yellow	Bruninghaus, 1910
Bismuth oxide.....	calcium oxide	0.522	blue	Bruninghaus, 1910
Bismuth sulphate.	calcium sulphate	0.640	red	Bruninghaus, 1910
Manganous carbonate.....	magnesium carbonate	0.620	red	Bruninghaus, 1910
oxide.....	calcium oxide	0.589	yellow	Lecoq & Boisbaudran 1886
phosphate.....	calcium phosphate	0.633	red	Bruninghaus, 1910
sulphate.....	Ca ₃ (PO ₄) ₂ calcium sulphate	0.540	green	Lecoq & Boisbaudran 1886
sulphide.....	calcium sulphide	0.589	yellow	Bruninghaus, 1910

FLUORESCENCE OF ORGANIC SUBSTANCES IN SOLUTION

EXCITATION BY WHITE LIGHT.

Substance.	Solvent.	Wave length microns.	Observer.
Anthracene.....	alcohol	{ 0.400 0.430 0.436	Stark & Meyer, 1907
Eosine.....	alcohol or water	0.589	
Esculine.....	alcohol	0.460	Nichols & Merritt, 1907
Fluorescein.....	water (alkaline)	0.542	Nichols & Merritt, 1907
Naphthalin, red..	alcohol	0.632	Nichols & Merritt, 1907
Quinine sulphate.	water	0.437	Nichols & Merritt, 1907
Resorcin blue....	water	0.65	Nichols & Merritt, 1907
Rhodamin.....	water	0.554	Nichols & Merritt, 1907

FLUORESCENCE GASES AND VAPORS.

Gas or vapor.	Condition.	Excitation.	Color or wave length of emitted light.	Observer.
Iodine...	Vapor at ordinary temperature.	Mercury arc $\lambda = .546\mu$	Strongest bands $\lambda = .5460\mu, .5774\mu$.5730, .5796	Wood, 1911
Mercury.	Vapor at ordinary temperature	Spark between aluminum electrodes	Broad band $\lambda = .5900-.3000$	
Oxygen ..	.....	Mercury arc in quartz tube	Strongest lines $\lambda = .1849, .1851$ (ultra-violet)	Streubing, 1910
Potassium	Vapor, 300°-400° C.	White light	Many strong lines from .6416-.6768, strongest .6544 and .6584	Wood & Carter, 1908
Rubidium	Vapor, at 270° C.	White light (elec. arc)	Strong red band $\lambda = .6900-.6620$.	Dunoyer, 1912
Sodium ..	Vapor at 350° C.	White light (elec. arc)	D, $\lambda = .5893$ (mean)	Dunoyer, 1912

FLUORESCENT SUBSTANCES

By Jack De Ment

The emission of light from matter under the influence of an exciting agent is termed fluorescence. When emission persists after removal of the exciting agent the process is termed phosphorescence. Both are practically identical, except in the duration of light emission, and may harmoniously be explained on the same basis. Luminescence is the term covering both phenomena, although candoluminescence, emission due to incandescent heat, may also be included. Fluorescence is classified according to the exciting agent(s) and special terms are derived therefrom.

Excitation includes over 30 processes by which energy is introduced into, and/or released from, the luminescent system; visible light (photoluminescence); low temperature heat (thermoluminescence); friction (triboluminescence); cold (baroluminescence); ion streams (ionoluminescence); cathode rays (cathodoluminescence); crystallization (crystalloluminescence); sound waves (sonoluminescence); Hertzian waves; radioelement radiations, e.g., alpha, beta (positrons), and gamma rays (radio-luminescence, etc.); neutrons; metabolic processes (bioluminescence); and a large number and wide variety of chemical reactions (chemiluminescence); etc. Terms such as radiophotoluminescence and tribothermoluminescence denote the exciting action of more than one agent.

Ultraviolet light is used with most success in ordinary studies on luminescent substances. Most effectively suited for general excitation of inorganic chemicals, phosphors, certain minerals, etc., whose exact absorption characteristics are unknown, is short wavelength ultraviolet light (Hg = 2537A, resonance radiation) filtered through a medium (usually glass) possessing peak transmission in this region and minimal transmission elsewhere, especially in the visible. For general excitation of organic and metal-organic compounds, and a few minerals, as well as tissues, long wavelength (Hg = 3650A) radiation is employed. All ultraviolet light must be filtered before adequate results are obtained.

Slight discordance is noted in the fluorescence of certain substances, especially in minerals and impure inorganic chemicals. Fluorescence may be affected by purity, age and source of the compound, particle size, water-content, and the solvent and concentration of solute. A great many substances, however, emit characteristic fluorescence which serves for detection and estimation in extremely small amounts, particularly after treatment with solvents, acids, or alkalis. The science of fluorochemistry embraces the applications of fluorescence and ultraviolet light to chemistry. The references should be consulted for additional details on fluorescent chemicals and fluorochemical analysis.

The following table gives the character of fluorescence for various substances when excited by radiation of wave length 3650 angstrom units, except where otherwise noted.

Key to Abbreviations

acet.....	acetone	KOH.....	potassium hydroxide
alk.....	alkalis, alkaline	l.....	light
al.....	ethyl alcohol	m.....	medium
	bright	oxid.....	oxidation
bz.....	benzene	oxy.....	oxyacids
d.....	dark	p.....	pale
dil.....	dilute	■.....	strong
dl.....	dull	sl.....	slight
dp.....	deep	soln.....	solutions
H ₂ O.....	water	xyl.....	xylene

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Abietic acid	green	—	4, 6
Acetaldehyde	blue-green	—	4
Acetanilid	bluish-violet	—	4
Acetoacetanilid	b. blue-white	—	4, 6
Acetophenone	brownish	—	2, 4
<i>p</i> -Acetylaminophenol	whitish	—	4
Acetyl homoumbelliferone	blue	KOH	7
2-Acetyl purpurin	yellowish	—	7
Acetylsalicylic acid	p. blue	—	4
Acridine	green	H ₂ O	4
Acridine picrate	yellow-green	H ₂ O	4, 6
Acridone	s. blue	al.	4
Acrylic aldehyde	bluish	—	4
Adenine sulfate	blue-white	—	4, 8
Ajacine	blue	al.	6
β -Alanine	purple-blue	—	4
<i>dl</i> -Alanine	rose-white	—	4
Alizarin	yellow	—	1
Aloin	red-yellow	—	4
Alloxan	violet	—	4
Allylamine picrate	crimson	—	4
Aluminum distearate	b. blue	—, xyl.	4
Aluminum monstearate	b. blue	—, xyl.	4
Aluminum palmitate	blue-white	—	4
Aluminum tristearate	b. blue	—, xyl.	4
Ambergris	m. blue	al.	4
Aminoacetal picrate	b. red-orange	—	4
<i>p</i> -Aminobenzoic acid	blue	—	4
2-Amino-5-chlorobenzoic acid	b. blue-white	—	4
Aminohydrastin	s. blue	—	1
Aminophyllin	s. blue-green	—	4
Aminopyrine	s. blue	—	4
Ammonium acetate	blue	—	4
Ammonium benzoate	blue	—	4
Ammonium mandelate	b. blue-white	—	4
Ammonium salicylate*	s. blue	—	1, 4
Amyl salicylate	purple	—	4
Anemonine	yellowish	—	4
Anisic aldehyde	p. brown	—	4
Anthracene	l. blue	—	4
Anthracene [+ chrysene]	brilliant green	—	4
Anthracene-1-carboxylic acid	blue	alk.	7
Anthracene-2-carboxylic acid	blue	alk.	7
Anthracene-1, 9-dicarboxylic acid	bluish	acids	6
Anthralin	green	NaOH soln.	7
Anthraquinone	orange	—	4
Apharmine	green	H ₂ SO ₄ + formalin	7
Apomorphine	b. blue	—	4
Apoquinine	violet	—	4
Arecoline	purplish	—	4
Arecoline hydrobromide	lavender	—	4
1 (+)-Arginine monohydrochloride	s. lavender	—	4
Ascorbic acid	lavender	—	4
<i>dl</i> -Aspartic acid	purplish-white	—	4
l(+)-Aspartic acid	purple-blue	—	4
Asterin hydrochloride	bluish	—	6
Atropine	bluish-white	—	4
Atropine sulfate	p. bluish	—	4

* Exciting wave length not given.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Auramine	b. yellow	H ₂ O, etc.	1, 2, 3, 4, 5
Azulmic acid	green	KOH soln.	7
Barium citrate*	bluish	—	4
Barium formate	blue-violet	—	1
Barium platinocyanide	b. green	with H ₂ O xln.	1
Barium salicylate	s. blue	—	1
Barium stearate	blue-white	—	4
Barium succinate	violet	—	1
4,5-Benzisocoumarancne	green	H ₂ S ₂ O soln.	7
Benzocain	blue	—	4
Benzyl acetate	b. violet	—	2
Benzyl ether	greenish-purple	—	4
Benzyl salicylate	violet	—	4
Berberine	yellow	—	1, 5
Berberine hydrochloride	yellow-green	—	4
Beryllium salicylate	s. blue	—	4
Bismuth subgallate	crimson	—	4
Bismuth subsalicylate	sl. lavender	—	4
Boldine	bluish	—	4
Borneol	whitish	—	2
5-Bromosalicylic acid	white	—	4
Butyl acetyl ricinoleate	d. blue-green	—	4
Butyl borate	p. bluish	—	4
Butyl chloride	p. bluish	—	4
Butyl lactate	sl. bluish	—	4
N-Butyl-2-naphthylamine	violet	—	7
Butyl oleate	green-yellow	—	4
Butyl ricinoleate	yellow-green	—	4
Butyl stearate	p. blue	—	4
Butyrone	bluish	—	4
Cadmium 8-hydroxyquinolin-ate	yellow-green	al.	4
Calcium benzoate	lavender	—	4
Calcium p-caseinate	yellow-blue	—	4
Calcium 8-hydroxyquinolate	dk. green	al.	4
Calcium iodo-di (triethanol-amine) theobromine	b. blue-green	—	4
Calcium o-iodoxybenzoate	b. blue	—	4
Calcium linoleate	blue-purple	—	6
Calcium mandelate	blue	—	4
Calcium pantothenate	d. lavender	—	4
Calcium salicylate	blue	—	1, 4
Calcium stearate	s. blue	—	4
Calcium uranyl acetate	greenish-blue	—	9
Campherol	blue	H ₂ SO ₄	6
Carbon dioxide (solid)	blue to violet	—	4
Chlorophyll A	red	—	1, 4
Chlorophyll B	brown-red	—	1, 4
Chromium stearate	lavender-blue	—	4
Cobalt resinat	d. blue	—	10
Cobaltous linoleate	brown-green	—	10
Cobaltous stearate	b. blue	—	4
Cupric salicylate†	green-blue	—	4
Cyanomaclurin	bluish	KOH fusion	6
Decacycene	green	—	1
Decyl naphthalene	s. blue	—	4
Dehydrocholic acid	violet-blue	—	4
Delphinine	p. green	—	4
Diallyl barbituric acid	violet	—	4

* Exciting wave length not given.

† Exciting wave length 2537.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
4, 4'-Dibromodiphenyl	white	—	4
Didymium salicylate	lavender	—	4
6, 4'-Dihydroxyflavone diethyl ether*	green	—	7
7, 2'-Dihydroxyflavone diethyl ether	blue	H ₂ SO ₄ soln.	7
3, 6-Dihydroxyxanthone	blue-violet	—	4
1 (-)-Diiodotyrosine dihydrate	purple	—	4
Dilantin	purplish	—	6
Dimethyl phthalate	green	—	4
2, 4-Dimethylpyrrole	blue	—	6, 7
3, 5-Dimethylpyrrole-2, 4-dicarboxylic acid	blue	260°C	6
Di-1-Naphthastilbene	violet	—	7
1', 2', 8', 9'-Dinaphthazine	blue	al., bz.	7
1', 2', 7', 8'-Dinaphthazine	yellow-green	bz.	7
2, 2'-Dinaphthyl	blue	—	6
2, 2'-Dinaphthylamine	blue	—	6
1, 1'-Dinaphthyl ether	bluish	—	7
1, 2 -Di(2-Xenoxo) ethane	white	—	4
Dodecacyclene	olive green	—	1
Emetine	yellow	—	4
Enanthic aldehyde	b. yellow-blue	—	4
Esculetin	dp. violet	—	1
Erbium salicylate	sky blue	—	4
Ergometrine	blue	—	2
Ergotine	yellow-brown	—	4
Ergotoxine	blue	—	2
Erythrosine	greenish	—, H ₂ O	2
Erythritol tetranitrate	dp. violet	—	4
Ethanolamine hydrochloride	violet	—	4
Ethyl acetate	p. bluish	—	4
Ethylene glycol monoethyl ether laurate	b. bluish	—	4
Ethylene glycol monoethyl ether ricinoleate	s. green-blue	—	4
Ethylene glycol monoethyl ether stearate	s. yellow-blue	—	4
Ethylene glycol monolaurate	b. blue	—	4
Ethylene glycol monooleate	bluish	—	4
Ethylene glycol monoricinoleate	green-blue	—	4
4-Ethoxyacridone	green	H ₂ O	4
Ethyl β-naphtholate	violet	—	2
Ethyl salicylate	greenish	—	1, 4
Eucaïne	gray	—	4
Ferric 8-hydroxyquinolate	bluish-black	al.	4
Ferrous 8-hydroxyquinolate	blue-brown	al.	4
Ferrous stearate	b. crimson	—	4
Flavazin S	b. orange	H ₂ O	1
Fluorene-2-sulfonic acid	dp. yellow	—	1
Fluorescein	b. green	alk. soln.	1, 2, 4, 5
Fluorescin	b. green	oxid. then KOH	4, 6
Fraxetin	blue-green	—	1
Fraxin	blue-green	—	1
Fumaric acid	l. yellow	—	1
Furfuryl alcohol	d. yellow	—	4
Furfuraldehyde	reddish	—	4
Gallium gluconate	p. blue	—	4

* Exciting wave length not given.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Gallium 8-hydroxyquinolate	yellowish	al.	4
Gallium salicylate	b. blue	—	4
Germanium salicylate	b. blue	—	4
l (+)-Glutamic acid	violet-white	—	4
Glutathione	b. lavender	—	4
Glyceric aldehyde	p. blue	—	4
Glyceryl citrate	bluish	—	4
Glyceryl α , γ -diphenyl ether	lavender-blue	—	4
Glyceryl furfural	violet-blue	—	4
Glyceryl α , -mono- <i>n</i> -butyl ether	p. blue-green	—	4
Glyceryl monohydroxystearate	p. bluish	—	4
Glyceryl monooleate	b. yellow-blue	—	4
Glyceryl monoricinoleate	blue-green	—	4
Glyceryl monostearate	b. yellow-blue	—	4
Glyceryl phthalate	yellow-blue	—	4
Glyceryl tartrate	b. blue	—	4
Glyceryl tristearate	b. violet-blue	—	4
Glycine	purplish-blue	—	4
Glycol dilaurate	yellow-blue	—	4
Glycollic acid	blue	—	4
Glycol monolaurate [polymerized]	b. blue	—	4
Glycol maleate [polymerized]	blue-yellow	—	4
Glycol monooleate [polymerized]	b. blue-brown	—	4
Glycol monostearate [polymerized]	brown-yellow	—	4
Glycol phthalate [polymerized]	b. bluish	—	4
Glycylglycine	purple-white	—	4
Glycyl-l (-)-leucine	purplish-white	—	4
Glyoxal	blue	—	4
Guanine [free base]	purple	—	8
Guanine hydrochloride	purple	—	8
Harmine	blue	—	3, 4
sym-Hemimellitenol	bluish	—	7
Heroin	yellow-grey	—	4
Heroin sulfate	yellowish	—	4
Hematoporphyrin	red	al, CCl ₄ , etc.	1
Hexaekosicyclene	olive-green	—	1
Hexamethylenetetramine	l. purple	—	4
Homatropine methyl bromide	lavender	—	4
Homoumbelliferone methyl ether	blue	H ₂ SO ₄	7
Hydrastin	b. greenish	—	1
Hydrastine salicylate	greenish-white	—	4
Hydrastine chloride	b. blue	—	1
Hydrofuramide	b. pink	—	4
Hydroquinone	blue-violet	—	4
Hydroxyperylene	green	—	7
2-Hydroxyphenanthrene	blue	—	7
methyl ether			
p-Hydroxyphenyl glycolcol	violet	—	4
3-Hydroxyquinoline	bluish	—	6, 7
7-Hydroxyquinoline	green	alk. soln.	7
6-Hydroxyquinoline methyl ether	blue	acids	7
Hyoscyamin	red-violet	—	1
Hypoxanthine	violet	—	8
Indium o-iodoxybenzoate	p. lavender	—	4
Indium salicylate	b. blue-green	—	4
α -Ionone	greenish	—	2, 4
β -Ionone	green-brown	—	2, 4

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Isocytosine	violet-white	—	8
Isodibenzanthrone	brown	PhNO ₂	7
Isoharman	blue-violet	H ₂ SO ₄ soln.	7
Isoguanine	purple-white	—	8
Lanthanum 8-hydroxyquinolate	yellow-green	al.	4
Lanthanum <i>o</i> -iodoxybenzoate	p. violet	—	4
Lanthanum salicylate	s. blue	—	4
Lead linoleate	d. green	—	10
Lead naphthenate	b. blue-green	—	4
Lead sebacate	b. lavender-white	—	4
Lead stearate	b. blue	—	4
Lithium benzoate	whitish-violet	—	4
Lithium salicylate	b. blue-green	—	4
Lithium stearate	bluish	—	4
Lotoflavin	bluish	KOH fusion	6
Luteolin	bluish	KOH fusion	6
Luteolinidinium chloride	green	H ₂ SO ₄	7
1 (+)-Lysine dihydrochloride	purple-white	—	4
Lysine hydrochloride	p. purple	—	4
1 (+)-Lysine hydrochloride	b. blue	—	4
Magnesium 8-hydroxyquinolate	golden-yellow	al., H ₂ O, etc.	4
Magnesium salicylate	purple-green	—	4
Magnesium stearate	blue-white	—	4
Magnesium uranyl acetate*	emerald green	—	9
Malonic acid	bluish-white	—	1
Manganous 8-hydroxyquinolate	s. green	al.	4
Manganous stearate	dp. rose	—	4
Manganese resinate	d. violet	—	10
Mannitol glyceryl mono-laurate	dp. green-brown	—	4
Mannitol glyceryl monooleate	b. brown-blue	—	4
Mannitol glyceryl monostearate	blue-gray	—	4
Mannitol triricinoleate	dp. green	—	4
Menthol	greenish	—	2
2-Mercaptobenzothiazole	reddish-brown	—	4
Mercuric salicylate	greenish	—	1
Mercurochrome	b. green	alk. soln.	5
Mercurophen	s. crimson	—	4
Mercurous benzoate	purple	—	4
Mercury dibromofluorescein	yellow-green	alk. soln.	4
Mericyl alcohol	blue-yellow	—	4
Mesobilirubin	reddish	—	1
Mesobilirubinogen	reddish	—	1
<i>dl</i> -Methionine	b. lavender	—	4
Methyl acetophenone	grey-brown	—	4
Methyl acridine*	green	—	11
<i>N</i> -Methyl anthranilic acid	blue	alk. soln.	7
<i>N</i> -Methyl anthranilic acid phenyl ester	blue	—	7
2-Methyl benzanthrone sulfonic acid	yellow	—	4
Methyl benzyl ether	blue-green	—	4
5-Methyl chromone	blue	H ₂ SO ₄ soln.	7
6-Methyl chromone	blue	H ₂ SO ₄ soln.	7
7-Methyl chromone	blue	H ₂ SO ₄ soln.	7
β -Methyl esculin	blue	H ₂ O, etc.	4
2-Methylgenistein	blue-green	H ₂ SO ₄	7

* Exciting wave length not given.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Methyl glycolphenetidin	violet	—	4
Methyl hexalin	green-blue	—	4
Methyl hydrastin	blue-green	—	1
Methyl hydrastinine hydrochloride	blue	—	6
4-Methyl indole	blue-green	—	1
7-Methyl indole	yellow-green	—	1
Methyl pentadecyl ketone	blue-brown	—	4
Methyl terephthalic acid	l. blue	—	1
Methyl tridecyl ketone	blue-yellow	—	4
β -Methyl umbelliferone	b. blue	H ₂ O, al.	4, 6
Methyl undecyl ketone	yellow-blue	—	4
Monoamyl naphthalene	dp. blue	—	4
Monobromoisovaleryl barbiturate	lavender	—	4
Monoethyl glycol ether	blue-yellow	—	4
Morin	blue-green	H ₂ SO ₄	3, 4, 6
Morindin chloride	greenish	H ₂ SO ₄ soln.	7
Morphenol	green	acids	7
Munjistin	green	AcOH	7
Musk ambrette	yellow-brown	—	2
Musk ketone	yellow-brown	—	2
Musk xylol	yellow-brown	—	2
Mycolic acid	blue	—	4
Myosalvarsan	green	alk. soln.	2
Myristic aldehyde	brownish-yellow	—	4
Myristone	yellowish	—	4
Naphthalene	l. blue	—	1
1,8-Naphthalenediamine-3,6-disulfonic acid	green	alk. soln.	7
Naphthastyril	green	al.	7
β -Naphthol	blue	—	4
2-Naphthol-1,3,6,7-tetra-sulfonic acid	blue-green	alk. soln.	7
2-Naphthol-1,3,7-trisulfonic acid	blue-green	alk. soln.	7
2-Naphthol-3,6,7-trisulfonic acid	blue-green	alk. soln.	7
2-Naphthol-3,6,8-trisulfonic acid	green	NaOH soln.	7
1-Naphthylamine-2,5-disulfonic acid	blue-green	acids and alk.	7
1-Naphthylamine-2,7-disulfonic acid	bluish	alk. soln.	7
1-Naphthylamine-2,8-disulfonic acid	green	alk. soln.	7
1-Naphthylamine-3,7-disulfonic acid	blue	acids and alk.	7
1-Naphthylamine-4,6-disulfonic acid	blue	acids and alk.	7
1-Naphthylamine-4,7-disulfonic acid	blue	acids and alk.	7
2-Naphthylamine-1,6-disulfonic acid	bluish	—	7
2-Naphthylamine-1,7-disulfonic acid	violet-blue	KOH soln.	7
2-Naphthylamine-3,6-disulfonic acid	violet-blue	—	7
2-Naphthylamine-4,7-disulfonic acid	blue	KOH soln.	7
2-Naphthylamine-4,8-disulfonic acid	blue	alk. soln.	7

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
2-Naphthylamine-5,7-disulfonic acid	green	alk.	7
2-Naphthylamine-6,8-disulfonic acid	blue	alk.	7
1-Naphthylamine-5-sulfonic acid	green	alk.	7
2-Naphthylamine-5-sulfonic acid	red-blue	alk.	7
2-Naphthylamine-6-sulfonic acid	blue	alk.	7
2-Naphthylamine-8-sulfonic acid	blue	acids and alk.	7
2-Naphthylamine-1,3,6,7-tetrasulfonic acid	violet-blue	alk. soln.	7
1-Naphthylamine-2,4,6-trisulfonic acid	blue	—	7
1-Naphthylamine-3,5,7-trisulfonic acid	green	alk. soln.	7
1-Naphthylamine-2,5,7-trisulfonic acid	green	—	7
2-Naphthylamine-1,3,7-trisulfonic acid	violet-blue	—	7
2-Naphthylamine-1,5,7-trisulfonic acid	blue	alk.	7
2-Naphthylamine-3,5,7-trisulfonic acid	green	alk. soln.	7
2-Naphthylamine-3,6,7-trisulfonic acid	blue	alk.	7
2-Naphthylamine-3,6,8-trisulfonic acid	sky blue	alk.	7
2-Naphthylamine-4,6,8-trisulfonic acid	b. blue	—	7
<i>N</i> - α -Naphthylanthranilic acid	blue-green	H ₂ SO ₄ soln.	7
Naringenin	bluish	KOH fusion	6
Neodymium citrate	blue	—	4
Neodymium salicylate	b. blue-green	—	4
Neosynephrine hydrochloride	p. violet	—	4
Nickel formate	carmine red	—	1
Nickel stearate	grey-purple	—	4
Nicotinamide	b. blue	—	4
Nicotinic acid	purple-white	—	4
Nicotine	azure blue	—	2
2-Nitro-2-methyl-1,3-propanediol	p. violet	—	4
2-Nitro-2-methyl-1-propanol	p. lavender	—	4
α -Nitro- β -naphthol	scarlet	—	4
2- <i>o</i> -Nitrophenylhydrazone	green	amyl al.	7
α -Nitroso- β -naphthol	reddish	—	4
6-Nitrothymol	bluish	bz.	7
3-Nitroxanthone	green	H ₂ SO ₄ soln.	7
Norharman	blue	acids	7
Norharmine hydrochloride	b. blue	—	7
Norleucine	purple-blue	—	4
<i>dl</i> -Norvaline	purple	—	4
Nucleic acid	lavender-rose	—	4
Nupercaine	violet	—	4
Octodecacyclene	green	—	1
Octohydrodecacyclene	olive-green	—	1
Orcin	yellow-green	—	1
Orcinaurine	green	H ₂ O	4
<i>dl</i> -Ornithine hydrochloride	purple-white	—	4
<i>p</i> -Oxybenzoic acid	l. violet	—	1
2-Oxy-6,8-diaminopurine	green-blue	—	8

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
β -Oxynaphthionic acid	green-yellow	—	4
Oxypeucedanine	bluish	KOH fusion	6
Palmitic aldehyde	blue-white	—	4
Parabanic acid	blue	—	4
Paraldehyde	b. bluish	—	4
Pentacene	blue	—	4
Pentachloroethane	green-blue	—	2
Pentamethylenetetrazol	blue-violet	H ₂ O	4
Percaine	b. blue	—	7
Perlatolic acid	green	CHCl ₃ + alk.	7
Perylene	blue	—	7
Perylene-3,10-dicarboxylic acid	green	alk.	7
Perylene-3,9-dicarboxylic acid dichloride	yellow-green	—	7
Phaetophytin	red	—	2
Phenanthrene	l. blue	—	1
<i>o</i> -Phenoxyphenyl benzoate	lavender-blue	—	4
<i>N</i> -Phenylacridone	blue	AcOH	7
<i>dl</i> -Phenylalanine	lavender-white	—	4
<i>N</i> -Phenyl-2-amino-5-naphthol-7-sulfonic acid	violet	Na ₂ CO ₃ soln.	7
9-Phenylanthracene	blue	—	7
<i>N</i> -Phenylanthranil	green-blue	—	7
1-Phenylbenzanthrone	orange-red	H ₂ SO ₄ soln.	7
10-Phenylbenzanthrone	golden-yellow	H ₂ SO ₄ soln.	7
5-Phenylbenzpyrene	green-yellow	—	1
6-Phenyl-10-benzyl-1,2-dibenzanthracene	greenish-yellow	—	1
2-Phenylcoumarone	blue	H ₂ SO ₄ soln.	7
3-Phenylcoumarone	blue	Hot H ₂ SO ₄	7
3-Phenylcyclohexanone	green	al.-H ₂ SO ₄	7
10-Phenyl-5, 10-dihydroacridine	blue	al.	7
<i>o</i> -Phenylenediamine	b. violet	—	4
<i>p</i> -Phenylenediamine	b. blue	—	4
Phenyl mercuric acetate	violet	—	4
Phenyl mercuric chloride	p. lavender	—	4
Phenyl mercuric nitrate	white	—	4
Phenyl mercuric nitrite	bluish	—	4
Phenyl mercuric sulfate	violet	—	4
2-Phenylnaphthalene	blue	—	7
Phenyl- α -naphthylamine	l. blue	—	4
Phenyl- β -naphthylamine	l. blue	—	4
4-Phenylquinaldine	blue	dil. acids	7
4-Phenylquinoline	blue	dil. acids	7
8-Phenylquinoline	yellow-green	—	7
Phenyl salicylate	strong blue	—	4
Phenyl- <i>o</i> -tolylguanidine	l. bluish-purple	—	4
Phloroglucinol	b. blue	—	1, 4, 6
Phloxine	yellow	water	4
Phycocerythrin	orange	—	2
Picrotoxine	yellow	—	4
Podophyllin	green	—	2
Polyamyl naphthalene	d. blue	—	4
Potassium ammonium platino-cyanide*	green	—	1
Potassium benzoate	bluish	—	4
Potassium opianate	blue	—	4
Potassium platinocyanide*	green	—	1
Potassium salicylate	violet-blue	—	4
Potassium stearate	blue-white	—	4

* Exciting wave length not given.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Potassium succinate	bluish-white	—	1
Proflavine	green	H ₂ O	4, 5
Protoporphyrin	red	—	2
Psychotrine	blue	—	7
Pyocyanine	green-yellow	CCl ₄	2
Pyramidon	s. blue	—	4
Pyrene	blue	—	1
Pyridanthrone	yellow	H ₂ SO ₄ soln.	7
Pyridoxine hydrochloride	b. blue	—	4
Quinetine	blue	H ₂ SO ₄ soln.	7
Quinidine	p. blue	—	4
Quinine	b. blue	dil. oxy.	1, 2, 3, 4, 5
Quinine bisulfate	b. blue-green	dil. oxy.	4
Quinine hydrochloride	l. blue	dil. oxy.	4
Quinine monosulfate	blue	dil. oxy.	4
Quinine salicylate	b. blue-green	—	4
Quinoline	green	—	1
Rhamnetin	greenish-blue	H ₂ SO ₄ soln.	4, 6
Rhodacene	red	—	7
Rhodamine	b. red-orange	H ₂ O, al., etc.	1, 2, 3, 4, 5
Rhodium salicylate	b. purple	—	4
Riboflavin	b. orange	—	4
Rose bengal	green	al. etc.	2
Saccharin	whitish	—	2
Salicylic acid	blue	—	4
Samarium gluconate	m. blue	—	4
Samarium 8-hydroxyquinolin-ate	yellow-red	—	4
Samarium salicylate	b. blue	—	4
Santonin	violet	—	4
Saponarin	blue	H ₂ SO ₄ soln.	7
dl-Serine	purplish-white	—	4
Silver 8-hydroxyquinolinate	yellow	—	4
Silver succinate	b. yellow	—	1
Sodium barbiturate	violet	—	4
Sodium benzoate	violet	—	1
Sodium benzyl morrhuate	b. yellow-green	—	4
Sodium 5-ethyl (1-methyl-1-butenyl) barbiturate	b. light blue	—	4
Sodium isoamyl barbiturate	bluish	—	4
Sodium isoamylethyl barbiturate	bluish	—	4
Sodium methyl salicylate	b. blue-green	—	4
Sodium o-nitrophenolate	red	—	4
Sodium oleate	blue-green	—	1
Sodium salicylate	b. blue-green	—	4
Sodium selenocyanide	bluish	H ₂ O	4
Sodium stearate	p. blue	—	4
Sorbitol lactate	dp. blue-green	—	4
Sorbitol tartrate	b. yellow-blue	—	4
Sorbitol triricinoleate	green	—	4
Stearic aldehyde	blue	—	4
trans-Stilbene	blue	—	7
Strontium benzoate	lavender	—	4
Strontium 8-hydroxyquinolin-ate	l. green	al.	4
Strontium lactate	yellow	—	1
Strontium stearate	blue-white	—	4
Strychnine	blue-white	—	4
Styrene	p. blue	—	6

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Sulfanilamide	violet	—	4
Sulfuricinic acid	b. yellow-blue	—	4
Syntropin	lavender	—	4
Syringetin	green	H ₂ SO ₄ soln.	7
Tartrazin	b. orange	al.	1
Thallium carbonate	blue	—	1
Thaloperazine	red-green	H ₂ SO ₄ soln.	7
Theobromine	b. blue-green	—	4
Theobromine calcium salicylate	b. blue-green	—	4
Thiamine hydrochloride	dl. lavender-white	—	4
Thiochrome	blue	in soln.	3
Thioflavin S	yellow	H ₂ O	1, 4
Thioindigo	red-yellow	xyl.	7
Thioxanthone	green	H ₂ SO ₄ son.	1
Thorium cyanide	pink	—	4
Thorium formate	b. blue	—	1
Thorium 8-hydroxyquinolate	d. green	al.	4
Thorium <i>o</i> -iodoxybenzoate	m. blue	—	4
Thorium salicylate	b. blue	—	4
Thymol iodide	s. crimson	—	4
Tin stearate	cream	—	4
Titanium 8-hydroxyquinolate	yellowish	—	4
Titanium stearate	grey-blue	—	4
Tetrahydrofurfuryl alcohol	blue	—	4
Tetradihydroxydesoxy-yohimbine	b. blue	—	1
5,7,2',4'-Tetrahydroxyflavone-2',4'-dimethyl ether	blue	H ₂ SO ₄ soln.	7
7,2',4',6'-Tetrahydroxyflavone	green	H ₂ SO ₄ soln.	7
7,3',4',5'-Tetrahydroxyflavone	green-yellow	—	7
1,4,5,8-Tetrahydroxy-2-methyl anthraquinone	red	H ₂ SO ₄ soln.	7
6,3',4',5'-Tetrahydroxyflavone-3',4',5'-trimethyl ether	green	H ₂ SO ₄ soln.	7
7,3',4',5'-Tetrahydroxyflavone tetramethyl ether	violet	al.	7
5,6,7,8-Tetramethylalloxazin	yellow-violet	—	1
1,3,6,8-Tetramethylanthracene	green	AcOH	7
2,4,5,8-Tetramethyl quinoline	blue-violet	acids	7
2,3,5,6-Tetraphenyl pyridine	blue	H ₂ SO ₄ soln.	8
α -Tocopherol	bl. blue-green	—	4
<i>N-p</i> -Tolyl-1-naphthylamine	blue	—	7
<i>N-m</i> -Tolyl-2-naphthylamine	blue	—	7
Transentin	b. yellow-green	H ₂ O	4, 6
Triethyl trimethylene triamine	d. yellow-green	—	4
6,7,4'-Trihydroxyflavone	green	H ₂ SO ₄ soln.	7
5,6,7-Trimethylalloxazin	greenish-yellow	—	1
6,7,8-Trimethylalloxazin	greenish-yellow	—	1
Tris(hydroxymethyl)amino-methane	green-blue	—	4
Tris(hydroxymethyl)nitro-methane	dp. pink	—	4
Umbelliferone	blue-violet	—	1
Uracil	violet	—	4, 8
Uranine	b. yellow	H ₂ O, al., etc.	1, 2, 3, 4, 5, 6
Uranyl compounds*	usually b. yellow	—	9, 2, 3, 4, 6
Uric acid	m. violet	—	2

* Exciting wave length not given.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Urobilin	reddish	—	1
Vanadic 8-hydroxyquinolate	dp. green	al.	4
Vanadic <i>o</i> -iodoxybenzoate	orange-red	—	4
Vanadous salicylate	lavender	—	4
Vanadyl cyanide	green	—	4
Vanillin	b. pink	—	4
Veronal	yellow-grey	—	2
Xanthanol	green	H ₂ SO ₄ soln.	6
Xanthone	b. blue	H ₂ SO ₄ soln.	4
Yan gonin	blue	acet., MeOH	7
Yttrium gluconate	b. blue	—	4
Yttrium 8-hydroxyquinolate	orange-red	al.	4
Yttrium <i>o</i> -iodoxybenzoate	bluish	—	4
Yttrium salicylate	b. dp. blue	—	4
Zinc butyl xanthate	dp. purple	—	6
Zinc dimethyldithiocarbamate	purple	—	4
Zinc fluoresceinate	b. green	alk. soln.	6
Zinc 8-hydroxyquinolate	b. green	al.	4
Zinc hydroxyquinoline sulfonate	b. yellow	—	2
Zinc palmitate	blue-white	—	4
Zinc resinate	cream-white	—	10, 2
Zinc salicylate	b. blue	—	1
Zinc sebacate	white	—	4
Zinc stearate	b. blue	—	4
Zinc sulfanilate	blue-purple	—	4
Zinc uranyl acetate*	greenish	—	9
Zinc urobilinate	b. dp. green	—	2, 3, 4
Zinc valerate	lavender	—	4
Zirconium 8-hydroxyquinolate	yellowish	al.	4

* Exciting wave length not given.

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COLORIMETRY

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Recommendations of the International Commission on Illumination

Standard Illuminants

A. Gas-filled tungsten incandescent lamp of color temperature 2848° K.

B. Noon Sunlight. Lamp as above in combination with the Davis-Gibson filter for converting color temperature 2848° to 4800° K.

The filter is to be composed of a layer one centimeter thick of each of two separate solutions B₁ and B₂, contained in a double cell of colorless optical glass.

Solution B₁

Copper sulphate (CuSO ₄ ·5H ₂ O).....	2.452 g
Mannite (C ₆ H ₈ (OH) ₆).....	2.452 g
Pyridine (C ₅ H ₅ N).....	30.0 cc
Distilled water to make.....	1000 cc

Solution B₂

Cobalt ammonium sulphate (CoSO ₄ ·(NH ₄) ₂ SO ₄ ·6H ₂ O).....	21.71 g
Copper sulphate (CuSO ₄ ·5H ₂ O).....	16.11 g
Sulphuric acid (density 1.835).....	10.0 cc
Distilled water to make.....	1000 cc

C. Average Daylight. Lamp as in **A** in combination with Davis-Gibson filter for converting color temperature 2848° to 6500° K.

The filter is composed of a layer one centimeter thick of each of two separate solutions C₁ and C₂, contained in a double cell made of colorless optical glass.

Solution C₁

Copper sulphate (CuSO ₄ ·5H ₂ O).....	3.412 g
Mannite (C ₆ H ₈ (OH) ₆).....	3.412 g
Pyridine (C ₅ H ₅ N).....	30.0 cc
Distilled water to make.....	1000 cc

Solution C₂

Cobalt ammonium sulphate (CoSO ₄ ·(NH ₄) ₂ SO ₄ ·6H ₂ O).....	30.580 g
Copper sulphate (CuSO ₄ ·5H ₂ O).....	22.520 g
Sulphuric acid (density 1.835).....	10.0 cc
Distilled water to make.....	1000 cc

See R. Davis and K. S. Gibson Bur. Stds. Misc. Pub. No. 114, Jan. 1931 or Bur. Stds. Jour. Research **7**, 796 (1931).

Standard Coordinate System

The tristimulus system of color specification is based on four chosen stimuli consisting of homogeneous radiant energy of wave lengths

700.0

546.1

435.8

m μ and of standard illuminant B (see above).

To establish the system of specification coordinates are assigned as follows:

Stimulus	<i>x</i>	<i>y</i>	<i>z</i>
700.0 m μ	0.73467	0.26533	0.00000
546.1 m μ	0.27376	0.71741	0.00883
435.8 m μ	0.16658	0.00886	0.82456
Standard illuminant B:	0.34842	0.35161	0.29997

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The Standard Observer

The "standard observer" is determined below by the specification for the equal energy spectrum both in fractions, x, y, z of the total amount for each wave length interval of $5\text{ m}\mu$ and directly $\bar{x}, \bar{y}, \bar{z}$. The fractional values are known as the **trilinear coordinates** or **trichromatic coefficients** of the spectrum; the direct values as the **distribution functions** or coefficients.

The sum of the trichromatic coefficients is unity, that is $x + y + z = 1$. Therefore the value of z may be and often is omitted from a specification.

Relative Visibility

The value of \bar{y} given in the table is the standard visibility function or relative visibility.

Wave length $\text{m}\mu$	Trichromatic coefficients			Distribution coefficients for equal energy			Wave length $\text{m}\mu$
	x	y	z	\bar{x}	\bar{y} (Rel. Vis.)	\bar{z}	
380	0.1741	0.0050	0.8209	0.0014	0.0000	0.0065	380
385	0.1740	0.0050	0.8210	0.0022	0.0001	0.0105	385
390	0.1738	0.0049	0.8213	0.0042	0.0001	0.0201	390
395	0.1736	0.0049	0.8215	0.0076	0.0002	0.0362	395
400	0.1733	0.0048	0.8219	0.0143	0.0004	0.0679	400
405	0.1730	0.0048	0.8222	0.0232	0.0006	0.1102	405
410	0.1726	0.0048	0.8226	0.0435	0.0012	0.2074	410
415	0.1721	0.0048	0.8231	0.0776	0.0022	0.3713	415
420	0.1714	0.0051	0.8235	0.1344	0.0040	0.6456	420
425	0.1703	0.0058	0.8239	0.2148	0.0073	1.0391	425
430	0.1689	0.0069	0.8242	0.2839	0.0116	1.3856	430
435	0.1669	0.0086	0.8245	0.3285	0.0168	1.6230	435
440	0.1644	0.0109	0.8247	0.3483	0.0230	1.7471	440
445	0.1611	0.0138	0.8251	0.3481	0.0298	1.7826	445
450	0.1566	0.0177	0.8257	0.3362	0.0380	1.7721	450
455	0.1510	0.0227	0.8263	0.3187	0.0480	1.7441	455
460	0.1440	0.0297	0.8263	0.2908	0.0600	1.6692	460
465	0.1355	0.0399	0.8246	0.2511	0.0739	1.5281	465
470	0.1241	0.0578	0.8181	0.1954	0.0910	1.2876	470
475	0.1096	0.0868	0.8036	0.1421	0.1126	1.0419	475
480	0.0913	0.1327	0.7760	0.0956	0.1390	0.8130	480
485	0.0687	0.2007	0.7306	0.0580	0.1693	0.6162	485
490	0.0454	0.2950	0.6596	0.0320	0.2080	0.4652	490
495	0.0235	0.4127	0.5638	0.0147	0.2586	0.3533	495
500	0.0082	0.5384	0.4534	0.0049	0.3230	0.2720	500
505	0.0039	0.6548	0.3413	0.0024	0.4073	0.2123	505
510	0.0139	0.7502	0.2359	0.0093	0.5030	0.1582	510
515	0.0389	0.8120	0.1491	0.0291	0.6082	0.1117	515
520	0.0743	0.8338	0.0919	0.0633	0.7100	0.0782	520
525	0.1142	0.8262	0.0596	0.1096	0.7932	0.0573	525
530	0.1547	0.8059	0.0394	0.1655	0.8620	0.0422	530
535	0.1929	0.7816	0.0255	0.2257	0.9149	0.0298	535
540	0.2296	0.7543	0.0161	0.2904	0.9540	0.0203	540
545	0.2658	0.7243	0.0099	0.3597	0.9803	0.0134	545
550	0.3016	0.6923	0.0061	0.4334	0.9950	0.0087	550
555	0.3373	0.6589	0.0038	0.5121	1.0002	0.0057	555
560	0.3731	0.6245	0.0024	0.5945	0.9950	0.0039	560
565	0.4087	0.5896	0.0017	0.6784	0.9786	0.0027	565
570	0.4441	0.5547	0.0012	0.7621	0.9520	0.0021	570

The Standard Observer (Continued)

Wave length $m\mu$	Trichromatic coefficients			Distribution coefficients for equal energy			Wave length $m\mu$
	x	y	z	\bar{x}	\bar{y} (Rel. Vis.)	\bar{z}	
575	0.4788	0.5202	0.0010	0.8425	0.9154	0.0018	575
580	0.5125	0.4866	0.0009	0.9163	0.8700	0.0017	580
585	0.5448	0.4544	0.0008	0.9786	0.8163	0.0014	585
590	0.5752	0.4242	0.0006	1.0263	0.7570	0.0011	590
595	0.6029	0.3965	0.0006	1.0567	0.6949	0.0010	595
600	0.6270	0.3725	0.0005	1.0622	0.6310	0.0008	600
605	0.6482	0.3514	0.0004	1.0456	0.5668	0.0006	605
610	0.6658	0.3340	0.0002	1.0026	0.5030	0.0003	610
615	0.6801	0.3197	0.0002	0.9384	0.4412	0.0002	615
620	0.6915	0.3083	0.0002	0.8544	0.3810	0.0002	620
625	0.7006	0.2993	0.0001	0.7514	0.3210	0.0001	625
630	0.7079	0.2920	0.0001	0.6424	0.2650	0.0000	630
635	0.7140	0.2859	0.0001	0.5419	0.2170	0.0000	635
640	0.7190	0.2809	0.0001	0.4479	0.1750	0.0000	640
645	0.7230	0.2770	0.0000	0.3608	0.1382	0.0000	645
650	0.7260	0.2740	0.0000	0.2835	0.1070	0.0000	650
655	0.7283	0.2717	0.0000	0.2187	0.0816	0.0000	655
660	0.7300	0.2700	0.0000	0.1649	0.0610	0.0000	660
665	0.7311	0.2689	0.0000	0.1212	0.0446	0.0000	665
670	0.7320	0.2680	0.0000	0.0874	0.0320	0.0000	670
675	0.7327	0.2673	0.0000	0.0636	0.0232	0.0000	675
680	0.7334	0.2666	0.0000	0.0468	0.0170	0.0000	680
685	0.7340	0.2660	0.0000	0.0329	0.0119	0.0000	685
690	0.7344	0.2656	0.0000	0.0227	0.0082	0.0000	690
695	0.7346	0.2654	0.0000	0.0158	0.0057	0.0000	695
700	0.7347	0.2653	0.0000	0.0114	0.0041	0.0000	700
705	0.7347	0.2653	0.0000	0.0081	0.0029	0.0000	705
710	0.7347	0.2653	0.0000	0.0058	0.0021	0.0000	710
715	0.7347	0.2653	0.0000	0.0041	0.0015	0.0000	715
720	0.7347	0.2653	0.0000	0.0029	0.0010	0.0000	720
725	0.7347	0.2653	0.0000	0.0020	0.0007	0.0000	725
730	0.7347	0.2653	0.0000	0.0014	0.0005	0.0000	730
735	0.7347	0.2653	0.0000	0.0010	0.0004	0.0000	735
740	0.7347	0.2653	0.0000	0.0007	0.0003	0.0000	740
745	0.7347	0.2653	0.0000	0.0005	0.0002	0.0000	745
750	0.7347	0.2653	0.0000	0.0003	0.0001	0.0000	750
755	0.7347	0.2653	0.0000	0.0002	0.0001	0.0000	755
760	0.7347	0.2653	0.0000	0.0002	0.0001	0.0000	760
765	0.7347	0.2653	0.0000	0.0001	0.0000	0.0000	765
770	0.7347	0.2653	0.0000	0.0001	0.0000	0.0000	770
775	0.7347	0.2653	0.0000	0.0000	0.0000	0.0000	775
780	0.7347	0.2653	0.0000	0.0000	0.0000	0.0000	780
Totals				21.3713	21.3714	21.3715	

SPECIFIC ROTATION

Specific rotation or rotatory power is given in degrees per decimeter for liquids and solutions and in degrees per millimeter for solids; + signifies right handed rotation, - left. Specific rotation varies with the wave length of light used, with temperature and, in the case of solutions, with the concentration. When sodium light is used, indicated by D in the wave length column, a value of $\lambda = 0.5893$ may be assumed.

Optical rotatory power for a large number of organic compounds will be found in the International Critical Tables, Vol. VII; for sugars, Vol. II.

SOLIDS

Substance	Wave length μ	Rotation deg./mm	Substance	Wave length μ	Rotation deg./mm
Cinnabar (HgS)...	D	+32.5	Quartz (continued)		
Lead hyposulfate...	D	5.5		0.3609	+63.628
Potassium hyposulfate.....	D	8.4		0.3582	64.459
Quartz.....	0.7604	12.668		0.3466	69.454
	0.7184	14.304		0.3441	70.587
	0.6867	15.746		0.3402	72.448
	0.6562	17.318		0.3360	74.571
	0.5895	21.684		0.3286	78.579
	0.5889	21.727		0.3247	80.459
	0.5269	27.543		0.3180	84.972
	0.4861	32.773		0.2747	121.052
	0.4307	42.604		0.2571	143.266
	0.4101	47.481		0.2313	190.426
	0.3968	51.193		0.2265	201.824
	0.3933	52.155		0.2194	220.731
	0.3820	55.625		0.2143	235.972
	0.3726	58.894	Sodium bromate	D	2.8
			Sodium chlorate	D	3.13

LIQUID

Liquid	Temp. °C	Wave length μ	Specific rotation deg./dm
Amyl alcohol.....	.....	D	- 5.7
Camphor.....	204	D	+ 70.33
Cedar oil.....	15	D	- 30 to -40
Citron oil.....	15	D	+ 62
Ethyl malate (C ₂ H ₅) ₂ C ₄ H ₄ O ₈	11	D	- 10.3 to -12.4
Menthol.....	35.2	D	- 49.7
Nicotine C ₁₀ H ₁₄ N ₂	10-30	D	-162
	20	0.6563	-126
	20	0.5351	-207.5
	20	0.4861	-253.5
Turpentine C ₁₀ H ₈	20	D	- 37
	20	0.6563	- 29.5
	20	0.5351	- 45
	20	0.4861	- 54.5

SPECIFIC ROTATION (Continued)

SOLUTIONS

Corrections for values of the specific rotation for concentration are given in the last column. *c* indicates concentration in grams per 100 milliliters of solution; *d* indicates the concentration in grams per 100 grams of solution.

Substance	Solvent	Temp. °C	Wave length μ	Specific rotation deg./dm	Correction for concen- tration or temperature
Albumen.....	water	..	D	-	25 to -38
Arabinose.....	water	20	D	-	105.0
Camphor.....	alcohol	20	D	+	54.4 - .135 <i>d</i> for <i>d</i> = 45-91
	benzene	20	D	+	56 - .166 <i>d</i> for <i>d</i> = 47-90
Dextrose <i>d</i> -glucose <chem>C6H12O6</chem>	ether	..	D	+	57
	water	20	D	+	52.5 + .025 <i>d</i> for <i>d</i> = 1-18
			.5461	+	62.03 + .04257 <i>c</i> for <i>c</i> = 6-32
Galactose.....	water	..	D	+	83.9 + .078 <i>d</i> - .21 <i>t</i> for <i>d</i> = 4-36 and <i>t</i> = 10-30°C
<i>l</i> -Glucose (β).....	water	20	D	-	51.4
Invert sugar <chem>C6H12O6</chem>	water	20	D	-	19.7 - .036 <i>c</i> for <i>c</i> = 9-35
					$\alpha_t = \alpha_{20} + .304(t - 20) + .00165(t - 20)^2$ for <i>t</i> = 3-30°C
		25	.5461	-	21.5
Lactose.....	water	20	D	+	52.4 + .072 (20° - <i>t</i>) for <i>c</i> = 5
			.5461	+	61.9 + .085(20° - <i>t</i>) for <i>c</i> = 5
Levulose fruit sugar...	water	25	D	-	88.5 - .145 <i>d</i> for <i>d</i> = 2.6-18.6
		25	.5461	-	105.30
Maltose.....	water	20	D	+	138.48 - .01837 <i>d</i> for <i>d</i> = 5-35
		25	.5461	+	153.75
Mannose.....	water	20	D	+	14.1 <i>c</i> = 10.2
Nicotine.....	water	20	D	-	77 for <i>d</i> = 1-16
	benzene	20	D	-	164 for <i>d</i> = 8-100
Potassium tartrate....	water	20	D	+	27.14 + .0992 <i>c</i> - .00094 <i>c</i> ² for <i>c</i> = 8-50
Quinine sulfate.....	water	17	D	-	214
Santonin.....	alcohol	20	D	-	161.0 <i>c</i> = 1.78
		20	D	+	693 <i>c</i> = 4.05
	chloroform	20	D	-	202.7 + .309 <i>d</i> for <i>d</i> = 75-96.5
	alcohol	20	.6867	+	442 <i>c</i> = 4.05
			.5269	+	991 <i>c</i> = 4.05
			.4861	+	1323 <i>c</i> = 4.05
Sodium potassium tar- trate (Rochelle salt)	water	20	D	+	29.75 - .0078 <i>c</i>
Sucrose (cane sugar) <chem>C12H22O11</chem>	water	20	D	+	66.412 + .01267 <i>d</i> - .000376 <i>d</i> ² for <i>d</i> = 0-50
					$\alpha_t = \alpha_{20}[1 - .00037(t - 20)]$ for <i>t</i> = 14- 30°C

SPECIFIC ROTATION (Continued)

Sucrose dissolved in water, 20°C.

μ	Spec. rot.	μ	Spec. rot.	μ	Spec. rot.
670.8 (Li)	+50.51	510.6 (Cu)	+90.46	435.3 (Fe)	+128.5
643.8 (Cd)	55.04	508.6 (Cd)	91.16	433.7 (Fe)	129.8
636.2 (Zn)	56.51	481.1 (Zn)	103.07	431.5 (Fe)	130.7
589.3 (Na)	66.45	480.0 (Cd)	103.62	428.2 (Fe)	133.6
578.2 (Cu)	69.10	472.2 (Zn)	107.38	427.2 (Fe)	134.2
578.0 (Hg)	69.22	468.0 (Zn)	109.49	426.1 (Fe)	134.9
570.0 (Cu)	71.24	467.8 (Cd)	109.69	419.1 (Fe)	140.0
546.1 (Hg)	78.16	438.4 (Fe)	126.5	414.4 (Fe)	144.2
521.8 (Cu)	86.21	437.6 (Fe)	127.2	388.9 (Fe)	166.7
515.3 (Cu)	88.68	435.8 (Hg)	128.49	383.3 (Fe)	171.8
				382.6 (Fe)	173.1

Substance	Solvent	°C	μ	Spec. rot.	Correct.
Tartaric acid (ord.)	water	20	D	+15.06	— .131c
		20	.6563	7.75	} for $d = 41$
		20	D	8.86	
		20	.5351	9.65	
		20	.4861	9.37	
Turpentine	alcohol	20	D	—37	— .00482d —
	benzene	20	D	.00013d ² for $d = 0-90$	
				—37 — .0265d for $d = 0-91$	
Xylose	water	20	D	+19.13	$d = 2.7$

OPTICAL ROTATION OF ACIDS AND BASES

Optical rotation of acids and bases commonly used in the resolution of racemic substances. Compiled by F. E. Ray.

Name	Formula	Solvent	Conc. %	α_D
Bromocamphor-sulfonic acid. K salt	$C_{10}H_{15}O_4BrS$	H_2O	....	72.1
Camphorsulfonic acid	$C_{10}H_{15}O_4S$	H_2O	....	23.9
Chlorocamphor-sulfonic acid	$C_{10}H_{15}ClO_4S$	H_2O	....	49.6
Codeinesulfonic acid	$C_{15}H_{21}NO_6S$	H_2O	3	— 190.1
Hydroxybutyric acid	$C_4H_5O_3$	H_2O	3.3	— 24.8
Lactic acid	$C_3H_5O_3$	H_2O	10.5	3.8
Malic acid	$C_4H_5O_5$	H_2O	....	2.4
Mandelic acid	$C_8H_8O_3$	H_2O	2.01	155.5
Methylene-camphor	$C_{11}H_{16}O$	C_2H_5OH	....	127
Phenylsuccinic acid	$C_{10}H_{10}O_4$	C_2H_5OH	1.5	148
Tartaric acid	$C_4H_6O_6$	C_2H_5OH and H_2O	....	3 to 25*
Brucine	$C_{23}H_{26}N_2O_4$	C_2H_5OH	5.4	— 85
Cinchonidine	$C_{19}H_{22}N_2O$	C_2H_5OH	1.0	— 111.0
Cinchonine	$C_{19}H_{22}N_2O$	$CHCl_3$	0.6	+209.6
Cocaine	$C_{17}H_{21}NO_4$	50% C_2H_5OH	1.1	— 35.4
Conine	$C_8H_{17}N$	$CHCl_3$	4	8.0
Codeine	$C_{18}H_{21}NO_3$	C_2H_5OH	5	— 135.8
Hydrastine	$C_{21}H_{21}NO_6$	50% C_2H_5OH	0.2	115
Menthol	$C_{10}H_{20}O$	C_2H_5OH	9.6	— 50.6
Menthylamine	$C_{10}H_{21}N$	C_2H_5OH	11.3	— 31.9
Narcotine	$C_{22}H_{23}NO_7$	$CHCl_3$	2.6	+200.0
Quinidine	$C_{20}H_{24}N_2O_4$	C_2H_5OH	1.0	+233.6
Quinine	$C_{20}H_{24}N_2O_2$	C_6H_6	0.6	— 136
Thebaine	$C_{19}H_{21}NO_3$	$CHCl_3$	5	— 229.5
Strychnine	$C_{21}H_{22}N_2O_2$	C_2H_5OH	0.9	— 128

* Varies greatly with temperature, solvent, and conc.

MAGNETO-OPTIC ROTATION

Revised by Park L. Turrill

$$\text{Verdet's Constant: } \rho = \frac{\alpha}{tH \cos \theta}$$

The specific power of magnetic rotation ρ , is expressed in the above formula, where α is the total angle of rotation in minutes, t the thickness of the substance in centimeters through which the light beam passes, H the magnetic field intensity in gauss, and θ the angle between the direction of the magnetic field and the path of light. Determinations made with sodium light. $\lambda_D = 5893 \text{ \AA}$.

Values from the Smithsonian Tables, the International Critical Tables, and the literature.

GASES

Substance	Pressure (atmospheres)	Temp. °C.	Verdet's Constant (minutes) $\rho \times 10^6$	Observer	Year
Atmospheric air.....	1	20	6.83	Becquerel	1880
Carbon dioxide.....	1.1	6.5	8.61	Siertsema	1895
Carbon disulfide.....	0.98	70	23.49	Bichat	1879
Ethylene.....	1	20	34.48	Becquerel	1880
Nitrogen.....	1	20	6.92	Becquerel	1880
Nitrous oxide.....	1	20	6.28	Becquerel	1880
Oxygen.....	1	20	31.39	Becquerel	1880
Sulfur dioxide.....	3.3	20	38.40	Bichat	1880

LIQUIDS, ORGANIC

	$\rho \times 10^3$				
Acetic acid.....	15.1	11.09	Schwers	1912	
Acetic acid.....	31.5	10.86	Schwers	1912	
Acetone.....	15.2	10.35	Schwers	1912	
Acetone.....	32.0	10.19	Schwers	1912	
Amyl alcohol.....	15	13.1	Becquerel	1880	
Benzine.....	20	29.7	Jahn		
Carbon disulfide.....	0	43.41	Becquerel	1885	
	15.6	42.4	Schwers	1912	
	18.0	43.0	Chaudier	1913	
	20	42.26	Bichat	1880	
	34	41.1	Schwers	1912	
Carbon tetrachloride.....	15	16.03	Schwers	1912	
Carvane.....	14.9	18.4	Herngrist	1914	
Chloroform.....	20	16.4	Jahn		
Citranellal.....	16.4	15.1	Herngrist	1914	
Diethyl malate.....	15.3	12.4	Herngrist	1914	
Diethyl tartrate.....	15.2	12.3	Herngrist	1914	
Dimethyl malate.....	15.3	11.8	Herngrist	1914	
Dipropyl tartrate.....	15.4	12.6	Herngrist	1914	
Ethanol.....	25.0	11.12	Theuvenet	1910	
Isobutyl alcohol.....	16.1	12.66	Schwers	1912	
Isobutyric acid.....	15.3	11.35	Schwers	1912	
Isovaleric acid.....	15.0	12.08	Schwers	1912	
Limonene.....	15.6	16.5	Herngrist	1914	
Menthone.....	16.7	13.7	Herngrist	1914	
Methyl chloride.....	18	12.9	Chaudier	1913	
Pulegone.....	14.9	16.4	Herngrist	1914	
n-Propanol.....	17.3	11.81	Schwers	1912	
Toluene.....	28.4	26.9	Becquerel	1880	
Xylene.....	15	22.1	Becquerel	1880	

MAGNETO-OPTIC ROTATION (Continued)

LIQUIDS, INORGANIC

Substance	Temp. °C.	Verdet's Constant (minutes) $\rho \times 10^3$	Observer	Year
Antimony pentachloride.....	16	70.4	Becquerel	1885
Arsenic trichloride.....	16	42.53	Becquerel	1885
Hydrogen peroxide.....	10	11.5	Giguère and Feeny	..... 1943
Nitric acid, fuming.....	16	8.75	Becquerel	1885
Nitrogen.....	-195.5	4.15	Chaudier	1913
Nitrous oxide.....	-92	5.54	Siertsema	1904
Oxygen.....	-182.5	7.82	Chaudier	1913
Phosphorus, fused.....	33	132.6	Becquerel	1877
Phosphorus, trichloride.....	16	27.7	Becquerel	1885
Silicon tetrachloride.....	16	18.9	Becquerel	1885
Sulfur, fused.....	114	80.9	Becquerel	1877
Sulfur dioxide.....	-10	18	Chaudier	1913
Sulfur monochloride.....	16	41.8	Becquerel	1885
Titanium tetrachloride.....	13.4	14.71	Siertsema	1915
Water ($\lambda = 5956 \text{ \AA}$).....	0	13.11	Rodger and Watson	..... 1895
	20	13.08		
	30	13.06		
	40	13.02		
	60	12.94		
	80	12.82		
	90	12.74		

SOLUTIONS, AQUEOUS

Substance	Density	Temp. °C	Verdet's Constant (minutes) $\rho \times 10^3$	Observer	Year
Ammonium hydroxide..	0.8918	.....	15.3	Perkin	1884
Antimony trichloride...	.....	.....	29.9	Becquerel	1885
Barium bromide.....	1.5399	20	21.5	Jahn	.....
Barium chloride.....	1.2897	20	16.8	Jahn	.....
Bismuth nitrate.....	.....	.....	19.22	Becquerel	1885
Cadmium chloride.....	1.3179	20	16.5	Jahn	.....
Calcium chloride.....	1.1504	20	16.5	Humburg	1893
Ferric chloride.....	1.6933	15	-202.6	Becquerel..	1885
Ferrous chloride.....	1.4331	15	2.5	Becquerel	1885
Hydriodic acid.....	1.2966	15	25.8	Perkin	1884
Hydrobromic acid.....	1.2039	15	19.4	Perkin	1884
Hydrochloric acid.....	1.0758	20	16.71	Schwers	1912
Lithium chloride.....	1.0619	20	14.5	Jahn	.....
Magnesium sulfate.....	1.1147	16	3.6	Schönrock	1893
Manganous sulfate.....	1.1212	16	4.0	Schönrock	1893
Mercuric chloride.....	1.0381	16	13.7	Schönrock	1893
Mercuric cyanide.....	1.0638	16	7.1	Schönrock	1893
Nickelous chloride.....	1.4685	.....	27.3	Becquerel	1885
Nitric acid.....	1.3366	15	10.5	Perkin	1884
Potassium bicarbonate..	1.1906	20	14.0	Humburg	1893
Potassium bichromate..	1.0786	15	12.6	Verdet	1863
Potassium bromide.....	1.1424	20	16.3	Humburg	1893
Potassium carbonate....	1.1960	20	14.0	Jahn	.....
Potassium chloride.....	1.6000	15	16.3	Becquerel	1885

MAGNETO-OPTIC ROTATION (Continued)

SOLUTIONS, AQUEOUS (Continued)

Substance	Density	Temp. °C.	Verdet's Constant (minutes) $\rho \times 10^3$	Observer	Year
Potassium iodide.....	1.6743	15	34.1	Becquerel	1885
Potassium nitrate.....	1.0634	20	13.0	Humburg	1893
Potassium sulfate.....	1.0475	20	13.3	Jahn	....
Silver nitrate.....	.....	.....	18.03	Becquerel	1885
Sodium bromide.....	1.1351	20	16.5	Jahn	....
Sodium carbonate.....	1.1006	20	14.0	Humburg	1893
Sodium chloride.....	1.2051	16	18.2	Becquerel	1885
Sodium sulfate.....	1.0061	20	13.5	Humburg	1893
Stannous chloride.....	1.3280	15	26.6	Verdet	1863
Sulfuric acid.....	1.5507	15	12.18	Schwers	1912
Zinc chloride.....	1.2851	16	19.6	Verdet	1863

SOLUTIONS, IN ETHYL ALCOHOL

Cadmium bromide.....	1.0446	20	15.9	Humburg	1893
Cadmium chloride.....	0.8303	20	11.8	Humburg	1893
Cadmium iodide.....	1.0988	20	19.9	Humburg	1893
Calcium bromide.....	0.9966	20	15.4	Humburg	1893
Mercuric chloride.....	0.9988	16	10.9	Schönrock	1893
Mercuric chloride.....	0.8857	16	12.1	Schönrock	1893
Mercuric cyanide.....	0.8527	16	6.4	Schönrock	1893
Mercuric cyanide.....	0.8348	16	5.3	Schönrock	1893
Mercuric iodide.....	0.8072	16	24.4	Schönrock	1893
Strontium bromide.....	0.9636	20	14.0	Humburg	1893
Strontium chloride.....	0.8313	20	11.8	Humburg	1893

SOLIDS

Amber.....	19	-9.60	Quincke	1885
Calcium fluoride (fluorite).....	16	8.83	Becquerel	1885
Carbon (diamond).....	16	12.8	Becquerel	1877
Carbon dioxide.....	26	2.07	Chaudier	1913
Glass, Jena (barium crown).....	18	22.0	duBois	1894
(phosphate crown).....	18	16.1	duBois	1894
(light flint).....	18	31.7	duBois	1894
(heavy flint).....	18	60.8	duBois	1894
(very heavy flint).....	18	88.8	duBois	1894
Potassium chloride (sylvite).....	16	28.58	Becquerel	1885
Sodium chloride (rock salt).....	16	35.85	Becquerel	1885
Sodium tetraborate (borax).....	16	17.2	Becquerel	1885
Silicon (quartz).....	20	16.64	Borel	1903
Stannous chloride.....	16	44.	Becquerel	1885
Zinc sulfide, β	16	225.	Becquerel	1885

QUANTITIES AND UNITS

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DEFINITIONS AND FORMULAE

The chemical terms have been compiled with the collaboration of
B. Clifford Hendricks

A compilation of chemical and physical terms including quantities, units, laws, theories and effects, with their expression as formulae or equations.

Abegg's rule.—For use in regard to a helical periodic system. If the maximum positive valence exhibited by an element be numerically added to its maximum negative valence, there is evidently a tendency for the sum to equal 8. This tendency is exhibited especially by the elements of the 4th, 5th, 6th and 7th groups and is known as Abegg's rule.

Absolute humidity.—See *Humidity*

Absolute pressure.—See *Pressure*

Absolute temperature.—Temperature reckoned from the absolute zero See *Temperature*

Absolute units.—A system of units based on the smallest possible number of independent units. Specifically, units of force, work, energy and power not derived from or dependent on gravitation

Absolute zero.—The temperature at which a gas would show no pressure if the general law for gases would hold for all temperatures It is equal to -273.18°C or -459.72°F

Absorption.—1 Penetration of a substance into the body of another 2 Transformation into other forms suffered by radiant energy passing through a material substance

Absorption coefficient.—See *Absorption factor*

Absorption factor.—The ratio of the intensity loss by absorption to the total original intensity of radiation If I_o represents the original intensity, I_r , the intensity of reflected radiation, I_t , the intensity of the transmitted radiation, the absorption factor is given by the expression

$$\frac{I_o - (I_r + I_t)}{I_o}$$

Also called coefficient of absorption

Absorption, Lambert's law.—If I_o is the original intensity, I the intensity after passing through a thickness x of a material whose absorption coefficient is k ,

$$I = I_o e^{-kx}$$

The **index of absorption** k' is given by the relation $k = (4\pi k'n)/\lambda$ where n is the index of refraction and λ the wave length in vacuo. The **mass absorption** is given by k/d when d is the density The transmission factor is given by I/I_o .

Absorption spectrum.—The spectrum obtained by the examination of light from a source, itself giving a continuous spectrum, after this light has passed through an absorbing medium in the gaseous state. The absorption spectrum will

DEFINITIONS AND FORMULAE (Continued)

consist of dark lines or bands, being the reverse of the emission spectrum of the absorbing substance.

When the absorbing medium is in the solid or liquid state the spectrum of the transmitted light shows broad dark regions which are not resolvable into lines and have no sharp or distinct edges

Absorptive power or absorptivity for any body is measured by the fraction of the radiant energy falling upon the body which is absorbed or transformed into heat. This ratio varies with the character of the surface and the wave length of the incident energy. It is the ratio of the radiation absorbed by any substance to that absorbed under the same conditions by a black body

Acceleration.—The time rate of change of velocity in either speed or direction. Cgs unit,—one centimeter per second per second. Dimensions,— $[l t^{-2}]$. See also under *Angular acceleration*

Acceleration due to gravity.—The acceleration of a body freely falling in a vacuum. The International Committee on Weights and Measures has adopted as a standard or accepted value, 980.665 cm/sec² or 32.174 ft/sec²

Acceleration due to gravity at any latitude and elevation.—If ϕ is the latitude and H the elevation in centimeters the acceleration in cgs units is, $g = 980.616 - 2.5928 \cos 2\phi + 0.0069 \cos^2 2\phi - 3.086 \times 10^{-6} H$ (Helmert's equation)

Achromatic.—A term applied to lenses signifying their more or less complete correction for chromatic aberration

Acids are substances whose molecules ionize in water solution to give the hydrogen ion from their constituent elements. The strength of an acid is proportional to the concentration of hydrogen ions present

Action is measured by the product of work by time. Cgs units of action are the erg-second and the joule-second. Dimensions,— $[m l^2 t^{-1}]$. Planck's quantum or constant of action is 6.554×10^{-27} erg-seconds

Active mass of a substance is the number of gram molecular weights per liter in solution, or in gaseous form

Adiabatic.—A body is said to undergo an adiabatic change when its condition is altered without gain or loss of heat. The line on the pressure volume diagram representing the above change is called an adiabatic line

Adsorption.—The condensation of gases, liquids, or dissolved substances on the surfaces of solids is called adsorption

Air columns, frequency of vibration in —See *Organ pipes*

Allotropy.—The property shown by certain elements of being capable of existence in more than one form, due to differences in the arrangement of atoms or molecules. (See *Monotropic* and *Enantiotropic*)

DEFINITIONS AND FORMULAE (Continued)

Alpha (α)-particle.—A helium nucleus—that is, a helium atom which has lost two electrons and has therefore a double positive charge.

Alpha (α)-rays are strongly ionizing and weakly penetrating radiations, deflected by magnetic and electric fields as positively charged particles. The particles are doubly charged helium atoms (ions) and are called α -particles.

Alternating current in circuits including resistance and inductance,

$$I = \frac{E}{\sqrt{R^2 + (2\pi fL)^2}}$$

where f is the frequency in cycles per second, L the inductance in henry. I will be given in effective amperes if R is in ohms and E in effective volts. The denominator is known as the impedance of the circuit.

For circuits involving also a capacitance C in farads, the impedance becomes,

$$\sqrt{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2}$$

Altitudes with the barometer.—If b_1 and b_2 denote the corrected barometer readings at two stations, t the mean of the temperatures, t_1 and t_2 of the air at the two stations, e_1 and e_2 the tension of water vapor at the two stations, h the mean height above sea level, ϕ the latitude; then the difference in elevation in centimeters is $H = 1,843,000 (\log b_1 - \log b_2) (1 + 0.00367t) (1 + 0.0026 \cos 2\phi + 0.00002h + \frac{3}{8}k)$, where

$$k = \frac{1}{2} \left(\frac{e_1}{b_1} + \frac{e_2}{b_2} \right)$$

An approximate formula, sufficient for differences not over 1000 meters is

$$H = 1,600,000 \frac{b_1 - b_2}{b_1 + b_2} (1 + 0.004t).$$

Amorphous.—Without definite form, not crystallized.

Ampere's rule.—To determine the direction in which the magnetic needle is deflected by a conductor carrying a current in a given direction.

If a man is imagined to be swimming in the direction in which the current is flowing, and facing the magnetic needle; then the north pole will be deflected toward his left hand, the south pole being deflected in the opposite direction.

Amplitude.—The maximum value of the displacement in an oscillatory motion.

Angle.—The ratio between the arc and the radius of the arc. Units of angle,—the radian, the angle subtended by an arc equal to the radius; the degree, $\frac{1}{360}$ part of the total angle about a point. Dimensions,—a numeric.

DEFINITIONS AND FORMULAE (Continued)

Angular acceleration.—The time rate of change of angular velocity either in angular speed or in direction of the axis of rotation (precession). Cgs unit,—one radian per second per second. Dimensions,— $[t^{-2}]$.

If the initial angular velocity is ω_0 , and the velocity after time t is ω_t , the angular acceleration,

$$\alpha = \frac{\omega_t - \omega_0}{t}$$

The angular velocity after time t ,

$$\omega_t = \omega_0 + \alpha t$$

The angle swept out in time t ,

$$\theta = \omega_0 t + \frac{1}{2} \alpha t^2$$

The angular velocity after movement through the arc θ ,

$$\omega = \sqrt{\omega_0^2 + 2\alpha\theta}$$

In the above equations, for angular displacement in radians, angular velocity will be in radians per second and angular acceleration in radians per second per second.

Angular aperture of an objective is the largest angular extent of wave surface which it can transmit.

Angular harmonic motion or harmonic motion of rotation.—Periodic, oscillatory angular motion in which the restoring torque is proportional to the angular displacement. Torsional vibration.

Angular momentum or moment of momentum.—Quantity of angular motion measured by the product of the angular velocity and the moment of inertia. Cgs unit,—unnamed, its nature is expressed by g-cm²/sec. Dimensions,— $[m l^2 t^{-1}]$.

The angular momentum of a mass whose moment of inertia is I , rotating with angular velocity ω , is $I\omega$.

Angular velocity.—Time rate of angular motion about an axis. Cgs unit,—one radian per second. Dimensions,— $[t^{-1}]$.

If the angle described in time t is θ , the angular velocity,

$$\omega = \frac{\theta}{t}$$

θ in radians and t in seconds gives ω in radians per second.

Anhydride (of acid or base).—An oxide which when combined with water gives an acid or base.

Anion.—A negatively charged ion.

Apochromat.—A term applied to photographic and microscope objectives indicating the highest degree of color correction.

Archimedes principle.—A body wholly or partly immersed in a fluid is buoyed up by a force equal to the weight of the

DEFINITIONS AND FORMULAE (Continued)

fluid displaced. A body of volume V cm³ immersed in a fluid of density ρ grams per cm³ is buoyed up by a force in dynes,

$$F = \rho g V.$$

where g is the acceleration due to gravity.

A floating body displaces its own weight of liquid.

Area, unit of.—The square centimeter. The area of a square whose sides are one centimeter in length. Other units of area are similarly derived. Dimensions,—[l^2].

Arrhenius theory of electrolytic dissociation states that the molecule of an electrolyte can give rise to two or more electrically charged atoms or ions.

Astigmatism is an error of spherical lenses peculiar to the formation of images by oblique pencils. The image of a point when astigmatism is present will consist of two focal lines at right angles to each other and separated by a measurable distance along the axis of the pencil. The error is not eliminated by reduction of aperture as is spherical aberration.

Atom.—The smallest part of an element which can participate in ordinary chemical changes. The atoms of a given element are unvarying in average mass, but are different in such mass from atoms of all other elements.

Atomic number.—The number of excess positive charges on the atomic nucleus. This charge of the nucleus is the essential feature which distinguishes one element from another and determines the position of the element in the periodic table.

Atomic theory.—All elementary forms of matter are composed of very small unit quantities called atoms. The atoms of a given element all have the same size and weight. The atoms of different elements have different sizes and weights. Atoms of the same or different elements unite with each other to form very small unit quantities of compound substances called molecules.

Atomic weight is the relative weight of the atom, on the basis of oxygen as 16. If these weights are expressed in grams they are called gram atomic weights.

Avogadro's law.—Equal volumes of different gases at the same pressure and temperature contain the same number of molecules.

Avogadro's number.—The number of molecules in a mole or in a mass in grams of substance equal numerically to its molecular weight, i.e., 6.02×10^{23} molecules.

Avogadro's principle (or theory).—The numbers of molecules present in equal volumes of gases at the same temperature and pressure are equal.

Babo's law.—The addition of a non-volatile solid to a liquid in which it is soluble lowers the vapor pressure of the solvent in proportion to the amount of substance dissolved.

DEFINITIONS AND FORMULAE (Continued)

Balanced or reversible action.—One which can be caused to proceed in either direction by suitable variation in the conditions of temperature, volume, pressure or of the quantities of reacting substances.

Balmer series of spectral lines. The wave lengths of a series of lines in the spectrum of hydrogen are given in angstroms by the equation

$$\lambda = 3646 \frac{N^2}{N^2 - 4}$$

where N is an integer having values greater than 2.

Bases are substances which ionize in water to give the hydroxyl ion from their constituent elements. The strength of a base is proportional to the concentration of hydroxyl ions.

Beats.—Two tones of slightly different frequencies sounded together interfere to give a sound of regularly varying intensity. The number of beats per second is the difference in frequency of the two tones.

Beer's law (1852).—If two solutions of the same salt be made in the same solvent, one of which is, say, twice the concentration of the other, the absorption due to a given thickness of the first solution should be equal to that of twice the thickness of the second.

Bernoulli's theorem.—At any point in a tube through which a liquid is flowing the sum of the pressure energy, potential energy, and kinetic energy is constant. If p is pressure; h , height above a reference plane; d , density of the liquid, and v , velocity of flow,

$$p + hdg + \frac{1}{2} dv^2 = \text{a constant.}$$

Berthelot principle of maximum work.—Of all possible chemical processes which can proceed without the aid of external energy, that process always takes place which is accompanied by the greatest evolution of heat. This law holds good for low temperatures only and does not account for endothermic reactions.

Beta (β)-particle.—One of the products emitted from the atomic nuclei of radioactive substances during their spontaneous disintegration. A negatively charged particle, which at rest has a mass about $\frac{1}{1836}$ that of a hydrogen atom. An electron.

Beta (β)-rays.—A radiation, more penetrating but less ionizing than α -rays. The rays are deflected by electric and magnetic fields as negatively charged particles. The particles consist of high speed electrons.

Black body.—If, for all values of the wave length of the incident radiant energy, all of the energy is absorbed the body is called a black body.

Boyle's law for gases.—At a constant temperature the volume of a given quantity of any gas varies inversely as the pressure to which the gas is subjected. For a perfect gas,

DEFINITIONS AND FORMULAE (Continued)

changing from pressure p and volume v to pressure p' and volume v' without change of temperature,

$$pv = p'v'$$

Bulk modulus.—The modulus of volume elasticity,

$$M_B = \frac{p_2 - p_1}{\frac{v_1 - v_2}{v_1}}$$

where $p_1, p_2; v_1, v_2$ are the initial and final pressure and volume respectively.

Brewster's law.—The tangent of the polarizing angle for a substance is equal to the index of refraction. The polarizing angle is that angle of incidence for which the reflected polarized ray is at right angles to the refracted ray. If n is the index of refraction and θ the polarizing angle, $n = \tan \theta$.

Brightness is measured by the flux emitted per unit emissive area as projected on a plane normal to the line of sight. The unit of brightness is that of a perfectly diffusing surface giving out one lumen per square centimeter of projected surface and is called the lambert. The millilambert (0.001 lambert) is a more convenient unit. **Candle per square centimeter** is the brightness of a surface which has, in the direction considered, a luminous intensity of one candle per cm^2 .

Brownian movement.—A continuous agitation of particles in a colloidal solution caused by unbalanced impacts with molecules of the surrounding medium. The motion may be observed with a microscope when a strong beam of light is caused to traverse the solution across the line of sight.

Capacitance is measured by the charge which must be communicated to a body to raise its potential one unit. Electrostatic unit capacitance is that which requires one electrostatic unit of charge to raise the potential one electrostatic unit. The farad = 9×10^{11} electrostatic units. A capacitance of one farad requires one coulomb of electricity to raise its potential one volt. Dimensions,— $[\epsilon l]; [\mu^{-1} l^{-1} t^2]$.

A conductor charged with a quantity Q to a potential V has a capacitance,

$$C = \frac{Q}{V}$$

Capacitance of a spherical conductor of radius r ,

$$C = Kr$$

Capacitance of two concentric spheres of radii r and r'

$$C = K \frac{rr'}{r - r'}$$

Capacitance of a parallel plate condenser, the area of whose plates is A and the distance between them d ,

$$C = \frac{KA}{4\pi d}$$

DEFINITIONS AND FORMULAE (Continued)

Capacitances will be given in electrostatic units if the dimensions of condensers are substituted in cm. K is the dielectric constant of the medium.

Capillary constant or specific cohesion,

$$a^2 = \frac{2T}{(d_1 - d_2)g} = hr$$

where T is surface tension, d_1 and d_2 , the densities of the two fluids, g the acceleration due to gravity, h the height of rise in a capillary tube of radius r . See *Surface tension*.

Carnot cycle.—A sequence of operations forming the working cycle of an ideal heat engine of maximum thermal efficiency. It consists of isothermal expansion, adiabatic expansion, isothermal compression, and adiabatic compression to the initial state.

Catalytic agent.—A substance which by its mere presence alters the velocity of a reaction, and may be recovered unaltered in nature or amount at the end of the reaction.

Cation.—A positively charged ion.

Cauchy's dispersion formula.

$$n = A + \frac{B}{\lambda^2} + \frac{C}{\lambda^4} + \dots$$

An empirical expression giving an approximate relation between the refractive index n of a medium and the wavelength λ of the light; A , B , and C being constants for a given medium.

Centripetal force.—The force required to keep a moving mass in a circular path. Centrifugal force is the name given to the reaction against centripetal force.

Charles' law or Gay-Lussac's law.—The volumes assumed by a given mass of a gas at different temperatures, the pressure remaining constant, are, within moderate ranges of temperature, directly proportional to the corresponding absolute temperatures.

Chromatic aberration.—Due to the difference in the index of refraction for different wave lengths, light of various wave lengths from the same source cannot be focused at a point by a simple lens. This is called chromatic aberration.

Chemiluminescence.—Emission of light during a chemical reaction.

Christiansen effect.—When finely powdered substances, such as glass or quartz, are immersed in a liquid of the same index of refraction complete transparency can only be obtained for monochromatic light. If white light is employed the transmitted color corresponds to the particular wave-length for which the two substances, solid and liquid have exactly the same index of refraction. Due to differences in dispersion the indices of refraction will match for only a narrow band of the spectrum.

DEFINITIONS AND FORMULAE (Continued)

Colligative property.—A property numerically the same for a group of substances, independent of their chemical nature.

Colloid.—A phase dispersed to such a degree that the surface forces become an important factor in determining its properties.

Coma.—An aberration of spherical lenses, occurring in the case of oblique incidence, when the bundle of rays forming the image is unsymmetrical. The image of a point is comet shaped, hence the name.

Combining volumes.—Under comparable conditions of pressure and temperature the volume ratios of gases involved in chemical reactions are simple whole numbers.

Combining weight of an element or radical is its atomic weight divided by its valence.

Combining weights, law of.—If the weights of elements which combine with each other be called their "combining weights," then elements always combine either in the ratio of their combining weights or of simple multiples of these weights.

Component substances, law of.—Every material consists of one substance, or is a mixture of two or more substances, each of which exhibits a specific set of properties, independent of the other substances.

Compounds are substances containing more than one constituent element and having properties, on the whole, different from those which their constituents had as elementary substances. The composition of a given pure compound is perfectly definite, and is always the same no matter how that compound may have been formed.

Compressibility.—Reciprocal of the bulk modulus.

Concentration.—The amount of a substance in weight, moles, or equivalents contained in unit volume.

Condensers in parallel and series.—If c_1, c_2, c_3 , etc. represent the capacitances of a series of condensers and C their combined capacitance,—

when in parallel, $C = c_1 + c_2 + c_3 \dots$

when in series, $\frac{1}{C} = \frac{1}{c_1} + \frac{1}{c_2} + \frac{1}{c_3} \dots$

Conductance, the reciprocal of resistance, is measured by the ratio of the current flowing through a conductor to the difference of potential between its ends. The practical unit of conductance, the mho, the conductance of a body through which one ampere of current flows when the potential difference is one volt. The conductance of a body in mho is the reciprocal of the value of its resistance in ohms. Dimensions,— $[\epsilon l t^{-1}]$;

DEFINITIONS AND FORMULAE (Continued)

Conductivity, electrical, is measured by the quantity of electricity transferred across unit area, per unit potential gradient per unit time. Reciprocal of resistivity. **Volume conductivity** or specific conductance, $k = 1/\rho$ where ρ is the volume resistivity. **Mass conductivity** $= k/d$ where d is density. **Equivalent conductivity** $\Lambda = k/c$ where c is the number of equivalents per unit volume of solution. **Molecular conductivity** $\mu = k/m$ where m is the number of moles per unit volume of solution. Dimensions: volume conductivity,— $[\epsilon t^{-1}]$; $[\mu^{-1} l^{-2} t]$,—mass conductivity,— $[\epsilon m^{-1} l^3 t^{-1}]$; $[\mu^{-1} m^{-1} lt]$.

Conductivity, thermal.—Time rate of transfer of heat by conduction, through unit thickness, across unit area for unit difference of temperature. It is measured as calories per second per square centimeter for a thickness of one centimeter and a difference of temperature of 1°C . Dimensions,— $[m l t^{-3} \theta^{-1}]$.

If the two opposite faces of a rectangular solid are maintained at temperatures t_1 and t_2 the heat conducted across the solid of section a and thickness d in a time T will be,

$$Q = \frac{K(t_2 - t_1)aT}{d}$$

K is a constant depending on the nature of the substance, designated as the specific heat conductivity. K is usually given for Q in calories, t_1 and t_2 in $^\circ\text{C}$, a in cm^2 , T in sec, and d in cm. See table *Heat conductivity*.

Conductors.—A class of bodies which are incapable of supporting electric strain. A charge given to a conductor spreads to all parts of the body.

Conjugate foci.—Under proper conditions light divergent from a point on or near the axis of a lens or spherical mirror is focused at another point. The point of convergence and the position of the source are interchangeable and are called conjugate foci.

Conservation of energy. (Chem).—In a chemical change there is no loss or gain but merely a transformation of energy from one form to another.

Conservation of energy, law of.—Energy can neither be created nor destroyed and therefore the total amount of energy in the universe remains constant.

Conservation of momentum, law of.—For any collision, the vector sum of the momenta of the colliding bodies after collision equals the vector sum of their momenta before collision. If two bodies of masses m_1 and m_2 have, before impact velocities v_1 and v_2 and after impact velocities u_1 and u_2 .

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

Conservation of mass.—In all ordinary chemical changes, the total of the reactants is always equal to the total mass of the products.

Constitutive property.—A property which depends on the constitution or structure of the molecule.

DEFINITIONS AND FORMULAE (Continued)

Couple.—Two equal and oppositely directed parallel but not colinear forces acting upon a body form a couple. The moment of the couple or torque is given by the product of one of the forces by the perpendicular distance between them. Dimension, — $[m l^2 t^{-2}]$.

Couple acting on a magnet of magnetic moment ml in a field of strength H . If the magnet is perpendicular to the direction of the field

$$C = Hml = HM$$

If the angle between the magnet and the field is θ

$$C = Hml \sin \theta$$

The couple will be in dyne-cm for cgs electromagnetic units of H , m and l .

Cryohydrate.—The solid which separates when a saturated solution freezes. It contains the solvent and the solute in the same proportions as they were in the saturated solution.

Crystal.—A homogeneous portion of a substance bounded by plane surfaces making definite angles with each other, giving a regular geometrical form.

Critical temperature is that temperature above which a gas cannot be liquefied by pressure alone. The pressure under which a substance may exist as a gas in equilibrium with the liquid at the critical temperature is the **critical pressure**.

Curie's law.—The intensity of magnetization,

$$I = \frac{AH}{T}$$

where H , is the magnetic field strength, T the absolute temperature and A Curie's constant. Used for paramagnetic substances.

Curie point.—All ferro-magnetic substances have a definite temperature of transition at which the phenomena of ferro-magnetism disappear and the substances becomes merely paramagnetic. This temperature is called the "Curie Point" and is usually lower than the melting point.

Current (electric).—The rate of transfer of electricity. The transfer at the rate of one electrostatic unit of electricity in one second is the electrostatic unit of current. The electromagnetic unit of current is a current of such strength that one centimeter of the wire in which it flows is pushed sideways with a force of one dyne when the wire is at right angles to a magnetic field of unit intensity. The practical unit of current is the **ampere**, a transfer of one coulomb per second, which is one tenth the electromagnetic unit. The **international ampere** is the unvarying electric current which, when passed through a solution of silver nitrate in accordance with certain specifications, deposits silver at the rate of 0.00111800 gram per second. The international ampere is equivalent to 0.999835 absolute ampere. The **ampere-turn** is the magnetic potential

DEFINITIONS AND FORMULAE (Continued)

produced between the two faces of a coil of one turn carrying one ampere. Dimensions,— $[e^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$.

Current in a simple circuit.—The current in a circuit including an external resistance R and a cell of electromotive force E and internal resistance r ,

$$I = \frac{E}{R + r}$$

If E is in volts and r and R in ohms the current will be in amperes.

For two cells in parallel,

$$I = \frac{E}{R + \frac{r}{2}}$$

For two cells in series,

$$I = \frac{2E}{R + 2r}$$

Dalton's law of partial pressures.—The pressure exerted by a mixture of gases is equal to the sum of the separate pressures which each gas would exert if it alone occupied the whole volume. This fact is expressed in the following formula:

$$PV = V(p_1 + p_2 + p_3, \text{ etc.})$$

Declination.—The angle between the vertical plane containing the direction of the earth's field at any point and a plane containing the geographic north and south meridian.

Decomposition is the chemical separation of a substance into two or more substances, which may differ from each other and from the original substances.

Definite proportions, law of.—In every sample of each compound substance the proportions by weight of the constituent elements are always the same.

Degree of freedom.—The number of the variables determining the state of a system (usually pressure, temperature, and concentrations of the components) to which arbitrary values can be assigned.

Density.—Concentration of matter, measured by the mass per unit volume. Dimensions,— $[m l^{-3}]$.

Dew point.—The temperature at which condensation of water vapor in the air takes place.

Diamagnetic bodies tend to set the longest dimension across the magnetic field. The permeability of a diamagnetic substance is less than unity.

Dielectric constant of a medium is defined by ϵ in the equation

$$F = \frac{QQ'}{\epsilon r^2}$$

DEFINITIONS AND FORMULAE (Continued)

where F is the force of attraction between two charges Q and Q' separated by a distance r in a uniform medium.

Dielectrics or insulators or non-conductors.—A class of bodies supporting an electric strain. A charge on one part of a non-conductor is not communicated to any other part.

Diffraction.—If the light source were a point, the shadow of any object would have its maximum sharpness; a certain amount of illumination, however, would be found within the geometrical shadow due to the diffraction of the light at the edge of the object.

Diffraction grating.—If s is the distance between the rulings, d the angle of diffraction, then the wave length where the angle of incidence is 90° is (for the n th order spectrum),

$$\lambda = \frac{s \sin d}{n}$$

If i is the angle of incidence, d the angle of diffraction, s the distance between the rulings, n the order of the spectrum, the

wave length is,
$$\lambda = \frac{s}{n} (\sin i + \sin d).$$

Diffusion.—If the concentration (mass of solid per unit volume of solution) at one surface of a layer of liquid is d_1 and at the other surface d_2 , the thickness of the layer h and the area under consideration A , then the mass of the substance which diffuses through the cross-section A in time t is,

$$m = \Delta A \frac{(d_2 - d_1)t}{h}$$

where Δ is the coefficient of diffusion.

Diffusivity or coefficient of diffusion is also given by Δ in the equation

$$\frac{dQ}{dt} = -\Delta \left(\frac{dc}{dx} \right) dy dz$$

where dQ is the amount passing through an area $dy dz$ in the direction of x in a time dt where dc/dx is the rate of increase of volume concentration in the direction of x . Dimensions,— $[l^2 t^{-1}]$.

Diffusivity of heat is given by Δ in the equation

$$\frac{dH}{dt} = -\Delta s d \frac{dT}{dx} dy dz$$

where dH is the quantity of heat passing through the area $dy dz$ in the direction of x in a time dt . The rate of variation of temperature along x is given by dT/dx , s is specific heat and d , density. Dimensions,— $[l^2 t^{-1}]$.

Dimensional formulae.—If mass, length, and time are considered fundamental quantities, the relation of other physical quantities and their units to these three may be expressed by a formula involving the symbols l , m and t respectively, with appropriate exponents. For example; the dimensional formula

DEFINITIONS AND FORMULAE (Continued)

for volume would be expressed,— $[l^3]$; velocity,— $[lt^{-1}]$; force— $[m\ l t^{-2}]$. Other fundamental quantities used in dimensional formulae may be indicated as follows: θ , temperature, ϵ the dielectric constant of a vacuum; μ , the magnetic permeability of a vacuum.

Diminution of pressure at the side of a moving stream.

If a fluid of density d moves with a velocity v , the diminution of pressure due to the motion is (neglecting viscosity),

$$p = \frac{1}{2} dv^2$$

Dip.—The angle measured in a vertical plane between the direction of the earth's magnetic field and the horizontal.

Dispersion.—The difference between the index of refraction of any substance for any two wave lengths is a measure of the dispersion for these wave lengths, called the coefficient of dispersion.

Dispersive power.—If n_1 and n_2 are the indices of refraction for wave lengths λ_1 and λ_2 and n the mean index or that for sodium light, the dispersive power for the specified wave length is,

$$\omega = \frac{n_2 - n_1}{n - 1}$$

Displacement is a reaction in which an elementary substance displaces and sets free a constituent element from a compound.

Displacement or elongation at any instant. The distance of a vibrating or oscillating particle from its position of equilibrium.

Distribution law.—A substance distributes itself between two immiscible solvents so that the ratio of its concentrations in the two solvents is approximately a constant (and equal to the ratio of the solubilities of the substance in each solvent). Requires modification if more than one molecular species is formed.

Doppler effect. (Light).—The apparent change in the wave-length of light produced by the motion in the line of sight of either the observer or the source of light.

Doppler's principle.—The apparent frequency of a sound as affected by motion of the hearer, the source and the medium is given by the following expression,

$$n = n_o \frac{V + w - v_o}{V + w - v_s}$$

where n_o is the original frequency of the source, V the velocity of sound, w that of the medium, v_o that of the observer and v_s that of the source. Only the components of motion parallel to the line connecting the source and observer are to be considered. All velocities are taken in the direction from the source to observer; if the motion is in the opposite direction the sign of the velocity substituted in the formula should be changed.

DEFINITIONS AND FORMULAE (Continued)

Double decomposition consists of a simple exchange of the parts of two substances to form two new substances.

Dulong and Petite, law of.—The specific heats of the several elements are inversely proportional to their atomic weights. The atomic heats of solid elements are constant and approximately equal to 6.3. Certain elements of low atomic weight and high melting point have, however, much lower atomic heats at ordinary temperatures.

Eddy current.—A current induced in a mass of conducting material by a varying magnetic field. Also called *Foucault current*.

Edison effect.—The name first given (after its discoverer) to the phenomenon of electrical conduction between an incandescent filament and an independent cold electrode contained in the same envelope, when the second electrode is made positive with respect to the filament.

Elasticity.—The property by virtue of which a body resists and recovers from deformation produced by force.

Elastic limit.—The smallest value of the stress producing permanent alteration.

Elastic moduli.

Young's modulus by stretching.—If an elongation s is produced by the weight of the mass m , in a wire of length l , and radius r , the modulus,

$$M = \frac{mgl}{\pi r^2 s}$$

Young's modulus by bending, bar supported at both ends. If a flexure s is produced by the weight of mass m , added midway between the supports separated by a distance l , for a rectangular bar with vertical dimensions of cross-section a and horizontal dimension b , the modulus is,

$$M = \frac{mgl^3}{4sa^3b}$$

For a cylindrical bar of radius r ,

$$M = \frac{mgl^3}{12\pi r^4 s}$$

For a bar supported at one end. In the case of a rectangular bar as described above,

$$M = \frac{4mgl^3}{sa^3b}$$

For a round bar supported at one end,

$$M = \frac{4mgl^3}{3\pi r^4 s}$$

Modulus of rigidity.—If a couple C ($= mgx$) produces a twist of θ radians in a bar of length l and radius r , the modulus is

$$M = \frac{2Cl}{\pi r^4 \theta}$$

DEFINITIONS AND FORMULAE (Continued)

The substitution in the above formulae for the elastic coefficients of m in grams, g in cm per sec², l , a , b , and r in cm, s in cm, and C in dyne-cm will give moduli in dynes per cm². The dimensions of elastic moduli are the same as of stress,— $[m\ l^{-1}\ t^{-2}]$.

Coefficient of restitution.—Two bodies moving in the same straight line, with velocities v_1 and v_2 respectively, collide and after impact move with velocities v_3 and v_4 . The coefficient of restitution is

$$C = \frac{v_4 - v_3}{v_2 - v_1}$$

Electric field intensity is measured by the force exerted on unit charge. Unit field intensity is the field which exerts the force of one dyne on unit positive charge. Dimensions,— $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}]$.

The field intensity or force exerted on unit charge at a point distant r from a charge q in a vacuum

$$H = \frac{q}{r^2}$$

If the dielectric in the above cases is not a vacuum the dielectric constant ϵ must be introduced. The formula becomes

$$H = \frac{q}{\epsilon r^2}$$

The value of ϵ is frequently considered unity for air. If the dielectric constant of a vacuum is considered unity the value for air at 0°C and 760 mm pressure is 1.000576.

Electrolysis.—If a current i flows for a time t and deposits a metal whose electrochemical equivalent is e , the mass deposited is

$$m = eit$$

The value of e is usually given for mass in grams, i in amperes and t in seconds.

Electrochemical equivalent of an ion is the mass liberated by the passage of unit quantity of electricity.

Electromotive force is defined as that which causes a flow of current. The electromotive force of a cell is measured by the maximum difference of potential between its plates. The electromagnetic unit of potential difference is that against which one erg of work is done in the transfer of electromagnetic unit quantity. The **volt** is that potential difference against which one joule of work is done in the transfer of one coulomb. One volt is equivalent to 10^8 electromagnetic units of potential. The **international** volt is the electrical potential which when steadily applied to a conductor whose resistance is one international ohm will cause a current of one international ampere to flow. The international volt = 1.00033 absolute volts. The electromotive force of a Weston standard cell is 1.0183 int. volts at 20°C. Dimensions,— $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}]$.

DEFINITIONS AND FORMULAE (Continued)

Electrolytic dissociation or ionization theory.—When an acid, base or salt is dissolved in water or any other dissociating solvent, a part or all of the molecules of the dissolved substance are broken up into parts called ions, some of which are charged with positive electricity and are called cations, and an equivalent number of which are charged with negative electricity and are called anions.

Electrolytic solution tension theory (or the Helmholtz double layer theory).—When a metal, or any other substance capable of existing in solution as ions, is placed in water or any other dissociating solvent, a part of the metal or other substances passes into solution in the form of ions, thus leaving the remainder of the metal or substances charged with an equivalent amount of electricity of opposite sign from that carried by the ions. This establishes a difference in potential between the metal and the solvent in which it is immersed.

Electromotive series is a list of the metals arranged in the decreasing order of their tendencies to pass into ionic form by losing electrons.

Electron.—A very small negatively charged particle. Electrons appear to be uniform in mass and charge and to be one of the basic elements of which atoms are made. The charge of the electron is accepted as 4.80×10^{-10} absolute electrostatic unit.

Electron theory of matter.—An atom is believed to consist of a nucleus bearing a positive charge, different for each sort of atom, surrounded by electrons or negative charges equal in total charge to the positive charge of the nucleus. The nucleus may consist of a certain number of protons and neutrons. The electrons revolve as satellites around the nucleus.

The nucleus contains practically all of the mass of the atom, the number of protons and neutrons determining the atomic weight. The number and arrangement of satellite electrons determines the chemical properties of the atom.

Elements are substances which cannot be decomposed by the ordinary types of chemical change, or made by chemical union.

Emissive power or emissivity is measured by the energy radiated from unit area of a surface in unit time for unit difference of temperature between the surface in question and surrounding bodies. For the cgs system the emissive power is given in ergs per second per square centimeter with the radiating surface at 1° absolute and the surroundings at absolute zero. See *Radiation formula*.

Enantiotropic.—Crystal forms capable of existing in reversible equilibrium with each other.

Energy.—The capability of doing work. **Potential energy** is energy due to position of one body with respect to another or to the relative parts of the same body. **Kinetic energy**

DEFINITIONS AND FORMULAE (Continued)

is energy due to motion. Cgs units,—the erg, the energy expended when a force of one dyne acts through a distance of one centimeter; the joule is 1×10^7 ergs. Dimensions,— $[m l^2 t^{-2}]$.

The potential energy of a mass m , raised through a distance h , where g is the acceleration due to gravity is

$$E = mgh.$$

The kinetic energy of mass m , moving with a velocity v , is

$$E = \frac{1}{2}mv^2.$$

Energy will be given in ergs if m is in grams, g in cm per sec², h in cm and v in cm per sec.

Energy of a charge in ergs where Q is the charge and V the potential in electrostatic units.

$$E = \frac{1}{2}QV.$$

Energy of the electric field.—If H is the electric field intensity in electrostatic units and K the specific inductive capacity, the energy of the field in ergs per cm³ is

$$E = \frac{KH^2}{8\pi}$$

Energy of rotation.—If a mass whose moment of inertia about an axis is I , rotates with angular velocity ω about this axis, the kinetic energy of rotation will be,

$$E = \frac{1}{2}I\omega^2$$

Energy will be given in ergs if I is in g-cm² and ω in radians per sec.

Entropy.—A quantity depending on the quantity of heat in a body and on its temperature, which, when multiplied by any lower temperature (minimum available), gives the unavailable energy, or unavoidable waste when mechanical work is derived from the heat energy of the body. Dimensions,— $[m l^2 t^{-2} \theta^{-1}]$.

Equilibrium, chemical.—A state of affairs in which a chemical reaction and its reverse reaction are taking place at equal velocities, so that the concentrations of reacting substances remain constant.

Equilibrium constant.—The product of the concentrations (or activities) of the substances produced at equilibrium in a chemical reaction divided by the product of concentrations of the reacting substances, each concentration raised to that power which is the coefficient of the substance in the chemical equation.

Equivalent weight or combining weight of an element or ion is its atomic or formula weight divided by its valence. Elements entering into combination always do so in quantities proportional to their equivalent weights.

Ettinghausen's effect (Von Ettinghausen's).—When an electric current flows across the lines of force of a magnetic

DEFINITIONS AND FORMULAE (Continued)

field an electromotive force is observed which is at right angles to both the primary current and the magnetic field: a temperature gradient is observed which has the opposite direction to the Hall electromotive force.

Eutectic.—A term applied to the mixture of two or more substances which has the lowest melting point.

Expansion of gases.

Charles' law or Gay-Lussac's law.—The volume of a gas at constant pressure increases proportionately to the absolute temperature. If V_1 and V_2 are volumes of the same mass of gas at absolute temperatures, T_1 and T_2 ,

$$\frac{V_1}{V_2} = \frac{T}{T_2}$$

For an original volume V_o at 0°C the volume at $t^\circ\text{C}$ (at constant pressure) is

$$V_t = V_o(1 + 0.00367t).$$

General law for gases.

$$p_t v_t = p_o v_o \left(1 + \frac{t}{273}\right)$$

where p_o , v_o , p_t , v_t represent the pressure and value at 0° and $t^\circ\text{C}$.
or

$$\frac{p_1 v_1}{T_1} = \frac{p_2 v_2}{T_2}$$

where p_1 , v_1 and T_1 represent pressure volume and absolute temperature in one case and p_2 , v_2 and T_2 the same quantities for the same mass of gas in another.

The law may also be expressed:

$$pv = RmT$$

where m is the mass of gas at absolute temperature T . R is the **gas constant** which depends on the units used. **Boltzmann's molecular gas constant** is obtained by expressing m in terms of the number of molecules.

For volume in cm^3 , pressure in dynes per cm^2 and temperature in Centigrade degrees on the absolute scale $R = 8.3136 \times 10^7$.

Reduction of a gas volume to 0°C , 760 mm pressure.—

If V is the original volume of a gas at temperature t and pressure H , the volume at 0°C and 760 mm pressure will be,

$$V_o = \frac{V}{(1 + \alpha t)} \frac{H}{760}$$

if d is the original density the density at 0°C and 760 mm pressure will be

$$d_o = d(1 + \alpha t) \frac{760}{H}$$

$$\alpha = 0.00367 \text{ approximately.}$$

Falling bodies.—For bodies falling from rest conditions are as for uniformly accelerated motion except that $v_o = 0$ and

DEFINITIONS AND FORMULAE (Continued)

g is the acceleration due to gravity. The formulae become,—air resistance neglected,

$$v_t = gt, s = \frac{1}{2}gt^2, v_s = \sqrt{2gs}.$$

For bodies projected vertically upward,—if v is the velocity of projection, the time to reach greatest height, neglecting the resistance of the air,

$$t = \frac{v}{g}$$

Greatest height,

$$h = \frac{v^2}{2g}$$

See also under *Projectiles*.

Faraday's laws.—In the process of electrolytic changes equal quantities of electricity charge or discharge equivalent quantities of ions at each electrode.

One gram equivalent weight of matter is chemically altered at each electrode for 96,500 coulombs, or one faraday, of electricity passed through the electrolyte.

Faraday effect.—The rotation of the plane of polarization produced when plane-polarized light is passed through a substance in a magnetic field, the light traveling in a direction parallel to the lines of force. For a given substance, the rotation is proportional to the thickness traversed by the light and to the magnetic field strength.

Fermat's principle of least time.—The path chosen by a ray joining two points is that which can be travelled over in the least possible time.

Fleming's rule.—A simple rule for relating the directions of the flux, motion, and e.m.f. in an electric machine. The forefinger, second finger and thumb, placed at right-angles to each other, represent respectively the directions of flux, e.m.f., and motion or torque. If the right hand is used the conditions are those obtaining in a generator and if the left hand is used the conditions are those obtaining in a motor.

Fluidity.—The reciprocal of viscosity. The cgs unit is the rho, the reciprocal of the poise. Dimensions,— $[m^{-1} lt]$.

Force.—That which changes the state of rest or motion in matter, measured by the rate of change of momentum. Absolute unit,—the **dyne**, the force which will produce an acceleration of one centimeter per second per second in a gram mass. The gram weight or weight of a gram mass is the cgs gravitational unit. The poundal is that force which will give an acceleration of one foot per second to a pound mass. Dimensions,— $[m lt^{-2}]$.

The force F required to produce an acceleration a in a mass m is given by

$$F = ma.$$

DEFINITIONS AND FORMULAE (Continued)

If m is substituted in grams and a in cm per sec², F will be given in dynes.

Force between two charges, Coulomb's law.—If two charges q and q' are at a distance r in a vacuum, the force between them is,

$$F = \frac{qq'}{r^2}$$

The force will be given in dynes if q and q' are in electrostatic units and r in cm.

Force between two magnetic poles.—If two poles of strength m and m' are separated by a distance r in a medium whose permeability is μ (unity for a vacuum), the force between them is,

$$F = \frac{mm'}{\mu r^2}$$

Force will be given in dynes if r is in cm and m and m' are in cgs units of pole strength.

The strength of a magnetic field at a point distance r from an isolated pole of strength m is

$$H = \frac{m}{\mu r^2}$$

The field will be given in gauss if m and r are in cgs units.

Formula, chemical.—A combination of symbols with their subscripts representing the constituents of a substance and their proportions by weight.

Foucault's pendulum.—The rate of rotation in degrees per hour of a line on the surface of the earth relative to the plane of a Foucault's pendulum at latitude ϕ is,

$$\omega = 15 \sin \phi$$

Fraunhofer's lines.—When sunlight is examined through a spectroscope it is found that the spectrum is traversed by an enormous number of dark lines parallel to the length of the slit. These dark lines are known as Fraunhofer's lines. Kirchhoff conceived the idea that the sun is surrounded by layers of vapors which act as filters of the white light arising from incandescent solids within and which abstract those rays which correspond in their periods of vibration to those of the components of the vapors. Thus reversed or dark lines are obtained due to the absorption by the vapor envelop, in place of the bright lines found in the emission spectrum.

Frequency in uniform circular motion or in any periodic motion is the number of revolutions or cycles completed in unit time. Cgs units,—cycles per second. Dimension,— $[t^{-1}]$.

DEFINITIONS AND FORMULAE (Continued)

Frequency of vibrating strings.—The fundamental frequency of a stretched string is given by

$$n = \frac{1}{2l} \sqrt{\frac{T}{m}}$$

where l is the length; T , the tension and m the mass per unit length.

For a string or wire of circular section of length, l , tension T , density d , and radius r , the frequency of the fundamental is

$$n = \frac{1}{2rl} \sqrt{\frac{T}{\pi d}}$$

The frequency in vibrations per second will be given if T is in dynes, r and l in cm and d in g per cm³.

Friction, coefficient of.—The coefficient of friction between two surfaces is the ratio of the force required to move one over the other to the total force pressing the two together.

If F is the force required to move one surface over another and W , the force pressing the surfaces together, the coefficient of friction,

$$k = \frac{F}{W}$$

Fundamental units.—See under *Mass. Length and Time.*

Gamma (γ) rays.—Highly penetrating radiations from radioactive substances, undeflected by electric or magnetic fields, representing a high frequency electromagnetic radiation. They have the same nature as X-rays but are of higher frequency.

Gas.—A state of matter in which the molecules are practically unrestricted by cohesive forces. A gas has neither definite shape nor volume.

Gas thermometer.—Where P_o , P_s and P_x represent the total pressure with the bulb at 0°C, at the boiling-point of water and at the unknown temperature respectively, t_s the temperature of steam and t_x the unknown temperature,

$$t_x = t_s \frac{P_x - P_o}{P_s - P_o}$$

(approximately). The total pressure on the gas in the bulb is the algebraic sum of barometric pressure at the time and that measured by the manometer.

Gay-Lussac's law.—See *Charles' law.*

Gay-Lussac's law of combining volumes.—If gases interact and form a gaseous product, the volumes of the reacting gases and the volumes of the gaseous products are to each other in simple proportions, which can be expressed by small whole numbers.

Gibbs' phase rule.— $F = C + 2 - P$ F , the number of degrees of freedom of a system, is the number of variable

DEFINITIONS AND FORMULAE (Continued)

factors (temperature, pressure and concentration) of the components, which must be arbitrarily fixed in order that the condition of the system may be perfectly defined. C , the number of the components of the system, is chosen equal to the smallest number of independently variable constituents by means of which the composition of each phase participating in the state of equilibrium can be expressed in the form of a chemical equation; the components must be chosen from among the constituents which are present when the system is in a state of true equilibrium and which take part in that equilibrium; as components are chosen the smallest number of such constituents necessary to express the composition of each phase participating in the equilibrium, zero and negative quantities of components being permissible; in any system the number of components is definite, but may alter with changes in conditions of experiment; a qualitative but not quantitative freedom of selection of components is allowed, the choice being influenced by suitability and simplicity of application. P , the number of phases of the system, are the homogeneous, mechanically separable and physically distinct portions of a heterogeneous system, the number of phases capable of existence varies greatly in different systems; there can never be more than one gas or vapor phase since all gases are miscible in all proportions, a heterogeneous mixture of solid substances forms as many phases as there are substances present.

Graham's law.—The relative rates of diffusion of gases under the same conditions are inversely proportional to the square roots of the densities of those gases.

Gram atom or gram atomic weight.—The mass in grams numerically equal to the atomic weight.

Gram equivalent of a substance is the weight of a substance displacing or otherwise reacting with 1.008 grams of hydrogen or combining with one-half of a gram atomic weight (8.00 grams) of oxygen.

Gram mole, gram formula weight, gram equivalent.—Mass in grams numerically equal to the molecular weight, formula weight or chemical equivalent, respectively.

Gram molecular weight or gram molecule.—A mass in grams of a substance numerically equal to its molecular weight. Gram mole.

Gravitation.—The universal attraction existing between all material bodies. The force of attraction between two masses m and m' , separated by a distance r , k being the constant of gravitation,

$$F = k \frac{mm'}{r^2}$$

(If m and m' are given in grams, and r in centimeters, F will be in dynes if $k = 6.670 \times 10^{-8}$.)

DEFINITIONS AND FORMULAE (Continued)

Hall effect.—When a steady current is flowing in a steady magnetic field, electromotive forces are developed which are at right angles both to the magnetic force and to the current and are proportional to the product of the intensity of the current, the magnetic force and the sine of the angle between the directions of these quantities.

Hardness.—Property of substances determined by their ability to abrade or indent one another. An arbitrary scale of hardness is based upon ten selected minerals. For metals the diameter of the indentation made by a hardened steel sphere (Brinnell) or the height of rebound of a small drop hammer (Shore Scleroscope) serve to measure hardness.

Harmonic motion.—See *Simple harmonic motion and Angular harmonic motion*.

Heat effect.—The heat in calories developed in a circuit by an electric current of I amperes flowing through a resistance of R ohms, with a difference of potential E volts for a time t seconds.

$$H = \frac{RI^2t}{4.18} = \frac{Eit}{4.18}$$

Heat equivalent, or latent heat, of fusion.—The quantity of heat necessary to change one gram of solid to a liquid with no temperature change. Dimensions, $—[l^2 t^{-2}]$.

Heat quantity is measured by the change of temperature produced. The cgs unit of heat is the **calorie**, the quantity of heat necessary to change the temperature of one gram of water from 3.5°C to 4.5°C (called a small calorie). If the temperature change involved is from 14.5 to 15.5°C, the unit is the normal calorie. The mean calorie is $\frac{1}{100}$ the quantity of heat necessary to raise one gram of water from 0°C to 100°C. The large calorie is equal to 1000 small calories. The British thermal unit is the heat required to raise the temperature of one pound of water at its maximum density, 1°F. It is equal to about 252 calories. Dimensions of energy, $—[m l^2 t^{-2}]$.

Heat of combustion of a substance is the amount of heat evolved by the combustion of 1 gram molecular weight of the substance.

Henry's law.—The mass of a slightly soluble gas that dissolves in a definite mass of a liquid at a given temperature is very nearly directly proportional to the partial pressure of that gas. This holds for gases which do not unite chemically with the solvent.

Hess' law of constant heat summation.—The amount of heat generated by a chemical reaction is the same whether reaction takes place in one step or in several steps, or all chemical reactions which start with the same original substances and end with the same final substances liberate the same amounts of heat, irrespective of the process by which the final state is reached.

DEFINITIONS AND FORMULAE (Continued)

Hooke's law.—Within the elastic limit of any body the ratio of the stress to the strain produced is constant.

Humidity, absolute.—Mass of water vapor present in unit volume of the atmosphere, usually measured as grams per cubic meter. It may also be expressed in terms of the actual pressure of the water vapor present.

Huygens' theory of light.—This theory states that light is a disturbance traveling through some medium, such as the ether. Thus light is due to wave motion in ether.

Every vibrating point on the wave-front is regarded as the center of a new disturbance. These secondary disturbances traveling with equal velocity, are enveloped by a surface identical in its properties with the surface from which the secondary disturbances start and this surface forms the new wave-front.

Hydrogen equivalent of a substance is the number of replaceable hydrogen atoms in 1 molecule or the number of atoms of hydrogen with which 1 molecule could react.

Hydrogen ion concentration or pH value is the logarithm of the reciprocal of the gram ionic hydrogen equivalents per liter; i.e., $\text{pH} = \log \frac{1}{(\text{H}^+)}$ per liter. Water has a concentration of H^+ ion of 10^{-7} and of OH^- ion of 10^{-7} moles per liter or a pH value of 7. Due to hydrolysis the composition of a weak acid solution titrated against a strong base is basic and of a weak base against a strong acid is acid. A truly neutral titrated solution of a strong acid or base has the same concentration of H^+ and OH^- ions as water.

Hydrolysis is a double decomposition reaction involving the splitting of water into its ions and the formation of a weak acid or base or both.

Hydrostatic pressure at a distance h from the surface of a liquid of density d ,

$$P = h d g.$$

The total force on an area A due to hydrostatic pressure,

$$F = P A = A h d g.$$

Force in dynes and pressure in dynes per cm^2 will be given if h is in cm, d in g per cm^3 and g in cm per sec^2 .

Hysteresis.—The magnetization of a sample of iron or steel due to a magnetic field which is made to vary through a cycle of values, lags behind the field. This phenomenon is called hysteresis.

Steinmetz' equation for hysteresis gives the loss of energy in ergs per cycle per cm^3 ,

$$W = \eta B^{1.6}$$

where B is the maximum induction in maxwells per cm^2 and η the coefficient of hysteresis.

DEFINITIONS AND FORMULAE (Continued)

Illumination on any surface is measured by the luminous flux incident on unit area. The units in use are: the **lux**, one lumen per square meter; the **phot**, one lumen per square centimeter and the lumen per square foot. Since at unit distance from a point source of unit intensity the illumination is unity, unit illumination may be defined as that produced by a unit source at unit distance, hence the **meter-candle** or **candle-meter** which is equal to the lux and the **foot-candle** equivalent to one lumen per square foot.

Index of refraction for any substance is the ratio of the velocity of light in a vacuum to its velocity in the substance. It is also the ratio of the sine of the angle of incidence to the sine of the angle of refraction. In general, the index of refraction for any substance varies with the wave length of the refracted light.

Induced electromotive force in a circuit is proportional to the rate of change of magnetic flux through the circuit.

$$E = - \frac{d\phi}{dt}.$$

where $d\phi$ is the change of magnetic flux in a time dt . The induced current will be given by

$$I = \frac{d\phi}{Rdt}$$

where R is the resistance of the circuit.

Inertia.—The resistance offered by a body to a change of its state of rest or motion, a fundamental property of matter. Dimension,—[m].

Indicators are substances which change from one color to another when the hydrogen ion concentration reaches a certain value, different for each indicator.

Inductance.—The change in magnetic field due to the variation of a current in a conducting circuit causes an induced counter electromotive force in the circuit itself. This phenomenon is known as **self-induction**. If an electromotive force is induced in a neighboring circuit the term mutual induction is used. Inductance may thus be distinguished as self- or mutual and is measured by the electromotive force produced in a conductor by unit rate of variation of the current. Units of inductance are the centimeter (absolute electromagnetic) and the henry, which is equal to 10^9 centimeters of inductance. The **henry** is that inductance in which an induced electromotive force of one volt is produced when the inducing current is changed at the rate of one ampere per second. Dimensions,—[$\epsilon^{-1} l^{-1} t^2$]; [μl].

Induction.—Any change in the intensity or direction of a magnetic field causes an electromotive force in any conductor in the field. The induced electromotive force generates an induced current if the conductor forms a closed circuit.

DEFINITIONS AND FORMULAE (Continued)

Intensity of illumination in candle meters of a screen illuminated by a source of illuminating power P candles at a distance r meters, for normal incidence,

$$I = \frac{P}{r^2}$$

If two sources of illuminating power P_1 and P_2 produce equal illumination on a screen when at distances r_1 and r_2 respectively,

$$\frac{P_1}{r_1^2} = \frac{P_2}{r_2^2} \quad \text{or} \quad \frac{P_1}{P_2} = \frac{r_1^2}{r_2^2}$$

If I_o is the intensity of illumination when the screen is normal to the incident light, I the intensity when an angle θ

$$I = I_o \cos \theta$$

Intensity of magnetization is given by the quotient of the magnetic moment of a magnet by its volume. Unit intensity of magnetization is the intensity of a magnet which has unit magnetic moment per cubic centimeter. Dimensions,— $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{3}{2}}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$.

Intensity of radiation is the radiant energy emitted in a specified direction per unit time, per unit area of surface, per unit solid angle.

Intensity of sound depends upon the energy of the wave motion. The intensity is measured by the energy in ergs transmitted per second through one square centimeter of surface. The energy in ergs per cm^3 in a sound wave is given by

$$E = 2\pi^2 d n^2 a^2$$

where d is density in g per cm^3 , n is frequency in vib. per sec and a is amplitude in cm. The energy reaching the ear in unit time will also be proportional to the velocity of propagation.

Ion.—Acids, bases and salts (electrolytes) when dissolved in certain solvents are more or less dissociated into electrically charged units, or parts of the molecules, called ions.

Some electrolytes dissociate into ions when fused.

Ions carry charges of electricity, and in consequence have different properties from the uncharged radicals.

Positive ions are atoms or group of atoms which have lost valence electrons; negative ions are those to which additional electrons have been added.

Ionization potential.—The potential required to transfer an electron from its normal quantum level to infinity.

Isomerism.—Existence of molecules having the same number and kinds of atoms but in different configurations.

Isothermal.—When a gas passes through a series of pressure and volume variations without change of temperature the changes are called isothermal. A line on a pressure-volume diagram representing these changes is called an isothermal line.

Isotopes are elements occupying the same place in the periodic system, having the same nuclear charge, but differing

DEFINITIONS AND FORMULAE (Continued)

somewhat in atomic weight. Most of the ordinary inactive elements have been shown to consist of a mixture of isotopes.

Joule-Thomson effect.—The cooling which occurs when a highly compressed gas is allowed to expand in such a way that no external work is done is known as the Joule-Thomson effect. This cooling is inversely proportional to the square of the absolute temperature.

Kepler's laws.

I. The planets move about the sun in ellipses, at one focus of which the sun is situated.

II. The radius vector joining each planet with the sun describes equal areas in equal times.

III. The cubes of the mean distances of the planets from the sun are proportional to the squares of their times of revolution about the sun.

Kerr effect.—When plane polarized light is incident on the pole of an electromagnet, polished so as to act like a mirror, the plane of polarization of the reflected light is not the same when the magnet is "on" as when it is "off." It was found that the direction of rotation was opposite to that of the currents exciting the pole from which the light was reflected.

Kinetic theory, expression for pressure.

$$P = \frac{1}{3}Nmv^2$$

where N is the number of molecules in unit volume, m the mass of each molecule and v^2 the mean square of the velocity of the molecules.

Kinetic theory of gases.—1738.—Gases are considered to be made up of minute, perfectly elastic particles which are ceaselessly moving about with high velocities, colliding with each other and with the walls of the containing vessel. The pressure exerted by a gas is due to the combined effect of the impacts of the moving molecules upon the walls of the containing vessel, the magnitude of the pressure being dependent upon the kinetic energy of the molecules and their number.

Kirchhoff's laws.

I. The algebraic sum of the currents which meet at any point is zero.

II. In any closed circuit the algebraic sum of the products of the current and the resistance in each conductor in the circuit is equal to the electromotive force in the circuit.

Kirchhoff's laws of radiation.—The relation between the powers of emission and the powers of absorption for rays of the same wave-length is constant for all bodies at the same temperature. First, a substance when excited by some means or other possess a certain power of emission; it tends to emit definite rays, whose wave-lengths depend upon the nature of the substance and upon the temperature. Second, the substance exerts a definite absorptive power, which is a maximum for the rays it tends to emit. Third, at a given temperature the ratio between the emissive and the absorptive power

DEFINITIONS AND FORMULAE (Continued)

for a given wave-length is the same for all bodies, and is equal to the emissive power of a perfectly black body.

Kohlrausch's law.—When ionization is complete, the conductivity of an electrolyte is equal to the sum of the conductivities of the ions into which the substance dissociates.

Kundt's law.—On approaching an absorption band from the red side of the spectrum the refractive index is abnormally increased by the presence of the band, while the approach is from the blue side and the index is abnormally decreased.

Lambert's law of absorption.—Each layer of equal thickness absorbs an equal fraction of the light which traverses it.

Lambert's law of illumination.—The illumination of a surface on which the light falls normally from a point source is inversely proportional to the square of the distance of the surface from the source. If the normal to the surface makes an angle with the direction of the rays, the illumination is proportional to the cosine of that angle.

Latent heat of vaporization.—The quantity of heat necessary to change one gram of liquid to vapor without change of temperature, measured as calories per gram. Dimensions,— $[L^2 t^{-2}]$.

Lattice energy.—The energy required to separate the ions of a crystal to an infinite distance from each other.

LeChateller's principle.—If some stress is brought to bear upon a system in equilibrium, a change occurs, such that the equilibrium is displaced in a direction which tends to undo the effect of the stress.

Length, units of.—The centimeter, one of the three fundamental units of the cgs system, is one one-hundredth the length of the International Prototype Meter, at Paris, at zero degrees centigrade. The meter is 1,553,164.13 times the wave length of the red cadmium line in air, 760 mm pressure, 15°C. The standard in the British system is the yard, the prototype of which is kept by the British government. The United States standard yard is defined as $\frac{3600}{3937}$ meter.

Lenses.—For a single thin lens whose surfaces have radii of curvature r_1 and r_2 whose principal focus is F , the index of refraction n , and conjugate focal distances f_1 and f_2 ,

$$\frac{1}{\bar{F}} = \frac{1}{f_1} + \frac{1}{f_2} = (n - 1) \left(\frac{1}{r_1} + \frac{1}{r_2} \right)$$

For a thick lens, of thickness t ,

$$F = \frac{nr_1r_2}{(n - 1)[n(r_1 + r_2) - t(n - 1)]}$$

Combinations of lenses.—If f_1 and f_2 are the focal lengths of two thin lenses separated by a distance d the focal length of the system,

$$F = \frac{f_1 f_2}{f_1 + f_2 - d}$$

DEFINITIONS AND FORMULAE (Continued)

Lenz's law.—When an electromotive force is induced in a conductor by any change in the relation between the conductor and the magnetic field, the direction of the electromotive force is such as to produce a current whose magnetic field will oppose the change.

Line of force.—A term employed in the description of an electric or magnetic field. A line such that its direction at every point is the same as the direction of the force which would act on a small positive charge (or pole) placed at that point. A line of force is defined as starting from a positive charge (or pole) and ending on a negative charge (or pole).

The line (of force) is also used as a unit of magnetic flux, equivalent to the maxwell.

Lissajous figures.—The path described by a particle which is simultaneously displaced by two simple harmonic motions at right angles, when the periods of the two motions are in the ratio of two small whole numbers, shows a variety of characteristic curves called Lissajous figures.

Liquid.—A state of matter in which the molecules are relatively free to change their positions with respect to each other but restricted by cohesive forces so as to maintain a relatively fixed volume.

Loschmidt's number.—The number of molecules per unit volume of an ideal gas at 0°C and normal atmospheric pressure.

$$n_0 = 2.687 \times 10^{19} \text{ per cm}^3.$$

Luminous flux.—The total visible energy emitted by a source per unit time is called the total luminous flux from the source. The unit of flux, the **lumen**, is the flux emitted in unit solid angle (steradian) by a point source of one candle luminous intensity. A uniform point source of one candle intensity thus emits 4π lumens.

Luminous intensity or candle-power is the property of a source of emitting luminous flux and may be measured by the luminous flux emitted per unit solid angle. The accepted unit of luminous intensity is the **international candle**. The **hefner unit**, which is equivalent to 0.9 international candles, is the intensity of a lamp of specified design burning amyl acetate, called the Hefner lamp.

The mean horizontal candle-power is the average intensity measured in a horizontal plane passing through the source. The mean spherical candle-power is the average candle-power measured in all directions and is equal to the total luminous flux in lumens divided by 4π .

Magnetic field due to a current.—The intensity of the magnetic field in oersted at the center of a circular conductor of radius r in which a current I in absolute electromagnetic units is flowing,

$$H = \frac{2\pi I}{r}$$

DEFINITIONS AND FORMULAE (Continued)

If the circular coil has n turns the magnetic intensity at the center is,

$$H = \frac{2\pi nI}{r}$$

The magnetic field in a long solenoid of n turns per centimeter carrying a current I in absolute electromagnetic units

$$H = 4\pi nI$$

If I is given in amperes the above formulae become,—

$$H = \frac{2\pi I}{10r}, \quad H = \frac{2\pi nI}{10r}, \quad H = \frac{4\pi nI}{10}$$

Magnetic field due to a magnet.—At a point on the magnetic axis prolonged, at a distance r cm from the center of the magnet of length $2l$ whose poles are $+m$ and $-m$ and magnetic moment M , the field strength in oersted is,

$$H = \frac{4mlr}{(r^2 - l^2)^2}$$

If r is large compared with l ,

$$H = \frac{2M}{r^3}$$

At a point on a line bisecting the magnet at right angles, with corresponding symbols,

$$H = \frac{2ml}{(r^2 + l^2)^{\frac{3}{2}}}$$

For large value of r ,

$$H = \frac{M}{r^3}$$

Magnetic field intensity or magnetizing force.—Is measured by the force acting on unit pole. Unit field intensity, the oersted, is that field which exerts a force of one dyne on unit magnetic pole. The field intensity is also specified by the number of lines of force intersecting unit area normal to the field, equal numerically to the field strength in oersted. Magnetizing force is measured by the space rate of variation of magnetic potential and as such its unit may be the **gilbert per centimeter**. The gamma (γ) is equivalent to 0.00001 oersted. Dimensions,— $[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$.

Magnetic flux through any area perpendicular to a magnetic field is measured as the product of the area by the field strength. The units of magnetic flux, the **maxwell** is the flux through a square centimeter normal to a field of one gauss. The line is also a unit of flux. It is equivalent to the maxwell. Dimensions,— $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$.

Magnetic induction resulting when any substance is subjected to a magnetic field is measured as the magnetic flux per unit area taken perpendicular to the direction of the

DEFINITIONS AND FORMULAE (Continued)

flux. The unit is the maxwell per square centimeter or its equivalent, the gauss. Dimensions,— $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{3}{2}}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$.

If a substance of permeability μ is placed in a magnetic field H the magnetic induction in the substance,

$$B = \mu H.$$

If I is the magnetic moment for unit volume, or intensity of magnetization,

$$B = H + 4\pi I.$$

The susceptibility,

$$\kappa = \frac{I}{H}, \quad \mu = 1 + 4\pi\kappa.$$

Magnetic moment of a magnet is measured by the torque experienced when it is at right angles to a uniform field of unit intensity. The value of the magnetic moment is given by the product of the magnetic pole strength by the distance between the poles. Unit magnetic moment is that possessed by a magnet formed by two poles of opposite sign and of unit strength, one centimeter apart. Dimensions,— $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$; $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}}]$.

If the poles are separated by a distance which is great compared with the dimensions of the magnet, the magnetic moment of a magnet of length l whose poles have values of $+m$ and $-m$ is,

$$M = ml.$$

Magnetic permeability is a property of materials modifying the action of magnetic poles placed therein and modifying the magnetic induction resulting when the material is subjected to a magnetic field or magnetizing force. The permeability of a substance may be defined as the ratio of the magnetic induction in the substance to the magnetizing field to which it is subjected. The permeability of a vacuum is unity. Dimensions,— $[\epsilon^{-1} l^{-2} t^2]$; $[\mu]$.

Magnetic pole or quantity of magnetism.—Two unit quantities of magnetism concentrated at points unit distance apart in a vacuum repel each other with unit force. If the distance involved is one centimeter and the force one dyne, the quantity of magnetism at each point is one cgs unit of magnetism. Dimensions,— $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$.

Magnetic potential or magnetomotive force at a point is measured by the work required to bring unit positive pole from an infinite distance (zero potential) to the point. The unit is the *gilbert*, that magnetic potential against which an erg of work is done when unit magnetic pole is transferred. Dimensions,— $[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$.

Magnifying power of an optical instrument is the ratio of the angle subtended by the image of the object seen through the instrument to the angle subtended by the object when seen by the unaided eye. In the case of the microscope or simple magnifier the object as viewed by the unaided eye is supposed to be a distance of 25 cm (10 in.).

DEFINITIONS AND FORMULAE (Continued)

Mass.—Quantity of matter. **Units of mass**—the gram is $\frac{1}{1000}$ the quantity of matter in the International Prototype Kilogram; one of the three fundamental units of the cgs system. The British standard of mass is the pound, of which a standard is preserved by the government. The United States standard mass is the avoirdupois pound defined as $1/2.20462$ kilogram.

Mass action, law of.—At a constant temperature the product of the active masses on one side of a chemical equation when divided by the product of the active masses on the other side of the chemical equation is a constant, regardless of the amounts of each substance present at the beginning of the action.

Mass by weighing on a balance with unequal arms.—If W_1 is the value for one side, W_2 the value for the other, the true mass,

$$W = \sqrt{W_1 W_2}.$$

Maxwell's rule.—A law stating that every part of an electric circuit is acted upon by a force tending to move it in such a direction as to enclose the maximum amount of magnetic flux.

Mechanical equivalent of heat is the quantity of energy which, when transformed into heat, is equivalent to unit quantity of heat; 4.18×10^7 ergs = 1 calorie (20°C).

Metallic elements in general are distinguished from the non-metallic elements by their lustre, malleability, conductivity and usual ability to form positive ions. **Non-metallic elements** are not malleable, have low conductivity and never form positive ions.

Minimum deviation.—The deviation or change of direction of light passing through a prism is a minimum when the angle of incidence is equal to the angle of emergence. If D is the angle of minimum deviation and A the angle of the prism, the index of refraction of the prism for the wave length used is,

$$n = \frac{\sin \frac{1}{2}(A + D)}{\sin \frac{1}{2}A}$$

Mixtures consist of two or more substances intermingled with no constant percentage composition, and with each component retaining its essential original properties.

Modulus of elasticity.—The stress required to produce unit strain, which may be a change of length (Young's modulus); a twist or shear (modulus of rigidity or modulus of torsion) or a change of volume (bulk modulus), expressed in dynes per square centimeter. Dimensions,—the same as of stress, [$m \ l^{-1} \ t^{-2}$].

A **molal solution** contains one mole per 1000 grams of solvent.

A **molar solution** contains one mole or gram molecular weight of the solute in one liter of solution.

DEFINITIONS AND FORMULAE (Continued)

Mole.—A mass numerically equal to the molecular weight.

Molecule.—The smallest unit quantity of matter which can exist by itself and retain all the properties of the original substance.

Molecular volume.—Volume occupied by one mole. Numerically equal to the molecular weight divided by the density.

Molecular weight.—The sum of the atomic weights of all the atoms in a molecule.

Mol volume.—The volume occupied by a mol or a gram molecular weight of any gas measured at standard conditions is 22.414 liters.

Moment of force or torque.—The effectiveness of a force to produce rotation about an axis, measured by the product of the force and the perpendicular distance from the line of action of the force to the axis. Cgs unit—the dyne-centimeter. Dimensions,— $[m l^2 t^{-2}]$. If a force F acts to produce rotation about a center at a distance d from the line in which the force acts, the force has a torque,

$$L = Fd.$$

Moment of inertia.—A measure of the effectiveness of mass in rotation. In the rotation of a rigid body not only the body's mass, but the distribution of the mass about the axis of rotation determines the change in the angular velocity resulting from the action of a given torque for a given time. Moment of inertia in rotation is analogous to mass (inertia) in simple translation. The cgs unit is g-cm². Dimensions,— $[m l^2]$.

If m_1, m_2, m_3 , etc. represent the masses of infinitely small particles of a body; r_1, r_2, r_3 , etc. their respective distances from an axis of rotation, the moment of inertia about this axis will be

$$I = (m_1 r_1^2 + m_2 r_2^2 + m_3 r_3^2 + \dots)$$

or

$$I = \Sigma(mr^2)$$

Momentum.—Quantity of motion measured by the product of mass and velocity. Cgs unit—, one gram-centimeter per second. Dimensions,— $[m l t^{-1}]$.

A mass m moving with velocity v has a momentum,

$$M = mv.$$

If a mass m has its velocity changed from v_1 to v_2 by the action of a force F for a time t ,

$$mv_2 - mv_1 = Ft.$$

Monochromatic emissive power is the ratio of the energy of certain defined wave lengths radiated at definite temperatures to the energy of the same wave lengths radiated by a black body at the same temperature and under the same conditions.

DEFINITIONS AND FORMULAE (Continued)

Monotropic.—Crystal forms one of which is always metastable with respect to the other.

Mosley's law.—The frequencies of the characteristic X-rays of the elements show a strict linear relationship with the square of the atomic number.

Motion, laws of.—See *Newton's law of motion*.

Multiple proportions, law of.—If two elements form more than one compound, the weights of the first element which combine with a fixed weight of the second element are in the ratio of integers to each other.

Nernst effect.—When heat flows across the lines of magnetic force, there is observed an electromotive force in the mutually perpendicular direction.

Neutralization is a reaction in which the hydrogen ion of an acid and the hydroxyl ion of a base unite to form water, the other product being a salt.

Neutron.—An elementary particle with approximately the mass of a hydrogen atom but without any electric charge. The neutron is one of the constituents of the atomic nucleus.

Newton's law of cooling.—The rate of cooling of a body under given conditions is proportional to the temperature difference between the body and its surroundings.

Newton's law of motion.

I. Every body continues in its state of rest or of uniform motion in a straight line except in so far as it may be compelled to change that state by the action of some outside force.

II. Change of motion is proportional to force applied and takes place in the direction of the line of action of the force

III. To every action there is always an equal and opposite reaction.

Nodal points.—Two points on the axis of a lens such that a ray entering the lens in the direction of one, leaves as if from the other and parallel to the original direction.

A **normal salt** is an ionic compound containing neither replaceable hydrogen nor hydroxyl ions.

A **normal solution** contains one gram molecular weight of the dissolved substance divided by the hydrogen equivalent of the substance (that is, one gram equivalent) per liter of solution.

Nucleus.—The heavy central part of an atom in which most of the mass and the total positive electric charge is concentrated. The charge of the nucleus, an integral multiple (Z) of the electronic charge, is the essential factor which distinguishes one element from another. Z is called the atomic number.

Numerical aperture is the sine of half the angular aperture, used as a measure of the optical power of an objective.

Ohm's law.—Current in terms of electromotive force E and resistance R .

DEFINITIONS AND FORMULAE (Continued)

$$I = \frac{E}{R}.$$

The current is given in amperes when E is in volts and R in ohms.

Organ pipes.—The frequency of vibration of a closed pipe or other air column of length l , where V is the velocity of sound in air, for the fundamental and first three overtones respectively is,

$$n_0 = \frac{V}{4l}, \quad n_1 = \frac{3V}{4l}, \quad n_2 = \frac{5V}{4l}, \quad n_3 = \frac{7V}{4l}$$

For an open pipe,

$$n_0 = \frac{V}{2l}, \quad n_1 = \frac{2V}{2l}, \quad n_2 = \frac{3V}{2l}, \quad n_3 = \frac{4V}{2l}$$

Oxidation is any process which increases the proportion of oxygen or acid-forming element or radical in a compound.

Paramagnetic bodies are those which tend to set the longest dimension parallel to the magnetic field. The permeability of a paramagnetic substance is greater than unity.

Pascal's law.—Pressure exerted at any point upon a confined liquid is transmitted undiminished in all directions.

Peltier effect.—When a current flows across the junction of two unlike metals it gives rise to an absorption or liberation of heat. If the current flows in the same direction as the current at the hot junction in a thermoelectric circuit of the two metals, heat is absorbed; if it flows in the same direction as the current at the cold junction of the thermoelectric circuit heat is liberated.

Pendulum.—For a simple pendulum of length l , for a small amplitude, the complete period,

$$T = 2\pi \sqrt{\frac{l}{g}} \quad \text{or} \quad g = 4\pi^2 \frac{l}{T^2}$$

T will be given in seconds if l is in cm and g in cm per sec². For a sphere suspended by a wire of negligible mass where d is the distance from the knife edge to the center of the sphere whose radius is r , the length of the equivalent simple pendulum,

$$l = d + \frac{2r^2}{5d}$$

If the period is P for an arc θ , the time of vibration in an infinitely small arc is approximately

$$T = \frac{P}{1 + \frac{1}{4} \sin^2 \frac{\theta}{4}}$$

For a compound pendulum, if a body of mass m be suspended from a point about which its moment of inertia is I with its center of gravity a distance h below the point of suspension, the period

DEFINITIONS AND FORMULAE (Continued)

$$T = 2\pi \sqrt{\frac{I}{mgh}}$$

Period in uniform circular motion is the time of one complete revolution. In any oscillatory motion it is the time of a complete oscillation. Dimension,—[*t*]

Period of vibration of a magnet of magnetic moment *M* and moment of inertia *I* vibrating in a field of strength *H*,

$$T = 2\pi \sqrt{\frac{I}{MH}}$$

Periodic law.—Elements when arranged in the order of their atomic weights or atomic numbers show regular variations in most of their physical and chemical properties.

Permeance, the reciprocal of reluctance. Unit permeance is the permeance of a cylinder one square centimeter cross-section and one centimeter length taken in a vacuum. Dimensions,—[$\epsilon^{-1} l^{-1} t^2$]; [μl].

Phase of oscillatory motion.—The fraction of a whole period which has elapsed since the moving particle last passed through its middle position in a positive direction.

Photographic density.—The density *D* of silver deposit on a photographic plate or film is defined by the relation

$$D = \log O$$

where *O* is the opacity. If *I*_o and *I* are the incident and transmitted intensities respectively the opacity is given by *I*_o/*I*. The transparency is the reciprocal of the opacity or *I*/*I*_o.

Piezo-electric effect.—The phenomenon exhibited by certain crystals of expansion along one axis and contraction along another when subjected to an electric field. The converse effect, whereby mechanical strains produce opposite charges on different faces of the crystal, also obtains.

Pinch effect.—When an electric current, either direct or alternating, passes through a liquid conductor, that conductor tends to contract in cross-section, due to *electromagnetic* forces.

Pitch of sound is determined by the frequency or number of vibrations per second.

Planck's constant (*h*) when multiplied by the frequency of radiation ν , gives the quantity of energy ($= h\nu$) contained in one quantum.

Poisson's ratio is the ratio of the transverse contraction per unit dimension of a bar of uniform cross-section to its elongation per unit length, when subjected to a tensile stress.

Polarized light.—Light which exhibits different properties in different directions at right angles to the line of propagation is said to be polarized. Specific rotation is the power of liquids to rotate the plane of polarization. It is stated in terms of specific rotation or the rotation in degrees per decimeter per unit density.

DEFINITIONS AND FORMULAE (Continued)

Polymorphism.—The ability to exist in two or more crystalline forms.

Positron.—A particle with a mass equal to that of the electron but possessing a positive charge.

Potential (electric) at any point is measured by the work necessary to bring unit positive charge from an infinite distance. Difference of potential between two points is measured by the work necessary to carry unit positive charge from one to the other. If the work involved is one erg we have the electrostatic unit of potential. Dimensions, $—[e^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}]$.

The potential at a point due to a charge q at a distance r in a medium whose dielectric constant is ϵ is,

$$V = \frac{q}{\epsilon r}$$

Power.—The time rate at which work is done. Units of power,—the watt, one joule (ten million ergs) per second; the kilowatt is equal to 1000 watts; the horse-power, 33,000 foot-pounds per minute, is equal to 746 watts. Dimensions,— $[m l^2 t^{-3}]$.

If an amount of work W is done in time t the power or rate of doing work is

$$P = \frac{W}{t}$$

Power will be obtained in watts if W is expressed in joules (10^7 ergs) and t in sec.

Power in watts for alternating current,

$$P = EI \cos \phi$$

where E and I are the effective values of the electromotive force and current in volts and amperes respectively and ϕ the phase angle between the current and the impressed electromotive force.

The ratio,

$$\frac{P}{EI} = \cos \phi$$

is called the power factor.

Power developed by a direct current.—The power in watts developed by an electric current flowing in a conductor, where E is the difference of potential at its terminals in volts, R its resistance in ohms, and I the current in amperes,

$$P = EI = RI^2$$

The work done in joules in a time t sec is,

$$W = EIt; RI^2t.$$

Power ratios in telephone engineering are measured in **decibels**. The gain or loss of power expressed in decibels is ten times the logarithm of the power ratio. By reference to an arbitrarily chosen "power level" the actual power may be expressed in decibels. The numerical values thus used will

DEFINITIONS AND FORMULAE (Continued)

not be proportional to the actual power level but roughly to the sensation on the ear produced when the electrical power is converted into sound. A difference of 1 decibel in the power supply to a telephone receiver produces approximately the smallest change in volume of sound which a normal ear can detect.

Pressure.—Force applied to, or distributed, over a surface; measured as force per unit area. Cgs unit,—the barye, one dyne per square centimeter. The megabarye is equal to 10^6 dynes per square centimeter. Pressure is also measured by the height of the column of mercury or water which it supports. Dimensions,— $[m\ l^{-1}\ t^{-2}]$.

The pressure due to a force F distributed over an area A ,

$$P = \frac{F}{A}$$

Absolute pressure.—Pressure measured with respect to zero pressure. *Gauge pressure*—pressure measured with respect to that of the atmosphere.

Principal focus of a lens or spherical mirror is the point of convergence of light coming from a source at an infinite distance.

Projectiles.—For bodies projected with velocity v at an angle a above the horizontal, the time to highest point of flight,

$$t = \frac{v \sin a}{g}$$

Total time of flight to reach the original horizontal plane,

$$T = \frac{2v \sin a}{g}$$

Maximum height,

$$h = \frac{v^2 \sin^2 a}{2g}$$

Horizontal range,

$$R = \frac{v^2 \sin 2a}{g}$$

In the above equations the resistance of the air is neglected g is the acceleration due to gravity.

Proton.—An elementary particle having a positive charge equivalent to the negative charge of the electron but possessing a mass approximately 1845 times as great. The proton is in effect the positive nucleus of the hydrogen atom.

Purkinje effect.—A phenomenon associated with the human eye, making it more sensitive to blue light when the illumination is poor (less than about 0.1 lumen per sq. ft.) and to yellow light when the illumination is good.

Quality or timbre of a sound depends on the coexistence with the fundamental of other vibrations of various frequencies and amplitudes.

DEFINITIONS AND FORMULAE (Continued)

Quantity of electricity or charge.—The electrostatic unit of charge, the quantity which when concentrated at a point and placed at unit distance from an equal and similarly concentrated quantity, is repelled with unit force. If the distance is one centimeter and force of repulsion one dyne and the surrounding medium a vacuum, we have the electrostatic unit of quantity. The electrostatic unit of quantity may be defined as that transferred by electrostatic unit current in unit time. The quantity transferred by one ampere in one second is the coulomb, the practical unit. The faraday is the electrical charge carried by one gram equivalent. The coulomb = 3×10^9 electrostatic units. Dimensions,—

$$[e^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-1}]; [\mu^{-2} m^{\frac{1}{2}} l^{\frac{3}{2}}].$$

Radiation.—If I_o is the intensity of normal radiation and I the intensity at an angle

$$I = I_o \cos \theta$$

This is called Lambert's law. It does not apply in all cases.

Radiation formula, Planck's.—The emissive power of a black body at wave length λ may be written

$$E_\lambda = \frac{c_1 \lambda^{-5}}{e^{c_2/\lambda T} - 1}$$

where c_1 and c_2 are constants with numerical values 3.7403×10^8 microwatts per cm^2 per 0.01μ zone of spectrum and 14384 micron degrees, respectively and T the absolute temperature.

Radioactive substances continuously undergo a process of atomic disintegration in which energy is liberated. One or more radiations known as α -rays, β -rays or γ -rays are spontaneously emitted.

Radius of curvature from spherometer readings.—If l is the mean length of the sides of the triangle formed by the points of the three legs, d the spherometer readings, the radius of curvature of the surface is

$$F = \frac{l^2}{6d} + \frac{d}{2}$$

Radius of gyration may be defined as the distance from the axis of rotation at which the total mass of a body might be concentrated without changing its moment of inertia. The product of total mass and the square of the radius of gyration will give (the) moment of inertia.

Rankine scale of temperature.—The absolute Fahrenheit scale.

Raoult's law.—Molar weights of non-volatile non-electrolytes when dissolved in a definite weight of a given solvent under the same conditions lower the solvent's freezing point, elevate its boiling point and reduce its vapor pressure equally for all such solutes.

DEFINITIONS AND FORMULAE (Continued)

Reduction is any process which increases the proportion of hydrogen or base-forming elements or radicals in a compound.

Reflection coefficient or reflectivity is the ratio of the light reflected from a surface to the total incident light. The coefficient may refer to diffuse or to specular reflection. In general it varies with the angle of incidence and with the wavelength of the light.

Reflection of light by a transparent medium in air. (Fresnel's formulæ).—If i is the angle of incidence, r the angle of refraction, n_1 the index of refraction for air (nearly equal to unity), n_2 index of refraction for a medium, then the ratio of the reflected light to the incident light is,

$$R = \frac{1}{2} \left(\frac{\sin^2 (i - r)}{\sin^2 (i + r)} + \frac{\tan^2 (i - r)}{\tan^2 (i + r)} \right)$$

If $i = 0$ (normal incidence), and $n_1 = 1$ (approximate for air),

$$R = \left(\frac{n_2 - 1}{n_2 + 1} \right)^2$$

Refraction.—See *Index of refraction; Snell's law.*

Refraction at a spherical surface.—If u be the distance of a point source, v the distance of the point image or the intersection of the refracted ray with the axis, n_1 and n_2 the indices of refraction of the first and second medium, and r the radius of curvature of the separating surface,

$$\frac{n_2}{v} + \frac{n_1}{u} = \frac{n_2 - n_1}{r}$$

If the first medium is air the equation becomes,

$$\frac{n}{v} + \frac{1}{u} = \frac{n - 1}{r}$$

Refractivity is given by $(n - 1)$ when n is the index of refraction; the **specific refractivity** is given by $\frac{n - 1}{d}$ where d is the density. **Molecular refractivity** is the product of specific refractivity by the molecular weight.

Relative humidity.—The ratio of the quantity of water vapor present in the atmosphere to the quantity which would saturate at the existing temperature. It is also the ratio of the pressure of water vapor present to the pressure of saturated water vapor at the same temperature.

Reluctance is that property of a magnetic circuit which determines the total magnetic flux in the circuit when a given magnetomotive force is applied. Unit, the reluctance of one centimeter length and one square centimeter cross-section of space taken in a vacuum. Dimensions,— $[el\ t^{-2}]$; $[\mu^{-1}\ l^{-1}]$.

Reluctivity or specific reluctance is the reciprocal of magnetic permeability. The reluctivity of empty space is taken as unity. Dimensions,— $[el^2\ t^{-2}]$; $[\mu^{-1}]$.

DEFINITIONS AND FORMULAE (Continued)

Replacement series.—The arrangement of the metals in order of the values of their oxidation potentials.

Resistance is a property of conductors depending on their dimensions, material and temperature which determines the current produced by a given difference of potential. The practical unit of resistance, the **ohm** is that resistance through which a difference of potential of one volt will produce a current of one ampere. The **international ohm** is the resistance offered to an unvarying current by a column of mercury at 0°C, 14.4521 grams in mass, of constant cross-sectional area and 106.300 centimeters in length, sometimes called the legal ohm. Dimensions,— $[\epsilon^{-1} l^{-1} t]$; $[\mu l t^{-1}]$.

Resistance of a conductor at 0°C, of length l , cross-section s and specific resistance ρ

$$R_o = \rho \frac{l}{s}$$

The resistivity may be expressed as ohm-cm when R is in ohms, l in cm and s in cm².

Resistance of a conductor at a temperature t whose resistance at 0°C is R_o and whose temperature resistance coefficient is α .

$$R_t = R_o(1 + \alpha t)$$

Resistance of conductors in series and parallel.—The total resistance of any number of resistances joined in series is the sum of the separate resistances. The total resistance of conductors in parallel whose separate resistances are $r_1, r_2, r_3 \dots r_n$ is given by the formula

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} \dots + \frac{1}{r_n}$$

Where R is the total resistance. For two terms this becomes.

$$R = \frac{r_1 r_2}{r_1 + r_2}$$

Resistivity or specific resistance, the reciprocal of conductivity, is measured by the resistance of a body of the substance of unit cross-section and of unit length at 0°C also called volume resistivity. The unit may be indicated as the ohm-centimeter. Dimensions,— $[\epsilon^{-1} t]$; $[\mu l^2 t^{-1}]$.

Mass resistivity is the longitudinal resistance per unit length of a uniform bar of the substance of such a sectional area that it contains one unit of mass per unit of length. Dimensions,— $[\epsilon^{-1} m l^{-2} t]$; $[\mu m l^{-1} t^{-1}]$.

Surface resistivity is the resistance of unit length and unit width of a surface.

Resolving power of a telescope or microscope is indicated by the minimum separation of two objects for which they appear distinct and separate when viewed through the instrument.

DEFINITIONS AND FORMULAE (Continued)

Restitution, coefficient of, for two bodies on impact.—The ratio of the difference in velocity, after impact to the difference before impact.

Reversible reactions are those in which the products of the reaction may in turn react upon each other to form the original reacting substances.

Rotatory power is the power of rotating the plane of polarized light, given in general by θ/l where θ is the total rotation which occurs in a distance l .

The **molecular or atomic rotatory power** is the product of the specific rotatory power by the molecular or atomic weight. Magnetic rotatory power is given by

$$\theta/e H \cos \alpha$$

where H the intensity of the magnetic field, and α the angle between the field and the direction of the light.

Rydberg formula.—A formula, similar to that of Balmer, for expressing the wave-numbers (ν) of the lines in a spectral series:

$$\nu = R \left[\frac{1}{(n+a)^2} - \frac{1}{(m+b)^2} \right]$$

where n and m are integers and $m > n$, a and b are constants for a particular series, and R is the *Rydberg constant*, 109677.8 cm^{-1} for hydrogen.

Salt.—Any substance which yields ions, other than hydrogen or hydroxyl ions. A salt is obtained by displacing the hydrogen of an acid by a metal.

Seebeck effect.—If a circuit consists of two metals, one junction hotter than the other, a current flows in the circuit. The direction of the flow depends on the metals and the temperature of the junctions.

Sensitiveness of a balance.—Assuming the three knife edges of a balance to lie on a straight line,—if M is the weight of the beam, h the distance of the center of gravity below the knife edge, L the length of the balance arms and m a small mass added to one pan, the deflection θ produced is given by

$$\tan \theta = \frac{mL}{Mh}.$$

Simple harmonic motion.—Periodic oscillatory motion in a straight line in which the restoring force is proportional to the displacement. If a point move uniformly in a circle, the motion of its projection on the diameter (or any straight line in the same plane) is simple harmonic motion.

If r is the radius of the reference circle, ω the angular velocity of the point in the circle, θ the angular displacement at the time t after the particle passes the mid-point of its path, the linear displacement,

$$x = r \sin \theta = r \sin \omega t.$$

DEFINITIONS AND FORMULAE (Continued)

The velocity at the same instant,

$$v = r\omega \cos \theta = \omega \sqrt{r^2 - x^2}$$

The acceleration,

$$a = -\omega^2 x.$$

The force for a mass m ,

$$F = m\omega^2 x = -\frac{4\pi^2 mx}{T^2}$$

The period,

$$T = 2\pi \sqrt{\frac{x}{a}}$$

In the above equations the cgs system calls for x and r in cm, v in cm per sec, a in cm per sec², T in sec, m in grams, F in dynes, θ in radians and ω in radians per sec.

Simple machine.—A contrivance for the transfer of energy and for increased convenience in the performance of work.

Mechanical advantage is the ratio of the resistance overcome to the force applied. Velocity ratio is the ratio of the distance through which force is applied to the distance through which resistance is overcome.

Efficiency is the ratio of the work done by a machine to the work done upon it.

If a force f applied to a machine through a distance S results in a force F exerted by the machine through a distance s , neglecting friction,

$$fS = Fs.$$

The theoretical mechanical advantage or velocity ratio in the above case is,

$$\frac{S}{s}.$$

Actually the force obtained from the machine will have a smaller value than will satisfy the equation above. If F' be the actual force obtained, the practical mechanical advantage

will be,

$$\frac{F'}{f}.$$

The efficiency of the machine,

$$E = \frac{F's}{fS}.$$

Snell's law of refraction.—If i is the angle of incidence, r the angle of refraction, v the velocity of light in the first medium, v' the velocity in the second medium, the index of refraction n ,

$$n = \frac{\sin i}{\sin r} = \frac{v}{v'}.$$

Solid.—A state of matter in which the relative motion of the molecules is restricted and they tend to retain a definite fixed position relative to each other, giving rise to crystal

DEFINITIONS AND FORMULAE (Continued)

structure A solid may be said to have a definite shape and volume.

Solid angle.—Measured by the ratio of the surface of the portion of a sphere enclosed by the conical surface forming the angle, to the square of the radius of the sphere. Unit of solid angle,—the steradian, the solid angle which encloses a surface on the sphere equivalent to the square of the radius. Dimensions,—unity.

Solubility of one liquid or solid in another is the mass of a substance contained in a solution which is in equilibrium with an excess of the substance. Under these conditions the solution is said to be saturated. Solubility of a gas is the ratio of concentration of gas in the solution to the concentration of gas above the solution.

Solute.—That constituent of a solution which is considered to be dissolved in the other, the solvent. The solvent is usually present in larger amount than the solute.

A **solution is saturated** if it contains at given temperature as much of a solute as it can retain in the presence of an excess of that solute.

A **true solution** is a mixture, liquid, solid or gaseous, in which the components are uniformly distributed throughout the mixture. The proportion of the constituents may be varied within certain limits.

Solubility product or precipitation value is the product of the concentrations of the ions of a substance in a saturated solution of the substance.

Solvent.—That constituent of a solution which is present in larger amount; or, the constituent which is liquid in the pure state, in the case of solutions of solids or gases in liquids.

Specific gravity.—The ratio of the mass of a body to the mass of an equal volume of water at 4°C or other specified temperature. Dimensions,—unity.

Specific heat of a substance is the ratio of its thermal capacity to that of water at 15°C. Dimensions,—unity.

If a quantity of heat H calories is necessary to raise the temperature of m grams of a substance from t_1 to t_2 °C, the specific heat, or more properly, thermal capacity of the substance,

$$s = \frac{H}{m(t_1 - t_2)}.$$

Specific heat by the method of mixtures.—Where a mass m_1 of the substance is heated to a temperature t_1 , then placed in a mass of water m_2 at a temperature t_2 contained in a calorimeter with stirrer (of same material) of mass m_3 , specific heat of the calorimeter c , t_3 the final temperature

$$m_1 s(t_1 - t_3) = (m_3 c + m_2)(t_3 - t_2).$$

DEFINITIONS AND FORMULAE (Continued)

Black's ice calorimeter.—If a body of mass m and temperature t melts a mass m' of ice, its temperature being reduced to 0°C , the specific heat of the substance is,

$$s = \frac{80.1m'}{mt}$$

Bunsen's ice calorimeter.—A body of mass m at temperature t causes a motion of the mercury column of l centimeters in a tube whose volume per unit length is v . The specific heat is

$$s = \frac{884lv}{mt}$$

Specific inductive capacity.—The ratio of the capacitance of a condenser with a given substance as dielectric to the capacitance of the same condenser with air or a vacuum as dielectric is called the specific inductive capacity. The ratio of the dielectric constant of a substance to that of a vacuum.

Specific rotation.—If there are n grams of active substance in v cubic centimeters of solution and the light passes through l centimeters, r being the observed rotation in degrees, the specific rotation (for 1 centimeter),

$$[\alpha] = \frac{rv}{nl}$$

Specific volume is the reciprocal of density. Dimensions,— $[m^{-1} l^3]$.

Spectral series are spectral lines or groups of lines which occur in an orderly sequence.

Speed.—Time rate of motion measured by the distance moved over in unit time. Cgs unit,—one centimeter per second. Dimension,— $[l t^{-1}]$.

Spherical aberration.—When large surfaces of spherical mirrors or lenses are used the light divergent from a point source is not exactly focused at a point. The phenomenon is known as spherical aberration. For axial pencils the error is known as axial spherical aberration; for oblique pencils, coma.

Spherical mirrors.—If R is the radius of curvature, F principal focus, and f_1 and f_2 any two conjugate focal distances,

$$\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{F} = \frac{2}{R}$$

If the linear dimensions of the object and image be O and I respectively and u and v their distances from the mirror,

$$\frac{O}{I} = \frac{u}{v}$$

Standard conditions for gases.—Measured volumes of gases are quite generally recalculated to 0° degrees C temperature and 760 mm pressure, which have been arbitrarily chosen as standard conditions.

DEFINITIONS AND FORMULAE (Continued)

Stark effect.—A change occurs in the number of spectral lines when the emission takes place in a strong electrical field. The phenomena are different for different lines and the observed effects depend upon the geometrical relation between the direction of emission and the direction of the electric field.

Stationary or standing waves are produced in a medium by the simultaneous transmission, in opposite directions of two similar wave motions. Fixed points of minimum amplitude are called **nodes**. A **segment** extends from one node to the next. An **antinode** or **loop** is the point of maximum amplitude between two nodes.

Stefan-Boltzman law of radiation.—The energy radiated in unit time by a black body is given by, $E = K(T^4 - T_o^4)$, where T is the absolute temperature of the body, T_o the absolute temperature of the surroundings, and K a constant.

Stoichiometric.—Pertaining to weight relations in chemical reactions.

Stoke's law gives the rate of fall of a small sphere in a viscous fluid. When a small sphere falls under the action of gravity through a viscous medium it ultimately acquires a constant velocity,

$$V = \frac{2ga^2(d_1 - d_2)}{9\eta}$$

where a is the radius of the sphere, d_1 and d_2 the densities of the sphere and the medium respectively, and η the coefficient of viscosity. V will be in cm per sec if g is in cm per sec², a in cm, d_1 and d_2 in g per cm³ and η in dyne-sec per cm² or poises.

Strain.—The deformation resulting from a stress measured by the ratio of the change to the total value of the dimension in which the change occurred. Dimensions,—unity.

Stress.—The force producing or tending to produce deformation in a body measured by the force applied per unit area. Cgs units,—one dyne per square centimeter. Dimensions,— $[m l^{-1} t^{-2}]$.

Surface density of electricity.—Quantity of electricity per unit area. Dimensions,— $[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{3}{2}}]$.

Surface density of magnetism.—Quantity of magnetism per unit area. Dimensions,— $[\epsilon^{-1} m^{\frac{1}{2}} l^{-\frac{3}{2}}]$, $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$.

Surface tension.—Two fluids in contact exhibit phenomena, due to molecular attractions which appear to arise from a tension in the surface of separation. It may be expressed as dynes per cm or as ergs per square centimeter. Dimensions,— $[m t^{-2}]$.

The total force along a line of length l on the surface of a liquid whose surface tension is T ,

$$F = lT.$$

Capillary tubes.—If a liquid of density d rises a height h in a tube of internal radius r the surface tension is,

DEFINITIONS AND FORMULAE (Continued)

$$T = \frac{rhdg}{2}$$

The tension will be in dynes per cm if r and h are in cm, d in g per cm³ and g in cm per sec².

Drops and bubbles.—Pressure in dynes per cm² due to surface tension on a drop of radius r cm for a liquid whose surface tension is T dynes per cm,

$$P = \frac{2T}{r}$$

For a bubble of mean radius r cm,

$$P = \frac{4T}{r}.$$

Susceptibility (magnetic) is measured by the ratio of the intensity of magnetization produced in a substance to the magnetizing force or intensity of field to which it is subjected. The susceptibility of a substance will be unity when unit intensity of magnetization is produced by a field of one gauss. Dimensions,—[$\epsilon^{-1} l^{-2} t^2$], [μ].

A **chemical symbol** is not only an abbreviation of the name but represents one atom and one gram atomic weight of that element.

Tangent galvanometer.—A tangent galvanometer with n turns, of radius r , in the earth's field H , has a deflection θ . The current flowing is,

$$i = \frac{Hr}{2\pi n} \tan \theta$$

If $\frac{2\pi n}{r} = G$ (the galvanometer constant)

$$i = \frac{H}{G} \tan \theta$$

Temperature may be defined as the condition of a body which determines the transfer of heat to or from other bodies. The customary unit of temperature is the **Centigrade** degree, $\frac{1}{100}$ the difference between the temperature of melting ice and that of water boiling under standard atmospheric pressure. The degree **Fahrenheit** is $\frac{1}{180}$, and the degree **Reaumur** $\frac{1}{80}$ the same difference of temperature.

The fundamental temperature scale is the absolute, thermodynamic or **Kelvin scale** in which the temperature measure is based on the average kinetic energy per molecule of a perfect gas. The zero of the Kelvin scale is -273.18°C . The temperature scale adopted by the International Bureau of Weights and Measures is that of the constant volume hydrogen gas thermometer. The magnitude of the degree in both these scales is defined as $\frac{1}{100}$ the difference between the temperature of melting ice and that of boiling water at 760 mm pressure.

DEFINITIONS AND FORMULAE (Continued)

Temperature resistance coefficient.—The ratio of the change of resistance in a wire due to a change of temperature of 1°C to its resistance at 0°C . Dimension,— $[\theta^{-1}]$.

Thermal capacity of a substance is the quantity of heat necessary to produce unit change of temperature in unit mass. It is ordinarily expressed as calories per gram per degree Centigrade. Numerically equivalent to specific heat.

Thermal capacity or water equivalent.—The total quantity of heat necessary to raise any body or system unit temperature, measured as calories per degree centigrade in the cgs system. Dimension,— $[m]$.

Thermal expansion.—The coefficient of linear expansion or expansivity is the ratio of the change in length per degree C to the length at 0°C . The coefficient of volume expansion (for solids) is approximately three times the linear coefficient. The coefficient of volume expansion for liquids is the ratio of the change in volume per degree to the volume at 0°C . The value of the coefficient varies with temperature. The coefficient of volume expansion for a gas under constant pressure is nearly the same for all gases and temperatures and is equal to 0.00367 for 1°C . Dimension,— $[\theta^{-1}]$.

If l_0 is the length at 0°C , α the coefficient of linear expansion, the length at $t_0^{\circ}\text{C}$ is,

$$l_t = l_0(1 + \alpha t).$$

General formula for thermal expansion.—The rate of thermal expansion varies with the temperature. The general equation giving the magnitude m_t (length or volume) at a temperature t , where m_0 is the magnitude at 0°C , is

$$m_t = m_0(1 + \alpha t + \beta t^2 + \gamma t^3 \dots)$$

where α , β , γ , etc. are empirically determined coefficients.

Volume expansion.—If V represents volume and β the coefficient of expansion,

$$V_t = V_0(1 + \beta t).$$

For solids,

$$\beta = 3\alpha \text{ (approximately).}$$

Thermodynamics, law of.

I. When mechanical work is transformed into heat or heat into work, the amount of work is always equivalent to the quantity of heat.

II. It is impossible by any continuous self-sustaining process for heat to be transferred from a colder to a hotter body.

Thermoelectric power is measured by the electromotive force produced by a thermocouple for unit difference of temperature between the two junctions. It varies with the average temperature and is usually expressed in microvolts per degree C. It is customary to list the thermoelectric power of the various metals with respect to lead. Dimensions,— $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1} \theta^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} t^{-1} \theta^{-1}]$.

DEFINITIONS AND FORMULAE (Continued)

Thomson thermoelectric effect is the designation of the potential gradient along a conductor which accompanies a temperature gradient. The magnitude and direction of the potential varies with the substance.

The coefficient of the Thomson effect or specific heat of electricity is expressed in joules per coulomb per degree Centigrade. Dimensions,— $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1} \theta^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2} \theta^{-1}]$.

Time, unit of.—The second, $\frac{1}{86400}$ of a mean solar day. One of the three fundamental units of the cgs system.

Torque produced by the action of one magnet on another.—The turning moment experienced by a magnet of pole strength m' and length $2l'$ placed at a distance r from another magnet of length $2l$ and pole strength m , where the center of the first magnet is on the axis (extended) of the second and the axis of the first is perpendicular to the axis of the second,

$$C = 8 \frac{mm' ll'}{r^3} = \frac{2MM'}{r^3}$$

If the first magnet is deflected through an angle θ , the expression becomes,

$$C = \frac{2MM'}{r^3} \cos \theta$$

Torsional vibration.—See *Angular harmonic motion*.

Total reflection.—When light passes from any medium to one in which the velocity is greater, refraction ceases and total reflection begins at a certain critical angle of incidence θ such that

$$\sin \theta = \frac{1}{n}$$

where n is the index of the first medium with respect to the second. If the second medium is air n has the ordinary value for the first medium. For any other second medium,

$$n = \frac{n_1}{n_2}$$

where n_1 and n_2 are the ordinary indices of refraction for the first and second medium respectively.

Tractive force of a magnet.—If a magnet with induction B has a pole face of area A the force, is,

$$F = \frac{B^2 A}{8\pi}$$

If B and A are in cgs units, F will be in dynes.

Triangle or polygon of forces.—If three or more forces acting on the same point are in equilibrium, the vectors representing them form, when added, a closed figure.

Uniform circular motion.—If r is the radius of a circle, v the linear speed in the arc, ω the angular velocity and T the

DEFINITIONS AND FORMULAE (Continued)

period or time of one revolution,

$$\omega = \frac{v}{r} = \frac{2\pi}{T}$$

The acceleration toward the center is

$$a = \frac{v^2}{r} = \omega^2 r = \frac{4\pi^2 r}{T^2}$$

The centrifugal force for a mass m ,

$$F = \frac{mv^2}{r} = m\omega^2 r = \frac{4\pi^2 mr}{T^2}$$

In the above equations ω will be in radians per second and a in cm per sec² if r is in cm, v in cm per sec and T in sec. F will be in dynes if mass is in grams and other units as above.

Application to the solar system.—If M is the mass of the sun, G the constant of gravitation, P the period of the planet and r the distance of the planet from the sun, then the mass of the sun

$$M = \frac{4\pi^2 r^3}{GP^2}, \quad (G = 6.670 \times 10^{-8} \text{ for cgs units}).$$

If P is the period and r the distance of a satellite revolving around the planet, the above expression for M gives the mass of the planet. The formula is written on the assumption that the orbit of the planet or satellite is circular, which is only approximately true.

Uniformly accelerated rectilinear motion.—If v_o is the initial velocity, v_t the velocity after time t , the acceleration,

$$a = \frac{v_t - v_o}{t}$$

The velocity after time t ,

$$v_t = v_o + at$$

Space passed over in time t ,

$$s = v_o t + \frac{1}{2}at^2$$

Velocity after passing over space s ,

$$v_s = \sqrt{v_o^2 + 2as}$$

Space passed over in the n th second

$$s = v_o + \frac{1}{2}a(2n - 1).$$

In the above and following similar equations the values of the space, velocity, and acceleration must be substituted in the same system. For space in *cm*, velocity will be in *cm* per sec and acceleration in *cm* per sec per sec.

Unit.—Specific magnitude of a quantity, set apart by appropriate definition, which is to serve as a basis of comparison or measurement for other quantities of the same nature.

Valence of an atom of an element is that property which is measured by the number of atoms of hydrogen (or its equiva-

DEFINITIONS AND FORMULAE (Continued)

lent) one atom of that element can hold in combination if negative, or can displace in a reaction if it is positive.

Valence electrons of the atom are electrons which are gained, lost or shared in chemical reactions.

Van't Hoff's principle.—If the temperature of interacting substances in equilibrium is raised, the equilibrium concentrations of the reaction are changed so that the products of that reaction which absorb heat are increased in quantity, or if the temperature for such an equilibrium is lowered, the products which evolve heat in their formation are increased in amounts.

Van der Waal's variation of Boyle's law.

$$(p + \frac{a}{v^2})(v - b) = RT$$

where p and v are the pressure and volume at any constant temperature and a and b are constants. R is the gas constant and T the absolute temperature. For values of R , a and b see tables.

Vectors, composition of.—If the angle between two vectors is A , and their magnitude a and b , their resultant,

$$C = \sqrt{a^2 + b^2 + 2ab \cos A}.$$

Velocity.—Time rate of motion in a fixed direction. Cgs units,—one centimeter per second. Dimensions,— $[l t^{-1}]$.

If s is space passed over in time t , the velocity,

$$v = \frac{s}{t}$$

Velocity of a compressional wave.—The velocity of a compressional wave in an elastic medium, in terms of elasticity E (bulk modulus) and density d ,

$$V = \sqrt{\frac{E}{d}}$$

For the velocity of sound in air, where p is the pressure and d the density,

$$V = \sqrt{\frac{1.4p}{d}}$$

Velocity of efflux of a liquid.—If h is the distance from the opening to the free surface of the liquid, the velocity of efflux is

$$V = \sqrt{2gh}$$

The above is the theoretical discharge velocity disregarding friction and the shape of orifice. For water issuing through a circular opening with sharp edges of area, A , the volume discharged per second is given approximately by,

$$Q = 0.62A\sqrt{2gh}$$

DEFINITIONS AND FORMULAE (Continued)

Velocity of sound, variation with temperature.—The velocity in meters per sec at any temperature t in $^{\circ}\text{C}$ is given approximately by

$$V = V_0 \sqrt{1 + \frac{t}{273}}$$

$$V = 331.5 + .607t$$

The **variation with humidity** is given by the equation

$$V_d = V_h \sqrt{1 - \frac{e}{p} \left(\frac{\gamma_w}{\gamma_a} - \frac{5}{8} \right)}$$

where V_d is the velocity in dry air, V_h that in air at barometric pressure p in which the pressure of water vapor is e . γ_w and γ_a are the specific heat ratios for water vapor and for air respectively.

Velocity of a transverse wave in a stretched cord. If T is the tension of the cord and m the mass per unit length,

$$V = \sqrt{\frac{T}{m}}$$

Velocity of water waves.—If the depth h is small compared with the wave length, the velocity,

$$V = \sqrt{gh}$$

In deep water for a wave length λ ,

$$V = \sqrt{\frac{g\lambda}{2\pi}}$$

If the wavelength is very small, less than about 1.6 cm, the velocity increases as the wave length decreases and is expressed by the following,

$$V = \sqrt{\frac{2\pi T}{\lambda d} + \frac{g\lambda}{2\pi}}$$

where T is the surface tension and d the density of the liquid. V will be given in cm per sec if h and λ are in cm, g in cm per sec², T in dynes per cm and d in g per cm³.

Velocity of a wave.—The velocity of propagation in terms of wavelength λ and the period T or frequency n is,

$$V = \frac{\lambda}{T} = n\lambda$$

Viscosity.—All fluids possess a definite resistance to change of form and many solids show a gradual yielding to forces tending to change their form. This property, a sort of internal friction, is called viscosity; it is expressed in dyne-seconds per cm² or poises. Dimensions,—[$m \, t^{-1} \, t^{-1}$]. If the tangential force per unit area, exerted by a layer of fluid upon one adjacent is one dyne for a space rate of variation of the tangential velocity of unity, the viscosity is one poise.

Kinematic viscosity is the ratio of viscosity to density.

DEFINITIONS AND FORMULAE (Continued)

Flow of liquids through a tube; where l is the length of the tube, r its radius, p the difference of pressure at the ends, η the coefficient of viscosity, the volume escaping per second,

$$v = \frac{\pi p r^4}{8 l \eta} \text{ (Poiseuille).}$$

The volume will be given in cm^3 per second if l and r are in cm, p in dynes per cm^2 and η in poises per dyne-seconds per cm^2 .

Visibility is measured by the ratio of the luminous flux in lumens to the total radiant energy in ergs per second or in watts.

Volume, unit of.—The cubic centimeter, the volume of a cube whose edges are one centimeter in length. Other units of volume are derived in a similar manner. Dimension,— $[l^3]$.

Wave motion.—A progressive disturbance propagated in a medium by the periodic vibration of the particles of the medium. Transverse wave motion is that in which the vibration of the particles is perpendicular to the direction of propagation. Longitudinal wave motion is that in which the vibration of the particles is parallel to the direction of propagation.

Weight.—The force with which a body is attracted toward the earth. Cgs unit,—the dyne. Dimensions,— $[m l t^{-2}]$.

Although the weight of a body varies with its location, the weights of various standards of mass are often used as units of force as,—pound weight, or pound force, gram weight, etc. The weight of mass m , where g is the acceleration due to gravity,

$$W = mg.$$

The weight will be given in dynes when m is in grams and g in cm per sec^2 .

Wien's displacement law.—When the temperature of a radiating black body increases, the wave length corresponding to maximum energy decreases in such a way that the product of the absolute temperature and wave length is constant.

$$\lambda_{max} T = w$$

w is known as **Wien's displacement constant**.

Wheatstone's bridge.—If the resistances r_1 , r_2 , r_3 , and r_4 form the arms of a Wheatstone's bridge in order as the circuit (omitting cell and galvanometer connections) is traced, when the bridge is balanced,

$$\frac{r_1}{r_2} = \frac{r_4}{r_3} \quad \text{or} \quad \frac{r_1}{r_4} = \frac{r_2}{r_3}$$

Work.—When a force acts against resistance to produce motion in a body the force is said to do work. Work is measured by the product of the force acting and the distance moved through against the resistance. Cgs units of work,—the erg, a force of one dyne acting through a distance of one centimeter. The joule is 1×10^7 ergs. Dimensions,— $[m l^2 t^{-2}]$. The foot-

DEFINITIONS AND FORMULAE (Continued)

pound is the work required to raise a mass of one pound a vertical distance of one foot where $g = 32.174 \text{ ft./sec}^2$. The foot-poundal is the work done by a force of one poundal acting through a distance of one foot. The International joule, a unit of electrical energy, is the work expended per second by a current of one International ampere flowing through one International ohm. The kilowatt-hour is the total amount of energy developed in one hour by a power of one kilowatt.

If a force F act through a space s , the work done is

$$W = Fs$$

Work will be given in ergs if F is in dynes and s in cm

Work done in rotation. If a torque L dyne-cm acts through an angle θ radians, the work done in ergs is

$$W = L\theta$$

Zeeman effect.—The splitting of a spectrum line into several symmetrically disposed components, which occurs when the source of light is placed in a strong magnetic field. The components are polarized, the directions of polarization and the appearance of the effect depending on the direction from which the source is viewed relative to the lines of force.

MEASURES AND UNITS

FUNDAMENTAL STANDARDS

The primary standard of **length** is defined as the distance between two lines at 0° C on a platinum-iridium bar known as the **International Prototype Meter** deposited at the International Bureau of Weights and Measures. The International Prototype Meter is 1553164.13 times the wave length of the red cadmium line in air, 760 mm pressure, 15° C.

The primary standard of **mass** is defined as the mass of the **International Prototype Kilogram** of platinum-iridium kept at the International Bureau of Weights and Measures at Sèvres. It is equal to the mass of 0.001000027 cubic meter of pure water at 4° C and 760 mm pressure.

The primary standard of **capacity** is the **liter** which is the volume of one kilogram of pure water at the temperature of maximum density and under normal atmospheric pressure.

The primary standard of **time** is the **mean solar second**, one eighty six thousand four hundredth ($\frac{1}{86400}$) part of a mean solar day.

The standard scale of **temperature** adopted by the International Committee of Weights and Measures 1887 is based on the variations in pressure of hydrogen at constant volume. The hydrogen is taken at an initial pressure, at the temperature of melting ice, of one meter of mercury (0° C, sea level, latitude 45°). The scale is defined by taking the temperature of melting ice as 0° and that of condensing steam under 760 mm pressure as 100°. This is known as the Centigrade (C) scale.

The **absolute** or **thermodynamic temperature scale** proposed by Lord Kelvin is based on the average kinetic energy per molecule of a perfect gas. The temperature of melting ice is 273.18° and that of the boiling point of water 373.18°. This is frequently referred to as the Kelvin (K) scale.

International Electrical Units

Adopted in the United States January 1, 1948

1 international ohm	= 1.000495 absolute ohms
1 international volt	= 1.00033 absolute volts
1 international ampere	= 0.999835 absolute ampere
1 international coulomb	= 0.999835 absolute coulomb
1 international henry	= 1.000495 absolute henries
1 international farad	= 0.999505 absolute farad
1 international watt	= 1.000165 absolute watts
1 international joule	= 1.000165 absolute joules

WEIGHTS AND MEASURES

Metric System

LENGTHS

Millimeters (mm)	Centimeters (cm)	Decimeters (dm)	Meters (m)	U. S. equivalent
1	0.1	0.01	0.001	0.0393700 inch
10	1	.1	.01	0.393700 inch
100	10	1	.1	{ 3.93700 inches
				{ 0.328083 foot
1.000	100	10	1	{ 39.3700 inches
				{ 3.28083 feet

Meters (m)	Dekameters (dkm)	Hectometers (hm)	Kilometers (km)	U. S. equivalent
1	0.1	0.01	0.001	{ 1.09361 yards
				{ 0.198838 rod
10	1	.1	.01	{ 10.9361 yards
				{ 1.98838 rods
100	10	1	.1	19.8838 rods
1,000	100	10	1	0.621372 mile

Millionth microns ($\mu\mu$)	Ång- ströms (Å)	Milli- microns ($m\mu$)	Microns (μ)	Centi- meters (cm)	U. S. equivalent inches
1	0.01	0.001	10^{-6}	10^{-10}	3.93700×10^{-11}
100	1	.1	10^{-4}	10^{-8}	3.93700×10^{-9}
1,000	10	1	10^{-3}	10^{-7}	3.93700×10^{-8}
10^6	10^4	1,000	1	10^{-4}	3.93700×10^{-5}

1 myriameter = 10,000 meters = 6.21372 miles.

AREA

Sq. milli- meters (mm^2)	Sq. centi- meters (cm^2)	Sq. deci- meters (dm^2)	Sq. meters or centares (m^2 , ca)	U. S. equivalent
1	0.01	0.0001	0.000001	0.00155000 sq. in.
100	1	.01	.0001	0.155000 sq. in.
10,000	100	1	.01	15.5000 sq. in.
1,000,000	10,000	100	1	10.76387 sq. ft.

WEIGHTS AND MEASURES (Continued)

Metric System (Continued)

AREA (Continued)

Sq. meters or centares (m ² , ca)	Sq. deka- meters or ares (dkm ² , a)	Sq. hecto- meters or hectares (hm ² , ha)	Sq. kilo- meters (km ²)	U. S. equivalent
1	0.01	0.0001	0.000001	0.039537 sq. rod
100	1	.01	.0001	0.02471044 acre
10,000	100	1	.01	2.471044 acres
1,000,000	10,000	100	1	0.3861006 sq. mile

VOLUME

Cu. millimeters (mm ³)	Cu. centimeters (cm ³ , cc)	Cu. decimeters (dm ³)	Cu. meters (m ³)	U. S. equivalent
1	0.001	0.000001	0.000000001	0.0000610234 cu. in.
1,000	1	.001	.000001	0.0610234 cu. in.
1,000,000	1,000	1	.001	61.0234 cu. in.
1,000,000,000	1,000,000	1,000	1	{ 35 3144 cu. ft. 1.30794 cu. yd.

1 stere = 1 cubic meter

CAPACITY

1 liter is the volume of pure water at 4° C and 760 mm pressure which weighs 1 kilogram. 1 liter = 1.000027 cubic decimeter = 1000.027 cubic centimeters.

Milliliters (ml)	Centiliters (cl)	Deciliters (dl)	Liters (l)	U. S. equivalent
1	0.1	0.01	0.001	{ 16.2311 minims 0.0610250 cu. inch
10	1	.1	.01	2.70518 fl. drams
100	10	1	.1	3.38147 fl. ounces
1,000	100	10	1	{ 270.518 fl. drams 33.8147 fl. ounces

Liters (l)	Dekaliters (dkl)	Hectoliters (hl)	Kiloliters (kl)	U. S. equivalent
1	0.1	0.01	0.001	{ 1.05671 liq. quarts 0.264178 gallon
10	1	.1	.01	1.81620 dry pints
100	10	1	.1	0.908102 dry quart
1,000	100	10	1	{ 18.1620 dry pints 9.08102 dry quart 1.13513 pecks 2.83782 bushels

WEIGHTS AND MEASURES (Continued)

Metric System (Continued)

MASS

Milligrams (mg)	Centigrams (cg)	Decigrams (dg)	Grams (g)	U. S. equivalent
1	0.1	0.01	0.001	0.015432356 grain
10	1	.1	.01	0.15432356 grain
100	10	1	.1	1.5432356 grains
				{ 15.432356 grains
1,000	100	10	1	{ 0.5643833 dram av.
				{ 0.03527396 ounce av.

Grams (g)	Deka-grams (dkg)	Hecto-grams (hg)	Kilo-grams (kg)	U. S. equivalent
1	0.1	0.01	0.001	{ 0.771618 scruple
				{ 0.2572059 dram apoth.
				{ 0.03215074 ounce apoth.
10	1	.1	.01	{ 0.002204622 pound av.
100	10	1	.1	{ 5.643833 drams av.
				{ 3.527396 ounces av.
1,000	100	10	1	{ 2.2046223 pounds av.
				{ 2.6792285 pounds troy or apoth.

1 kilogram = 15,432.35639 grains = 0.00110231 short ton = 0.00098421 long ton.

1 metric carat = 200 milligrams = 3.0864712 grains.

1 myriagram = 10,000 grams = 10 kilograms = 22.04622 pounds avoirdupois.

1 quintal (metric) = 100 kilograms = 220.4622 pounds avoirdupois.

1 millier or tonne = 1,000 kilograms = 2,204.622 pounds avoirdupois = 2,679.229 pounds troy = 0.98420640 long ton = 1 1023112 short tons.

PREFIXES

The prefixes mega-, meaning one million, and micro-, one millionth, are used in connection with various simple and derived units of the metric system.

WEIGHTS AND MEASURES (Continued)

U. S. System

Miscellaneous Units and Equivalents

LENGTHS

The United States standard yard is defined as $3600/3937^{th}$ s meter.

Inches (in.)	Feet (ft.)	Yards (yd.)	Rods (rd.)	Miles (mi.)	Metric equivalent
1	0.083333	0.027778	0.00505051	0.0000157828	2.54001 cm
12	1	.33333	.0606061	.000189394	0.304801 m
36	3	1	.181818	.000568182	0.914402 m
198	16.5	5.5	1	.003125	5.029210 m
63,360	5,280	1,760	320	1	1.60935 km

- 1 mil = 0.001 inch = 25.4001 microns = .0254001 millimeter.
- 1 hand = 4 inches = 10.1600 centimeters.
- 1 span = 9 inches = 22.86005 centimeters.
- 1 fathom (fath.) = 6 feet = 1.828804 meters.
- 1 link (li.) = 0.66 foot = 7.92 inches = 20.11684 centimeters.
- 1 rod (rd.) = 25 links = 5.029210 meters.
- 1 surveyor's or Gunter's chain (ch.) = 4 rods = 100 links = 66 feet = 20.11684 meters.
- 1 engineer's or Ramsden's chain = 100 links of one foot each = 100 feet = 30.4801 meters.
- 1 knot or nautical mile = 1.1516 statute miles = 6,080.27 feet = 1.85325 kilometers = 1' of arc on the Earth's surface at the equator.
- 1 British yard = 3 feet = 36 inches = 0.914399 meter.
- 1 British inch = 2.539998 centimeters.
- 1 British mile = 1,760 yards = 1.60934 kilometers.
- 1 furlong (fur.) = 40 rods = 220 yards = 660 feet = 201.168 meters.
- 1 pole (British) = 5.5 yards = 5.0292 meters = approximately 1 rod.
- 1 British fathom = 6.00 feet.
- 1 toise = 6 Paris feet = 1.94904 meters.
- 1 Paris foot (pied) = 12 Paris inches = 0.324839 meter.
- 1 Paris inch (pouce) = 12 Paris lines = 2.70700 centimeters.
- 1 Paris line (ligne) = 0.225583 centimeter.
- 1 light year = 5.9×10^{12} miles = 9.5×10^{12} kilometers.
- 1 point (type sizes) = $\frac{1}{72}$ or 0.01389 inch.
- 1 line = $\frac{1}{12}$ or 0.083333 inch.
- 1 cubit = 18 inches.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

AREA

Sq. inches (sq. in.)	Sq. feet (sq. ft.)	Sq. yards (sq. yd.)	Sq. rods (sq. rd.)	Acres (A.)	Sq. miles (sq. mi.)	Metric equivalent
1	0.0069444	.....	.....	.....	.....	6.451626 sq. cm
144	1	0.111111	.....	.....	.....	0.09290341 sq. m
1,296	9	1	0.03305785	.....	.....	0.8361307 sq. m
	272.25	30.25	1	0.00625	.....	25.29295 sq. m
	43,560	4,840	160	1	0.0015625	40.46873 sq. dkm
	27,878,400	3,097,600	102,400	640	1	2.589998 sq. km

1 square mil = .000001 square inch = .00064516 square millimeter.

1 circular mil = area of a circle whose diameter is one mil = .00000078540 square inch.

1 square link = 62.7264 square inches = 404.6873 square centimeters.

1 square rod (sq. rd.) = 625 square links = 25.29295 square meters.

1 square chain (sq. ch.) = 16 square rods = 404.6873 square meters.

1 acre (A.) = 10 square chains = 4,046.873 square meters.

1 British square yard = 9 square feet = 0.836126 square meter.

1 British square foot = 144 square inches = 9.29029 square decimeters.

1 British square inch = 6.45159 square centimeters.

1 square perch (British) = 30.25 square yards = 25.293 square meters.

1 rood (British) = 40 square perches = 10.117 ares or square dekameters.

1 acre (British) = 4 roods.

VOLUME

Cubic inches (cu. in.)	Cubic feet (cu. ft.)	Cubic yards (cu. yd.)	Metric equivalent
1	0.000578704	.....	16.3872 cu. cm
1,728	1	0.0370370	0.0283170 cu. m
46,656	27	1	0.764559 cu. m

1 board foot (bd. ft.) = 144 cubic inches = 2,359.8 cubic centimeters.

1 cord = 128 cubic feet = 3.625 cubic meters.

1 British cubic foot = 1,728 cubic inches = 0.0283168 cubic meter.

1 British cubic yard = 27 cubic feet = 0.764553 cubic meter.

1 cubic foot = 6.229 British gallons = 7.481 U. S. gallons.

1 cubic yard = 168.17 British gallons.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

CAPACITY—LIQUID MEASURE

Gills (gi.)	Pints (pt.)	Quarts (qt.)	Gallons (gal.)	Cubic inches	Metric equivalent
1	0.25	0.125	0.03125	7.21875	118.292 milliliters
4	1	.5	.125	28.875	0.473167 liter
8	2	1	.25	57.749	0.946333 liter
32	8	4	1	231	3.785332 liters

1 gill = 4 fluid ounces = 1.18292 deciliters.

1 gallon (U. S.) of water at 15° weighs about 8.337 pounds avoirdupois or 3.7820 kilograms = 0.83268 British gallon.

1 hogshead = 63 gallons.

1 firkin = 9 gallons = 34.06799 liters.

1 tun = 252 gallons.

1 British gill = 1.4206 deciliters.

1 British pint = 4 gills = 0.56825 liter.

1 British quart = 2 pints = 1.13650 liters.

1 British gallon = 4 quarts = 277.3 cubic inches = 0.16054 cubic foot = 4.5459631 liters.

1 British gallon of water at 15° C weighs 10 pounds = 1.20094 U. S. gallons.

APOTHECARIES' FLUID MEASURE

Minims (min. or m)	Fluid drams (fl. dr. or ʒ)	Fluid ounces (fl. oz. or ʒ)	Pints (pt.)	Metric equivalent
1	0.016667	0.0020833	.....	0.0616102 milliliter
60	1	.125	.....	3.69661 milliliters
480	8	1	0.0625	29.5729 milliliters
7,680	128	16	1	0.473167 liter

1 fluid ounce = 1.80469 cubic inches.

1 gallon = 128 fluid ounces = 8 pints.

1 British Imperial gallon = 8 pints = 160 fluid ounces = 4.5459631 liters.

1 British fluid ounce = 8 drachms = 28.4130 cubic centimeters.

1 British fluid drachm = 60 minims = 3.5515 cubic centimeters.

1 British minim = 0.059194 cubic centimeter.

DRY MEASURE

Pints (pt.)	Quarts (qt.)	Pecks (pk.)	Bushels (bu.)	Cubic inches	Metric equivalent
1	0.5	0.0625	0.015625	33.6003	0.550599 liter
2	1	.125	.03125	67.2006	1.101198 liters
16	8	1	.25	537.605	8.80958 liters
64	32	4	1	2,150.42	35.2383 liters

1 British peck = 2 British gallons = 554.6 cubic inches = 9.09193 liters.

1 British bushel = 8 British gallons = 2,219.3 cubic inches = 36.3677 liters = 1.03205 U. S. bushels.

1 British quarter = 8 bushels = 2.909 hectoliters.

1 U. S. bushel = 0.96895 British bushel.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

MASS

Note: Three systems are in use,—avoirdupois, troy and apothecaries'. The grain is the same in all.

AVOIRDUPOIS—COMMERCIAL

The U. S. Standard pound avoirdupois is defined as 453.5924277 grams.

Grains (gr.)	Drams (dr. av.)	Ounces (oz. av.)	Pounds (lb. av.)	Tons (short) (tn.)	Metric equivalent
1	0 03657143	.....	.....	.....	0.064798918 g
27.34375	1	0.0625	.....	.....	1.771845 g
437.5	16	1	0.0625	.....	28.349527 g
7,000	256	16	1	0.0005	{ 453.5924 g
.....	.....	32,000	2,000	1	{ 0.4535924 kg
					907.18486 kg

1 pound avoirdupois is the mass of 27.692 cubic inches of water weighed in air at 4° C, 760 mm pressure.

1 short hundredweight (cwt.) = 100 pounds = 45.359243 kilograms.

1 short ton = 20 short hundredweight = 2,430.56 troy pounds = 907.18486 kilograms.

1 stone (British) = 14 pounds = 6.350 kilograms.

1 quarter (British) = 28 pounds = 12.70 kilograms.

1 long hundredweight (British) = 4 quarters = 112 pounds = 50.802352 kilograms.

1 long ton (British) = 20 long hundredweight = 1,016.04704 kilograms.

1 long ton = 1.12000 short tons = 2,722.22 troy pounds = 1.01605 metric tons.

1 short ton = 0.892857 long ton = 29,166.66 troy or apothecaries' ounces = 0.907185 metric ton.

1 avoirdupois pound = 1.21528 troy or apothecaries' pounds = 14.5833 troy ounces.

1 avoirdupois ounce = 0.911458 troy or apothecaries' ounce

TROY WEIGHT

Grains (gr.)	Pennyweights (dwt.)	Ounces (oz. t.)	Pounds (lb. t.)	Metric equivalent
1	0.041667	0.0020833	.....	{ 64.798918 mg
24	1	.05	0.0041667	{ 0.064798918 g
480	20	1	.083333	1.555174 g
5,760	240	12	1	31.103481 g
				373.24177 g

1 troy pound = 5,760/7,000 or 0.822857 avoirdupois pound = 13.1657 avoirdupois ounces.

1 carat (1877) = 3.168 grains = 205.6 milligrams.

1 troy ounce = 1.09714 avoirdupois ounces.

1 troy pound = 0.00036735 long ton = 0.00041143 short ton = 0.00037324 metric ton.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

APOTHECARIES' WEIGHT

Grains (gr.)	Scruples (\mathfrak{z} or s. ap.)	Drams (\mathfrak{z} or dr. ap.)	Ounces (\mathfrak{z} or oz. ap.)	Pounds (lb. ap.)	Metric equivalent
1	0.05	0.016667	0.0020833		64.798918 mg
20	1	.33333	.041667	0.0034722	1.2959784 g
60	3	1	.125	.0104167	3.8879351 g
480	24	8	1	.083333	31.103481 g
5,760	288	96	12	1	373.24177 g

TIME

Seconds (sec.)	Minutes (min.)	Hours (hr.)	Days (da.)	Years (yr.)
1	0.0166667	0.000277778		
60	1	.0166667	0.000694446	
3,600	60	1	.0416667	
86,400	1,440	24	1	
.....	.....	.....	365.2422	1 (common)
.....	.....	.....	365.256	1 (sidereal)

1 lunar month (mo.) = 29 days 12 hours 44 minutes.

1 sidereal second = 0.997270 mean solar second.

ANGLE

Seconds ($''$)	Minutes ($'$)	Degrees ($^{\circ}$)	Circum- ference	Radians
1	0.0166667	0.000277778	0.00000771605	0.00000484814
60	1	.0166667	.0000462963	.000290888
3,600	60	1	.00277778	.0174533
1,296,000	21,600	360	1	6.28319
206,265	3,437.75	57.2958	0.159155	1

1 radian = $57^{\circ} 17' 44.8'' = 1/2\pi$ of a circumference.

2π radians = $360^{\circ} = 1$ circumference.

π radians = 180° .

$\pi/2$ radians = 90° .

$\pi/4$ radians = 45° .

1 grade = $\frac{1}{400}$ circumference = 100 centesimal minutes = 0.0157079 radian.

1 centesimal minute = $100''$ centesimal seconds.

SOLID ANGLE

1 steradian = $1/4\pi$ of the solid angle around a point.

UNITS AND CONVERSION FACTORS

Each unit named is followed by its equivalent in one or more other units of the same quantity. While the list of equivalents is incomplete it is intended to include all those which will be in common use

Symbols in the dimensional formulae given after the headings have the following significance: *m*, mass, *l*, length; *t*, time; *θ*, temperature; *ε*, dielectric constant of a vacuum; *μ*, permeability of a vacuum.

Mass, Length, Time, Angle, Area and Volume

Acre (A.) (U. S.).—0 0015625 square mile, 10 square chains (Gunter's), 160 square rods or square perches; 4840 square yards; 4.3560×10^4 square feet, 1×10^6 square links (Gunter's), 0.4046873 hectare or square hectometer, 40 46873 ares or square dekameters; 4046.873 square meters

Acre (A.) (British).—4 roods (British); 4840 square yards (British); 0.4046849 hectare or square hectometer, 4046 849 square meters

Ångström Unit (Å. or Å. U.).— $3\ 937 \times 10^{-9}$ inch; 0.003937 millionths of an inch; 1×10^{-10} meter, 1×10^{-8} centimeter, 1×10^{-4} micron (*μ*); 0.1 milli-micron or micro-millimeter; 100 millionth microns or micro-microns (*μμ*)

Are (a).— 3.8610×10^{-5} square mile, 0.02471044 acre (U. S.); 119.60 square yards; 1076.4 square feet, 0.01 hectare, 1 square dekameter, 100 square meters

Astronomical unit.— 1.495×10^8 kilometers

Bag (British).—3 bushels (dry), 0 109107 cubic meter

Barleycorn (British).— $1/3$ inch, 0.84667 centimeter

Barrel (bbl.) (U. S., dry).—3.281 bushels, 105.0 quarts (dry); 7056 cubic inches for dry commodities except cranberry barrel which=5826 cubic inches; 0 11562 cubic meter

Barrel (bbl.) (U. S., liquid).—31.5 gallons, 0 11924 cubic meter

Barrel (bbl.) (British, dry).—36 gallons (British), 0 16366 cubic meter

Board Foot (bd. ft.).— $1/12$ cubic foot, 144 cubic inches ($1\text{ foot} \times 1\text{ foot} \times 1\text{ inch}$); 2359.8 cubic centimeters

Bolt (U. S., cloth.).—120 linear feet; 36.576 meters.

Bucket (British, dry).—4 gallons (British); 1.8184×10^4 cubic centimeters.

UNITS AND CONVERSION FACTORS (Continued)

Bushel (bu.) (U. S., dry).—0.304785 barrel; 0.96895 bushel (British); 1.2444 cubic feet, 4 pecks, 32 quarts (dry); 64 pints (dry); 2150.42 cubic inches; 0.035239 cubic meter; 0.35238 hectoliter, 3.5238 dekaliters; 35.238 liters; 3.5239×10^4 cubic centimeters.

Bushel (bu.) (British, dry).— $\frac{1}{8}$ or 0.125 quarter (British, capacity); $\frac{1}{3}$ or 0.33333 bag (British); 1.03205 bushels (U. S.); 1.2843 cubic feet; 8 gallons (British); 2219.3 cubic inches; 0.363677 hectoliter, 3.63677 dekaliters; 36.3677 liters; 3.6369×10^4 cubic centimeters.

Butt (British, dry).—126 gallons; 0.57281 cubic meter.

Cable Length (British & U. S.).—720 feet; 219.46 meters.

Carat (c) (metric)—3.08647 grains; 0.2 gram; 200 milligrams

Carat (c) (1877).—3.168 grains, 205.6 milligrams.

Cental—100 pounds, 45.359 kilograms.

Centare (ca).—1.196 square yards, 10.764 square feet; 1550 square inches; 0.01 are, 1 square meter

Centigram (cg).—0.1543236 grain; 0.01 gram.

Centiliter (cl).—0.33815 ounce (fluid, U. S.); 0.61025 cubic inch; 2.705179 drams (fluid, U. S.); 0.01 liter; 10.00027 cubic centimeters.

Centimeter (cm).—0.01093611 yard (U. S.); 0.01093614 yard (British); 0.032808 foot (U. S. or British); 0.39370 inch (U. S. or British), 4.4330 lignes (Paris lines); 393.70 mils; 0.01 meter; 10 millimeters; 1×10^4 microns; 1×10^7 milli-microns or micro-millimeters; 1×10^8 Ångström units.

Chain (ch.) (Engineer's or Ramden's).—100 feet; 100 links of 1 foot each; 30.4801 meters

Chain (ch.) (Surveyor's or Gunter's).—0.1 furlong; 0.0125 mile, 4 rods; 22 yards; 66 feet, 100 links; 792 inches; 20.117 meters; 2011.7 centimeters

Chaldron (U. S., dry)—*36 bushels (U. S.); 1.2686 cubic meters

Chaldron (British, dry).—*32 bushels (British); 1.1638 cubic meters

Circle (cir)— 2π or 6.2832 radians, 12 signs; 360 degrees

Circular Inch.—Area of circle, diameter of which is one inch, 0.78540 square inch; 5.0671 square centimeters.

Circular Mil.—Area of circle, diameter of which is one mil

*Variable.

UNITS AND CONVERSION FACTORS (Continued)

or $1/1000$ inch; 7.854×10^{-7} square inch; 0.78540 square mil; 5.0671×10^{-6} square centimeter; 5.0671×10^{-4} square millimeter.

Circular Millimeter.—0.0078540 square centimeter; 0.78540 square millimeter.

Circumference.— 2π or 6.28319 radians; 360 degrees; 400 grades; 2.1600×10^4 minutes; 1.296000×10^6 seconds.

Clove or Customary Stone (British).—8 pounds; 3.6287 kilograms.

Coomb (British, dry).—4 bushels; 0.14548 cubic meter.

Cord (cd.).—8 cord feet; 128 cubic feet (8 feet \times 4 feet \times 4 feet); 3.625 cubic meters.

Cord-Foot (cd. ft.).— $\frac{1}{8}$ or 0.125 cord; 16 cubic feet (4 feet \times 4 feet \times 1 foot).

Cubic Centimeter (cm³).— 1.3079×10^{-6} cubic yard; 2.7496×10^{-5} bushel (British); 2.83776×10^{-5} bushel (U. S.); 3.531445×10^{-5} cubic foot (U. S.); 3.531477×10^{-5} cubic foot (British); 2.1997×10^{-4} gallon (British); 2.6417×10^{-4} gallon (U. S.); 4.2376×10^{-4} board foot; 8.7988×10^{-4} quart (liquid, British); 9.0808×10^{-4} quart (dry, U. S.); 0.0010567 quart (liquid, U. S.); 0.0018162 pint (dry, U. S.); 0.0021134 pint (liquid, U. S.); 0.033814 ounce (fluid, U. S.); 0.035195 ounce (fluid, British); 0.061023 cubic inch; 0.27051 dram (fluid, U. S.); 0.28157 drachm (fluid, British); 16.231 minims (U. S.); 16.894 minims (British); 1×10^{-6} cubic meter; 9.9997×10^{-4} liter; 0.001 cubic decimeter; 0.99997 milliliter; 1000 cubic millimeters.

Cubic Decimeter (dm³).—0.0013079 cubic yard; 0.035314 cubic foot; 61.023 cubic inches; 0.001 cubic meter; 0.99997 liter; 1000 cubic centimeters.

Cubic Dekameter (dkm³).—1000 cubic meters.

Cubic Foot (ft.³ or cu. ft.) (U. S.).— $1/128$ or 0.0078125 cord. 0.01 register ton (British); $1/27$ or 0.037037 cubic yard; $1/16$ or 0.0625 cord-foot; 0.77861 bushel (British); 0.80357 bushel (U. S.); 6.229 gallons (British); 7.481 gallons (U. S.); 12 board feet; 25.714 quarts (dry, U. S.); 29.922 quarts (liquid, U. S.); 59.844 pints (liquid, U. S.); 1728 cubic inches; 0.02831701 cubic meter; 28.316 liters; 2.8317×10^4 cubic centimeters.

Cubic Foot (ft.³ or cu. ft.) (British).—0.02831677 cubic meter; 2.831677×10^4 cubic centimeters.

Cubic Inch (in.³ or cu. in.) (U. S.).— 2.143347×10^{-5} cubic yard; 4.65025×10^{-4} bushel (U. S.); 5.78704×10^{-4} cubic foot; 0.00186010 peck; 0.0043290 gallon (U. S.); $1/144$ or 0.006944 board foot; 0.014881 quart (dry, U. S.); 0.017316 quart (liquid, U. S.); 0.0297616 pint (dry); 0.5541 ounce (fluid); 4.4329 drams

UNITS AND CONVERSION FACTORS (Continued)

(fluid); 1.6387162×10^{-5} cubic meter; 0.0163868 liter; 1.63868 centiliters; 16.3868 milliliters; 16.387162 cubic centimeters; 1.6387162×10^4 cubic millimeters.

Cubic Inch (in.³ or cu. in.) (British).— 4.5081×10^{-4} bushel (British); 5.7870×10^{-4} cubic foot (British); 0.0018031 peck (British); 0.003606 gallon (British); 16.3870253 cubic centimeters.

Cubic Hectometer (hm³).— 1×10^6 cubic meters.

Cubic Kilometer (km³).— 1×10^9 cubic meters.

Cubic Meter (m³).—0.2759 cord; 1.3079428 cubic yards (U. S.); 1.307954 cubic yards (British); 28.3776 bushels (U. S.); 35.314445 cubic feet (U. S.); 35.31477 cubic feet (British); 264.173 gallons (U. S.); 1056.7 quarts (liquid); 2113.4 pints (liquid, U. S.); 6.1023×10^4 cubic inches; 1 stere; 999.973 liters; 1000 cubic decimeters; 1×10^6 cubic centimeters; 1×10^9 cubic millimeters.

Cubic Millimeter (mm³).— 6.1023×10^{-5} cubic inch; 0.01623 minim (U. S.); 0.01689 minim (British); 1×10^{-9} cubic meter; 0.001 cubic centimeter.

Cubic Yard (yd.³ or cu. yd.) (U. S.).—27 cubic feet; 168.17 gallons (British); 202.0 gallons (U. S.); 807.9 quarts (liquid, U. S.); 1616 pints (liquid, U. S.); 4.6656×10^4 cubic inches; 0.76455945 cubic meter; 764.54 liters; 7.6455945×10^5 cubic centimeters.

Cubic Yard (yd.³ or cu. yd.) (British).—27 cubic feet; 0.76455285 cubic meter.

Cubit.—18 inches; 45.72 centimeters.

Dalton.— $1/16$ the mass of an atom of oxygen; 1.650×10^{-24} gram.

Day (da) (tropical, mean solar).—24 hours (mean solar); 1440 minutes (mean solar); 8.6400×10^4 seconds (mean solar).

Day (da) (sidereal).— 8.6164×10^4 seconds (mean solar).

Decigram (dg.).—1.543236 grains; 0.1 gram.

Deciliter (dl).—0.176 pint (British); 3.38147 ounces (fluid, U. S.); 0.1 liter; 100.0027 cubic centimeters.

Decimeter (dm).—0.3280833 foot (U. S.); 0.3280843 foot (British); 3.93700 inches (U. S.); 3.937011 inches (British); 0.1 meter.

Decistere (ds).—0.1 stere or cubic meter.

Degree (°).— $1/360$ or 0.0027778 circumference or revolution; $1/90$ or 0.01111 quadrant; 0.017453 radian; 60 minutes; 3600 seconds.

Dekagram (dkg).—0.35273957 ounce (avoirdupois); 5.64383 drams (avoirdupois); 0.01 kilogram; 10 grams.

UNITS AND CONVERSION FACTORS (Continued)

Dekaliter (dkl).—0.27497 bushel (British); 0.28378 bushel (U. S.); 1.13513 pecks (U. S.); 9.08102 quarts (U. S., dry); 18.162 pints (dry, U. S.); 10 liters; 10.00027 cubic decimeters.

Dekameter (dkm).—1.98838 rods (U. S.); 10.93611 yards (U. S.); 10.93614 yards (British); 393.70 inches; 10 meters.

Dekastere (dks).—10 steres or cubic meters.

Drachm (fluid) (dr. fl. or $\bar{3}$ fl.) (British).— $\frac{1}{8}$ or 0.125 ounce (fluid, British); 60 minims; 3.5515 cubic centimeters.

Dram (apothecaries' or troy) (dr. ap. or t. or $\bar{3}$ ap. or t.)—(Same as British Drachm)—0.008571429 pound (avoirdupois); $\frac{1}{96}$ or 0.010416667 pound (apothecary or troy); $\frac{1}{8}$ or 0.12500 ounce (apothecary or troy); 0.1371429 ounce (avoirdupois); 2.194286 drams (avoirdupois); 2.5 pennyweights; 3 scruples; 60 grains; 3.8879351 grams.

Dram (avoirdupois) (dr. av. or $\bar{3}$ av.).— $\frac{1}{256}$ or 0.00390625 pound (avoirdupois); 0.0047471788 pound (apothecary or troy); 0.056966146 ounce (apothecary or troy); 0.0625 ounce (avoirdupois); 0.4557292 dram (apothecary or troy); 1.139323 pennyweights; 1.3671875 scruples; 27.34375 grains; 1.771845 grams; 1771.845 milligram.

Dram (fluid) (dr. fl. or $\bar{3}$ fl.) (U.S.).—0.00390625 quart (liquid, U. S.); 0.0078125 pint (liquid, U. S.); 0.03125 gill (U. S.); $\frac{1}{8}$ or 0.125 ounce (fluid); 0.225586 cubic inch; 60 minims; 3.6966 milliliters; 3.6967 cubic centimeters.

Ell.—45 inches; 114.30 centimeters.

Em, Pica (printing industry).— $\frac{1}{6}$ or 0.16667 inch; 0.42333 centimeter.

Fathom (fath.) (nautical).—6 feet, 1.828804 meter.

Firkin (fir.) (U. S.).—9 gallons (U. S.); 34.068 liters.

Firkin (fir.) (British).—9 gallons (British); 40.914 liters.

Fluid Ounce (fl. oz.)—See Ounce (Fluid).

Foot (ft.) (U. S.).— 1.6447×10^{-4} mile (nautical); 1.893939×10^{-4} mile (statute); 0.00151515 furlong; 0.0151515 chain (Gunter's); 0.0606061 rod; $\frac{1}{6}$ or 0.16667 fathom; $\frac{1}{3}$ or 0.33333 yard; 12 inches; 0.3048006 meter, 30.48006 centimeter; 473404 wave-lengths of red line of cadmium.

Foot (ft.) (British).—0.4 pace (British); 30.47997 centimeters.

Foot (Paris).—(See Pied).

Furlong (fur.) (U. S. or British).— $\frac{1}{8}$ or 0.125 mile (U. S.); 10 chains (Gunter's); 40 rods, 220 yards; 660 feet; 201.168 meters.

UNITS AND CONVERSION FACTORS (Continued)

Gallon (gal.) (U.S.).—1 U. S. gallon of water at 62°F weighs 3.7820 kilograms or 8.337 pounds (avoirdupois); 0.004951 cubic yard; 0.031746 barrel (liquid, U. S.); 0.13368 cubic foot; 0.83268 gallons (British); 4 quarts (liquid); 8 pints (liquid); 32 gills; 128 ounces (fluid); 231.00 cubic inches; 6.1440×10^4 minims; 0.0037854 cubic meter; 3.7853 liters; 3785.4 cubic centimeters.

Gallon (gal.) (British Imperial) (Canadian).—1 British gallon of water at 62°F has a mass of 10 pounds (avoirdupois); 0.02778 barrel (dry, British); $\frac{1}{8}$ or 0.125 bushel (dry, British); 0.16054 cubic foot; 0.5 peck (British); 1.20094 gallons (U. S.); 4 quarts (liquid, British); 8 pints (liquid, British); 32 gills (liquid, British); 160 ounces (fluid, British); 277.3 cubic inches; 4.54596 liters; 4546.1 cubic centimeters.

Geepound—See Slug.

Gill (gi.) (U. S.).— $\frac{1}{32}$ or 0.03125 gallon (U. S.); $\frac{1}{8}$ or 0.125 quart (liquid, U. S.); $\frac{1}{4}$ or 0.25 pint (liquid, U. S.); 4 ounces (fluid); 7.21875 cubic inches; 32 drams (fluid); 1920 minims; 0.118292 liters; 118.295 cubic centimeters.

Gill (gi.) (British).— $\frac{1}{32}$ or 0.03125 gallon (British); $\frac{1}{4}$ or 0.25 pint (liquid, British); 5 ounces (fluid, British); 0.14206 liter; 142.07 cubic centimeters.

Grade— $\frac{1}{400}$ or 0.0025 circumference; 0.0157079 radian; 0.9 degree; 100 centesimal minutes.

Grain (gr.).— $\frac{1}{7000}$ or 1.42857×10^{-4} pound (avoirdupois); $\frac{1}{5760}$ or 1.736111×10^{-4} pound (apothecary or troy); 0.0020833 ounce (apothecary or troy); 0.0022857 ounce (avoirdupois); 0.016667 dram (apothecary or troy); 0.03657143 dram (avoirdupois); 0.0416667 pennyweight (troy); 0.05000 scruple (apothecary); 0.064798918 gram; 0.3240 carat (metric); 64.798918 milligram.

Gram (g).—0.00220462 pound (avoirdupois); 0.00267923 pound (apothecary or troy); 0.0321507 ounce (apothecary or troy); 0.0352739 ounce (avoirdupois); 0.257206 dram (apothecary or troy); 0.564383 dram (avoirdupois); 0.6430149 pennyweight; 0.771618 scruple; 15.4324 grains; 1×10^{-6} ton (metric); 1×10^{-4} myriagram; 0.001 kilogram; 5 carats (metric); 1000 milligrams; 1×10^6 microgram.

Hand.—4 inches; 10.160 centimeters.

Hectare (ha).—2.471044 acres (U. S.); 2.471058 acres (British); 395.367 square rods (U. S.); 1.125985×10^4 square yards (U. S.); 1.0764×10^5 square feet; 100 ares; 1×10^4 square meters.

Hectogram (hg).—3.52739 ounces (avoirdupois); 100 grams.

UNITS AND CONVERSION FACTORS (Continued)

Hectoliter (hl).—2.7497 bushels (British); 2.8378 bushels (U. S.); 11.3513 pecks (U. S.); 100 liters.

Hectometer (hm).—19.8838 rods; 109.3611 yards (U. S.); 109.3614 yards (British); 328.08 feet (U. S.); 100 meters.

Hemisphere.—0.5 sphere; 4 spherical right angles; 6.2832 steradians.

Hogshead (hhd.) (British).—63 gallons (British); 10.114 cubic feet; 0.28640 cubic meters.

Hogshead (hhd.) (U. S.).—63 gallons (U. S.); 8.4218 cubic feet; 0.23848 cubic meter.

Hour (hr.) (tropical, mean solar).—0.0059524 week; 0.041667 day (mean solar); 60 minutes (mean solar); 3600 seconds (mean solar).

Hundredweight (cwt.) (short).—100 pounds; 0.044643 ton (long); 0.05 ton (short); 4 quarters (British); 1600 ounces (avoirdupois); 0.0453592 ton (metric); 45.3592 kilograms.

Hundredweight (cwt.) (long).—112 pounds; 0.05 ton (long); 4 quarters (British); 50.8023 kilograms.

Inch (in.) (U. S.).— 1.57828×10^{-5} mile; 0.00126263 chain (Gunter's); 0.00505051 rod; $1/36$ or 0.027778 yard; $1/12$ or 0.08333 foot; 0.126263 link (Gunter's); 72 points (printer's type); 1000 mils; 2.540005 centimeter; 25.40005 millimeters; 2.5400×10^8 Ångström unit; 39450.33 wave lengths of red line of cadmium.

Inch (in.) (British).— $1/36$ or 0.027778 yard (British); $1/9$ or 0.1111 quarter (British, linear); 2.539998 centimeters; 25.39998 millimeter.

Inch (Paris).—See Pouce.

Kilderkin (British).—18 gallons (British); 0.081830 cubic meter.

Kilogram (kg).— 9.842064×10^{-4} ton (long); 0.0011023112 ton (short); 0.019684 hundredweight (long); 0.022046223 hundredweight (short); 0.07874 quarter (British); 2.2046223 pounds (avoirdupois); 2.6792285 pounds (apothecary or troy); 32.150742 ounces (apothecary or troy); 35.273957 ounces (avoirdupois); 257.21 dram (apothecary or troy); 564.38 dram (avoirdupois); 643.01 pennyweight; 771.62 scruples; 1.54324×10^4 grains; 0.001 ton (metric); 1000 grams.

Kiloliter (kl).—1.3080 cubic yards; 35.316 cubic feet; 264.18 gallons (liquid, U. S.); 1.000027 cubic meters; 1000 liters.

Kilometer (km).— 1.0567×10^{-13} light year; 0.53961 mile (nautical); 0.62137 mile (statute); 1093.6 yards; 3280.8 feet; 0.1 myriameter; 1000 meters; 1×10^5 centimeters.

UNITS AND CONVERSION FACTORS (Continued)

Knot as a unit of length.—1 nautical mile, which see. The knot is properly a unit of speed or velocity. See under that heading.

Last (British).—*80 bushels; 2.9095 cubic meters.

League (statute).—3 statute miles; 4.8280 kilometers.

League (nautical).—3 nautical miles; 5.5597 kilometers.

Light Year (yr.).— 5.9×10^{12} miles; 9.4637×10^{12} kilometers.

Ligne (Paris line).— $1/12$ or 0.083333 pouce or Paris inch; 0.225583 centimeter.

Line (British) (obsolete)— $1/12$ or 0.08333 inch; 0.21167 centimeters.

Link (li.) (Engineer's or Ramden's).—0.01 chain (Engineer's); 1 foot; 12 inches; 30.480 centimeter.

Link (li.) (Surveyor's or Gunter's).— 1.2500×10^{-4} mile 0.01 chain (Gunter's); 0.04 rod; 0.22 yards; 0.66 foot; 7.92 inches; 0.2011684 meter; 20.11684 centimeters.

Liter (l).—0.0013080 cubic yard; 0.027497 bushel (British); 0.028378 bushel (U. S.); 0.21998 gallon (British); 0.26417762 gallon (U. S.); 0.035316 cubic foot; 0.10999 peck (British); 0.11351 peck (U. S.); 0.87990 quart (British); 0.908102 quart (dry, U. S.); 1.056710 quarts (liquid, U. S.); 1.7598 pints (British); 1.8162 pints (dry, U. S.); 2.1134 pints (liquid, U. S.); 7.0392 gills (British); 8.4538 gills (U. S.); 33.8147 ounces (fluid, U. S.); 35.196 ounces (fluid, British); 61.025 cubic inches; 270.5179 drams (fluid, U. S.); 0.001000027 cubic meter; 1.000027 cubic decimeter; 1000.027 cubic centimeter.

Megameter.— 1×10^6 meter.

Meter (m).— 5.3961×10^{-4} mile (nautical); 6.2137×10^{-4} mile (statute); 0.00497096 furlong; 0.0497096 chain (Gunter's); 0.198838 rod (U. S.); 0.54681 fathom; 1.093611 yards (U. S.); 1.093614 yards (British); 3.0784 pied (French foot); 3.280833 feet (U. S.); 3.280843 feet (British); 4.970960 links (Gunter's); 39.3700 inches (U. S.); 39.3701 inches (British); 1×10^{-6} megameter; 0.001 kilometer; 100 centimeters; 1×10^9 milli-microns or micro-millimeters; 1×10^{10} Angstrom unit; 1×10^{12} millionth microns ($\mu\mu$) 1.55316413×10^6 wave-lengths of red line of cadmium.

Metric carat (c) See Carat (metric).

Metric Ton (t) See Tonne.

Microgram (μg or γ).— 1×10^{-6} gram; 0.001 milligram.

*Variable.

UNITS AND CONVERSION FACTORS (Continued)

Microliter (μl or λ).— 1×10^{-6} liter.

Micromicron ($\mu\mu$).— 1×10^{-12} meter.

Micron (μ).— 3.937×10^{-5} inch; 0.039370 mil; 39.37 millionths of an inch; 1×10^{-6} meter; 1×10^{-4} centimeter; 0.001 millimeter; 1000 milli-microns or micro-millimeters; 1×10^4 Ångström units.

Mil.—0.001 inch; 0.00254001 centimeter; 0.0254001 millimeter; 25.4001 microns.

Mile (mi.) (U. S., statute).— 1.69×10^{13} light year; 0.86836 mile (nautical); 8 furlongs; 80 chains (Gunter's); 320 rods; 1760 yards; 5280 feet; 8000 links (Gunter's); 6.3360×10^4 inches; 0.160935 myriameters; 1.60935 kilometers; 1609.35 meters.

Mile (mi.) (British).—1.60934 kilometers.

Mile (mi.) (nautical).—The length of 1 minute of arc on the earth's surface at the equator; $1/3$ or 0.33333 league; 1.1516 miles (statute); 2026.8 yards; 6080.2 feet; 1.85325 kilometers.

Millier (t) See **Tonne**.

Milligram (mg).— 2.2046×10^{-6} pound (avoirdupois); 2.67923×10^{-6} pound (apothecary or troy); 3.215074×10^{-5} ounce (apothecary or troy); 3.52739×10^{-5} ounce (avoirdupois); 2.57206×10^{-4} dram (apothecary or troy); 5.64383×10^{-4} dram (avoirdupois); 6.43015×10^{-4} pennyweight; 7.71618×10^{-4} scruple; 0.01543236 grain; 1×10^{-6} kilogram; 0.001 gram; 0.005 carat (metric).

Milliliter (ml).—0.0084538 gill (U. S.); 0.0338147 ounce (fluid, U. S.); 0.035196 ounce (fluid, British); 0.061025 cubic inch; 0.2705179 dram (fluid, U. S.); 16.2311 minims (U. S.); 0.001 liter; 1.000027 cubic centimeter.

Millimeter (mm).—0.0393700 inch (U. S.); 0.0393701 inch (British); 39.37 mils; 0.001 meter; 0.1 centimeter; 1000 microns.

Milli-Micron or Micro-Millimeter ($m\mu$).— 1×10^{-9} meter; 1×10^{-7} centimeter; 0.001 micron; 10 Ångström units.

Millionth Micron or Micro-Micron ($\mu\mu$).— 1×10^{-12} meter; 1×10^{-10} centimeter; 0.01 Ångström units.

Minim (min. or m) (British).—0.059194 cubic centimeter.

Minim (min. or m) (fluid, U. S.).— $1/61440$ or 1.6276×10^{-5} gallon (U. S.); 1.3021×10^{-4} pint (liquid, U. S.); 5.2083×10^{-4} gill (U. S.); $1/480$ or 0.0020833 ounce (fluid, U. S.); $1/60$ or 0.016667 dram (fluid, U. S.); 0.061610 milliliter; 0.061612 cubic centimeter; 61.612 cubic millimeter.

Minute ($'$) (angle).— 1.8519×10^{-4} quadrant; 2.90888×10^{-4} radian; $1/60$ or 0.016667 degree; 60 seconds.

UNITS AND CONVERSION FACTORS (Continued)

Minute (min.) (time).— 9.9206×10^{-5} week; 6.94446×10^{-4} day; 0.016667 hour; 60 seconds.

Month (mo.) (mean calendar).—30.42 days; 730 hours; 4.3800×10^4 minutes; 2.628×10^6 seconds.

Month (mo.) (lunar).—29 days 12 hours 44 minutes.

Myriagram (Mg).—22.04622 pounds (avoirdupois); 10 kilograms; 1×10^4 grams.

Myriameter (Mm).—6.21372 miles; 10 kilometers; 1×10^4 meters.

Nail (British).—2.25 inch; 5.715 centimeters.

Noggin (British).— $1/32$ or 0.03125 gallon (liquid); 142.06 cubic centimeters.

Ounce (Fluid) (oz. fl. or $\overline{3}$ fl.) (U. S.).— $1/128$ or 0.0078125 gallon (U. S.); 0.03125 quart (liquid, U. S.); $1/16$ or 0.0625 pint (liquid); $1/4$ or 0.25 gill (U. S.); 1.80469 cubic inches; 8 drams (fluid); 480 minims; 0.0295729 liter; 0.295729 deciliter; 29.5729 milliliters; 29.5737 cubic centimeters.

Ounce (fluid) (oz. fl. or $\overline{3}$ fl.) (British).—0.006250 gallon (British); 8 drachms (fluid, British); 480 minims; 28.4130 cubic centimeters.

Ounce (avoirdupois) (oz. av. or $\overline{3}$ av.).— 2.790179×10^{-5} ton (long); 3.125×10^{-5} ton (short); 6.25×10^{-4} hundredweight (short); $1/16$ or 0.062500 pound (avoirdupois); 0.075954861 pound (apothecary or troy); 0.9114583 ounce (apothecary or troy); 7.29166 drams (apothecary or troy); 16 drams (avoirdupois); 18.22917 pennyweights; 21.875 scruples (apothecary); 437.5 grains; 2.83495×10^{-5} ton (metric); 28.349527 grams.

Ounce (apothecary or troy) (oz. ap. or t. or $\overline{3}$ ap. or t.).— 3.4285×10^{-5} ton (short); 0.06857143 pound (avoirdupois); 0.08333 pound (apothecary or troy); 1.09714 ounces (avoirdupois); 8 drams (apothecary or troy); 17.55428 drams (avoirdupois); 20 pennyweights (troy); 24 scruples; 480 grains; 31.103481 grams; 3.1103481×10^4 milligrams.

Pace.— $2\frac{1}{2}$ feet; 30 inches (British); 76.2 centimeters.

Palm (British).—3 inches; 7.62 centimeters.

Parsec.— 19×10^{12} miles; 3.084×10^{13} kilometers.

Peck (pk.) (U. S.).— $1/4$ or 0.25 bushel; 8 quarts; 16 pints; 537.605 cubic inches; 0.880958 dekaliter; 8.80958 liters.

Peck (pk.) (British).—2 gallons (British); 554.6 cubic inches; 9.0919 liters.

Pennyweight (dwt.) (troy).—0.003428571 pound (avoirdupois); 0.0041667 pound (apothecary or troy); $1/20$ or 0.05

UNITS AND CONVERSION FACTORS (Continued)

ounce (apothecary or troy); 0.0548571 ounce (avoirdupois); 0.8777143 dram (avoirdupois); 24 grains; 1.55517 grams; 1555.17 milligrams.

Perch (British & U. S.).—1 rod; 16.5 feet; 5.0292 meters.

Perch (masonry).—24.75 cubic feet.

Pied (French foot).— $1/6$ or 0.16667 toise (French); 12 Paris inches; 0.3248 meter.

Pint (pt.) (dry, U. S.).— $1/64$ or 0.015625 bushel; 0.0625 peck; 0.5 quart; 33.600 cubic inches; 0.550599 liter; 550.61 cubic centimeters.

Pint (pt.) (liquid, U. S.).— 6.1881×10^{-4} cubic yard; 0.016711 cubic foot; $1/8$ or 0.125 gallon (U. S.); 0.5 quart (U. S.); 0.83268 British pint; 4 gills (U. S.); 16 fluid ounces (U. S.); 28.875 cubic inches; 128 fluid drams; 7680 minims; 0.473167 liter; 473.167 milliliters; 473.179 cubic centimeters.

Pint (pt.) (liquid, British).— $1/8$ or 0.125 gallon (British); 0.5 quart (British); 1.20094 U. S. pints; 4 gills (British); 20 fluid ounces (British); 0.56825 liter; 568.25 milliliters; 568.26 cubic centimeters.

Point (printer's type).— $1/72$ or 0.01389 inch; 0.035278 centimeter.

Pole (British).—1 rod; 5.5 yards; 16.5 feet; 5.0292 meters.

Pottle (British).— $1/2$ gallon (liquid); 2.273 cubic decimeters.

Pouce (Paris inch).— $1/12$ or 0.083333 pied or Paris foot; 12 lignes or Paris lines; 2.70700 centimeters.

Pound (avoirdupois) (lb. av.) (U. S. or British).—Is the mass of 27.692 cubic inches of water weighed in air at 4°C , 760 mm pressure; 4.464286×10^{-4} ton (long); 5×10^{-4} ton (short); 0.0089286 hundredweight (long); 0.01 hundredweight (short); 1.2152778 pounds (apothecary or troy); 14.5833 ounces (apothecary or troy); 16 ounces (avoirdupois); 116.6667 drams (apothecary or troy); 256 drams (avoirdupois); 291.6667 pennyweights; 350.01 scruples; 7000 grains; 4.5359243×10^{-4} ton (metric); 0.4535924 kilogram; 453.5924 grams.

Pound (apothecary or troy) (lb. ap. or t.) (U. S. or British).— 3.6735×10^{-4} ton (long); 4.1143×10^{-4} ton (short); 0.822857 pound (avoirdupois); 12 ounces (apothecary or troy); 13.165714 ounces (avoirdupois); 96 drams (apothecary or troy); 210.6514 drams (avoirdupois); 240 pennyweights; 288 scruples; 5760 grains; 3.7324×10^{-4} ton (metric); 0.3732418 kilogram; 373.2418 grams.

Puncheon (British).—70 gallons (British); 84 wine gallons; 0.31823 cubic meter.

Quadrant.—1.57080 radians; 90 degrees; 5400 minutes.

UNITS AND CONVERSION FACTORS (Continued)

Quart (qt.) (U. S., dry).— $1/32$ or 0.03125 bushel; 0.038889 cubic foot; $1/8$ or 0.125 peck; 2 pints (dry); 67.2006 cubic inches; 1.10120 liters; 1101.23 cubic centimeters.

Quart (qt.) (U. S., liquid).—0.033421 cubic foot; $1/4$ or 0.25 gallon; 2 pints (liquid); 8 gills; 32 ounces (fluid); 57.749 cubic inches; 256.00 drams (fluid); 0.946333 liter; 946.358 cubic centimeters.

Quart (qt.) (British, liquid).— $1/4$ gallon (British); 2 pints (liquid, British); 1.13650 liters; 1136.52 cubic centimeters.

Quarter (U. S., mass).— $1/4$ short ton or 500 pounds; 226.795 kilograms.

Quarter (U. S., mass).— $1/4$ long ton or 560 pounds; 254.01 kilograms.

Quarter (British, capacity)—8 bushels; 2.909 hectoliters.

Quarter (British, linear).—1 span; $1/4$ yard; 9 inches; 22.860 centimeters.

Quarter (British, mass).— $1/4$ short hundredweight or 25 pounds; 11.340 kilograms.

Quarter (British, mass).— $1/4$ long hundredweight or 28 pounds; 12.70 kilograms.

Quartern (British, dry).— $1/2$ gallon; 2273.1 cubic centimeters.

Quartern (British, liquid).— $1/32$ gallon; 142.07 cubic centimeters.

Quintal (q) (metric).—1.96841 hundredweights (long); 220.46 pounds; 100 kilograms; 1×10^5 grams.

Quintal* (q) (U. S. or British).—100 or 112 pounds.

Quire.—25 sheets.

Radian.— $1/2\pi$ or 0.159155 circumference or revolution; 0.637 quadrant; 57.29578 degrees; $57^\circ 17' 44.8''$; 3437.75 minutes; 2.06265×10^5 seconds.

Ream.—500 sheets.

Register Ton (British).—100 cubic feet; 2.8317 cubic meters.

Revolution.—4 quadrants; 2π or 6.2832 radians; 360 degrees.

Rod (rd.) (surveyor's measure).—0.003125 mile; 0.025 furlong; 0.25 chain (Gunter's); 1 perch; 5.5 yards; 16.5 feet; 25 links; 198 inches; 5.029210 meters.

Rod (rd.) (British, volume).—1000 cubic feet; 28.317 cubic meters.

*Variable.

UNITS AND CONVERSION FACTORS (Continued)

Rood (British).— $\frac{1}{4}$ or 0.25 acre; 40 square perches; 1210 square yards; 10.117 ares or square dekameters.

Rope (British).—20 feet; 6.0960 meters.

Sack (British).—3 bushels; 0.10911 cubic meter.

Scruples (apothecary) (s. ap. or ℥).—0.002857143 pound (avoirdupois); 0.003472222 pound (apothecary or troy); 0.041667 ounce (apothecary or troy); 0.0457143 ounce (avoirdupois); $\frac{1}{3}$ or 0.33333 dram (apothecary or troy); 0.7314286 dram (avoirdupois); 0.833333 pennyweight; 20 grains; 1.2959784 grams; 1295.9784 milligrams.

Seam (British).—8 bushels; 0.29095 cubic meter.

Second (Angle) (").— 4.84814×10^{-6} radian; 2.7778×10^{-4} degree; 0.016667 minute.

Second (sec) (time, mean solar).— 1.1574×10^{-5} day (mean solar); 1.1606×10^{-5} day (sidereal); 2.7778×10^{-4} hour (mean solar); 0.016667 minute (mean solar); 1.00273791 seconds (sidereal).

Second (sec) (time, sidereal).—0.997270 second (mean solar).

Sign (s).—30 degrees.

Skein.—360 feet; 109.73 meters.

Slug.—1 geepound; 32.174 pounds; 14.594 kilograms.

Space, Entire (solid angle).— 4π or 12.5664 steradians.

Span.— $\frac{1}{8}$ fathom; 1 quarter (British, linear); 9 inches; 22.86005 centimeters.

Sphere (solid angle).—2 hemispheres; 4π or 12.5664 steradians.

Spherical Right Angle.— $\frac{1}{8}$ or 0.125 sphere; $\frac{1}{4}$ or 0.25 hemisphere; $\pi/2$ or 1.5708 steradians.

Square Centimeter (cm²).— 2.47104×10^{-7} square chain; 3.95367×10^{-6} square rod; 1.1960×10^{-4} square yard; 0.0010764 square foot; 0.00247104 square link; 0.15500 square inch; 1.5500×10^5 square mils; 1.9735×10^5 circular mils; 127.32 circular millimeters; 1×10^{-4} square meter; 0.01 square decimeter; 100 square millimeters.

Square Chain (sq. ch.) (Gunter's).— 1.5625×10^{-4} square mile; 16 square rods; 484 square yards; 4356 square feet; 1×10^4 square links; 6.27264×10^5 square inches; 404.6873 square meters.

Square Decimeter (dm²).—15.500 square inch; 0.01 square meter; 100 square centimeters.

UNITS AND CONVERSION FACTORS (Continued)

Square Degree.— 3.0462×10^{-4} steradian.

Square Dekameter (dkm²).—0.02471044 acre (U. S.); 119.60 square yards; 1 are; 100 square meters.

Square Foot (ft.² or sq. ft.) (U. S.).— 3.58701×10^{-8} square mile; 2.29568×10^{-5} acre; 2.29568×10^{-4} square chain; 0.00367309 square rod; 1/9 or 0.111111 square yard; 2.29568 square links; 144 square inches; 9.290341×10^{-4} are; 0.09290341 square meter; 929.0341 square centimeters.

Square Foot (ft.² or sq. ft.) (British).—0.09290289 square meter.

Square Hectometer (hm²).—2.471044 acres (U. S.); 2.471058 acres (British); 1×10^4 square meters.

Square Inch (in.² or sq. in.) (U. S.).— 1.59423×10^{-6} square chain; 1/144 or 0.0069444 square foot; 1/1296 or 0.000771605 square yard; 0.0159423 square link; 1×10^6 square mils; 1.27324×10^6 circular mils; 6.4516258×10^{-4} square meter; 6.4516258 square centimeters; 645.16258 square millimeters.

Square Inch (in.² or sq. in.) (British). 6.4515898 square centimeters.

Square Kilometer (km²).—0.3861006 square mile (U. S.); 247.1044 acres (U. S.); 247.1058 acres (British); 1.1960×10^6 square yards; 1.0764×10^7 square feet; 1×10^6 square meters.

Square Link (li.² or sq. li.) (Gunter's).— 1×10^{-5} acre; 1×10^{-4} square chain; 0.0016 square rod; 0.0484 square yard; 0.4356 square foot; 62.7264 square inches; 0.040469 square meter; 404.69 square centimeters.

Square Meter (m²).— 3.8610×10^{-7} square mile; 2.471044×10^{-4} acre (U. S.); 2.471058×10^{-4} acre (British); 0.00247104 square chain (Gunter's); 0.039537 square rod; 1.195985 square yards (U. S.); 1.195992 square yards (British); 10.76387 square feet (U. S.); 10.76390 square feet (British); 24.7104 square links (Gunter's); 1550.0 square inches; 1×10^{-6} square kilometer; 1×10^{-4} hectare or square hectometer; 0.01 are; 1 centare 1×10^4 square centimeters; 1×10^6 square millimeters.

Square Mil.— 1×10^{-6} square inch; 1.2732 circular mils; 6.4516×10^{-6} square centimeter; 6.4516×10^{-4} square millimeter.

Square Mile (mi.² or sq. mi.).—640 acres; 6400 square chains; 1.02400×10^5 square rods; 3.0976×10^6 square yards; 2.78784×10^7 square feet; 2.589998 square kilometers; 258.9998 hectares; 2.589998×10^6 square meters.

Square Millimeter (mm²).—0.0015500 square inch; 1550.0 square mils; 1973.5 circular mils; 1×10^{-6} square meter; 0.01 square centimeter; 1.2732 circular millimeters.

UNITS AND CONVERSION FACTORS (Continued)

Square Perch (British & U. S.).— $1/160$ or 0.00625 acre; 30.25 square yards; 25.293 square meters.

Square Pole (British).—30.25 square yards.

Square Rod (rd. ² or sq. rd.).— 9.765625×10^{-6} mile; 0.00625 acre; 0.0625 square chain (Gunter's); 30.25 square yards; 272.25 square feet; 625 square links (Gunter's); 3.9204×10^4 square inches; 0.002529² hectare or square hectometer; 25.293 square meters or centares.

Square Yard (yd. ² or sq. yd.) (U. S.).— 3.22831×10^{-7} square mile; 2.06612×10^{-4} acre; 0.00206612 square chain; 0.0330579 square rod or square perch; 9 square feet; 20.6612 square link; 1296 square inches; 8.36131×10^{-5} hectare; 0.0083613 square dekameter or are; 0.83613 square meter or centare; 8361.31 square centimeters.

Square Yard (yd. ² or sq. yd.) (British).— 2.0661×10^{-4} acre (British); 8.2645×10^{-4} rood (British); 0.836126 square meter.

Steradian.— $\frac{1}{4}\pi$ of the solid angle around a point; 0.07958 sphere; 0.15916 hemisphere; 0.6366 spherical right angle; 3282.8 square degrees.

Stere (s).—0.1 dekastere; 1 cubic meter; 10 decisteres; 999.973 liters.

Stone (British).—14 pounds (avoirdupois); 6.350 kilograms.

Strike (British).—2 bushels (dry); 0.072738 cubic meter.

Toise (French).—6 Paris feet; 1.9490365 meters (legal, 1799); 1.949090 meters (measured, 1887).

Ton (long) (tn. l.) (U. S. or British).—1.12000 tons (short); 22.400 hundredweights (short); 2240 pounds (avoirdupois); 2722.22 pounds (apothecary or troy); 3.5840×10^4 ounces (avoirdupois); 1.0160470 metric tons; 1016.0470 kilograms.

Ton (short) (tn. sh.) (U. S.).—0.89286 ton (long); 20 hundredweights (short); 2000 pounds (avoirdupois); 2430.56 pounds (apothecary or troy); 2.916666×10^4 ounces (apothecary or troy); 3.2000×10^4 ounces (avoirdupois); 0.907185 ton (metric); 907.185 kilograms.

Tonne (t) (metric ton, millier).—0.984206 ton (long); 1.10231 tons (short); 22.046223 hundredweights (short); 2204.62 pounds (avoirdupois); 2679.23 pounds (apothecary or troy); 3.527396×10^4 ounces (avoirdupois); 1000 kilograms; 1×10^6 grams.

Township (U. S.).—36 square miles; 2.3040×10^4 square yards; 93.240 square kilometers.

Tun.—252 gallons.

Week (wk.).—168 hours; 1.0080×10^4 minutes; 6.04800×10^5 seconds.

UNITS AND CONVERSION FACTORS (Continued)

Wey (British, capacity).—*40 bushels.

Wey (British, mass).—*252 pounds.

Yard (yd.) (U. S.).— 5.68182×10^{-4} mile; 0.00454545 furlong; 0.0454545 chain (Gunter's); 0.181818 rod; 3 feet; 4.54545 links (Gunter's); 36 inches; 3600/3937 or 0.91440183 meter; 91.440183 centimeters.

Yard (yd.) (British).—0.18182 pole (British); 4 quarters (British, linear); 0.9143992 meter (present legal equivalent of Imperial yard); 91.43992 centimeters; 1.420212×10^6 wave lengths of red line of cadmium.

Year (yr.) (leap).—366 days; 8784 hours.

Year (yr.) (tropical, mean^ssolar).—365.2422 day (mean solar); 8765.8128 hours (mean solar); 3.15569×10^7 seconds (mean solar).

Year (yr.) (sidereal).—365.256 days (mean solar); 8766.144 hours (mean solar).

*Variable.

RECIPROCAL UNITS

x per Ångström = $1 \times 10^8 x$ per centimeter.

x per circular mil = $1.9735 \times 10^5 x$ per square centimeter.

x per circular millimeter = 127.324 x per square centimeter.

x per circumference = 0.159155 x per radian.

x per cubic foot = $3.5314 \times 10^{-6} x$ per cubic centimeter.

x per cubic inch = 0.061023 x per cubic centimeter.

x per cubic yard = 1.3079 x per cubic meter.

x per day (mean solar) = $1.15741 \times 10^{-5} x$ per second (mean solar).

x per degree = 57.29578 x per radian.

x per entire space = 0.079577 x per steradian.

x per foot = 0.032808 x per centimeter.

x per gallon (British) = $2.1997 \times 10^{-4} x$ per cubic centimeter.

x per gallon (U. S.) = $2.6417 \times 10^{-4} x$ per cubic centimeter.

x per grain = 0.01543236 x per milligram.

x per hemisphere = 0.15916 x per steradian.

x per hour (mean solar) = $2.77778 \times 10^{-4} x$ per second (mean solar).

UNITS AND CONVERSION FACTORS (Continued)

- x per **inch** = $0.39370\ x$ per centimeter.
 x per **liter** = $9.9997 \times 10^{-4}\ x$ per cubic centimeter.
 x per **micron** = $1.0000 \times 10^4\ x$ per centimeter.
 x per **mil** = $393.70\ x$ per centimeter.
 x per **mile** = $0.62137\ x$ per kilometer.
 x per **minute** = $3437.75\ x$ per radian.
 x per **minute (mean solar)** = $0.0166667\ x$ per second (mean solar).
 x per **ounce (avoirdupois)** = $0.035274\ x$ per gram.
 x per **ounce (apothecary or troy)** = $0.032151\ x$ per gram.
 x per **ounce (fluid, British)** = $0.035195\ x$ per cubic centimeter.
 x per **ounce (fluid, U. S.)** = $0.033814\ x$ per cubic centimeter.
 x per **pound (avoirdupois)** = $0.00220462\ x$ per gram.
 x per **quart (dry, U. S.)** = $9.0808 \times 10^{-4}\ x$ per cubic centimeter.
 x per **quart (liquid, U. S.)** = $0.0010567\ x$ per cubic centimeter.
 x per **quart (British)** = $8.7988 \times 10^{-4}\ x$ per cubic centimeter.
 x per **second** = $2.06265 \times 10^5\ x$ per radian.
 x per **second (sidereal)** = $1.002738\ x$ per second (mean solar).
 x per **square degree** = $3282.8\ x$ per steradian.
 x per **square foot** = $0.0010764\ x$ per square centimeter.
 x per **square inch** = $0.15500\ x$ per square centimeter.
 x per **square meter** = $1 \times 10^{-4}\ x$ per square centimeter.
 x per **square mile** = $0.38610\ x$ per square kilometer.
 x per **square millimeter** = $100.0000\ x$ per square centimeter.
 x per **square yard** = $1.19599 \times 10^{-4}\ x$ per square centimeter.
 x per **ton (2000 pounds)** = $0.00110231\ x$ per kilogram.
 x per **ton (2240 pounds)** = $9.8421 \times 10^{-4}\ x$ per kilogram.
 x per **year (mean solar)** = $0.00273781\ x$ per day (mean solar) = $3.16888 \times 10^{-8}\ x$ per second (mean solar).

Velocity [lt^{-1}]

Centimeter per second.— 3.728×10^{-4} mile per minute; 0.02237 mile per hour; 0.032808 foot per second; 0.03600 kilometer per hour; 0.6000 meter per minute; 1.9685 feet per minute.

UNITS AND CONVERSION FACTORS (Continued)

Degree per second.—0.002778 revolution per second; 0.017453 radian per second; 0.1667 revolution per minute.

Foot per minute.—0.005080 meter per second; 0.011364 mile per hour; 0.016667 foot per second; 0.01829 kilometer per hour; 0.3048 meter per minute; 0.5080 centimeter per second.

Foot per second.—0.011364 mile per minute; 0.5921 knot per hour; 0.6818 mile per hour; 1.0973 kilometers per hour; 18.29 meters per minute; 30.4801 centimeters per second.

Kilometer per hour.—0.016667 kilometer per minute; 0.27778 meter per second; 0.5396 knot; 0.6214 mile per hour; 0.9113 foot per second; 16.67 meters per minute; 27.7778 centimeters per second; 54.68 feet per minute.

Kilometer per minute.—0.6215 mile per minute; 37.284 miles per hour; 60 kilometers per hour; 1666.7 centimeters per second; 3280.8 feet per minute.

Knot—1 nautical mile per hour; 1.1516 miles per hour; 1.689 feet per second; 1.853 kilometers per hour; 51.48 centimeters per second; 6080.20 feet per hour.

Meter per minute.—0.03728 mile per hour; 0.05468 foot per second; 0.06 kilometer per hour; 1.6667 centimeters per second; 3.281 feet per minute.

Meter per second.—0.03728 mile per minute; 0.06000 kilometer per minute; 2.2369 miles per hour; 3.281 feet per second; 3.600 kilometers per hour; 196.8 feet per minute.

Mile per hour.—0.016667 mile per minute; 0.8684 knot; 1.4667 feet per second; 1.6093 kilometers per hour; 26.82 meters per minute; 44.7041 centimeters per second; 88 feet per minute.

Mile per minute.—52.104 knot; 1.609 kilometers per minute; 60 miles per hour; 88 feet per second; 2682.2 centimeters per second.

Radian per second.—0.1592 revolution per second; 9.549 revolutions per minute; 57.296 degrees per second.

Revolution per day.— 7.2722×10^{-5} radian per second.

Revolution per minute (R.P.M.).—0.01667 revolution per second; 0.10472 radian per second; 6 degrees per second.

Revolution per second.—6.2832 radians per second; 60 revolutions per minute; 360 degrees per second.

Velocity of light.— 2.9986×10^{10} centimeters per second.

UNITS AND CONVERSION FACTORS (Continued)

Acceleration [$l\ t^{-2}$]

Centimeter per second per second.—0.02237 mile per hour per second; 0.03281 foot per second per second; 0.03600 kilometer per hour per second.

Foot per second per second.—0.304801 meter per second per second; 0.6818 mile per hour per second; 1.097 kilometer per hour per second; 30.4801 centimeter per second per second.

Gravity, standard.—32.174 feet per second per second; 980.665 centimeters per second per second.

Kilometer per hour per second.—0.27778 meter per second per second; 0.6214 mile per hour per second; 0.9133 foot per second per second; 27.778 centimeters per second per second.

Meter per second per second.—2.237 miles per hour per second; 3.2808 feet per second per second; 3.600 kilometers per hour per second; 100.00 centimeters per second per second.

Mile per hour per minute.—0.74507 centimeter per second per second.

Mile per hour per second.—0.44704 meter per second per second; 1.467 feet per second per second; 1.609 kilometers per hour per second; 44.704 centimeters per second per second.

Radians per second per second.—0.1592 revolution per second per second; 9.549 revolutions per minute per second; 572.96 revolutions per minute per minute.

Revolution per minute per second.—0.10420 radian per second per second.

Revolution per minute per minute.— 2.778×10^{-4} revolution per second per second; 0.0017453 radian per second per second; 0.01667 revolution per minute per second.

Revolution per second per second.—6.2832 radians per second per second; 60 revolutions per minute per second; 3600 revolutions per minute per minute.

Density [$m\ l^{-3}$]

Demal.—1 gram equivalent per cubic decimeter.

Gram per cubic foot.—2.288 grams per cubic meter.

Gram per cubic centimeter.— 3.405×10^{-7} pound per foot; 0.03613 pound per cubic inch; 8.3452 pounds per gallon

UNITS AND CONVERSION FACTORS (Continued)

(U. S.); 10.022 pounds per gallon (British); 62.43 pounds per cubic foot.

Gram per cubic meter.—0.437 grains per cubic foot.

Gram per milliliter.—(Numerically equal to specific gravity $t^{\circ}/4^{\circ}$); 0.999973 gram per cubic centimeter.

Kilogram per cubic meter.— 3.613×10^{-6} pound per cubic inch; 0.001 gram per cubic centimeter; 0.06243 pound per cubic foot.

Mercury at 0°C.—13.5951 grams per cubic centimeter (Internationally accepted conventional value to be used in expressing pressures in terms of columns of mercury.)

Pound per cubic foot.— 5.787×10^{-4} pound per cubic inch; 0.016018 gram per cubic centimeter; 16.018 kilograms per cubic meter.

Pound per cubic inch.—27.680 grams per cubic centimeter; 2.768×10^4 kilograms per cubic meter.

Pound per mil foot.— 2.9369×10^6 grams per cubic centimeter.

Pound per gallon (U. S.).—0.119826 gram per cubic centimeter.

Pound per gallon (British).—0.099776 gram per cubic centimeter.

Slug per cubic foot.—0.5154 gram per cubic centimeter.

Mass Concentration

Gram per metric ton.—1.0000 milligram per kilogram.

Gram per ton (2000 pound).—1.1023 milligrams per kilogram.

Gram per ton (2240 pound).—0.9842 milligram per kilogram.

Karat (1 of gold to 24 of mixture).—41.667 milligrams per gram.

Milligram per assay ton (Equals one troy ounce per 2000 pound (avoirdupois).)—34.276 milligrams per kilogram.

Milligram per kilogram.—0.002 pound (avoirdupois) per ton (2000 pound); 0.029175 milligram per assay ton; 0.032000 ounce (avoirdupois) per ton (2000 pound); 1 gram per metric ton.

Ounce (avoirdupois) per ton (2000 pound).—31.2500 milligrams per kilogram.

UNITS AND CONVERSION FACTORS (Continued)

Ounce (avoirdupois) per ton (2240 pound).—27.9018 milligrams per kilogram.

Pound (avoirdupois) per ton (2000 pound).—500.000 milligrams per kilogram.

Pound (avoirdupois) per ton (2240 pound).—446.429 milligrams per kilogram.

Flow [l^3t^{-1}]

Cubic centimeter per second.—0.0021186 cubic foot per minute.

Cubic foot per minute.—0.1247 gallon per second; 0.4720 liter per second; 62.4 pounds of water per minute; 472.0 cubic centimeters per second.

Cubic foot per second.—2.2222 cubic yards per minute; 448.83 gallons per minute; 1699.3 liters per minute.

Cubic yard per minute.—0.45 cubic foot per second; 3.367 gallons per second; 12.74 liters per second.

Gallon per second.—0.297 cubic yard per minute; 8.0192 cubic feet per minute.

Gallon per minute.—0.002228 cubic foot per second; 0.06308 liter per second.

Liter per minute.— 5.885×10^{-4} cubic foot per second; 0.004403 gallon per second.

Liter per second.—0.078493 cubic yard per minute; 2.12 cubic feet per minute; 15.85 gallons per minute (U. S.).

Miner's Inch.—1.2 cubic feet per minute.

Pounds of water per minute.—0.01603 cubic foot per minute.

Force [mlt^{-2}]

Conversion factors between the absolute and gravitational units of force, torque, energy and power are dependent on the value of g , the acceleration due to gravity. The standard value of g adopted by the International Committee on Weights and Measures is 980.665 cm/sec². This value or its equivalent, 32.174 ft./sec², is used except where otherwise noted.

Dyne.— 2.2481×10^{-6} pound weight; 7.2330×10^{-5} poundal; 0.0010197 gram weight; 0.015737 grain weight.

Grain weight.—63.546 dynes.

Gram weight.—0.070932 poundal; 980.665 dynes.

UNITS AND CONVERSION FACTORS (Continued)

Kilogram weight.—70.932 poundals; 9.80665×10^5 dynes.

Newton.— 1×10^5 dynes.

Poundal.—0.031081 pound weight; 14.098 grams weight; 1.3825×10^4 dynes.

Pound weight.—32.174 poundals; 453.59 grams weight; 4.4482×10^5 dynes.

Ton weight (2000 pound).— 8.8964×10^8 dynes.

Ton weight (2240 pound).— 9.9640×10^8 dynes.

RECIPROCAL FORCE [$m^{-1} l^{-1} t^2$]

x per gram weight = $0.0010197 x$ per dyne.

x per poundal = $7.2330 \times 10^{-5} x$ per dyne.

x per pound weight = $2.2481 \times 10^{-6} x$ per dyne.

Pressure [$m l^{-1} t^{-2}$]

Atmosphere (normal).—Pressure exerted by 76 cm of Hg, density 13.5951 g/cm^3 , $g = 980.665 \text{ cm/sec}^2$; 0.0073480 ton (2000 pound) per square inch; 1.0133 bars; 1.0581 tons (2000 pound) per square foot; 14.696 pounds per square inch; 29.921 inches of mercury at 32°F ; 33.899 feet of water at 39.1°F ; 760 millimeters of mercury at 0°C ; 1033.2 grams per square centimeter; 2116.2 pounds per square foot; 1.0332×10^4 kilograms per square meter; 1.01325×10^6 dynes per square centimeter.

Bar.—0.98692 atmosphere; 14.504 pounds per square inch, 1.01971×10^4 kilograms per square meter; 1.000×10^6 dynes per square centimeter. (This value accords with the only internationally accepted use of this term; but "bar" has also been used to denote a pressure of one dyne per square centimeter).

Barye.—1.0000 dyne per square centimeter.

Centimeter of mercury at 0°C .—0.013158 atmosphere; 0.19337 pound per square inch; 0.44604 foot of water; 27.845 pounds per square foot; 135.95 kilograms per square meter; 1.33322×10^4 dynes per square centimeter.

Centimeter of water at 4°C .—980.638 dynes per square centimeter.

Dyne per square centimeter.— 9.8692×10^{-7} atmosphere; 1×10^{-6} bar; 1.4504×10^{-5} pound per square inch; 2.9530×10^{-5} inch of mercury at 32°F ; 4.0148×10^{-4} inch of water at 4°C ; 7.5006×10^{-4} millimeter of mercury; 0.00101971 gram per square centimeter; 0.00101974 centimeter of water at 4°C ; 0.0020886 pound per square foot; 0.0101971 kilogram per square meter.

Foot of water at 4°C or 39.1°F .—0.029499 atmosphere; 0.43352 pound per square inch; 0.88265 inch of mercury at

UNITS AND CONVERSION FACTORS (Continued)

32°F; 62.426 pounds per square foot; 304.79 kilograms per square meter.

Gram (weight) per square centimeter.— 9.6784×10^{-4} atmosphere; 0.014223 pound per square inch; 0.73556 millimeter of mercury at 0°C; 2.0482 pound per square foot; 10 kilograms per square meter; 980.665 dynes per square centimeter.

Inch of mercury at 32°F.—0.033421 atmosphere; 0.49116 pound per square inch; 1.13299 feet of water at 39.1°F; 13.595 inches of water at 4°C; 70.727 pounds per square foot; 345.31 kilograms per square meter; 3.38639×10^4 dynes per square centimeter.

Inch of water at 4°C.—0.0024583 atmosphere; 0.036136 pound per square inch; 0.073554 inch of mercury; 0.57818 ounce per square inch; 5.2022 pounds per square foot; 25.399 kilograms per square meter; 2490.82 dynes per square centimeter.

Kilogram (weight) per square centimeter.—14.223 pounds per square inch; 73.556 centimeters of mercury at 0°C; 980,665 dynes per square centimeter.

Kilogram (weight) per square meter.— 9.6784×10^{-5} atmosphere; 0.0014223 pound per square inch; 0.0028959 inch of mercury; 0.0032809 foot of water; 0.073556 millimeter of mercury; 0.1 gram per square centimeter; 0.20482 pound per square foot; 98.0665 dyne per square centimeter.

Kilogram (weight) per square millimeter.—0.71114 ton (2000 pounds) per square inch; 1×10^6 kilograms per square meter; 9.80665×10^7 dynes per square centimeter.

Millimeter of mercury at 0°C.—0.0013158 atmosphere; 0.019337 pound per square inch; 1.3595 grams per square centimeter; 2.7845 pounds per square foot; 13.595 kilograms per square meter; 1333.22 dynes per square centimeter.

Ounce (weight) per square inch.—0.0625 pound per square inch; 4309.2 dynes per square centimeter.

Pound (weight) per square foot.— 4.7254×10^{-4} atmosphere; 4.7880×10^{-4} bar; 0.0069445 pound per square inch; 0.016018 foot of water at 39.1°F; 0.35913 millimeter of mercury at 0°C; 0.48824 gram per square centimeter; 4.8824 kilograms per square meter; 478.80 dynes per square centimeter.

Pound (weight) per square inch.— 5×10^{-4} ton (2000 pound) per square inch; 0.068046 atmosphere; 0.068947 bar; 0.070307 kilogram per square centimeter; 2.0360 inches of mercury at 32°F; 2.3066 feet of water at 39.1°F; 5.1715 centimeters of mercury at 0°C; 27.673 inches of water at 4°C; 51.715 millimeters of mercury; 70.307 grams per square centimeter; 703.07 kilograms per square meter; 6.8947×10^4 dynes per square centimeter.

UNITS AND CONVERSION FACTORS (Continued)

Ton (2000 pound) (weight) per square foot.—0.94509 atmosphere; 13.889 pounds per square inch; 9764.8 kilograms per square meter; 9.5760×10^5 dynes per square centimeter.

Ton (2240 pound) (weight) per square foot.— 10.7251×10^5 dynes per square centimeter.

Ton (2000 pound) (weight) per square inch.—1.4062 kilograms per square millimeter; 2000 pounds per square inch; 1.4062×10^6 kilograms per square meter; 1.3789×10^8 dynes per square centimeter.

Ton (2240 pound) (weight) per square inch.—1.5749 kilograms per square millimeter; 152.42 atmospheres; 1.5444×10^8 dynes per square centimeter.

Work and Energy [$m l^2 t^{-2}$]

British thermal unit (mean) (BTU).— 2.930×10^{-4} kilowatt-hour; 3.9292×10^{-4} horse power-hour; 0.25198 kilogram-calorie or large calorie (mean); 0.2930 watt-hour; 10.409 liter-atmospheres; 107.56 kilogram-meters; 251.98 gram-calories (mean); 777.97 foot-pounds; 1054.8 joules (absolute); 0.3676 cubic foot-atmospheres; 2.5030×10^4 foot-poundals; 1.0548×10^{10} ergs.

British thermal unit (39 °F) (BTU).—1060.4 joules (absolute).

British thermal unit (60 °F) (BTU).—1054.6 joules (absolute).

Calorie.—*See* gram-calorie or kilogram-calorie.

Centigrade thermal unit (15 °C) (CTU).—1898.3 joules (absolute).

Centimeter-dyne.—*See* erg.

Centimeter-gram force.—*See* gram-centimeter.

Cheval-vapeur heure.— 2.6478×10^6 joules (absolute).

Cubic centimeter-atmosphere (normal).—0.101325 joule (absolute).

Cubic foot atmosphere.—2.7203 British thermal unit (mean); 28.313 liter-atmospheres; 292.59 kilogram-meters; 680.74 gram-calories (mean); 2116.3 foot-pounds; 2869.4 joules (absolute).

Erg.— 2.3889×10^{-11} kilogram-calorie (mean); 9.4805×10^{-11} British thermal unit (mean); 1.0197×10^{-8} kilogram-meter; 2.3889×10^{-8} gram-calorie (mean); 7.3756×10^{-8} foot-pound; 1×10^{-7} joule; 2.3730×10^{-6} foot-poundal; 0.0010197 gram-centimeter; 1 dyne-centimeter.

Foot-Pound.— 3.7662×10^{-7} kilowatt-hour; 5.0505×10^{-7} horse power-hour; 3.2389×10^{-4} kilogram-calorie (mean); 3.7662×10^{-4} watt-hour; 4.7253×10^{-4} cubic foot-atmosphere; 0.0012854 Brit-

UNITS AND CONVERSION FACTORS (Continued)

ish thermal unit (mean); 0.013381 liter-atmosphere; 0.138255 kilogram-meter; 0.32389 gram-calorie (mean); 1.35582 joule (absolute); 32.174 foot-pounds; 1.3825×10^4 gram-centimeters; 1.35582×10^7 ergs or centimeter-dynes.

Foot-poundal.— 3.9952×10^{-5} British thermal unit (mean); 4.1589×10^{-4} liter-atmosphere (normal); 0.0042972 kilogram-meter; 0.010067 gram-calorie; 0.031081 foot-pound; 0.042140 joule; 4.21402×10^5 ergs.

Gram-calorie (mean).— 1.5593×10^{-6} horse power hours; 0.001 kilogram-calorie; 0.0011628 watt-hour; 0.001459 cubic foot-atmosphere; 0.0039685 British thermal unit (mean); 0.041311 liter-atmosphere; 0.42685 kilogram-meter; 3.0874 foot-pounds; 4.186 joules (absolute); 99.334 foot-poundals.

Gram-calorie (15°C).—4.185 joules (absolute).

Gram-calorie (20°C).—4.181 joules (absolute).

Gram-centimeter.— 2.3427×10^{-8} kilogram-calorie (mean); 9.2972×10^{-8} British thermal unit (mean); 1×10^{-5} kilogram-meter; 2.3427×10^{-5} gram-calorie (mean); 7.233×10^{-5} foot-pound; 9.80665×10^{-5} joule (absolute); 980.7 ergs.

Horse power hour. (HP hr. or h. p. hr.).—0.7457 kilowatt-hour; 641.30 kilogram-calories (mean); 745.7 watt-hours; 2545.0 British thermal units (mean); 2.7374×10^5 kilogram-meters; 1.9800×10^6 foot-pounds; 2.6845×10^6 joules (absolute).

Horse power hour (electrical, U. S. & British).— 2.6856×10^6 joules (absolute).

International volt (v) electronic charge.— 1.5927×10^{-19} joule (absolute).

International volt (v) Faraday.— 9.6541×10^4 joules (absolute).

Joule (absolute).— 2.778×10^{-7} kilowatt-hour; 3.725×10^{-7} horse power-hour; 2.3889×10^{-4} kilogram-calorie (mean); 2.778×10^{-4} watt-hour; 3.485×10^{-4} cubic foot-atmosphere; 9.480×10^{-4} British thermal unit (mean); 0.009869 liter-atmosphere; 0.10197 kilogram-meter; 0.23889 gram-calorie (mean); 0.23895 gram-calorie at 15°C; 0.23918 gram-calorie at 20°C; 0.73756 foot-pound; 0.999835 joule (International); 1 watt-second; 23.730 foot-poundals; 1.0197×10^4 gram-centimeters; 1×10^7 ergs.

Joule (International).—1.000165 joule (absolute).

Kilogram-calorie or large calorie (mean).—0.0011628 kilowatt-hour; 0.0015593 horse power-hour; 1.1628 watt-hour; 3.9685 British thermal units (mean); 426.85 kilogram-meters; 1000 small or gram-calories; 3087.4 foot-pounds; 4186 joules; 4.2686×10^7 gram-centimeters; 4.186×10^{10} ergs.

Kilogram-meter.— 2.7235×10^{-6} kilowatt hour; 3.6530×10^{-6}

UNITS AND CONVERSION FACTORS (Continued)

horse power-hour; 0.0027235 watt-hour; 0.0034177 cubic foot-atmosphere; 0.0092972 British thermal unit (mean); 0.096782 liter-atmosphere; 2.3427 gram-calories (mean); 7.2330 foot-pounds; 9.80665 joules (absolute); 232.71 foot-pounds; 1×10^5 gram-centimeters; 9.80665×10^7 ergs.

Kilowatt-hour.—1.3410 horse power-hours; 1000 watt-hours; 3413.0 British thermal units (mean); 3.6710×10^5 kilogram-meters; 8.6001×10^5 gram-calories (mean); 2.6552×10^6 foot-pounds; 3.6000×10^6 joules (absolute).

Large Calorie.—*See* kilogram-calorie.

Liter-atmosphere (normal).— 3.7745×10^{-5} horse power-hour; 0.035319 cubic foot-atmosphere; 0.09607 British thermal unit (mean); 10.333 kilogram-meters; 24.206 gram-calories (mean); 74.735 foot-pounds; 101.328 joules (absolute); 2404.5 foot-pounds.

Liter-atmosphere (lat. 45° , $g=980.616$).—101.323 joules (absolute).

Megalerg.— 1×10^6 ergs.

Meter-kilogram.—*See* kilogram-meter.

Watt-hour.—0.001 kilowatt-hour; 0.0013410 horse power-hour; 0.86001 kilogram-calorie (mean); 3.4130 British thermal units (mean); 367.10 kilogram-meters; 860.01 gram-calories (mean); 2655.3 foot-pounds; 3600 joules.

Power [$m \ l^2 \ t^{-3}$]

British thermal unit (BTU) (mean) per minute.—0.023575 horse power; 17.580 watts (absolute).

British thermal unit (BTU) (mean) per second.—1.4145 horse power; 1054.8 watts (absolute).

British thermal unit (BTU) ($39^\circ F$) per second.—1060.4 watts (absolute).

British thermal unit (BTU) ($60^\circ F$) per second.—1054.6 watts (absolute).

Cheval-vapeur.—For electrical purposes usually used as 736 watts. *See* Force de cheval.

Erg per second.— 1×10^{-10} kilowatt; 1.3412×10^{-10} horse power; 1.4333×10^{-9} kilogram-calorie (mean) per minute; 5.688×10^{-9} British thermal unit (mean) per minute; 7.3756×10^{-8} foot-pound per second; 1×10^{-7} watt; 4.4254×10^{-6} foot-pound per minute; 1 dyne-centimeter per second.

Foot-pound per minute.— 2.2597×10^{-5} kilowatt; 3.0303×10^{-5} horse power; 3.072×10^{-5} horse power (metric); 3.2389×10^{-4}

UNITS AND CONVERSION FACTORS (Continued)

kilogram-calorie (mean) per minute; 0.0012854 British thermal unit (mean) per minute; 0.016667 foot-pound per second; 0.022597 watt.

Foot-pound per second.—0.0013558 kilowatt; 0.0018182 horse power; 0.019433 kilogram-calorie (mean) per minute 0.077124 British thermal unit (mean) per minute; 1.35582 watt (absolute).

Force de cheval (cheval-vapeur).—*See* horse power (metric).

Gram-centimeter per second.— 9.80665×10^{-5} watt (absolute).

Hectowatt.—100 watts.

Horse power (h. p. or IP).—0.70696 British thermal unit (mean) per second; 0.7452 kilowatt ($g=980$); 0.74570 ($g=980.665$) kilowatt; 1.0139 horse power (metric) or cheval-vapeur. 10.688 kilogram-calories (mean) per minute; 42.418 British thermal units (mean) per minute; 550 foot-pounds per second; 745.2 watts ($g=980$); 745.70 watts ($g=980.665$); 3.3000×10^4 foot-pounds per minute.

Horse power, electrical (U. S. & British).—746.00 watt (absolute) (Commonly used in rating electrical machinery).

Horse power, metric (cheval vapeur).—0.98632 horse power (U. S.); 75 kilogram-meters per second; 735.499 watts; 3.2549×10^4 foot-pounds per minute.

Kilogram-calorie (mean) per minute.—0.093557 horse power; 51.457 foot-pounds per second; 69.767 watts.

Kilogram calorie (mean) per second.—4.186 kilowatts.

Kilogram-meter per second.—9.80665 watts (absolute).

Kilowatt.—0.23889 kilogram-calorie (mean) per second; 0.94827 British thermal unit (mean) per second; 1.3410 horse power; 1.3597 horse power (metric); 14.333 kilogram-calories (mean) per minute; 56.896 British thermal units (mean) per minute; 737.56 foot-pounds per second; 1000 watts; 4.4254×10^4 foot-pounds per minute; 2.6552×10^6 foot-pounds per hour.

Lumen.—0.001496 watt.

Metric horse power.—*See* horse power, metric.

Watt (absolute).—0.001 kilowatt; 0.0013410 horse power; 0.0013596 force de cheval or horse power (metric); 0.01433 kilogram-calorie (mean) per minute; 0.056896 British thermal unit (mean) per minute; 0.73756 foot-pound per second; 1 joule per second; 44.254 foot-pounds per minute; 1×10^7 ergs per second.

Watt (International).—1.000165 watt (absolute).

Watt of maximum visibility radiation.—668 lumens.

UNITS AND CONVERSION FACTORS (Continued)

Action [$m\ l^2\ t^{-1}$]

Calorie (15°C) second.— 6.3854×10^{33} quanta.

Calorie (15°C) second / N_o *.— 1.0535×10^{10} quanta.

Joule second.— 1.5258×10^{33} quanta.

Joule second / N_o *.— 2.5173×10^9 quanta.

Planck's quantum.— 6.624×10^{-27} erg second.

Volt electronic-charge second.— 2.4292×10^{14} quanta.

Volt faraday second.— 1.4724×10^{38} quanta.

* N_o denotes Avogadro's number, the number of molecules per gram mole.

Torque or Moment of Force [$m\ l^2\ t^{-2}$]

Dyne-centimeter.— 1.0197×10^{-8} kilogram-meter; 7.3757×10^{-8} pound-foot; 8.8511×10^{-7} pound-inch; 2.3731×10^{-6} poundal-foot.

Kilogram-meter.— 9.8066×10^7 dyne-centimeters.

Pound-foot.— 1.3558×10^7 dyne-centimeters.

Poundal-foot.— 4.2140×10^5 dyne-centimeters.

Pound-inch.— 1.1298×10^6 dyne-centimeters.

Moment of Area [l^4]

Square centimeter-centimeter squared.—0.02402 square inch-inch squared.

Square foot-foot squared.— 2.074×10^4 square inch-inch squared.

Square inch-inch squared.— 4.823×10^{-5} square foot-foot squared; 41.62 square centimeter-centimeter squared.

Moment of Inertia [$m\ l^2$]

Gram-centimeter squared ($g\ cm^2$).— 2.3730×10^{-6} pound-foot squared; 3.4172×10^{-4} pound-inch squared.

Kilogram-centimeter squared.—0.0023730 pound-foot squared; 0.3417 pound-inch squared.

Pound-foot squared.—144 pound-inches squared; 421.40 kilogram-centimeters squared; 4.2140×10^5 gram-centimeters squared.

Pound-inch squared.—0.006945 pound-foot squared; 2.9264 kilogram-centimeters squared; 2926.4 gram-centimeters squared.

UNITS AND CONVERSION FACTORS (Continued)

Thermal Units

TEMPERATURE

Degree Centigrade ($^{\circ}\text{C}$).—0.8 or $4/5$ degree Réaumur; 1.00 degree absolute, Kelvin; 1.8 or $9/5$ degrees Fahrenheit.

Degree Fahrenheit ($^{\circ}\text{F}$).—0.44444 or $4/9$ degree Réaumur; 0.55556 or $5/9$ degree Centigrade.

Degree Réaumur ($^{\circ}\text{R}$).—1.25 or $5/4$ degrees Centigrade; 2.25 or $9/4$ degrees Fahrenheit.

Temperature, absolute Centigrade or Kelvin (K) scale.— $x^{\circ}\text{K} = \text{T}^{\circ}\text{C} + 273.18$.

Temperature, degrees Centigrade ($^{\circ}\text{C}$).— $x^{\circ}\text{C} = 5/9 (\text{T}^{\circ}\text{F} - 32)$; $x^{\circ}\text{C} = 5/4 \text{T}^{\circ}\text{R}$.

Temperature, degrees Fahrenheit ($^{\circ}\text{F}$).— $x^{\circ}\text{F} = 9/5 \text{T}^{\circ}\text{C} + 32$; $x^{\circ}\text{F} = 9/4 \text{T}^{\circ}\text{R} + 32$.

Temperature, degrees Réaumur ($^{\circ}\text{R}$).— $x^{\circ}\text{R} = 4/9 (\text{T}^{\circ}\text{F} - 32)$; $x^{\circ}\text{R} = 4/5 \text{T}^{\circ}\text{C}$.

THERMAL CAPACITY OF A SUBSTANCE

British thermal unit (mean) per pound per $^{\circ}\text{F}$.—1 gram-calorie per gram per $^{\circ}\text{C}$; 4.186 joules per gram per $^{\circ}\text{C}$.

Gram-calorie (mean) per gram per $^{\circ}\text{C}$.—1 British thermal unit (60°F) per pound per $^{\circ}\text{F}$; 4.186 joules per gram per $^{\circ}\text{C}$.

Joule per gram per $^{\circ}\text{C}$.—0.2389 gram-calorie (mean) per gram per $^{\circ}\text{C}$; 0.2389 British thermal unit (mean) per pound per $^{\circ}\text{F}$.

THERMAL CAPACITY OF A BODY. WATER EQUIVALENT

British thermal unit (60°F) per $^{\circ}\text{F}$.—453.59 gram-calories per $^{\circ}\text{C}$; 1898.3 joules per $^{\circ}\text{C}$.

Gram-calorie (15°) per $^{\circ}\text{C}$.—0.0022046 British thermal unit (60°F) per $^{\circ}\text{F}$; 4.185 joules per $^{\circ}\text{C}$.

Joule per $^{\circ}\text{C}$.— 5.268×10^{-4} British thermal unit (60°F) per $^{\circ}\text{F}$; 0.2389 gram-calorie per $^{\circ}\text{C}$.

HEAT EQUIVALENT. LATENT HEAT

British thermal unit (mean) per pound.—0.5556 gram-calorie (mean) per gram; 2.325 joules per gram.

UNITS AND CONVERSION FACTORS (Continued)

Gram-calories (mean) per gram.—1.8 British thermal units (mean) per pound; 4.186 joules per gram.

Joule per gram.—0.2389 gram-calories (mean) per gram; 0.4301 British thermal unit per pound.

THERMAL CONDUCTIVITY

British thermal unit (mean) per square foot per second for a temperature gradient of 1°F per inch=5.191 joules (absolute) per square centimeter per second for a temperature gradient of 1°C per centimeter=1.2404 gram-calories (15°C) per square centimeter per second for a temperature gradient of 1°C per centimeter.

Gram-calorie (15°C) per square centimeter per second for a temperature gradient of 1°C per centimeter=4.185 joules (absolute) per square centimeter per second for a temperature gradient of 1°C per centimeter=0.80620 British thermal units (mean) per square foot per second for a temperature gradient of 1°F per inch.

Joule per square centimeter per second for a temperature gradient of 1°C per centimeter=0.2389 gram-calorie (15°C) per square centimeter per second for a temperature gradient of 1°C per centimeter=0.1926 British thermal unit per square foot per second for a temperature gradient of 1°F per inch.

Photometric Units

Bougie Decimale (intensity of source).—1.0 International candle (approximately).

Candle (International) (intensity of source).—0.104 Carcel unit (approximately); 1.0000 International lumen per steradian; 1 Pentane candle (approximately); 1 English sperm candle (approximately); 1.11 Hefner unit (approximately).

Candle per square centimeter (surface brightness).—3.1416 lamberts; 3141.6 millilamberts.

Candle per square inch (surface brightness).—0.48695 lambert; 486.95 millilamberts.

Carcel unit (intensity of source).—9.6 International candle (approximately).

English sperm candle (intensity of source).—1.0 International candle (approximately).

Foot-candle (illumination of a surface).—1 lumen incident per square foot; 1.0764 milliphot; 10.764 lumen per square meter; 10.764 lux.

UNITS AND CONVERSION FACTORS (Continued)

Hefner unit (intensity of source).—0.90 International candle (approximately).

Lambert (surface brightness).—0.3183 candle per square centimeter; 2.054 candles per square inch; 1 lumen emitted per square centimeter of a perfectly diffusing surface.

Lumen (flux of luminous energy).—Is emitted by 0.07958 spherical candle power. A source of one spherical candle power emits 4π or 12.566 lumens.

Lumen per square centimeter per steradian (surface brightness).—3.1416 lambert.

Lumen per square foot (illumination of a surface).—1 foot-candle; 10.764 lumens per square meter.

Lumen per square foot per steradian (surface brightness).—3.3816 millilambert.

Lumen per square meter (surface illumination).— 1×10^{-4} phot; 0.092902 foot candle or lumen per square foot.

Lux (illumination of a surface).— 1×10^{-4} phot; 0.1 milliphot; 0.092902 foot-candle; 1.000 lumen per square meter.

Meter-candle (illumination of a surface).—1.000 lumen per square meter.

Millilambert (surface brightness).—0.929 lumen emitted per square foot (perfect diffusion).

Milliphot (illumination of a surface).—0.001 phot; 0.929 foot-candle.

Pentane candle (intensity of source).—1.0 International candle (approximately).

Phot (illumination of a surface).—1 lumen incident per square centimeter; 1000 milliphot; 1.000×10^4 lumens per square meter; 1×10^4 lux.

Stilb (surface brightness).—1 candle per square centimeter

Viscosity

VISCOSITY [$ml^{-1} t^{-1}$]

Gram weight second per square centimeter.—980.665 poise.

Poise.—1.00 gram per centimeter per second.

Pound weight second per square foot.—478.8 poise.

Pound weight second per square inch.— 6.895×10^4 poise.

KINEMATIC VISCOSITY [$l^2 t^{-1}$]

Inch squared per second.—6.451 centimeters squared per second.

UNITS AND CONVERSION FACTORS (Continued)

Poise centimeter cubed per gram.—1.000 centimeter squared per second.

Poise foot cubed per pound.—62.43 centimeters squared per second.

Poise inch cubed per gram.—16.387 centimeters squared per second.

RECIPROCAL VISCOSITY (FLUIDITY) [$m^{-1} l$]

Rhe.—1.000 per poise.

Diffusivity; Coefficient of Diffusion [$l^2 t^{-1}$]

Centimeter squared per day.— 1.1574×10^{-5} centimeter squared per second.

Inch squared per second.—6.4516 centimeters squared per second.

Liter per centimeter per day.—0.011574 centimeter squared per second.

Surface Tension [mt^{-2}]

Dyne per centimeter.—0.01 erg per square millimeter; 0.10197 milligram weight per millimeter; 1 erg per square centimeter; 2.5901 milligram weight per inch.

Erg per square centimeter.—0.01000 erg per square millimeter; 1.0000 dyne per centimeter.

Erg per square millimeter.—100.00 dynes per centimeter; 100.00 ergs per square centimeter.

Milligram weight per inch.—0.38609 dyne per centimeter.

Milligram weight per millimeter.—9.80665 dynes per centimeter.

Rotatory Power [l^{-1}]

Degree per centimeter.—0.017453 radian per centimeter.

Degree per foot.— 5.7261×10^{-4} radian per centimeter.

Degree per inch.—0.0068714 radian per centimeter.

Minute per centimeter.— 2.9089×10^{-4} radian per centimeter.

Radian per centimeter.—57.296 degrees per centimeter; 145.50 degrees per inch; 1746.4 degrees per foot; 3437.7 minutes per centimeter.

UNITS AND CONVERSION FACTORS (Continued)

ELECTRICAL UNITS

Electrical units are designated as "absolute" when based on the electromagnetic cgs system, "International" when based on legal definitions of the ohm, Weston cell or silver voltammeter.

The basis of International units is indicated as follows: "(a)" based on a silver deposit of 1.11800 mg per International ampere second; "(v)" based on the International ohm and Weston cell,—1.018300 volts at 20°C.

New adjusted values of International units were adopted in the United States on January 1, 1948. Relations between absolute and International units given below are based on these values.

Quantity or Charge [$\epsilon^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{3}{2}}t^{-1}$], [$\mu^{-\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}$]

Abcoulomb.—*See* electromagnetic cgs unit electrical quantity.

Ampere-hour (absolute).—3600.0 coulomb (absolute)

Coulomb (absolute).—0.1000 electromagnetic cgs unit or abcoulomb; 1.000165 International coulombs; 2.99796×10^9 electrostatic cgs units or statcoulombs; 6.281×10^{18} electronic charges.

Electromagnetic cgs unit or abcoulomb.—10.0000 coulombs (absolute); 2.99796×10^{10} electrostatic cgs units or statcoulombs

Electronic charge.— 1.5921×10^{-20} electromagnetic cgs unit or abcoulomb; 1.5921×10^{-19} coulomb (absolute), 4.774×10^{-10} electrostatic cgs unit or statcoulomb

Electrostatic cgs unit or statcoulomb.— 3.33560×10^{-11} electromagnetic cgs unit or abcoulomb, 3.33560×10^{-10} coulomb (absolute), 2.0947×10^9 electronic charges

Electrostatic foot-pound second unit.— 1.1952×10^{-6} coulomb (absolute); 117.58 electromagnetic cgs units or abcoulombs; 3583.9 electrostatic cgs units or statcoulombs

Faraday.— 9.6500×10^4 coulombs (absolute); 9.6517×10^4 International coulombs; 2.89365×10^{14} electrostatic cgs units or statcoulombs

International coulomb.—0.999835 coulomb (absolute)

Statecoulomb.—*See* electrostatic cgs unit

RECIPROCAL QUANTITY [$\epsilon^{-\frac{1}{2}}m^{-\frac{1}{2}}l^{-\frac{3}{2}}t$]; [$\mu^{\frac{1}{2}}m^{-\frac{1}{2}}l^{-\frac{1}{2}}$]

x per **ampere-hour** = $2.7778 \times 10^{-4} x$ per coulomb (absolute)

x per **coulomb (absolute)** = 0.999835 x per International coulomb

UNITS AND CONVERSION FACTORS (Continued)

x per electromagnetic cgs unit = $0.1000\ x$ per coulomb (absolute)

x per electronic charge = $6\ 281 \times 10^{18}\ x$ per coulomb (absolute)

x per electrostatic cgs unit = $2\ 99796 \times 10^9\ x$ per coulomb (absolute)

x per faraday = $1\ 0363 \times 10^{-5}\ x$ per coulomb (absolute)

Current [$e^{\frac{1}{2}}m^{\frac{1}{2}}t^{-2}$]; [$\mu^{-\frac{1}{2}}m^{\frac{1}{2}}t^{-1}$]

Abampere.—*See* electromagnetic cgs unit.

Ampere (absolute).— 1.0363×10^{-5} faraday per second; 0.1 electromagnetic cgs unit or abampere; 1.000165 International amperes (U. S. 1948); 2.99796×10^9 electrostatic cgs units or statamperes

Electromagnetic cgs unit or abampere.—10.0000 amperes (absolute); $2\ 99796 \times 10^{10}$ electrostatic cgs units or statamperes.

Electrostatic cgs unit or statampere.— 3.33560×10^{-11} electromagnetic cgs unit or abampere; 3.33560×10^{-10} ampere (absolute)

Faraday per second— 9.6500×10^4 ampere (absolute).

International ampere (U. S. 1948).—0.999835 ampere (absolute).

International ampere (a)—Based on the deposit of 0.00111800 grams of silver per second; 0 99993 ampere (absolute)

International ampere (v)—As defined by the International ohm and volt, 0 99990 ampere (absolute)

International ampere (U S before 1911)—0.99916 International ampere (v)

International ampere (England before 1906)—0 99870 International ampere (v)

International ampere (England 1906-8).—0.99894 International ampere (v)

International ampere (England 1909-10)—0.99990 International ampere (v)

International ampere (France before 1911).—0.9998 International ampere (v)

International ampere (Germany before 1911).—0.99968 International ampere (v)

Statampere.—*See* electrostatic cgs unit

UNITS AND CONVERSION FACTORS (Continued)

Electrical Field Strength [$\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{-\frac{1}{2}}t^{-1}$]; [$\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-2}$]

Electrostatic cgs unit of potential per centimeter.—299.796 volts per centimeter (absolute).

Electrostatic cgs unit of potential per inch.—118.05 volts per centimeter (absolute).

Electromagnetic cgs unit of potential per centimeter.— 1.0000×10^{-8} volt per centimeter (absolute).

Electromagnetic cgs unit of potential per inch.— 3.9370×10^{-9} volt per centimeter (absolute).

Volt per inch.—0.39370 volt per centimeter.

Potential [$\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-1}$]; [$\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-2}$]

Abvolt.—See electromagnetic cgs unit.

Electromagnetic cgs unit or abvolt.— 3.33560×10^{-11} electrostatic cgs unit or statvolt; 1.0000×10^{-8} volt (absolute).

Electrostatic cgs unit or statvolt.—299.796 volts (absolute); 2.99796×10^{10} electromagnetic cgs units or abvolts.

International volt (U. S. 1948).—1.00033 volts (absolute)

International volt (a).—Based on the International ohm and ampere; 1.00045 volts (absolute).

International volt (v).—Based on the acceptance of the electromotive force of a Weston cell at 20°C as 1.0183 International volts; 1.00042 volts (absolute).

International volt (U. S. before 1911).—0.99916 International volt (v).

International volt (England before 1906).—0.99870 International volt (v).

International volt (England 1906-8).—0.99894 International volt (v).

International volt (England 1909-10).—0.99990 International volt (v).

International volt (Germany and France, before 1911).—0.99968 International volt (v).

Statvolts.—See electrostatic cgs unit.

Volt (absolute).—0.0033356 electrostatic cgs unit or statvolts; 0.999670 International volt (U. S. 1948); 1×10^8 electromagnetic cgs units or abvolts.

UNITS AND CONVERSION FACTORS (Continued)

Resistance [$\epsilon^{-1}l^{-1}t$]; [$\mu l t^{-1}$]

Abohm.—*See* electromagnetic cgs unit.

Board of trade unit (England 1903).—0.9984 International ohm.

Electromagnetic cgs unit or abohm.— 1.11263×10^{-21} electrostatic cgs unit or statohm; 1×10^{-15} megohm; 1.0000×10^{-9} ohm (absolute); 0.001 microhm.

Electrostatic cgs unit or statohm.— 8.98776×10^{11} ohms (absolute); 8.98776×10^{20} electromagnetic cgs units or abohms.

International ohm.—The resistance of a uniform column of mercury at 0°C , 106.300 centimeters long, having a mass of 14.4521 grams; 1.000495 ohms (absolute); 1.0016 board of trade unit (England 1903); 1.0630 Siemens unit.

International ohm (France before 1911).—0.9999 International ohm.

“Legal ohm” of 1884 (England).—0.99718 International ohm.

Megohm.— 1×10^6 ohms.

Microhm.— 1.11263×10^{-18} electrostatic cgs unit or statohm; 1×10^{-12} megohm; 1×10^{-6} ohm; 1000 electromagnetic cgs units or abohms.

Ohm (absolute).— 1.11263×10^{-12} electrostatic cgs unit or statohm; 1×10^{-6} megohm (absolute); 0.999505 International ohm; 1×10^6 microhms (absolute); 1×10^9 electromagnetic cgs units or abohms.

Siemens unit.—0.94073 International ohm.

Statohm.—*See* electrostatic cgs unit.

Volume Resistivity [$\epsilon^{-1}t$]; [$\mu l^2 t^{-1}$]

Electromagnetic cgs unit (abohm)-centimeter.— 9.99505×10^{-10} International ohm-centimeter; 0.001 microhm-centimeter; 0.0060153 ohm-mil*-foot.

Electrostatic cgs unit-centimeter.— 8.98776×10^{11} ohm-centimeters (absolute).

International annealed copper standard (20°C).—Volume resistivity of annealed copper; 1.7241 microhm-centimeters.

International ohm-centimeter.—1.000495 ohm-centimeters (absolute).

Microhm-centimeter.— 1.0000×10^{-6} ohm-centimeter; 0.3937 microhm-inch; 6.0153 ohm-mil*-foot; 1000 abohm-centimeters.

*The unit thus marked refers to the diameter of a wire of circular cross section.

UNITS AND CONVERSION FACTORS (Continued)

Microhm-inch.—2.5400 microhm-centimeters.

Ohm-centimeter (absolute).—0.999505 International ohm-centimeter; 1×10^6 microhm-centimeters.

Ohm inch.— 2.5400×10^6 microhm-centimeters.

Ohm-meter-millimeter².—100.0000 microhm-centimeters.

Ohm-meter-millimeter*.—78.540 microhm-centimeters.

Ohm-mil*-foot.—0.16624 microhm-centimeter; 166.24 electromagnetic cgs unit (abohm) centimeters.

Mass Resistivity [$\epsilon^{-1}ml^{-3}t$]; [$\mu ml^{-1}t^{-1}$]

Electromagnetic cgs unit.— 9.9951×10^{-6} International ohm-meter-gram.

Electrostatic cgs unit.— 8.9869×10^{15} International ohm-meter-gram.

International ohm-meter-gram.—1.000495 ohm (absolute)-meter-gram.

Ohm (absolute)-meter-gram.—0.999505 International ohm-meter-gram.

Ohm-centimeter-gram.—D† ohm-centimeter; 1.0000×10^4 ohm-meter-gram.

Ohm-mile-pound.— 1.7513×10^{-4} ohm-meter-gram.

Volume Conductivity [ϵt^{-1}]; [$\mu^{-1}l^{-2}t$]

Electromagnetic cgs unit or abmhos per centimeter cube (ohm⁻¹-centimeter⁻¹).—166.2 mhos per mil* foot; 1000 megmhos per centimeter cube; 1.000495×10^3 International ohm⁻¹-centimeter⁻¹.

Electrostatic cgs unit.— 1.11318×10^{-12} International ohm⁻¹-centimeter⁻¹.

International annealed copper standard (20°C).—0.5800 microhm⁻¹-centimeter⁻¹.

International ohm⁻¹-centimeter⁻¹.—0.999505 ohm⁻¹-centimeter⁻¹ (absolute).

Megmhos per centimeter cube.—0.001 abmhos per centi-

†D represents the density in grams per centimeter cubed.

*The unit thus marked refers to the diameter of a wire of circular cross section.

UNITS AND CONVERSION FACTORS (Continued)

meter cube; 0.1662 mhos per mil* foot; 2.540 megmhos per inch cube; 1 microhm⁻¹-centimeter⁻¹.

Megmhos per inch cube.—0.39370 megmhos per centimeter cube; 1 microhm⁻¹-inch⁻¹.

Mho centimeter cube.—1 ohm⁻¹-centimeter⁻¹.

Microhm⁻¹-centimeter⁻¹.—1.0000×10⁶ ohm⁻¹-centimeter⁻¹; 1 megmho per centimeter cube.

Microhm⁻¹-inch⁻¹.—0.39370 microhm⁻¹-centimeter⁻¹; 1 megmho per inch cube.

Ohm⁻¹-centimeter⁻¹ (absolute).—1 mho per centimeter cube; 1.000495 International ohm⁻¹-centimeter⁻¹.

Ohm⁻¹-inch⁻¹.—3.9370×10⁻⁷ microhm⁻¹-centimeter⁻¹.

Ohm⁻¹ (meter, millimeter*)⁻¹.—0.012732 microhm⁻¹-centimeter⁻¹.

Ohm⁻¹ (meter, millimeter²)⁻¹.—0.01000 microhm⁻¹-centimeter⁻¹.

Ohm⁻¹ (mil, foot)⁻¹.—6.0153 microhm⁻¹-centimeter⁻¹.

100% conductivity (20°C).—0.5800 microhm⁻¹-centimeter⁻¹.

Mass Conductivity [$\epsilon m^{-1} l^3 t^{-1}$]; [$\mu^{-1} m^{-1} l t$]

x per **electromagnetic cgs unit** = 1.000495×10⁵ x per International ohm-meter-gram.

x per **electrostatic cgs unit** = 1.1132×10⁻¹⁶ x per International ohm-meter-gram.

x per **International ohm-meter-gram** = 0.999505 x per ohm (absolute)-meter-gram.

x per **ohm (absolute)-meter-gram** = 1.000495 x per International ohm-meter-gram.

x per **ohm-centimeter-gram** = 1.0000×10⁻⁴ x per ohm-meter-gram.

x per **ohm-mile-pound** = 0.0057100 x per ohm-meter-gram.

Capacitance [ϵl]; [$\mu^{-1} l^{-1} t^2$]

Electromagnetic cgs unit or abfarad.—1.0000×10⁹ farads (absolute); 1×10¹⁵ microfarads; 8.98776×10²⁰ electrostatic cgs units or statfarads.

*The unit thus marked refers to the diameter of a wire of circular cross section.

UNITS AND CONVERSION FACTORS (Continued)

Electrostatic cgs unit (statfarad or centimeter).— 1.11263×10^{-21} electromagnetic cgs unit or abfarad; 1.11263×10^{-12} farad (absolute); 1.11263×10^{-6} microfarad.

Farad (absolute).— 1×10^{-9} electromagnetic cgs unit or abfarad; 1.000495 International farad; 1×10^6 microfarads; 8.98776×10^{11} electrostatic cgs units or statfarads.

International farad.—0.999505 farad (absolute).

Microfarad.— 1×10^{-15} electromagnetic cgs unit or abfarad; 1×10^{-6} farad; 8.98776×10^5 electrostatic cgs units or statfarads.

Micromicrofarad.— 1×10^{-12} farad.

Statfarad.—*See* electrostatic cgs unit.

Inductance [$\epsilon^{-1} l^{-1} t^2$]; [μl]

Abhenry.—*See* electromagnetic cgs unit.

Electromagnetic cgs unit (abhenry or centimeter).— 1.11263×10^{-21} electrostatic cgs unit or stathenry; 1.0000×10^{-9} henry (absolute); 1×10^{-6} millihenry.

Electrostatic cgs unit or stathenry.— 8.98776×10^{11} henry (absolute); 8.98776×10^{14} millihenries; 8.98776×10^{20} abhenries.

Henry (absolute).— 1.11263×10^{-12} electrostatic cgs unit or stathenry; 0.999505 International henry; 1000 millihenries; 1×10^9 electromagnetic cgs units or abhenries.

International henry.—1.000495 henry (absolute).

Millihenry.— 1.11263×10^{-15} stathenry; 0.001 henries; 1×10^6 abhenries.

Stathenry.—*See* electrostatic cgs unit.

Thermoelectric Units

THERMOELECTRIC POWER [$\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1} \theta^{-1}$]; [$\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2} \theta^{-1}$]

Electromagnetic cgs unit of potential per °C.—0.010000 microvolt per °C (absolute).

Electromagnetic cgs unit of potential per °F.—0.018000 microvolt per °C (absolute).

Electrostatic cgs unit of potential per °C.— 2.9986×10^8 microvolt per °C (absolute).

Electrostatic cgs unit of potential per °F.— 5.3975×10^8 microvolt per °C (absolute).

Microvolt per °F.—1.8000 microvolt per °C.

UNITS AND CONVERSION FACTORS (Continued)

PELTIER COEFFICIENT [$\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}$]; [$\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}$]

Calorie (15°C) per ampere-hour.—0.011625 joule per electromagnetic unit quantity.

Calorie (15°C) per coulomb.—41.850 joules per electromagnetic unit quantity.

Joule per ampere-hour (absolute).— 9.2636×10^{-14} joule per electrostatic unit quantity; 0.0027778 joule per electromagnetic unit quantity.

Joule per coulomb.—10.000 joules per electromagnetic unit quantity.

Joule per electron.— 6.2811×10^{19} joules per electromagnetic unit quantity.

Joule per faraday.— 1.0363×10^{-4} joule per electromagnetic unit quantity.

COEFFICIENT OF THOMSON EFFECT

[$\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1} \theta^{-1}$]; [$\mu^{\frac{1}{2}} m^{\frac{1}{2}} t^{-2} \theta^{-1}$]

Joule per coulomb per °F.—1.8000 joules per coulomb per °C

Joule per electromagnetic unit quantity per °F.—0.1800 joule per coulomb per °C.

Joule per electron per °C.— 6.2811×10^{18} joules per coulomb per °C.

Joule per electrostatic unit quantity per °C.— 2.9986×10^9 joules per coulomb per °C.

Joule per electrostatic unit quantity per °F.— 5.3975×10^9 joules per coulomb per °C.

Joule per faraday per °C.— 1.0363×10^{-5} joule per coulomb per °C.

Volt per °C.—1.0000 joule per coulomb per °C.

Piezoelectric Constant [$\epsilon^{\frac{1}{2}} m^{-\frac{1}{2}} l^{\frac{1}{2}} t$]; [$\mu^{-\frac{1}{2}} m^{-\frac{1}{2}} l^{-\frac{1}{2}} t^2$]

Coulomb per kilogram weight.—3057.7 electrostatic unit quantity per dyne.

Electromagnetic unit quantity per kilogram weight.— 3.0577×10^4 electrostatic unit quantity per dyne.

Electromagnetic unit quantity per pound weight— 6.7411×10^4 electrostatic unit quantity per dyne.

UNITS AND CONVERSION FACTORS (Continued)

Electron per kilogram weight.— 4.868×10^{-16} electrostatic unit quantity per dyne.

Electrostatic unit quantity per kilogram weight.— 1.0197×10^{-6} electrostatic unit quantity per dyne.

Electrostatic unit quantity per pound weight.— 2.2481×10^{-6} electrostatic unit quantity per dyne.

Faraday per kilogram weight.— 2.9507×10^8 electrostatic unit quantity per dyne.

Flux of Magnetic Induction; Magnetic Flux; Pole Strength

$$[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}}]; [\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-1}]$$

Electromagnetic cgs unit (unit pole).— 4π maxwell (absolute).

Electrostatic cgs unit.— 2.99796×10^{10} maxwells (absolute).

International maxwell (U. S. 1948).—1.00033 maxwells (absolute).

Kilolines.—1000 maxwells.

Line.—1.0000 maxwell (absolute).

Maxwell (absolute).— 3.3356×10^{-11} electrostatic cgs unit; 0.999670 International maxwell; 1.0000 line.

Megaline.— 1×10^6 maxwells.

Volt-second.— 1×10^8 maxwells.

Weber.—1 volt-second; 1×10^8 maxwells.

Magnetic Field Intensity [$\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}$]; [$\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}$]

The name oersted was given to the unit of field intensity formerly known and given below as the gauss, by the International Electrotechnical Commission in 1930.

Ampere-turn per centimeter.—1.2566 gauss.

Ampere-turn per inch.—0.49474 gauss.

Electromagnetic cgs unit.—1.0000 gauss (absolute).

Electrostatic cgs unit.— 3.33560×10^{-11} gauss (absolute).

Gamma (γ).— 1.0000×10^{-5} gauss.

Gauss (absolute).—0.79580 ampere-turn per centimeter; 1 electromagnetic cgs unit; 1 gilbert per centimeter; 1.000165 International gauss; 2.0213 ampere-turns per inch; 6.452 lines per square inch; 1×10^5 gamma (γ); 2.99796×10^{10} electrostatic cgs units.

UNITS AND CONVERSION FACTORS (Continued)

Gilbert per centimeter.—1.0000 gauss; 2.021 ampere-turns per inch.

International gauss (U. S. 1948).—0.999835 gauss (absolute).

Lines per square centimeter.—1 gauss.

Lines per square inch.—0.1550 gauss.

Magnetomotive Force; Magnetic Potential

$$[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}]; [\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$$

Abampere-turn.—10 ampere-turns; 12.566 gilberts.

Ampere-turn.—0.1 abampere-turn; 1.2566 gilberts.

Electromagnetic cgs unit.—1.00000 gilbert (absolute).

Electrostatic cgs unit.— 3.33560×10^{-11} gilbert (absolute).

Gilbert (absolute).—0.07958 abampere-turn; 0.7958 ampere-turn; 1.000165 International gilbert.

Reluctance $[\epsilon l t^{-2}]; [\mu^{-1} l^{-1}]$

Since 1930 oersted has been used as the name for magnetic field intensity. The oersted as used below is equivalent to one ampere-turn per maxwell.

Electromagnetic cgs unit.—1.0000 oersted (absolute).

Electrostatic cgs unit.— 1.1122×10^{-21} oersted (absolute).

International oersted.—0.999505 oersted (absolute).

Oersted (absolute).—1.000495 International oersted.

Magnetic Induction; Intensity of Magnetization

$$[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{3}{2}}]; [\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$$

Since 1930 the name gauss has been used for unit magnetic induction, one maxwell per square centimeter.

Electromagnetic cgs unit.—1.00000 maxwell (absolute) per square centimeter.

Electrostatic cgs unit.— 2.9986×10^{10} maxwells (absolute) per square centimeter.

International maxwell per square centimeter.—1.00033 maxwells (absolute) per square centimeter.

UNITS AND CONVERSION FACTORS (Continued)

Line per square centimeter.—1.00000 maxwell per square centimeter.

Line per square inch.—0.15500 maxwell per square centimeter.

Maxwell per square centimeter (absolute).—0.999670 International maxwell per square centimeter.

Maxwell per square inch.—0.15500 maxwell per square centimeter.

Dielectric Constant; Electrical Inductivity; Magnetic Permeability; Susceptibility.

Electromagnetic cgs unit.— 8.9916×10^{20} electrostatic cgs units.

Foot-pound-second electromagnetic unit.—0.0010764 electromagnetic cgs unit; 9.6784×10^{17} electrostatic cgs units.

Foot-pound-second-electrostatic unit.—1.0000 electrostatic cgs unit.

Magnetic Effects

COEFFICIENT OF LEDUC EFFECT [$\epsilon^{-\frac{1}{2}} m^{-\frac{1}{2}} l^{-\frac{1}{2}} t^2$]; [$\mu^{\frac{1}{2}} m^{-\frac{1}{2}} l^{\frac{1}{2}} t$]

x centimeters per ampere-turn = 0.79577 x per gauss.

x centimeters per gilbert = 1.0000 x per gauss.

x per electrostatic cgs unit = 2.9986×10^{10} x per gauss.

x inches per ampere-turn = 2.0213 x per gauss.

COEFFICIENT OF HALL EFFECT [$\epsilon^{-\frac{1}{2}} m^{-\frac{1}{2}} l^{-\frac{1}{2}} t^3$]; [$\mu^{\frac{1}{2}} m^{-\frac{1}{2}} l^{\frac{1}{2}}$]

Electrostatic cgs unit.— 2.6962×10^{31} electromagnetic cgs unit.

Volt centimeter per ampere gauss (absolute).— 1.0000×10^9 electromagnetic cgs unit.

Volt inch per ampere gauss (absolute).— 2.5400×10^9 electromagnetic cgs unit.

COEFFICIENT OF ETTINGHAUSEN EFFECT

[$\epsilon^{-1} m^{-1} l^{-1} t^4 \theta$]; [$\mu m^{-1} l t^2 \theta$]

°C centimeter per ampere gauss (absolute).—10.000 °C centimeter per electromagnetic cgs unit.

UNITS AND CONVERSION FACTORS (Continued)

°C centimeter per electrostatic cgs unit.— 8.9916×10^{20} °C centimeter per electromagnetic cgs unit.

°F inch per ampere gauss (absolute).— 45.720 °C centimeter per electromagnetic cgs unit.

COEFFICIENT OF NERNST EFFECT [$\epsilon^{-1} t \theta^{-1}$]; [$\mu l^2 t^{-1} \theta^{-1}$]

Electrostatic cgs unit per °C.— 8.9916×10^{20} electromagnetic cgs unit per °C.

Volt per gauss °C (absolute).— 1.0000×10^8 electromagnetic cgs unit per °C.

Volt per gauss °F (absolute).— 1.8000×10^8 electromagnetic cgs unit per °C.

VERDET'S CONSTANT [$\epsilon^{-\frac{1}{2}} m^{-\frac{1}{2}} l^{-\frac{1}{2}} t^2$]; [$\mu^{\frac{1}{2}} m^{-\frac{1}{2}} l^{-\frac{1}{2}} t$]

Minute per ampere-turn.— 1.2566 minute per electromagnetic cgs unit.

Minute per gilbert.— 1.0000 minute per electromagnetic cgs unit.

Radian per gilbert.— 3437.7 minute per electromagnetic cgs unit.

RELATIONS OF ELECTRICAL UNITS

1 ohm	= 10^9 electromagnetic	= $1/9 \times 10^{-11}$ electrostatic
1 volt	= 10^8 electromagnetic	= $1/3 \times 10^{-2}$ electrostatic
1 ampere	= 10^{-1} electromagnetic	= 3×10^9 electrostatic
1 coulomb	= 10^{-1} electromagnetic	= 3×10^9 electrostatic
1 farad	= 10^{-9} electromagnetic	= 9×10^{11} electrostatic
1 farad	= 1,000,000 microfarads	
1 henry	= 10^9 electromagnetic	= $1/9 \times 10^{-11}$ electrostatic

VALUE OF THE GAS CONSTANT *R* FOR VARIOUS UNITS

8.3144×10^7 ergs per °C per mole

1.9865 calories (15°) per °C per mole

Units of pressure	Units of volume.	<i>R</i> per gram molecule.
Atmospheres	Volume at 0° C.	0.003662
Atmospheres.....	cm ³	82.07
Atmospheres.....	liters	0.08207
Atmospheres.....	cubic meters	
Dynes per cm ² [barye]..	cm ³	8.3156×10^7
Kilograms per m ² [<i>g</i> = 980.6].....	cm ³	8.48×10^5
		<i>R</i> per lb. molecule.
Pounds per sq.in.....	cu.in.	18510.
Pounds per sq.in.....	cu.ft.	10.71
Atmospheres.....	cu.in.	1260.
Atmospheres.....	cu.ft.	0.729

FACTORS FOR CONVERSION OF ENERGY UNITS

(From Perkins' Introduction to General Thermodynamics, John Wiley & Sons, publishers, by permission.)

	Gram-calories (4° C)	B.T.U.*	Joules	Foot- pounds	Kilogr.- meters	Liter-atmos.	Cu.ft.-atmos.	Foot- poundals	Horse-power hours
Gram-calorie.....	1.	3.988×10^{-3}	4.185	3.087	.4267	4.130×10^{-2}	1.459×10^{-3}	99.31	1.5591×10^{-6}
B.T.U.....	252.	1	1055.	777.9	107.5	10.41	.3676	25030	3.929×10^{-4}
Joule.....	.2389	9.482×10^{-4}	1.	.73756	.1019	9.869×10^{-3}	3.485×10^{-4}	23.73	3.725×10^{-7}
Foot-pound.....	3240	1.286×10^{-3}	1.356	1.	.13826	1.3381×10^{-2}	4.7253×10^{-4}	32.174	5.0505×10^{-7}
Kilogr.-meter....	2.343	9.298×10^{-3}	9.806	7.2327	1.	9.678×10^{-2}	3.4177×10^{-3}	232.7	3.6529×10^{-6}
Liter-atmos.....	24.21	9.607×10^{-2}	101.32	74.733	10.333	1.	3.5319×10^{-2}	2403.8	3.7734×10^{-5}

* At temp. of maximum density.

CONVERSION OF PRESSURE UNITS

(From Perkins' Introduction to General Thermodynamics, John Wiley & Sons, publishers, by permission.)

	Dynes per sq. cm	Grams per sq. cm	Kilo. per sq. meter	Mm of mercury	Atmospheres	Lbs. per sq. in.	Lbs. per sq. ft.
Dynes per sq. centimeter...	1.	1.0198×10^{-3}	1.0198×10^{-2}	7.5010×10^{-4}	9.8697×10^{-7}	1.4504×10^{-6}	2.0887×10^{-3}
Gram per sq. centimeter...	980.6	1	10	7.3551×10^{-1}	9.6777×10^{-4}	1.4223×10^{-2}	2.0481
Kilogram per sq. meter...	98.06	10^{-1}	1	7.3551×10^{-2}	9.6777×10^{-5}	1.4223×10^{-3}	2.0481×10^{-1}
Millimeter of mercury.....	1332.	1.3595	13.595	1	1.3158×10^{-3}	1.9337×10^{-2}	2.7845
Atmosphere.....	1013200.	1033.3	10333	760	1	14.696	2116.32
Pound per square inch.....	68944	70.308	703.12	51.715	6.8046×10^{-2}	1	144
Pound per square foot.....	478.78	4.883×10^{-1}	4.883	3.5912×10^{-1}	4.7252×10^{-4}	6.9445×10^{-3}	1

In the two tables above the numbers show the value of the energy or pressure unit named at the left in the units named at the top. For example, 1 gram-calorie is equivalent to 3.968×10^{-3} B.T.U.

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10

Length

COMPARISON OF UNITS

INCHES	MILLI- METERS	INCHES	CENTI- METERS	FEET	METERS	U. S. YARDS	METERS	U. S. MILES	KILO- METERS
0.03937 =	1	0.3937 =	1	1	= 0.304801	1	= 0.914402	0.62137 =	1
0.07874 =	2	0.7874 =	2	2	= 0.609601	1	= 1.093611	1.24274 =	1.60935
0.11811 =	3	1 =	2.54001	3	= 0.914402	2	= 1.828804	1.86411 =	2
0.15748 =	4	1.1811 =	3	3.28083 =	1	2	= 2.187222 =		3
0.19685 =	5	1.5748 =	4	4	= 1.219202	3	= 2.743205		3.21869
0.23622 =	6	1.9685 =	5	5	= 1.524003	3	= 3.280833 =	2.48548 =	4
0.27559 =	7	2 =	5.08001	6	= 1.828804	4	= 3.657607	3.10685 =	4.82804
0.31496 =	8	2.3622 =	6	6.56167 =	2	4	= 4.374444 =	3.72822 =	5
0.35433 =	9	2.7559 =	7	7	= 2.133604	5	= 4.572009		6
1 =	25.4001	3 =	7.62002	8	= 2.438405	5	= 5.486411	4 =	6.43739
2 =	50.8001	3.1496 =	8	9	= 2.743205	6	= 6.561667 =	4.34959 =	7
3 =	76.2002	3.5433 =	9	9.84250 =	3	6	= 8.229616	4.97096 =	8
4 =	101.6002	4 =	10.16002	13.12333 =	4	7	= 9.842500 =	5 =	8.04674
5 =	127.0003	5 =	12.70003	16.40417 =	5	7	= 7.315215	5.59233 =	9
6 =	152.4003	6 =	15.24003	19.68500 =	6	8	= 8.748889 =	6 =	9.65608
7 =	177.8004	7 =	17.78004	22.96583 =	7	8	= 9.842500 =	7 =	11.26543
8 =	203.2004	8 =	20.32004	26.24667 =	8	9	= 10.936111 =	8 =	12.87478
9 =	228.6005	9 =	22.86005	29.52750 =	9	9.842500 =		9 =	14.48412

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Area

COMPARISON OF UNITS (Continued)

SQUARE INCHES	SQUARE MILLI- METERS	SQUARE INCHES	SQUARE CENTI- METERS	SQUARE FEET	SQUARE METERS	SQUARE YARDS	SQUARE METERS	SQUARE MILES	SQUARE KILO- METERS
0.00155 =	1	0.1550 =	1	1	= 0.09290	1	= 0.8361	0.3861 =	1
0.00310 =	2	0.3100 =	2	2	= 0.18581	1.1960 =	1	0.7722 =	2
0.00465 =	3	0.4650 =	3	3	= 0.27871	2	= 1.6723	1	2.5900
0.00620 =	4	0.6200 =	4	4	= 0.37161	2.3920 =	2	1.1583 =	3
0.0075 =	5	0.7750 =	5	5	= 0.46452	3	2.5084	1.5444 =	4
0.00930 =	6	0.9300 =	6	6	= 0.55742	3.5880 =	3	1.9305 =	5
0.01085 =	7	1	6.452	7	= 0.65032	4	3.3445	2	5.1800
0.01240 =	8	1.0850 =	7	8	= 0.74323	4.7839 =	4	2.3166 =	6
0.01395 =	9	1.2400 =	8	9	= 0.83613	5	4.1807	2.7027 =	7
1 =	645.16	1.3950 =	9	10.764 =	1	5.9799 =	5	3	7.7700
2 =	1,290.33	2 =	12.903	21.528 =	2	6	5.0168	3.0888 =	8
3 =	1,935.49	3 =	19.355	32.292 =	3	7	5.8529	3.4749 =	9
4 =	2,580.65	4 =	25.807	43.055 =	4	7.1759 =	6	4	10.3600
5 =	3,225.81	5 =	32.258	53.819 =	5	8	6.6890	5	12.9500
6 =	3,870.98	6 =	38.710	64.583 =	6	8.3719 =	7	6	15.5400
7 =	4,516.14	7 =	45.161	75.347 =	7	9	7.5252	7	18.1300
8 =	5,161.30	8 =	51.613	86.111 =	8	9.5679 =	8	8	20.7200
9 =	5,806.46	9 =	58.065	96.875 =	9	10.7639 =	9	9	23.3100

COMPARISON OF UNITS (Continued)

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Volume							AREA—Continued		
CUBIC INCHES	CUBIC MILLI-METERS	CUBIC INCHES	CUBIC CENTI-METERS	CUBIC FEET	CUBIC METERS	CUBIC YARDS	CUBIC METERS	ACRES	HECTARES
0.000061 =	1	0.0610 =	1	1	= 0.02832	1	= 0.7646	1	= 0.4047
0.000122 =	2	0.1220 =	2	2	= 0.05663	1.3079	= 1	2	= 0.8094
0.000183 =	3	0.1831 =	3	3	= 0.08495	2	= 1.5291	2.471	= 1
0.000244 =	4	0.2441 =	4	4	= 0.11327	2.6159	= 2	3	= 1.2141
0.000305 =	5	0.3051 =	5	5	= 0.14159	3	= 2.2937	4	= 1.6187
0.000366 =	6	0.3661 =	6	6	= 0.16990	3.9238	= 3	4.942	= 2
0.000427 =	7	0.4272 =	7	7	= 0.19822	4	= 3.0582	5	= 2.0234
0.000488 =	8	0.4882 =	8	8	= 0.22654	5	= 3.8228	6	= 2.4281
0.000549 =	9	0.5492 =	9	9	= 0.25485	5.2318	= 4	7	= 2.8328
1 =	16,387.2	1	= 16.3872	35.314	= 1	6	= 4.5874	7.413	= 3
2 =	32,774.3	2	= 32.7743	70.629	= 2	6.5397	= 5	8	= 3.2375
3 =	49,161.5	3	= 49.1615	105.943	= 3	7	= 5.3519	9	= 3.6422
4 =	65,548.6	4	= 65.5486	141.258	= 4	7.8477	= 6	9.884	= 4
5 =	81,935.8	5	= 81.9358	176.572	= 5	8	= 6.1165	12.355	= 5
6 =	98,323.0	6	= 98.3230	211.887	= 6	9	= 6.8810	14.826	= 6
7 =	114,710.1	7	= 114.7101	247.201	= 7	9.1556	= 7	17.297	= 7
8 =	131,097.3	8	= 131.0973	282.516	= 8	10.4635	= 8	19.768	= 8
9 =	147,484.5	9	= 147.4845	317.830	= 9	11.7715	= 9	22.239	= 9

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10 (Continued)

Capacity

The following equivalents are computed on the basis 1 liter = 1.000027 cubic decimeters.

MILLI-LITERS	U. S. LIQUID OUNCES	MILLI-LITERS	U. S. APOTHECARIES' DRAMS	U. S. APOTHECARIES' SCRUPLES	MILLI-LITERS	U. S. LIQUID QUARTS	LITERS	U. S. LIQUID GALLONS	LITERS
1	= 0.03382	1	= 0.2705	0 8116	= 1	1	= 0 94633	0 26418	= 1
2	= 0.06763	2	= 0 5410	1 6231	= 2	2	= 1 89267	0 52836	= 2
3	= 0.10144	3	= 0 8116	2 4347	= 3	3	= 2 83900	0 79253	= 3
4	= 0.13526	4	= 1 0821	3 2462	= 4	4	= 3 78533	1 1	= 3 78533
5	= 0.16907	5	= 1 3526	4 0578	= 5	5	= 4 73167	1 05671	= 4
6	= 0.20289	6	= 1 6231	4 8693	= 6	6	= 5 67800	1 32089	= 5
7	= 0.23670	7	= 1 8936	5 6809	= 7	7	= 6 62433	1 58507	= 6
8	= 0.27052	8	= 2 1641	6 4924	= 8	8	= 7 57066	1 84924	= 7
9	= 0 30433	9	= 2 4347	7 3040	= 9	9	= 8 51039	2 11342	= 8
29.573	= 1	3	= 2 1641	6 4924	= 8	7	= 7 57066	2 11342	= 8
59.146	= 2	6	= 2 4347	7 3040	= 9	8	= 8 51039	2 37760	= 9
88.719	= 3	11	= 3 6520	7 3040	= 9	8	= 8 51039	3 3	= 11 35600
118.292	= 4	14	= 4 8693	7 3040	= 9	9	= 8 51039	4 4	= 15 14133
147.864	= 5	18	= 5 6809	7 3040	= 9	9	= 8 51039	5 5	= 18 92666
177.437	= 6	22	= 6 4924	7 3040	= 9	9	= 8 51039	6 6	= 22 71199
207.010	= 7	25	= 7 3040	7 3040	= 9	9	= 8 51039	7 7	= 26 49732
236.583	= 8	29	= 8 51039	7 3040	= 9	9	= 8 51039	8 8	= 30 28266
266.156	= 9	33	= 9 8576	7 3040	= 9	9	= 8 51039	9 9	= 34 06799

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10 (Continued)

Capacity

The following equivalents are computed on the basis 1 liter = 1.000027 cubic decimeters

U. S. DRY QUARTS	LITERS	U. S. PECKS	LITERS	DEKA- LITERS	U. S. PECKS	U. S. BUSHEL S	HECTO- LITERS	U. S. BUSHEL S PER ACRE	HECTO LITERS PER HECTARE
0 9081 = 1		0.11351 = 1	0.8810	1	1	1	= 0.35238	1	= 0 87078
1 1812 = 2		0.22703 = 2	1 7620	2	= 1.1351	2	= 0.70477	1 14840	= 1
1 8162 = 2		0.34054 = 3	2	2	= 2	2	837819 = 1	2	= 1.74156
2 = 2.2024		0.45405 = 4			= 2.2703	3	= 1.05715	2 29680	= 2
2 7243 = 3		0.56756 = 5	2 6429		= 3	4	= 1.40953	3	= 2.61233
3 = 3.3036		0.68108 = 6	3		= 3.4054	5	= 1.76192	3 44519	= 3
3 6324 = 4		0.79459 = 7	3 5238		= 4	5	675638 = 2	4	= 3.48311
4 = 4.4048		0.90810 = 8	4 4048		= 4.5405	6	= 2.11430	4 59359	= 4
4 5405 = 5		1 = 8.80958			= 5	7	= 2.46668	5	= 4.35389
5 = 5.5060		1.02161 = 9	5		= 5.6756	8	= 2.81907	5 74199	= 5
5 4487 = 6		= 17.61916	5 2857		= 6	8	513457 = 3	6	= 5.22467
6 = 6.6072		= 26.42875	6		= 6.8108	9	= 3.17145	6 89039	= 6
6 3568 = 7		= 35.23833	6 1667		= 7	11	351276 = 4	7	= 6.09545
7 = 7.7084		= 44.04791	7		= 7.9459	14	189095 = 5	8	= 6.96622
7 2649 = 8		= 52.85749	7 0477		= 8	17	026914 = 6	8 03879	= 7
8 = 8.8096		= 61.66708	7 9286		= 9	19	864733 = 7	9	= 7.83700
8 1730 = 9		= 70.47666	8		= 9.0810	22	702552 = 8	9 18719	= 8
9 = 9.9108		= 79.28624	9		= 10.2161	25	540371 = 9	10 33558	= 9

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Weight (or Mass)

COMPARISON OF UNITS (Continued)

GRAINS	GRAMS	AVOIRDU- POIS OUNCES	GRAMS	TROY OUNCES	GRAMS	AVOIRDU- POIS POUNDS	KILO- GRAMS	TROY POUNDS	KILO- GRAMS
1	= 0.06480	0.03527	1	0.03215	1	1	= 0.45359	1	= 0.37324
2	= 0.12960	0.07055	2	0.06430	2	2	= 0.90718	2	= 0.74648
3	= 0.19440	0.10582	3	0.09645	3	2.20462	= 1	2.67923	= 1
4	= 0.25920	0.14110	4	0.12860	4	3	= 1.36078	3	= 1.11973
5	= 0.32399	0.17637	5	0.16075	5	4	= 1.81437	4	= 1.49297
6	= 0.38879	0.21164	6	0.19290	6	4.40924	= 2	5	= 1.86621
7	= 0.45359	0.24692	7	0.22506	7	5	= 2.26796	5.35846	=
8	= 0.51839	0.28219	8	0.25721	8	6	= 2.72155	6	= 2.23945
9	= 0.58319	0.31747	9	0.28936	9	6.61387	= 3	7	= 2.61269
15.4324	= 1	1	= 28.3495	1	= 31.10348	7	= 3.17515	8	= 2.98593
30.8647	= 2	2	= 56.6991	2	= 62.20696	8	= 3.62874	8.03769	=
46.2971	= 3	3	= 85.0486	3	= 93.31044	8.81849	= 4	9	= 3.35918
61.7294	= 4	4	= 113.3981	4	= 124.41392	9	= 4.08233	10.71691	= 4
77.1618	= 5	5	= 141.7476	5	= 155.51740	11.02311	= 5	13.39614	= 5
92.5941	= 6	6	= 170.0972	6	= 186.62088	13.22773	= 6	16.07537	= 6
108.0265	= 7	7	= 198.4467	7	= 217.72437	15.43236	= 7	18.75460	= 7
123.4589	= 8	8	= 226.7962	8	= 248.82785	17.63698	= 8	21.43383	= 8
138.8912	= 9	9	= 255.1457	9	= 279.93133	19.84160	= 9	24.11306	= 9

TONS AND POUNDS

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES
From 1 to 10 Units

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
0.00036735	0.00041143	0.00037324	0.37324	0.822857	1. 21528
0.00044643	0.00050000	0.00045359	0.45359	1.	1. 21528
0.00073469	0.00082286	0.00074648	0.74648	1.64571	2. 43056
0.00089286	0.00100000	0.00090718	0.90718	2.	2. 43056
0.00098421	0.00110231	0.00100000	1.	2.20462	2. 67923
0.00110204	0.00123429	0.00111973	1.11973	2.46857	3.
0.00133929	0.00150000	0.00136078	1.36078	3.	3. 64583
0.00146939	0.00164571	0.00149297	1.49297	3.29143	4.
0.00178571	0.00200000	0.00181437	1.81437	4.	4. 86111
0.00183673	0.00205714	0.00186621	1.86621	4.11429	5.
0.00196841	0.00220462	0.00200000	2.	4.40924	5. 35846
0.00220408	0.00246857	0.00223945	2.23945	4.93714	6.
0.0023214	0.00250000	0.00226796	2.26796	5.	6. 07639
0.00257143	0.00288000	0.00261269	2.61269	5.76000	7.
0.00267857	0.00300000	0.00272155	2.72155	6.	7. 29167
0.00293878	0.00329143	0.00298593	2.98593	6.58286	8.
0.00295262	0.00330693	0.00300000	3.	6.61387	8. 03769
0.00312500	0.00350000	0.00317515	3.17515	7.	8. 50694
0.00330612	0.00370286	0.00335918	3.35918	7.40571	9.
0.00357143	0.00400000	0.00362874	3.62874	8.	9. 72222

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES (Continued)

From 1 to 10 Units

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
0.00393683	0.00440924	0.00400000	4.	8.81849	10.71691
0.00401786	0.00450000	0.00408233	4.08233	9.	10.93750
0.00492103	0.00551156	0.00500000	5.	11.0231	13.39614
0.00590524	0.00661387	0.00600000	6.	13.2277	16.07537
0.00688944	0.00771618	0.00780000	7.	15.4324	18.75460
0.00787365	0.00881849	0.00800000	8.	17.6370	21.43383
0.00885786	0.00992080	0.00900000	9.	19.8416	24.11306
0.89287	1.	0.90718	907.18	2,000.	2,430.56
0.98421	1.10231	1.	1,000.	2,204.62	2,679.23
1.	1.12000	1.01605	1,016.05	2,240.00	2,722.22
1.78571	2.	1.81437	1,814.37	4,000.00	4,861.11
1.96841	2.20462	2.	2,000.00	4,409.24	5,358.46
2.	2.24000	2.03209	2,032.09	4,480.00	5,444.44
2.67857	3.	2.72155	2,721.55	6,000.00	7,291.67
2.95262	3.30693	3.	3,000.00	6,613.87	8,037.69
3.	3.36000	3.04814	3,048.14	6,720.00	8,166.67
3.57143	4.	3.62874	3,628.74	8,000.00	9,722.22
3.93683	4.40924	4.	4,000.00	8,818.49	10,716.91
4.	4.48000	4.06419	4,064.19	8,960.00	10,888.89
4.46429	5.	4.53592	4,535.92	10,000.00	12,152.78

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE
UNITED STATES (Continued)

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
4. 92103	5. 51156	5.	5,000.00	11,023.11	13,396.14
5. 35714	5. 60000	5. 08024	5,080.24	11,200.00	13,611.11
5. 90524	6. 61387	5. 44311	5,443.11	12,000.00	14,583.33
6.	6. 61387	6.	6,000.00	13,227.73	16,075.37
	6. 72000	6. 09623	6,096.28	13,440.00	16,333.33
6. 25000	7.	6. 35029	6,350.29	14,000.00	17,013.89
6. 88944	7. 71618	7.	7,000.00	15,432.36	18,754.60
7. 14286	7. 84000	7. 11232	7,112.32	15,680.00	19,055.56
7. 87365	8. 81849	7. 25748	7,257.48	16,000.00	19,444.44
	8.	8.	8,000.00	17,636.98	21,433.83
8.	8. 96000	8. 12838	8,128.38	17,920.00	21,777.78
8. 03571	9.	8. 16466	8,164.66	18,000.00	21,875.00
8. 85786	9. 92080	9.	9,000.00	19,841.60	24,113.06
9.	10. 08000	9. 14442	9,144.42	20,160.00	24,500.00

LENGTHS — CENTIMETERS TO INCHES

0.1 to 100 Units

1 centimeter = 0.393700 inches

The values found in the body of the table give, in inches, the lengths indicated in centimeters at the top and side.

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.39370	0.03937	0.07874	0.11811	0.15748	0.19685	0.23622	0.27559	0.31496	0.35433
1	0.78740	0.43307	0.47244	0.51181	0.55118	0.59055	0.62992	0.66929	0.70866	0.74803
2	1.1811	0.82677	0.86614	0.90551	0.94488	0.98425	1.0236	1.0630	1.1024	1.1417
3	1.5748	1.2205	1.2598	1.2992	1.3386	1.3780	1.4173	1.4567	1.4961	1.5354
4	1.9685	1.6142	1.6535	1.6929	1.7323	1.7717	1.8110	1.8504	1.8898	1.9291
5	2.3622	2.0079	2.0472	2.0866	2.1260	2.1654	2.2047	2.2441	2.2835	2.3228
6	2.7559	2.4016	2.4409	2.4803	2.5197	2.5591	2.5984	2.6378	2.6772	2.7165
7	3.1496	2.7953	2.8346	2.8740	2.9134	2.9528	2.9921	3.0315	3.0709	3.1102
8	3.5433	3.1890	3.2283	3.2677	3.3071	3.3465	3.3858	3.4252	3.4646	3.5039
9		3.5827	3.6220	3.6614	3.7008	3.7402	3.7795	3.8189	3.8583	3.8976

CENTIMETERS TO INCHES (Continued)

LENGTHS—CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
10	3.9370	3.9764	4.0158	4.0551	4.0945	4.1339	4.1732	4.2126	4.2520	4.2913
11	4.3307	4.3701	4.4094	4.4488	4.4882	4.5276	4.5669	4.6063	4.6457	4.6850
12	4.7244	4.7638	4.8031	4.8425	4.8819	4.9213	4.9606	5.0000	5.0394	5.0787
13	5.1181	5.1575	5.1968	5.2362	5.2756	5.3150	5.3543	5.3937	5.4331	5.4724
14	5.5118	5.5512	5.5905	5.6299	5.6693	5.7087	5.7480	5.7874	5.8268	5.8661
15	5.9055	5.9449	5.9842	6.0236	6.0630	6.1024	6.1417	6.1811	6.2205	6.2598
16	6.2992	6.3386	6.3779	6.4173	6.4567	6.4961	6.5354	6.5748	6.6142	6.6535
17	6.6929	6.7323	6.7716	6.8110	6.8504	6.8898	6.9291	6.9685	7.0079	7.0472
18	7.0866	7.1260	7.1653	7.2047	7.2441	7.2835	7.3228	7.3622	7.4016	7.4409
19	7.4803	7.5197	7.5590	7.5984	7.6378	7.6772	7.7165	7.7559	7.7953	7.8346
20	7.8740	7.9134	7.9527	7.9921	8.0315	8.0709	8.1102	8.1496	8.1890	8.2283
21	8.2677	8.3071	8.3464	8.3858	8.4252	8.4646	8.5039	8.5433	8.5827	8.6220
22	8.6614	8.7008	8.7401	8.7795	8.8189	8.8583	8.8976	8.9370	8.9764	9.0157
23	9.0551	9.0945	9.1338	9.1732	9.2126	9.2520	9.2913	9.3307	9.3701	9.4094
24	9.4488	9.4882	9.5275	9.5669	9.6063	9.6457	9.6850	9.7244	9.7638	9.8031
25	9.8425	9.8819	9.9212	9.9606	10.0000	10.039	10.079	10.118	10.157	10.197
26	10.236	10.275	10.315	10.354	10.394	10.433	10.472	10.512	10.551	10.591
27	10.630	10.669	10.709	10.748	10.787	10.827	10.866	10.905	10.945	10.984
28	11.024	11.063	11.102	11.142	11.181	11.220	11.260	11.299	11.339	11.378
29	11.417	11.457	11.496	11.535	11.575	11.614	11.654	11.693	11.732	11.772

LENGTHS — CENTIMETERS TO INCHES (Continued)

CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
30	11.811	11.850	11.890	11.929	11.968	12.008	12.047	12.087	12.126	12.165
31	12.205	12.244	12.283	12.323	12.362	12.402	12.441	12.480	12.520	12.559
32	12.598	12.638	12.677	12.717	12.756	12.795	12.835	12.874	12.914	12.953
33	12.992	13.031	13.071	13.110	13.150	13.189	13.228	13.268	13.307	13.346
34	13.386	13.425	13.465	13.504	13.543	13.583	13.622	13.661	13.701	13.740
35	13.780	13.819	13.858	13.898	13.937	13.976	14.016	14.055	14.094	14.134
36	14.173	14.213	14.252	14.291	14.331	14.370	14.409	14.449	14.488	14.528
37	14.567	14.606	14.646	14.685	14.724	14.764	14.803	14.842	14.882	14.921
38	14.961	15.000	15.039	15.079	15.118	15.157	15.197	15.236	15.276	15.315
39	15.354	15.394	15.433	15.472	15.512	15.551	15.591	15.630	15.669	15.709
40	15.748	15.787	15.827	15.866	15.905	15.945	15.984	16.024	16.063	16.102
41	16.142	16.181	16.220	16.260	16.299	16.339	16.378	16.417	16.457	16.496
42	16.535	16.575	16.614	16.654	16.693	16.732	16.772	16.811	16.850	16.890
43	16.929	16.968	17.008	17.047	17.087	17.126	17.165	17.205	17.244	17.283
44	17.323	17.362	17.402	17.441	17.480	17.520	17.559	17.598	17.638	17.677
45	17.717	17.756	17.795	17.835	17.874	17.913	17.953	17.992	18.031	18.071
46	18.110	18.150	18.189	18.228	18.268	18.307	18.346	18.386	18.425	18.465
47	18.504	18.543	18.583	18.622	18.661	18.701	18.740	18.779	18.819	18.858
48	18.898	18.937	18.976	19.016	19.055	19.094	19.134	19.173	19.213	19.252
49	19.291	19.331	19.370	19.409	19.449	19.488	19.528	19.567	19.606	19.646

LENGTHS—CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
50	19.685	19.724	19.764	19.803	19.842	19.882	19.921	19.961	20.000	20.039
51	20.079	20.118	20.157	20.197	20.236	20.276	20.315	20.354	20.394	20.433
52	20.472	20.512	20.551	20.591	20.630	20.669	20.709	20.748	20.787	20.827
53	20.866	20.905	20.945	20.984	21.024	21.063	21.102	21.142	21.181	21.220
54	21.260	21.299	21.339	21.378	21.417	21.457	21.496	21.535	21.575	21.614
55	21.654	21.693	21.732	21.772	21.811	21.850	21.890	21.929	21.968	22.008
56	22.047	22.087	22.126	22.165	22.205	22.244	22.283	22.323	22.362	22.402
57	22.441	22.480	22.520	22.559	22.598	22.638	22.677	22.716	22.756	22.795
58	22.835	22.874	22.913	22.953	22.992	23.031	23.071	23.110	23.150	23.189
59	23.228	23.268	23.307	23.346	23.386	23.425	23.465	23.504	23.543	23.583
60	23.622	23.661	23.701	23.740	23.779	23.819	23.858	23.898	23.937	23.976
61	24.016	24.055	24.094	24.134	24.173	24.213	24.252	24.291	24.331	24.370
62	24.409	24.449	24.488	24.528	24.567	24.606	24.646	24.685	24.724	24.764
63	24.803	24.842	24.882	24.921	24.961	25.000	25.039	25.079	25.118	25.157
64	25.197	25.236	25.276	25.315	25.354	25.394	25.433	25.472	25.512	25.551
65	25.591	25.630	25.669	25.709	25.748	25.787	25.827	25.866	25.905	25.945
66	25.984	26.024	26.063	26.102	26.142	26.181	26.220	26.260	26.299	26.339
67	26.378	26.417	26.457	26.496	26.535	26.575	26.614	26.653	26.693	26.732
68	26.772	26.811	26.850	26.890	26.929	26.968	27.008	27.047	27.087	27.126
69	27.165	27.205	27.244	27.283	27.323	27.362	27.402	27.441	27.480	27.520

CENTIMETERS TO INCHES (Continued)

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
70	27.559	27.598	27.638	27.677	27.716	27.756	27.795	27.835	27.874	27.913
71	27.953	27.992	28.031	28.071	28.110	28.150	28.189	28.228	28.268	28.307
72	28.346	28.386	28.425	28.465	28.504	28.543	28.583	28.622	28.661	28.701
73	28.740	28.779	28.819	28.858	28.898	28.937	28.976	29.016	29.055	29.094
74	29.134	29.173	29.213	29.252	29.291	29.331	29.370	29.409	29.449	29.488
75	29.528	29.567	29.606	29.646	29.685	29.724	29.764	29.803	29.842	29.882
76	29.921	29.961	30.000	30.039	30.079	30.118	30.157	30.197	30.236	30.276
77	30.315	30.354	30.394	30.433	30.472	30.512	30.551	30.590	30.630	30.669
78	30.709	30.748	30.787	30.827	30.866	30.905	30.945	30.984	31.024	31.063
79	31.102	31.142	31.181	31.220	31.260	31.299	31.339	31.378	31.417	31.457
80	31.496	31.535	31.575	31.614	31.653	31.693	31.732	31.772	31.811	31.850
81	31.890	31.929	31.968	32.008	32.047	32.087	32.126	32.165	32.205	32.244
82	32.283	32.323	32.362	32.402	32.441	32.480	32.520	32.559	32.598	32.638
83	32.677	32.716	32.756	32.795	32.835	32.874	32.913	32.953	32.992	33.031
84	33.071	33.110	33.150	33.189	33.228	33.268	33.307	33.346	33.386	33.425
85	33.465	33.504	33.543	33.583	33.622	33.661	33.701	33.740	33.779	33.819
86	33.858	33.898	33.937	33.976	34.016	34.055	34.094	34.134	34.173	34.213
87	34.252	34.291	34.331	34.370	34.409	34.449	34.488	34.527	34.567	34.606
88	34.646	34.685	34.724	34.764	34.803	34.842	34.882	34.921	34.961	35.000
89	35.039	35.079	35.118	35.157	35.197	35.236	35.276	35.315	35.354	35.394

CENTIMETERS TO INCHES (Continued)

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
90	35.433	35.472	35.512	35.551	35.590	35.630	35.669	35.709	35.748	35.787
91	35.827	35.866	35.905	35.945	35.984	36.024	36.063	36.102	36.142	36.181
92	36.220	36.260	36.299	36.339	36.378	36.417	36.457	36.496	36.535	36.575
93	36.614	36.653	36.693	36.732	36.772	36.811	36.850	36.890	36.929	36.968
94	37.008	37.047	37.087	37.126	37.165	37.205	37.244	37.283	37.323	37.362
95	37.402	37.441	37.480	37.520	37.559	37.598	37.638	37.677	37.716	37.756
96	37.795	37.835	37.874	37.913	37.953	37.992	38.031	38.071	38.110	38.150
97	38.189	38.228	38.268	38.307	38.346	38.386	38.425	38.464	38.504	38.543
98	38.583	38.622	38.661	38.701	38.740	38.779	38.819	38.858	38.898	38.937
99	38.976	39.016	39.055	39.094	39.134	39.173	39.213	39.252	39.291	39.331

METERS TO FEET

LENGTHS — METERS TO FEET

From 1 to 1,000 Units

Reduction factor: 1 meter = 3.280833333 feet

The values found in the body of the table give, in feet, the length indicated in meters at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	.....	3.2808	6.5617	9.8425	13.123	16.404	19.685	22.966	26.247	29.527
10	32.808	36.089	39.370	42.651	45.932	49.212	52.493	55.774	59.055	62.336
20	65.617	68.897	72.178	75.459	78.740	82.021	85.302	88.583	91.863	95.144
30	98.425	101.71	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.80	141.08	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.88	177.16	180.45	183.73	187.01	190.29	193.57
60	196.85	200.13	203.41	206.69	209.97	213.25	216.53	219.82	223.10	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.90	259.19
80	262.47	265.75	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.99
90	295.27	298.56	301.84	305.12	308.40	311.68	314.96	318.23	321.52	324.80

METERS TO FEET (Continued)

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
100	328.08	331.36	334.64	337.93	341.21	344.49	347.77	351.05	354.33	357.61
110	360.89	364.17	367.45	370.73	374.01	377.30	380.58	383.86	387.14	390.42
120	393.70	396.98	400.26	403.54	406.82	410.10	413.38	416.67	419.95	423.23
130	426.51	429.79	433.07	436.35	439.63	442.91	446.19	449.47	452.75	456.04
140	459.32	462.60	465.88	469.16	472.44	475.72	479.00	482.28	485.56	488.84
150	492.12	495.41	498.69	501.97	505.25	508.53	511.81	515.09	518.37	521.65
160	524.93	528.21	531.49	534.78	538.06	541.34	544.62	547.90	551.18	554.46
170	557.74	561.02	564.30	567.58	570.86	574.15	577.43	580.71	583.99	587.27
180	590.55	593.83	597.11	600.39	603.67	606.95	610.23	613.52	616.80	620.08
190	623.36	626.64	629.92	633.20	636.48	639.76	643.04	646.32	649.61	652.89
200	656.17	659.45	662.73	666.01	669.29	672.57	675.85	679.13	682.41	685.69
210	688.97	692.26	695.54	698.82	702.10	705.38	708.66	711.94	715.22	718.50
220	721.78	725.06	728.34	731.63	734.91	738.19	741.47	744.75	748.03	751.31
230	754.59	757.87	761.15	764.43	767.71	771.00	774.28	777.56	780.84	784.12
240	787.40	790.68	793.96	797.24	800.52	803.80	807.08	810.37	813.65	816.93
250	820.21	823.49	826.77	830.05	833.33	836.61	839.89	843.17	846.45	849.74
260	853.02	856.30	859.58	862.86	866.14	869.42	872.70	875.98	879.26	882.54
270	885.82	889.11	892.39	895.67	898.95	902.23	905.51	908.79	912.07	915.35
280	918.63	921.91	925.19	928.48	931.76	935.04	938.32	941.60	944.88	948.16
290	951.44	954.72	958.00	961.28	964.56	967.85	971.13	974.41	977.69	980.97

METERS TO FEET (Continued)

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
300	984.25	987.53	990.81	994.09	997.37	1,000.7	1,003.9	1,007.2	1,010.5	1,013.8
310	1,017.1	1,020.3	1,023.6	1,026.9	1,030.2	1,033.5	1,036.7	1,040.0	1,043.3	1,046.6
320	1,049.9	1,053.1	1,056.4	1,059.7	1,063.0	1,066.3	1,069.6	1,072.8	1,076.1	1,079.4
330	1,082.7	1,086.0	1,089.2	1,092.5	1,095.8	1,099.1	1,102.4	1,105.6	1,108.9	1,112.2
340	1,115.5	1,118.8	1,122.0	1,125.3	1,128.6	1,131.9	1,135.2	1,138.4	1,141.7	1,145.0
350	1,148.3	1,151.6	1,154.9	1,158.1	1,161.4	1,164.7	1,168.0	1,171.3	1,174.5	1,177.8
360	1,181.1	1,184.4	1,187.7	1,190.9	1,194.2	1,197.5	1,200.8	1,204.1	1,207.3	1,210.6
370	1,213.9	1,217.2	1,220.5	1,223.8	1,227.0	1,230.3	1,233.6	1,236.9	1,240.2	1,243.4
380	1,246.7	1,250.0	1,253.3	1,256.6	1,259.8	1,263.1	1,266.4	1,269.7	1,273.0	1,276.2
390	1,279.5	1,282.8	1,286.1	1,289.4	1,292.6	1,295.9	1,299.2	1,302.5	1,305.8	1,309.1
400	1,312.3	1,315.6	1,318.9	1,322.2	1,325.5	1,328.7	1,332.0	1,335.3	1,338.6	1,341.9
410	1,345.1	1,348.4	1,351.7	1,355.0	1,358.3	1,361.5	1,364.8	1,368.1	1,371.4	1,374.7
420	1,377.9	1,381.2	1,384.5	1,387.8	1,391.1	1,394.4	1,397.6	1,400.9	1,404.2	1,407.5
430	1,410.8	1,414.0	1,417.3	1,420.6	1,423.9	1,427.2	1,430.4	1,433.7	1,437.0	1,440.3
440	1,443.6	1,446.8	1,450.1	1,453.4	1,456.7	1,460.0	1,463.3	1,466.5	1,469.8	1,473.1
450	1,476.4	1,479.7	1,482.9	1,486.2	1,489.5	1,492.8	1,496.1	1,499.3	1,502.6	1,505.9
460	1,509.2	1,512.5	1,515.7	1,519.0	1,522.3	1,525.6	1,528.9	1,532.1	1,535.4	1,538.7
470	1,542.0	1,545.3	1,548.6	1,551.8	1,555.1	1,558.4	1,561.7	1,565.0	1,568.2	1,571.5
480	1,574.8	1,578.1	1,581.4	1,584.6	1,587.9	1,591.2	1,594.5	1,597.8	1,601.0	1,604.3
490	1,607.6	1,610.9	1,614.2	1,617.5	1,620.7	1,624.0	1,627.3	1,630.6	1,633.9	1,637.1

METERS TO FEET (Continued)

LENGTHS—METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
500	1,640.4	1,643.7	1,647.0	1,650.3	1,653.5	1,656.8	1,660.1	1,663.4	1,666.7	1,669.9
510	1,673.2	1,676.5	1,679.8	1,683.1	1,686.3	1,689.6	1,692.9	1,696.2	1,699.5	1,702.8
520	1,706.0	1,709.3	1,712.6	1,715.9	1,719.2	1,722.4	1,725.7	1,729.0	1,732.3	1,735.6
530	1,738.8	1,742.1	1,745.4	1,748.7	1,752.0	1,755.2	1,758.5	1,761.8	1,765.1	1,768.4
540	1,771.7	1,774.9	1,778.2	1,781.5	1,784.8	1,788.1	1,791.3	1,794.6	1,797.9	1,801.2
550	1,804.5	1,807.7	1,811.0	1,814.3	1,817.6	1,820.9	1,824.1	1,827.4	1,830.7	1,834.0
560	1,837.3	1,840.5	1,843.8	1,847.1	1,850.4	1,853.7	1,857.0	1,860.2	1,863.5	1,866.8
570	1,870.1	1,873.4	1,876.6	1,879.9	1,883.2	1,886.5	1,889.8	1,893.0	1,896.3	1,899.6
580	1,902.9	1,906.2	1,909.4	1,912.7	1,916.0	1,919.3	1,922.6	1,925.8	1,929.1	1,932.4
590	1,935.7	1,939.0	1,942.3	1,945.5	1,948.8	1,952.1	1,955.4	1,958.7	1,961.9	1,965.2
600	1,968.5	1,971.8	1,975.1	1,978.3	1,981.6	1,984.9	1,988.2	1,991.5	1,994.7	1,998.0
610	2,001.3	2,004.6	2,007.9	2,011.2	2,014.4	2,017.7	2,021.0	2,024.3	2,027.6	2,030.8
620	2,034.1	2,037.4	2,040.7	2,044.0	2,047.2	2,050.5	2,053.8	2,057.1	2,060.4	2,063.6
630	2,066.9	2,070.2	2,073.5	2,076.8	2,080.0	2,083.3	2,086.6	2,089.9	2,093.2	2,096.5
640	2,099.7	2,103.0	2,106.3	2,109.6	2,112.9	2,116.1	2,119.4	2,122.7	2,126.0	2,129.3
650	2,132.5	2,135.8	2,139.1	2,142.4	2,145.7	2,148.9	2,152.2	2,155.5	2,158.8	2,162.1
660	2,165.4	2,168.6	2,171.9	2,175.2	2,178.5	2,181.8	2,185.0	2,188.3	2,191.6	2,194.9
670	2,198.2	2,201.4	2,204.7	2,208.0	2,211.3	2,214.6	2,217.8	2,221.1	2,224.4	2,227.7
680	2,231.0	2,234.2	2,237.5	2,240.8	2,244.1	2,247.4	2,250.7	2,253.9	2,257.2	2,260.5
690	2,263.8	2,267.1	2,270.3	2,273.6	2,276.9	2,280.2	2,283.5	2,286.7	2,290.0	2,293.3

LENGTHS—METERS TO FEET (Continued)

METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
700	2,296.6	2,299.9	2,303.1	2,306.4	2,309.7	2,313.0	2,316.3	2,319.5	2,322.8	2,326.1
710	2,329.4	2,332.7	2,336.0	2,339.2	2,342.5	2,345.8	2,349.1	2,352.4	2,355.6	2,358.9
720	2,362.2	2,365.5	2,368.8	2,372.0	2,375.3	2,378.6	2,381.9	2,385.2	2,388.4	2,391.7
730	2,395.0	2,398.3	2,401.6	2,404.9	2,408.1	2,411.4	2,414.7	2,418.0	2,421.3	2,424.5
740	2,427.8	2,431.1	2,434.4	2,437.7	2,440.9	2,444.2	2,447.5	2,450.8	2,454.1	2,457.3
750	2,460.6	2,463.9	2,467.2	2,470.5	2,473.7	2,477.0	2,480.3	2,483.6	2,486.9	2,490.2
760	2,493.4	2,496.7	2,500.0	2,503.3	2,506.6	2,509.8	2,513.1	2,516.4	2,519.7	2,523.0
770	2,526.2	2,529.5	2,532.8	2,536.1	2,539.4	2,542.6	2,545.9	2,549.2	2,552.5	2,555.8
780	2,559.0	2,562.3	2,565.6	2,568.9	2,572.2	2,575.5	2,578.7	2,582.0	2,585.3	2,588.6
790	2,591.9	2,595.1	2,598.4	2,601.7	2,605.0	2,608.3	2,611.5	2,614.8	2,618.1	2,621.4
800	2,624.7	2,627.9	2,631.2	2,634.5	2,637.8	2,641.1	2,644.4	2,647.6	2,650.9	2,654.2
810	2,657.5	2,660.8	2,664.0	2,667.3	2,670.6	2,673.9	2,677.2	2,680.4	2,683.7	2,687.0
820	2,690.3	2,693.6	2,696.8	2,700.1	2,703.4	2,706.7	2,710.0	2,713.2	2,716.5	2,719.8
830	2,723.1	2,726.4	2,729.7	2,732.9	2,736.2	2,739.5	2,742.8	2,746.1	2,749.3	2,752.6
840	2,755.9	2,759.2	2,762.5	2,765.7	2,769.0	2,772.3	2,775.6	2,778.9	2,782.1	2,785.4
850	2,788.7	2,792.0	2,795.3	2,798.6	2,801.8	2,805.1	2,808.4	2,811.7	2,815.0	2,818.2
860	2,821.5	2,824.8	2,828.1	2,831.4	2,834.6	2,837.9	2,841.2	2,844.5	2,847.8	2,851.0
870	2,854.3	2,857.6	2,860.9	2,864.2	2,867.4	2,870.7	2,874.0	2,877.3	2,880.6	2,883.9
880	2,887.1	2,890.4	2,893.7	2,897.0	2,900.3	2,903.5	2,906.8	2,910.1	2,913.4	2,916.7
890	2,919.9	2,923.2	2,926.5	2,929.8	2,933.1	2,936.3	2,939.6	2,942.9	2,946.2	2,949.5

METERS TO FEET (Continued)

LENGTHS—METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
900	2,952.8	2,956.0	2,959.3	2,962.6	2,965.9	2,969.2	2,972.4	2,975.7	2,979.0	2,982.3
910	2,985.6	2,988.8	2,992.1	2,995.4	2,998.7	3,002.0	3,005.2	3,008.5	3,011.8	3,015.1
920	3,018.4	3,021.6	3,024.9	3,028.2	3,031.5	3,034.8	3,038.1	3,041.3	3,044.6	3,047.9
930	3,051.2	3,054.5	3,057.7	3,061.0	3,064.3	3,067.6	3,070.9	3,074.1	3,077.4	3,080.7
940	3,084.0	3,087.3	3,090.5	3,093.8	3,097.1	3,100.4	3,103.7	3,106.9	3,110.2	3,113.5
950	3,116.8	3,120.1	3,123.4	3,126.6	3,129.9	3,133.2	3,136.5	3,139.8	3,143.0	3,146.3
960	3,149.6	3,152.9	3,156.2	3,159.4	3,162.7	3,166.0	3,169.3	3,172.6	3,175.8	3,179.1
970	3,182.4	3,185.7	3,189.0	3,192.3	3,195.5	3,198.8	3,202.1	3,205.4	3,208.7	3,211.9
980	3,215.2	3,218.5	3,221.8	3,225.1	3,228.3	3,231.6	3,234.9	3,238.2	3,241.5	3,244.7
990	3,248.0	3,251.3	3,254.6	3,257.9	3,261.1	3,264.4	3,267.7	3,271.0	3,274.3	3,277.6

LENGTHS — KILOMETERS TO MILES

From 1 to 1,000 Units

Reduction factor: 1 kilometer = 0.6213699495 mile

Values found in the body of the table give, in miles, the length indicated in kilometers at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	.....	0.62137	1.2427	1.8641	2.4855	3.1069	3.7282	4.3496	4.9710	5.5923
10	6.2137	6.8351	7.4564	8.0778	8.6992	9.3206	9.9419	10.563	11.185	11.806
20	12.427	13.049	13.670	14.292	14.913	15.534	16.156	16.777	17.398	18.020
30	18.641	19.262	19.884	20.505	21.127	21.748	22.369	22.991	23.612	24.233
40	24.855	25.476	26.098	26.719	27.340	27.962	28.583	29.204	29.826	30.447
50	31.069	31.690	32.311	32.933	33.554	34.175	34.797	35.418	36.039	36.661
60	37.282	37.904	38.525	39.146	39.768	40.389	41.010	41.632	42.253	42.875
70	43.496	44.117	44.739	45.360	45.981	46.603	47.224	47.845	48.467	49.088
80	49.710	50.331	50.952	51.574	52.195	52.816	53.438	54.059	54.681	55.302
90	55.923	56.545	57.166	57.787	58.409	59.030	59.652	60.273	60.894	61.516

KILOMETERS TO MILES (Continued)

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
100	62.137	62.758	63.380	64.001	64.622	65.244	65.865	66.487	67.108	67.729
110	68.351	68.972	69.593	70.215	70.836	71.458	72.079	72.700	73.322	73.943
120	74.564	75.186	75.807	76.429	77.050	77.671	78.293	78.914	79.535	80.157
130	80.778	81.399	82.021	82.642	83.264	83.885	84.506	85.128	85.749	86.370
140	86.992	87.613	88.235	88.856	89.477	90.099	90.720	91.341	91.963	92.584
150	93.205	93.827	94.448	95.070	95.691	96.312	96.934	97.555	98.176	98.798
160	99.419	100.04	100.66	101.28	101.90	102.53	103.15	103.77	104.39	105.01
170	105.63	106.25	106.88	107.50	108.12	108.74	109.36	109.98	110.60	111.23
180	111.85	112.47	113.09	113.71	114.33	114.95	115.57	116.20	116.82	117.44
190	118.06	118.68	119.30	119.92	120.55	121.17	121.79	122.41	123.03	123.65
200	124.27	124.90	125.52	126.14	126.76	127.38	128.00	128.62	129.24	129.87
210	130.49	131.11	131.73	132.35	132.97	133.59	134.22	134.84	135.46	136.08
220	136.70	137.32	137.94	138.57	139.19	139.81	140.43	141.05	141.67	142.29
230	142.92	143.54	144.16	144.78	145.40	146.02	146.64	147.26	147.89	148.51
240	149.13	149.75	150.37	150.99	151.61	152.24	152.86	153.48	154.10	154.72
250	155.34	155.96	156.59	157.21	157.83	158.45	159.07	159.69	160.31	160.93
260	161.56	162.18	162.80	163.42	164.04	164.66	165.28	165.91	166.53	167.15
270	167.77	168.39	169.01	169.63	170.26	170.88	171.50	172.12	172.74	173.36
280	173.98	174.60	175.23	175.85	176.47	177.09	177.71	178.33	178.95	179.58
290	180.20	180.82	181.44	182.06	182.68	183.30	183.93	184.55	185.17	185.79

KILOMETERS TO MILES (Continued)

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
300	186.41	187.03	187.65	188.28	188.90	189.52	190.14	190.76	191.38	192.00
310	192.62	193.25	193.87	194.49	195.11	195.73	196.35	196.97	197.60	198.22
320	198.84	199.46	200.08	200.70	201.32	201.95	202.57	203.19	203.81	204.43
330	205.05	205.67	206.29	206.92	207.54	208.16	208.78	209.40	210.02	210.64
340	211.27	211.89	212.51	213.13	213.75	214.37	214.99	215.62	216.24	216.86
350	217.48	218.10	218.72	219.34	219.96	220.59	221.21	221.83	222.45	223.07
360	223.69	224.31	224.94	225.56	226.18	226.80	227.42	228.04	228.66	229.29
370	229.91	230.53	231.15	231.77	232.39	233.01	233.64	234.26	234.88	235.50
380	236.12	236.74	237.36	237.98	238.61	239.23	239.85	240.47	241.09	241.71
390	242.33	242.96	243.58	244.20	244.82	245.44	246.06	246.68	247.31	247.93
400	248.55	249.17	249.79	250.41	251.03	251.65	252.28	252.90	253.52	254.14
410	254.76	255.38	256.00	256.63	257.25	257.87	258.49	259.11	259.73	260.35
420	260.98	261.60	262.22	262.84	263.46	264.08	264.70	265.32	265.95	266.57
430	267.19	267.81	268.43	269.05	269.67	270.30	270.92	271.54	272.16	272.78
440	273.40	274.02	274.65	275.27	275.89	276.51	277.13	277.75	278.37	279.00
450	279.62	280.24	280.86	281.48	282.10	282.72	283.34	283.97	284.59	285.21
460	285.83	286.45	287.07	287.69	288.32	288.94	289.56	290.18	290.80	291.42
470	292.04	292.67	293.29	293.91	294.53	295.15	295.77	296.39	297.01	297.64
480	298.26	298.88	299.50	300.12	300.74	301.36	301.99	302.61	303.23	303.85
490	304.47	305.09	305.71	306.34	306.96	307.58	308.20	308.82	309.44	310.06

KILOMETERS TO MILES (Continued)

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
500	310.68	311.31	311.93	312.55	313.17	313.79	314.41	315.03	315.66	316.28
510	316.90	317.52	318.14	318.76	319.38	320.01	320.63	321.25	321.87	322.49
520	323.11	323.73	324.36	324.98	325.60	326.22	326.84	327.46	328.08	328.70
530	329.33	329.95	330.57	331.19	331.81	332.43	333.05	333.68	334.30	334.92
540	335.54	336.16	336.78	337.40	338.03	338.65	339.27	339.89	340.51	341.13
550	341.75	342.37	343.00	343.62	344.24	344.86	345.48	346.10	346.72	347.35
560	347.97	348.59	349.21	349.83	350.45	351.07	351.70	352.32	352.94	353.56
570	354.18	354.80	355.42	356.05	356.67	357.29	357.91	358.53	359.15	359.77
580	360.39	361.02	361.64	362.26	362.88	363.50	364.12	364.74	365.37	365.99
590	366.61	367.23	367.85	368.47	369.09	369.72	370.34	370.96	371.58	372.20
600	372.82	373.44	374.06	374.69	375.31	375.93	376.55	377.17	377.79	378.41
610	379.04	379.66	380.28	380.90	381.52	382.14	382.76	383.39	384.01	384.63
620	385.25	385.87	386.49	387.11	387.73	388.36	388.98	389.60	390.22	390.84
630	391.46	392.08	392.71	393.33	393.95	394.57	395.19	395.81	396.43	397.06
640	397.68	398.30	398.92	399.54	400.16	400.78	401.40	402.03	402.65	403.27
650	403.89	404.51	405.13	405.75	406.38	407.00	407.62	408.24	408.86	409.48
660	410.10	410.73	411.35	411.97	412.59	413.21	413.83	414.45	415.08	415.70
670	416.32	416.94	417.56	418.18	418.80	419.42	420.05	420.67	421.29	421.91
680	422.53	423.15	423.77	424.40	425.02	425.64	426.26	426.88	427.50	428.12
690	428.75	429.37	429.99	430.61	431.23	431.85	432.47	433.09	433.72	434.34

KILOMETERS TO MILES (Continued)

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
700	434.96	435.58	436.20	436.82	437.44	438.07	438.69	439.31	439.93	440.55
710	441.17	441.79	442.42	443.04	443.66	444.28	444.90	445.52	446.14	446.76
720	447.39	448.01	448.63	449.25	449.87	450.49	451.11	451.74	452.36	452.98
730	453.60	454.22	454.84	455.46	456.09	456.71	457.33	457.95	458.57	459.19
740	459.81	460.44	461.06	461.68	462.30	462.92	463.54	464.16	464.78	465.41
750	466.03	466.65	467.27	467.89	468.51	469.13	469.76	470.38	471.00	471.62
760	472.24	472.86	473.48	474.11	474.73	475.35	475.97	476.59	477.21	477.83
770	478.45	479.08	479.70	480.32	480.94	481.56	482.18	482.80	483.43	484.05
780	484.67	485.29	485.91	486.53	487.15	487.78	488.40	489.02	489.64	490.26
790	490.88	491.50	492.13	492.75	493.37	493.99	494.61	495.23	495.85	496.47
800	497.10	497.72	498.34	498.96	499.58	500.20	500.82	501.45	502.07	502.69
810	503.31	503.93	504.55	505.17	505.80	506.42	507.04	507.66	508.28	508.90
820	509.52	510.14	510.77	511.39	512.01	512.63	513.25	513.87	514.49	515.12
830	515.74	516.36	516.98	517.60	518.22	518.84	519.47	520.09	520.71	521.33
840	521.95	522.57	523.19	523.81	524.44	525.06	525.68	526.30	526.92	527.54
850	528.16	528.79	529.41	530.03	530.65	531.27	531.89	532.51	533.14	533.76
860	534.38	535.00	535.62	536.24	536.86	537.49	538.11	538.73	539.35	539.97
870	540.59	541.21	541.83	542.46	543.08	543.70	544.32	544.94	545.56	546.18
880	546.81	547.43	548.05	548.67	549.29	549.91	550.53	551.16	551.78	552.40
890	553.02	553.64	554.26	554.88	555.50	556.13	556.75	557.37	557.99	558.61

LENGTHS—KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
900	559.23	559.85	560.48	561.10	561.72	562.34	562.96	563.58	564.20	564.83
910	565.45	566.07	566.69	567.31	567.93	568.55	569.17	569.80	570.42	571.04
920	571.66	572.28	572.90	573.52	574.15	574.77	575.39	576.01	576.63	577.25
930	577.87	578.50	579.12	579.74	580.35	580.98	581.60	582.22	582.85	583.47
940	584.09	584.71	585.33	585.95	586.57	587.19	587.82	588.44	589.06	589.68
950	590.30	590.92	591.54	592.17	592.79	593.41	594.03	594.65	595.27	595.89
960	596.52	597.14	597.76	598.38	599.00	599.62	600.24	600.86	601.49	602.11
970	602.73	603.35	603.97	604.59	605.21	605.84	606.46	607.08	607.70	608.32
980	608.94	609.56	610.19	610.81	611.43	612.05	612.67	613.29	613.91	614.53
990	615.16	615.78	616.40	617.02	617.64	618.26	618.88	619.51	620.13	620.75

CAPACITIES—LITERS TO LIQUID QUARTS

From 1 to 1,000 *Units*

Reduction factor: 1 liter = 1.056710 liquid quarts (U. S.)

The values found in the body of the table give, in liquid quarts, the capacities indicated in liters at the top and side.

	0	1	2	3	4	5	6	7	8	9
0		1.0567	2.1134	3.1701	4.2268	5.2836	6.3403	7.3970	8.4537	9.5104
10	10.567	11.624	12.681	13.737	14.794	15.851	16.907	17.964	19.021	20.077
20	21.134	22.191	23.248	24.304	25.361	26.418	27.474	28.531	29.588	30.645
30	31.701	32.758	33.815	34.871	35.928	36.985	38.042	39.098	40.155	41.212
40	42.268	43.325	44.382	45.439	46.495	47.552	48.609	49.665	50.722	51.779
50	52.836	53.892	54.949	56.006	57.062	58.119	59.176	60.232	61.289	62.346
60	63.403	64.459	65.516	66.573	67.629	68.686	69.743	70.800	71.856	72.913
70	73.970	75.026	76.083	77.140	78.197	79.253	80.310	81.367	82.423	83.480
80	84.537	85.594	86.650	87.707	88.764	89.820	90.877	91.934	92.990	94.047
90	95.104	96.161	97.217	98.274	99.331	100.39	101.44	102.50	103.56	104.61

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

LITERS TO QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	105.67	106.73	107.78	108.84	109.90	110.95	112.01	113.07	114.12	115.18
110	116.24	117.29	118.35	119.41	120.46	121.52	122.58	123.64	124.69	125.75
120	126.81	127.86	128.92	129.98	131.03	132.09	133.15	134.20	135.26	136.32
130	137.37	138.43	139.49	140.54	141.60	142.66	143.71	144.77	145.83	146.88
140	147.94	149.00	150.05	151.11	152.17	153.22	154.28	155.34	156.39	157.45
150	158.51	159.56	160.62	161.68	162.73	163.79	164.85	165.90	166.96	168.02
160	169.07	170.13	171.19	172.24	173.30	174.36	175.41	176.47	177.53	178.58
170	179.64	180.70	181.75	182.81	183.87	184.92	185.98	187.04	188.09	189.15
180	190.21	191.26	192.32	193.38	194.43	195.49	196.55	197.60	198.66	199.72
190	200.77	201.83	202.89	203.95	205.00	206.06	207.12	208.17	209.23	210.29
200	211.34	212.40	213.46	214.51	215.57	216.63	217.68	218.74	219.80	220.85
210	221.91	222.97	224.02	225.08	226.14	227.19	228.25	229.31	230.36	231.42
220	232.48	233.53	234.59	235.65	236.70	237.76	238.82	239.87	240.93	241.99
230	243.04	244.10	245.16	246.21	247.27	248.33	249.38	250.44	251.50	252.55
240	253.61	254.67	255.72	256.78	257.84	258.89	259.95	261.01	262.06	263.12
250	264.18	265.23	266.29	267.35	268.40	269.46	270.52	271.57	272.63	273.69
260	274.74	275.80	276.86	277.91	278.97	280.03	281.08	282.14	283.20	284.25
270	285.31	286.37	287.43	288.48	289.54	290.60	291.65	292.71	293.77	294.82
280	295.88	296.94	297.99	299.05	300.11	301.16	302.22	303.28	304.33	305.39
290	306.45	307.50	308.56	309.62	310.67	311.73	312.79	313.84	314.90	315.96

LITERS TO QUARTS (Continued)

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	317.01	318.07	319.13	320.18	321.24	322.30	323.35	324.41	325.47	326.52
310	327.58	328.64	329.69	330.75	331.81	332.86	333.92	334.98	336.03	337.09
320	338.15	339.20	340.26	341.32	342.37	343.43	344.49	345.54	346.60	347.66
330	348.71	349.77	350.83	351.88	352.94	354.00	355.05	356.11	357.17	358.22
340	359.28	360.34	361.39	362.45	363.51	364.56	365.62	366.68	367.74	368.79
350	369.85	370.91	371.96	373.02	374.08	375.13	376.19	377.25	378.30	379.36
360	380.42	381.47	382.53	383.59	384.64	385.70	386.76	387.81	388.87	389.93
370	390.98	392.04	393.10	394.15	395.21	396.27	397.32	398.38	399.44	400.49
380	401.55	402.61	403.66	404.72	405.78	406.83	407.89	408.95	410.00	411.06
390	412.12	413.17	414.23	415.29	416.34	417.40	418.46	419.51	420.57	421.63
400	422.68	423.74	424.80	425.85	426.91	427.97	429.02	430.08	431.14	432.19
410	433.25	434.31	435.36	436.42	437.48	438.53	439.59	440.65	441.70	442.76
420	443.82	444.87	445.93	446.99	448.05	449.10	450.16	451.22	452.27	453.33
430	454.39	455.44	456.50	457.56	458.61	459.67	460.73	461.78	462.84	463.90
440	464.95	466.01	467.07	468.12	469.18	470.24	471.29	472.35	473.41	474.46
450	475.52	476.58	477.63	478.69	479.75	480.80	481.86	482.92	483.97	485.03
460	486.09	487.14	488.20	489.26	490.31	491.37	492.43	493.48	494.54	495.60
470	496.65	497.71	498.77	499.82	500.88	501.94	502.99	504.05	505.11	506.16
480	507.22	508.28	509.33	510.39	511.45	512.50	513.56	514.62	515.67	516.73
490	517.79	518.84	519.90	520.96	522.01	523.07	524.13	525.18	526.24	527.30

LITERS TO QUARTS (Continued)

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	528.36	529.41	530.47	531.53	532.58	533.64	534.70	535.75	536.81	537.87
510	538.92	539.98	541.04	542.09	543.15	544.21	545.26	546.32	547.38	548.43
520	549.49	550.55	551.60	552.66	553.72	554.77	555.83	556.89	557.94	559.00
530	560.06	561.11	562.17	563.23	564.28	565.34	566.40	567.45	568.51	569.57
540	570.62	571.68	572.74	573.79	574.85	575.91	576.96	578.02	579.08	580.13
550	581.19	582.25	583.30	584.36	585.42	586.47	587.53	588.59	589.64	590.70
560	591.76	592.81	593.87	594.93	595.98	597.04	598.10	599.15	600.21	601.27
570	602.32	603.38	604.44	605.49	606.55	607.61	608.66	609.72	610.78	611.84
580	612.89	613.95	615.01	616.06	617.12	618.18	619.23	620.29	621.35	622.40
590	623.46	624.52	625.57	626.63	627.69	628.74	629.80	630.86	631.91	632.97
600	634.03	635.08	636.14	637.20	638.25	639.31	640.37	641.42	642.48	643.54
610	644.59	645.65	646.71	647.76	648.82	649.88	650.93	651.99	653.05	654.10
620	655.16	656.22	657.27	658.33	659.39	660.44	661.50	662.56	663.61	664.67
630	665.73	666.78	667.84	668.90	669.95	671.01	672.07	673.12	674.18	675.24
640	676.29	677.35	678.41	679.46	680.52	681.58	682.63	683.69	684.75	685.80
650	686.86	687.92	688.97	690.03	691.09	692.15	693.20	694.26	695.32	696.37
660	697.43	698.49	699.54	700.60	701.66	702.71	703.77	704.83	705.88	706.94
670	708.00	709.05	710.11	711.17	712.22	713.28	714.34	715.39	716.45	717.51
680	718.56	719.62	720.68	721.73	722.79	723.85	724.90	725.96	727.02	728.07
690	729.13	730.19	731.24	732.30	733.36	734.41	735.47	736.53	737.58	738.64

LITERS TO QUARTS (Continued)

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	739 70	740 75	741 81	742 87	743 92	744 98	746 04	747 09	748 15	749 21
710	750 26	751 32	752 38	753 43	754 49	755 55	756 60	757 66	758 72	759 77
720	760 83	761 89	762 94	764 00	765 06	766 11	767 17	768 23	769 28	770 34
730	771 40	772 46	773 51	774 57	775 63	776 68	777 74	778 80	779 85	780 91
740	781 97	783 02	784 08	785 14	786 19	787 25	788 31	789 36	790 42	791 48
750	792 53	793 59	794 65	795 70	796 76	797 82	798 87	799 93	800 99	802 04
760	803 10	804 16	805 21	806 27	807 33	808 38	809 44	810 50	811 55	812 61
770	813 67	814 72	815 78	816 84	817 89	818 95	820 01	821 06	822 12	823 18
780	824 23	825 29	826 35	827 40	828 46	829 52	830 57	831 63	832 69	833 74
790	834 80	835 86	836 91	837 97	839 03	840 08	841 14	842 20	843 25	844 31
800	845 37	846 42	847 48	848 54	849 59	850 65	851 71	852 76	853 82	854 88
810	855 94	856 99	858 05	859 11	860 16	861 22	862 28	863 33	864 39	865 45
820	866 50	867 56	868 62	869 67	870 73	871 79	872 84	873 90	874 96	876 01
830	877 07	878 13	879 18	880 24	881 30	882 35	883 41	884 47	885 52	886 58
840	887 64	888 69	889 75	890 81	891 86	892 92	893 98	895 03	896 09	897 15
850	898 20	899 26	900 32	901 37	902 43	903 49	904 54	905 60	906 66	907 71
860	908 77	909 83	910 88	911 94	913 00	914 05	915 11	916 17	917 22	918 28
870	919 34	920 39	921 45	922 51	923 56	924 62	925 68	926 73	927 79	928 85
880	929 90	930 96	932 02	933 07	934 13	935 19	936 25	937 30	938 36	939 42
890	940 47	941 53	942 59	943 64	944 70	945 76	946 81	947 87	948 93	949 98

LITERS TO QUARTS (Continued)

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	951.04	952.10	953.15	954.21	955.27	956.32	957.38	958.44	959.49	960.55
910	961.61	962.66	963.72	964.78	965.83	966.89	967.95	969.00	970.06	971.12
920	972.17	973.23	974.29	975.34	976.40	977.46	978.51	979.57	980.63	981.68
930	982.74	983.80	984.85	985.91	986.97	988.02	989.08	990.14	991.19	992.25
940	993.31	994.36	995.42	996.48	997.53	998.59	999.65	1,000.7	1,001.8	1,002.8
950	1,003.9	1,004.9	1,006.0	1,007.0	1,008.1	1,009.2	1,010.2	1,011.3	1,012.3	1,013.4
960	1,014.4	1,015.5	1,016.6	1,017.6	1,018.7	1,019.7	1,020.8	1,021.8	1,022.9	1,024.0
970	1,025.0	1,026.1	1,027.1	1,028.2	1,029.2	1,030.3	1,031.3	1,032.4	1,033.5	1,034.5
980	1,035.6	1,036.6	1,037.7	1,038.7	1,039.8	1,040.9	1,041.9	1,043.0	1,044.0	1,045.1
990	1,046.1	1,047.2	1,048.3	1,049.3	1,050.4	1,051.4	1,052.5	1,053.5	1,054.6	1,055.7

KILOGRAMS TO POUNDS

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS

From 1 to 1,000 Units

Reduction factor: 1 kilogram = 2.204622341 avoirdupois pounds

The values found in the body of the table give, in avoirdupois pounds, the weights indicated in kilograms at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	.....	2.2046	4.4092	6.6139	8.8185	11.023	13.228	15.432	17.637	19.842
10	22.046	24.251	26.455	28.660	30.865	33.069	35.274	37.479	39.683	41.888
20	44.092	46.297	48.502	50.706	52.911	55.116	57.320	59.525	61.729	63.934
30	66.139	68.343	70.548	72.753	74.957	77.162	79.366	81.571	83.776	85.980
40	88.185	90.390	92.594	94.799	97.003	99.208	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.84	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.23	209.44	211.64	213.85	216.05	218.26

KILOGRAMS TO POUNDS (Continued)

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	220.46	222.67	224.87	227.08	229.28	231.49	233.69	235.89	238.10	240.30
110	242.51	244.71	246.92	249.12	251.33	253.53	255.74	257.94	260.15	262.35
120	264.55	266.76	268.96	271.17	273.37	275.58	277.78	279.99	282.19	284.40
130	286.60	288.81	291.01	293.21	295.42	297.62	299.83	302.03	304.24	306.44
140	308.65	310.85	313.06	315.26	317.47	319.67	321.87	324.08	326.28	328.49
150	330.69	332.90	335.10	337.31	339.51	341.72	343.92	346.13	348.33	350.54
160	352.74	354.94	357.15	359.35	361.56	363.76	365.97	368.17	370.38	372.58
170	374.79	376.99	379.20	381.40	383.60	385.81	388.01	390.22	392.42	394.63
180	396.83	399.04	401.24	403.45	405.65	407.86	410.06	412.26	414.47	416.67
190	418.88	421.08	423.29	425.49	427.70	429.90	432.11	434.31	436.52	438.72
200	440.92	443.13	445.33	447.54	449.74	451.95	454.15	456.36	458.56	460.77
210	462.97	465.18	467.38	469.58	471.79	473.99	476.20	478.40	480.61	482.81
220	485.02	487.22	489.43	491.63	493.84	496.04	498.24	500.45	502.65	504.86
230	507.06	509.27	511.47	513.68	515.88	518.09	520.29	522.50	524.70	526.90
240	529.11	531.31	533.52	535.72	537.93	540.13	542.34	544.54	546.75	548.95
250	551.16	553.36	555.56	557.77	559.97	562.18	564.38	566.59	568.79	571.00
260	573.20	575.41	577.61	579.82	582.02	584.22	586.43	588.63	590.84	593.04
270	595.25	597.45	599.66	601.86	604.07	606.27	608.48	610.68	612.89	615.09
280	617.29	619.50	621.70	623.91	626.11	628.32	630.52	632.73	634.93	637.14
290	639.34	641.55	643.75	645.95	648.16	650.36	652.57	654.77	656.98	659.18

KILOGRAMS TO POUNDS (Continued)

WEIGHTS -- KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	661.29	663.59	665.80	668.00	670.21	672.41	674.61	676.82	679.02	681.23
310	683.43	685.64	687.84	690.05	692.25	694.46	696.66	698.87	701.07	703.27
320	705.48	707.68	709.89	712.09	714.30	716.50	718.71	720.91	723.12	725.32
330	727.53	729.73	731.93	734.14	736.34	738.55	740.75	742.96	745.16	747.37
340	749.57	751.78	753.98	756.19	758.39	760.59	762.80	765.00	767.21	769.41
350	771.62	773.82	776.03	778.23	780.44	782.64	784.85	787.05	789.25	791.46
360	793.66	795.87	798.07	800.28	802.48	804.69	806.89	809.10	811.30	813.51
370	815.71	817.91	820.12	822.32	824.53	826.73	828.94	831.14	833.35	835.55
380	837.76	839.96	842.17	844.37	846.58	848.78	850.98	853.19	855.39	857.60
390	859.80	862.01	864.21	866.42	868.62	870.83	873.03	875.24	877.44	879.64
400	881.85	884.05	886.26	888.46	890.67	892.87	895.08	897.28	899.49	901.69
410	903.90	906.10	908.30	910.51	912.71	914.92	917.12	919.33	921.53	923.74
420	925.94	928.15	930.35	932.56	934.76	936.96	939.17	941.37	943.58	945.78
430	947.99	950.19	952.40	954.60	956.81	959.01	961.22	963.42	965.62	967.83
440	970.03	972.24	974.44	976.65	978.85	981.06	983.26	985.47	987.67	989.88
450	992.08	994.28	996.49	998.69	1,000.9	1,003.1	1,005.3	1,007.5	1,009.7	1,011.9
460	1,014.1	1,016.3	1,018.5	1,020.7	1,022.9	1,025.1	1,027.4	1,029.6	1,031.8	1,034.0
470	1,036.2	1,038.4	1,040.6	1,042.8	1,045.0	1,047.2	1,049.4	1,051.6	1,053.8	1,056.0
480	1,058.2	1,060.4	1,062.6	1,064.8	1,067.0	1,069.2	1,071.4	1,073.7	1,075.9	1,078.1
490	1,080.3	1,082.5	1,084.7	1,086.9	1,089.1	1,091.3	1,093.5	1,095.7	1,097.9	1,100.1

KILOGRAMS TO POUNDS (Continued)

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	1,102.3	1,104.5	1,106.7	1,108.9	1,111.1	1,113.3	1,115.5	1,117.7	1,119.9	1,122.2
510	1,124.4	1,126.6	1,128.8	1,131.0	1,133.2	1,135.4	1,137.6	1,139.8	1,142.0	1,144.2
520	1,146.4	1,148.6	1,150.8	1,153.0	1,155.2	1,157.4	1,159.6	1,161.8	1,164.0	1,166.2
530	1,168.4	1,170.7	1,172.9	1,175.1	1,177.3	1,179.5	1,181.7	1,183.9	1,186.1	1,188.3
540	1,190.5	1,192.7	1,194.9	1,197.1	1,199.3	1,201.5	1,203.7	1,205.9	1,208.1	1,210.3
550	1,212.5	1,214.7	1,217.0	1,219.2	1,221.4	1,223.6	1,225.8	1,228.0	1,230.2	1,232.4
560	1,234.6	1,236.8	1,239.0	1,241.2	1,243.4	1,245.6	1,247.8	1,250.0	1,252.2	1,254.4
570	1,256.6	1,258.8	1,261.0	1,263.2	1,265.5	1,267.7	1,269.9	1,272.1	1,274.3	1,276.5
580	1,278.7	1,280.9	1,283.1	1,285.3	1,287.5	1,289.7	1,291.9	1,294.1	1,296.3	1,298.5
590	1,300.7	1,302.9	1,305.1	1,307.3	1,309.5	1,311.8	1,314.0	1,316.2	1,318.4	1,320.6
600	1,322.8	1,325.0	1,327.2	1,329.4	1,331.6	1,333.8	1,336.0	1,338.2	1,340.4	1,342.6
610	1,344.8	1,347.0	1,349.2	1,351.4	1,353.6	1,355.8	1,358.0	1,360.3	1,362.5	1,364.7
620	1,366.9	1,369.1	1,371.3	1,373.5	1,375.7	1,377.9	1,380.1	1,382.3	1,384.5	1,386.7
630	1,388.9	1,391.1	1,393.3	1,395.5	1,397.7	1,399.9	1,402.1	1,404.3	1,406.5	1,408.8
640	1,411.0	1,413.2	1,415.4	1,417.6	1,419.8	1,422.0	1,424.2	1,426.4	1,428.6	1,430.8
650	1,433.0	1,435.2	1,437.4	1,439.6	1,441.8	1,444.0	1,446.2	1,448.4	1,450.6	1,452.8
660	1,455.1	1,457.3	1,459.5	1,461.7	1,463.9	1,466.1	1,468.3	1,470.5	1,472.7	1,474.9
670	1,477.1	1,479.3	1,481.5	1,483.7	1,485.9	1,488.1	1,490.3	1,492.5	1,494.7	1,496.9
680	1,499.1	1,501.3	1,503.6	1,505.8	1,508.0	1,510.2	1,512.4	1,514.6	1,516.8	1,519.0
690	1,521.2	1,523.4	1,525.6	1,527.8	1,530.0	1,532.2	1,534.4	1,536.6	1,538.8	1,541.0

KILOGRAMS TO POUNDS (Continued)

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	1,543.2	1,545.4	1,547.6	1,549.8	1,552.1	1,554.3	1,556.5	1,558.7	1,560.9	1,563.1
710	1,565.3	1,567.5	1,569.7	1,571.9	1,574.1	1,576.3	1,578.5	1,580.7	1,582.9	1,585.1
720	1,587.3	1,589.5	1,591.7	1,593.9	1,596.1	1,598.4	1,600.6	1,602.8	1,605.0	1,607.2
730	1,609.4	1,611.6	1,613.8	1,616.0	1,618.2	1,620.4	1,622.6	1,624.8	1,627.0	1,629.2
740	1,631.4	1,633.6	1,635.8	1,638.0	1,640.2	1,642.4	1,644.6	1,646.9	1,649.1	1,651.3
750	1,653.5	1,655.7	1,657.9	1,660.1	1,662.3	1,664.5	1,666.7	1,668.9	1,671.1	1,673.3
760	1,675.5	1,677.7	1,679.9	1,682.1	1,684.3	1,686.5	1,688.7	1,690.9	1,693.2	1,695.4
770	1,697.6	1,699.8	1,702.0	1,704.2	1,706.4	1,708.6	1,710.8	1,713.0	1,715.2	1,717.4
780	1,719.6	1,721.8	1,724.0	1,726.2	1,728.4	1,730.6	1,732.8	1,735.0	1,737.2	1,739.4
790	1,741.7	1,743.9	1,746.1	1,748.3	1,750.5	1,752.7	1,754.9	1,757.1	1,759.3	1,761.5
800	1,763.7	1,765.9	1,768.1	1,770.3	1,772.5	1,774.7	1,776.9	1,779.1	1,781.3	1,783.5
810	1,785.7	1,787.9	1,790.2	1,792.4	1,794.6	1,796.8	1,799.0	1,801.2	1,803.4	1,805.6
820	1,807.8	1,810.0	1,812.2	1,814.4	1,816.6	1,818.8	1,821.0	1,823.2	1,825.4	1,827.6
830	1,829.8	1,832.0	1,834.2	1,836.5	1,838.7	1,840.9	1,843.1	1,845.3	1,847.5	1,849.7
840	1,851.9	1,854.1	1,856.3	1,858.5	1,860.7	1,862.9	1,865.1	1,867.3	1,869.5	1,871.7
850	1,873.9	1,876.1	1,878.3	1,880.5	1,882.7	1,885.0	1,887.2	1,889.4	1,891.6	1,893.8
860	1,896.0	1,898.2	1,900.4	1,902.6	1,904.8	1,907.0	1,909.2	1,911.4	1,913.6	1,915.8
870	1,918.0	1,920.2	1,922.4	1,924.6	1,926.8	1,929.0	1,931.2	1,933.5	1,935.7	1,937.9
880	1,940.1	1,942.3	1,944.5	1,946.7	1,948.9	1,951.1	1,953.3	1,955.5	1,957.7	1,959.9
890	1,962.1	1,964.3	1,966.5	1,968.7	1,970.9	1,973.1	1,975.3	1,977.5	1,979.8	1,982.0

KILOGRAMS TO POUNDS (Continued)

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	1,984.2	1,986.4	1,988.6	1,990.8	1,993.0	1,995.2	1,997.4	1,999.6	2,001.8	2,004.0
910	2,006.2	2,008.4	2,010.6	2,012.8	2,015.0	2,017.2	2,019.4	2,021.6	2,023.8	2,026.0
920	2,028.3	2,030.5	2,032.7	2,034.9	2,037.1	2,039.3	2,041.5	2,043.7	2,045.9	2,048.1
930	2,050.3	2,052.5	2,054.7	2,056.9	2,059.1	2,061.3	2,063.5	2,065.7	2,067.9	2,070.1
940	2,072.3	2,074.5	2,076.8	2,079.0	2,081.2	2,083.4	2,085.6	2,087.8	2,090.0	2,092.2
950	2,094.4	2,096.6	2,098.8	2,101.0	2,103.2	2,105.4	2,107.6	2,109.8	2,112.0	2,114.2
960	2,116.4	2,118.6	2,120.8	2,123.1	2,125.3	2,127.5	2,129.7	2,131.9	2,134.1	2,136.3
970	2,138.5	2,140.7	2,142.9	2,145.1	2,147.3	2,149.5	2,151.7	2,153.9	2,156.1	2,158.3
980	2,160.5	2,162.7	2,164.9	2,167.1	2,169.3	2,171.6	2,173.8	2,176.0	2,178.2	2,180.4
990	2,182.6	2,184.8	2,187.0	2,189.2	2,191.4	2,193.6	2,195.8	2,198.0	2,200.2	2,202.4

CONVERSION OF THERMOMETER SCALES

By I. Gottfried

1

FAHRENHEIT TO CENTIGRADE (WITH CONSTANT, 32. F.) (FROM 1. F. TO 9999. F.)

F.	C.	F.	C.	F.	C.	F.	C.
1	-17.22	10	-12.22	100	37.78	1000	537.78
2	-16.67	20	- 6.67	200	93.33	2000	1093.33
3	-16.11	30	- 1.11	300	148.89	3000	1648.89
4	-15.56	40	+ 4.44	400	204.44	4000	2204.44
5	-15	50	10	500	260	5000	2760
6	-14.44	60	15.56	600	315.56	6000	3315.56
7	-13.89	70	21.11	700	371.11	7000	3871.11
8	-13.33	80	26.67	800	426.67	8000	4426.67
9	-12.78	90	32.22	900	482.22	9000	4982.22

2

FAHRENHEIT TO CENTIGRADE (WITHOUT CONSTANT)

F.	C.	F.	C.	F.	C.	F.	C.
1	.56	10	5.56	100	55.56	1000	555.56
2	1.11	20	11.11	200	111.11	2000	1111.11
3	1.67	30	16.67	300	166.67	3000	1666.67
4	2.22	40	22.22	400	222.22	4000	2222.22
5	2.78	50	27.78	500	277.78	5000	2777.78
6	3.33	60	33.33	600	333.33	6000	3333.33
7	3.89	70	38.89	700	388.89	7000	3888.89
8	4.44	80	44.44	800	444.44	8000	4444.44
9	5.00	90	50.00	900	500.00	9000	5000.00

TO CONVERT DEGREES FAHRENHEIT TO DEGREES CENTIGRADE

Use the first table for one of the digits, and the second table for the others; then add.

Examples: To find the Centigrade equivalent for 35. F.

$$\begin{array}{rcl}
 30 & = & 16.67(2) \quad 30 = -1.11(1) \\
 5 & = & -15 \quad (1) \text{ or, } 5 = 2.78(2) \\
 \hline
 35. F & = & 1.67. C \quad 35. F = 1.67. C
 \end{array}$$

To find the C. equivalent for 355. F. and 5445. F.

$$\begin{array}{rcl}
 300 & 148.89(1) \\
 50 & 27.78(2) \text{ or, } \\
 5 & 2.78(2) \\
 \hline
 355. F & 179.45. C
 \end{array}$$

CONVERSION OF THERMOMETER SCALES (Continued)

300	166.67(2)	5000	2760	(1)
50	10 (1)	400	222.22(2)	
5	2.78(2)	40	22.22(2)	
<u>355</u> .F. = <u>179.45</u> .C.		<u>5</u>	<u>2.78(2)</u>	
		<u>5445</u> .F. = <u>3007.22</u> .C.		

1

CENTIGRADE TO FAHRENHEIT (WITH CONSTANT 32.F.)

C.	F.	C.	F.	C.	F.	C.	F.
				000	32		
1	33.8	10	50	100	212	1000	1832
2	35.6	20	68	200	392	2000	3632
3	37.4	30	86	300	572	3000	5432
4	39.2	40	104	400	752	4000	7232
5	41	50	122	500	932	5000	9032
6	42.8	60	140	600	1112		
7	44.6	70	158	700	1292		
8	46.4	80	176	800	1472		
9	48.2	90	194	900	1652		

2

CENTIGRADE TO FAHRENHEIT (WITHOUT CONSTANT)

C.	F.	C.	F.	C.	F.	C.	F.
1	1.8	10	18	100	180	1000	1800
2	3.6	20	36	200	360	2000	3600
3	5.4	30	54	300	540	3000	5400
4	7.2	40	72	400	720	4000	7200
5	9.0	50	90	500	900	5000	9000
6	10.8	60	108	600	1080		
7	12.6	70	126	700	1260		
8	14.4	80	144	800	1440		
9	16.2	90	162	900	1620		

CONVERSION OF THERMOMETER SCALES (Continued)

TO CONVERT DEGREES CENTIGRADE TO DEGREES FAHRENHEIT

Use the first table for one digit, and the second table for the others; then add.

Examples: To find the Fahrenheit equivalents for 15.°C.; 155.°C.; and 5432.°C.

10	=	50(1)	18(2)	100	=	212(1)	=	180(2)
5	=	9(2)	or, 41(1)	50	=	90(2)	or, =	90(2)
15.°C.	=	59.°F.	59.°F.	5	=	9(2)		41(1)
				155.°C.	=	311.°F.	=	311.°F.
5000	=	9000(2)			=	9000(2)		
400	=	720(2)	or,		=	752(1)		
30	=	54(2)			=	54(2)		
2	=	35.6(1)			=	3.6(2)		
5432.°C.	=	9809.6.°F.			=	9809.6.°F.		

THERMOMETER SCALES

Corrections to Reduce Gas Thermometer Temperature to Thermodynamic Scale.

The values below are corrections to be applied to temperatures determined by the gas thermometer indicated to give temperatures in the thermodynamic centigrade scale for an initial pressure of 100 cm.

Temp. °C	Corrections in °C					
	Constant Volume			Constant Pressure		
	Hydro- gen	Nitro- gen	Helium	Hydro- gen	Nitro- gen	Helium
+1200		+1.0			+2.3	
1000		+0.7			+1.8	
800		+ .5			+1.3	
600		+ .3			+0.9	
500		+ .2			+ .7	
450		+ .17	+0.05		+ .6	+0.008
400		+ .14	+ .04		+ .5	+ .006
350		+ .10	+ .03		+ .4	+ .005
300		+ .07	+ .02	+0.04	+ .3	+ .003
250		+ .04	+ .01	+ .03	+ .2	+ .002
200	+0.02	+ .02	+ .006	+ .02	+ .12	+ .001
150	+ .01	+ .01	+ .002	+ .01	+ .05	+ .001
100	.000	.000	.000	.000	.00	.000
75	— .001	— .005	— .001	— .003	— .02	.000
50	— .002	— .010	— .001	— .004	— .03	.000
+ 25	— .001	— .008	— .001	— .003	— .02	— .001
0	.000	.00	.000	.000	.00	.000
— 50	+ .005	+ .03	+ .002	+ .02	+ .12	+ .002
— 100	+ .015	+ .06	+ .005	+ .04	+ .4	+ .005
— 150	+ .03	+ .2	+ .01	+ .1	+1.3	+ .02
— 200	+ .06	+ .5	+ .02	+ .3		+ .04
— 250	+ .12		+ .04			

THERMOMETER SCALES (Continued)

Corrections to reduce Liquid in Glass to Standard Thermodynamic Scale.

Temp. °C	Corrections in °C					
	Mercury in			Pentane in Jena 16III	Alcohol in verre dur	Toluene in verre dur
	Jena 16III	Jena 59III	Jena 1565III			
-190				-23.4		
-180				-21.0		
-170				-18.6		
-160				-16.2		
-150				-13.9		
-140				-11.6		
-130				-9.4		
-120				-7.3		
-110				-5.3		
-100				-3.4		
-90				-1.7		
-80				-0.2		0.0
-78.5				0.0	0.0	0.0
-70				+1.0	+0.3	+ .4
-60				+2.0	+ .6	+ .8
-50				+2.6	+ .7	+1.1
-40				+3.0	+ .9	+1.2
-30	0.28	0.13		+2.9	+ .9	+1.2
-20	.16	.07		+2.4	+ .8	+1.0
-10	.07	.03		+1.5	+ .5	+0.6
0	.00	.00	0.00	0.0	.0	0.0
+10	-.06	-.02	-.03	-2.0		
20	-.09	-.04	-.05	-4.4		
30	-.11	-.04	-.06	-7.6	-3.6	
40	-.12	-.03	-.06			
50	-.12	-.03	-.05			
60	-.10	-.02	-.04			
70	-.08	-.01	-.03			
80	-.06	.00	-.02			
90	-.03	+ .02	-.01			
100	.00	.00	.00			-24.4
120	+ .03	-.05	+ .06			
140	+ .02	-.16	+ .03			
160	-.02	-.31	-.13			
180	-.12	-.52	-.38			
200	-.29	-.84	-.90			
220	-.5	-1.3	-1.3			
240	-.9	-1.9	-1.8			
260	-1.4	-2.6	-2.4			
280	-2.0	-3.4	-3.1			
300	-2.7	-4.4	-3.9			
320		-5.8	-4.8			
340		-7.2	-5.9			
360		-8.8	-7.3			
380		-10.6	-8.9			
400		-12.6	-10.5			
420		-14.9	-12.4			
440		-17.4	-14.7			
460		-20.2	-17.2			
480		-23.3	-20.0			
500		-26.9	-23.1			
550			-32.			
600			-44.			
650			-58.			

TEMPERATURES — CENTIGRADE TO FAHRENHEIT

Conversion Table

The values in the body of the table give, in degrees Fahrenheit, the temperatures indicated in degrees Centigrade at the top and side.

$$1^{\circ} \text{C.} = 1.8^{\circ} \text{F.}$$

For temperatures below 0°C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
0	+ 32.0	30.2	28.4	26.6	24.8	23.0	21.2	19.4	17.6	15.8
- 10	+ 14.0	12.2	10.4	8.6	6.8	5.0	3.2	+ 1.4	- 0.4	- 2.2
- 20	- 4.0	5.8	7.6	9.4	11.2	13.0	14.8	16.6	18.4	20.2
- 30	- 22.0	23.8	25.6	27.4	29.2	31.0	32.8	34.6	36.4	38.2
- 40	- 40.0	41.8	43.6	45.4	47.2	49.0	50.8	52.6	54.4	56.2
- 50	- 58.0	59.8	61.6	63.4	65.2	67.0	68.8	70.6	72.4	74.2
- 60	- 76.0	77.8	79.6	81.4	83.2	85.0	86.8	88.6	90.4	92.2
- 70	- 94.0	95.8	97.6	99.4	101.2	103.0	104.8	106.6	108.4	110.2
- 80	- 112.0	113.8	115.6	117.4	119.2	121.0	122.8	124.6	126.4	128.2
- 90	- 130.0	131.8	133.6	135.4	137.2	139.0	140.8	142.6	144.4	146.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
-100	-148.0	149.8	151.6	153.4	155.2	157.0	158.8	160.6	162.4	164.2
-110	-166.0	167.8	169.6	171.4	173.2	175.0	176.8	178.6	180.4	182.2
-120	-184.0	185.8	187.6	189.4	191.2	193.0	194.8	196.6	198.4	200.2
-130	-202.0	203.8	205.6	207.4	209.2	211.0	212.8	214.6	216.4	218.2
-140	-220.0	221.8	223.6	225.4	227.2	229.0	230.8	232.6	234.4	236.2
-150	-238.0	239.8	241.6	243.4	245.2	247.0	248.8	250.6	252.4	254.2
-160	-256.0	257.8	259.6	261.4	263.2	265.0	266.8	268.6	270.4	272.2
-170	-274.0	275.8	277.6	279.4	281.2	283.0	284.8	286.6	288.4	290.2
-180	-292.0	293.8	295.6	297.4	299.2	301.0	302.8	304.6	306.4	308.2
-190	-310.0	311.8	313.6	315.4	317.2	319.0	320.8	322.6	324.4	326.2
-200	-328.0	329.8	331.6	333.4	335.2	337.0	338.8	340.6	342.4	344.2
-210	-346.0	347.8	349.6	351.4	353.2	355.0	356.8	358.6	360.4	362.2
-220	-364.0	365.8	367.6	369.4	371.2	373.0	374.8	376.6	378.4	380.2
-230	-382.0	383.8	385.6	387.4	389.2	391.0	392.8	394.6	396.4	398.2
-240	-400.0	401.8	403.6	405.4	407.2	409.0	410.8	412.6	414.4	416.2
-250	-418.0	419.8	421.6	423.4	425.2	427.0	428.8	430.6	432.4	434.2
-260	-436.0	437.8	439.6	441.4	443.2	445.0	446.8	448.6	450.4	452.2
-270	-454.0	455.8	457.6	459.4	.....	.....	.....	.....	.....	.....

-273.18° C = -459.72° F. = absolute zero

For	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
interpolation	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
0	32.0	33.8	35.6	37.4	39.2	41.0	42.8	44.6	46.4	48.2
10	50.0	51.8	53.6	55.4	57.2	59.0	60.8	62.6	64.4	66.2
20	68.0	69.8	71.6	73.4	75.2	77.0	78.8	80.6	82.4	84.2
30	86.0	87.8	89.6	91.4	93.2	95.0	96.8	98.6	100.4	102.2
40	104.0	105.8	107.6	109.4	111.2	113.0	114.8	116.6	118.4	120.2
50	122.0	123.8	125.6	127.4	129.2	131.0	132.8	134.6	136.4	138.2
60	140.0	141.8	143.6	145.4	147.2	149.0	150.8	152.6	154.4	156.2
70	158.0	159.8	161.6	163.4	165.2	167.0	168.8	170.6	172.4	174.2
80	176.0	177.8	179.6	181.4	183.2	185.0	186.8	188.6	190.4	192.2
90	194.0	195.8	197.6	199.4	201.2	203.0	204.8	206.6	208.4	210.2
100	212.0	213.8	215.6	217.4	219.2	221.0	222.8	224.6	226.4	228.2
110	230.0	231.8	233.6	235.4	237.2	239.0	240.8	242.6	244.4	246.2
120	248.0	249.8	251.6	253.4	255.2	257.0	258.8	260.6	262.4	264.2
130	266.0	267.8	269.6	271.4	273.2	275.0	276.8	278.6	280.4	282.2
140	284.0	285.8	287.6	289.4	291.2	293.0	294.8	296.6	298.4	300.2
150	302.0	303.8	305.6	307.4	309.2	311.0	312.8	314.6	316.4	318.2
160	320.0	321.8	323.6	325.4	327.2	329.0	330.8	332.6	334.4	336.2
170	338.0	339.8	341.6	343.4	345.2	347.0	348.8	350.6	352.4	354.2
180	356.0	357.8	359.6	361.4	363.2	365.0	366.8	368.6	370.4	372.2
190	374.0	375.8	377.6	379.4	381.2	383.0	384.8	386.6	388.4	390.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
200	392.0	393.8	395.6	397.4	399.2	401.0	402.8	404.6	406.4	408.2
210	410.0	411.8	413.6	415.4	417.2	419.0	420.8	422.6	424.4	426.2
220	428.0	429.8	431.6	433.4	435.2	437.0	438.8	440.6	442.4	444.2
230	446.0	447.8	449.6	451.4	453.2	455.0	456.8	458.6	460.4	462.2
240	464.0	465.8	467.6	469.4	471.2	473.0	474.8	476.6	478.4	480.2
250	482.0	483.8	485.6	487.4	489.2	491.0	492.8	494.6	496.4	498.2
260	500.0	501.8	503.6	505.4	507.2	509.0	510.8	512.6	514.4	516.2
270	518.0	519.8	521.6	523.4	525.2	527.0	528.8	530.6	532.4	534.2
280	536.0	537.8	539.6	541.4	543.2	545.0	546.8	548.6	550.4	552.2
290	554.0	555.8	557.6	559.4	561.2	563.0	564.8	566.6	568.4	570.2
300	572.0	573.8	575.6	577.4	579.2	581.0	582.8	584.6	586.4	588.2
310	590.0	591.8	593.6	595.4	597.2	599.0	600.8	602.6	604.4	606.2
320	608.0	609.8	611.6	613.4	615.2	617.0	618.8	620.6	622.4	624.2
330	626.0	627.8	629.6	631.4	633.2	635.0	636.8	638.6	640.4	642.2
340	644.0	645.8	647.6	649.4	651.2	653.0	654.8	656.6	658.4	660.2
350	662.0	663.8	665.6	667.4	669.2	671.0	672.8	674.6	676.4	678.2
360	680.0	681.8	683.6	685.4	687.2	689.0	690.8	692.6	694.4	696.2
370	698.0	699.8	701.6	703.4	705.2	707.0	708.8	710.6	712.4	714.2
380	716.0	717.8	719.6	721.4	723.2	725.0	726.8	728.6	730.4	732.2
390	734.0	735.8	737.6	739.4	741.2	743.0	744.8	746.6	748.4	750.2

For interpolation

°C

°F

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

0.18 0.36 0.54 0.72 0.90 1.08 1.26 1.44 1.62 1.80

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
400	752.0	753.8	755.6	757.4	759.2	761.0	762.8	764.6	766.4	768.2
410	770.0	771.8	773.6	775.4	777.2	779.0	780.8	782.6	784.4	786.2
420	788.0	789.8	791.6	793.4	795.2	797.0	798.8	800.6	802.4	804.2
430	806.0	807.8	809.6	811.4	813.2	815.0	816.8	818.6	820.4	822.2
440	824.0	825.8	827.6	829.4	831.2	833.0	834.8	836.6	838.4	840.2
450	842.0	843.8	845.6	847.4	849.2	851.0	852.8	854.6	856.4	858.2
460	860.0	861.8	863.6	865.4	867.2	869.0	870.8	872.6	874.4	876.2
470	878.0	879.8	881.6	883.4	885.2	887.0	888.8	890.6	892.4	894.2
480	896.0	897.8	899.6	901.4	903.2	905.0	906.8	908.6	910.4	912.2
490	914.0	915.8	917.6	919.4	921.2	923.0	924.8	926.6	928.4	930.2
500	932.0	933.8	935.6	937.4	939.2	941.0	942.8	944.6	946.4	948.2
510	950.0	951.8	953.6	955.4	957.2	959.0	960.8	962.6	964.4	966.2
520	968.0	969.8	971.6	973.4	975.2	977.0	978.8	980.6	982.4	984.2
530	986.0	987.8	989.6	991.4	993.2	995.0	996.8	998.6	1000.4	1002.2
540	1004.0	1005.8	1007.6	1009.4	1011.2	1013.0	1014.8	1016.6	1018.4	1020.2
550	1022.0	1023.8	1025.6	1027.4	1029.2	1031.0	1032.8	1034.6	1036.4	1038.2
560	1040.0	1041.8	1043.6	1045.4	1047.2	1049.0	1050.8	1052.6	1054.4	1056.2
570	1058.0	1059.8	1061.6	1063.4	1065.2	1067.0	1068.8	1070.6	1072.4	1074.2
580	1076.0	1077.8	1079.6	1081.4	1083.2	1085.0	1086.8	1088.6	1090.4	1092.2
590	1094.0	1095.8	1097.6	1099.4	1101.2	1103.0	1104.8	1106.6	1108.4	1110.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
600	1112.0	1113.8	1115.6	1117.4	1119.2	1121.0	1122.8	1124.6	1126.4	1128.2
610	1130.0	1131.8	1133.6	1135.4	1137.2	1139.0	1140.8	1142.6	1144.4	1146.2
620	1148.0	1149.8	1151.6	1153.4	1155.2	1157.0	1158.8	1160.6	1162.4	1164.2
630	1166.0	1167.8	1169.6	1171.4	1173.2	1175.0	1176.8	1178.6	1180.4	1182.2
640	1184.0	1185.8	1187.6	1189.4	1191.2	1193.0	1194.8	1196.6	1198.4	1200.2
650	1202.0	1203.8	1205.6	1207.4	1209.2	1211.0	1212.8	1214.6	1216.4	1218.2
660	1220.0	1221.8	1223.6	1225.4	1227.2	1229.0	1230.8	1232.6	1234.4	1236.2
670	1238.0	1239.8	1241.6	1243.4	1245.2	1247.0	1248.8	1250.6	1252.4	1254.2
680	1256.0	1257.8	1259.6	1261.4	1263.2	1265.0	1266.8	1268.6	1270.4	1272.2
690	1274.0	1275.8	1277.6	1279.4	1281.2	1283.0	1284.8	1286.6	1288.4	1290.2
700	1292.0	1293.8	1295.6	1297.4	1299.2	1301.0	1302.8	1304.6	1306.4	1308.2
710	1310.0	1311.8	1313.6	1315.4	1317.2	1319.0	1320.8	1322.6	1324.4	1326.2
720	1328.0	1329.8	1331.6	1333.4	1335.2	1337.0	1338.8	1340.6	1342.4	1344.2
730	1346.0	1347.8	1349.6	1351.4	1353.2	1355.0	1356.8	1358.6	1360.4	1362.2
740	1364.0	1365.8	1367.6	1369.4	1371.2	1373.0	1374.8	1376.6	1378.4	1380.2
750	1382.0	1383.8	1385.6	1387.4	1389.2	1391.0	1392.8	1394.6	1396.4	1398.2
760	1400.0	1401.8	1403.6	1405.4	1407.2	1409.0	1410.8	1412.6	1414.4	1416.2
770	1418.0	1419.8	1421.6	1423.4	1425.2	1427.0	1428.8	1430.6	1432.4	1434.2
780	1436.0	1437.8	1439.6	1441.4	1443.2	1445.0	1446.8	1448.6	1450.4	1452.2
790	1454.0	1455.8	1457.6	1459.4	1461.2	1463.0	1464.8	1466.6	1468.4	1470.2

For

interpolation

°C

°F

1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0
1.80	1.62	1.44	1.26	1.08	0.90	0.72	0.54	0.36	0.18	0.00

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
800	1472.0	1473.8	1475.6	1477.4	1479.2	1481.0	1482.8	1484.6	1486.4	1488.2
810	1490.0	1491.8	1493.6	1495.4	1497.2	1499.0	1500.8	1502.6	1504.4	1506.2
820	1508.0	1509.8	1511.6	1513.4	1515.2	1517.0	1518.8	1520.6	1522.4	1524.2
830	1526.0	1527.8	1529.6	1531.4	1533.2	1535.0	1536.8	1538.6	1540.4	1542.2
840	1544.0	1545.8	1547.6	1549.4	1551.2	1553.0	1554.8	1556.6	1558.4	1560.2
850	1562.0	1563.8	1565.6	1567.4	1569.2	1571.0	1572.8	1574.6	1576.4	1578.2
860	1580.0	1581.8	1583.6	1585.4	1587.2	1589.0	1590.8	1592.6	1594.4	1596.2
870	1598.0	1599.8	1601.6	1603.4	1605.2	1607.0	1608.8	1610.6	1612.4	1614.2
880	1616.0	1617.8	1619.6	1621.4	1623.2	1625.0	1626.8	1628.6	1630.4	1632.2
890	1634.0	1635.8	1637.6	1639.4	1641.2	1643.0	1644.8	1646.6	1648.4	1650.2
900	1652.0	1653.8	1655.6	1657.4	1659.2	1661.0	1662.8	1664.6	1666.4	1668.2
910	1670.0	1671.8	1673.6	1675.4	1677.2	1679.0	1680.8	1682.6	1684.4	1686.2
920	1688.0	1689.8	1691.6	1693.4	1695.2	1697.0	1698.8	1700.6	1702.4	1704.2
930	1706.0	1707.8	1709.6	1711.4	1713.2	1715.0	1716.8	1718.6	1720.4	1722.2
940	1724.0	1725.8	1727.6	1729.4	1731.2	1733.0	1734.8	1736.6	1738.4	1740.2
950	1742.0	1743.8	1745.6	1747.4	1749.2	1751.0	1752.8	1754.6	1756.4	1758.2
960	1760.0	1761.8	1763.6	1765.4	1767.2	1769.0	1770.8	1772.6	1774.4	1776.2
970	1778.0	1779.8	1781.6	1783.4	1785.2	1787.0	1788.8	1790.6	1792.4	1794.2
980	1796.0	1797.8	1799.6	1801.4	1803.2	1805.0	1806.8	1808.6	1810.4	1812.2
990	1814.0	1815.8	1817.6	1819.4	1821.2	1823.0	1824.8	1826.6	1828.4	1830.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1000	1832.0	1833.8	1835.6	1837.4	1839.2	1841.0	1842.8	1844.6	1846.4	1848.2
1010	1850.0	1851.8	1853.6	1855.4	1857.2	1859.0	1860.8	1862.6	1864.4	1866.2
1020	1868.0	1869.8	1871.6	1873.4	1875.2	1877.0	1878.8	1880.6	1882.4	1884.2
1030	1886.0	1887.8	1889.6	1891.4	1893.2	1895.0	1896.8	1898.6	1900.4	1902.2
1040	1904.0	1905.8	1907.6	1909.4	1911.2	1913.0	1914.8	1916.6	1918.4	1920.2
1050	1922.0	1923.8	1925.6	1927.4	1929.2	1931.0	1932.8	1934.6	1936.4	1938.2
1060	1940.0	1941.8	1943.6	1945.4	1947.2	1949.0	1950.8	1952.6	1954.4	1956.2
1070	1958.0	1959.8	1961.6	1963.4	1965.2	1967.0	1968.8	1970.6	1972.4	1974.2
1080	1976.0	1977.8	1979.6	1981.4	1983.2	1985.0	1986.8	1988.6	1990.4	1992.2
1090	1994.0	1995.8	1997.6	1999.4	2001.2	2003.0	2004.8	2006.6	2008.4	2010.2
1100	2012.0	2013.8	2015.6	2017.4	2019.2	2021.0	2022.8	2024.6	2026.4	2028.2
1110	2030.0	2031.8	2033.6	2035.4	2037.2	2039.0	2040.8	2042.6	2044.4	2046.2
1120	2048.0	2049.8	2051.6	2053.4	2055.2	2057.0	2058.8	2060.6	2062.4	2064.2
1130	2066.0	2067.8	2069.6	2071.4	2073.2	2075.0	2076.8	2078.6	2080.4	2082.2
1140	2084.0	2085.8	2087.6	2089.4	2091.2	2093.0	2094.8	2096.6	2098.4	2100.2
1150	2102.0	2103.8	2105.6	2107.4	2109.2	2111.0	2112.8	2114.6	2116.4	2118.2
1160	2120.0	2121.8	2123.6	2125.4	2127.2	2129.0	2130.8	2132.6	2134.4	2136.2
1170	2138.0	2139.8	2141.6	2143.4	2145.2	2147.0	2148.8	2150.6	2152.4	2154.2
1180	2156.0	2157.8	2159.6	2161.4	2163.2	2165.0	2166.8	2168.6	2170.4	2172.2
1190	2174.0	2175.8	2177.6	2179.4	2181.2	2183.0	2184.8	2186.6	2188.4	2190.2

For

Interpolation

°C

°F

1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0
1.80	1.62	1.44	1.26	1.08	0.90	0.72	0.54	0.36	0.18	0.00

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1200	2192.0	2193.8	2195.6	2197.4	2199.2	2201.0	2202.8	2204.6	2206.4	2208.2
1210	2210.0	2211.8	2213.6	2215.4	2217.2	2219.0	2220.8	2222.6	2224.4	2226.2
1220	2228.0	2229.8	2231.6	2233.4	2235.2	2237.0	2238.8	2240.6	2242.4	2244.2
1230	2246.0	2247.8	2249.6	2251.4	2253.2	2255.0	2256.8	2258.6	2260.4	2262.2
1240	2264.0	2265.8	2267.6	2269.4	2271.2	2273.0	2274.8	2276.6	2278.4	2280.2
1250	2282.0	2283.8	2285.6	2287.4	2289.2	2291.0	2292.8	2294.6	2296.4	2298.2
1260	2300.0	2301.8	2303.6	2305.4	2307.2	2309.0	2310.8	2312.6	2314.4	2316.2
1270	2318.0	2319.8	2321.6	2323.4	2325.2	2327.0	2328.8	2330.6	2332.4	2334.2
1280	2336.0	2337.8	2339.6	2341.4	2343.2	2345.0	2346.8	2348.6	2350.4	2352.2
1290	2354.0	2355.8	2357.6	2359.4	2361.2	2363.0	2364.8	2366.6	2368.4	2370.2
1300	2372.0	2373.8	2375.6	2377.4	2379.2	2381.0	2382.8	2384.6	2386.4	2388.2
1310	2390.0	2391.8	2393.6	2395.4	2397.2	2399.0	2400.8	2402.6	2404.4	2406.2
1320	2408.0	2409.8	2411.6	2413.4	2415.2	2417.0	2418.8	2420.6	2422.4	2424.2
1330	2426.0	2427.8	2429.6	2431.4	2433.2	2435.0	2436.8	2438.6	2440.4	2442.2
1340	2444.0	2445.8	2447.6	2449.4	2451.2	2453.0	2454.8	2456.6	2458.4	2460.2
1350	2462.0	2463.8	2465.6	2467.4	2469.2	2471.0	2472.8	2474.6	2476.4	2478.2
1360	2480.0	2481.8	2483.6	2485.4	2487.2	2489.0	2490.8	2492.6	2494.4	2496.2
1370	2498.0	2499.8	2501.6	2503.4	2505.2	2507.0	2508.8	2510.6	2512.4	2514.2
1380	2516.0	2517.8	2519.6	2521.4	2523.2	2525.0	2526.8	2528.6	2530.4	2532.2
1390	2534.0	2535.8	2537.6	2539.4	2541.2	2543.0	2544.8	2546.6	2548.4	2550.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	■	9
1400	2552.0	2553.8	2555.6	2557.4	2559.2	2561.0	2562.8	2564.6	2566.4	2568.2
1410	2570.0	2571.8	2573.6	2575.4	2577.2	2579.0	2580.8	2582.6	2584.4	2586.2
1420	2588.0	2589.8	2591.6	2593.4	2595.2	2597.0	2598.8	2600.6	2602.4	2604.2
1430	2606.0	2607.8	2609.6	2611.4	2613.2	2615.0	2616.8	2618.6	2620.4	2622.2
1440	2624.0	2625.8	2627.6	2629.4	2631.2	2633.0	2634.8	2636.6	2638.4	2640.2
1450	2642.0	2643.8	2645.6	2647.4	2649.2	2651.0	2652.8	2654.6	2656.4	2658.2
1460	2660.0	2661.8	2663.6	2665.4	2667.2	2669.0	2670.8	2672.6	2674.4	2676.2
1470	2678.0	2679.8	2681.6	2683.4	2685.2	2687.0	2688.8	2690.6	2692.4	2694.2
1480	2696.0	2697.8	2699.6	2701.4	2703.2	2705.0	2706.8	2708.6	2710.4	2712.2
1490	2714.0	2715.8	2717.6	2719.4	2721.2	2723.0	2724.8	2726.6	2728.4	2730.2
1500	2732.0	2733.8	2735.6	2737.4	2739.2	2741.0	2742.8	2744.6	2746.4	2748.2
1510	2750.0	2751.8	2753.6	2755.4	2757.2	2759.0	2760.8	2762.6	2764.4	2766.2
1520	2768.0	2769.8	2771.6	2773.4	2775.2	2777.0	2778.8	2780.6	2782.4	2784.2
1530	2786.0	2787.8	2789.6	2791.4	2793.2	2795.0	2796.8	2798.6	2800.4	2802.2
1540	2804.0	2805.8	2807.6	2809.4	2811.2	2813.0	2814.8	2816.6	2818.4	2820.2
1550	2822.0	2823.8	2825.6	2827.4	2829.2	2831.0	2832.8	2834.6	2836.4	2838.2
1560	2840.0	2841.8	2843.6	2845.4	2847.2	2849.0	2850.8	2852.6	2854.4	2856.2
1570	2858.0	2859.8	2861.6	2863.4	2865.2	2867.0	2868.8	2870.6	2872.4	2874.2
1580	2876.0	2877.8	2879.6	2881.4	2883.2	2885.0	2886.8	2888.6	2890.4	2892.2
1590	2894.0	2895.8	2897.6	2899.4	2901.2	2903.0	2904.8	2906.6	2908.4	2910.2

For
interpolation

°C

°F

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
0.18 0.36 0.54 0.72 0.90 1.08 1.26 1.44 1.62 1.80

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1600	2912.0	2913.8	2915.6	2917.4	2919.2	2921.0	2922.8	2924.6	2926.4	2928.2
1610	2930.0	2931.8	2933.6	2935.4	2937.2	2939.0	2940.8	2942.6	2944.4	2946.2
1620	2948.0	2949.8	2951.6	2953.4	2955.2	2957.0	2958.8	2960.6	2962.4	2964.2
1630	2966.0	2967.8	2969.6	2971.4	2973.2	2975.0	2976.8	2978.6	2980.4	2982.2
1640	2984.0	2985.8	2987.6	2989.4	2991.2	2993.0	2994.8	2996.6	2998.4	3000.2
1650	3002.0	3003.8	3005.6	3007.4	3009.2	3011.0	3012.8	3014.6	3016.4	3018.2
1660	3020.0	3021.8	3023.6	3025.4	3027.2	3029.0	3030.8	3032.6	3034.4	3036.2
1670	3038.0	3039.8	3041.6	3043.4	3045.2	3047.0	3048.8	3050.6	3052.4	3054.2
1680	3056.0	3057.8	3059.6	3061.4	3063.2	3065.0	3066.8	3068.6	3070.4	3072.2
1690	3074.0	3075.8	3077.6	3079.4	3081.2	3083.0	3084.8	3086.6	3088.4	3090.2
1700	3092.0	3093.8	3095.6	3097.4	3099.2	3101.0	3102.8	3104.6	3106.4	3108.2
1710	3110.0	3111.8	3113.6	3115.4	3117.2	3119.0	3120.8	3122.6	3124.4	3126.2
1720	3128.0	3129.8	3131.6	3133.4	3135.2	3137.0	3138.8	3140.6	3142.4	3144.2
1730	3146.0	3147.8	3149.6	3151.4	3153.2	3155.0	3156.8	3158.6	3160.4	3162.2
1740	3164.0	3165.8	3167.6	3169.4	3171.2	3173.0	3174.8	3176.6	3178.4	3180.2
1750	3182.0	3183.8	3185.6	3187.4	3189.2	3191.0	3192.8	3194.6	3196.4	3198.2
1760	3200.0	3201.8	3203.6	3205.4	3207.2	3209.0	3210.8	3212.6	3214.4	3216.2
1770	3218.0	3219.8	3221.6	3223.4	3225.2	3227.0	3228.8	3230.6	3232.4	3234.2
1780	3236.0	3237.8	3239.6	3241.4	3243.2	3245.0	3246.8	3248.6	3250.4	3252.2
1790	3254.0	3255.8	3257.6	3259.4	3261.2	3263.0	3264.8	3266.6	3268.4	3270.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1800	3272.0	3273.8	3275.6	3277.4	3279.2	3281.0	3282.8	3284.6	3286.4	3288.2
1810	3290.0	3291.8	3293.6	3295.4	3297.2	3299.0	3300.8	3302.6	3304.4	3306.2
1820	3308.0	3309.8	3311.6	3313.4	3315.2	3317.0	3318.8	3320.6	3322.4	3324.2
1830	3326.0	3327.8	3329.6	3331.4	3333.2	3335.0	3336.8	3338.6	3340.4	3342.2
1840	3344.0	3345.8	3347.6	3349.4	3351.2	3353.0	3354.8	3356.6	3358.4	3360.2
1850	3362.0	3363.8	3365.6	3367.4	3369.2	3371.0	3372.8	3374.6	3376.4	3378.2
1860	3380.0	3381.8	3383.6	3385.4	3387.2	3389.0	3390.8	3392.6	3394.4	3396.2
1870	3398.0	3399.8	3401.6	3403.4	3405.2	3407.0	3408.8	3410.6	3412.4	3414.2
1880	3416.0	3417.8	3419.6	3421.4	3423.2	3425.0	3426.8	3428.6	3430.4	3432.2
1890	3434.0	3435.8	3437.6	3439.4	3441.2	3443.0	3444.8	3446.6	3448.4	3450.2
1900	3452.0	3453.8	3455.6	3457.4	3459.2	3461.0	3462.8	3464.6	3466.4	3468.2
1910	3470.0	3471.8	3473.6	3475.4	3477.2	3479.0	3480.8	3482.6	3484.4	3486.2
1920	3488.0	3489.8	3491.6	3493.4	3495.2	3497.0	3498.8	3500.6	3502.4	3504.2
1930	3506.0	3507.8	3509.6	3511.4	3513.2	3515.0	3516.8	3518.6	3520.4	3522.2
1940	3524.0	3525.8	3527.6	3529.4	3531.2	3533.0	3534.8	3536.6	3538.4	3540.2
1950	3542.0	3543.8	3545.6	3547.4	3549.2	3551.0	3552.8	3554.6	3556.4	3558.2
1960	3560.0	3561.8	3563.6	3565.4	3567.2	3569.0	3570.8	3572.6	3574.4	3576.2
1970	3578.0	3579.8	3581.6	3583.4	3585.2	3587.0	3588.8	3590.6	3592.4	3594.2
1980	3596.0	3597.8	3599.6	3601.4	3603.2	3605.0	3606.8	3608.6	3610.4	3612.2
1990	3614.0	3615.8	3617.6	3619.4	3621.2	3623.0	3624.8	3626.6	3628.4	3630.2

For	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
interpolation	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2000	3632.0	3633.8	3635.6	3637.4	3639.2	3641.0	3642.8	3644.6	3646.4	3648.2
2010	3650.0	3651.8	3653.6	3655.4	3657.2	3659.0	3660.8	3662.6	3664.4	3666.2
2020	3668.0	3669.8	3671.6	3673.4	3675.2	3677.0	3678.8	3680.6	3682.4	3684.2
2030	3686.0	3687.8	3689.6	3691.4	3693.2	3695.0	3696.8	3698.6	3700.4	3702.2
2040	3704.0	3705.8	3707.6	3709.4	3711.2	3713.0	3714.8	3716.6	3718.4	3720.2
2050	3722.0	3723.8	3725.6	3727.4	3729.2	3731.0	3732.8	3734.6	3736.4	3738.2
2060	3740.0	3741.8	3743.6	3745.4	3747.2	3749.0	3750.8	3752.6	3754.4	3756.2
2070	3758.0	3759.8	3761.6	3763.4	3765.2	3767.0	3768.8	3770.6	3772.4	3774.2
2080	3776.0	3777.8	3779.6	3781.4	3783.2	3785.0	3786.8	3788.6	3790.4	3792.2
2090	3794.0	3795.8	3797.6	3799.4	3801.2	3803.0	3804.8	3806.6	3808.4	3810.2
2100	3812.0	3813.8	3815.6	3817.4	3819.2	3821.0	3822.8	3824.6	3826.4	3828.2
2110	3830.0	3831.8	3833.6	3835.4	3837.2	3839.0	3840.8	3842.6	3844.4	3846.2
2120	3848.0	3849.8	3851.6	3853.4	3855.2	3857.0	3858.8	3860.6	3862.4	3864.2
2130	3866.0	3867.8	3869.6	3871.4	3873.2	3875.0	3876.8	3878.6	3880.4	3882.2
2140	3884.0	3885.8	3887.6	3889.4	3891.2	3893.0	3894.8	3896.6	3898.4	3900.2
2150	3902.0	3903.8	3905.6	3907.4	3909.2	3911.0	3912.8	3914.6	3916.4	3918.2
2160	3920.0	3921.8	3923.6	3925.4	3927.2	3929.0	3930.8	3932.6	3934.4	3936.2
2170	3938.0	3939.8	3941.6	3943.4	3945.2	3947.0	3948.8	3950.6	3952.4	3954.2
2180	3956.0	3957.8	3959.6	3961.4	3963.2	3965.0	3966.8	3968.6	3970.4	3972.2
2190	3974.0	3975.8	3977.6	3979.4	3981.2	3983.0	3984.8	3986.6	3988.4	3990.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2200	3992.0	3993.8	3995.6	3997.4	3999.2	4001.0	4002.8	4004.6	4006.4	4008.2
2210	4010.0	4011.8	4013.6	4015.4	4017.2	4019.0	4020.8	4022.6	4024.4	4026.2
2220	4028.0	4029.8	4031.6	4033.4	4035.2	4037.0	4038.8	4040.6	4042.4	4044.2
2230	4046.0	4047.8	4049.6	4051.4	4053.2	4055.0	4056.8	4058.6	4060.4	4062.2
2240	4064.0	4065.8	4067.6	4069.4	4071.2	4073.0	4074.8	4076.6	4078.4	4080.2
2250	4082.0	4083.8	4085.6	4087.4	4089.2	4091.0	4092.8	4094.6	4096.4	4098.2
2260	4100.0	4101.8	4103.6	4105.4	4107.2	4109.0	4110.8	4112.6	4114.4	4116.2
2270	4118.0	4119.8	4121.6	4123.4	4125.2	4127.0	4128.8	4130.6	4132.4	4134.2
2280	4136.0	4137.8	4139.6	4141.4	4143.2	4145.0	4146.8	4148.6	4150.4	4152.2
2290	4154.0	4155.8	4157.6	4159.4	4161.2	4163.0	4164.8	4166.6	4168.4	4170.2
2300	4172.0	4173.8	4175.6	4177.4	4179.2	4181.0	4182.8	4184.6	4186.4	4188.2
2310	4190.0	4191.8	4193.6	4195.4	4197.2	4199.0	4200.8	4202.6	4204.4	4206.2
2320	4208.0	4209.8	4211.6	4213.4	4215.2	4217.0	4218.8	4220.6	4222.4	4224.2
2330	4226.0	4227.8	4229.6	4231.4	4233.2	4235.0	4236.8	4238.6	4240.4	4242.2
2340	4244.0	4245.8	4247.6	4249.4	4251.2	4253.0	4254.8	4256.6	4258.4	4260.2
2350	4262.0	4263.8	4265.6	4267.4	4269.2	4271.0	4272.8	4274.6	4276.4	4278.2
2360	4280.0	4281.8	4283.6	4285.4	4287.2	4289.0	4290.8	4292.6	4294.4	4296.2
2370	4298.0	4299.8	4301.6	4303.4	4305.2	4307.0	4308.8	4310.6	4312.4	4314.2
2380	4316.0	4317.8	4319.6	4321.4	4323.2	4325.0	4326.8	4328.6	4330.4	4332.2
2390	4334.0	4335.8	4337.6	4339.4	4341.2	4343.0	4344.8	4346.6	4348.4	4350.2

For

Interpolation

°C

°F

1.0

1.80

0.9

1.62

0.8

1.44

0.7

1.26

0.6

1.08

0.5

0.90

0.4

0.72

0.3

0.54

0.2

0.36

0.1

0.18

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)
Conversion Table
 For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2400	4352.0	4353.8	4355.6	4357.4	4359.2	4361.0	4362.8	4364.6	4366.4	4368.2
2410	4370.0	4371.8	4373.6	4375.4	4377.2	4379.0	4380.8	4382.6	4384.4	4386.2
2420	4388.0	4389.8	4391.6	4393.4	4395.2	4397.0	4398.8	4400.6	4402.4	4404.2
2430	4406.0	4407.8	4409.6	4411.4	4413.2	4415.0	4416.8	4418.6	4420.4	4422.2
2440	4424.0	4425.8	4427.6	4429.4	4431.2	4433.0	4434.8	4436.6	4438.4	4440.2
2450	4442.0	4443.8	4445.6	4447.4	4449.2	4451.0	4452.8	4454.6	4456.4	4458.2
2460	4460.0	4461.8	4463.6	4465.4	4467.2	4469.0	4470.8	4472.6	4474.4	4476.2
2470	4478.0	4479.8	4481.6	4483.4	4485.2	4487.0	4488.8	4490.6	4492.4	4494.2
2480	4496.0	4497.8	4499.6	4501.4	4503.2	4505.0	4506.8	4508.6	4510.4	4512.2
2490	4514.0	4515.8	4517.6	4519.4	4521.2	4523.0	4524.8	4526.6	4528.4	4530.2
2500	4532.0	4533.8	4535.6	4537.4	4539.2	4541.0	4542.8	4544.6	4546.4	4548.2
2510	4550.0	4551.8	4553.6	4555.4	4557.2	4559.0	4560.8	4562.6	4564.4	4566.2
2520	4568.0	4569.8	4571.6	4573.4	4575.2	4577.0	4578.8	4580.6	4582.4	4584.2
2530	4586.0	4587.8	4589.6	4591.4	4593.2	4595.0	4596.8	4598.6	4600.4	4602.2
2540	4604.0	4605.8	4607.6	4609.4	4611.2	4613.0	4614.8	4616.6	4618.4	4620.2
2550	4622.0	4623.8	4625.6	4627.4	4629.2	4631.0	4632.8	4634.6	4636.4	4638.2
2560	4640.0	4641.8	4643.6	4645.4	4647.2	4649.0	4650.8	4652.6	4654.4	4656.2
2570	4658.0	4659.8	4661.6	4663.4	4665.2	4667.0	4668.8	4670.6	4672.4	4674.2
2580	4676.0	4677.8	4679.6	4681.4	4683.2	4685.0	4686.8	4688.6	4690.4	4692.2
2590	4694.0	4695.8	4697.6	4699.4	4701.2	4703.0	4704.8	4706.6	4708.4	4710.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2600	4712.0	4713.8	4715.6	4717.4	4719.2	4721.0	4722.8	4724.6	4726.4	4728.2
2610	4730.0	4731.8	4733.6	4735.4	4737.2	4739.0	4740.8	4742.6	4744.4	4746.2
2620	4748.0	4749.8	4751.6	4753.4	4755.2	4757.0	4758.8	4760.6	4762.4	4764.2
2630	4766.0	4767.8	4769.6	4771.4	4773.2	4775.0	4776.8	4778.6	4780.4	4782.2
2640	4784.0	4785.8	4787.6	4789.4	4791.2	4793.0	4794.8	4796.6	4798.4	4800.2
2650	4802.0	4803.8	4805.6	4807.4	4809.2	4811.0	4812.8	4814.6	4816.4	4818.2
2660	4820.0	4821.8	4823.6	4825.4	4827.2	4829.0	4830.8	4832.6	4834.4	4836.2
2670	4838.0	4839.8	4841.6	4843.4	4845.2	4847.0	4848.8	4850.6	4852.4	4854.2
2680	4856.0	4857.8	4859.6	4861.4	4863.2	4865.0	4866.8	4868.6	4870.4	4872.2
2690	4874.0	4875.8	4877.6	4879.4	4881.2	4883.0	4884.8	4886.6	4888.4	4890.2
2700	4892.0	4893.8	4895.6	4897.4	4899.2	4901.0	4902.8	4904.6	4906.4	4908.2
2710	4910.0	4911.8	4913.6	4915.4	4917.2	4919.0	4920.8	4922.6	4924.4	4926.2
2720	4928.0	4929.8	4931.6	4933.4	4935.2	4937.0	4938.8	4940.6	4942.4	4944.2
2730	4946.0	4947.8	4949.6	4951.4	4953.2	4955.0	4956.8	4958.6	4960.4	4962.2
2740	4964.0	4965.8	4967.6	4969.4	4971.2	4973.0	4974.8	4976.6	4978.4	4980.2
2750	4982.0	4983.8	4985.6	4987.4	4989.2	4991.0	4992.8	4994.6	4996.4	4998.2
2760	5000.0	5001.8	5003.6	5005.4	5007.2	5009.0	5010.8	5012.6	5014.4	5016.2
2770	5018.0	5019.8	5021.6	5023.4	5025.2	5027.0	5028.8	5030.6	5032.4	5034.2
2780	5036.0	5037.8	5039.6	5041.4	5043.2	5045.0	5046.8	5048.6	5050.4	5052.2
2790	5054.0	5055.8	5057.6	5059.4	5061.2	5063.0	5064.8	5066.6	5068.4	5070.2

For interpolation

°C
°F

0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2800	5072.0	5073.8	5075.6	5077.4	5079.2	5081.0	5082.8	5084.6	5086.4	5088.2
2810	5090.0	5091.8	5093.6	5095.4	5097.2	5099.0	5100.8	5102.6	5104.4	5106.2
2820	5108.0	5109.8	5111.6	5113.4	5115.2	5117.0	5118.8	5120.6	5122.4	5124.2
2830	5126.0	5127.8	5129.6	5131.4	5133.2	5135.0	5136.8	5138.6	5140.4	5142.2
2840	5144.0	5145.8	5147.6	5149.4	5151.2	5153.0	5154.8	5156.6	5158.4	5160.2
2850	5162.0	5163.8	5165.6	5167.4	5169.2	5171.0	5172.8	5174.6	5176.4	5178.2
2860	5180.0	5181.8	5183.6	5185.4	5187.2	5189.0	5190.8	5192.6	5194.4	5196.2
2870	5198.0	5199.8	5201.6	5203.4	5205.2	5207.0	5208.8	5210.6	5212.4	5214.2
2880	5216.0	5217.8	5219.6	5221.4	5223.2	5225.0	5226.8	5228.6	5230.4	5232.2
2890	5234.0	5235.8	5237.6	5239.4	5241.2	5243.0	5244.8	5246.6	5248.4	5250.2
2900	5252.0	5253.8	5255.6	5257.4	5259.2	5261.0	5262.8	5264.6	5266.4	5268.2
2910	5270.0	5271.8	5273.6	5275.4	5277.2	5279.0	5280.8	5282.6	5284.4	5286.2
2920	5288.0	5289.8	5291.6	5293.4	5295.2	5297.0	5298.8	5300.6	5302.4	5304.2
2930	5306.0	5307.8	5309.6	5311.4	5313.2	5315.0	5316.8	5318.6	5320.4	5322.2
2940	5324.0	5325.8	5327.6	5329.4	5331.2	5333.0	5334.8	5336.6	5338.4	5340.2
2950	5342.0	5343.8	5345.6	5347.4	5349.2	5351.0	5352.8	5354.6	5356.4	5358.2
2960	5360.0	5361.8	5363.6	5365.4	5367.2	5369.0	5370.8	5372.6	5374.4	5376.2
2970	5378.0	5379.8	5381.6	5383.4	5385.2	5387.0	5388.8	5390.6	5392.4	5394.2
2980	5396.0	5397.8	5399.6	5401.4	5403.2	5405.0	5406.8	5408.6	5410.4	5412.2
2990	5414.0	5415.8	5417.6	5419.4	5421.2	5423.0	5424.8	5426.6	5428.4	5430.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Concluded)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
3000	5432.0	5433.8	5435.6	5437.4	5439.2	5441.0	5442.8	5444.6	5446.4	5448.2
3010	5450.0	5451.8	5453.6	5455.4	5457.2	5459.0	5460.8	5462.6	5464.4	5466.2
3020	5468.0	5469.8	5471.6	5473.4	5475.2	5477.0	5478.8	5480.6	5482.4	5484.2
3030	5486.0	5487.8	5489.6	5491.4	5493.2	5495.0	5496.8	5498.6	5500.4	5502.2
3040	5504.0	5505.8	5507.6	5509.4	5511.2	5513.0	5514.8	5516.6	5518.4	5520.2
3050	5522.0	5523.8	5525.6	5527.4	5529.2	5531.0	5532.8	5534.6	5536.4	5538.2
3060	5540.0	5541.8	5543.6	5545.4	5547.2	5549.0	5550.8	5552.6	5554.4	5556.2
3070	5558.0	5559.8	5561.6	5563.4	5565.2	5567.0	5568.8	5570.6	5572.4	5574.2
3080	5576.0	5577.8	5579.6	5581.4	5583.2	5585.0	5586.8	5588.6	5590.4	5592.2
3090	5594.0	5595.8	5597.6	5599.4	5601.2	5603.0	5604.8	5606.6	5608.4	5610.2
For interpolation		°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
		°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44
									0.9	1.0
									1.62	1.80

MOMENT OF INERTIA FOR VARIOUS BODIES

The mass of the body is indicated by m .

Body	Axis	Moment of inertia
Uniform thin rod	Normal to the length, at one end	$\frac{l^3}{m \cdot 3}$
Uniform thin rod	Normal to the length, at the center	$\frac{l^3}{m \cdot 12}$
Thin rectangular sheet, sides a and b	Through the center parallel to b	$\frac{a^3}{m \cdot 12}$
Thin rectangular sheet, sides a and b	Through the center perpendicular to the sheet	$\frac{a^3 + b^3}{m \cdot 12}$
Thin circular sheet of radius r	Normal to the plate through the center	$\frac{r^3}{m \cdot 2}$
Thin circular sheet of radius r	Along any diameter	$\frac{r^3}{m \cdot 4}$
Thin circular ring. Plane figure formed by two concentric circles of radius r_1 and r_2	Through center normal to plane of ring	$\frac{r_1^3 + r_2^3}{m \cdot 2}$
Thin circular ring. Plane figure formed by two concentric circles of radius, r_1 and r_2	Any diameter	$\frac{r_1^3 + r_2^3}{m \cdot 4}$
Rectangular parallelopiped, edges a , b , and c	Through center perpendicular to face ab , (parallel to edge c)	$\frac{a^3 + b^3}{m \cdot 12}$
Sphere, radius r	Any diameter	$\frac{2}{m \cdot 5} r^2$
Spherical shell, external radius, r_1 internal, radius r_2	Any diameter	$\frac{2}{m \cdot 5} \frac{(r_1^5 - r_2^5)}{(r_1^3 - r_2^3)}$

MOMENT OF INERTIA FOR VARIOUS BODIES (Continued)

The mass of the body is indicated by m .

Body	Axis	Moment of inertia
Spherical shell, very thin, mean radius, r	Any diameter	$m \frac{2r^2}{3}$
Right circular cylinder (or disk) of radius r	The longitudinal axis of the solid (central axis perpendicular to circular section of disk)	$m \frac{r^2}{2}$
Right circular cylinder of radius r , length l	Through center perpendicular to the axis of the figure, (transverse diameter)	$m \left(\frac{r^2}{4} + \frac{l^2}{12} \right)$
Hollow circular cylinder, length l , external radius r_1 internal radius r_2	The longitudinal axis of the figure	$m \frac{(r_1^2 + r_2^2)}{2}$
Thin cylindrical shell, length l , mean radius, r	The longitudinal axis of the figure	mr^2
Hollow circular cylinder, length l , external radius r_1 , internal radius r_2	Transverse diameter	$m \left[\frac{r_1^2 + r_2^2}{4} + \frac{l^2}{12} \right]$
Hollow circular cylinder, length l , very thin, mean radius r	Transverse diameter	$m \left(\frac{r^2}{2} + \frac{l^2}{12} \right)$
Elliptic cylinder, length l , transverse semiaxes a and b	Longitudinal axis	$m \left(\frac{a^2 + b^2}{4} \right)$
Right cone, altitude h , radius of base r	Axis of the figure	$m \frac{3}{10} r^2$
Spheroid of revolution, equatorial radius r	Polar axis	$m \frac{2r^2}{5}$
Ellipsoid, axes $2a$, $2b$, $2c$	Axis $2a$	$m \frac{(b^2 + c^2)}{5}$

RADIO FORMULÆ

A collection of formulae useful in the computation of inductance, capacitance, and other constants of oscillating circuits. From Radio Instruments and Measurements, Bureau of Standards.

CAPACITANCE

Units.—In the following formula all lengths are expressed in centimeters, areas in square centimeters; the dielectric constant K , is taken as unity for air. Capacitances will be given in micromicrofarads = 10^{-12} farads. The electrostatic unit of capacitance, sometimes called the centimeter = 1.1124 micromicrofarads.

Parallel plate condenser.—If s be the area of one plate; t , the thickness of the dielectric; K , the dielectric constant; and N , the number of plates,—the capacitance

$$C = 0.0885 K \frac{(N - 1)s}{t}.$$

Variable condenser, semicircular plates.—Where N is the total number of parallel plates; r_1 the outer, and r_2 the inner radius of the plates; t , the thickness of the dielectric, and K the dielectric constant,—the maximum capacitance is given by

$$C = 0.1390K \frac{(N - 1)(r_1^2 - r_2^2)}{t}.$$

Isolated thin circular disk.—If d is the diameter of the disk

$$C = 0.354d.$$

Isolated sphere.—If d is the diameter of the sphere

$$C = 0.556d.$$

Two concentric spheres.—If r_1 is the radius of the outer sphere; r_2 , that of the inner sphere; K , the dielectric constant of the material between the spheres,

$$C = 1.112K \frac{r_1 r_2}{r_1 - r_2}.$$

Two coaxial cylinders.—If r_1 is the radius of the outer cylinder; r_2 , that of the inner; l , the length of the cylinders; K , the dielectric constant,

$$C = K \frac{0.2416 l}{\log_{10} \frac{r_1}{r_2}}.$$

Single long wire parallel to the ground.—For a wire of length l ; diameter, d ; suspended at a height h above the ground, where the diameter is small compared with the length,

RADIO FORMULAE (Continued)

$$\text{For } \frac{4h}{l} = \text{or} < 1 \quad C = \frac{0.2416 l}{\log_{10} \frac{4h}{d} - k_1}$$

$$\text{For } \frac{l}{4h} = \text{or} < 1 \quad C = \frac{0.2416 l}{\log_{10} \frac{2l}{d} - k_2}$$

In which,

$$k_1 = \log_{10} \left[\frac{1 + \sqrt{1 + \left(\frac{4h}{l}\right)^2}}{2} \right] \quad k_2 = \log_{10} \left[\frac{l}{4h} + \sqrt{1 + \left(\frac{l}{4h}\right)^2} \right]$$

the values of which may be found in a table at the end of this section.

Vertical wire. — For a wire of length l , relatively high above the ground; of diameter d , the approximate capacitance is as follows,

$$C = \frac{0.2416 l}{\log_{10} \frac{2l}{d}}$$

Two horizontal parallel wires at the same height. — If d is the diameter of each wire; l , the length of each; h , the height above the ground; D , the distance between wires, — where d and D are small compared to l ,

$$C = \frac{0.1208 l}{\log_{10} \frac{2D}{d} - \frac{D^2}{8h^2}}$$

Two parallel horizontal wires, one above the other. — Use the preceding formula for parallel wires at the same height, substituting the mean height for h .

Two parallel wires joined together, both at the same height. — Let l be the length of each wire; D , the distance between centers; h , the height above the ground; d_2 the diameter of cross section of the wire. If d^2 and D^2 are small compared with l^2 and $4h^2$ respectively

$$\text{For } \frac{4h}{l} = \text{or} < 1 \quad C = \frac{0.4831 l}{\log_{10} \frac{4h}{d} + \log_{10} \frac{2h}{D} - 2k_1}$$

$$\text{For } \frac{l}{4h} = \text{or} < 1 \quad C = \frac{0.4831 l}{\log_{10} \frac{2l}{d} + \log_{10} \frac{l}{D} - 2k_2}$$

k_1 and k_2 have the same significance as above and may be found from the tables at the end of the section.

RADIO FORMULAE (Continued)

Several wires in parallel.—If n parallel wires are joined together; D , the spacing between the wires; d , the diameter of the wire; h , the height above the ground; l , the length of the group,—the approximate capacitance is,

$$C = \frac{1.112 l}{\frac{p_{11} + (n-1)p_{12}}{n} - k}$$

p_{11} and p_{12} may be computed from the following:

For $\frac{4h}{l} = \text{or} < 1$ $p_{11} = 4.605 \left[\log_{10} \frac{4h}{d} - k_1 \right]$

$p_{12} = 4.605 \left[\log_{10} \frac{2h}{D} - k_1 \right]$

For $\frac{l}{4h} = \text{or} < 1$ $p_{11} = 4.605 \left[\log_{10} \frac{2l}{d} - k_2 \right]$

$p_{12} = 4.605 \left[\log_{10} \frac{l}{D} - k_2 \right]$

Values of k , k_1 , k_2 may be found in the following table.

TABLE 1

$\frac{4h}{l}$	k_1	$\frac{l}{4h}$	k_2	n	k	n	k
0	0	0	0	2	0	11	2.22
0.1	0.001	0.1	0.043	3	0.308	12	2.37
.2	.004	.2	.086	4	.621	13	2.51
.3	.009	.3	.128	5	.906	14	2.63
.4	.016	.4	.169	6	1.18	15	2.74
.5	.025	.5	.209	7	1.43	16	2.85
.6	.035	.6	.247	8	1.66	17	2.95
.7	.045	.7	.283	9	1.86	18	3.04
.8	.057	.8	.318	10	2.05	19	3.14
.9	.069	.9	.351			20	3.24
1.0	.082	1.0	.383				

INDUCTANCE

Units.—In the following formulæ all lengths are expressed in centimeters. The inductance calculated will be in microhenries = 10^{-6} henry.

Long straight round wire.—If l is the length; d , the diameter of cross section; μ the permeability of the material,—the inductance at zero or low frequency is,

$$L = 0.002 l \left[2.303 \log_{10} \frac{4l}{d} - 1 + \frac{\mu}{4} \right]$$

RADIO FORMULAE (Continued)

For all except iron wire $\mu = 1$ and the last term becomes 0.25.
For wires whose length is less than about 1000 times the diameter the term $+\frac{d}{2l}$ should be added inside the brackets.

For any frequency:

$$L = 0.002l \left[2.303 \log_{10} \frac{4l}{d} - 1 + \mu\delta \right]$$

where δ is a quantity given in Table 2 below as a function of x .
 x is to be computed from the relation

$$x = 0.1405d\sqrt{\frac{\mu f}{\rho}}$$

where d and μ are as above; f , the frequency and ρ the resistivity of the material of the wire expressed in microhm-centimeters. (See Properties of Metallic Conductors.)

For copper at 20° C.

$$x = 0.1071 d\sqrt{f}.$$

For wires other than iron, whose length is 100,000 times the diameter the inductance at infinite frequency is about 2% less than at zero frequency.

TABLE 2

Values of δ for computing inductance at any frequency.

x	δ	x	δ
0	0.250	12	0.059
0.5	.250	14	.050
1.0	.249	16	.044
1.5	.247	18	.039
2.0	.240	20	.035
2.5	.228	25	.028
3.0	.211	30	.024
3.5	.191	40	.0175
4.0	.1715	50	.014
4.5	.154	60	.012
5.0	.139	70	.010
6.0	.116	80	.009
7.0	.100	90	.008
8.0	.088	100	.007
9.0	.078	∞	.000
10.0	.070		

RADIO FORMULAE (Continued)

Two parallel round wires, return circuit.—If l is the length of each wire; d , the diameter; D , the distance between centers of wires; μ the permeability,—the inductance for any frequency is

$$L = 0.004 l \left[2.303 \log_{10} \frac{2D}{d} - \frac{D}{l} + \mu \delta \right]$$

where δ is a quantity to be obtained from the table above as a function of x which is to be computed as explained for the previous formula.

For copper and at low frequency the term δ becomes 0.25.

Square of round wire.—If a is the length of the side of the square; d , the diameter of the wire; μ the permeability, the inductance for any frequency is,

$$L = 0.008 a \left[2.303 \log_{10} \frac{2a}{d} + \frac{d}{2a} - 0.774 + \mu \delta \right]$$

where δ is obtained as above. For low frequency and for wires other than iron δ becomes 0.25; for infinite frequency the value is zero.

Grounded horizontal wire, the Earth acting as return circuit. If l is the length of wire; h , the height above the ground; d , the diameter of the wire; μ the permeability and δ the frequency constant (see table 2), the inductance,—where d is small compared with l ,—is given as follows:

$$\text{For } \frac{2h}{l} = \text{or } < 1 \quad L = 0.002 l \left[2.3026 \log_{10} \frac{4h}{d} - P + \mu \delta \right]$$

$$\text{For } \frac{l}{2h} = \text{or } < 1 \quad L = 0.002 l \left[2.3026 \log_{10} \frac{4l}{d} - Q + \mu \delta \right]$$

P and Q may be found in the following table.

TABLE 3

$\frac{2h}{l}$	P	$\frac{l}{2h}$	Q	$\frac{2h}{l}$	P	$\frac{l}{2h}$	Q
0	0	0	1.0000	0.6	0.5136	0.6	1.2918
0.1	0.0975	0.1	1.0499	.7	.5840	.7	1.3373
.2	.1900	.2	1.0997	.8	.6507	.8	1.3819
.3	.2778	.3	1.1489	.9	.7139	.9	1.4251
.4	.3608	.4	1.1975	1.0	.7740	1.0	1.4672
.5	.4393	.5	1.2452	.....	.....	.....	.....

The mutual inductance of the case above may be expressed.

RADIO FORMULAE (Continued)

$$\text{For } \frac{2h}{l} = \text{or } < 1 \quad M = 0.002 l \left[2.3026 \log_{10} \frac{2h}{D} - P + \frac{D}{l} \right]$$

$$\text{For } \frac{l}{2h} = \text{or } < 1 \quad M = 0.002 l \left[2.3026 \log_{10} \frac{2l}{D} - Q + \frac{D}{l} \right]$$

The values of P and Q are found in the table above.

Grounded wires in parallel. — Compute by the above formulae the inductance L_1 per unit length of a single wire and the mutual inductance M_1 per unit length of two adjacent wires, using the actual length in determining the ratios $\frac{2h}{l}$.

$\frac{2l}{d}$ etc. Then the inductance of n parallel wires will be,

$$L = l \left[\frac{L_1 + (n-1)M_1}{n} - 0.001k \right]$$

where k is a function of n found in Table 1 under capacity formulae.

Circular ring of round wire. — If a is the mean radius of the ring; d , the diameter of the wire, the inductance at any frequency is

$$L = 0.01257a \left[2.303 \log_{10} \frac{16a}{d} - 2 + \mu\delta \right]$$

where δ is determined from the table above.

Circular coil of circular cross section. — For a coil of n fine wires wound with mean radius of the turns a , the cross section of whose winding is a circle of diameter d , the inductance at low frequency, for wire other than iron, neglecting insulation space is,

$$L = 0.01257an^2 \left[2.303 \log_{10} \frac{16a}{d} - 1.75 \right]$$

Torus with a single layer transverse winding, — a circular solenoid of circular cross section. If r is the distance from the center of the torus to the center of the transverse section; a , the radius of the turns of the winding; n , the number of turns, the inductance at low frequency is

$$L = 0.01257n^2 \left[r - \sqrt{r^2 - a^2} \right]$$

Solenoid, single layer. If n is the number of turns; a the radius of the coil; b , the length, the approximate inductance at any frequency is,

$$L = \frac{0.03948a^2n^2}{b} K$$

where K is a function of $\frac{2a}{b}$ given in the table below.

RADIO FORMULAE (Continued)

TABLE 4

$\frac{2a}{b}$	K	$\frac{2a}{b}$	K	$\frac{2a}{b}$	K
0.00	1.0000	2.00	0.5255	7.00	0.2584
.05	.9791	2.10	.5137	7.20	.2537
.10	.9588	2.20	.5025	7.40	.2491
.15	.9391	2.30	.4918	7.60	.2448
.20	.9201	2.40	.4816	7.80	.2406
.25	.9016	2.50	.4719	8.00	.2366
.30	.8838	2.60	.4626	8.50	.2272
.35	.8665	2.70	.4537	9.00	.2185
.40	.8499	2.80	.4452	9.50	.2106
.45	.8337	2.90	.4370	10.00	.2033
.50	.8181	3.00	.4292	.....	.....
.55	.8031	3.10	.4217	11.0	.1903
.60	.7885	3.20	.4145	12.0	.1790
.65	.7745	3.30	.4075	13.0	.1692
.70	.7609	3.40	.4008	14.0	.1605
.75	.7478	3.50	.3944	15.0	.1527
.80	.7351	3.60	.3882	16.0	.1457
.85	.7228	3.70	.3822	17.0	.1394
.90	.7110	3.80	.3764	18.0	.1336
.95	.6995	3.90	.3708	19.0	.1284
1.00	.6884	4.00	.3654	20.0	.1236
1.05	.6777	4.10	.3602	22.0	.1151
1.10	.6673	4.20	.3551	24.0	.1078
1.15	.6573	4.30	.3502	26.0	.1015
1.20	.6475	4.40	.3455	28.0	.0959
1.25	.6381	4.50	.3409	30.0	.0910
1.30	.6290	4.60	.3364	35.0	.0808
1.35	.6201	4.70	.3321	40.0	.0728
1.40	.6115	4.80	.3279	45.0	.0664
1.45	.6031	4.90	.3238	50.0	.0611
1.50	.5950	5.00	.3198	60.0	.0528
1.55	.5871	5.20	.3122	70.0	.0467
1.60	.5795	5.40	.3050	80.0	.0419
1.65	.5721	5.60	.2981	90.0	.0381
1.70	.5649	5.80	.2916	100.0	.0350
1.75	.5579	6.00	.2854	.....	.....
1.80	.5511	6.20	.2795	.....	.....
1.85	.5444	6.40	.2739	.....	.....
1.90	.5379	6.60	.2685	.....	.....
1.95	.5316	6.80	.2633	.....	.....

Long multiple layer solenoid. — The inductance is given approximately by,

$$L = L_1 - \frac{0.01257n^2ac}{b}(0.693 + B_s)$$

RADIO FORMULAE (Continued)

where L_1 is the inductance calculated from the formula for a single layer solenoid, n being the number of turns of the winding; a , the radius of the coil measured from the axis to the center of the cross section of the winding; b , the length of the coil; c , the radial depth of the winding; B_s a correction given in table below as a function of b/c .

TABLE 5

b/c	B_s	b/c	B_s
1	0.0000	16	0.3017
2	.1202	17	.3041
3	.1753	18	.3062
4	.2076	19	.3082
5	.2292	20	.3099
6	.2446	21	.3116
7	.2563	22	.3131
8	.2656	23	.3145
9	.2730	24	.3157
10	.2792	25	.3169
11	.2844	26	.3180
12	.2888	27	.3190
13	.2927	28	.3200
14	.2961	29	.3209
15	.2991	30	.3218

Square coil of rectangular cross section. — If a be the side of the square measured to the center of the rectangular section which has sides b and c and if n be the number of turns,

$$L = 0.008an^2 \left[2.303 \log_{10} \frac{a}{b+c} + 0.2235 \frac{b+c}{a} + 0.726 \right]$$

If the cross section is a square $b = c$ and the expression becomes

$$L = 0.008an^2 \left[2.303 \log_{10} \frac{a}{b} + 0.447 \frac{b}{a} + 0.033 \right]$$

MUTUAL INDUCTANCE

Two parallel wires. — If l be the length of each wire; D , the distance between, the inductance is

$$M = 0.002l \left[2.303 \log_{10} \frac{2l}{D} - 1 + \frac{D}{l} \right]$$

Coaxial solenoids, single layer coils, not concentric. If a is the radius of the smaller coil; A , the radius of the larger: n_1 and n_2 the number of turns on the smaller and larger coil respectively; $2l$ the length of the smaller coil; $2x$, the length of

RADIO FORMULAE (Continued)

the larger; D , the distance between the centers of the coils measured along the common axis,

$$M = 0.009870 \frac{a^2 A^2 n_1 n_2}{2x \cdot 2l} \left[K_1 k_1 + K_3 k_3 + K_5 k_5 \right]$$

where

$$\begin{aligned} K_1 &= \frac{2}{A^2} \left(\frac{x_2}{r_2} - \frac{x_1}{r_1} \right) & k_1 &= 2l \\ K_3 &= \frac{1}{2} \left(\frac{x_1}{r_1^5} - \frac{x_2}{r_2^5} \right) & k_3 &= a^2 l \left(3 - 4 \frac{l^2}{a^2} \right) \\ K_5 &= -\frac{A^2}{8} \left[\frac{x_1}{r_1^9} \left(3 - 4 \frac{x_1^2}{A^2} \right) - \frac{x_2}{r_2^9} \left(3 - 4 \frac{x_2^2}{A^2} \right) \right] \\ & & k_5 &= a^4 l \left(\frac{5}{2} - 10 \frac{l^2}{a^2} + 4 \frac{l^4}{a^4} \right) \end{aligned}$$

where

$$\begin{aligned} x_1 &= D - x & r_1 &= \sqrt{x_1^2 + A^2} \\ x_2 &= D + x & r_2 &= \sqrt{x_2^2 + A^2} \end{aligned}$$

The above is most accurate for short coils with relatively great distance between.

Coaxial, concentric solenoids, outer coil the longer. If a be the radius of the smaller coil; A , that of the larger; $2l$, the length of the inner coil; $2x$, the length of the outer; n_1 and n_2 the number of turns on the inner and outer coil respectively,

$$M = \frac{0.01974 a^2 n_1 n_2}{g} \left[1 + \frac{A^2 a^2}{8g^4} \left(3 - 4 \frac{l^2}{a^2} \right) \right]$$

where $g = \sqrt{x^2 + A^2}$.

Coaxial, concentric solenoids, outer coil the shorter. Assuming the symbols as before except

$$g = \sqrt{l^2 + A^2}$$

$$M = 0.01974 \frac{a^2 n_1 n_2}{g} \left[1 + \frac{A^2 a^2}{8g^4} \left(3 - 4 \frac{x^2}{a^2} \right) \right]$$

HIGH FREQUENCY RESISTANCE

Cylindrical straight wires.—The ratio R/R_0 of the high frequency resistance to the resistance at low frequency may be found from the table below, by calculating first the value of x from the relation,

$$x = \pi d \sqrt{\frac{2\mu f}{\rho}} \sqrt{\frac{1}{1000}}$$

where d is the diameter of the wire in centimeters; μ , the magnetic permeability; f , the frequency; ρ , the resistivity in microhm-centimeters.

RADIO FORMULAE (Continued)

For copper wire $x = 10da$ where a has a value given by $a = 0.01071 \sqrt{f}$. The value of a for various frequencies may be found in the second of the two tables below. The above method gives the high-frequency resistance of simple circuits of any shape where the length is great compared with the diameter of the wire and the different portions of the circuit are not close to each other.

TABLE 6

Ratio of High-Frequency Resistance to the Direct-Current Resistance.

x	R/R_0	x	R/R_0	x	R/R_0
0	1.0000	5.2	2.114	14.0	5.209
0.5	1.0003	5.4	2.184	14.5	5.386
.6	1.0007	5.6	2.254	15.0	5.562
.7	1.0012	5.8	2.324	16.0	5.915
.8	1.0021	6.0	2.394	17.0	6.268
.9	1.0034	6.2	2.463	18.0	6.621
1.0	1.005	6.4	2.533	19.0	6.974
1.1	1.008	6.6	2.603	20.0	7.328
1.2	1.011	6.8	2.673	21.0	7.681
1.3	1.015	7.0	2.743	22.0	8.034
1.4	1.020	7.2	2.813	23.0	8.387
1.5	1.026	7.4	2.884	24.0	8.741
1.6	1.033	7.6	2.954	25.0	9.094
1.7	1.042	7.8	3.024	26.0	9.447
1.8	1.052	8.0	3.094	28.0	10.15
1.9	1.064	8.2	3.165	30.0	10.86
2.0	1.078	8.4	3.235	32.0	11.57
2.2	1.111	8.6	3.306	34.0	12.27
2.4	1.152	8.8	3.376	36.0	12.98
2.6	1.201	9.0	3.446	38.0	13.69
2.8	1.256	9.2	3.517	40.0	14.40
3.0	1.318	9.4	3.587	42.0	15.10
3.2	1.385	9.6	3.658	44.0	15.81
3.4	1.456	9.8	3.728	46.0	16.52
3.6	1.529	10.0	3.799	48.0	17.22
3.8	1.603	10.5	3.975	50.0	17.93
4.0	1.678	11.0	4.151	60.0	21.47
4.2	1.752	11.5	4.327	70.0	25.00
4.4	1.826	12.0	4.504	80.0	28.54
4.6	1.899	12.5	4.680	90.0	32.07
4.8	1.971	13.0	4.856	100.0	35.61
5.0	2.043	13.5	5.033	.....	.....

As an extension of the above table the following relation may be used:

$$R/R_0 = x/2.828 + 0.25.$$

The equation is valid for values of x greater than 7 at which point the error is about 1% and decreasing with increasing values of x .

RADIO FORMULAE (Continued)

TABLE 7

Values of a ($=0.01071\sqrt{f}$) for various frequencies.

f	a	Wave-length meters	f	a	Wave-length meters
100	0.1071	.....	50,000	2.395	6,000
200	.1514	.....	60,000	2.624	5,000
300	.1855	.....	70,000	2.834	4,286
400	.2142	.....	80,000	3.029	3,750
500	.2395	.....	90,000	3.213	3,333
600	.2624	.....	100,000	3.387	3,000
700	.2834	.....	150,000	4.148	2,000
800	.3029	.....	200,000	4.790	1,500
900	.3213	.....	250,000	5.355	1,200
1,000	.3387	.....	300,000	5.866	1,000
2,000	.4790	.....	333,333	6.184	900
3,000	.5866	.....	375,000	6.564	800
4,000	.6774	.....	428,570	7.012	700
5,000	.7573	.....	500,000	7.573	600
6,000	.8296	.....	600,000	8.296	500
7,000	.8960	.....	700,000	8.960	429
8,000	.9579	.....	750,000	9.275	400
9,000	1.0160	.....	800,000	9.579	375
10,000	1.071	30,000	900,000	10.16	333
15,000	1.312	20,000	1,000,000	10.71	300
20,000	1.514	15,000	1,500,000	13.12	200
30,000	1.855	10,000	3,000,000	18.55	100
40,000	2.142	7,500	.....	.....	.....

WAVE LENGTH

The wave length in meters is given by the following expression when L , the inductance, is in microhenries and C , the capacitance, is in microfarads. The resistance is assumed negligible.

$$\lambda = 1884\sqrt{LC}$$

VALUES OF "L C"

The following table gives values of the product of the inductance and capacitance (L C) in microhenries and microfarads for wave lengths from 1 to 20,000 meters, and the corresponding frequencies in kilocycles.

Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads	Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads
1	300,000.	.00000028	570	526.3	.09141
10	30,000.	.00002816	580	517.2	.09467
20	15,000.	.0001129	590	508.5	.09803
30	10,000.	.0002530	600	500.	.1014
40	7,500.	.0004503	610	491.8	.1047
50	6,000.	.0007039	620	483.7	.1082
60	5,000.	.001014	630	476.2	.1117
70	4,286.	.001378	640	468.7	.1154
80	3,750.	.001801	650	461.5	.1188
90	3,333.	.002280	660	454.5	.1225
100	3,000.	.002816	670	447.8	.1263
110	2,727.	.003404	680	441.2	.1302
120	2,500.	.004052	690	434.8	.1341
130	2,308.	.004757	700	428.6	.1378
140	2,144.	.005518	710	422.5	.1419
150	2,000.	.006335	720	416.7	.1459
160	1,875.	.007204	730	411.	.1501
170	1,765.	.008134	740	405.4	.1540
180	1,667.	.009120	750	400.	.1583
190	1,579.	.01016	760	394.7	.1625
200	1,500.	.01129	770	389.6	.1668
210	1,428.5	.01239	780	384.6	.1714
220	1,364.	.01362	790	379.8	.1756
230	1,304.2	.01490	800	375.	.1801
240	1,250.	.01624	810	370.4	.1847
250	1,200.	.01755	820	365.9	.1893
260	1,153.8	.01901	830	361.4	.1941
270	1,111.	.02052	840	357.1	.1985
280	1,071.3	.02209	850	352.9	.2034
290	1,034.3	.02372	860	348.8	.2082
300	1,000.	.02530	870	344.8	.2132
310	967.7	.02704	880	340.9	.2179
320	937.5	.02884	890	337.1	.2229
330	909.1	.03069	900	333.3	.2280
340	882.4	.03250	910	329.7	.2332
350	859.1	.03446	920	326.1	.2381
360	833.3	.03648	930	322.6	.2434
370	810.8	.03856	940	319.1	.2487
380	789.5	.04070	950	315.9	.2541
390	769.2	.04277	960	312.5	.2595
400	750.	.04503	970	309.3	.2647
410	731.7	.04733	980	306.1	.2704
420	714.3	.04968	990	303.	.2759
430	697.7	.05198	1,000	300.	.2816
440	681.8	.05446	1,010	297.03	.2870
450	666.7	.05700	1,020	294.12	.2927
460	652.2	.05960	1,030	291.26	.2986
470	638.3	.06225	1,040	288.45	.3045
480	625.	.06485	1,050	285.71	.3105
490	612.2	.06757	1,060	283.	.3161
500	600.	.07039	1,070	280.37	.3222
510	588.2	.07327	1,080	277.78	.3283
520	576.9	.07606	1,090	275.23	.3345
530	566.	.07903	1,100	272.73	.3404
540	555.6	.08208	1,110	270.27	.3467
550	545.4	.08518	1,120	267.85	.3531
560	535.7	.08836	1,130	265.48	.3595

VALUES OF "L C" (Continued)

Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads	Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads
1,140	263.15	.3660	1,740	172.41	.8520
1,150	260.86	.3721	1,750	171.43	.8620
1,160	258.61	.3787	1,760	170.46	.8720
1,170	256.4	.3853	1,770	169.49	.8821
1,180	254.23	.3921	1,780	168.54	.8916
1,190	252.1	.3988	1,790	167.6	.9019
1,200	250.	.4052	1,800	166.67	.912
1,210	247.93	.4121	1,810	165.75	.9224
1,220	245.9	.4190	1,820	164.84	.9327
1,230	243.9	.4260	1,830	163.94	.9425
1,240	241.93	.4326	1,840	163.04	.9530
1,250	240.	.4397	1,850	162.22	.9634
1,260	238.09	.4469	1,860	161.29	.9741
1,270	236.22	.4541	1,870	160.43	.9844
1,280	234.37	.4610	1,880	159.58	.9948
1,290	232.56	.4683	1,890	158.73	1.0056
1,300	230.76	.4757	1,900	157.89	1.0164
1,310	229.01	.4831	1,910	157.06	1.0265
1,320	227.27	.4906	1,920	156.30	1.0375
1,330	225.56	.4978	1,930	155.44	1.0485
1,340	223.87	.5053	1,940	154.63	1.0597
1,350	222.22	.5130	1,950	153.84	1.0706
1,360	220.59	.5208	1,960	153.06	1.0811
1,370	218.97	.5281	1,970	152.28	1.0923
1,380	217.39	.5359	1,980	151.51	1.1035
1,390	215.83	.5438	1,990	150.75	1.1148
1,400	214.38	.5518	2,000	150.	1.1256
1,410	212.76	.5598	2,100	142.85	1.2412
1,420	211.26	.5674	2,200	136.36	1.3624
1,430	209.79	.5755	2,300	130.43	1.4893
1,440	208.34	.5837	2,400	125.00	1.6218
1,450	206.90	.5919	2,500	120.	1.7597
1,460	205.47	.5998	2,600	115.38	1.9026
1,470	204.08	.6081	2,700	111.11	2.0520
1,480	202.70	.6165	2,800	107.14	2.207
1,490	201.34	.6250	2,900	103.45	2.3663
1,500	200.	.6335	3,000	100.	2.533
1,510	198.68	.6416	3,100	96.77	2.705
1,520	197.36	.6502	3,200	93.75	2.883
1,530	196.07	.6590	3,300	90.91	3.065
1,540	194.80	.6670	3,400	88.24	3.255
1,550	193.56	.6760	3,500	85.91	3.448
1,560	192.31	.6849	3,600	83.33	3.648
1,570	191.06	.6938	3,700	81.08	3.854
1,580	189.86	.7028	3,800	78.95	4.065
1,590	188.67	.7118	3,900	76.92	4.281
1,600	187.5	.7204	4,000	75.00	4.500
1,610	186.34	.7295	4,100	73.17	4.732
1,620	185.19	.7387	4,200	71.43	4.966
1,630	184.05	.7480	4,300	69.77	5.206
1,640	182.93	.7573	4,400	68.18	5.451
1,650	181.82	.7662	4,500	66.67	5.700
1,660	180.73	.7756	4,600	65.22	5.956
1,670	179.64	.7852	4,700	63.83	6.219
1,680	178.57	.7946	4,800	62.500	6.486
1,690	177.51	.8037	4,900	61.22	6.759
1,700	176.46	.8134	5,000	60.00	7.038
1,710	175.44	.8231	5,100	58.82	7.32
1,720	174.42	.8329	5,200	57.69	7.61
1,730	173.41	.8422	5,300	56.60	7.91

VALUES OF "L C" (Continued)

Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads	Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads
5,400	55.56	8.21	10,600	28.30	31.6
5,500	54.55	8.51	10,800	27.78	32.8
5,600	53.57	8.83	11,000	27.275	34.0
5,700	52.63	9.15	11,200	26.785	35.3
5,800	51.72	9.47	11,400	26.315	36.6
5,900	50.85	9.81	11,600	25.86	37.9
6,000	50.	10.1	11,800	25.425	39.2
6,100	49.18	10.5	12,000	25.0	40.4
6,200	48.55	10.8	12,200	24.590	42.0
6,300	47.62	11.1	12,400	24.275	43.3
6,400	46.87	11.5	12,600	23.86	44.4
6,500	46.15	11.9	12,800	23.435	46.0
6,600	45.45	12.3	13,000	23.075	47.6
6,700	44.78	12.6	13,200	22.275	49.2
6,800	44.12	13.0	13,400	22.39	50.4
6,900	43.48	13.4	13,600	22.06	52.0
7,000	42.86	13.8	13,800	21.74	53.2
7,100	42.25	14.2	14,000	21.43	55.2
7,200	41.67	14.6	14,200	21.125	56.8
7,300	41.1	15.0	14,400	20.835	58.4
7,400	40.54	15.4	14,600	20.55	60.0
7,500	40.	15.8	14,800	20.27	61.6
7,600	39.47	16.3	15,000	20.00	63.2
7,700	38.96	16.7	15,200	19.735	65.2
7,800	38.46	17.1	15,400	19.48	66.1
7,900	37.98	17.6	15,600	19.23	68.4
8,000	37.50	18.0	15,800	18.990	70.4
8,100	37.04	18.5	16,000	18.75	72.0
8,200	36.59	18.9	16,200	18.52	74.0
8,300	36.14	19.4	16,400	18.295	75.6
8,400	35.71	19.9	16,600	18.07	77.6
8,500	35.29	20.3	16,800	17.855	79.6
8,600	34.88	20.8	17,000	17.645	81.2
8,700	34.48	21.3	17,200	17.440	83.2
8,800	34.09	21.8	17,400	17.24	85.2
8,900	33.71	22.3	17,600	17.045	87.2
9,000	33.33	22.8	17,800	16.855	89.2
9,100	32.97	23.3	18,000	16.665	91.2
9,200	32.61	23.8	18,200	16.485	93.2
9,300	32.26	24.3	18,400	16.305	95.2
9,400	31.91	24.9	18,600	16.13	97.2
9,500	31.59	25.4	18,800	15.955	99.6
9,600	31.25	25.9	19,000	15.795	101.6
9,700	30.93	26.5	19,200	15.625	103.6
9,800	30.61	27.0	19,400	15.465	106.0
9,900	30.31	27.6	19,600	15.305	108.0
10,000	30.00	28.1	19,800	15.155	110.4
10,200	29.41	29.3	20,000	15.00	112.4
10,400	28.845	30.4			

VALUES OF w AND $1/w^2$

Computed by C. W. Winkler,
submitted by J. Johnsen

The values for w were computed to 9 significant figures and rounded to 8. These values, in the range 100 to 1000 kc, were obtained by adding the common difference $2\pi \times 10^{-2}$ for intervals of 1 kc. Every fifth entry was checked by adding $\pi \times 10^{-1}$ to the previous key entry. Values from 1000 to 2000 kc were obtained in the same way except the common difference here is $2\pi \times 10^{-3}$. The values for $1/w^2$ were obtained by taking the reciprocal of the squared values of w and were checked with some previously computed tables.

EXTENSION OF TABLES

Let the tabulated value for w be M . The range of the tables may be extended as follows:

Frequency	w	$1/w^2$
5 cycles	$M \times 10^{-5}$	$M \times 10^{10}$
50 cycles	$M \times 10^{-4}$	$M \times 10^8$
500 cycles	$M \times 10^{-3}$	$M \times 10^6$
5 kc	$M \times 10^{-2}$	$M \times 10^4$
50 kc	$M \times 10^{-1}$	$M \times 10^2$
500 kc	M	M
5 mc	$M \times 10$	$M \times 10^{-2}$
50 mc	$M \times 10^2$	$M \times 10^{-4}$
500 mc	$M \times 10^3$	$M \times 10^{-6}$
5000 mc	$M \times 10^4$	$M \times 10^{-8}$

VALUES OF w

Freq. kc	$w \times 10^5$	Freq. kc	$w \times 10^6$	Freq. kc	$w \times 10^6$	Freq. kc	$w \times 10^6$
100	6.2831853						
105	6.5973446	205	1.2880530	305	1.9163715	405	2.5446900
110	6.9115038	210	1.3194689	310	1.9477874	410	2.5761060
115	7.2256631	215	1.3508848	315	1.9792034	415	2.6075219
120	7.5398224	220	1.3823008	320	2.0106192	420	2.6389378
125	7.8539816	225	1.4137167	325	2.0420352	425	2.6703538
130	8.1681409	230	1.4451326	330	2.0734511	430	2.7017697
135	8.4823001	235	1.4765485	335	2.1048671	435	2.7331856
140	8.7964594	240	1.5079645	340	2.1362830	440	2.7646015
145	9.1106187	245	1.5393804	345	2.1676989	445	2.7960175
150	9.4247779	250	1.5707963	350	2.1991148	450	2.8274334
155	9.7389372	255	1.6022122	355	2.2305308	455	2.8588493
160	10.0530965	260	1.6336282	360	2.2619467	460	2.8902652
	$w \times 10^6$	265	1.6650441	365	2.2933626	465	2.9216812
165	1.0367256	270	1.6964600	370	2.3247786	470	2.9530971
170	1.0681415	275	1.7278759	375	2.3561945	475	2.9845130
175	1.0995574	280	1.7592919	380	2.3876104	480	3.0159289
		285	1.7907078	385	2.4190263	485	3.0473449
180	1.1309733	290	1.8221237	390	2.4504423	490	3.0787608
185	1.1623893	295	1.8535397	395	2.4818582	495	3.1101767
190	1.1938052	300	1.8849556	400	2.5132741	500	3.1415927
195	1.2252211						
200	1.2566371						

VALUES OF W (Continued)

Freq. kc	w × 10 ⁶	Freq. kc	w × 10 ⁶	Freq. kc	w × 10 ⁶	Freq. kc	w × 10 ⁶
505	3.1730086	755	4.7438049	1005	6.3146012	1255	7.8853976
510	3.2044245	760	4.7752208	1010	6.3460172	1260	7.9168135
515	3.2358404	765	4.8066368	1015	6.3774331	1265	7.9482294
520	3.2672564	770	4.8380527	1020	6.4088490	1270	7.9796453
525	3.2986723	775	4.8694686	1025	6.4402649	1275	8.0110613
530	3.3300882	780	4.9008845	1030	6.4716809	1280	8.0424772
535	3.3615041	785	4.9323005	1035	6.5030968	1285	8.0738931
540	3.3929200	790	4.9637164	1040	6.5345127	1290	8.1053090
545	3.4243360	795	4.9951323	1045	6.5659286	1295	8.1367250
550	3.4557519	800	5.0265482	1050	6.5973446	1300	8.1681409
555	3.4871678	805	5.0579642	1055	6.6287605	1305	8.1995568
560	3.5185838	810	5.0893801	1060	6.6601764	1310	8.2309727
565	3.5499997	815	5.1207960	1065	6.6915923	1315	8.2623887
570	3.5814156	820	5.1522119	1070	6.7230083	1320	8.2938046
575	3.6128315	825	5.1836279	1075	6.7544242	1325	8.3252205
580	3.6442475	830	5.2150438	1080	6.7858401	1330	8.3566364
585	3.6756634	835	5.2464597	1085	6.8172561	1335	8.3880524
590	3.7070793	840	5.2778757	1090	6.8486720	1340	8.4194683
595	3.7384953	845	5.3092916	1095	6.8800879	1345	8.4508842
600	3.7699112	850	5.3407075	1100	6.9115038	1350	8.4823002
605	3.8013271	855	5.3721234	1105	6.9429198	1355	8.5137161
610	3.8327430	860	5.4035394	1110	6.9743357	1360	8.5451320
615	3.8641590	865	5.4349553	1115	7.0057516	1365	8.5765479
620	3.8955749	870	5.4663712	1120	7.0371675	1370	8.6079639
625	3.9269908	875	5.4977871	1125	7.0685835	1375	8.6393798
630	3.9584067	880	5.5292031	1130	7.0999994	1380	8.6707957
635	3.9896827	885	5.5606190	1135	7.1314153	1385	8.7022116
640	4.0212386	890	5.5920349	1140	7.1628312	1390	8.7336276
645	4.0526545	895	5.6234508	1145	7.1942472	1395	8.7650435
650	4.0840704	900	5.6548668	1150	7.2256631	1400	8.7964594
655	4.1154864	905	5.6862827	1155	7.2570790	1405	8.8278753
660	4.1469023	910	5.7176986	1160	7.2884949	1410	8.8592913
665	4.1783182	915	5.7491145	1165	7.3199109	1415	8.8907072
670	4.2097342	920	5.7805305	1170	7.3513268	1420	8.9221231
675	4.2411501	925	5.8119464	1175	7.3827427	1425	8.9535391
680	4.2725660	930	5.8433623	1180	7.4141587	1430	8.9849550
685	4.3039819	935	5.8747783	1185	7.4455746	1435	9.0163709
690	4.3353979	940	5.9061942	1190	7.4769905	1440	9.0477868
695	4.3668138	945	5.9376101	1195	7.5084064	1445	9.0792028
700	4.3982297	950	5.9690260	1200	7.5398224	1450	9.1106187
705	4.4296456	955	6.0004420	1205	7.5712383	1455	9.1420346
710	4.4610616	960	6.0318579	1210	7.6026542	1460	9.1734505
715	4.4924775	965	6.0632738	1215	7.6340701	1465	9.2048665
720	4.5238934	970	6.0946897	1220	7.6654861	1470	9.2362824
725	4.5553093	975	6.1261057	1225	7.6969020	1475	9.2676983
730	4.5867253	980	6.1575216	1230	7.7283180	1480	9.2991142
735	4.6181412	985	6.1889375	1235	7.7597338	1485	9.3305302
740	4.6495571	990	6.2203534	1240	7.7911498	1490	9.3619461
745	4.6809730	995	6.2517694	1245	7.8225657	1495	9.3933620
750	4.7123890	1000	6.2831853	1250	7.8539816	1500	9.4247779

VALUES OF W (Continued)

Freq. kc	w × 10 ⁶	Freq. kc	w × 10 ⁶	Freq. kc	w × 10 ⁶	Freq. kc	w × 10 ⁶
1505	9.4561939	1630	1.0241592	1755	1.1026990	1880	1.1812388
1510	9.4876098	1635	1.0273008	1760	1.1058406	1885	1.1843804
1515	9.5190257	1640	1.0304424	1765	1.1089822	1890	1.1875220
1520	9.5504417	1645	1.0334840	1770	1.1121238	1895	1.1906636
1525	9.5818576	1650	1.0367256	1775	1.1152654	1900	1.1938052
1530	9.6132735	1655	1.0398672	1780	1.1184070	1905	1.1969468
1535	9.6446894	1660	1.0430088	1785	1.1215486	1910	1.2000884
1540	9.6761054	1665	1.0461504	1790	1.1246902	1915	1.2032300
1545	9.7075213	1670	1.0492919	1795	1.1278318	1920	1.2063716
1550	9.7389372	1675	1.0524335	1800	1.1309734	1925	1.2095132
1555	9.7703531	1680	1.0555751	1805	1.1341149	1930	1.2126548
1560	9.8017691	1685	1.0587167	1810	1.1372565	1935	1.2157964
1565	9.8331850	1690	1.0618583	1815	1.1403981	1940	1.2189379
1570	9.8646009	1695	1.0649999	1820	1.1435397	1945	1.2220795
1575	9.8960168	1700	1.0681415	1825	1.1466813	1950	1.2252211
1580	9.9274328	1705	1.0712831	1830	1.1498229	1955	1.2283627
1585	9.9588487	1710	1.0744247	1835	1.1529645	1960	1.2315043
1590	9.9902646	1715	1.0775663	1840	1.1561061	1965	1.2346459
1595	10.0216806	1720	1.0807079	1845	1.1592477	1970	1.2377875
1600	10.0530965	1725	1.0838495	1850	1.1623893	1975	1.2409291
1605	1.0084512	1730	1.0869911	1855	1.1655309	1980	1.2440707
1610	1.0115928	1735	1.0901326	1860	1.1686725	1985	1.2472123
1615	1.0147344	1740	1.0932742	1865	1.1718141	1990	1.2503539
1620	1.0178760	1745	1.0964158	1870	1.1749557	1995	1.2534955
1625	1.0210176	1750	1.0995574	1875	1.1780972	2000	1.2566371

VALUES OF 1/W²

Freq. kc	1/w ² × 10 ⁻¹²	Freq. kc	1/w ² × 10 ⁻¹³	Freq. kc	1/w ² × 10 ⁻¹³	Freq. kc	1/w ² × 10 ⁻¹³
100	2.533029	205	6.027435	305	2.722955	405	1.544294
105	2.297532	210	5.743831	310	2.635826	410	1.506858
110	2.093412	215	5.479783	315	2.552813	415	1.470767
115	1.915334	220	5.258299	320	2.473661	420	1.435957
120	1.759048	225	5.003515	325	2.398134	425	1.402369
125	1.621138	230	4.788335	330	2.326014	430	1.369945
130	1.498834	235	4.586744	335	2.257099	435	1.338633
135	1.389865	240	4.397620	340	2.191202	440	1.308383
140	1.292362	245	4.219957	345	2.128149	445	1.279146
145	1.204770	250	4.052847	350	2.067779	450	1.250878
150	1.125790	255	3.895470	355	2.009942	455	1.223538
155	1.054330	260	3.747085	360	1.954498	460	1.197083
	1/w ² × 10 ⁻¹³	265	3.607019	365	1.901317	465	1.171478
160	9.894647	270	3.474663	370	1.850277	470	1.146686
165	9.304056	275	3.349460	375	1.801265	475	1.122672
170	8.764808	280	3.230905	380	1.754175	480	1.099405
175	8.271117	285	3.118534	385	1.708908	485	1.076853
		290	3.011925	390	1.665371	490	1.054989
180	7.817993	295	2.910691	395	1.623476	495	1.033784
185	7.401108	300	2.814477	400	1.583143	500	1.013211
190	7.016702						
195	6.661485						
200	6.332573						

VALUES OF $1/W^2$ (Continued)

Freq. kc	$1/w^2 \times 10^{-14}$	Freq. kc	$1/w^2 \times 10^{-14}$	Freq. kc	$1/w^2 \times 10^{-14}$	Freq. kc	$1/w^2 \times 10^{-14}$
505	9.932475	755	4.44372	1005	2.50789	1255	1.60825
510	9.738676	760	4.38542	1010	2.48312	1260	1.59550
515	9.55051	765	4.32831	1015	2.45871	1265	1.58292
520	9.36772	770	4.27227	1020	2.43467	1270	1.57048
525	9.19013	775	4.21732	1025	2.41097	1275	1.55819
530	9.01754	780	4.16342	1030	2.38763	1280	1.54604
535	8.84977	785	4.11055	1035	2.36461	1285	1.53403
540	8.68664	790	4.05869	1040	2.34193	1290	1.52216
545	8.52800	795	4.00780	1045	2.31957	1295	1.51043
550	8.37365	800	3.95785	1050	2.29753	1300	1.49883
555	8.22345	805	3.90884	1055	2.27581	1305	1.48737
560	8.07726	810	3.86074	1060	2.25438	1310	1.47604
565	7.93495	815	3.81550	1065	2.23327	1315	1.46484
570	7.79650	820	3.76714	1070	2.21239	1320	1.45376
575	7.66134	825	3.72162	1075	2.19191	1325	1.44281
580	7.52981	830	3.67692	1080	2.17166	1330	1.43198
585	7.40166	835	3.63302	1085	2.15170	1335	1.42127
590	7.27673	840	3.58990	1090	2.13200	1340	1.41069
595	7.15495	845	3.54753	1095	2.11257	1345	1.40022
600	7.03620	850	3.50592	1100	2.09341	1350	1.38986
605	6.92039	855	3.46504	1105	2.07451	1355	1.37963
610	6.80738	860	3.42487	1110	2.05586	1360	1.36950
615	6.69716	865	3.38539	1115	2.03747	1365	1.35949
620	6.58955	870	3.34660	1120	2.01931	1370	1.34957
625	6.48456	875	3.30844	1125	2.00416	1375	1.33978
630	6.38201	880	3.27095	1130	1.98373	1380	1.33009
635	6.28190	885	3.23410	1135	1.96629	1385	1.32051
640	6.18416	890	3.19786	1140	1.94908	1390	1.31102
645	6.08863	895	3.16110	1145	1.93210	1395	1.30164
650	5.99535	900	3.12719	1150	1.91533	1400	1.29236
655	5.90416	905	3.09274	1155	1.89879	1405	1.28318
660	5.81503	910	3.05885	1160	1.88245	1410	1.27410
665	5.72792	915	3.02551	1165	1.86633	1415	1.26511
670	5.64274	920	2.99270	1170	1.85041	1420	1.25621
675	5.55958	925	2.96044	1175	1.83469	1425	1.24741
680	5.47800	930	2.92869	1180	1.81918	1430	1.23870
685	5.39831	935	2.89745	1185	1.80386	1435	1.23009
690	5.32037	940	2.86671	1190	1.78873	1440	1.22185
695	5.24408	945	2.83646	1195	1.77380	1445	1.21312
700	5.16944	950	2.80667	1200	1.75905	1450	1.20477
705	5.09640	955	2.77737	1205	1.74448	1455	1.19650
710	5.02486	960	2.74851	1210	1.73010	1460	1.18832
715	4.95483	965	2.72011	1215	1.71588	1465	1.18023
720	4.88626	970	2.69213	1220	1.70185	1470	1.17221
725	4.81908	975	2.66459	1225	1.68798	1475	1.16428
730	4.75339	980	2.63747	1230	1.67429	1480	1.15642
735	4.68885	985	2.61077	1235	1.66076	1485	1.14865
740	4.62569	990	2.58446	1240	1.64739	1490	1.14096
745	4.56382	995	2.55855	1245	1.63419	1495	1.13333
750	4.50317	1000	2.53303	1250	1.62114	1500	1.12579

VALUES OF $1/W^2$ (Continued)

Freq. kc	$1/w^2 \times 10^{-14}$	Freq. kc	$1/w^2 \times 10^{-15}$	Freq. kc	$1/w^2 \times 10^{-15}$	Freq. kc	$1/w^2 \times 10^{-15}$
1505	1.11832	1630	9.53375	1755	8.22406	1880	7.16679
1510	1.11193	1635	9.47556	1760	8.17738	1885	7.12882
1515	1.10361	1640	9.41785	1765	8.13113	1890	7.09115
1520	1.09636	1645	9.36070	1770	8.08526	1895	7.05378
1525	1.08918	1650	9.30404	1775	8.03977	1900	7.01670
1530	1.08208	1655	9.24792	1780	7.99467	1905	6.97992
1535	1.07504	1660	9.19230	1785	7.94994	1910	6.94342
1540	1.06807	1665	9.13717	1790	7.90559	1915	6.90721
1545	1.06117	1670	9.08256	1795	7.86161	1920	6.87128
1550	1.05433	1675	9.02840	1800	7.81799	1925	6.83563
1555	1.04756	1680	8.97475	1805	7.77474	1930	6.80026
1560	1.04086	1685	8.92155	1810	7.73185	1935	6.76516
1565	1.03422	1690	8.86882	1815	7.68930	1940	6.73034
1570	1.02764	1695	8.81659	1820	7.64711	1945	6.69578
1575	1.02113	1700	8.76480	1825	7.60527	1950	6.66149
1580	1.01467	1705	8.71348	1830	7.56377	1955	6.62745
1585	1.00828	1710	8.66260	1835	7.52260	1960	6.59368
1590	1.00195	1715	8.61216	1840	7.48177	1965	6.56017
	$1/w^2 \times 10^{-15}$	1720	8.56218	1845	7.44128	1970	6.52691
		1725	8.51260	1850	7.40111	1975	6.49391
1595	9.95678	1730	8.46371	1855	7.36126	1980	6.46115
1600	9.89464	1735	8.41475	1860	7.32174	1985	6.42864
		1740	8.36647	1865	7.28253	1990	6.39638
1605	9.83310	1745	8.31858	1870	7.24364	1995	6.36436
1610	9.77211	1750	8.27112	1875	7.20506	2000	6.33257
1615	9.71170						
1620	9.65184						
1625	9.59254						

CHARACTERISTICS OF

Compiled by

Since the exact operating characteristics may vary considerably depending upon the use information should be consulted for further details.

Abbreviations

A.C., alternating current	D.C., direct current
A.F., audio frequency	Det., detector
Amp., amperes, amplifier, amplification	Diss., dissipation
B, bayonet	Fil., filament
Coat., coated	Heat., heater
Cond., conductance	H. F., high frequency
Conv., converter, conversion	m, milli-
Cur., current	M, medium

RECEIVING

Metal tubes are designated by the letter M in front of the tube number. The type of connections are indicated by diagrams with the corresponding numbers, following the tables.

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type ¹	Potential volts	Current amp.			
00-A	Detector, triode.....	MB 4-4	D.C. Fil.	5.0	0.25	45	1.5	.....
01-A	Det., ² amp., class A.....	MB 4-4	D.C. Fil.	5.0	0.25	90	2.5	.....
						135	3.0	.....
1A4 ³	R.F. amp., pentode, class A	S 4-11	D.C. Fil.	2.0	0.06	90	2.2	67.5
						180	2.3	67.5
1A6 ³	Pentagrid conv. ⁴	S 6-10	D.C. Fil.	2.0	0.06	135	1.2	67.5
						180	1.3	67.5
1B4	R.F. amp., pentode, class A	S 4-11	D.C. Fil.	2.0	0.06	90	1.6	67.5
						180	1.7	67.5
1B5, 25S ³	Duplex diode, triode, class A amp.	S 6-11	D.C. Fil.	2.0	0.06	135	0.8	.....
1C6 ³	Pentagrid conv. ⁴	S 6-10	D.C. Fil.	2.0	0.12	135	1.3	67.5
						180	1.5	67.5
1F4 ³	Pow. amp., pentode, class A	M 5-9	D.C. Fil.	2.0	0.12	135	8.0	135
1F6 ³	Duplex diode, pentode							
	Pentode unit as R.F. amp.	S 6-17	D.C. Fil.	2.0	0.06	180	2.0	67.5
	Pentode unit as A.F. amp.	S 6-17	D.C. Fil.	2.0	0.06	135 ¹⁴	.....	.....
2A3	Pow. amp., triode							
	Class A.....	M 4-4	Fil.	2.5	2.5	250	60.0	.....
	Push-pull, Class AB ₁ ⁷ ..	M 4-4	Fil.	2.5	2.5	300	80.0	.....
						300	80.0	.....
2A5	Pow. amp., pentode.....	M 6-2	Heat.	2.5	1.75	.....	
2A6	Duplex diode, high-mu triode, triode unit as amp.	S 6-7	Heat.	2.5	0.8	250	.....	.....
2A7	Pentagrid conv. ⁴	S 7-3	Heat.	2.5	0.8	250	.....	100
2B7	Duplex diode, pentode, amp.	S 7-4	Heat.	2.5	0.8	250	.....	125

THERMIONIC VACUUM TUBES

J. R. Martin

to which the electronic devices may be put, the manufacturers' specifications and special

Abbreviations

Ma, milliampere	Pow., power
Max., maximum	Resist., resistance
Meg., megohm	R.F., radio frequency
Min., minimum	S, small
Mod., modulator	Thor., thoriated
Mog.Scr., mogul screw	Tung., tungsten
O, octal	Volt., voltage
Osc., oscillator	μ , micro-

TUBES

base is indicated by two numbers the first of which is the number of prongs. The base

Type No.	Screen current ma	Grid bias ¹ volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
00-A	Return to (—) filament		30000	20	666		
01-A	...	— 4.5	11000	8	725		
	...	— 9.0	10000	8	800		
1A4	0.9	— 3.0 min.	600000	425	720		
	0.8	— 3.0 min.	1000000	750	750		
1A6	2.5	— 3.0 min.	400000	Anode-grid (#2): 180 ^s max. volts, 2.3 ma.			
	2.4	— 3.0 min.	500000	Osc.-grid (#1) resistor, 50000 ohms			
				Conv. cond., 300 micromhos.			
1B4	0.7	— 3.0	1000000	550	600		
	0.6	— 3.0	1500000	1000	650		
1B5, 25S	...	— 3.0	35000	20	575		
1C6	2.0	— 3.0 min.	550000	Anode-grid (#2): 180 ^s max. volts, 3.3 ma.			
	2.0	— 3.0 min.	750000	Osc.-grid (#1) resistor, 50000 ohms.			
				Conv. cond., 325 micromhos.			
1F4	2.6	— 4.5	200000	340	1700	0.34	16000
1F6							
	0.6	— 1.5	1000000	650	650		
	...	— 2.0	Screen supply, 135 volts applied through 0.8 megohm resistor. Grid resistor, ⁶ 1.0 megohm. Voltage gain, 46.				
2A3		— 45.0	800	4.2	5250	3.5	2500
	Self-bias, 780 ohms	...	.....	.....	.....	10.0 ^s	5000
	...	— 62.0	.....	.....	.....	15.0 ^s	3000
2A5	.....	.....	See type number 42.				
2A6	.....	.....	See type number 75.				
2A7	.....	.....	See type number 6A7.				
2B7	.....	.....	See type number 6B7.				

RECEIVING

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type ¹	Potential volts	Current amp.			
6A4, LA	Pow. amp., pentode, class A.	M 5-2	Fil.	6.3	0.3	100 130	9.0 22.0	100 180
6A6	Twin triode, amp.	M 7-2	Heat.	6.3	0.8	300		
6A7	Pentagrid conv. ⁴	S 7-3	Heat.	6.3	0.3	100 250	1.3 3.5	50 100
M 6A8 ³	Pentagrid conv. ⁴	SO 8-1	Heat.	6.3	0.3	100 250	1.2 3.3	50 100
6B7	Duplex diode, pentode							
	Pentode unit as R.F. amp.	S 7-4	Heat.	6.3	0.3	100 250	5.8 9.0	100 125
	Pentode unit as A.F. amp.	S 7-4	Heat.	6.3	0.3	90 ¹⁴ 300 ¹⁴		
M 6B8	Duplex diode, pentode							
	Pentode unit as R.F. amp.	SO 8-5	Heat.	6.3	0.3	250	10.0	125
	Pentode unit as A.F. amp.	SO 8-5	Heat.	6.3	0.3	90 ¹⁴ 300 ¹⁴		
M 6C5 ³	Det., ² amp., triode							
	Class A amp.	SO 6-12	Heat.	6.3	0.3	250 250 ¹⁵	8.0 1.0	
6C6	Bias detector	SO 6-12	Heat.	6.3	0.3	250		
6D6	Triple grid det., amp.	S 6-6	Heat.	6.3	0.3	250		100
	Triple grid amp.							
	Screen grid R.F. amp. .	S 6-6	Heat.	6.3	0.3	100 250	8.0 8.2	100 100
	Mixer in superheterodyne	S 6-6	Heat.	6.3	0.3	100 250		100 100
6E5	Electron ray tube, visual indicator	S 6-13	Heat.	6.3	0.3	100 250 ⁹		
M 6F5 ³	High-mu triode, class A amp.	SO 5-11	Heat.	6.3	0.3	250 250 ¹⁴	0.9 0.4	
M 6F6 ³	Pow. amp., pentode							
	Pentode, class A.	SO 7-14	Heat.	6.3	0.7	250 315	34.0 42.0	250 315
	Triode, ¹⁰ class A.	SO 7-14	Heat.	6.3	0.7	250	31.0	
	Pentode, push-pull, class AB ₂ ⁷	SO 7-14	Heat.	6.3	0.7	375 375	54.0 34.0	250 250
	Triode, push-pull, ¹⁰ class AB ₂ ⁷	SO 7-14	Heat.	6.3	0.7	350 350	50.0 45.0	
6F7	Triode, pentode							
	Triode, class A amp.	S 7-5	Heat.	6.3	0.3	100	3.5	
	Pentode, class A amp. .	S 7-5	Heat.	6.3	0.3	100 250	6.3 6.5	100 100
	Pentode unit as mixer. .	S 7-5	Heat.	6.3	0.3	250	2.8	100

TUBES (Continued)

Type No.	Screen current ma	Grid bias ¹ volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
6A4, LA	1.6 3.9	— 6.5 —12.0	83250 45500	100 100	1200 2200	0.31 1.40	11000 8000
6A7	2.5 2.2	— 3.0 min. — 3.0 min.	600000 360000	See type number 6N7. Anode-grid (#2): 250 ^s max. volts, 4.0 ma. Osc.-grid (#1) resistor, 50000 ohms. Conv. cond., 520 micromhos.			
M 6A8	1.5 3.2	— 3.0 min. — 3.0 min.	600000 360000	Anode-grid (#2): 250 ^s max. volts, 4.0 ma. Osc.-grid (#1) resistor, 50000 ohms. Conv. cond., 500 micromhos.			
6B7	1.7 2.3	— 3.0 — 3.0	300000 650000	285 730	950 1125		
	Self-bias, 3500 ohms. Screen resistor = 1.1 meg. Grid resistor, ⁶ 0.5 megohm. Gain per stage = 55.						
	Self-bias, 1600 ohms. Screen resistor = 1.2 meg. Grid resistor, ⁶ 0.5 megohm. Gain per stage = 79.						
M 6B8	2.3	— 3.0	600000	800	1325		
	Self-bias, 3500 ohms. Screen resistor = 1.1 meg. Grid resistor, ⁶ 0.5 megohm. Gain per stage = 55.						
	Self-bias, 1600 ohms. Screen resistor = 1.2 meg. Grid resistor, ⁶ 0.5 megohm. Gain per stage = 79.						
M 6C5	...	— 8.0 — 5.0 —17.0 approx.	10000	20	2000		
	Gain per stage = 14. Plate current to be adjusted to 0.2 ma with no signal.						
6C6	See type number 6J7.						
6D6	2.2 2.0	— 3.0 min. — 3.0 min. —10.0 —10.0	250000 800000	375 1280	1500 1800		
	Oscillator peak volts = 7.0						
6E5	Plate & target supply = 100 volts. Triode plate resistor = 0.5 meg. Target cur = 4.5 ma. Grid bias, —3.3 volts; shadow angle, 0°. Bias, 0 volts; angle, 90°; plate cur., 0.19 ma. Plate & target supply = 250 volts. Triode plate resistor = 1.0 meg. Target cur. = 4.5 ma. Grid bias, —8.0 volts; shadow angle, 0°. Bias, 0 volts; angle, 90°; plate cur., 0.24 ma.						
M 6F5	...	— 2.0 — 0.3	66000	100	1500		
	Grid resistor, 0.25 meg. ⁶ Gain per stage = 52.						
M 6F6	6.5 8.0 ... 8.0 5.0	—16.5 —22.0 —20.0 Self-bias —26.0 Self-bias —38.0	80000 75000 2600	200 200 7	2500 2650 2700	3.0 5.0 0.85 19.0 ^s 19.0 ^s 14.0 ^s 18.0 ^s	7000 7000 4000 10000 10000 10000 6000
	Self-bias resistor, 340 ohms. Self-bias resistor, 730 ohms.						
6F7	...	— 3.0	16000	8	500		
	1.6 1.5 0.6	— 3.0 min. — 3.0 min. —10.0	290000 850000	300 900	1050 1100		
	Osc. peak volts = 7.0. Conv. cond. = 300 micromhos.						

RECEIVING

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type ¹	Potential volts	Current amp.			
6G5	Electron ray tube, visual indicator	S 6-13	Heat.	6.3	0.3	100 250 ⁹	.....	.....
M 6J7 ³	Triple grid det., amp. Screen grid, R.F. amp. Screen grid, A.F. amp.	SO 7-13 SO 7-13	Heat. Heat.	6.3 6.3	0.3 0.3	100 250 90 ¹⁴ 300 ¹⁴	2.0 2.0	100 100
	Bias detector.....	SO 7-13	Heat.	6.3	0.3	250	11	100
M 6K7 ³	Triple grid amp. Screen grid R.F. amp.. Mixer in superheterodyne	SO 7-13 SO 7-13	Heat. Heat.	6.3 6.3	0.3 0.3	90 250 250	5.4 10.5	90 125 100
M 6L6 ³	Beam pow. amp. Single tube, class A ₁ ⁷ ... Push-pull, class A ₁ ⁷ ... Push-pull, class AB ₁ ⁷ .. Push-pull, class AB ₂ ⁷ ..	SO 7-18 SO 7-18 SO 7-18 SO 7-18	Heat. Heat. Heat. Heat.	6.3 6.3 6.3 6.3	0.9 0.9 0.9 0.9	250 250 250 400 400 400	72.0 75.0 120.0 120.0 102.0 112.0 88.0 102.0	250 250 250 300 300 300 250 300
M 6L7 ³	Pentagrid mixer, ¹² amp. Mixer in superheterodyne Class A amp.....	SO 7-15 SO 7-15	Heat. Heat.	6.3 6.3	0.3 0.3	250 250	2.4 5.3	100 100
M 6N7 ³	Twin triode, amp. Class A (as driver) ¹³ ... Class B.....	SO 8-2 SO 8-2	Heat. Heat.	6.3 6.3	0.8 0.8	250 294 250 300	6.0 7.0	.....
M 6Q7 ³	Duplex diode, high-mu triode, triode unit as class A amp.	SO 7-16	Heat.	6.3	0.3	100 250 100 ¹⁶ 250 ¹⁷	0.35 1.1 0.25 0.5	.....
M 6R7 ³	Duplex diode, triode, triode unit as class A amp.	SO 7-16	Heat.	6.3	0.3	250 250 ¹⁵	9.5 1.3	.....
10	Pow. amp., triode, class A	MB 4-4	Fil.	7.5	1.25	350 425	16.0 18.0	.....
12	Det., ² amp., triode, class A	MB 4-4	D.C. Fil.	1.1	0.25	90 135	2.5 3.0	.....
12-A	General purpose.....	4-4	Fil.	5.0	0.25	180	7.6	.....
15	R.F. amp., pentode, class A	S 5-6	Heat.	2.0	0.22	67.5 135	1.85 1.85	67.5 67.5
18	Output pentode.....	6-1	Heat.	14.0	0.30	250	34.0	250
19 ³	Twin triode, amp., class B	S 6-3	D.C. Fil.	2.0	0.26	135 135	.....	.....
20	Pow. amp., triode, class A	S 4-4	D.C. Fil.	3.3	0.132	90 135	3.0 6.5	.....

TUBES (Continued)

Type No.	Screen current ma.	Grid bias ¹ volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
6G5	Plate & target supply = 100 volts. Triode plate resistor = 0.5 meg. Target cur. = 4.5 ma. Grid bias, -8 volts; shadow angle, 0°. Bias, 0 volts; angle, 90°; plate cur., 0.19 ma. Plate & target supply = 250 volts. Triode plate resistor = 1.0 meg. Target cur. = 4.5 ma. Grid bias, -22 volts; shadow angle, 0°. Bias, 0 volts; angle, 90°; plate cur., 0.24 ma.						
M 6J7	0.5	- 3.0	1000000	1185	1185		
	0.5	- 3.0	>1500000	>1500	1225		
	Self-bias, 2600 ohms. Screen resistor = 1.2 meg. Grid resistor, ⁶ 0.5 megohm. Gain per stage = 85. Self-bias, 1200 ohms. Screen resistor = 1.2 meg. Grid resistor, ⁶ 0.5 megohm. Gain per stage = 140. 11						
		- 4.3	.....	Plate resistor, 500000 ohms. Grid resistor, ⁶ 250000 ohms.			
M 6K7	1.3	- 3.0 min.	315000	400	1275		
	2.6	- 3.0 min.	600000	990	1650		
	...	-10.0	Oscillator peak volts = 7.0.				
M 6L6	5.0	-14.0	.....			6.5	2500
	5.4	Self-bias	Self-bias resistor, 170 ohms.			6.5	2500
	10.0	-16.0	.....			14.5 ⁸	5000
	10.0	Self-bias	Self-bias resistor, 125 ohms.			13.8 ⁸	5000
	6.0	-25.0	.....			34.0 ⁸	6600
	7.0	Self-bias	Self-bias resistor, 200 ohms.			32.0 ⁸	6600
	4.0	-20.0	.....			40.0 ⁸	6000
	6.0	-25.0	.....			60.0 ⁸	3800
M 6L7	6.2	- 3.0	Osc.-grid (#3) bias, -10 volts. Grid #3 peak swing, 12 volts min. Conv. cond., 350 micromhos.				
	5.5	- 3.0 min. ¹⁸	800000	880	1100		
M 6N7	...	- 5.0	11300	35	3100	>0.4	>20000
	...	- 6.0	11000	35	3200	>0.4	>20000
	...	0	Power output is for one tube at stated plate-to-plate load.			8.0	8000
	...	0	.....			10.0	10000
M 6Q7	...	- 1.5	87500	70	800		
	...	- 3.0	58000	70	1200		
	...	- 1.1	(Grid resistor, ⁶ 0.5) Gain per stage = 35.				
	...	- 2.0	(megohm.) Gain per stage = 43.				
M 6R7	...	- 9.0	8500	16	1900	0.28	10000
	...	- 6.0	Grid resistor, ⁶ 0.5 megohm. Gain per stage = 12.				
10	...	-32.0	5150	8	1550	0.9	11000
	...	-40.0	5000	8	1600	1.6	10200
12	...	- 4.5	15500	6.6	425		
	...	-10.5	15000	6.6	440		
12-A	...	-13.5	5000	8.5	1700	0.260	10800
15	0.3	- 1.5	630000	450	710		
	0.3	- 1.5	800000	600	750		
18	...	-16.5	75000	165	2200	3.000	9000
19	...	0	Power output is for one tube at stated plate-to-plate load.			2.1	10000
	...	- 3.0	.....			1.9	10000
20	...	-16.5	8000	3.3	415	0.045	9600
	...	-22.5	6300	3.3	525	0.110	6500

RECEIVING

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type ¹	Potential volts	Current amp.			
22	R.F. amp., tetrode.....	M 4-9	D.C. Fil.	3.3	0.132	135	1.7	45
22	R.F. amp.....	5-5	Heat.	15.0	0.35	135	3.7	67.5
24-A	R.F. amp., tetrode					135	1.0	30
	R.F. amp.....	M 5-5	Heat.	2.5	1.75	180	4.0	90
						250	4.0	90
	Bias detector.....	M 5-5	Heat.	2.5	1.75	250 ¹⁹		20to45
M	Pow. amp., pentode, class	SO 7-14	Heat.	25.0	0.3	95	20.0	95
25A6 ³	A					180	38.0	135
26	Amp., triode, class A....	M 4-4	Fil.	1.5	1.05	90	2.9	
						180	6.2	
26	Detector.....	5-1	Heat.	15.0	0.35	90	4.5	
27	Det., ² amp., triode							
	Class A amp.....	M 5-1	Heat.	2.5	1.75	135	4.5	
						250	5.2	
	Bias detector.....	M 5-1	Heat.	2.5	1.75	250		
28	General purpose.....	5-1	Heat.	15.0	0.35	90	7.5	
29	Special detector.....	5-1	Heat.	2.5	1.00	180	4.5	
30 ³	Det., ² amp., triode,							
	Class A amp.....	S 4-4	D.C. Fil.	2.0	0.06	90	2.5	
						135	3.0	
						180	3.1	
	Class B amp.....	S 4-4	D.C. Fil.	2.0	0.06	157.5	1.0	
30	Power amp.....	5-1	Heat.	15.0	0.35	180	22.0	
31	Pow. amp., triode, class A	S 4-4	D.C. Fil.	2.0	0.13	135	8.0	
						180	12.3	
32	R.F. amp., tetrode							
	R.F. amp.....	M 4-9	D.C. Fil.	2.0	0.06	135	1.7	67.5
						180	1.7	67.5
	Bias detector.....	M 4-9	D.C. Fil.	2.0	0.06	180 ¹⁵		67.5
32	Voltage amp.....	5-1	Heat.	15.0	0.35	135	1.5	
33	Pow. amp., pentode, class	M 5-9	D.C. Fil.	2.0	0.26	180	22.0	180
	A							
34	R.F. amp., pentode.....	M 4-11	D.C. Fil.	2.0	0.06	135	2.8	67.5
						180	2.8	67.5
35	R.F. amp., tetrode.....	M 5-5	Heat.	2.5	1.75	180	6.3	90
						250	6.5	90
36	R.F. amp., tetrode							
	R.F. amp.....	S 5-5	Heat.	6.3	0.3	100	1.8	55
						250	3.2	90
	Bias detector.....	S 5-5	Heat.	6.3	0.3	100 ¹⁹		55
						250 ¹⁹		90
37	Det., ² amp., triode							
	Class A amp.....	S 5-1	Heat.	6.3	0.3	90	2.5	
						250	7.5	
	Bias detector.....	S 5-1	Heat.	6.3	0.3	90		
						250		
38	Pow. amp., pentode, class	S 5-6	Heat.	6.3	0.3	100	7.0	100
	A					250	22.0	250
39, 44	R.F. amp., pentode.....	S 5-6	Heat.	6.3	0.3	90	5.6	90
						250	5.8	90
40	Voltage amp., triode,	MB 4-4	D.C. Fil.	5.0	0.25	135 ¹⁴	0.2	
	class A					180 ¹⁴	0.2	
40	Power amp.....	5-1	Heat.	15.0	0.40	180	21.0	
41 ³	Pow. amp., pentode, class	S 6-2	Heat.	6.3	0.4	100	9.0	100
	A					250	32.0	250

TUBES (Continued)

Type No.	Screen current ma	Grid bias ¹ volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
22	0.6 max.	- 1.5	725000	270	375		
22	1.3 max.	- 1.5	325000	160	500		
24-A	...	- 1.5	700000	400	570		
	1.7 max.	- 3.0	400000	400	1000		
	1.7 max.	- 3.0	600000	630	1050		
M 25A6	...	- 5.0 approx.	Plate cur. to be adjusted to 0.1 ma with no signal.				
	4.0	-15.0	45000	90	2000	0.9	4500
	7.5	-20.0	40000	100	2500	2.75	5000
26	...	- 7.0	8900	8.3	935		
26	...	-14.5	7300	8.3	1150		
27	...	- 1.5	9000	10.5	1165		
	...	- 9.0	9000	9	1000		
	...	-21.0	9250	9	975		
	...	-30.0 approx.	Plate current to be adjusted to 0.2 ma with no signal.				
28	...	- 1.5	9000	10.5	1165		
29	...	- 3.0	20700	30	1450		
30	...	- 4.5	11000	9.3	850		
	...	- 9.0	10300	9.3	900		
	...	-13.5	10300	9.3	900		
	...	-15.0	...	...	...	2.1 ^s	8000
30	...	-27.0	3500	3.8	1100		
31	...	-22.5	4100	3.8	925	0.185	7000
	...	-30.0	3600	3.8	1050	0.375	5700
32	0.4 max.	- 3.0	950000	610	640		
	0.4 max.	- 3.0	1200000	780	650		
	...	- 6.0 approx.	Plate current to be adjusted to 0.2 ma with no signal.				
32	...	- 3.0	32000	30	940		
33	5.0	-18.0	55000	90	1700	1.4	6000
34	1.0	- 3.0 min.	600000	360	600		
	1.0	- 3.0 min.	1000000	620	620		
35	2.5 max.	- 3.0 min.	300000	305	1020		
	2.5 max.	- 3.0 min.	400000	420	1050		
36	...	- 1.5	550000	470	850		
	1.7 max.	- 3.0	550000	595	1080		
	...	- 5.0	Grid bias values are approximate. Plate current to be adjusted to 0.1 ma with no signal.				
	...	- 8.0					
37	...	- 6.0	11500	9.2	800		
	...	-18.0	8400	9.2	1100		
	...	-10.0	Grid bias values are approximate. Plate current to be adjusted to 0.2 ma with no signal.				
	...	-28.0					
38	1.2	- 9.0	140000	120	875	0.27	15000
	3.8	-25.0	100000	120	1200	2.50	10000
39, 44	1.6	- 3.0 min.	375000	360	960		
	1.4	- 3.0 min.	1000000	1050	1050		
40	...	- 1.5	150000	30	200		
	...	- 3.0	150000	30	200		
40	...	-40.5	2000	3	1500		
41	1.6	- 7.0	103500	150	1450	0.33	12000
	5.5	-18.0	68000	150	2200	3.40	7600

RECEIVING

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type ¹	Potential volts	Current amp.			
42	Pow. amp., pentode Pentode, class A.....	M 6-2	Heat.	6.3	0.7	250 315	34.0 42.0	250 315
	Triode, ¹⁰ class A.....	M 6-2	Heat.	6.3	0.7	250	31.0	.....
	Pentode, push-pull, class AB ₂ ⁷	M 6-2	Heat.	6.3	0.7	375 375	54.0 34.0	250 250
	Triode, push-pull, ¹⁰ class AB ₂ ⁷	M 6-2	Heat.	6.3	0.7	350 350	50.0 45.0	.....
43	Pow. amp., pentode, class A	M 6-2	Heat.	25.0	0.3	95 180	20.0 38.0	95 135
45	Pow. amp., triode Class A.....	M 4-4	Fil.	2.5	1.5	180 275	31.0 36.0	.....
	Class AB ₂ ⁷	M 4-4	Fil.	2.5	1.5	275 275	72.0 28.0	.....
46	Dual grid pow. amp. Class A ¹⁰	M 5-3	Fil.	2.5	1.75	250	22.0	.....
	Class B ²⁰	M 5-3	Fil.	2.5	1.75	300 400	8.0 12.0	.....
47	Pow. amp., pentode, class A	M 5-2	Fil.	2.5	1.75	250	31.0	250
48	Pow. amp., tetrode Tetrode, class A.....	M 6-1	D.C. Heat.	30.0	0.4	96 125	52.0 56.0	96 100
	Tetrode, push-pull, class A	M 6-1	D.C. Heat.	30.0	0.4	125	100.0	100
48	General purpose.....	5-1	Heat.	15.0	0.35	90	4.5	.....
49	Dual grid pow. amp. Class A ¹⁰	M 5-3	D.C. Fil.	2.0	0.12	135	6.0	.....
	Class B ²⁰	M 5-3	D.C. Fil.	2.0	0.12	180	4.0	.....
50	Pow. amp., triode, class A	MB 4-4	Fil.	7.5	1.25	300 400 450	35.0 55.0 55.0	.....
51	Variable mu.....	5-5	Fil.	2.5	1.75	180 250	5.8 6.3	75 90
52	Output amp.....	4-4	Fil.	6.3	0.30	100	42.0	.....
53	Twin triode, amp.....	M ²¹ 7-2	Heat.	2.5	2.0	300	.....	.....
55	Duplex diode, triode, triode unit as amp.	S 6-7	Heat.	2.5	1.0	250	.....	.....
56	Super-triode amp., det. ² ..	S 5-1	Heat.	2.5	1.0	250	.....	.....
57	Triple grid det., amp....	S 6-6	Heat.	2.5	1.0	250	.....	100
58	Triple grid amp., mixer..	S 6-6	Heat.	2.5	1.0	250	.....	100
59	Triple grid pow. amp. Triode, ²² class A.....	M 7-1	Heat.	2.5	2.0	250	26.0	.....
	Pentode, ²³ class A.....	M 7-1	Heat.	2.5	2.0	250	35.0	250
	Triode, ²⁴ class B.....	M 7-1	Heat.	2.5	2.0	300 400	20.0 26.0	.....
64	R. F. amp.....	5-5	Heat.	6.3	0.40	135	3.0	67
65	R. F. amp.....	5-5	Heat.	6.3	0.40	135	3.5	67
67	Power amp.....	5-1	Heat.	6.3	0.40	135	5.0	.....
68	Output pentode.....	6-1	Heat.	6.3	0.40	135	14.0	135
69	Special detector.....	6-1	Heat.	6.3	0.30	180	4.5	.....
71-A	Pow. amp., triode, class A	MB 4-4	Fil.	5.0	0.25	90 180	10.0 20.0	.....
75	Duplex diode, high-mu triode	S 6-7	Heat.	6.3	0.3	250 ¹⁴	0.4	.....

TUBES (Continued)

Type No.	Screen current ma	Grid bias ¹ volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
42	6.5 8.0 8.0 5.0 Self-bias	-16.5 -22.0 -20.0 Self-bias -26.0 Self-bias, 730 ohms.	80000 100000 2700 Self-bias resistor, 340 ohms.	190 260 6.2	2350 2600 2300	3.0 5.0 0.65 19.0 ^a 19.0 ^a 14.0 ^a	7000 7000 3000 10000 10000 10000
43	4.0 7.5	-38.0 -15.0 -20.0	45000 40000	90 100	2000 2500	18.0 ^a 0.90 2.75	6000 4500 5000
45	... ... Self-bias	-31.5 -56.0 Self-bias, 775 ohms.	1650 1700	3.5 3.5	2125 2050	0.82 2.00 12.0 ^a 18.0 ^a	2700 4600 5060 3200
46	... ... ...	-68.0 -33.0 0 0	2380	5.6	2350	... 1.25 16.0 ^a 20.0 ^a	... 6400 5200 5800
47	6.0	-16.5	60000	150	2500	2.7	7000
48	9.0 9.5 ...	-19.0 -20.0 -20.0	...	...	3800 3900	2.0 2.5 5.0 ^a	1500 1500 3000
48	...	-4.5	9000	10.5	1185		
49	... ... ...	-20.0 0 ...	4175	4.7	1125	0.17 3.5 ^a	11000 12000
50	... ... ... ... ...	-54.0 -70.0 -84.0 ...	2000 1800 1800	3.8 3.8 3.8	1900 2100 2100	1.6 3.4 4.6	4600 3670 4350
51	... ... ...	-1.5 -3.0 0	500000 500000	525 525	1050 1050		
52	...	0	Class B operation.				
53	...	See type number 6N7.					
55	...	See type number 85.					
56	...	See type number 76.					
57	...	See type number 6J7.					
58	...	See type number 6D6.					
59	... 9.0	-28.0 -18.0 0 0	2300 40000	6 100	2600 2500	1.25 3.0 15.0 ^a 20.0 ^a	5000 6000 4600 6000
64	...	-1.5	350000	370	1050		
65	...	-1.5	320000	320	1000		
67	...	-9.0	8200	9	1100		
68	...	-13.5	64500	90	1400		
69	...	-3.0	20700	30	1450		
71-A	... ...	-19.0 -43.0	2170 1750	3 3	1400 1700	0.125 0.790	3000 4800
75	...	-1.35	...	...	...	Gain per stage = 50-60	

RECEIVING

Type No.	Description and	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type ¹	Potential volts	Current amp.			
70	Super-triode amp., det. ² Class A amp.....	S 5-1	Heat.	6.3	0.3	100 250 250 ¹⁵	2.5 5.0 1.0	.....
77	Bias detector..... Triple grid det., amp. Screen grid, R.F. amp.	S 5-1 S 6-6	Heat. Heat.	6.3 6.3	0.3 0.3	250 100 250	..... 1.7 2.3	..... 60 100
	Bias detector.....	S 6-6	Heat.	6.3	0.3	250	25 ²⁵	50
78	Triple grid amp., mixer..	S 6-6	Heat.	6.3	0.3	250	.....	125
79	Twin triode, amp., class B	S 6-8	Heat.	6.3	0.6	180 250	.....	.....
85	Duplex diode, triode, triode unit as class A amp.	S 6-7	Heat.	6.3	0.3	135 250	3.7 8.0	.....
89	Triple grid pow. amp. Triode, ²² class A amp..	S 6-6	Heat.	6.3	0.4	160 250	17.0 32.0	.....
	Pentode, ²³ class A amp.	S 6-6	Heat.	6.3	0.4	100 250	9.5 32.0	100 250
	Triode, ²⁴ class B amp..	S 6-6	Heat.	6.3	0.4	180 180	6.0 6.0	.....
99	Det., ² amp., triode, class A	S 4-4	D.C. Fil.	3.3	0.063	90	2.5	.....
112-A	Det., ² amp., triode, class A	MB 4-4	D.C. Fil.	5.0	0.25	90 180	5.0 7.7	.....
182-B	Power amp.....	4-4	Heat.	5.0	1.25	200	18.0	.....
183	Power amp.....	4-4	Fil.	5.0	1.25	250	25.0	.....
210	Power amp.....	4-4	Fil.	7.5	1.25	250 350 425	10.0 16.0 18.0	.....
257	Power pentode.....	5-3	Fil.	5.0	0.30	110	20.0	110
291	A.F. amp.....	5-1	Heat.	12.3	0.30	120	3.0	.....
293	A.F. amp.....	Output stage 5-1	Heat.	6.3	0.60	120 173	30.0 4.0	.....
295	A.F. amp.....	Output stage 5-1	Heat.	2.5	4.0	180 250	17.5 4.0	.....
303-A, ²⁶	309-A ²⁶	Output stage	.....	.....	.....	250	52.0	.....
401	General purpose.....	4-4	Fil.	3.0	1.00	90	3.0	.....
402	Power output.....	4-4	Fil.	3.0	1.50	180	20.0	.....
483	Power output.....	4-4	Fil.	5.0	1.35	180	15.3	.....
484	General purpose.....	4-4	Fil.	3.0	1.30	135	6.0	.....
485	General purpose.....	5-1	Heat.	3.0	1.30	135	5.5	.....
864	Amp., det.....	4-4	Fil.	1.1	0.25	135 90	..... 2.9	.....
874	Voltage regulator.....	MB 4-14	.....	.....	.....	.....	.....	.....
876	Current regulator.....	Mog.Sor.	Fil.	.....	.....	.....	.....	.....
886	Current regulator.....	Mog.Sor.	Fil.	.....	.....	.....	.....	.....
956	R.F. amp., pentode.....	.....	Heat.	6.3	0.15	250	5.5	100
1603	Triple grid det., amp. Class A amp., pentode. Class A amp., triode...	S 6-6 S 6-6	Heat. Heat.	6.3 6.3	0.3 0.3	250 250	2.0 6.5	100
GA	Pentode.....	.....	Fil.	5.0	0.25	180	7.5	180
KR-5	Output pentode.....	.....	Fil.	6.3	0.30	165	17.0	165

TUBES (Continued)

Type No.	Screen current ma	Grid bias ¹ volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
76	...	- 5.0	12000	13.8	1150		
	...	-13.5	9500	13.8	1450		
	...	- 9.0					
	...	-20.0 approx.	Plate current to be adjusted to 0.2 ma with no signal.				
77	0.4	- 1.5	650000	715	1100		
	0.5	- 3.0	1500000	1500	1250		
	25	- 1.95	.....	Plate resistor, 250000 ohms., resistor, ⁶ 250000 ohms			Grid
78	.....	See type number 6K7.					
79	...	0	Power output is for one tube at stated plate-to-plate load.			5.5	7000
	...	0				8.0	14000
85	...	-10.5	11000	8.3	750	0.075	25000
	...	-20.0	7500	8.3	1100	0.350	20000
89	...	-20.0	3300	4.7	1425	0.30	7000
	...	-31.0	2600	4.7	1800	0.90	5500
	1.6	-10.0	104000	125	1200	0.33	10700
	5.5	-25.0	7000	125	1800	3.40	6750
	...	0	.....	.....	.....	2.50 ⁸	13600
	...	0	.....	.....	.....	3.50 ⁸	9400
99	...	- 4.5	15500	6.6	425		
112-A	...	- 4.5	5400	8.5	1575		
	...	-13.5	4700	8.5	1800		
182-B	...	-29.0	3330	5	1500		
183	...	-60.0	1670	3	1800		
210	...	-22.0	6000	8	1330	0.400	13000
	...	-31.0	5150	8	1550	0.900	11000
	...	-39.0	5000	8	1600	1.600	10200
257	...	-21.5	41000	55	1350	0.800	6000
291	...	-11.0	8700	6.8	750	.....	20000
	...	-11.0	4400	11.2	2550	1.250	3000
293	...	- 6.5	.....	.....	.....	.....	100000
	...	- 6.5	.....	.....	.....	1.250	8000
295	...	-14.0	12000	14.4	1200	.....	7500
	...	- 3.0	3000	13	4350	4.500	4000
401	...	- 4.5	10000	8	1000		
402	...	-40.0	2000	3	1000		
483	...	-40.5	2450	3.3	1340		
484	...	- 6.0	8900	12.5	1400		
485	...	- 6.0	8900	12.5	1400		
864	...	- 9.0	.....	8.2			
	...	- 4.5	13500	8.2	610		
874	Min. D.C. starting supply voltage, 125 volts. D.C. operating current, 10-50 ma.						
	D.C. operating voltage, 90 volts. Max. current (continuous), 50 ma.						
876	Voltage range, 40 to 60 volts. Operating current, 1.7 amperes.						
886	Voltage range, 40 to 60 volts. Operating current, 2.05 amperes.						
956	1.8	- 3.0	800000	1440	1800		
1603	0.5	- 3.0	>1500000	>1500	1225		
	...	- 8.0	10500	20	1900		
GA	...	-10.0	30000	60	2000	0.800	7000
KR-5	...	-11.0	47000	100	2100	1.200	8000

RECEIVING

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type ¹	Potential volts	Current amp.			
KR-20	Two grid det.....		Heat.	2.5	1.00	250	3.5	.....
KR-22	Two grid det.....		Heat.	6.3	0.40	250	3.5	.....
KR-25	Output pentode.....		Heat.	2.5	1.75	250	34.0	250

¹ Either A.C. or D.C. may be used on filament or heater, except as specifically noted. For use of D.C. on A.C. filament types, decrease stated grid volts by $\frac{1}{2}$ (approx.) of filament voltage.

² For grid leak detection, plate volts 45, grid return to + filament or to cathode.

³ Also available in octal base, glass bulb type. Characteristics data for the glass type, except for some difference in capacitance value, are the same as for the type listed. In certain cases where socket connection to shield on metal type tube is indicated there is no connection on the glass type tube.

⁴ Grids #3 and #5 are screen. Grid #4 is signal input control grid.

⁵ Supply voltage applied through 20000 ohm voltage dropping resistor.

⁶ For grid of following tube.

⁷ Subscript 1 on class of amplifier service (as AB₁) indicates that grid current does not flow during any part of input cycle. Subscript 2 on class of amplifier service (as AB₂) indicates that grid current flows during some part of the input cycle.

⁸ Power output is for two tubes at stated plate-to-plate load.

⁹ Triode plate supply voltage and maximum target voltage; minimum target voltage = 90 volts.

¹⁰ Grid #2 tied to plate.

TELEPHONE AND

Type No.	Description and use	Cathode			Max. plate potential volts	Max. plate current ma
		Type	Potential volts	Current amp.		
101-D	Repeater.....	Coat.	4.5	1.00	130	7.5
101-F	Amp., repeater.....	Coat.	4.15	0.50	190	10.0
101-H	Repeater.....	Coat.	4.5	1.00	130	7.5
101-J	Amp., repeater.....	Coat.	4.15	0.50	190	10.9
102-D	Volt. amp., det.....	Coat.	2.1	1.0	190	1.46
102-F	Volt. amp., det.....	Coat.	2.1	0.50	190	1.75
102-G	Volt. amp., det.....	Coat.	2.1	1.0	190	1.46
104-H	Cable amp.....	Coat.	4.5	1.00	130	20.5
105-A	Amplifier.....	Coat.	4.0	0.50	150	40.0
107-A	18-cm osc.....	Tung.	4.0	3.00	— 50	10.0
203-D	General purpose.....	Coat.	2.6	1.00	60	1.8
205-D, E	A.F. & R.F. amp., osc.....	Oxide	4.5	1.6	400	50.0
215-A	Amp., det., osc.....	Coat.	1.0	0.25	100	2.1
216-A	General purpose.....	Coat.	6.0	1.05	130	6.5
230-D	General purpose.....	Coat.	3.1	0.06	90	2.1
231-D	Amp., det., osc.....	Coat.	3.1	0.060	135	2.50
235-D	General purpose.....	Coat.	5.0	0.25	135	5.0
239-A	General purpose.....	Coat.	1.1	0.27	100	2.3
244-A	Amp., osc.....	Heat.	2.0	1.6	180	6.2
245-A	Volt. amp., det., tetrode.....	Heat.	2.0	1.60	180	5.1

TUBES (Continued)

Type No.	Screen current ma	Grid bias ¹ volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
KR-20	...	0	10000	14	1400	.....	100000
KR-22	...	0	10000	14	1400	.....	100000
KR-25	...	-16.5	100000	220	2200	3.000	9000

¹¹ Cathode current, 0.43 ma.

¹² Grids #2 and #4 are screen. Grid #1 is signal input control grid.

¹³ Both grids connected together; likewise, both plates.

¹⁴ Applied through plate resistor of 250000 ohms.

¹⁵ Applied through plate resistor of 100000 ohms.

¹⁶ Applied through plate resistor of 150000 ohms.

¹⁷ Applied through 200000 ohm plate resistor.

¹⁸ For signal input control grid (#1); control grid #3 bias, -3 volts.

¹⁹ Applied through plate resistor of 250000 ohms or 500 henry choke shunted by 0.25 megohm resistor.

²⁰ Grids #1 and #2 tied together.

²¹ Requires different socket from small 7-pln.

²² Grid #1 is control grid. Grids #2 and #3 tied to plate.

²³ Grid #1 is control grid. Grid #2 is screen. Grid #3 tied to cathode.

²⁴ Grids #1 and #2 connected together. Grid #3 tied to plate.

²⁵ Cathode current, 0.65 ma.

²⁶ Tubes number 303-A and 309-A, often used as receiving tubes, are listed under *Telephone and Industrial Tubes*.

INDUSTRIAL TUBES

Type No.	Screen grid potential volts	Screen grid current ma	Grid bias volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output m watts
101-D	-9.0	5700	5.9	1030	.....
101-F	-14.0	4800	6.5	1120	250
101-H	-9.0	5700	5.9	1030	.....
101-J	-14.0	5000	6.6	.....	250
102-D	-2.0	43000	30.2	700	.....
102-F	-2.0	36000	30.6	850	.....
102-G	-2.0	43000	30.2	700	.....
104-H	-20.0	2100	2.5	1190	.....
105-A	0	3000	5.0	1500	.....
107-A	60.0 (C.G.)	+250.0	.....	.....	.....	.....
203-D	-3.0	10000	6.8	680	.....
205-D, E	-29.0	3800	7.2	1890	1400
215-A	-10.0	14500	5.6	390	26
216-A	-9.0	6000	5.8	970	.....
230-D	-3.0	16000	8.0	500	.....
231-D	-7.5	15600	8.4	540	27
235-D	-6.0	7000	9.0	1280	.....
239-A	-8.0	15000	6.2	410	.....
244-A	-10.0	10000	9.8	980	128
245-A	45.0	1.5	-1.5	220000	170.0	770	.....

TELEPHONE AND

Type No.	Description and use	Cathode			Max. plate potential volts	Max. plate current ma
		Type	Potential volts	Current amp.		
246-A	Volt. amp., det., tetrode.....	Coat.	3.3	0.100	180	1.55
247-A	Amp., det., osc.....	Heat.	2.0	1.6	135	2.0
252-A	Amp., osc.....	Coat.	5.0	2.0	500	58
257-A	Amp., det., osc.....	Coat.	3.1	0.060	135	2.50
259-A	Volt. amp., det., tetrode.....	Heat.	2.0	1.60	250	5.7
259-B	Volt. amp., det., tetrode.....	Heat.	2.0	1.6	250	5.7
262-A	A.F. amp.....	Heat.	10.0	0.32	180	2.8
264	A.F. amp.....	Coat.	1.1	0.25	90	2.9
264-A, B	A.F. amp.....	Coat.	1.5	0.300	100	2.70
271-A	A.F. or R.F. amp., osc.....	Heat.	5.0	2.0	450	60.0
272-A	A.F. or R.F. amp., det.....	Heat.	10.0	0.32	180	6.2
273-A	Detector.....	Heat.	2.0	1.60	135	50.0
275-A	A.F. amp.....	Coat.	5.0	1.2	300	51.0
281-A	A.F. amp., control, tetrode.....	Oxide	5.0	1.6	250	45.0
283-A	Volt. amp., tetrode.....	Heat.	2.0	1.60	250	6.0
285-A	A.F. amp., pentode.....	Heat.	2.0	1.60	250	12.5
286-A	Volt. amp., pentode.....	Heat.	2.0	1.60	250	6.3
300-A	A.F. amp.....	Heat.	5.0	1.2	450	80.0
303-A	A.F. amp., det., rectifier.....	Heat.	2.0	1.60	200	3.2
309-A	A.F. or R.F. amp., pentode.....	Heat.	10.0	0.32	250	4.85
310-A]	Voltage amp., pentode.....	Heat.	10.0	0.32	250	5.5
864	Non-microphonic.....	Coat.	1.1	0.25	90	2.7
DRH-500	Ionization gauge.....	Tung.	5.5	1.15	180	3.5
DRH-501	Ionization gauge.....	Tung.	5.0	3.00	180	4.5
DRH-505	Electrometer tube.....	Coat.	2.5	0.25	6	0.2
DRJ-521	Interstage amp.....	Coat.	2.5	1.00	250	13.0
DRJ-522	Interstage amp.....	Coat.	2.5	1.00	250	5.0
DRJ-524	Non-microphonic.....	Coat.	1.1	0.25	90	2.5
DRJ-528	Low-filament cur.....	Coat.	10.0	0.06	135	9.0
DRJ-546	Volt. amp.....	Coat.	2.5	1.5	450	13.5
DRJ-548	Volt. amp.....	Coat.	5.0	0.25	180	1.4
DRJ-549	Volt. amp.....	Coat.	2.5	1.00	180	4.0
DRJ-551	Current amp.....	Coat.	7.5	1.25	450	38.0
DRJ-552	Current amp.....	Coat.	7.5	0.50	425	20.0
DRJ-554	Current amp.....	Coat.	1.1	0.25	135	8.0
DRJ-555	Osc., current amp.....	Coat.	7.5	1.25	450	55.0
DRJ-556	Low grid current amp.....	Coat.	2.5	0.25	95	4.5
DRJ-557	Current amp.....	Heat.	2.5	1.00	180	20.0
DRJ-559	Low grid current.....	Coat.	2.5	0.25	95	3.5
DRJ-562	Current amp.....	Coat.	2.5	1.00	180	17.5
DRJ-564	Current amp.....	Coat.	2.5	4.00	250	320.0
DRJ-571	Three grid tube.....	Heat.	2.5	1.00	250	4.0
FP-54	Low grid current, tetrode.....	Thor.	2.5	0.09	6	0.06
FP-62	Ionization gauge.....	Tung.	4.5	1.48	.....	.....
FP-110	A.F. amp.....	Thor.	5.0	1.00	125	100.0
PJ-2	Volt. amp.....	Thor.	4.5	1.10	350	4.5
PJ-4	Power amp.....	Thor.	4.5	1.10	350	19.0
PJ-7	Volt. amp.....	Thor.	4.5	1.10	350	40.0
PJ-8	A.F. or R.F. amp., osc.....	Thor.	4.5	1.10	350	40.0
PJ-11	Volt. amp.....	Thor.	5.0	0.25	180	0.45
PJ-21	A.F. amp., mod.....	Thor.	4.5	1.10	350	19.5
RJ-526	Interstage amp.....	Coat.	1.25	0.92	135	5.2
RJ-544	Non-microphonic.....	Coat.	1.1	0.25	180	1.0
RJ-550	Low grid current.....	Coat.	2.5	0.92	95	6.0
RJ-553	Low grid current amp.....	Coat.	6.0	1.05	95	8.5
RJ-563	Current amp.....	Coat.	2.5	3.00	250	200.0

INDUSTRIAL TUBES (Continued)

Type No.	Screen grid potential volts	Screen grid current ma	Grid bias volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output m watts
246-A	45.0	0.15	- 1.5	820000	335.0	410	.. ..
247-A	- 6.0	19600	14.5	730	50
252-A	-70.0	1500	5.12	3450	8300
257-A	- 7.5	15600	8.4	540	27
259-A	75.0	1.1	- 1.5	430000	610.0	1420	.....
259-B	75.0	1.1	- 1.5	430000	610.0	1420	.....
262-A	- 7.5	16200	14.7	910	90
264	- 4.5	13400	8.2	610	.....
264-A, B	- 7.0	11400	7.2	630	28
271-A	-30.0	2450	8.5	3480	3400
272-A	-21.0	7200	5.5	760	230
273-A	- 1.5	320000	102.0	320	.....
275-A	-80.0	1100	2.7	2450	4900
281-A	65.0	0.2	-70.0	3600	5.2	.....	4200
283-A	75.0	1.5	- 1.5	700000	980.0	1400	.....
285-A	200.0	2.2	-16.5	137000	140.0	1020	1350
286-A	75.0	1.5	- 1.5	1050000	1275.0	1210	.....
300-A	-97.0	.....	.....	.....	17800
303-A	- 9.0	18000	13.2	.....	105
309-A	75.0	1.1	- 1.5	1300000	1450.0	1110	.....
310-A	135.0	2.5	- 3.0	.....	.....	.....	480
864	- 4.5	15000	8.2	560	.....
DRH-500	-12.0	19000	6.6	350	.....
DRH-501	-12.0	16500	6.6	400	.....
DRH-505	- 4.5	20000	1.0	50	.....
DRJ-521	- 9.0	6000	12.0	2000	.....
DRJ-522	-13.5	9500	13.8	1450	.....
DRJ-524	- 4.5	15000	8.0	530	.....
DRJ-528	- 9.0	5000	5.7	1150	.....
DRJ-546	- 4.5	13500	30.0	2200	.....
DRJ-548	- 1.5	40000	37.0	925	.....
DRJ-549	- 1.5	25000	30.0	1200	.....
DRJ-551	-32.0	2900	8.0	2750	.....
DRJ-552	-30.0	4000	8.4	2100	.....
DRJ-554	-15.0	7000	3.5	5000	.....
DRJ-555	-80.0	1800	3.8	2100	.....
DRJ-556	- 5.0	7500	6.8	900	.....
DRJ-557	-22.5	3500	3.5	1000	.....
DRJ-559	- 5.0	8800	8.4	950	.....
DRJ-562	-22.5	2500	4.8	1925	.....
DRJ-564	- 5.0	500	3.5	7000	.....
DRJ-571	- 3.0	200000	200.0	1000	.....
FP-54	- 4.0	45000	0.9	20	.....
FP-62	112.5	10.0	-22.5	.....	.....	.....	.....
FP-110	-50.0	320	0.8	2500	.....
PJ-2	- 4.0	26800	30.0	1120	.....
PJ-4	-20.0	6400	8.5	1330	.....
PJ-7	- 4.0	26800	30.0	1120	.....
PJ-8	-20.0	6400	8.5	1330	.....
PJ-11	- 1.5	100000	30.0	300	.....
PJ-21	-83.0	3160	3.0	950	.....
RJ-526	- 9.0	8000	8.2	1050	.....
RJ-544	- 1.5	75000	35.0	465	.....
RJ-550	- 5.0	5150	8.5	1650	.....
RJ-553	-12.0	3200	3.85	1200	.....
RJ-563	- 5.0	800	4.0	5000	.....

TRANSMITTING

Type No.	Description and use	Cooling	Cathode			Max. plate potential volts	Max. plate current amp.
			Type	Potential volts	Current amp.		
100-A	Osc., R.F. pow. amp.	Air	Tung.	11.0	25.00	2000	0.175
101-A	Osc., R.F. pow. amp.	Water	Tung.	28.0	51.0	1000	1.100
102-A	Osc., R.F. pow. amp.	Air	Tung.	10.0	11.0	7000	0.150
203-A	A.F. or R.F. pow. amp., osc.	Air	Tung.	10.0	3.25	1250	0.175
204-A	A.F. or R.F. pow. amp., osc.	Air	Thor.	11.0	3.85	3000	0.275
206	Osc., R.F. pow. amp.	Air	Tung.	11.0	14.75	15000	0.023
207	Osc., R.F. pow. amp.	Water	Tung.	22.0	52.00	15000	0.750
211	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	1250	0.175
211-D, E	A.F. amp.	Air	Coat.	10.0	3.00	750	0.065
212-D	250-w amp.	Air	Coat.	14.0	6.00	1500	0.015
212-E	A.F. or R.F. amp., osc.	Air	Thor.	14.0	6.0	3000	0.350
220-B	A.F. or R.F. amp., osc.	Water	Tung.	21.5	41.0	12000	1.5
220-C	A.F. or R.F. amp., osc.	Water	Tung.	21.5	41.0	15000	1.5
223-A	A.F. or R.F. amp., osc.	Water	Tung.	21.5	41.0	6000	1.5
232-A	25-kw amp.	Water	Tung.	21.0	61.0	18000	3.0
232-B	A.F. or R.F. amp., osc.	Water	Tung.	20.0	60.0	20000	3.0
236-A	A.F. or R.F. amp., osc.	Water	Tung.	21.5	41.0	20000	2.0
240-A	H.F. osc.	Water	Tung.	21.0	41.0	10000	1.5
240-B	A.F. or R.F. amp., osc.	Water	Tung.	21.5	41.0	12000	1.7
241-A	H.F. amp.	Air	Coat.	14.0	6.00	1500	0.200
241-B	A.F. or R.F. amp., osc.	Air	Thor.	14.0	6.0	3000	0.350
242-A	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	1250	0.150
242-B	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	1250	0.150
242-C	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	1250	0.150
243-A	R.F. amp.	Water	Tung.	10.5	41.00	10000	0.400
248-A	50-w amp.	Air	Coat.	10.0	3.00	750	0.065
251-A	A.F. or R.F. amp., osc.	Air	Thor.	10.0	16.0	3000	0.600
254-A	R.F. amp., osc., tetrode.	Air	Thor.	5.0	3.25	750	0.060
254-B	R.F. amp., osc., tetrode.	Air	Thor.	7.5	3.25	750	0.075
260-A	R.F. amp., osc., tetrode.	Air	Thor.	10.0	3.25	3000	0.100
261-A	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	1250	0.150
265-A	R.F. amp.	Water	Tung.	22.0	183.00	18000	8.000
268-A	A.F. or R.F. amp., osc.	Air	Thor.	5.0	3.25	750	0.060
270-A	A.F. or R.F. amp., osc.	Air	Thor.	10.0	9.75	3000	0.375
276-A	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.0	1250	0.125
278-A	R.F. amp., osc., tetrode.	Air	Thor.	10.0	15.6	3000	0.600
279-A	A.F. or R.F. amp., osc.	Air	Thor.	10.0	21.0	3000	0.800
282-A	R.F. amp., osc., tetrode.	Air	Thor.	10.0	3.0	1000	0.100
284-D	A.F. amp., mod.	Air	Thor.	10.0	3.25	1250	0.150
295-A	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	1250	0.175
304-B	A.F. or R.F. amp., osc., ultra high frequency	Air	Thor.	7.5	3.25	1250	0.100
305-A	R.F. amp., osc., ultra high frequency, tetrode	Air	Thor.	10.0	3.1	1000	0.125
306-A	A.F. or R.F. amp., osc., pentode	Air	.....	2.75	2.0	300	0.060
307-A	A.F. or R.F. amp., osc., pentode	Air	.....	5.5	1.0	500	0.060
308-B	A.F. or R.F. amp., osc.	Air	Thor.	14.0	6.0	2250	0.325
312-A	Amp., osc., pentode.	Air	Thor.	10.0	2.8	1250	0.100
316-A	Ultra H.F. osc. and amp.	Air	Thor.	2.0	3.65	450	0.080
348-A	Modulator.	Water	Tung.	22.0	52.0	5000	3.00
358-A	H.F. osc. and amp.	Water	Tung.	22.0	52.0	15000	1.20
363-A	Osc., power amp.	Water	Tung.	22.0	52.0	10000	0.80
500	Osc., R.F. amp.	Water	Tung.	22.0	30.0	10000	0.800

TUBES

Type No.	Screen grid potential volts	Max. R.F. grid current amp.	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Max. plate diss. watts
100-A	...	8.0	7000	14	2000	500
101-A	...	50.0	3000	18	6000	35000
102-A	...	30.0	3000	8	1500	150
203-A	...	7.5	6000	25	4200	100
204-A	...	10.0	6300	25	4000	250
206	...	10.0	300000	350	1170	350
207	...	30.0	3500	20	5700	10000
211	...	7.5	3400	12	3530	100
211-D, E	3200	12	3900	65
212-D	2150	16	7500	250
212-E	...	5.0	1900	16	8500	275
220-B	...	20.0	8000	40	5000	10000
220-C	...	20.0	7000	35	5000	10000
228-A	...	20.0	2500	16	6500	5000
232-A	7000	40	5700	25000
232-B	...	40.0	6150	40	6500	25000
236-A	...	25.0	6200	40	6450	20000
240-A	9000	40	4450	10000
240-B	...	60.0	8000	40	5000	10000
241-A	2150	16	7500	200
241-B	...	5.0	1900	16	8500	275
242-A	...	5.0	3500	12.5	3600	85
242-B	...	5.0	3500	12.5	3600	100
242-C	...	5.0	3500	12.5	3600	100
243-A	20000	40	2000	2000
248-A	3500	12	3400	65
251-A	...	15.0	2750	10.5	3800	1000
254-A	175	5.0	80000	80	1000	20
254-B	150	5.0	86000	100	1160	25
260-A	300	10.0	175000	200	1150	100
261-A	...	5.0	3000	12	4000	100
265-A	2250	32	14000	100000
268-A	...	3.0	3250	5	800	25
270-A	...	10.0	2800	16	5700	350
276-A	...	5.0	3000	12	4000	100
278-A	750	15.0	105000	400	3800	800
279-A	...	15.0	2000	10	5000	1200
282-A	250	5.0	70000	100	1430	70
284-D	...	5.0	1900	4.8	2500	85
295-A	...	7.5	6000	25	4200	100
304-B	...	6.0	5500	11	2000	50
305-A	200	5.0	40000	56	1400	60
306-A	300	....	70000	290	4150	15
307-A	300	....	.....	.....	.....	15
308-B	...	5.0	1070	8	7500	250
312-A	500	5.0	290000	1100	3800	50
316-A	2700	6.5	2400	30
348-A	...	30.0	2400	8	3300	10000
358-A	...	60.0	8700	42	4800	20000
363-A	...	30.0	7800	50	6400	10000
500	...	20.0	3800	.....	3950	5000

TRANSMITTING

Type No.	Description and use	Cooling	Cathode			Max. plate potential volts	Max. plate current amp.
			Type	Potential volts	Current amp.		
504	Osc., R.F. amp.		Thor.	11.0	14.75	2500	0.275
510	Osc. or amp.		Oxide	7.5	1.25	500	0.06
520-B	Osc., R.F. amp.	Water	Tung.	22.0	34.00	10000	0.400
520-M	Modulator.	Water	Tung.	22.0	34.00	6000	0.800
525	H.F. osc., amp.	Air		7.5	2.50	425	.....
545	A.F. amp., mod.		Thor.	10.0	3.25	1000	.....
571	Osc., R.F. pow. amp.	Air	Thor.	11.0	10.0	3000	0.250
800	A.F. or R.F. amp., osc.	Air		7.5	3.25	1250	0.115
801	A.F. or R.F. amp., osc.	Air	Thor.	7.5	1.25	600	0.070
802	R.F. amp., osc., pentode.	Air	Heat.	6.3	0.9	500	0.060
803	R.F. amp., osc., pentode.	Air	Thor.	10.0	5.0	2000	0.175
804	R.F. amp., osc., pentode.	Air	Thor.	7.5	3.0	1250	0.095
805	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	1500	0.210
806	A.F. or R.F. amp., osc.	Air	Thor.	5.0	10.0	3000	0.200
807	Beam power amp.	Air	Heat.	6.3	0.9	400	0.120
808	A.F. or R.F. amp., osc.	Air	Thor.	7.5	4.0	1500	0.150
820-B	A.F. or R.F. amp., osc.	Air	Thor.	10.0	2.0	1000	0.150
831	Shortwave osc.	Air	Thor.	11.0	10.0	3500	0.133
834	R.F. amp., osc.	Air	Thor.	7.5	3.25	1250	0.100
838	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	1250	0.175
841	A.F. or R.F. amp., osc.	Air	Thor.	7.5	1.25	450	0.060
842	A.F. power amp., mod.	Air	Thor.	7.5	1.25	425	0.034
843	A.F. or R.F. amp.	Air	Heat.	2.5	2.50	500	0.025
844	General purpose, tetrode.		Heat.	2.5	2.50	500	0.030
845	A.F. pow. amp., mod.	Air	Thor.	10.0	3.25	1250	0.095
846	Shortwave osc.	Water	Tung.	11.0	49.0	7500	0.15
848	General purpose.	Water	Tung.	22.0	52.0	15000	0.750
849	A.F. or R.F. amp., osc.	Air	Thor.	11.0	5.0	3000	0.350
850	Osc., R.F. amp., tetrode.	Air	Thor.	10.0	3.25	1250	0.175
851	General purpose.	Air	Thor.	11.0	15.50	2500	0.300
852	A.F. or R.F. amp., osc.	Air	Thor.	10.0	3.25	3000	0.150
853	Osc., R.F. pow. amp.	Air	Tung.	10.0	16.75	2500	0.130
858	Osc., R.F. pow. amp.	Water	Tung.	22.0	52.00	20000	0.750
860	Osc. R.F. amp., tetrode.	Air	Thor.	10.0	3.25	3000	0.150
861	Osc., R.F. amp., tetrode.		Thor.	11.0	10.0	4000	0.350
862	Osc., R.F. pow. amp.	Water	Tung.	33.0	207.0	20000	3.000
863	Osc., R.F. pow. amp.	Water	Tung.	22.0	52.00	15000	0.750
865	Osc., R.F. amp., tetrode.	Air	Thor.	7.5	2.0	750	0.060
954	R.F. amp., det., pentode.	Air	Heat.	6.3	0.15	250	0.002
955	ultra high frequency Amp., det., osc., ultra high frequency	Air	Heat.	6.3	0.15	180	0.008
1652	General purpose.	Water	Tung.	14.5	52.00	7500	0.750
AW-220	Osc., R.F. pow. amp.	Water	Tung.	30.0	325.0	22000	5.00
DRJ-571	Tetrode.		Heat.	2.5	1.0	.....	.....
FH-11	Osc., magnetron.	Air	Tung.	5.0	5.0	1500	0.075
FP-1	Osc., R.F. pow. amp.	Air	Thor.	10.0	3.25	3000	0.100
FP-2	Osc., R.F. pow. amp.	Air	Thor.	11.0	10.0	3500	0.350
FP-3	General purpose.	Air	Thor.	11.0	5.0	3000	0.350
FP-57	R.F. amp., osc., tetrode.	Air	Thor.	10.0	3.25	1250	0.175
FP-70	R.F. amp., osc.	Water	Tung.	11.0	51.0	7500	1.0
FP-126	Ultra H.F. osc.	Air	Tung.	5.0	6.6	-150	.....
FP-152	R.F. amp., osc.	Air	Thor.	10.0	3.25	1500	0.200
PJ-12	General purpose.	Air	Thor.	10.0	3.25	1250	0.175
PJ-13	General purpose.	Air	Thor.	7.5	1.25	450	0.060

TUBES (Continued)

Type No.	Screen grid potential volts	Max. R.F. grid current amp.	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Max. plate diss. watts
504	...	10.0	5000	25	5000	250
510	...	5.0	5450	8	1550	15
520-B	...	20.0	4000	16	4000	5000
520-M	...	.....	1600	8	5000	.....
525	...	.....	.....	6	.....	.....
545	...	.....	2100	5	2380	.....
571	...	.....	5000	16	3200	5000
800	...	5.0	.....	15	.....	35
801	...	5.0	4300	8	1840	20
802	250	.....	.....	.....	2250	10
803	600	.....	.....	.....	4000	125
804	300	.....	.....	.....	3250	40
805	...	.....	.....	.....	.....	125
806	...	.....	.....	12.6	.....	150
807	300	.....	.....	.....	6000	21
808	...	.....	.....	47	.....	50
830-B	...	.....	.....	25	.....	60
831	...	10.0	6450	14.5	2250	400
834	...	.....	.....	10.5	.....	50
838	...	7.5	.....	.....	.....	100
841	...	5.0	40000	30	750	15
842	...	.....	2500	3	1200	12
843	...	.....	4250	8.5	2000	.....
844	180	2.0	125000	75	.....	15
845	...	.....	1800	5.3	3000	75
846	...	30.0	.....	38	.....	2500
848	...	30.0	2400	8	3300	10000
849	...	10.0	3200	19	6000	400
850	175	7.5	200000	550	2750	100
851	...	10.0	1400	20	15000	750
852	...	10.0	10000	12	1200	100
853	...	.....	4100	12	2900	250
858	...	60.0	8700	42	4800	20000
860	300	10.0	180000	200	1100	100
861	750	10.0	143000	300	.....	400
862	...	60.0	2800	48	17150	100000
863	...	30.0	7200	50	7000	10000
865	125	5.0	200000	150	750	15
954	100	.....	>1500000	>2000	1400	.....
955	...	.....	12500	25	2000	.....
1652	...	10.0	2600	14	5400	5000
AW-220	...	.....	640	10.5	21000	150000
DRJ-571	100	.....	200000	200	.....	.....
FH-11	...	.....	.....	.....	.....	60
FP-1	...	10.0	10000	12	1200	100
FP-2	...	10.0	6450	14.5	2250	400
FP-3	...	10.0	3200	19	6000	400
FP-57	...	7.5	200000	550	2750	100
FP-70	...	30.0	18500	40	2160	2500
FP-126	D.C. grid voltage, 300 volts; D.C. grid current, 0.10 amp.; grid diss., 20 watts.					
FP-152	...	7.5	6250	25	4000	125
PJ-12	...	7.5	3400	12	3530	100
PJ-13	...	5.0	5000	8	1600	15

TRANSMITTING

Type No.	Description and use	Cooling	Cathode			Max. plate potential volts	Max. plate current amp.
			Type	Potential volts	Current amp.		
PJ-27	R.F. amp., osc., tetrode...	Air	Thor.	7.5	2.0	750	0.000
PR-3B	A.F. or R.F. amp., osc....	Air	Thor.	10.0	3.25	1250	0.175
PR-4B	R.F. amp., osc.....	Air	Thor.	11.0	3.85	2500	0.275
PR-11A	A.F. or R.F. amp., osc....	Air	Thor.	10.0	3.25	1250	0.175
PR-51A	A.F. or R.F. amp., osc....	Air	Thor.	11.0	15.5	3000	1.0
PR-845	A.F. or R.F. amp., osc....	Air	Thor.	10.0	3.25	1250	0.175
PR-861	R.F. amp., osc., tetrode...	Air	Thor.	11.0	10.0	3500	0.350
PT-210	A.F. or R.F. amp., osc....	Air	Thor.	7.5	1.25	450	0.060
PT-841	Voltage amp.....	Air	Thor.	7.5	1.25	450	0.060
PT-842	A.F. or R.F. amp., osc....	Air	Thor.	7.5	1.25	425	0.060
PT-860	R.F. amp., osc., tetrode...	Air	Thor.	10.0	3.25	3000	0.150

GASEOUS RECTIFIERS

Type No.	Cathode			Max. peak inverse potential volts	Max. peak current amp.	Max. average current amp.
	Type	Potential volts	Current amp.			
82	Coat.	2.5	3.0	1400	0.400	0.125
83	Coat.	5.0	3.0	1400	0.800	0.250
249-A	Coat.	2.5	7.0	6500	1.1	.....
249-B	Coat.	2.5	7.5	7500	1.5	.....
253-A	Coat.	2.5	3.0	3500	0.5	.....
255-A	Coat.	5.0	21.0	20000	5.0	.....
255-B	Coat.	5.0	19.0	20000	5.0	.....
258-A	Coat.	2.5	7.0	6300	1.1	.....
258-B	Coat.	2.5	7.5	7500	1.5	.....
263-A	Coat.	2.5	15.0	100	6.0	.....
263-B	Coat.	2.5	15.0	100	10.0	.....
266-A	Coat.	5.0	60.0	.....	12.0	.....
266-B	Coat.	5.0	42.0	20000	20.0	.....
267-A	Coat.	5.0	10.0	5000	2.5	.....
267-B	Coat.	5.0	6.75	7500	2.5	.....
280-A	Coat.	2.5	3.0	3500	0.5	.....
301-A	.....	5.0	3.0	1800	1.0	.....
313-A ¹	Cold	...	.....	.....	0.030	0.010
314-A	.....	5.0	5.0	300	2.5	.....
315-A	.....	5.0	10.0	12500	2.5	.....
321-A	.....	5.0	10.0	12500	2.5	.....
857	Coat.	5.0	37.0	20000	20.0	.....
866	Coat.	2.5	5.0	7500	1.0	0.25
866-A	Coat.	2.5	5.0	10000	0.6	.....
869	Coat.	5.0	20.0	20000	5.0	.....
871	Coat.	2.5	2.0	5000	0.3	.....
872	Coat.	5.0	10.0	7500	2.5	.....
872-A	Coat.	5.0	6.75	10000	2.5	.....
985	Coat.	5.0	0.5	500	0.1	.....

¹ May be used as relay or voltage regulator in special circuits.

TUBES (Continued)

Type No.	Screen grid potential volts	Max. R.F. grid current amp.	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Max. plate diss. watts
PJ-27	5.0	200000	150	750	15
PR-3B	7.5	6000	25	4200	100
PR-4B	10.0	6300	25	4000	250
PR-11A	7.5	3400	12	3530	100
PR-51A	8.0	1400	20.5	15000	750
PR-845	7.5	1800	5	3000	100
PR-861	500	10.0	143000	300	2100	400
PT-210	5.0	5000	8	1600	15
PT-841	5.0	21500	30	1400	15
PT-842	5.0	2500	3	1200	15
PT-860	300	10.0	180000	200	1100	100

GASEOUS RECTIFIERS (Continued)

Type No.	Cathode			Max. peak inverse potential volts	Max. peak current amp.	Max. average current amp.
	Type	Potential volts	Current amp.			
BA	.....	.....	.....	350	.....	0.35
BH	.....	.....	.....	350	.....	0.12
BR	.....	.....	.....	600	.....	0.05
DKI-606	Mercury pool	3 phase	.....	15000	50.0	20.0
DKI-624	Coat.	5.0	40.0	5000	65.0	25.0
FG-15	Heat.	5.0	37.0	20000	40.0	10.0
FG-19	Coat.	5.0	10.0	7500	5.0	1.25
FG-19-A	Coat.	5.0	6.75	10000	5.0	1.25
FG-26	Coat.	5.0	7.0	1000	10.0	2.5
FG-28	Heat.	5.0	17.5	3500	75.0	12.5
FG-32	Heat.	5.0	4.5	1000	15.0	2.5
FG-42	Heat.	5.0	80.0	15000	450.0	75.0
FG-52	Heat.	5.0	80.0	1500	600.0	100.0
FG-64	Coat.	2.5	2.0	1000	0.5	0.12
FG-104	Heat.	5.0	10.0	1500	40.0	6.4
FG-139 ²	Mercury pool	.....	.....	900	1125.0	7.5
FG-190 ³	Fil.	2.5	12.0	175	5.00	1.25
FG-194 ²	.....	.....	.....	900	105.0	1.25
FG-235-A ²	Mercury pool	.....	.....	900	1000.0	135.0
FG-253 ²	Mercury pool	.....	.....	900	600.0	2.4
FG-258-A ²	Mercury pool	.....	.....	900	7500.0	100.0
KI-605	Coat.	2.5	2.0	5000	0.3	0.2
KI-620	Coat.	5.0	11.5	5000	10.0	4.0
KI-625	Coat.	5.0	20.0	5000	22.5	10.0
KI-626	Coat.	2.5	6.0	5000	1.2	0.64
KR-1	Heat.	6.3	0.3	500	0.2	0.05
PJ-20 ¹	Cold	.....	.....	160	200.0	0.25
PJ-26	Coat.	5.0	20.0	20000	10.0	2.5
PJ-28	Coat.	2.5	5.0	7500	2.0	0.5
PJ-28-A	Coat.	2.5	5.0	10000	2.0	0.5

¹ Ignitron.

² All metal tube.

³ Surge absorber tube.

HIGH VACUUM RECTIFIERS

Type No.	Cooling	Cathode			Max. peak potential volts	Max. peak current amp
		Type	Potential volts	Current amp.		
1-v	....	Heat	6.3	0.3	350	0.050
5W4 ¹	....	Fil.	5.0	1.5	350	0.110
5Z3	....	Fil.	5.0	3.0	500	0.250
5Z4 ¹	....	Heat.	5.0	2.0	400	0.125
6H6 ¹	....	Heat	6.3	0.3	100	0.004
6X5 ¹	....	Heat.	6.3	0.6	350	0.075
12Z3	....	Heat.	12.6	0.3	250	0.060
25Z5 ²	....	Heat.	25.0	0.3	250	0.085
25Z6 ^{1,2}	....	Heat.	25.0	0.3	250	0.085
80	....	Coat.	5.0	2.0	550	0.135
81	....	Coat.	7.5	1.25	700	0.085
83-v	....	Heat.	5.0	2.0	400	0.200
84, 6Z4	....	Heat.	6.3	0.5	350	0.060
103-A	Water	Tung.	28.0	51.00	60000	6.500
104-A	Air	Tung.	11.0	25.00	30000	1.250
214	Water	Tung.	22.0	52.00	50000	7.500
214-E	Air	Thor.	10.0	3.20	.....	0.150
217-A	Air	Coat.	6.0	1.00	.....	0.025
217-A	Air	Thor.	10.0	3.25	3500	0.600
217-C	Air	Thor.	10.0	3.25	7500	0.600
218	Air	Tung.	11.0	14.75	50000	0.750
219	Air	Tung.	22.00	24.50	50000	2.500
219-D	Air	Coat.	14.0	6.00	.....	0.250
222-A	Water	Tung.	21.5	41.0	25000	5.0
233-A	Water	Tung.	21.5	41.00	.....	2.000
234-A	Air	Thor.	11.0	3.90	.....	1.000
237-A	Water	Tung.	20.0	61.0	50000	8.0
274-A	Air	Coat.	5.0	2.0	660	0.160
282	Air	Coat.	2.5	3.00	1400	0.400
283	Air	Coat.	2.5	5.00	500	0.250
1651	Air	Tung.	11.0	14.75	4000	0.250
DRO-580	Air	Oxide	5.0	0.25	600	0.040
DRO-581	Air	Tung.	5.0	2.20	3000	0.010
DRO-582	Air	Tung.	5.0	2.50	7500	0.015
DRO-583	Air	Tung.	5.0	4.50	15000	0.025
DRO-584	Air	Tung.	5.0	5.50	30000	0.035
DRO-587	Air	Oxide	2.5	4.00	750	0.450
DRO-588	Air	Oxide	2.5	4.00	1500	0.450
FP-52	Air	Thor.	10.0	3.25	1500	0.200
FP-78	Air	Tung.	10.0	10.00	125000	0.300
FP-84	Oil, air	Tung.	10.0	14.50	75000	0.300
FP-85	Air	Tung.	10.0	5.0	20000	0.100
FP-92	Air	Tung.	10.0	14.50	140000	0.300
KC-1	Air	Tung.	9.0	32.00	100000	1.000
KC-3	Air	Tung.	12.5	32.00	150000	1.000
KC-4	Air	Tung.	20.0	25.00	140000	1.000
KP-2	Air, oil	Tung.	10.0	10.0	75000	0.200
WL-608	Air	Tung.	10.0	10.00	50000	0.200
WL-612	Air	Tung.	10.0	50.00	150000	0.100
WL-613	Air	Tung.	10.0	10.00	140000	0.200
WL-660	Air	Tung.	10.0	10.00	230000	0.100

¹ Metal tube.

² Also used as voltage doubler.

GRID CONTROLLED RECTIFIERS

Thyratrons, Grid-glow Tubes, Etc.

Type No.	Cathode			Max. peak inverse potential volts	Max. peak current amp.	Max. average current amp.
	Type	Potential volts	Current amp.			
256-A	Heat.	2.3	1.7	325	0.075	.....
269-A	Coat.	2.2	0.55	275	0.020	.....
277-A	Heat.	5.0	2.0	350	0.5	.....
287-A	....	2.5	7.0	2500	3.0	2.0
323-A	....	2.5	7.0	500	3.0	2.0
DKU-622	Coat.	5.0	40.0	5000	65.0	25.0
DKU-623	Coat.	5.0	20.0	5000	22.5	10.0
DKU-632	Coat.	2.5	2.0	1500	0.30	0.10
FG-17	Coat.	2.5	5.0	2500	2.0	0.5
FG-27	Coat.	5.0	7.0	1000	10.0	2.5
FG-27-A	Coat.	5.0	4.5	1000	10.0	2.5
FG-29	Heat.	5.0	17.5	3500	75.0	12.5
FG-33	Heat.	5.0	4.5	1000	15.0	2.5
FG-37	Heat.	115.0	0.2	1000	15.0	2.5
FG-41	Heat.	5.0	20.0	10000	75.0	12.5
FG-43	Heat.	5.0	80.0	15000	450.0	75.0
FG-53	Heat.	5.0	60.0	1500	600.0	100.0
FG-57	Heat.	5.0	4.5	1000	15.0	2.5
FG-65	Coat.	2.5	2.0	1000	0.5	0.125
FG-67	Heat.	5.0	4.5	1000	15.0	2.5
FG-81	Coat.	2.5	5.0	180	2.0	0.50
FG-95 ¹	Heat.	5.0	4.5	1000	15.0	2.5
FG-97 ¹	Coat.	2.5	5.0	1000	2.0	0.5
FG-98 ¹	Coat.	2.5	5.0	180	2.0	0.5
FG-105 ¹	Heat.	5.0	10.0	1000	40.0	6.4
FG-154 ¹	Coat.	5.0	7.0	500	10.0	2.5
FG-172 ^{1,2}	Heat.	5.0	10.0	1000	40.0	6.4
FG-178	Coat.	2.5	2.25	310	0.500	0.125
KU-610	Coat.	2.5	6.5	1500	0.80	0.40
KU-618	Cold	.....	.....	800	0.1	0.015
KU-627	Coat.	2.5	6.0	5000	1.2	0.64
KU-628	Coat.	5.0	11.5	5000	10.0	4.0

¹ Double grid.

² All metal.

BASE CONNECTIONS

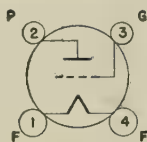
Looking at Bottom of Tube

BP, bayonet pin	H, heater	P, plate
F, filament	K, cathode	PBF, beam forming plates
G, grid	NC, no connection	TA, target

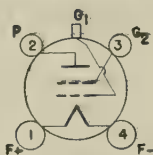
Alphabetical subscripts D, P and T indicate, respectively, diode unit, pentode unit, and triode unit in multi-unit types.

Numerical subscripts are used (1) in multi-grid types to indicate relative position of grids to cathode or filament, and (2) in multi-unit types to differentiate between two identical electrodes which would otherwise have the same designation.

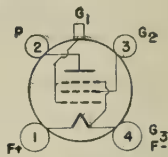
BASE CONNECTIONS (Continued)



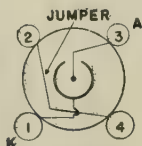
4-4



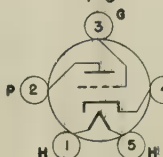
4-9



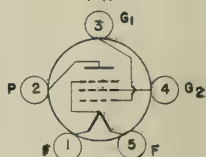
4-11



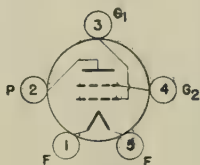
4-14



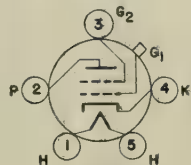
5-1



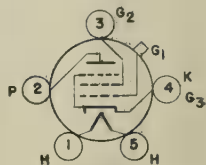
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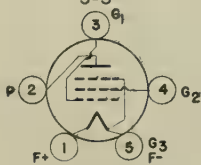
5-3



5-5



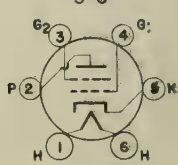
5-6



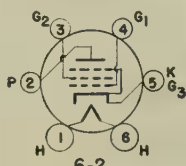
5-9



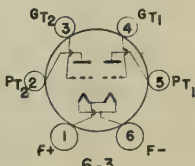
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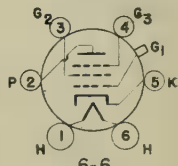
6-1



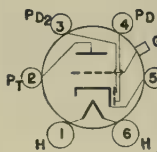
6-2



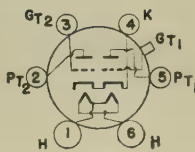
6-3



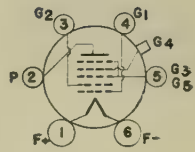
6-6



6-7

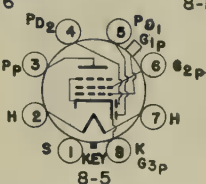
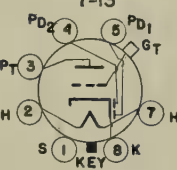
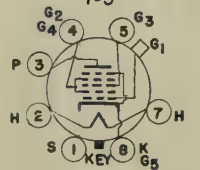
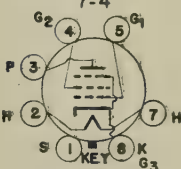
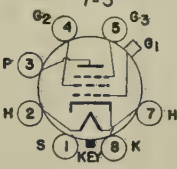
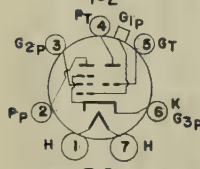
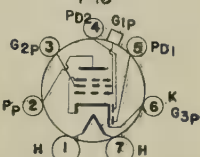
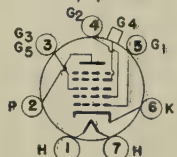
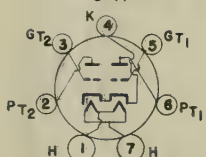
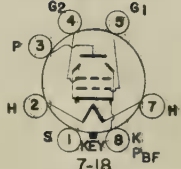
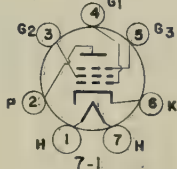
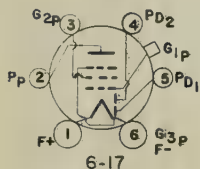
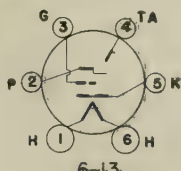
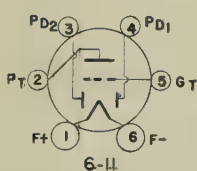


6-8



6-10

BASE CONNECTIONS (Continued)



CONVERSION TABLE FOR TRANSMISSION UNITS

Decibels		Amplf'n ratio	Attenu'n ratio	Decibels		Amplf'n ratio	Attenu'n ratio
For current or voltage ratio	For power ratio			For current or voltage ratio	For power ratio		
0.1	0.05	1.012	0.989	4.5	2.25	1.679	0.596
0.2	0.1	1.023	0.977	4.6	2.3	1.698	0.589
0.3	0.15	1.035	0.966	4.7	2.35	1.718	0.582
0.4	0.2	1.047	0.955	4.8	2.4	1.738	0.575
				4.9	2.45	1.758	0.569
0.5	0.25	1.059	0.944	5.0	2.5	1.778	0.562
0.6	0.3	1.072	0.933	5.1	2.55	1.799	0.556
0.7	0.35	1.084	0.923	5.2	2.6	1.820	0.550
0.8	0.4	1.096	0.912	5.3	2.65	1.841	0.543
0.9	0.45	1.109	0.902	5.4	2.7	1.862	0.537
1.0	0.5	1.122	0.891	5.5	2.75	1.884	0.531
1.1	0.55	1.135	0.881	5.6	2.8	1.906	0.525
1.2	0.6	1.148	0.871	5.7	2.85	1.928	0.519
1.3	0.65	1.162	0.861	5.8	2.9	1.950	0.513
1.4	0.7	1.175	0.851	5.9	2.95	1.972	0.507
1.5	0.75	1.188	0.841	6.0	3.0	1.995	0.501
1.6	0.8	1.202	0.832	6.1	3.05	2.018	0.495
1.7	0.85	1.216	0.822	6.2	3.1	2.04	0.490
1.8	0.9	1.230	0.813	6.3	3.15	2.06	0.484
1.9	0.95	1.245	0.804	6.4	3.2	2.09	0.479
2.0	1.0	1.259	0.794	6.5	3.25	2.11	0.473
2.1	1.05	1.274	0.785	6.6	3.3	2.14	0.468
2.2	1.1	1.288	0.776	6.7	3.35	2.16	0.462
2.3	1.15	1.303	0.767	6.8	3.4	2.19	0.457
2.4	1.2	1.318	0.759	6.9	3.45	2.21	0.452
2.5	1.25	1.334	0.750	7.0	3.5	2.24	0.447
2.6	1.3	1.349	0.741	7.1	3.55	2.26	0.442
2.7	1.35	1.365	0.733	7.2	3.6	2.29	0.437
2.8	1.4	1.380	0.724	7.3	3.65	2.32	0.432
2.9	1.45	1.396	0.716	7.4	3.7	2.34	0.427
3.0	1.5	1.413	0.708	7.5	3.75	2.37	0.422
3.1	1.55	1.429	0.700	7.6	3.8	2.40	0.417
3.2	1.6	1.445	0.692	7.7	3.85	2.42	0.412
3.3	1.65	1.462	0.684	7.8	3.9	2.45	0.407
3.4	1.7	1.479	0.676	7.9	3.95	2.48	0.403
3.5	1.75	1.496	0.668	8.0	4.0	2.51	0.398
3.6	1.8	1.514	0.661	8.1	4.05	2.54	0.394
3.7	1.85	1.531	0.653	8.2	4.1	2.57	0.389
3.8	1.9	1.549	0.645	8.3	4.15	2.60	0.385
3.9	1.95	1.567	0.638	8.4	4.2	2.63	0.380
4.0	2.0	1.585	0.631	8.5	4.25	2.66	0.376
4.1	2.05	1.603	0.624	8.6	4.3	2.69	0.372
4.2	2.1	1.622	0.617	8.7	4.35	2.72	0.367
4.3	2.15	1.641	0.610	8.8	4.4	2.75	0.363
4.4	2.2	1.660	0.603	8.9	4.45	2.79	0.359
4.5	2.25	1.679	0.596	9.0	4.5	2.82	0.355

CONVERSION TABLE FOR TRANSMISSION UNITS

Decibels		Amplf'n ratio	Attenu'n ratio	Decibels		Amplf'n ratio	Attenu'n ratio
For current or voltage ratio	For power ratio			For current or voltage ratio	For power ratio		
9.0	4.5	2.82	0.355	14.0	7.0	5.01	0.200
9.1	4.55	2.85	0.351	14.1	7.05	5.07	0.197
9.2	4.6	2.88	0.347	14.2	7.1	5.13	0.195
9.3	4.65	2.91	0.343	14.3	7.15	5.19	0.193
9.4	4.7	2.95	0.339	14.4	7.2	5.25	0.191
9.5	4.75	2.98	0.335	14.5	7.25	5.31	0.188
9.6	4.8	3.02	0.331	14.6	7.3	5.37	0.186
9.7	4.85	3.05	0.327	14.7	7.35	5.43	0.184
9.8	4.9	3.09	0.324	14.8	7.4	5.50	0.182
9.9	4.95	3.13	0.320	14.9	7.45	5.56	0.180
10.0	5.0	3.16	0.316	15.0	7.5	5.62	0.178
10.1	5.05	3.20	0.313	15.1	7.55	5.69	0.176
10.2	5.1	3.24	0.309	15.2	7.6	5.75	0.174
10.3	5.15	3.27	0.305	15.3	7.65	5.82	0.172
10.4	5.2	3.31	0.302	15.4	7.7	5.89	0.170
10.5	5.25	3.35	0.298	15.5	7.75	5.96	0.168
10.6	5.3	3.39	0.295	15.6	7.8	6.03	0.166
10.7	5.35	3.43	0.291	15.7	7.85	6.10	0.164
10.8	5.4	3.47	0.288	15.8	7.9	6.17	0.162
10.9	5.45	3.51	0.285	15.9	7.95	6.24	0.160
11.0	5.5	3.55	0.282	16.0	8.0	6.31	0.158
11.1	5.55	3.59	0.279	16.1	8.05	6.38	0.157
11.2	5.6	3.63	0.275	16.2	8.1	6.45	0.155
11.3	5.65	3.67	0.272	16.3	8.15	6.53	0.153
11.4	5.7	3.72	0.269	16.4	8.2	6.61	0.151
11.5	5.75	3.76	0.266	16.5	8.25	6.68	0.150
11.6	5.8	3.80	0.263	16.6	8.3	6.76	0.148
11.7	5.85	3.85	0.260	16.7	8.35	6.84	0.146
11.8	5.9	3.89	0.257	16.8	8.4	6.92	0.144
11.9	5.95	3.94	0.254	16.9	8.45	7.00	0.143
12.0	6.0	3.98	0.251	17.0	8.5	7.08	0.141
12.1	6.05	4.03	0.248	17.1	8.55	7.16	0.140
12.2	6.1	4.07	0.245	17.2	8.6	7.24	0.138
12.3	6.15	4.12	0.242	17.3	8.65	7.33	0.136
12.4	6.2	4.17	0.240	17.4	8.7	7.41	0.135
12.5	6.25	4.22	0.237	17.5	8.75	7.50	0.133
12.6	6.3	4.27	0.234	17.6	8.8	7.59	0.132
12.7	6.35	4.32	0.232	17.7	8.85	7.67	0.130
12.8	6.4	4.37	0.229	17.8	8.9	7.76	0.129
12.9	6.45	4.42	0.226	17.9	8.95	7.85	0.127
13.0	6.5	4.47	0.224	18.0	9.0	7.94	0.126
13.1	6.55	4.52	0.221	18.1	9.05	8.04	0.124
13.2	6.6	4.57	0.219	18.2	9.1	8.13	0.123
13.3	6.65	4.62	0.216	18.3	9.15	8.22	0.122
13.4	6.7	4.68	0.214	18.4	9.2	8.32	0.120
13.5	6.75	4.73	0.211	18.5	9.25	8.41	0.119
13.6	6.8	4.79	0.209	18.6	9.3	8.51	0.118
13.7	6.85	4.84	0.206	18.7	9.35	8.61	0.116
13.8	6.9	4.90	0.204	18.8	9.4	8.71	0.115
13.9	6.95	4.95	0.202	18.9	9.45	8.81	0.114
14.0	7.0	5.01	0.200	19.0	9.5	8.91	0.112

CONVERSION TABLE FOR TRANSMISSION UNITS

(Continued)

Decibels		Amplf'n ratio	Attenu'n ratio	Decibels		Amplf'n ratio	Attenu'n ratio
For current or voltage ratio	For power ratio			For current or voltage ratio	For power ratio		
19.0	9.5	8.91	0.112	55	27.5	562.	0.00178
19.1	9.55	9.02	0.111	56	28.0	631.	0.00158
19.2	9.6	9.12	0.110	57	28.5	708.	0.00141
19.3	9.65	9.23	0.108	58	29.0	794.	0.00126
19.4	9.7	9.33	0.107	59	29.5	891.	0.00112
19.5	9.75	9.44	0.106	60	30.0	1000.	0.00100
19.6	9.8	9.55	0.105	61	30.5	1120.	0.000891
19.7	9.85	9.66	0.104	62	31.0	1260.	0.000794
19.8	9.9	9.77	0.102	63	31.5	1410.	0.000708
19.9	9.95	9.89	0.101	64	32.0	1580.	0.000631
20	10.0	10.00	0.100	65	32.5	1780.	0.000562
21	10.5	11.2	0.0891	66	33.0	2000.	0.000501
22	11.0	12.6	0.0794	67	33.5	2240.	0.000447
23	11.5	14.1	0.0708	68	34.0	2510.	0.000398
24	12.0	15.8	0.0631	69	34.5	2820.	0.000355
25	12.5	17.8	0.0562	70	35.0	3160.	0.000316
26	13.0	20.0	0.0501	71	35.5	3550.	0.000282
27	13.5	22.4	0.0447	72	36.0	3980.	0.000251
28	14.0	25.1	0.0398	73	36.5	4470.	0.000224
29	14.5	28.2	0.0355	74	37.0	5010.	0.000200
30	15.0	31.6	0.0316	75	37.5	5620.	0.000178
31	15.5	35.5	0.0282	76	38.0	6310.	0.000158
32	16.0	39.8	0.0251	77	38.5	7080.	0.000141
33	16.5	44.7	0.0224	78	39.0	7940.	0.000126
34	17.0	50.1	0.0200	79	39.5	8910.	0.000112
35	17.5	56.2	0.0178	80	40.0	10000.	0.000100
36	18.0	63.1	0.0158	81	40.5	11200.	0.0000891
37	18.5	70.8	0.0141	82	41.0	12600.	0.0000794
38	19.0	79.4	0.0126	83	41.5	14100.	0.0000708
39	19.5	89.1	0.0112	84	42.0	15800.	0.0000631
40	20.0	100.	0.0100	85	42.5	17800.	0.0000562
41	20.5	112.	0.00891	86	43.0	20000.	0.0000501
42	21.0	126.	0.00794	87	43.5	22400.	0.0000447
43	21.5	141.	0.00708	88	44.0	25100.	0.0000398
44	22.0	158.	0.00631	89	44.5	28200.	0.0000355
45	22.5	178.	0.00562	90	45.0	31600.	0.0000316
46	23.0	200.	0.00501	91	45.5	35500.	0.0000282
47	23.5	224.	0.00447	92	46.0	39800.	0.0000251
48	24.0	251.	0.00398	93	46.5	44700.	0.0000224
49	24.5	282.	0.00355	94	47.0	50100.	0.0000200
50	25.0	316.	0.00316	95	47.5	56200.	0.0000178
51	25.5	355.	0.00282	96	48.0	63100.	0.0000158
52	26.0	398.	0.00251	97	48.5	70800.	0.0000141
53	26.5	447.	0.00224	98	49.0	79400.	0.0000126
54	27.0	501.	0.00200	99	49.5	89100.	0.0000112
55	27.5	562.	0.00178	100	50.0	100000.	0.0000100

LABORATORY ARTS AND RECIPES

Many of the following recipes have been contributed by users of the Handbook. To those who have cooperated in this way we extend our grateful acknowledgment.

BLUING STEEL AND IRON

The metal is cleaned with a potassium bichromate-sulfuric acid mixture, then washed with ammonium hydroxide and rubbed dry. Apply ammonium polysulfide until the desired depth of color is obtained, allowing the object to dry after each application and rubbing briskly with soft clean cloth. The result is a deep blue which may be made very nearly black by repeated applications. Rubbing with boiled linseed oil will deepen this color more. The finish thus obtained is very resistant to oxidation.

CEMENTS AND ADHESIVES

Acid Proof Cement

1

A handy acid resisting cement can be made by mixing sodium silicate and asbestos powder to the consistency of a thin paste. If allowed to dry for a day, the resulting cement will resist the strongest acids.

2

Barium sulfate 4 parts, water glass 3 parts, asbestos 1 part. Sodium fluosilicate or sodium fluoborate is advised in addition when the cement is used on glass.

Aquarium Cement

1

Glazier's putty.....	10 lb.
Litharge.....	1 lb.
Red lead.....	1 lb.
Asphaltum.....	4 oz. fl.

Mix with boiled linseed oil to the proper consistency. Lamp black may be added to give a gray color.

2

Red lead.....	3 parts
Litharge.....	7 parts
Fine sand.....	10 parts
Powdered rosin.....	1 part

Add sufficient spar varnish to give the proper consistency.

Cement for Cellophane

The following is said to be a very satisfactory glue or cement for cellophane:

Gum acacia (gum arabic).....	16.5 parts by weight
Glycerin.....	29.5 parts by weight
Water.....	49.5 parts by weight
Formaldehyde (40 %).....	4.5 parts by weight

ARTS AND RECIPES (Continued)

Cupric Oxide Cement

For a strong adhesive cement for attaching metal articles to each other or for cementing glass, a paste of cupric oxide and phosphoric acid is very satisfactory. The cement is adhesive, strong and sets quite rapidly.

De Khotinsky Cement

1

About 70 grams of light brown orange shellac is added in small amounts to 30 grams of heated pine tar. The mixture is stirred at frequent intervals for a period of two hours (or four hours) and maintained at a temperature of 130° C. or slightly lower. (The longer heating period gives a cement that is suitable for high vacuum work.) The product may be tested at intervals by dropping some of it into cold water and then subjecting it to bending pressure. Under such treatment, the product should not bend but break with a conchoidal fracture.

If a harder product is desired, 85 grams of light brown shellac may be mixed and heated with 30 grams of pine tar.

The finished product, while still warm, may be spread on a stone slab or a smooth surface and rolled into small sticks.

This sealing cement will be found useful whenever two pieces of apparatus are to be cemented together. The cementing is effected by warming the surfaces and applying melted cement. The removal of the cement may be facilitated by softening it with alcohol.

2

A handy water-proof laboratory cement of the type "Kotinsky Cement" is made from:

Dry yellow or orange shellac.....	3 parts by weight
Pine tar.....	1 part by weight

Place the shellac in a double boiler using water in the outer member. Add the pine tar and permit to digest with occasional stirring until the mass is homogeneous; this will take about five hours. Pull out like taffy and make into sticks. The cement can be made harder or softer by varying the amount of tar.

General Hints

Glues of all kinds are useful for wood, leather, paper and glass, where the joints are not required to be waterproof.

For waterproof joints of nearly all substances, including metals, shellac may be used. Flakes of solid shellac may be used with heat or it may be used as a solution in alcohol.

Kotinsky cement, Chatterton's compound and other resinous cements are used for similar purposes and in the same way as solid shellac. Glass cells made up with compounds of this nature may be made impervious to alcohol by painting over the joints with a rubber cement made by melting up small pieces of rubber tubing and adding carbon disulfide to make a thin syrup.

For celluloid a cement made by dissolving celluloid shavings in acetone is recommended.

Brass fittings are usually cemented on glass tubing with sealing wax. The glass tube should be wound with thread or twine to secure a close fit. The glass and the brass fitting should be warmed

ARTS AND RECIPES (Continued)

slightly above the melting point of wax. (Thick or pressed glass should be warmed slowly.) Wax may be applied to both parts and the thread well saturated with the melted wax. Enough should be used to insure filling the space completely. Join the parts while the wax is very soft and clamp in position until it is thoroughly cold.

For optical purposes, cementing glass, etc., Canada balsam is universally employed, and makes a permanent and nearly invisible joint.

Laboratory Adhesive

Nitrated cotton (5-6 sec.)..... 30 grams

Make up a solution of:

Di methyl ketone (acetone).....	100	milliliters (c.c.)
Amyl acetate.....	45	milliliters (c.c.)
Butyl acetate.....	15	milliliters (c.c.)
Ethyl acetate.....	15	milliliters (c.c.)
*Ethyl abietate.....	1.5	milliliters (c.c.)

* $\frac{1}{2}$ above of castor oil is a substitute.

Using the latter solution as solvent, add the nitrated cotton until the solution is of the consistency of syrup. Dissolving the cotton takes about two hours. If the mixture is too thick, a little more of the above solvent, which should be kept on hand, is added.

The above solution should not blush when applied to any surface. It should dry quickly into a tough film which is stable over a long period owing to the plasticizer, ethyl abietate.

The above is useful for cementing cross hairs, coating labels, sealing rubber to tubing, etc.

In case a more flexible film is desired the amount of the plasticizer may be doubled. In case of blushing increase amyl acetate.

Litharge Cement for Joining Metal to Glass

In the preparation of tanks with glass sides or bottom, it is desired to make these water tight by cementing the glass to the iron frame or to repair the leaks that may occur.

Litharge (PbO).....	260 grams
Glycerin solution (glycerin 2 parts, water 1 part).....	100 milliliters (c.c.)

Place the litharge in a mortar, add the diluted glycerin slowly while grinding. Mix thoroughly by grinding a short time. Heat will be evolved and the mixture will begin to set. While still soft, pour it into place and by means of a spatula work it into position as in the case of putty. Allow to stand for a day when it will be thoroughly hard.

If desired, it may be covered with a layer of white lead or aluminum paint.

Mucilage or Paste

Gum arabic (gum acacia).....	1 part
Rice starch.....	1 part
Sugar.....	4 parts
Water.....	10 parts

ARTS AND RECIPES (Continued)

Warm the gum arabic with some of the water until it has a jelly-like consistency. Mix the sugar and starch with enough water to make a smooth paste. Combine these two mixtures, and boil until the starch is clear.

Shellac Cement

DE KHOTINSKY TYPE

(Benzene Resistant)

Note: Most recipes for de Khotinsky cement call for pine tar, to the amount of 40 to 50 %, as the material with which shellac is plasticized for the application in question. Recent investigation indicates that pine tar is inferior to the creosote plasticizer recommended below.

Prepare the plasticizer by mixing one volume of terpeneol with three volumes of beechwood creosote (alkali-soluble). Coal-tar creosote, not completely alkali-soluble, will not do.

Heat from 12 to 25 grams of the plasticizer to about 130° C. With constant stirring add 85 grams of shellac as fast as it dissolves smoothly. When the mixture is homogeneous, allow to cool until it will barely flow from the vessel, and pour into molds which have been lightly but completely covered with petrolatum. The use of only 12 grams of plasticizer gives a very hard cement; 25 grams gives a very soft product.

Shellac-Wax Cement

(Benzene Soluble)

Rosin.....	35 grams
Shellac.....	20 grams
Beeswax.....	20 grams
Talc, fibrous (asbestine pulp).....	0 to 30 grams

Melt the rosin in a large (6 or 8 in.) hemispherical iron pan, add the shellac and beeswax with stirring. Heat strongly with a large Bunsen flame so that the temperature reaches 360° C. in six minutes; then extinguish the burner. When the temperature has reached about 275° C., add the talc, if any is to be used. Finally when the mixture is so viscous that it will barely pour from the pan, pour into metal molds which have previously been very thoroughly scoured with washing powder and thickly coated with aqueous dextrine paste which is still wet. The talc gives a more viscous cement at temperatures just above the melting point.

Transparent Sealing Resin

A transparent resin which adheres well to glass, quartz and metals may be made by heating together equimolal quantities of phthallic anhydride and ethylene glycol for 24 hours at 200° C. The resin softens at 95°–110° C. It is unaffected by water but slowly dissolved by organic solvents and is particularly useful for high-vacuum seals.

Vacuum Wax

Wax for coating joints which may be used for ordinary vacuum distillations etc. where the temperature does not get too high:

Melt together equal parts (by weight) of beeswax and rosin. The product is pliable and easily removed from apparatus by simply using hot water.

ARTS AND RECIPES (Continued)

CLEANING COMPOUNDS AND METHODS

Alcoholic Sodium Hydroxide Solution for Cleaning

Dissolve 120 grams sodium hydroxide in 120 c.c. water. Dilute to 1 liter with 95 % alcohol.

Burette Cleaning Assembly

A burette cleaning assembly may consist of a 300 c.c. beaker of cleaning solution mounted on a ring stand having a $7 \times 9''$ base. Higher on the stand is a clamp for engaging the burette to be cleaned and still higher a mounting of $\frac{1}{4}''$ rubber tubing connected with an aspirator. The cleaning solution is heated, the burette placed with its top dipping into the cleaning solution while the aspirator tubing is slipped on the delivery end of the burette. When hot cleaning liquid has been aspirated to near the glass stopcock or pinch-cock, the cock is closed and the aspirator tubing slipped off, leaving the cleaning solution in the burette. After a minute or so, the cock is opened and the cleaning solution is allowed to run out of the burette, which will leave a uniform film if the burette is clean. The burette is transferred to a sink and after cooling is rinsed with tap and distilled water. By this means 50 burettes per hour may be made ready for use.

Brown Stains on Burettes

Brown stains left on the inside of burettes used for KMnO_4 solutions may be removed by filling the burette with FeSO_4 solution after which the liquid is removed and completely washed out. A convenient, ready for use, solution of FeSO_4 may be made by placing small nails in a dilute H_2SO_4 solution, keeping the flask closed except for a hydrogen vent, thus preventing oxidation of the iron.

Cleaning Engler Flasks

To thoroughly remove all of the carbonaceous deposit baked in the bottom of an Engler flask from gasoline distillation, place 2 or 3 grams of commercial Na_2SO_4 in the flask to be cleaned; apply heat directly to the flask from a Bunsen burner. Heat until all the carbon residue has been loosened. Cool, rinse and drain.

Cleaning Fermentation Tubes and Other Glassware

Fermentation tubes (used in water testing) and other glassware difficult to clean in the ordinary way, may be cleaned as follows:

Moisten the inside of the tube with ethyl alcohol. Pour off the excess alcohol, leaving not to exceed two c.c. of the liquid in the tube. Add ten c.c. of concentrated nitric acid and let it stand. Soon a vigorous reaction takes place with the elimination of large quantities of nitrogen dioxide. When the reaction stops, wash with water. As some nitric acid may be blown out of the tube, it should be placed in a sink (preferably in a hood) until the reaction ceases. Do not close the tube.

Cleaning Fluid

An excellent solution for cleaning grease stains from cloth or leather consists of the following:

CCl_4	80 %
Ligroin.....	16 %
Amyl alcohol (ter.).....	4 %

ARTS AND RECIPES (Continued)

Cleaning Mercury

Mercury may be cleaned sufficiently for many laboratory purposes without distilling. Allow the mercury to fall in a fine spray into a quantity of dilute nitric acid, 25 parts of acid to 75 parts of distilled water. After being passed through the acid one or more times it should be passed through distilled water and dried. Most of the water may be removed with a clean filter, and the mercury heated in a porcelain dish to about 110°C . To produce the spray the stem of a glass funnel may be drawn down so as to leave only a small opening for the escape of mercury or a glass tube with a capillary point attached to a funnel with a tightly fitting rubber tube.

A three- to four-foot length of one-inch glass tube closed at one end and supported in a vertical position may be used to contain the acid solution. If a small glass tube be fused into the lower closed end of the large tube, and bent so as to stand up for a distance a little greater than $1/13.6$ the column of acid solution in the large tube, a U-tube is formed in which a short column of mercury supports the long column of acid solution.

The end of the small tube should be bent over at the top so as to facilitate the delivery of the mercury and a short piece of clean rubber tubing with a pinch-cock put on at the start; as soon as mercury enough has collected in the bottom of the tube the pinch-cock may be opened. The mercury will rise nearly or quite to the top of the small tube, and as the quantity increases will be delivered from the small tube as fast as it falls in the spray.

The reversed end of the small tube should be short to avoid forming a siphon, which would completely empty the apparatus.

An efficient procedure, especially if the mercury is greasy, consists in spraying the mercury by means of the above apparatus, first, through a dilute solution (10 %) of potassium hydroxide, then through dilute nitric acid (10–15 %) and finally through distilled water.

Cleaning Optical Surfaces for Silvering

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

Probably the most important part of the silvering process is the proper cleaning of the surface to be silvered.

The surface is thoroughly cleaned of grease or other organic matter by the usual methods, using alcohol or chromic acid. Then it should be carefully cleansed with strong nitric acid, the whole surface being firmly rubbed with clean cotton tied to a rod of wood or glass. Care should be taken not to injure the surface. Rinse with water, and then wash the surface thoroughly with a strong solution of caustic potash, rubbing with a cotton brush as before. Finally, rinse with distilled water, and keep the surface wet until it is placed in the silvering solution. If the distilled water wets the whole surface uniformly the cleaning may be sufficient; if it does not wet uniformly, the operations must be repeated. The fingers should not touch the edges of the glass during the latter cleaning operations, as a layer of organic matter is apt to spread over the surface and render the silvering uneven.

Dr. Brashear recommends that the surface, after the washings described above, be rubbed with prepared chalk on a cotton wad until it is thoroughly dry and clean. It may then be put into the silvering solution at one's convenience.

ARTS AND RECIPES (Continued)

Cleaning Solution for Glass

35 c.c. saturated sodium dichromate (technical)

1 liter conc. sulfuric acid poured into the dichromate solution

Avoid contact with the flesh or clothing.

Cleaning Solution

Trisodium phosphate.....	2 oz.
Sodium oleate.....	1 oz.
Distilled water... ..	1 pint

Soak apparatus in the warm solution 10-15 minutes, then brush with a stiff brush.

Iodine Stains

Iodine stains can readily be removed from clothing by washing the stain with a 10 % solution of sodium thiosulfate ("hypo") in water.

Paint Brush Cleaner

(1) Kerosene.....	2 pints
Oleic acid.....	1 pint
(2) Aqueous ammonia (conc.).....	$\frac{1}{4}$ pint
Denatured alcohol.....	$\frac{1}{4}$ pint

Stir (2) into (1) until uniform. To clean brushes, place in the mixture over night. Wash thoroughly with warm water.

Removal of Carbonaceous Matter

A 10-15 % solution of NaOH or KOH removes carbon etc. quickly. Rinse well with acid and H₂O.

Removing Carbon Deposits from Flasks

First rinse flask with acetone or carbon disulfide to remove traces of oil or tar. Add a few grams of magnesium nitrate. Heat gradually over a free Bunsen flame till water is all expelled and the magnesium nitrate melts. Rotate the flask to distribute the melt and continue the heating till the brown fumes of nitric oxide cease to evolve. Finally cool and dissolve the residual magnesium oxide in dilute acid by boiling.

Large deposits of carbon or tar will require a repetition of the above procedure.

Removing Carbon Residue from Glassware

Tri-sodium phosphate (Na ₃ PO ₄).....	2 tablespoonfuls
Sodium oleate.....	1 tablespoonful
Soft water.....	1 quart

Allow to stand in the solution for several minutes, brush off the incrustation and rinse with water.

COLORED LIQUIDS

For rendering columns of water easily visible, add a few drops of one per cent alcoholic solution of fluorescein to a liter of water. The dilute solution of fluorescein is bright green by reason of its fluorescence, although colorless by transmitted light.

A small quantity of an aqueous (1 %) solution of uranine (the sodium salt of fluorescein) may be used in place of the alcoholic solution mentioned above.

ARTS AND RECIPES (Continued)

If liquids showing color by transmission are desired, dilute aqueous solutions may be made with any of the following dyes:

Dye	Color
Erythrosine	Pink
Eosine	Pink (green fluorescence)
Rhodamine B	Pink (red fluorescence)
Ponceau 2R	Scarlet
Naphthol green	Green
Methylene green	Bluish green
Methylene blue	Blue
Methyl violet	Purple

CROSS HAIRS

The spider lines which serve as an index in reading telescopes may be quickly replaced in an emergency by single silk fibers (from ordinary sewing silk) attached by soft wax. Single fibers may easily be removed from an untwisted strand.

Spider web should be used in permanent work. The fibers of the egg nest of certain species are employed and may be obtained of most dealers in scientific apparatus. In mounting them the following suggestions may be useful: The cross hair diaphragm of the telescope should be removed and clamped in a horizontal position. A bow of brass wire, about No. 28, should be employed to stretch the fiber. A background of black velvet makes the fibers more easily visible. With soft wax or other convenient adhesive ready on both tips of the bow, a fiber of the required length is to be disentangled with tweezers and wrapped several times about the ends of the bow under tension sufficient to straighten the fiber. The fiber, now conveniently handled by the wire bow, should be cautiously lowered onto the diaphragm in the proper position, the wire left hanging.

A small drop of shellac varnish applied at each side will hold the fiber in position as soon as it is thoroughly dry, after which the ends of the fiber should be cut away.

DIALYZERS

As a substitute for parchment and similar natural membranes, it has been found that those made from cellulose trinitrate are superior. Parlodion (DuPont) may be used, dissolving one part of the nitrate in 2 each of ethanol and ethyl ether. The water adhering to the Parlodion should first be removed (the shreds are preserved by covering with water), otherwise a clear solution will not be obtained. Cut the round end off a $\frac{3}{4}$ " or 1" test tube, and dip the flared end of the tube into the alcohol-ether solution of Parlodion. Upon removing the tube from the solution a film will be found across the tube and after evaporation of the solvents the film will be found to be of sufficient strength to meet the purposes of a dialyzer. The liquid to be dialyzed is poured into the tube and contents are then set in a beaker of water. In a short time the working of the semi-permeable membrane will be shown by the rise of the level of the liquid inside the tube.

EXPANSION OF GLASSES, TEST FOR EQUALITY OF

In order to compare the coefficients of expansion of two pieces of glass, prior to sealing them together, melt the drawn out ends of each piece to beads; press these molten beads together with tweezers and draw into a thread. If the glasses can be sealed

ARTS AND RECIPES (Continued)

together, the thread will be straight; otherwise, it will curve because of the different coefficients of expansion.

FLUORESCENT SCREENS

For observations of the ultraviolet spectrum, moisten a small quantity of anthracene with water and brush a thin layer over a ground-glass surface. On drying most of the anthracene will adhere to the glass. The prepared surface should be placed so as to receive the radiation directly, glass being comparatively opaque to the shorter wave lengths.

GLASS GRINDING FLUID

Turpentine.....	45	c.c.
Ether (ethyl oxide).....	22.5	c.c.
Camphor gum.....	31	g

To be used with powdered emery for grinding glass.

For smoothing edges a sheet of emery cloth moistened with the above solution may be used.

Plane surfaces should be ground on thick plate glass.

For grinding glass stoppers use coarse emery, turn in one direction, finish with fine emery.

GLASS GRINDING MEDIUM

Glycerin may be used instead of a camphor-turpentine mixture for a medium in which to suspend emery powder for grinding glass. Glycerin has body enough and is sufficiently viscous to carry the emery well, and besides this it is water-soluble, thus making it very easy to wash away the excess grinding agent when the job is done or when it is desirable to make a close inspection of the work done.

HEATING BATH

A bath fluid at temperatures above 150° C. and which does not appreciably affect glass is prepared by fusing 10 parts of potassium nitrate with 8.5 parts of sodium nitrite.

HEATING BATHS

For uniform heating of reactions the following materials have proven satisfactory:

For temperatures up to 100° C.....	Steam
For temperatures from 100° — 250° C.	Crisco or Nujol
For temperatures from 200° — 300° C.	<i>o</i> -tolyl phosphate
For temperatures above 250° C.....	Wood's metal.

HECTOGRAPH FILLER

Ingredients: $\frac{1}{2}$ oz. of ground (dried) glue; 2 oz. of dried gelatine; 18 fluid oz. glycerin. These amounts should provide sufficient filler for a pan 12" \times 9" \times $\frac{1}{2}$ ".

Mix the glue with water and digest it on a water bath (a double boiler may be used) until it has the consistency of cream and is thoroughly melted. Soak the gelatine in cold water till soft free it from as much water as is possible by pressure in a cheese-cloth and then melt it on a water bath or in a double boiler. Pour the three liquids together, and after they are thoroughly mixed, pour them into the pan. If any bubbles appear on the surface

ARTS AND RECIPES (Continued)

of the filler, scrape them off with the edge of a piece of cardboard while the filler is hot. Do not use the filler until at least six hours after it has been poured into the pan. The materials gel slowly. Keep the pan level and covered until its contents is no longer fluid.

HECTOGRAPH INK

Violet

Aniline violet.....	1 oz.
Hot water.	7 oz. fl.

On cooling, add:

Alcohol.....	1 oz.
Glycerin.....	$\frac{1}{4}$ oz.
Carbolic acid (phenol).....	a few drops

Black

Nigrosine.....	1 part
Water.....	14 parts
Glycerin.....	4 parts

HYDROGEN SULFIDE

Pure hydrogen sulfide may be generated by allowing distilled water to drop on aluminum sulfide.

HYDROGEN SULFIDE SUPPLY

Mix and heat slightly 3 parts by weight of sulfur with 1 part by weight of paraffin. Then mix with sufficient shredded asbestos to make a porous mass. Partly fill an 8" Pyrex test tube, connect with delivery tube and safety bottle. Heat. Furnishes good supply of H_2S . No leakage into the room as generation of H_2S ceases as soon as heat is removed. Mixture keeps. Test tube may be heated over again until reactants are used up.

INK FOR GLASS MARKING

Barium sulfate.....	15 parts by weight
Ammonium bifluoride.....	15 parts by weight
Ammonium sulfate.....	10 parts by weight
Oxalic acid.....	8 parts by weight
Glycerin.....	40 parts by weight
Water.....	12 parts by weight

If too thick, add more water. If the action is too slow, up to 5 % of sodium fluoride may be added. Use in a hood or well ventilated room.

LABEL PROTECTION

Collodion for Labels on Bottles

Dissolve 3-4 grams pyroxylin in 100 c.c. 1:3 mixture of alcohol and ether (25 c.c. absolute alcohol, 75 c.c. dry ether).

First soak the pyroxylin in the alcohol, then add the ether.

Labels for Bottles

Labels should be written in India Ink. They can be made waterproof and durable by coating with a saturated solution of paraffin in benzene.

ARTS AND RECIPES (Continued)

Lacquer for Protecting Labels

An excellent lacquer for protecting labels may be made by dissolving 20 grams of vinyl acetate polymer (Vinylite A) in 100 c.c. of a mixture of 3 parts of toluene and 1 part of 95 % alcohol. This lacquer forms a colorless, transparent film which resists most reagents very well.

Protecting Varnish for Labels

Typed labels may be protected by several coats of a varnish made by dissolving ordinary tooth brush handles in acetone. The quantity of solvent should be adjusted to give a convenient viscosity. The varnish is water and acid resistant.

LOW MELTING ALLOY

The following alloy, Wood's metal, melts at about 65° C.:

Bismuth.....	50	parts by weight
Lead.....	25	parts by weight
Tin.....	12.5	parts by weight
Cadmium.....	12.5	parts by weight

LUBRICANT, DRY

Melt a quantity of paraffin and add as much fine flake or powdered graphite as is readily moistened by the melted wax. Cool and cut while soft into convenient sticks.

This lubricant when rubbed on the surfaces involved, adheres and greatly reduces friction. It is particularly useful when one or both of the surfaces are of wood or other non-metallic substance.

MILDEW PREVENTION ON LEATHER BOOK BINDINGS

Make a 2 % to 5 % solution—not more than 5 %—of copper sulfate. Immerse a soft towel or cloth in this solution. Remove the cloth and thoroughly wring out. Then hang out to dry. When thoroughly dried, it can be used to rub leather bound books. One treatment of the cloth will easily take care of scores or a hundred volumes, and the leather will not be marked by the chemical.

MIRRORS FOR SPECTROMETER ADJUSTMENT

A small square of thick plate glass with edges ground smooth and silvered on one surface affords a means of accurate adjustment.

To avoid the necessity of frequently resilvering, which arises where the mirrors are in constant use, the following course is suggested:

From selected German plate mirror 2 to 3 mm thick, cut two pieces of the same size, say 4 × 5 cm. Remove the protective layer of varnish or paint from both pieces by soaking in alcohol and rubbing with cotton, being careful not to injure the silver surface. From one piece remove every trace of varnish by repeated rinsing, dry and polish the silver surface thus exposed by stroking lightly with a chamois rouge pad. From the other piece remove the silver by nitric acid, wash thoroughly in distilled water and dry. Cement the clear piece on the silver face of the other with Canada balsam. This is accomplished by placing two or three drops of Canada balsam in xylol (obtained in collapsible tubes) on the center of the silver face, and evenly lowering upon it the clear glass. The balsam should spread rapidly to the edges of

ARTS AND RECIPES (Continued)

the plates. Minute bubbles of air in the balsam film are harmless; if large bubbles are present the plates should be slipped apart, cleaned with alcohol and the process repeated.

The balsam will be sufficiently hard in a few days to allow the excess to be scraped from the edges and the plates bound together with lantern slide binding strip. Gentle heat may be used to harden the balsam more rapidly.

PHENOL (CARBOLIC ACID) BURNS

To c. p. glycerin add bromine until slightly colored or saturated. Keep in glass stoppered bottle and apply quickly to phenol burns. The bromide reacts instantly with the phenol to form phenyl bromides.

POLARITY TEST PAPER

Dissolve one gram of phenolphthalein in a small quantity of alcohol. Add the solution of phenolphthalein to 100 c.c. of a 10 per cent solution of potassium chloride in distilled water. Filter paper should be soaked in the solution and dried. A strip of paper moistened with water and placed in contact with the two terminals will show a bright red stain at the negative terminal.

PURIFICATION OF ALCOHOL

To remove aldehydes from alcohol intended for use in the preparation of alcoholic solutions of sodium or potassium hydroxide, add to one liter of alcohol 5 to 10 grams of aluminum or zinc and 8 to 10 grams of potassium hydroxide; boil under reflux for 20 minutes, and distil. Best results are obtained if an all-glass apparatus is used. Alcoholic solutions, prepared with alcohol so treated, will not discolor if the purification of the alcohol has been carefully carried out.

RESISTANT PAINTS AND VARNISHES

Acid Proof Wood Stain

Solution No. 1	Solution No. 2
125 grams of copper sulfate	150 grams of good fresh anilin oil
125 grams of potassium chlorate	180 grams of concentrated hydrochloric acid
1000 grams of water	1000 grams of water

Wood must be free from paint, varnish, grease or chemicals. Apply two coats of solution No. 1 boiling hot with a paint brush, allowing each coat to dry thoroughly before the next coat is applied. Then apply two coats of solution No. 2 in the same way. When the wood is completely dried wash off excess chemicals with hot soapsuds. Finish with raw linseed oil. Polish comes from rubbing the oil down well with a cloth or sponge. Whenever the tables get dingy again go over them with a coat of linseed oil and rub smooth.

Resistant Coal Tar Varnish

A resistant varnish is made from coal tar pitch as follows:

Coal tar pitch	65 parts by weight
Phenol	5 parts by weight
Benzene	30 parts by weight

ARTS AND RECIPES (Continued)

Resistant Paint

The following paint when used on galvanized iron has been found to hold up well, without cracking or peeling in a three year's test. It can also be used on black iron, tin, copper, or stone such as is used for laboratory desk tops. It withstands dilute acids.

Formula: Stir in 10 parts by weight of benzol into 30 parts by weight of ordinary thin coal tar. Then add with vigorous stirring 10 parts by weight of Silica Black (a new product patented under U. S. No. 1,940,352).

SCALE POLISH

To brighten up refractometer and polarimeter scales without injury to the metal rub with bone black or clarifying charcoal. A dry cloth with a little of the bone black is rubbed on the scale until a bright polish is produced. The divisions then stand out clearly and are easily read. The great advantage is that the fine lines are not worn away and no corrosive material is left to cause discolorations.

SILVERING GLASS

BRASHEAR'S PROCESS

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

Two solutions are required, one, the reducing solution, should be prepared at least a week before it is used, and it may be made in large quantity and kept in stock with advantage; the other solution is to be prepared when used.

REDUCING SOLUTION

Distilled water.....	700 c.cm.
Pure sugar (loaf, granulated or rock candy) ..	80 g.

When dissolved add

Alcohol.....	175 c.cm.
Strong nitric acid (sp. gr. 1.42).....	3 c.cm.
Add water to make.....	1000 c.cm.

For silvering, the mirror may rest face up on the bottom of a suitable dish; it may stand on edge, or be supported in any manner, face downward, dipping into the upper part of the solution. In the latter case, the mirror may be fastened with wax to a stick laid across the dish, or it may be supported on glass feet or on paraffined wood wedges. Dr. Brashear recommends that the mirror, if round, form the bottom of the silvering dish, which is completed by wrapping a strip of paraffined paper around the edge of the mirror, this being held in place by rubber bands or fastened with several wrappings of cord.

Having selected a dish and support for the mirror, measure with water the quantity of solution that will be required to make a layer a centimeter or two thick over the surface to be silvered. For each 150 c.cm. of final solution, 1 g. of silver nitrate and 0.5 g. of caustic potash (purified by alcohol) will be required. Dissolve the silver and potash separately, using quantities of water of the proportion of 100 c.cm. to 1 g. of the solid. Ordinary graduated or flasks are the most convenient form of vessel in which to mix the solutions. Into the silver nitrate solution pour a few drops of dilute aqua ammonia. The solution will turn to a dark brown color; add ammonia little by little till the precipitate is nearly but not quite redissolved. Now add the potash solution,

ARTS AND RECIPES (Continued)

when a precipitate will again be formed. This is to be nearly, but not entirely, redissolved by the addition of more ammonia, a few drops being sufficient this time. After the ammonia has been added shake or stir the solution well and wait a minute or two to be certain that it does not entirely clear. If by chance too much ammonia has been used, a little silver nitrate is to be dissolved and added, a few drops at a time, till a permanent precipitate is formed. This excess of silver must be present, the solution showing a decided brown tint. The solution may be filtered, though usually this is not necessary.

A quantity of reducing solution equal to about a twenty-fifth part of the solution just prepared is measured out. The mirror, having been properly cleaned and rinsed with distilled water, is placed in position. The reducing solution is poured into the silver and potash solution, and mixed by a quick shaking of the graduate or stirring with a glass rod; the whole is then poured into the dish. If the mirror is immersed face down, care is necessary to remove air bubbles; the mirror may well be immersed after the solution is in, being dipped in at one side first. If the mirror is at the bottom of the dish, after cleaning it is covered with a thin layer of water, and the prepared solutions are poured into the dish without further trouble. In the latter case the dish must be rocked during the time of deposition.

The solution soon turns to a black color, which in a few minutes will turn to a brown; and when it becomes a light gray and the precipitate is flocculent, which may be in ten or fifteen minutes, the operation is at an end. If the mirror is allowed to remain in the solution too long, the surface will have a bleached appearance, which polishing will hardly remove. Remove the mirror, rinse with water, and carefully wipe off the sediment with a tuft of absorbent cotton. It is then set on edge to dry; a rinsing with alcohol will facilitate the drying, or all water may be safely taken up by pressing clean blotting paper over the surface.

When dry, the surface may be polished, if necessary, with a small pad of chamois leather stuffed with cotton, on which is spread a little rouge. Small, circular strokes of the pad, with light pressure, will soon bring out the deep luster of the silver.

A uniform temperature of the bath and the glass, of about 20° is essential to success.

Since fulminating silver is liable to be produced by the action of ammonia on silver oxide, especially in a warm room, all solutions should be thrown away as soon as the silvering operation is completed. The used solutions may be poured into a large jar, in which is thrown some common salt; this causes the silver to be precipitated as the chloride, and about 90 per cent of the original silver may be recovered.

ROCHELLE SALTS PROCESS

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

For depositing the uniform thin film of silver required on the half-silvered glass of the interferometer, the following method is more suitable than the one described above, as the silver is deposited more slowly. If a thick film is desired, two or more successive deposits may be made, each of which may require an hour's time.

Dissolve 5 g. of silver nitrate in 300 c.cm. of distilled water, and add dilute aqua ammonia until the precipitate formed is nearly, but not entirely, redissolved in the manner explained in

ARTS AND RECIPES (Continued)

the preceding method. Filter the solution and add water to make 500 c.cm.

Dissolve one g. of silver nitrate in a small quantity of water and pour into about half a liter of boiling water; dissolve 0.83 g. of Rochelle salts in a small quantity of water, and add to the boiling solution. Continue the boiling for half an hour, till the gray precipitate collects as a powder in the bottom of the flask. Filter hot, and add water to make 500 c.cm.

These solutions may be kept in the dark for a month or two.

For silvering, equal volumes of the two solutions are mixed, and the glass is supported in the mixture in whatever fashion is convenient. Various methods are mentioned in the preceding article. The thickest possible deposit may require an hour's time. A second deposit may be made upon the first if necessary to secure the desired thickness. The drying and polishing may be carried out as described above.

A half-silvered film will be produced in about a minute; only experience can determine when the proper thickness has been secured. The glass appears as though it were very lightly smoked. A film that reflects a little more than half the light incident at 45° is desirable for interferometer use. A simple method of testing is to look at two similar gas flames, one seen through the film and the other seen reflected by it. It is well to silver at once all four surfaces of the two plane-parallel plates of the interferometer and to select for use that film which is of the proper and most uniform thickness.

SOAP SOLUTION FOR SOAP FILM EXPERIMENTS

Pure castile or palm-oil soap.....	1 oz.
Distilled water.....	8 oz.
Pure glycerin.....	4 oz.

Cut the soap in thin shavings and dissolve in the water. When the solution is complete, add the glycerin and mix very thoroughly. On standing the liquid becomes clear at the bottom. The clear portion may conveniently be removed by a siphon and preserved indefinitely.

SODIUM FLAME

An intense sodium flame is readily obtained by placing a small lump of rock salt in the center of the screen on a lighted Meker burner.

SODIUM LIGHT

Paper is to be soaked in a saturated solution of common salt, borax or other salt of sodium, and dried. When wrapped around a Bunsen burner, secured by a twist of wire and pushed up into the edge of the flame, a sodium flame of considerable intensity is obtained. As the ash of the paper breaks away it must be occasionally raised. Lithium chloride may be used in place of or with sodium salt to give the lithium line for spectrometric measurement. Sheet asbestos (thin) may replace the paper if desired. Since the asbestos is not consumed it is necessary to moisten the mantle with salt solution at intervals.

SOLDERING PYREX GLASS TO METAL

Dip the Pyrex glass tube to be soldered into a solution of chlorplatinic acid (or platinum chloride may be substituted) made by

ARTS AND RECIPES (Continued)

preparing a mixture consisting of 0.2 gram of the acid with 5 c.c. each of alcohol and ethyl ether to which 4 or 5 drops of turpentine have been added. After dipping the tube, carefully burn all the adhering liquid away leaving a film of platinum metal. That film will serve to hold the solder to the Pyrex glass and in doing so makes a very satisfactory gas-tight joint for a metal to glass connection.

SOLDERS

Composition by weight						Temperature of fusion	Metals for which it is used	Flux commonly used
Lead	Tin	Copper	Zinc	Silver	Gold			
1	1	....	....	....	..	188° C.	Lead	Tallow
3	5	....	....	....	..	176	Zinc	Zinc chloride
2	5	....	....	....	..	170	Copper brass	25 % HCl
		2	1	....	..	.....	Iron	Zinc chloride (neutral) or resin
		55	45	....	..	880	Fe, Cu, Fe, Cu, brass	Zinc chloride or NH ₄ Cl
		4.5	0.5	15.0	..	1005	Fe, Cu, Au, Fe, Cu, Au, Gold	Borax
		6.5	2.0	11.0	..	983		Borax
		4	....	6	10	.....	

STOPCOCK LUBRICANTS

Seal for Ground Glass Joints

Glycerin makes a very satisfactory seal for ground glass joints to prevent leakage of petroleum ether, ethyl ether or any other fluid in which glycerin is insoluble. Glycerin on the ground glass surface prevents sticking and so allows for the easy dismantling of the apparatus.

Stopcock Grease

Shepherd and Ledig (J. Ind. Eng. Chem. 19, 1059, 1927) prepare stopcock grease from the following ingredients by mixing with continuous stirring for 190 hours at 155° C., then placing the mixture in small 2 oz. containers, immediately chilling the contents on ice and allowing to age for 10 days before use. For high vacuum: 31 parts crepe rubber, 24 parts white "Vaseline" petroleum jelly, 5 parts paraffin (m. p. 36° C.); for general lubricant: 6 parts crepe rubber, 7 parts "Vaseline" petroleum jelly, 1 part paraffin; for light lubricant: 10 parts smoked sheet or pale crepe rubber, 18 parts "Vaseline" petroleum jelly and 1 part paraffin (m. p. 30° C.).

Stopcock Grease

Black rubber (red or pure gum)..... 1 part
 Paraffin..... 2 parts
 "Vaseline" petroleum jelly..... 4 parts

Melt the paraffin and "Vaseline" petroleum jelly together, add the rubber slowly and in small pieces taking care not to burn the rubber. A larger quantity of "Vaseline" petroleum jelly may be desirable.

ARTS AND RECIPES (Continued)

Stopcock Lubricant

Petrolatum (500 grams) and raw crepe rubber (50 grams) are stirred together and kept in an oven at 125°–150° C. for several days, or until the mixture is homogeneous.

Stopcock Lubricant

Standard Viscous Oil No. 32 (Standard Oil Co. of California).....	200 grams
Aluminum stearate.....	50 grams

Dissolve the stearate in the oil, heated to about 150° C., and cool. This makes an extremely sticky, ropy, tough adhesive for ground glass surfaces.

Stopcock Lubricant

In the laboratory it is often desirable to have a stopcock lubricant that will not dissolve away with the ordinary fat solvents such as the hydrocarbons or chlorinated hydrocarbons. In some set-ups the ordinary stopcock greases are quite useless, and syrupy phosphoric acid is very unsatisfactory.

A paste of Bentonite (colloidal clay) and glycerin may be used for such a purpose. One can adjust the viscosity of the paste to suit his needs. Such a lubricant is entirely unaffected by the non-aqueous solvents, and even in the presence of water holds remarkably long, probably due to the fact that the Bentonite makes a jelly with either glycerin or water. In addition it has the very decided advantage of permitting a stopcock lubricant to be used at temperatures up to or even well above 100° C. The viscosity does not diminish very much with rise in temperature.

UNIVERSAL WAX

(1) A soft wax useful in the laboratory may be made by melting together paraffin, "Vaseline" petroleum jelly and paraffin oil in various proportions according to the pliability desired.

(2) Another authority recommends equal quantities of beeswax and turpentine (by weight). It is customary to color the wax by adding finely-powdered Venetian red.

(3) Melt together 1 part of Venice turpentine and 5 parts of beeswax. Color with vermilion.

PHOTOGRAPHIC FORMULAE

Pure water, preferably distilled, should be used in all solutions. Chemicals should be dissolved in the order given.

Desiccated or anhydrous sodium carbonate and sodium sulfite are specified in the following formulae. If the crystalline forms are employed, a larger quantity must be used.

Sodium carbonate exists in three forms: the anhydrous or desiccated, Na_2CO_3 ; the monohydrate, $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$; "washing soda," $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$. If the monohydrate is substituted for the desiccated, 1.17 times the specified quantity should be used. If the "crystal" form $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ is substituted for the desiccated, 2.7 times the specified quantity should be used.

Sodium sulfite exists in two forms; the anhydrous or desiccated, Na_2SO_3 , and a form, $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$. If the latter "crystal" form is substituted for the desiccated, 2 times the specified amount should be used.

Quantities required are given in both English and metric units. The values are, in most cases, not interchangeable since the amounts of water are not the same. According to recent usage quantities of liquid are often specified in milliliters (ml). The milliliter is 1.000027 cubic centimeters; the units are, of course, interchangeable for photographic formulae. The U. S. avoirdupois system of weights is used.

The following abbreviations are employed:

anh.	anhydrous
c.c.	cubic centimeter
dr.	dram
g	gram
gal.	gallon
gr.	grain
l	liter
min.	minim
ml	milliliter (equivalent to cubic centimeter, cm^3 or c.c.)
oz. (av.)	ounce (avoirdupois)
oz. fl.	fluid ounce
qt.	quart

DEVELOPERS FOR PLATES AND FILMS

When a time of development is suggested, it is intended to serve as a guide only. Individual requirements as to density and contrast vary. Greater or less contrast may be obtained by developing for a longer or a shorter time respectively.

GENERAL PURPOSE NEGATIVE DEVELOPERS

Amidol (Diaminophenol hydrochloride)

For plates and films, to be mixed immediately before use.

Water.....	10 oz. fl.	1000 ml
Sodium sulfite, anh.....	120 gr.	29 g
Amidol.....	30 gr.	7 g
Potassium bromide.....	6-10 gr.	1.4-2 g

Amidol oxidizes so rapidly in solution that it is customary to make up this developer immediately before it is to be used. The time required for development is from 3 to 5 minutes at 18°C . or 65°F .

PHOTOGRAPHIC FORMULAE (Continued)

Amidol

Sulfite Stock Solution

Sodium sulfite, anh.....	2 oz.	100 g
Potassium metabisulfite.....	0.5 oz.	25 g
Water.....	20 oz.	1000 c.c.

Boil after dissolving in warm water. Developer is made when needed by adding dry amidol to the stock solution of sulfite which keeps for a long period.

Stock solution of sodium sulfite.....	2 oz.	200 c.c.
Water.....	10 oz.	1000 c.c.
Amidol.....	20-30 gr.	4.5-7 g

Athenon. See *Glycin*

Elon-Hydroquinone (Kodak D-76)

Developer for maximum speed at normal contrast on films and plates.

Water, about 125° F. (52° C.).....	24 oz.	750 c.c.
Elon.....	29 gr.	2 g
Sodium sulfite, desiccated.....	3 oz. 145 gr. (1458 gr.)	100 g
Hydroquinone.....	73 gr.	5 g
Borax, granular.....	29 gr.	2 g
Water to make.....	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

Average development time about 17 minutes at 68° F. (20° C.).

See individual recommendations listed for each material.

Replenisher (Kodak D-76R)

Water, about 125° F. (52° C.).....	24 oz.	750 c.c.
Elon.....	44 gr.	3 g
Sodium sulfite, desiccated.....	3 oz. 145 gr. (1458 gr.)	100 g
Hydroquinone.....	$\frac{1}{2}$ oz.	7.5 g
Borax, granular.....	290 gr.	20 g
Water to make.....	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

Use the replenisher without dilution and add to the tank to maintain the activity of the developer.

Elon-Hydroquinone-Pyro (Kodak D-75)

A long life deep tank developer for roll film.

Solution No. 1

Water (about 125° F.) (52° C.).....	16 oz.	500 c.c.
Elon.....	44 gr.	3 g

Solution No. 2

Water (about 125° F.) (52° C.).....	16 oz.	500 c.c.
Sodium sulfite, anh.....	260 gr.	18 g
Sodium bisulfite.....	1 oz. 85 gr.	36 g

Solution No. 3

Hot water (about 160° F.) (71° C.).....	16 oz.	500 c.c.
Sodium sulfite, anh.....	260 gr.	18 g
Hydroquinone.....	175 gr.	12 g
Pyro.....	44 gr.	3 g

PHOTOGRAPHIC FORMULAE (Continued)

Solution No. 4

Water (about 125° F.) (52° C.).....	16 oz.	500 c.c.
Sodium carbonate, anh.....	2 oz.	175 gr. 72 g
Mix each solution separately and add to the tank at once in the order given.		
Then add water to make.....	1 gal.	4000 c.c.

Develop 7 to 14 minutes at 65° F. (18° C.), in the fresh developer according to the contrast desired. Greater or less contrast may be obtained by developing for longer or shorter times than those specified. Avoid the use of galvanized ware when mixing, or trouble from fog will be encountered. Cool the mixture of the first three solutions, before adding the cooled solution No. 4 to it, to avoid effervescence.

For small scale mixing, that is, less than 1 gallon (4000 c.c.), all the chemicals may be dissolved in the order given in one-half the total volume of water (125° F.) (52° C.) and cold water added to make up to volume.

Replenisher Stock Solution

Water (about 125° F.) (52° C.).....	64 oz.	2000 c.c.
Elon.....	$\frac{1}{2}$ oz.	15 g
Sodium sulfite, anh.....	3 oz.	90 g
Sodium bisulfite.....	3 oz.	90 g
Hydroquinone.....	1 oz.	30 g
Sodium carbonate, anh.....	8 oz.	240 g
Water to make.....	1 gal.	4000 c.c.

Dilute 1 part of stock solution with 1 part of water and add to the tank as required.

Elon-Pyro (Kodak D-7)

Stock Solution A

Water (about 125° F.) (52° C.).....	16 oz.	500 c.c.
Elon.....	$\frac{1}{4}$ oz.	7.5 g
Sodium bisulfite.....	$\frac{1}{4}$ oz.	7.5 g
Pyro.....	1 oz.	30 g
Potassium bromide.....	60 gr.	4.2 g
Water to make.....	32 oz.	1000 c.c.

Stock Solution B

Water.....	32 oz.	1000 c.c.
Sodium sulfite, desiccated.....	5 oz.	150 g

Stock Solution C

Water.....	32 oz.	1000 c.c.
Sodium carbonate, desiccated.....	2 $\frac{1}{2}$ oz.	75 g

Dissolve chemicals in the order given

TRAY DEVELOPMENT: Take 1 part of A, 1 part of B, 1 part of C, and 8 parts of water. Develop about 7 minutes at 68° F. (20° C.).

TANK DEVELOPMENT: Take 1 part of A, 1 part of B, 1 part of C, and 13 parts of water. Develop about 10 minutes at 68° F. (20° C.).

This developer can be used for two or three weeks if the volume is maintained by adding fresh developer in the proportion of 1 part each of A, B, and C to 4 parts of water. It is usually necessary to increase the development time as the developer ages.

PHOTOGRAPHIC FORMULAE (Continued)

Glycin (Parahydroxyphenyl glycin)

Stock Solution

Water.....	10 oz. fl.	1000 ml
Sodium sulfite, anh.....	300 gr.	68.5 g
Glycin.....	120 gr.	27.5 g
Sodium carbonate, anh.....	240 gr.	54.8 g

TRAY DEVELOPMENT: Dilute with 4 parts of water to 1 of stock solution. Develop 6 to 10 minutes.

TANK DEVELOPMENT: Use 15 parts of water to 1 of stock solution; develop 20 to 30 minutes.

Glycin developer keeps well. The image is fine-grained and free from fog or stain.

Glycin

Stock Solution

Hot water (200° F.).....	60 oz.	1700 c.c.
Sodium carbonate, anh.....	2 oz.	57 g
Glycin.....	0.5 oz.	14 g
Sodium sulfite, anh.....	0.5 oz.	14 g

Dissolve in order. For use take stock solution, 6 parts; water, 58 parts.

At 60° F. develop 30 min.; at 65° F. 25 min.; at 70° F. 20 min.

Glycin (Kodak D-78)

Water.....	2.5 qt.	750 c.c.
Sodium sulfite, anh.....	175 gr.	3 g
Glycin.....	175 gr.	3 g
Sodium carbonate, anh.....	350 gr.	6 g
Water to make.....	1 gal.	1000 c.c.

Time of development: 15 to 25 minutes at 65° F. (18° C.)

Glycin Developer (Agfa 72)

This formula is recommended for use with commercial films in reproduction work and is also suitable for development of roll, pack and cut film.

Stock Solution

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Sodium sulfite, anh.....	4 $\frac{1}{4}$ oz.	1 lb. 1 oz.	125 g
Potassium carbonate.....	8 $\frac{1}{2}$ oz.	2 lb. 2 oz.	250 g
Glycin.....	1 $\frac{1}{2}$ oz. 80 gr.	6 $\frac{3}{4}$ oz.	50 g
	(736 gr.)		
Water to make.....	32 oz.	1 gal.	1000 c.c.

TANK DEVELOPMENT: Take one part stock solution, fifteen parts water and develop 20 to 25 minutes at 65° F. (18° C.).

TRAY DEVELOPMENT: Take one part stock solution, four parts water and develop 5 to 10 minutes at 65° F. (18° C.).

Hydroquinone

Water.....	10 oz. fl.	1000 ml
Sodium sulfite, anh.....	220 gr.	50 g
Hydroquinone.....	50 gr.	11.5 g
Sodium carbonate, anh.....	162 gr.	37 g

For use take 1 part of water to 1 part of stock solution. This is a slow acting developer. The temperature should not be allowed to fall below 60° F. (15° C.) as the developer becomes inert.

PHOTOGRAPHIC FORMULAE (Continued)

Metaborate Metol-Hydroquinone (Agfa 48M)

This formula is recommended for photofinishing, professional, and amateur developing and is suitable for deep tank use over a long period of time.

Hot water (125° F. or

52° C.).....	3 qt.	2½ gal.	750 c.c.
Metol.....	119 gr.	418 gr.	2 g
Sodium sulfite, anh..	5¼ oz.	1 lb. 2¼ oz. (18¼ oz.)	40 g
Hydroquinone.....	88 gr.	309 gr.	1.5 g
Sodium metaborate..	1½ oz. 30 gr. (577 gr.)	4½ oz.	10 g
Potassium bromide..	30 gr.	½ oz.	.5 g
Water to make.....	1 gal.	3½ gal.	1000 c.c.

Do not dilute for use.

TANK DEVELOPMENT: Normal developing time 5 to 7 minutes at 65° F. (18° C.).

TRAY DEVELOPMENT: Normal developing time 4 to 6 minutes at 65° F. (18° C.).

Replenisher (Agfa 48M)

Add whenever necessary to keep tank up to full volume.

Hot water (125° F. or 52° C.)...	24 oz.	3 qt.	750 c.c.
Metol.....	90 gr.	358 gr.	6.3 g
Sodium sulfite, anh.....	1 oz.	4 oz.	30 g
Hydroquinone.....	144 gr.	1½ oz.	10 g
Sodium metaborate.....	1¼ oz.	5 oz.	40 g
Water to make.....	1 qt.	1 gal.	1000 c.c.

Metol

Water, warm.....	20 oz.	1000 c.c.
Metol.....	150 gr.	17 g
Sodium sulfite, anh.....	1.25 oz.	63 g
Sodium carbonate, anh.....	1.75 oz.	88 g
Potassium bromide.....	16 gr.	1.8 g

Always dissolve metol first.

For use dilute with equal part of water for portraiture; for landscape use two parts of water to one of stock solution. Gives detail without density except by prolonged development.

Metol-Hydroquinone

Note: Elon may be used with hydroquinone in place of metol, in equal quantity.

Solution A

Water.....	64 oz.	1820 c.c.
Metol.....	120 gr.	7.8 g
Hydroquinone.....	120 gr.	7.8 g
Sodium sulfite, anh.....	2 oz.	57 g

Solution B

Water.....	16 oz.	455 c.c.
Sodium carbonate, anh.....	2 oz.	57 g

For use take A, 4 oz.; B, 1 oz.; water, 4 oz.

PHOTOGRAPHIC FORMULAE (Continued)

Metol-Hydroquinone Tray Developer (Agfa 40)

This is a brilliant tray developer for roll, pack and sheet film.

Stock Solution

Hot water (125° F. or 52° C.)	29 oz.	3½ qt.	900 c.c.
Metol.....	66 gr.	264 gr.	4.5 g
Sodium sulfite, anh.....	1¾ oz. 25 gr. (791 gr.)	7¼ oz.	54 g
Hydroquinone.....	¼ oz.	1 oz.	7.5 g
Sodium carbonate, mono- hydrated.....	1¾ oz. 25 gr. (791 gr.)	7¼ oz.	54 g
Potassium bromide.....	45 gr.	189 gr.	3 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

For use dilute 1 part stock solution with 2 parts water.

Development time 4 to 5 minutes at 65° F. (18° C.).

Metol-Hydroquinone Tray Developer (Agfa 61)

This developer is recommended for use with commercial film to produce negatives of normal contrast. It may also be used satisfactorily for roll, pack and sheet film for negatives of average brilliance.

Hot water (125° F. or 52° C.).....	24 oz.	3 qt.	750 c.c.
Metol..	15 gr.	60 gr.	1 g
Sodium sulfite, anh.....	½ oz.	2 oz.	15 g
Hydroquinone.....	30 gr.	119 gr.	2 g
Sodium carbonate, monohydrated...	½ oz.	2 oz.	15 g
Potassium bromide.....	15 gr.	60 gr.	1 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

Do not dilute for use. Normal development time, 4 to 6 minutes at 65° F. (18° C.).

Metol-Hydroquinone Developer (Agfa 47)

This is a long-life, clean-working formula which will give excellent results as a standard film developer for either tray or tank development.

Hot water (125° F. or 52° C.)	3 qt.	2½ gal.	750 c.c.
Metol.....	88 gr.	309 gr.	1.5 g
Sodium sulfite, anh.....	6 oz.	1 lb. 5 oz. (21 oz.)	45 g
Sodium bisulfite.....	60 gr.	½ oz.	1 g
Hydroquinone.....	179 gr.	1¼ oz. 80 gr. (627 gr.)	3 g
Sodium carbonate, mono- hydrated.....	348 gr.	2½ oz.	6 g
Potassium bromide.....	47 gr.	269 gr.	.8 g
Water to make.....	1 gal.	3½ gal.	1000 c.c.

TANK DEVELOPMENT: Used without dilution. Normal development time 6 to 8 minutes at 65° F. (18° C.) with occasional agitation. For longer developing times, dilute one part developing solution with one part water and develop 12 to 16 minutes at 65° F. (18° C.).

PHOTOGRAPHIC FORMULAE (Continued)

TRAY DEVELOPMENT: Normal development time 5 to 7 minutes at 65° F. (18° C.).

Replenisher (Agfa 47A)

Add whenever necessary to keep tank up to full volume.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.....	45 gr.	179 gr.	3 g
Sodium sulfite, anh.....	1½ oz.	6 oz.	45 g
Sodium bisulfite.....	30 gr.	119 gr.	2 g
Hydroquinone.....	88 gr.	348 gr.	6 g
Sodium carbonate, mono-hydrated.	174 gr.	1½ oz. 50 gr. (706 gr.)	12 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

Metol-Hydroquinone Tank Developer (Agfa 42)

This is a soft-working tank formula recommended for pack, roll and portrait films.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.....	12 gr.	47 gr.	.8 g
Sodium sulfite, anh.....	1½ oz.	6 oz.	45 g
Hydroquinone.....	18 gr.	70 gr.	1.2 g
Sodium carbonate, mono-hydrated.	119 gr.	1 oz. 40 gr. (478 gr.)	8 g
Potassium metabisulfite.....	59 gr.	239 gr.	4 g
Potassium bromide.....	22 gr.	88 gr.	1.5 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.

Develop 15 to 20 minutes at 65° F. (18° C.).

Ortol

Solution A

Ortol.....	140	gr.	16 g
Potassium metabisulfite.....	70	gr.	8 g
Cold water.....	20	oz.	1000 c.c.

Solution B

Sodium carbonate, anh.....	1.25 oz.	63 g
Sodium sulfite, anh.....	1.75 oz.	88 g
Potassium bromide.....	10-20 gr.	1.1-2.3 g
Water.....	20 oz.	1000 c.c.

For rapid developer take A, 1 part; B, 1 part. For slower, softer development take A, 1 part; B, 1 part; water, 1 part.

Paraformaldehyde Developer (Agfa 79B)

(Two Solution)

This developer has better keeping quality than when made in one solution.

Solution 1

Water (not over 90° F. or 32° C.).....	24 oz.	3 qt.	750 c.c.
Sodium sulfite, anh.....	15 gr.	60 gr.	1 g
Paraformaldehyde.....	1 oz.	4 oz.	30 g
Potassium metabisulfite.....	154 gr.	1¼ oz. 60 gr. (607 gr.)	10.5 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

PHOTOGRAPHIC FORMULAE (Continued)

Solution 2

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750	c.c.
Sodium sulfite, anh.....	4 oz.	1 lb.	120	g
Boric acid.....	1 oz.	4 oz.	30	g
Hydroquinone.....	3 oz.	12 oz.	90	g
Potassium bromide.....	88 gr.	348 gr.	6	g
Water to make.....	96 oz.	3 gal.	3000	c.c.

For use mix one part Solution 1 with three parts Solution 2.

Normal development time 2 to 3 minutes at 65° to 70° F. (18° to 21° C.).

Paraminophenol

Water, boiling.....	20 oz.	1000	c.c.
Potassium metabisulfite.....	6 oz.	300	g
Paraminophenol.....	2 oz.	100	g

Add sodium or potassium hydroxide in small quantities to dissolve the precipitate first formed.

For use take 1 part stock solution with 20 parts water.

Pyro Developer (Agfa 45)

This formula is recommended to those who prefer Pyro development. Stock solutions should be kept in stoppered bottles.

Solution 1

Sodium bisulfite.....	144 gr.	1½ oz. 25 gr. (572 gr.)	9.8	g
Pyro.....	2 oz.	8 oz.	60	g
Potassium bromide.....	16 gr.	64 gr.	1.1	g
Water to make.....	32 oz.	1 gal.	1000	c.c.

Solution 2

Sodium sulfite, anh.....	3½ oz.	14 oz.	105	g
Water to make.....	32 oz.	1 gal.	1000	c.c.

Solution 3

Sodium carbonate, mono-hydrated.....	2¾ oz.	11 oz.	85	g
Water to make.....	32 oz.	1 gal.	1000	c.c.

TANK DEVELOPMENT: Take one part each Solutions 1, 2, 3 and add 11 parts water. Normal development time, from 9 to 12 minutes at 65° F. (18° C.).

TRAY DEVELOPMENT: Take 1 part each Solutions 1, 2, 3 and add 7 parts water. Normal development time, from 6 to 8 minutes at 65° F. (18° C.). Solutions will keep well when stored separately but final developer should be used immediately after mixing.

Pyro Developer (Kodak D-1)

Stock Solution A

Sodium bisulfite.....	140	gr.	9.8	g
Pyro.....	2	oz.	60	g
Potassium bromide.....	16	gr.	1.1	g
Water to make.....	32	oz.	1000	c.c.

Stock Solution B

Water.....	32	oz.	1000	c.c.
Sodium sulfite, anh.....	3½	oz.	105	■

PHOTOGRAPHIC FORMULAE (Continued)

Stock Solution C

Water.....	32 oz.	1000	c.c.
Sodium carbonate, anh.....	2½ oz.	75	g

For tray development take 1 part of A, 1 part of B, 1 part of C, and 7 parts of water. Develop about 5 to 7 minutes at 65° F. (18° C.).

For tank development take 1 part of A, 1 part of B, 1 part of C, and 11 parts of water. Develop about 12 minutes at 65° F. (18° C.).

Pyro Developer (Kodak D-90)

Stock Solution A

Sodium sulfite, anh.....	2 oz.	145	gr.	70	g
Sodium bisulfite.....		245	gr.	17	g
Pyro.....		290	gr.	20	g
Water to make.....	32	oz.	1000	c.c.	

Stock Solution B

Stock Solution B			
Sodium carbonate, anh.....	2½ oz.	75 g	
Potassium bromide.....	15 gr.	1 g	
Water to make.....	32 oz.	1000 c.c.	

For average use take 1 part of stock solution A, 1 part of stock solution B, and 2 parts of water. Develop 4 to 6 minutes at 65° F. (18° C.). For greater contrast, use 1 part of A, 1 part of B, and 1 part of water; for less contrast, use 1 part of A, 1 part of B, and 4 parts of water.

Pyro Tank Developer

Pyro Tank Developer			
Water.....	48 oz.	1360	c.c.
Sodium sulfite, anh.....	115 gr.	7.5	g
Sodium carbonate, anh.....	90 gr.	5.8	g
Pyro.....	45 gr.	2.9	g

Dissolve immediately before use. Use full strength.
Develop 15 minutes at 65° F. (18° C.).

Pyro Tank Developer

(Three Solutions)

Solution A

Solution A				
Water.....	16 oz.	455	c.c.	
Oxalic acid.....	10 gr.	0.65	g	
Pyro.....	1 oz.	28	g	

Solution B

Water.....	16 oz.	455	c.c.
Sodium sulfite, anh.....	3 oz.	85	g

Solution C

Water.....	16 oz.	455	c.c.
Sodium carbonate, anh.....	1 oz.	28	g

For use take A, 1 part; B, 1 part; C, 1 part; water, 61 parts.
Develop 30 minutes at 65° F. (18° C.) for best results.

For temperature 60° F. develop 35 minutes.

For temperature 65° F. develop 30 minutes.

For temperature 70° F. develop 25 minutes.

PHOTOGRAPHIC FORMULAE (Continued)

CONTRAST NEGATIVE DEVELOPERS

Elon-Hydroquinone

Contrast Developer for Photomicrography

Water (52° C.).....	16 oz.	500 c.c.
Elon.....	14 gr.	1 g
Sodium sulfite.....	2½ oz.	75 g
Hydroquinone.....	130 gr.	9 g
Sodium carbonate.....	360 gr.	25 g
Potassium bromide.....	70 gr.	5 g
Water to make.....	32 oz.	1000 c.c.

Elon-Hydroquinone (Kodak D-11)

Process tank or tray developer for high contrast on films and plates.

Water, about 125° F. (52° C.).....	16 oz.	500 c.c.
Elon.....	15 gr.	1 g
Sodium sulfite, desiccated.....	2½ oz.	75 g
Hydroquinone.....	130 gr.	9 g
Sodium carbonate, desiccated.....	365 gr.	25 g
Potassium bromide.....	73 gr.	5 g
Cold water to make.....	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

For process photography use without dilution. For development of copies of continuous-tone subjects, dilute with an equal volume of water. Develop about 5 minutes in a tank or 4 minutes in a tray at 68° F. (20° C.).

Hydroquinine Developer for Line Work

Also for lantern slides, or wherever increased contrast is desired.

A

Distilled water.....	32 oz.
Hydroquinone.....	1½ oz.
Sodium sulfite, anh.....	1 oz.
Sulfuric acid (conc.).....	60 min.

B

Distilled water.....	32 oz.
Sodium carbonate, anh.....	1 oz.
Potassium carbonate, anh.....	3 oz.
Potassium bromide.....	130 gr.
Sodium sulfite, anh.....	3 oz.

For tray or tank development, use equal parts of A and B without further dilution. Develop at 65° F. for 5 to 10 minutes according to exposure or density desired.

Hydroquinone-Caustic Soda (Kodak D-9)

Process Tray Developer

Stock Solution A

Water (about 125° F.) (52° C.).....	16 oz.	500 c.c.
Sodium bisulfite.....	3 oz.	22.5 g
Hydroquinone.....	3 oz.	22.5 g
Potassium bromide.....	3 oz.	22.5 g
Cold water to make.....	32 oz.	1000 c.c.

PHOTOGRAPHIC FORMULAE (Continued)

Stock Solution B

Cold water.....	32 oz.	1000 c.c.
Sodium hydroxide (caustic soda).....	1 $\frac{3}{4}$ oz.	52.5 g

Use equal parts of A and B and develop not more than two minutes at 65° F. (18° C.). Wash thoroughly after development and before fixing, otherwise stains and dichroic fog will result. Development slows up greatly below 55° F. (13° C.).

Cold water should always be used when dissolving sodium hydroxide (caustic soda) because considerable heat is evolved. If hot water is used, the solution will boil with explosive violence and may cause serious burns if the hot alkali spatters on the hands or face. Solution A should be stirred thoroughly when the caustic alkali is added to it; otherwise the heavy caustic solution will sink to the bottom.

Hydroquinone Caustic Soda (Kodak D-8)

Developer for very high contrast on films and plates.

Stock Solution

Water, about 90° F. (32° C.).....	24 oz.	750 c.c.
Sodium sulfite, desiccated.....	3 oz.	90 g
Hydroquinone.....	1 $\frac{1}{2}$ oz.	45 g
Sodium hydroxide (caustic soda).....	1 $\frac{1}{4}$ oz.	37.5 g
Potassium bromide.....	1 oz.	30 g
Water to make.....	32 oz.	1000 c.c.

Dissolve chemicals in the order given. Stir the solution thoroughly before use.

For use, take 2 parts of stock solution and 1 part of water. Develop about 2 minutes in a tray at 65° F. (18° C.).

For general use, a developer which is slightly less alkaline and gives almost as much density can be obtained by using 410 gr. of sodium hydroxide per 32 oz. of stock solution (28 g per 1000 c.c.) instead of the quantity given in this formula.

Hydroquinone Caustic Soda (Agfa 70)

This developer is recommended for Process film used in reproduction work.

Solution 1

Hot water (125° F. or 52° C.).....	24 oz.	3 qt.	750 c.c.
Hydroquinone.....	368 gr.	3 $\frac{1}{2}$ oz. 40 gr. (1462 gr.)	25 g
Potassium metabisulfite.....	368 gr.	3 $\frac{1}{2}$ oz. 40 gr. (1462 gr.)	25 g
Potassium bromide.....	368 gr.	3 $\frac{1}{4}$ oz. 40 gr. (1462 gr.)	25 g
Cold water.....	32 oz.	1 gal.	1000 c.c.

Solution 2

Cold water.....	32 oz.	1 gal.	1000 c.c.
*Sodium hydroxide (Caustic soda flakes).....	1 oz. 90 gr. (528 gr.)	4 $\frac{3}{4}$ oz. 30 gr. (2108 gr.)	36 g

*May be substituted by:

Potassium hydroxide....	1 $\frac{1}{2}$ oz. 80 gr. (736 gr.)	6 $\frac{3}{4}$ oz.	50 g
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Mix equal parts of Solutions 1 and 2 immediately before use. Develop films within 3 minutes at 65° F. (18° C.).

PHOTOGRAPHIC FORMULAE (Continued)

Metol-Hydroquinone (Agfa 90)

This developer has been particularly designed for use with commercial and process films to produce negatives of brilliant contrast.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.....	75 gr.	294 gr.	5 g
Sodium sulfite, anh.....	1½ oz. 40 gr.	5½ oz.	40 g
	(587 gr.)		
Hydroquinone.....	88 gr.	348 gr.	6 g
Sodium carbonate, mono-hydrated.	1½ oz. 40 gr.	5½ oz.	40 g
	(587 gr.)		
Potassium bromide.....	45 gr.	179 gr.	3 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.

Normal development time, 4 to 6 minutes at 65° F. (18° C.).

For results of higher contrast, this developer may be modified by the addition of 3 g of potassium bromide per 1000 c.c. of developer (45 gr. per 32 oz.), with developing time of 2 to 3 minutes at 65° F. (18° C.).

Metol-Hydroquinone (Agfa 22)

This formula is recommended for tray or tank development of cine title film and positive film to obtain results of high contrast.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.....	12 gr.	52 gr.	.8 g
Sodium sulfite, anh.....	1½ oz.	5 oz.	40 g
Hydroquinone.....	119 gr.	1 oz. 40 gr.	8 g
		(478 gr.)	
Sodium carbonate, mono-hydrated.....	1¾	7 oz.	50 g
Potassium bromide.....	75 gr.	299 gr.	5 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

Do not dilute for use. Normal developing time 5 to 8 minutes at 65° F. (18° C.).

FINE GRAIN DEVELOPERS

Elon-Hydroquinone-Borax (Kodak D-76)

For low contrast and greatest shadow detail on panchromatic films and plates.

Water (about 125° F.) (52° C.).....	96 oz.	3000 c.c.
Elon.....	116 gr.	8 g
Sodium sulfite, anh.....	13¼ oz.	400 g
Hydroquinone.....	290 gr.	20 g
*Borax.....	116 gr.	8 g
Water to make.....	1 gal.	4000 c.c.

*Such as 20-Mule Team Borax.

Use without dilution. For tank use, develop 15 to 25 minutes at 65° F. (18° C.) in the fresh developer according to the contrast desired; for tray use, decrease the time about 20 %. A faster working developer can be obtained by increasing the quantity of borax.

Still finer grained results may be secured by adding potassium bromide to the developer. The maximum quantity which may be added without too great a loss of speed is 300 grains per gallon (20 grams per 4000 c.c.). As bromide is added, it will be necessary

PHOTOGRAPHIC FORMULAE (Continued)

to increase both the time of development and the exposure for best results.

Replenisher Solution

Water (about 125° F.) (52° C.).....	96 oz.	3000 c.c.
Elon.....	175 gr.	12 g
Sodium sulfite, anh.....	13¼ oz.	400 g
Hydroquinone.....	1 oz.	30 g
*Borax.....	2 oz. 290 gr.	80 g
Water to make.....	1 gal.	4000 c.c.

*Such as 20-Mule Team Borax.

Use the replenisher without dilution and add to the tank to maintain the level of the solution.

Fine Grain Developer for Films and Plates (Kodak DK-20)

Water, about 125° F. (52° C.).....	96 oz.	750 c.c.
Elon.....	290 gr.	5 g
Sodium sulfite, desiccated.....	13¼ oz.	100 g
Kodalk (sodium metaborate, 4H ₂ O).....	116 gr.	2 g
Sodium thiocyanate (sulfocyanate).....	58 gr.	1 g
Potassium bromide.....	29 gr.	.5 g
Cold water to make.....	1 gal.	1000 c.c.

Dissolve chemicals in the order given.

Average development time about 15 minutes in a tank at 68° F. (20° C.). See individual recommendations listed for each material.

The useful life of this developer can be increased 5 to 10 times by use of the following replenisher.

Replenisher (Kodak DK-20R)

Water, about 125° F. (52° C.).....	96 oz.	750 c.c.
Elon.....	1 oz.	7.5 g
Sodium sulfite, desiccated.....	13¼ oz.	100 g
Kodalk (sodium metaborate 4H ₂ O).....	2 oz. 290 gr. (1165 gr.)	20 g
Sodium thiocyanate (sulfocyanate).....	290 gr.	5 g
Potassium bromide.....	58 gr.	1 g
Cold water to make.....	1 gal.	1000 c.c.

Dissolve chemicals in the order given. The replenisher should be added at a rate which will maintain constant development activity.

Metol-Hydroquinone, Automatic System

Two Solutions

A

Water.....	1 qt.
Metol.....	95 gr.
Sulfite of soda, anh.....	750 gr.
Hydroquinone.....	95 gr.

B

Saturated solution of borax

To mix solution A take one-half of the water, add the metol and, when dissolved, add one-half of the sulfite. To the other half of the water, hot, add the rest of the sulfite and, when dissolved, add the hydroquinone. Cool and add this second solution to the first, making solution A.

PHOTOGRAPHIC FORMULAE (Continued)

To use pour enough of solution A into a tray to well cover the film or plate, add drops of saturated solution of potassium bromide, enough for the kind of material in use. Some do not require any, others do. Use only enough to keep the whites clear. Soak the film or plate in the A solution for at least two minutes, drain but do not rinse, and then soak in solution B for at least two minutes. Rinse, fix and wash as usual. If a tank is used, the time in each solution must be at least two minutes after the tank is filled. It is necessary to give a full exposure as the high lights cannot be over developed and the shadows will go as far as the exposure will permit. This system gives a gamma of about 0.7 and will be found to produce a very fine negative for enlarging. It is especially good for work in photomicrography.

These solutions are very concentrated and must not be allowed to go below 60° F. They can be used repeatedly and keep well. Results are best at about 70° F., but it makes very little difference between 65° and 80° F.

Metol-Hydroquinone (Agfa 17M)

Fine-Grain Metaborate Tank Developer

This developer is recommended for those who desire a formula similar to Agfa 17, but permitting greater variation in developing time.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.....	22 gr.	88 gr.	1.5 g
Sodium sulfite, anh.....	2½ oz. 80 gr. (1174 gr.)	10¾ oz.	80 g
Hydroquinone.....	45 gr.	179 gr.	3 g
Sodium metaborate.....	30 gr.	119 gr.	2 g
Potassium bromide.....	7½ gr.	30 gr.	.5 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.

Development time at 65° F. (18° C.), 10 to 15 minutes for fine-grain films.

Larger amounts of sodium metaborate may be used with corresponding reduction of developing time (up to 10 g of sodium metaborate per 1000 c.c. with a developing time of 5 minutes at 65°) although slightly coarser grain size will then be experienced.

Replenisher (Agfa 17M)

Add whenever necessary to keep tank up to full volume.

Hot water (125° F. or 52° C.).....	24 oz.	3 qt.	750 c.c.
Metol.....	32 gr.	129 gr.	2.2 g
Sodium sulfite, anh.....	2½ oz. 80 gr. (1174 gr.)	10¾ oz.	80 g
Hydroquinone.....	65 gr.	269 gr.	4.5 g
Sodium metaborate.....	119 gr.	478 gr.	8 g
Water to make.....	1 qt.	1 gal.	1000 c.c.

Metol-Hydroquinone (Agfa 17)

Fine Grain Borax Tank Developer

In addition to its usefulness as a fine-grain developer, this formula is satisfactory for obtaining soft gradation. It is also recommended for motion picture negative development.

PHOTOGRAPHIC FORMULAE (Continued)

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.....	22 gr.	88 gr.	1.5 g
Sodium sulfite, anh.....	2½ oz. 80 gr.	10¾ oz.	80 g
	(1174 gr.)		
Hydroquinone.....	45 gr.	179 gr.	3 g
Borax.....	45 gr.	179 gr.	3 g
Potassium bromide.....	7½ gr.	30 gr.	.5 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.

Development time at 65° F. (18° C.), 10 to 15 minutes for fine-grain films, 12 to 20 minutes for direct copy, direct duplicating, and portrait cut films.

Replenisher (Agfa 17A)

Add whenever necessary to keep tank up to full volume.

Hot water (125° F. or 52° C.).....	24 oz.	3 qt.	750 c.c.
Metol.....	32 gr.	129 gr.	2.2 g
Sodium sulfite, anh..	2½ oz. 80 gr.	10¾ oz.	80 g
	(1174 gr.)		
Hydroquinone.....	65 gr.	269 gr.	4.5 g
Borax.....	263 gr.	2¼ oz. 75 gr.	18 g
		(1059 gr.)	
Water to make.....	32 oz.	1 gal.	1000 c.c.

Paraphenylene Diamine

Paraphenylene diamine.....	10 g
Sodium sulfite, anh.....	60 g
Tribasic sodium phosphate (10 %).....	20 c.c.
Potassium bromide (10 %).....	10 c.c.
Water.....	1000 c.c.

Develop one hour at 65° F.

Paraphenylene-diamine Glycin

	No. 1	No. 2	No. 3	No. 4
Water.....	32 oz.	32 oz.	32 oz.	32 oz.
Sodium sulfite, dry.....	3 oz.	3 oz.	3 oz.	3 oz.
Paraphenylene-diamine.....	146 gr.	146 gr.	146 gr.	146 gr.
Glycin.....		15 gr.	88 gr.	175 gr.

No. 1 gives the finest grain, and requires three to four times normal exposure. The other formulas require about twice normal exposure, develop a film in a shorter time, and give more graininess as the glycin content increases. Formula No. 3 is standard.

LANTERN SLIDE DEVELOPERS

Elon-Hydroquinone (Kodak D-34)

Developer for blue black tones on lantern slide plates.

Stock Solution A

Water (about 125° F.) (52° C.).....	16 oz.	500 c.c.
Elon.....	60 gr.	4.2 g
Sodium sulfite, anh.....	1 oz.	15 g
Hydroquinone.....	12 oz.	15 g
Cold water to make.....	32 oz.	1000 c.c.

PHOTOGRAPHIC FORMULAE (Continued)

Stock Solution B

Water.....	32 oz.	1000 c.c.
Sodium carbonate, anh.....	$\frac{1}{2}$ oz.	15 g
Potassium bromide.....	30 gr.	2.1 g

For use, take equal parts of A and B.

For softer tones, dilute with an equal volume of water.

Develop $1\frac{1}{2}$ to 3 minutes at 70° F. (21° C.).

Hydroquinone (Kodak D-32)

Developer for warm tones on lantern slide plates.

Stock Solution A

Water, about 125° F. (52° C.).....	16 oz.	500 c.c.
Sodium sulfite, desiccated.....	90 gr.	6.3 g
Hydroquinone.....	100 gr.	7 g
Potassium bromide.....	50 gr.	3.5 g
Citric acid.....	10 gr.	0.7 g
Cold water to make.....	32 oz.	1000 c.c.

Stock Solution B

Cold water.....	32 oz.	1000 c.c.
Sodium carbonate, desiccated.....	1 oz.	30 g
Sodium hydroxide (caustic soda).....	60 gr.	4.2 g

Dissolve chemicals in the order given.

For use, take 1 part of A and 1 part of B. For still warmer tones, 1 part of A and 2 parts of B. Stir thoroughly before use. Develop about 5 minutes in a tray at 68° F. (20° C.).

Maximum Energy Developer (Kodak D-82)

For high speed films or plates.

Water (about 125° F.) (52° C.).....	24 oz.	750 c.c.
Wood alcohol.....	$1\frac{1}{2}$ oz.	48 c.c.
Elon.....	200 gr.	14 g
Sodium sulfite, anh.....	$1\frac{3}{4}$ oz.	52.5 g
Hydroquinone.....	200 gr.	14 g
Sodium hydroxide (caustic soda).....	125 gr.	8.8 g
Potassium bromide.....	125 gr.	8.8 g
Cold water to make.....	32 oz.	1000 c.c.

Develop about four to five minutes at 65° F. (18° C.).

The prepared developer does not keep more than a few days. If wood alcohol is not added and the developer is diluted, the solution is not so active as in the concentrated form. This developer gives the greatest possible density with negatives having a minimum exposure.

Motion Picture Film Developer (Kodak D-79)

Pyro

For negative motion picture film.

Water.....	2.5 qt.	750 c.c.
Sodium sulfite, anh.....	3.3 oz.	25 g
Pyro.....	145.8 gr.	2.5 g
Sodium carbonate, anh.....	291.6 gr.	5 g
Potassium bromide.....	29.2 gr.	0.5 g
Water to make.....	1 gal.	1000 c.c.

Time of development: 9 to 12 minutes at 65° F. (18° C.).

PHOTOGRAPHIC FORMULAE (Continued)

PORTRAIT DEVELOPER

Elon-Hydroquinone (Kodak DK-50)

Developer for professional films and plates.

Stock Solution

Water, about 125° F. (52° C.)	64 oz.	500 c.c.
Elon	145 gr.	2.5 g
Sodium sulfite, desiccated	4 oz.	30 g
Hydroquinone	145 gr.	2.5 g
Kodalk (sodium metaborate 4H ₂ O)	1 oz. 145 gr. (583 gr.)	10 g
Potassium bromide	29 gr.	.5 g
Water to make	1 gal.	1000 c.c.

Dissolve chemicals in the order given.

For tank development of portrait negatives, dilute with an equal volume of water; develop about 9 minutes at 68° F. (20° C.). For tray development, use without dilution; develop about 5 minutes at 68° F. (20° C.).

For commercial work, use without dilution. Develop about 8 minutes in a tank or 6 minutes in a tray at 68° F. (20° C.).

Replenisher (Kodak DK-50R)

Water, about 125° F. (52° C.)	96 oz.	750 c.c.
Elon	290 gr.	5 g
Sodium sulfite, desiccated	4 oz.	30 g
Hydroquinone	1 oz. 145 gr. (583 gr.)	10 g
Kodalk (sodium metaborate 4H ₂ O)	5½ oz.	40 g
Water to make	1 gal.	1000 c.c.

Dissolve chemicals in the order given.

Add to the developer to maintain the activity constant, as described in the instructions for Replenisher DK-20R.

If the developer is diluted 1 to 1 for use, the replenisher should be diluted in the same proportion.

Elon-Hydroquinone (Kodak D-61a)

Developer for professional films and plates.

Stock Solution

Water, about 125° F. (52° C.)	16 oz.	500 c.c.
Elon	45 gr.	3.1 g
Sodium sulfite, desiccated	3 oz.	90 g
Sodium bisulfite	30 gr.	2.1 g
Hydroquinone	85 gr.	5.9 g
Sodium carbonate, desiccated	165 gr.	11.5 g
Potassium bromide	24 gr.	1.7 g
Cold water to make	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

TRAY DEVELOPMENT: Take 1 part of stock solution to 1 part of water. Develop about 6 minutes at 68° F. (20° C.).

PHOTOGRAPHIC FORMULAE (Continued)

TANK DEVELOPMENT: Take 1 part of stock solution and 3 parts of water. Develop about 12 minutes at 68° F. (20° C.). Add stock solution (diluted 1:3) at intervals to maintain the volume, or the replenisher, Kodak D-61R, to maintain the strength of the solution.

Replenisher (Kodak D-61R) Stock Solution A

Water, about 125° F. (52° C.).....	96 oz.	3000 c.c.
Elon.....	85 gr.	5.9 g
Sodium sulfite, desiccated.....	6 oz.	180 g
Sodium bisulfite.....	55 gr.	3.8 g
Hydroquinone.....	170 gr.	11.9 g
Potassium bromide.....	45 gr.	3.1 g
Cold water to make.....	1½ gal.	6000 c.c.

Stock Solution B

Sodium carbonate, desiccated.....	8 oz.	240 g
Water to make.....	64 oz.	2000 c.c.

Dissolve chemicals in the order given.

For use take 3 parts of A and 1 part of B and add to the tank of developer as needed. Do not mix solutions A and B until ready to use.

Elon-Pyro (Kodak D-7)

For professional films and plates.

Stock Solution A

Water, about 125° F. (52° C.).....	16 oz.	500 c.c.
Elon.....	¼ oz.	7.5 g
Sodium bisulfite.....	¼ oz.	7.5 g
Pyro.....	1 oz.	30 g
Potassium bromide.....	60 gr.	4.2 g
Water to make.....	32 oz.	1000 c.c.

Stock Solution B

Water.....	32 oz.	1000 c.c.
Sodium sulfite, desiccated.....	5 oz.	150 g

Stock Solution C

Water.....	32 oz.	1000 c.c.
Sodium carbonate, desiccated.....	2½ oz.	75 g

Dissolve chemicals in the order given.

TRAY DEVELOPMENT: Take 1 part of A, 1 part of B, 1 part of C and 8 parts of water. Develop about 7 minutes at 68° F. (20° C.).

TANK DEVELOPMENT: Take 1 part of A, 1 part of B, 1 part of C and 13 parts of water. Develop about 10 minutes at 68° F. (20° C.).

This developer can be used for two or three weeks if the volume is maintained by adding fresh developer in the proportion of 1 part each of A, B, and C to 4 parts of water. It is usually necessary to increase the development time as the developer ages.

PHOTOGRAPHIC FORMULAE (Continued)

POSITIVE FILM DEVELOPER

Metol-Hydroquinone (Agfa 20)

This clean-working developer is recommended for normal contrast with tray or tank development of positive film.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.....	30 gr.	119 gr.	2 g
Sodium sulfite, anh.....	368 gr.	3½ oz. 40 gr.	25 g
		(1462 gr.)	
Hydroquinone.....	60 gr.	239 gr.	4 g
Sodium carbonate, mono-hydrated.....	269 gr.	2½ oz.	18.5 g
Potassium bromide.....	30 gr.	119 gr.	2 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

Do not dilute for use. Normal developing time 3 to 4 minutes at 65° F. (18° C.).

SPEED PROCESSING

Metol-Hydroquinone

Water (cool, 60° F. to 70° F.).....	90 oz.
Metol.....	1¾ oz. 30 gr. (796 gr.)
Sodium sulfite, anh.....	10 oz.
Hydroquinone.....	3½ oz. 60 gr. (1591 gr.)
Sodium hydroxide.....	3½ oz. 60 gr. (1591 gr.)
Water to concentration.....	(about 112 oz.)

Dissolve chemicals in the order given, using full strength. Develop 10 seconds in tray at 80° F. Rinse for the same time.

STANDARD DEVELOPERS FOR SENSITOMETRY

Pyro

Hurter and Driffeld standard developer for plate testing:

Pyro.....	8 parts
Sodium sulfite, crystal.....	40 parts
Sodium carbonate, crystal.....	40 parts
Water to make.....	1000 parts

Paraminophenol

Adopted at Eighth International Congress of Photography

<i>p</i> -Aminophenol hydrochloride.....	7.25 g
Sodium sulfite, anh.....	50.00 g
Sodium carbonate, anh.....	50.00 g
Water to make.....	1000.00 c.c.

TROPICAL DEVELOPERS

Metol for Tropical Development of Films and Plates (Kodak DK-15)

Water, about 125° F. (52° C.).....	24 oz.	750 c.c.
Elon.....	82 gr.	5.7 g
Sodium sulfite, desiccated.....	3 oz.	90 g
Kodalk (sodium metaborate 4H ₂ O).....	¾ oz.	22.5 g
Potassium bromide.....	27 gr.	1.9 g
*Sodium sulfate, desiccated.....	1½ oz.	45 g
Cold water to make.....	32 oz.	1000 c.c.

*If it is desired to use crystalline sodium sulfate instead of the desiccated sulfate, then 3½ oz. per 32 oz. (105 g per 1000 c.c.) should be used.

PHOTOGRAPHIC FORMULAE (Continued)

Dissolve chemicals in the order given.

Average time for tank development is about 10 minutes at 68° F. (20° C.) and 2 to 3 minutes at 90° F. (32° C.) in the fresh developer according to the contrast desired. When working *below* 75° F. (24° C.) the sulfate may be omitted if a more rapid formula is required. Development time *without* the sulfate is about 6 minutes at 68° F. (20° C.). Develop about 20 percent less for tray use.

When development is completed, rinse the film or plate in water for 1 or 2 seconds only and immerse in the Tropical Hardener or Hardening Bath SB-4 for 3 minutes (omit water rinse if film tends to soften); then fix for at least 10 minutes in an acid hardening fixing bath, and wash for 10 to 15 minutes in water (not over 95° F.) (35° C.).

Kodak developers make it impossible to produce gas blisters, because Kodak does not evolve a gas when treated with an acid. This is a distinct advantage, especially for summer work, when temperature control of solutions is often difficult.

Developer for Low Contrast Tropical Development of Films and Plates (Kodak DK-15a)

A developer which gives less contrast than Kodak DK-15 can be obtained by reducing the quantity of Kodak to 73 gr. per 32 oz. of developer (5 g per 1000 c.c.).

Development times and processing instructions are the same as for the above developer.

Paraminophenol for Tropical Development

Water (at 125° F.)	96 oz.
Paraminophenol hydrochloride	400 gr.
Sodium sulfite, desiccated	6 oz. 290 gr. (2915 gr.)
Sodium carbonate, desiccated	6 oz. 290 gr. (2915 gr.)
Water to make	1 gal.

Dissolve chemicals in the order given, using full strength. Average time of development 7 to 9 minutes in tray at 65° F., and 3 to 4 minutes at 80° F. If the temperature of the developer is 80° F. or above, add 6 oz. sodium sulfate, desiccated, to 1 gal. of solution.

Metol-Hydroquinone, Rapid (Tropical) Developer (Agfa 64)

This is a clean-working developer of particular value for rapid development or development at high temperatures.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	36 gr.	144 gr.	2.5 g
Sodium sulfite, anh.	368 gr.	3½ oz. 40 gr. (1462 gr.)	25 g
Hydroquinone	95 gr.	383 gr.	6.5 g
Sodium carbonate, mono-hydrated	234 gr.	2 oz. 60 gr. (935 gr.)	16 g
Potassium bromide	15 gr.	60 gr.	1 g
Water to make	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.

Normal development time—3 to 4 minutes at 65° F. (18° C.).

2 to 3 minutes at 85° F. (29° C.).

PHOTOGRAPHIC FORMULAE (Continued)

UNDEREXPOSURES

Elon-Hydroquinone Developer for Extreme Underexposure (Kodak D-82)

Water, about 125° F. (52° C.).....	24 oz.	750 c.c.
Wood alcohol.....	1½ oz. fl.	48 g
Elon.....	200 gr.	14 g
Sodium sulfite, desiccated.....	1¼ oz.	52.5 g
Hydroquinone.....	200 gr.	14 g
Sodium hydroxide (caustic soda).....	125 gr.	8.8 g
Potassium bromide.....	125 gr.	8.8 g
Cold water to make.....	32 gr.	1000 c.c.

Dissolve chemicals in the order given.

Develop about 5 minutes in a tray at 68° F. (20° C.).

The prepared developer does not keep more than a few days in a full bottle or about 2 hours in an open tray. If wood alcohol is omitted and the developer is diluted, the solution is not so active as in the concentrated form.

UNIVERSAL DEVELOPERS

Amidol for Films, Plates or Papers

The following developer will give excellent results for plates, films, lantern slides, bromide paper or gaslight paper. It should be dissolved immediately before using, since it keeps only a few hours in solution.

Amidol.....	25 gr.	1.6 g
Sodium sulfite.....	120 gr.	7.8 g
Water.....	10 oz.	300 c.c.

For lantern slides, bromide paper or gaslight papers add to the above,

Potassium bromide.....	7 gr.	0.5 g
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The concentration given is satisfactory for any of the purposes mentioned. Develop three to five minutes at a temperature of 65° F. or 18° C.

Elon-Hydroquinone (Kodak D-72)

Stock Solution

Water, about 125° F. (52° C.).....	16 oz.	500 c.c.
Elon.....	45 gr.	3.1 g
Sodium sulfite, desiccated.....	1½ oz.	45 g
Hydroquinone.....	175 gr.	12 g
Sodium carbonate, desiccated.....	2¼ oz.	67.5 g
Potassium bromide.....	27 gr.	1.9 g
Water to make.....	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

For fast chloride papers such as Velox: stock solution 1 part, water 1 part. Develop 45 seconds at 70° F. (21° C.).

For chloride papers such as Azo: stock solution 1 part, water 2 parts. Develop 45 seconds at 70° F. (21° C.).

PHOTOGRAPHIC FORMULAE (Continued)

For bromide papers: stock solution 1 part, water 4 parts. Develop not less than $1\frac{1}{2}$ minutes at 70° F. (21° C.).

For films and plates: stock solution 1 part, water 1 part and develop about 4 minutes in a tray or 5 minutes in a tank.

Kodolon (Kodak DK-93)

Developer for films, plates, and papers.

Water, about 125° F. (52° C.)	16 oz.	500	c.c.
Kodolon (paraminophenol oxalate)	73 gr.	5	g
Sodium sulfite, desiccated	1 oz.	30	g
Hydroquinone	37 gr.	2.5	g
Kodalk (sodium metaborate $4H_2O$)	290 gr.	20	g
Potassium bromide	7 gr.	.5	g
Cold water to make	32 oz.	1000	c.c.

Dissolve the chemicals in the order given.

Use without dilution. Develop roll films about 9 minutes in a tank of fresh developer at 68° F. (20° C.). Develop professional films and plates about 6 minutes at 68° F. (20° C.). Greater or less contrast may be obtained by developing longer or shorter times than those specified.

For warm tones on papers, use without dilution and develop for 2 minutes at 68° F. (20° C.). For colder tones, double the quantity of Kodalk; use without dilution and develop 1 to 2 minutes at 68° F. (20° C.). In either case, the tones given with this developer are slightly warmer than the normal tones given with Kodak Developers D-52 and D-72.

The use of Kodak DK-93 is especially recommended for those persons subject to trouble from skin irritation.

Metol-Hydroquinone (Agfa 103)

Universal film and paper developer. This formula may be used both as a developer for film and as a developer for Convira, Speedex and Brovira papers when cold, blue-black tones are desired.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	50 gr.	204 gr.	3.5 g
Sodium sulfite, anh.	$1\frac{1}{2}$ oz.	6 oz.	45 g
Hydroquinone	164 gr.	$1\frac{1}{2}$ oz.	11.5 g
Sodium carbonate, mono-hydrated	$2\frac{1}{2}$ oz. 35 gr. (1129 gr.)	$10\frac{1}{2}$ oz.	78 g
Potassium bromide	18 gr.	72 gr.	1.2 g
Water to make	32 oz.	1 gal.	1000 c.c.

FILM DEVELOPMENT: Dilute one part stock solution with two parts water. Normal development time 5 minutes at 65° F. (18° C.).

PAPER DEVELOPMENT: Dilute 1 part stock solution with 2 parts water. For Brovira and similar bromide papers, develop 1 to $1\frac{1}{2}$ minutes at 70° F. (21° C.). For Speedex and Convira (new type) normal development time is 45 seconds. Other contact papers may require 1 to $1\frac{1}{2}$ minutes.

For slower, softer development of Brovira dilute 1 to 4. Develop $1\frac{1}{2}$ to 3 minutes, at 70° F. (21° C.).

PHOTOGRAPHIC FORMULAE (Continued)

X-RAY DEVELOPERS

Elon-Hydroquinone (Kodak D-19b)

Water (about 125° F.) (52° C.).....	16 oz.	500	c.c.
Elon.....	32 gr.	2.2	g
Sodium sulfite, anh.....	2 oz. 175 gr.	72	g
Hydroquinone.....	128 gr.	8.8	g
Sodium carbonate, anh.....	1 oz. 265 gr.	48	g
Potassium bromide.....	60 gr.	4	g
Cold water to make.....	32 oz.	1000	c.c.

Use without dilution. Develop for 5 minutes at 65° F. (18° C.).

Metol-Hydroquinone (Agfa-30)

This developer is recommended when results of maximum brilliance are desired. It is clean-working, has long life and gives high contrast.

Hot water (125° F. or 52° C.).....	24 oz.	3 qt.	750	c.c.
Metol.....	50 gr.	204 gr.	3.5	g
Sodium sulfite, anh..	2 oz.	8 oz.	60	g
Hydroquinone.....	129 gr.	1 oz. 80 gr. (517 gr.)	9	g
Sodium carbonate, monohydrated....	1½ oz. 40 gr. (587 gr.)	5¼ oz.	40	g
Potassium bromide..	30 gr.	119 gr.	2	g
Water to make.....	32 oz.	1 gal.	1000	c.c.

Do not dilute for use.

Normal development time at 65° F. (18° C.), for x-ray film, 6 minutes, for non-screen x-ray film, 8 minutes, for direct copy film and direct duplicating film, 4 to 5 minutes, for S. S. Pan-Aero film 10-15 minutes depending upon the type of developing machine.

DESENSITIZERS

Pinakryptol Yellow Desensitizer

Pinakryptol yellow.....	15 gr.	1	g
Water to make.....	32 oz.	1000	c.c.

Use without dilution at a temperature of 65° F. (18° C.). Immerse films in total darkness for two minutes. Orthochromatic film may then be handled in bright red light, panchromatic film in bright green light. Pinakryptol yellow desensitizer should be used as a separate bath and not mixed with the developer.

Use of a 50-50 water alcohol mixture for solution will improve the keeping qualities of the desensitizer.

Pinakryptol Green Desensitizer

This solution is not recommended for high speed panchromatic films.

Stock Solution

Pinakryptol green.....	15 gr.	1	g
Water to make.....	16 oz.	500	c.c.

For use dilute one part stock desensitizing solution with ten parts water. Immerse films in total darkness for two minutes at 65° F. (18° C.). Development may then be carried out in bright red light.

PHOTOGRAPHIC FORMULAE (Continued)

The same stock solution may be used, if preferred, directly in the developer in the proportion: desensitizer: one part, developer: thirty parts. After two minutes' development in total darkness, bright red light may be used as above.

Use of a 50-50 water-alcohol mixture for solution will improve the keeping qualities of the desensitizer.

DEVELOPERS FOR PAPERS

Amidol (Kodak D-51)

Developer for bromide papers.

Stock Solution

Water (about 125° F.) (52° C.).....	24 oz.	750 c.c.
Sodium sulfite, anh.....	4 oz.	120 g
Di-aminophenol hydrochloride (amidol).....	1½ oz.	37.5 g
Cold water to make.....	32 oz.	1000 c.c.

For use, take 6 ounces (180 c.c.) stock solution, $\frac{3}{4}$ dram (3 c.c.) 10 % potassium bromide solution, and 24 ounces (750 c.c.) of water. This developer oxidizes rapidly when exposed to the air so that only a quantity sufficient for immediate use should be mixed.

Amidol Paper Developer (Agfa 113)

This formula is intended for tray development only and must be mixed fresh each time. It is recommended only for small lots of prints.

Amidol.....	96 gr.	6.6 g
Sodium sulfite, anh.....	1½ oz. 90 gr. (637 gr.)	44 g
Potassium bromide.....	8 gr.	.55 g
Water to make.....	32 oz.	1000 c.c.

Do not dilute for use. If hot water is used for dissolving chemicals, the sodium sulfite and potassium bromide should be dissolved first and the amidol added only after the solution has cooled.

For development of Cykora and similar papers use twice the amount of potassium bromide specified above.

Develop 1 to 2 minutes at 70° F. (21° C.).

Elon-Hydroquinone (Kodak D-52)

Developer for warm tone papers.

Stock Solution

Water, about 125° F. (52° C.).....	16 oz.	500 c.c.
Elon.....	22 gr.	1.5 g
Sodium sulfite, desiccated.....	$\frac{3}{4}$ oz.	22.5 g
Hydroquinone.....	90 gr.	6.3 g
Sodium carbonate, desiccated.....	$\frac{1}{2}$ oz.	15 g
Potassium bromide.....	22 gr.	1.5 g
Cold water to make.....	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

For use, take 1 part of stock solution to 1 part of water. Develop about 2 minutes at 68° F. (20° C.).

More bromide may be added if warmer tones are desired.

PHOTOGRAPHIC FORMULAE (Continued)

Glycin-Hydroquinone Developer (Agfa 115)

This is a warm-tone developer suitable for Cykron, Cykora, Indiatone, Brovira, and similar papers.

Stock Solution				
Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750	c.c.
Sodium sulfite, anh.....	3 oz.	12 oz.	90	g
Sodium carbonate, mono-hydrated.....	5 oz.	1 lb. 4 oz.	150	g
Glycin.....	1 oz.	4 oz.	30	g
Hydroquinone.....	139 gr.	1½ oz. 10 gr. (557 gr.)	9.5	g
Potassium bromide.....	60 gr.	239 gr.	4	g
Water to make.....	32 oz.	1 gal.	1000	c.c.

For warm tones, dilute 1 part stock solution with 3 parts water and develop prints 2½ to 3 minutes at 70° F. (21° C.).

For very warm tones and more open shadows, especially with Cykora, dilute 1 part stock solution with 6 parts water, giving prints 3 to 4 times normal exposure and 2½ to 5 minutes development. Because of dilution of the developer, solution will exhaust more rapidly and will require more frequent replacement.

Hydroquinone (Agfa 110)

Direct brown-black paper developer. Beautiful warm tones may be obtained with this developer on both contact and projection papers.

Stock Solution				
Hot water (125° F. or 52° C.).....	24 oz.	3 qt.	750	c.c.
Hydroquinone.....	¾ oz.	3 oz.	22.5	g
Sodium sulfite, anh.....	1 ¾ oz. 50 gr. (816 gr.)	7½ oz.	57	g
Sodium carbonate, mono-hydrated.....	2½ oz.	10 oz.	75	g
Potassium bromide.....	40 gr.	159 gr.	2.75	g
Water to make.....	32 oz.	1 gal.	1000	c.c.

For use dilute 1 part stock solution with 5 parts water.

Give prints 3 to 4 times normal exposure and develop 5 to 7 minutes at 70° F. (21° C.).

Metol (Agfa 120)

This is a soft-working developer, primarily intended for portrait work where soft gradation is required.

Stock Solution				
Hot water (125° F. or 52° C.).....	24 oz.	3 qt.	750	c.c.
Metol.....	179 gr.	1½ oz. 60 gr. (716 gr.)	12.3	g
Sodium sulfite, anh.....	1 oz. 88 gr. (526 gr.)	4¾ oz.	36	g
Sodium carbonate, mono-hydrated.....	1 oz. 88 gr. (526 gr.)	4¾ oz.	36	g
Potassium bromide.....	27 gr.	1 oz.	1.8	g
Water to make.....	32 oz.	1 gal.	1000	c.c.

PHOTOGRAPHIC FORMULAE (Continued)

For use, dilute 1 part stock solution with 2 parts water.
Normal developing time, $1\frac{1}{2}$ to 3 minutes at 70° F. (21° C.).

Metol-Hydroquinone (Agfa 135)

This developer is recommended for rich, warm-black tones with Cykon, Convira, Cykora, Brovira, Indiatone and similar papers.

Stock Solution

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.	24 gr.	96 gr.	1.6 g
Sodium sulfite, anh.	348 gr.	$3\frac{1}{4}$ oz.	24 g
Hydroquinone.	96 gr.	388 gr.	6.6 g
Sodium carbonate, monohydrated.	348 gr.	$3\frac{1}{4}$ oz.	24 g
Potassium bromide.	40 gr.	159 gr.	2.8 g
Water to make.	32 oz.	1 gal.	1000 c.c.

For use, dilute 1 part stock solution with 1 part water. A properly exposed print will be fully developed at 70° F. (21° C.) in about $1\frac{1}{2}$ to 2 minutes. Complete development may be expected to take slightly longer with rough-surfaced papers than with semi-glossy or luster-surfaced papers. For greater softness, dilute the bath with water up to equal quantities of developer and water. To increase the warmth, add bromide up to double the amount in the formula. The quantity of bromide specified in the formula, however, assures rich, warm, well-balanced tones.

Metol-Hydroquinone (Agfa 130)

This formula is a universal developer for all projection and contact papers. It gives rich black tones with excellent brilliance and detail. It provides unusual latitude in development and is clean-working even with long developing times.

Stock Solution

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.	32 gr.	129 gr.	2.2 g
Sodium sulfite, anh.	$1\frac{3}{4}$ oz.	$6\frac{3}{4}$ oz.	50 g
Hydroquinone.	159 gr.	$1\frac{1}{2}$ oz.	11 g
Sodium carbonate, monohydrated	$2\frac{1}{2}$ oz.	$10\frac{1}{2}$ oz.	78 g
Potassium bromide.	80 gr.	$\frac{3}{4}$ oz.	5.5 g
Glycin.	159 gr.	$1\frac{1}{2}$ oz.	11 g
Water to make.	32 oz.	1 gal.	1000 c.c.

The prepared stock solution is clear but slightly colored. The coloration in this case does not indicate the developer has deteriorated or is unfit for use.

For use dilute 1 part stock solution with 1 part water.

Normal developing time at 70° F. (21° C.) for Brovira, 2 to 6 minutes, for Convira and Indiatone, $1\frac{1}{2}$ to 3 minutes.

Greater contrast can be obtained by using the developer stock solution full strength. Softer results can be obtained by diluting 1 part stock solution with 2 parts water.

Metol-Hydroquinone (Agfa 125)

This formula is recommended for development of Cykon, Cykora, Brovira and similar papers. It can also be used as recommended below for the rapid development of press films.

PHOTOGRAPHIC FORMULAE (Continued)

Stock Solution

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol.....	45 gr.	179 gr.	3 g
Sodium sulfite, anh.....	1½ oz.	6 oz.	44 g
Hydroquinone.....	169 gr.	1½ oz. 20 gr. (676 gr.)	12 g
Sodium carbonate, mono- hydrated.....	2¼ oz.	9 oz.	65 g
Potassium bromide.....	30 gr.	119 gr.	2 g
Water to make.....	32 oz.	1 gal.	1000 c.c.

PAPER DEVELOPMENT: Dilute 1 part stock solution with 2 parts water. Develop 1 to 2 minutes at 70° F. (21° C.). For softer and slower development dilute 1 to 4, and develop 1½ to 3 minutes at 70° F. (21° C.). For greater brilliance, shorten the exposure slightly and lengthen the development time. For greater softness, lengthen the exposure slightly and shorten the development time.

RINSING, HARDENING AND FIXING BATHS

Rinsing Bath or Short Stop

After development rinse prints (or negatives) for five seconds before fixing.

Water.....	32 oz.	1000 c.c.
Acetic acid (glacial).....	0.5 oz.	6 c.c.

Stop Bath (Kodak SB-1)

For papers.

Water.....	32 oz.	1000 c.c.
Acetic acid, 28 %.....	1½ oz.	48 c.c.

To make approximately 28 % acetic acid from glacial acetic acid, dilute three parts of glacial acetic acid with eight parts of water.

Rinse prints for at least 5 seconds. Capacity: about 20 8 × 10-inch prints per quart (1000 c.c.).

Stop Bath (Kodak SB-1a)

For films, plates, and papers for graphic arts.

Water.....	32 oz.	1000 c.c.
Acetic acid, 28 %.....	4 oz.	125 c.c.

To make approximately 28 % acetic acid from glacial acetic acid, dilute three parts of glacial acetic acid with eight parts of water.

The action of this bath checks development instantly, provided the acid has not been neutralized. It also tends to prevent uneven spots and streaks when the prints or negatives are immersed in the fixing bath.

Hardening Bath (Kodak SB-3)

For use at 65° to 75° F. with films and plates.

Water.....	32 oz.	1000 c.c.
Potassium chrome alum.....	1 oz.	30 g

This bath is intended for use in hot weather after development and before fixation in conjunction with Kodak Fixing Bath F-5.

PHOTOGRAPHIC FORMULAE (Continued)

Agitate the negatives for a few seconds when first immersed in hardener. Leave them in the bath for 3 to 5 minutes to secure maximum hardening. This bath should be renewed frequently.

Hardening Bath (Kodak SB-4)

For use at 75° to 90° F. with films and plates.

This solution is recommended for use in conjunction with the High Temperature Developer (Kodak DK-15), when working above 75° F. (24° C.).

Water.....	32 oz.	1000 c.c.
Potassium chrome alum.....	1 oz.	30 g
*Sodium sulfate, desiccated.....	2 oz.	60 g

*If crystalline sodium sulfate is preferred instead of the desiccated, use 4½ oz. (140 g) in the above formula.

Agitate the negatives for 30 to 45 seconds when they are first immersed in the hardener, or streakiness will result. Leave them in the bath for at least 3 minutes between development and fixation. If the temperature is below 85° F. (29° C.), rinse for 1 to 2 seconds in water before immersing in the hardener bath.

The hardening bath is a violet blue color by tungsten light when freshly mixed, but it ultimately turns a yellow-green with use; it then ceases to harden and should be replaced with a fresh bath. The hardening bath should never be overworked. An unused bath will keep indefinitely, but the hardening power of a partially used bath decreases rapidly on standing for a few days.

Formaldehyde Hardener (Kodak SH-1)

For after treatment of films and plates.

Water.....	16 oz.	500 c.c.
Formaldehyde (about 37 % solution by weight).	2½ dr.	10 c.c.
Sodium carbonate, desiccated.....	73 gr.	5 g
Water to make.....	32 oz.	1000 c.c.

This formula is recommended for the treatment of negatives which normally would be softened by a chemical treatment as for the removal of stains or for intensification or reduction.

After hardening for three minutes, negatives should be rinsed and immersed for five minutes in a fresh acid fixing bath and then washed thoroughly before they are given any further chemical treatment.

Plain Non-hardening Fixing Bath

Water.....	32 oz.	852 c.c.
Hypo (sodium thiosulfate).....	8 oz.	227 g

Do not use the bath when it is discolored; it must be made fresh each day.

Non-Hardening Metabisulfite Fixer (Agfa 203)

This fixing bath is recommended for use when hardening is not desired. It is highly desirable for accuracy of registration in color work with Reprolith Film.

Stock Solution

Hypo.....	4 lb.	1900 g
Potassium metabisulfite.....	9 oz.	270 g
Water to make.....	1 gal.	4000 c.c.

PHOTOGRAPHIC FORMULAE (Continued)

The metabisulfite should be added only when the hypo solution is cool.

For use dilute one part stock solution with one part water. Normal fixing time 5 to 10 minutes at 65° F. (18° C.).

Fixing Bath Non-Hardening; For Special Processes (Kodak F-24)

Water, about 125° F. (52° C.).....	16 oz.	500 c.c.
Sodium thiosulfate (hypo)	8 oz.	240 g
Sodium sulfite, desiccated.....	145 gr.	10 g
Sodium bisulfite.....	365 gr.	25 g
Cold water to make.....	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

This bath may be used for films, plates or paper when no hardening is desired.

For satisfactory use, the temperature of the developer, rinse bath, and wash water should not be higher than 68° F. (20° C.).

Acid Hardening Fixer (Agfa 201)

This hardening fixing bath for use with either film or paper may be stored indefinitely and used repeatedly until exhausted. If the fixing bath froths, turns cloudy, or takes longer than 10 minutes to fix out completely, it must be replaced by a fresh solution.

Solution 1

Hot water (125° F. or 52° C.).....	16 oz.	$\frac{1}{2}$ gal.	500 c.c.
Hypo.....	8 oz.	2 lb.	240 g

Solution 2

Hot water (125° F. or 52° C.).....	5 oz.	20 oz.	150 c.c.
Sodium sulfite, anh.....	$\frac{1}{2}$ oz.	2 oz.	15 g
Acetic acid (28 %).....	$1\frac{1}{2}$ oz.	6 oz.	45 c.c.
Potassium alum.....	$\frac{1}{2}$ oz.	2 oz.	15 g

Add solution 2 to 1 and add water to make.....	32 oz.	1 gal.	1000 c.c.
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Dissolve chemicals thoroughly in order given and stir rapidly while adding solution 2 to solution 1. Glacial acetic acid may be diluted to 28 % concentration by adding 3 parts of acid to 8 parts of water. Do not dilute for use. Normal fixing time 5 to 10 minutes at 65° to 70° F. (18° to 21° C.).

Acid Hardening Fixing Bath (Kodak F-5)

For films, plates, and papers.

Water, about 125° F. (52° C.).....	20 oz.	600 c.c.
Sodium thiosulfate (hypo).....	8 oz.	240 g
Sodium sulfite, desiccated.....	$\frac{1}{2}$ oz.	15 g
*Acetic acid, 28 %.....	$1\frac{1}{2}$ oz. fl.	48 c.c.
Boric acid, crystals.....	$\frac{1}{4}$ oz.	7.5 g
Potassium alum.....	$\frac{1}{2}$ oz.	15 g
Cold water to make.....	32 oz.	1000 c.c.

*To make approximately 28 % acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

Films or plates should be fixed properly in 10 to 20 minutes in a freshly prepared bath. The bath need not be discarded until the fixing time exceeds 20 minutes.

PHOTOGRAPHIC FORMULAE (Continued)

This bath has the advantage over the older type of fixing baths, which do not contain boric acid, that it gives much better hardening and has less tendency to precipitate a sludge of aluminum sulfite.

Acid Fixing Bath for Papers

(May also be used for plates or films)

Water.....	64 oz.
Hypo.....	16 oz.

Dissolve, then add the following acid hardener:

Water.....	5 oz.
Sodium sulfite, anh.....	$\frac{1}{2}$ oz.
Acetic acid, 25 %.....	3 oz.
Alum, anh.....	$\frac{1}{2}$ oz.

This fixing bath is also excellent for dry plates and films, and will keep indefinitely before using; therefore it can be made up some time in advance. One pint of the bath should fix at least fifty 4 × 5 prints. The acid fixing bath can be used repeatedly. It keeps with but little care. It will by degrees become alkaline by the gradual addition of developer adhering to the prints. It should be discarded entirely when it becomes frothy, and a fresh bath prepared.

Rapid Fixing Bath for General Photographic Use (Kodak F-7)

Water, about 125° F. (52° C.).....	80 oz.	600 c.c.
Sodium thiosulfate (hypo).....	3 lb.	360 g
Ammonium chloride.....	6 $\frac{3}{4}$ oz.	50 g
Sodium sulfite, desiccated.....	2 oz.	15 g
*Acetic acid, 28 %.....	6 oz. fl.	48 c.c.
Boric acid, crystals.....	1 oz.	7.5 g
Potassium alum.....	2 oz.	15 g
Cold water to make.....	1 gal.	1000 c.c.

* To make approximately 28 % acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

Dissolve chemicals in the order given.

Chrome Alum Fixing Bath for Films and Plates (Kodak F-16)

Solution A

Sodium thiosulfate (hypo).....	2 lb.	960 g
Sodium sulfite, desiccated.....	2 oz.	60 g
Water to make.....	96 oz.	3000 c.c.

Solution B

Water.....	32 oz.	1000 c.c.
Potassium chrome alum.....	2 oz.	60 g
Sulfuric acid.....	$\frac{1}{4}$ oz. fl.	8 c.c.

Caution: Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise the solution may boil and spatter the acid on the hands or face, causing serious burns.

Pour solution B into solution A slowly while stirring A rapidly. This bath, when freshly mixed, is recommended for use in hot weather, but it rapidly loses its hardening properties with or without use, when it should be replaced by a fresh bath. With an old bath there is a tendency for scum to form on the surface of the film. Any such scum should be removed by swabbing with cotton before the film is dried. It is not advisable to use this bath in metal tanks.

PHOTOGRAPHIC FORMULAE (Continued)

Hypo Eliminator

Water.....	16	oz.
Hydrogen peroxide (3 percent).....	4	oz. fl.
Ammonia (3 percent).....	3 $\frac{1}{4}$	oz. fl.
Water to make.....	32	oz.

Directions for use: Wash prints for 30 minutes at 65° F. Immerse each print for 6 minutes in hypo eliminator solution, then wash for 10 minutes and dry. Capacity of bath is about fifty 8 × 10 prints or the equivalent per gallon.

Hypo Test Solution

Water (cool, 60° F. to 70° F., preferably distilled).....	8	oz.
Potassium permanganate.....	4	gr.
Sodium hydroxide.....	8	gr.

Use $\frac{1}{4}$ dr. (15 drops) of above solution to 8 oz. of water, preferably distilled. Pour $\frac{1}{2}$ oz. of this solution in small graduate. Take equivalent of six 4 × 6 inch prints from water, drain hurriedly, and allow drippings to drip into the $\frac{1}{2}$ oz. of solution for 30 seconds. The least trace of hypo in the water draining from the prints will cause this violet solution to turn to an orange color. If more hypo is present in the drippings, the solution will change to a greenish-yellow color. As certain impurities in water will cause similar discoloration of the solution, a number of drops of tap water, equivalent to number of drops to be dropped from prints, should be dropped into the $\frac{1}{2}$ oz. of violet-colored solution. If no change in color takes place, any change in color that will take place from the water drained from prints will be due to the presence of hypo which will prove that the prints have not been sufficiently washed.

STAIN REMOVERS

Hand Stain Remover (Kodak S-5)

Solution A

Potassium permanganate.....	$\frac{1}{4}$	oz.	7.5	g.
Water.....	32	oz.	1000	c.c.

Solution B

Sodium bisulfite.....	16	oz.	480	g.
Water.....	32	oz.	1000	c.c.

Rub the hands with a small amount of solution A, rinse in water; then pour a small quantity of solution B into the palm of one hand, rub it quickly over the hands, and, when free of stain, wash them thoroughly with water. If the original stain is not entirely removed, repeat the treatment with solutions A and B.

If it is desired to immerse the hands in solution B, 1 part of the solution should be diluted with 4 parts of water.

Stain Remover for Removal of Developer Stain on Negatives (Kodak S-6)

Developer or oxidation stain may be removed by first hardening the film for 2 or 3 minutes in the formalin hardener then washing for 5 minutes and bleaching in:

Stock Solution A

Potassium permanganate.....	75	gr.	5.2	g.
Water to make.....	32	oz.	1000	c.c.

PHOTOGRAPHIC FORMULAE (Continued)

Stock Solution B

Cold water.....	16 oz.	500 c.c.
Sodium chloride.....	2½ oz.	75 g
Sulfuric acid.....	½ oz.	16 c.c.
Water to make.....	32 oz.	1000 c.c.

Caution: Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise the solution may boil and spatter the acid on the hands or face, causing serious burns.

Use equal parts of A and B. The solutions should not be mixed until ready for immediate use since they do not keep long after mixing. All particles of permanganate should be dissolved completely when preparing solution A, since undissolved particles are likely to produce spots on the negative. Bleaching should be complete in 3 or 4 minutes at 68° F. (20° C.). The brown stain of manganese dioxide formed in the bleach bath is best removed by immersing the negative in 1 % sodium bisulfite solution. Then rinse well and develop in strong light, preferably sunlight, with any general purpose developer. Then wash thoroughly.

Iron Clearing Solution

To remove yellow stain caused by pyro or hydroquinone developer, wash well to free from hypo and place in

Water.....	20 oz.	568 c.c.
Ferrous sulfate, pure.....	3 oz.	85 g
Sulfuric acid, C. P.....	1 oz.	28 g
Powdered alum.....	1 oz.	28 g

until stain is gone, then wash well.

INTENSIFIERS

Mercury Intensifier for Films and Plates (Kodak In-1)

BLEACH the negative in the following solution until it is white, *then wash thoroughly.*

Potassium bromide.....	3 oz.	22.5 g
Mercuric chloride.....	4 oz.	22.5 g
Water to make.....	32 oz.	1000 c.c.

The negative can be blackened with 10 % sulfite solution, a developing solution, or 10 % ammonia (1 part concentrated ammonia (28 %) to 9 parts water), these giving progressively greater density in the order given.

Chromium Intensifier for Films and Plates (Kodak In-4)

Stock Solution

Potassium bichromate.....	3 oz.	90 g
Hydrochloric acid.....	2 oz. fl.	64 c.c.
Water to make.....	32 oz.	1000 c.c.

For use, take 1 part of stock solution to 10 parts of water.

Harden the negative first in a formaldehyde hardening solution. Bleach thoroughly at 65° to 70° F. (18° to 21° C.), then wash five minutes and redevelop fully in artificial light or daylight (not sunlight) in any quick-acting, non-staining developer which does not contain an excess of sulfite; for example, about 10 minutes at 68° F. (20° C.) in any general purpose developer. Developers containing a high proportion of sodium sulfite should be avoided.

PHOTOGRAPHIC FORMULAE (Continued)

Then rinse, fix for five minutes, and wash thoroughly. Greater intensification can be secured by repeating the process. Negatives intensified with chromium are more permanent than those intensified with mercury.

Silver Intensifier for Films and Plates (Kodak In-5)

The following formula is the only intensifier known that will not change the color of the image on positive film on projection. It gives proportional intensification and is easily controlled by varying the time of treatment. The formula is equally suitable for positive and negative film.

Stock Solution No. 1 (Store in brown bottle)

Silver nitrate, crystals.....	2 oz.	60 g
Distilled water to make.....	32 oz.	1000 c.c.

Stock Solution No. 2

Sodium sulfite, desiccated.....	2 oz.	60 g
Water to make.....	32 oz.	1000 c.c.

Stock Solution No. 3

Sodium thiosulfate (hypo).....	3½ oz.	105 g
Water to make.....	32 oz.	1000 c.c.

Stock Solution No. 4

Sodium sulfite, desiccated.....	½ oz.	15 g
Elon.....	350 gr.	24 g
Water to make.....	96 oz.	3000 c.c.

Prepare the intensifier solution for use as follows: Slowly add 1 part of solution No. 2 to 1 part of solution No. 1, shaking or stirring to obtain thorough mixing. The white precipitate which appears is then dissolved by the addition of 1 part of solution No. 3. Allow the resulting solution to stand a few minutes until clear. Then add, with stirring, 3 parts of solution No. 4. The intensifier is then ready for use and the film should be treated immediately. The mixed intensifier solution is stable for approximately 30 minutes at 68° F. (20° C.).

The degree of intensification obtained depends upon the time of treatment which should not exceed 25 minutes. After intensification, immerse the film for 2 minutes with agitation in a plain 30 % hypo solution. Then wash thoroughly.

The stability of the mixed intensifier solution and the rate of intensification are very sensitive to changes in the thiosulfate concentration. A more active but less stable working solution may be obtained by using a stock solution No. 3 prepared with 3 oz. of hypo per 32 oz. (90 g per 1000 c.c.) instead of the quantity in the formula. The directions for preparing the working solution are the same as before but the mixed intensifier will not keep over 20 minutes at 68° F. (20° C.).

For best results, the intensifier should be used in artificial light; the solution tends to form a precipitate of silver quite rapidly when exposed directly to sunlight.

REDUCERS

Farmer's Reducer, Proportional, for Lowering Contrast (Kodak R-4b)

Farmer's Reducer also may be used as a two-bath formula by treating the negative in the ferricyanide solution first and sub-

PHOTOGRAPHIC FORMULAE (Continued)

sequently in the hypo solution. This method gives almost proportional reduction and corrects for overdevelopment. The single solution Farmer's Reducer gives only cutting reduction and corrects for overexposure.

Solution A

Potassium ferricyanide.....	$\frac{1}{4}$ oz.	7.5 g
Water to make.....	32 oz.	1000 c.c.

Solution B

Sodium thiosulfate (hypo).....	$6\frac{3}{4}$ oz.	200 g
Water to make.....	32 oz.	1000 c.c.

Treat the negatives in solution A with uniform agitation for 1 to 4 minutes at 65-70° F. (18-20° C.) depending on the degree of reduction desired. Then immerse them in solution B for 5 minutes and wash thoroughly. The process may be repeated if more reduction is desired. For the reduction of general fog, one part of solution A should be diluted with one part of water.

Farmer's Reducer (Agfa 310)

This is a cutting reducer for lessening the density of heavy negatives and at the same time increasing their contrast. It is especially valuable for reproduction films to clear the whites.

Solution 1

Hypo.....	8 oz.	240 g
Water to make.....	32 oz.	1000 c.c.

Solution 2

Potassium ferricyanide.....	274 gr.	19 g
Water to make.....	8 oz.	250 c.c.

For use mix one part solution 2 and four parts solution 1 in 32 parts water. Solutions 1 and 2 should be stored separately and mixed immediately before use.

Flattening Reducer (Agfa 311)

This reducer is useful for lessening the density and contrast of heavy negatives.

Solution 1

Potassium ferricyanide.....	1 oz. 75 gr. (513 gr.)	35 g
Potassium bromide.....	149 gr.	10 g
Water to make.....	32 oz.	1000 c.c.

Bleach in solution 1 and after thorough washing, redevelop to desired density and contrast in any except fine-grain developers. Then fix and wash in usual manner. Conduct operation in subdued light.

Farmer's Reducer for Amateur Use for Clearing Shadow Areas (Kodak R-4)

Solution A

Water.....	1 oz.	32 c.c.
Potassium ferricyanide.....	15 gr.	1 g

Solution B

Water.....	32 oz.	1000 c.c.
Sodium thiosulfate (hypo).....	1 oz.	30 g

PHOTOGRAPHIC FORMULAE (Continued)

Add A to B and immediately pour over the negative to be reduced. The reducer solution decomposes rapidly after mixing together the A and B solutions and therefore should be used at once. When the negative has been reduced sufficiently, wash thoroughly before drying. Local areas may be reduced by applying the solution with a cotton pad.

Reducer for Clearing Shadow Areas (Kodak R-2)

Stock Solution A

Water.....	32 oz.	1000 c.c.
Potassium permanganate..	1 $\frac{3}{4}$ oz.	52.5 g

Stock Solution B

Water.....	32 oz.	1000 c.c.
Sulfuric acid.....	1 oz. fl.	32 c.c.

Caution: Always add the sulfuric acid to the water slowly stirring constantly, and never the water to the acid; otherwise the solution may boil and spatter the acid on the hands or face causing serious burns.

The best method of dissolving the permanganate crystals in solution A is to use a small volume of hot water (about 180° F.) (82° C.) and shake or stir the solution vigorously until completely dissolved; then dilute to volume with cold water.

The negative must be thoroughly washed to remove all traces of hypo before it is reduced. For use, take 1 part A, 2 parts B and 64 parts of water. When the negative has been reduced sufficiently, place it in a fresh acid fixing bath for a few minutes, to remove yellow stains, then wash thoroughly.

If reduction is too rapid, use a larger volume of water when diluting the solution for use. This solution should *not be used* as a stain remover as it has a tendency to attack the image before it removes the stain.

The two solutions should not be combined until immediately before use. They will not keep long in combination.

Proportional Reducer for Lowering Contrast (Kodak R-5)

Stock Solution A

Water.....	32 oz.	1000 c.c.
Potassium permanganate.....	4 gr.	.3 g
Sulfuric acid (10 % solution).....	$\frac{1}{2}$ oz. fl.	16 c.c.

Stock Solution B

Water.....	96 oz.	3000 c.c.
Ammonium persulfate.....	3 oz.	90 g

To make a 10 % solution of sulfuric acid, take 1 part of sulfuric acid and add it to 9 parts of water, slowly with stirring. *Never add the water to the acid* because the solution may boil and spatter the acid on the hands or face, causing serious burns.

For use, take one part of solution A to three parts of solution B. When sufficient reduction is secured, the negative should be cleared

PHOTOGRAPHIC FORMULAE (Continued)

in a 1 % solution of sodium bisulfite. Wash the negative thoroughly before drying.

Semi-Proportional Reducer for Lowering Contrast and Clearing Shadow Areas (Kodak R-8)

This is the only single solution which keeps well in a tank.

Water, about 125° F. (52° C.).....	24 oz.	750 c.c.
Ferric chloride.....	365 gr.	25 g
Potassium citrate.....	2½ oz.	75 g
Sodium sulfite, desiccated.....	1 oz.	30 g
Citric acid.....	290 gr.	20 g
Sodium thiosulfate (hypo).....	6¾ oz.	200 g
Water to make.....	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

Use full strength for maximum rate of reduction. Treat negatives 1 to 10 minutes at 65° to 70° F. (18° to 21° C.). Then wash thoroughly. If a slower action is desired, dilute one part of solution with one part of water. The reducer is especially recommended for the treatment of dense, contrasty negatives.

Super-Proportional Reducer for Great Reduction of Contrast (Kodak R-1)

Water.....	32 oz.	1000 c.c.
Ammonium persulfate.....	2 oz.	60 g
Sulfuric acid.....	¾ dr.	3 c.c.

Caution: Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise the solution may boil and spatter the acid on the hands or face causing serious burns.

For use, take 1 part stock solution and 2 parts water.

Treat the negative in a formaldehyde hardener solution and wash thoroughly before reduction. When reduction is complete, immerse in an acid fixing bath for a few minutes and wash thoroughly before drying. If reduction is too rapid, dilute the solution with a further volume of water.

TONING FORMULAE

Hypo Alum Toner (Agfa 222)

This toner is recommended for beautiful reddish-brown tones.

Solution 1

Water.....	80 oz.	2350 c.c.
Hypo.....	15 oz.	450 g

Solution 2

Water.....	1 oz.	30 c.c.
Silver nitrate.....	20 gr.	1.3 g

Solution 3

Water.....	1 oz.	30 c.c.
Potassium iodide.....	40 gr.	2.7 g

Add solution 2 to solution 1. Then add solution 3 to the mixture. Finally add 105 grams (3½ oz.) of potassium alum to this solution, and heat the entire bath to the boiling point or until sulfurization

PHOTOGRAPHIC FORMULAE (Continued)

takes place (indicated by a milky appearance of the solution). Tone prints 20 to 60 minutes in this bath at 110–125° F. (43–52° C.). Agitate prints occasionally until toning is complete. Care should be taken to see that the blacks are fully converted before removing the prints from the toning bath, otherwise double tones may result.

Hypo Alum Sepia Toner for Papers (Kodak T-1a)

Cold water.....	90 oz.	2800	c.c.
Sodium thiosulfate (hypo).....	16 oz.	480	g

Dissolve thoroughly, and add the following solution:

Hot water, about 160° F. (70° C.).....	20 oz.	640	c.c.
Potassium alum.....	4 oz.	120	g

Then add the following solution (including precipitate) *slowly to the hypo-alum solution while stirring the latter rapidly.*

Cold water.....	2 oz.	64	c.c.
Silver nitrate, crystals.....	60 gr.	4.2	g
Sodium chloride.....	60 gr.	4.2	g

After combining above solutions,

Add water to make.....	1 gal.	4000	c.c.
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Note: The silver nitrate should be dissolved completely before adding the sodium chloride and immediately afterward, the solution containing the milky white precipitate should be added to the hypo-alum solution as directed above. The formation of a black precipitate in no way impairs the toning action of the bath if proper manipulation technique is used.

For use, pour into a tray supported in a water bath and heat to 120° F. (49° C.). At this temperature prints will tone in 12 to 15 minutes depending on the type of paper. Never use the solution at a temperature above 120° F. (49° C.). Blisters and stains may result. Toning should not be continued longer than 20 minutes at 120° F. (49° C.).

In order to produce good sepia tones, the prints should be exposed so that the print is slightly darker than normal when developed normally (1½ to 2 minutes).

The prints to be toned should be fixed thoroughly and washed for a few minutes before being placed in the toning bath. Dry prints should be soaked thoroughly in water. To insure even toning, the prints should be immersed completely, and separated occasionally, especially during the first few minutes.

After prints are toned, they should be wiped with a soft sponge and warm water to remove any sediment, and washed for one hour in running water.

Sulfide Sepia for Papers (Kodak T-7a)

Stock Bleaching Solution A

Potassium ferricyanide.....	2½ oz.	75	g
Potassium bromide.....	2½ oz.	75	g
Potassium oxalate.....	6½ oz.	195	g
Acetic acid, 28 %.....	1½ oz. fl.	40	c.c.
Water.....	64 oz.	2000	c.c.

PHOTOGRAPHIC FORMULAE (Continued)

To make approximately 28 % acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

Stock Toning Solution B

Sodium sulfide (not sulfite).....	1 ½ oz.	45 g
Water.....	16 oz.	500 c.c.

Prepare bleaching bath as follows:

Stock solution A.....	16 oz.	500 c.c.
Water.....	16 oz.	500 c.c.

Prepare toner as follows:

Stock solution B.....	4 oz.	125 c.c.
Water to make.....	32 oz.	1000 c.c.

Stock hardener solution (Kodak F-1a)

Water, about 125° F. (52° C.).....	14 oz.	425 c.c.
Sodium sulfite, desiccated.....	2 oz.	60 g
Acetic acid, 28 %.....	6 oz. fl.	190 c.c.
Potassium alum.....	2 oz.	60 g
Cold water to make.....	32 oz.	1000 c.c.

To make approximately 28 % acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with eight parts of water.

Dissolve the chemicals in the order given. The sodium sulfite should be dissolved completely before the acetic acid is added. After the sulfite-acid solution has been mixed thoroughly, add the potassium alum with constant stirring.

The print to be toned should first be washed thoroughly. Place it in the bleaching bath, and allow it to remain until only faint traces of the halftones are left and the black of the shadows has disappeared. This operation will take about one minute.

Note: Particular care should be taken *not* to use trays with any *iron* exposed, otherwise blue spots may result.

Rinse *thoroughly* in clean cold water.

Place in toner solution until original detail returns. This will require about 30 seconds. Give the print an immediate and thorough water rinse; then immerse it for five minutes in a hardening bath composed of 1 part of the stock hardener Kodak F-1a and 16 parts of water. The color and gradation of the finished print will not be affected by the use of this hardening bath. Remove the print from the hardener bath and wash for one-half hour in running water.

Sepia Toner (Agfa 221)

This toner is recommended for warm-brown sepia tones.

Solution 1

Hot water (125° F. or 52° C.).....	24 oz.	750 c.c.
Potassium ferricyanide.....	1 ½ oz. 80 gr. (736 gr.)	50 g
Potassium bromide.....	144 gr.	10 g
Sodium carbonate, monohydrated.....	289 gr.	20 g
Water to make.....	32 oz.	1000 c.c.

Solution 2

Sodium sulfide.....	1 ½ oz.	45 g
Water to make.....	16 oz.	500 c.c.

PHOTOGRAPHIC FORMULAE (Continued)

For use as described below, dilute one part solution 2 with eight parts water. **IMPORTANT**—Be sure to use sodium sulfide, not sodium sulfite, in compounding the re-developer. Also, use clean trays, free from exposed iron spots, especially with bleaching bath. Otherwise blue spots may form on prints.

Prints should be washed thoroughly and then bleached in solution 1 until the black image is converted to a very light brown color (about 1 minute). Prints should then be washed for 10 to 15 minutes and redeveloped in diluted solution 2.

Redevelopment should be complete in about 1 minute. After redevelopment the prints should be washed for about 30 minutes and then dried. If the toner should leave sediment which results in streaks or finger marks on the surface of the paper, the print should be immersed for a few seconds in a 3 % solution of acetic acid, after which a 10-minute washing is necessary.

Sulfide Toner for Warm Sepia Tones on Lantern Slides

(Kodak T-10)

Solution A

Potassium ferricyanide.....	1 oz.	30 g
Potassium bromide.....	$\frac{1}{2}$ oz.	15 g
Water to make.....	32 oz.	1000 c.c.

Solution B

Sodium sulfide (not sulfite).....	13 gr.	.9 g
Water to make.....	32 oz.	1000 c.c.

Use three times the quantity if crystalline sodium sulfide is used.

The well washed slide, or film, is thoroughly bleached in solution A, washed for 5 minutes, and immersed in solution B for about 2 minutes until thoroughly toned. The slide should then be washed thoroughly for 10 to 15 minutes before drying. The transparency of the tone is much improved by the addition of a little hypo to the B solution, say, 66 gr. per 32 oz. or 4.5 g per 1000 c.c.

Uranium Toning Bath for Papers (Kodak T-17)

Stock Solution

Uranium nitrate.....	116 gr.	8 g
Oxalic acid, crystals.....	58 gr.	4 g
Potassium ferricyanide.....	58 gr.	4 g
Water to make.....	32 oz.	1000 c.c.

Dissolve the uranium nitrate in a small volume of water, about 8 oz. (250 c.c.) (about 125° F.) (50° C.). Dissolve the oxalic acid separately in about 8 oz. (250 c.c.) of water and filter; then add the oxalic acid solution to the uranium nitrate solution. Dissolve the potassium ferricyanide separately in about 8 oz. (250 c.c.) of water; if the solution is clear, add it to the uranium nitrate and oxalic acid solution. If not clear, filter before mixing together.

For Use as a Toning Bath (Chocolate to Brick Red). Dilute 1 part of the stock solution with 2 parts of water. As the toning time is increased, the tone changes from chocolate to brown and finally to brick red. The print may be removed at any stage.

Wash until the highlights are clean; this usually requires from 10 to 15 minutes. Prolonged washing should be avoided.

PHOTOGRAPHIC FORMULAE (Continued)

Uranium Toner for Brown to Red Tones on Slides or Films (Kodak T-9)

Uranium nitrate.....	35	gr.	2.5	g
Potassium oxalate.....	35	gr.	2.5	g
Potassium ferricyanide.....	15	gr.	1	g
Ammonium alum.....	85	gr.	6	g
Hydrochloric acid, 10 % solution.....	1½	dr.	5	c.c.
Water to make.....	32	oz.	1000	c.c.

To make a 10 % solution, add 1 part of hydrochloric acid to 9 parts of water, slowly with stirring.

Dissolve chemicals in the order given.

The solution should be perfectly clear and pale yellow in color. *It is light sensitive, however, and should be stored in the dark.*

The maximum toning effect is produced in about 10 minutes, the tone passing from brown to red during this time.

After toning, wash for about 10 minutes; the washing should not be prolonged, especially if the water is slightly alkaline, since the toned image is soluble in alkali.

Gold Toner (Agfa 231)

This formula gives a range of red tones to sepia-toned prints, the brilliance of the tone depending on the paper used. Brilliant chalk-red tones are produced on Cykon, while with Indiatone and Cykora darker shades are formed. If desired, deep blue tones may also be obtained with this formula by using black-and-white prints instead of prints that have first been sepia-toned. Unusual effects of mixed tones of blue-black shadows and soft reddish highlights can be produced by using prints which have been partially toned in a hypo alum sepia-toner.

Hot water (125° F. or 52° C.).....	24	oz.	750	c.c.
*Ammonium sulfocyanate.....	3½	oz.	105	g
Gold chloride, 1 % solution.....	2	oz. fl.	60	c.c.
Water to make.....	32	oz.	1000	c.c.

*May be substituted by:

Sodium sulfocyanate.....	3¾	oz.	110	g
or				
Potassium sulfocyanate.....	4½	oz.	135	g

For Red Tones: Prints must first be bleached and toned by sulfide redevelopment method. After washing, place prints in above solution until toning is complete (requires 15-45 minutes). For redder tones one-half the specified amount of sulfocyanate may be used.

For Deep Blue Tones: Omit sepia toning operation and place well-washed black-and-white prints directly in above toning solution.

For Mixed Tones: Prints should be incompletely toned in a hypo alum toner and washed before treatment in above solution.

Iron Toner for Blue Tones on Papers (Kodak T-12)

Ferric ammonium citrate (green scales).....	58	gr.	4	g
Oxalic acid, crystals.....	58	gr.	4	g
Potassium ferricyanide.....	58	gr.	4	g
Water to make.....	32	oz.	1000	c.c.

PHOTOGRAPHIC FORMULAE (Continued)

Dissolve each chemical separately in a small volume of water, about 8 oz. (250 c.c.) and filter before mixing together. This solution does not keep well except in brown bottles.

Immerse the well-washed print in the toning bath for 10 to 15 minutes until the desired tone is obtained. Then wash until the highlights are clear.

Iron Blue Toner (Agfa 241)

Producing brilliant blue tones, this formula is suitable for use with Cykora, Brovira and Indiatone papers.

Hot water (125° F. or 52° C.).....	16 oz.	500 c.c.
Ferric ammonium citrate.....	$\frac{1}{4}$ oz.	8 g
Potassium ferricyanide.....	$\frac{1}{4}$ oz.	8 g
Acetic acid, 28 %.....	9 oz.	265 c.c.
Water to make.....	32 oz.	1000 c.c.

Solution should be prepared with distilled water if possible. If enameled iron trays are used, no chips or cracks in the enamel should be present or spots and streaks may appear in the print.

Prints for blue toning should be fixed in plain, non-hardening hypo bath (which should be kept at a temperature of 68° or under to avoid undue swelling). When prints have been fully toned in the above solution, they will be greenish in appearance, but will be easily washed out to a clear blue color when placed in running water.

The depth of the blue toning will vary somewhat with the quality of prints toned in it, light-toned prints generally toning to lighter blues. Some intensification of the print usually occurs in toning; consequently, prints should be slightly lighter than the density desired in the final toned print.

Wash water should be acidified slightly with acetic acid since the blue tone is quite soluble in alkaline solutions and is considerably weakened when wash water is alkaline. Pleasing variations in the tone can be obtained by bathing the washed prints in a $\frac{1}{2}$ % solution (5 g per 1000 c.c.) of borax which produces softer, blue-gray tones, the extent depending on the length of treatment.

Iron Toner for Blue Tones on Slides or Films (Kodak T-11)

Ammonium persulfate.....	7 gr.	.5 g
Iron and ammonium sulfate (ferric alum)....	20 gr.	1.4 g
Oxalic acid.....	45 gr.	3 g
Potassium ferricyanide.....	15 gr.	1 g
Ammonium alum.....	73 gr.	5 g
Hydrochloric acid, 10 % solution.....	$\frac{1}{4}$ dr.	1 c.c.
Water to make.....	32 oz.	1000 c.c.

To make a 10 % solution, add 1 part of hydrochloric acid to 9 parts of water, slowly with stirring.

Dissolve chemicals in the order given.

The method of compounding this bath is important. Each of the solid chemicals should be dissolved separately in a small volume of water; the solutions then should be mixed strictly in the order given, and the whole diluted to the required volume. If these instructions are followed, the bath will be pale yellow in color and perfectly clear.

Immerse the slides or films from 2 to 10 minutes at 68° F. (20° C.) until the desired tone is obtained. Wash for 10 to 15 minutes until

PHOTOGRAPHIC FORMULAE (Continued)

the highlights are clear. A slight permanent yellow coloration of the clear gelatin will usually occur, but should be too slight to be detectable on projection. If the highlights are stained blue, then either the slide (film) was fogged during development, or the toning bath was stable or not mixed correctly.

Since the toned image is soluble in alkali, washing should not be carried out for too long a period, especially if the water is slightly alkaline.

BLUE PRINT PAPER, FORMULAE FOR SENSITIZING

1

Solution A

Water.....	8.5 oz.	50 c.c.
Iron and ammonium citrate.....	1.7 oz.	10 g

Solution B

Water.....	8.5 oz.	50 c.c.
Potassium ferricyanide.....	1.4 oz.	8 g

Filter separately. The solutions, which may be preserved separately for some time, are best kept in the dark. For use, mix, in a dark room or by an artificial light of low intensity, equal quantities of the two solutions.

Any non-absorbent paper may be sensitized by brushing the solution over it rapidly with a soft, wide, flat brush, going over the surface twice, the second coat being applied in a direction at right angles to the first. An alternative method is to lower the paper, beginning at one edge, on to the surface of the solution in a tray and allow it to float for a few seconds. Care must be taken to exclude air bubbles. After sensitizing by either method, the paper should be hung by one edge in a dark room to dry.

2

Blue printing depends to a large extent upon surface of paper.

The following formula is recommended as producing clear whites:

Solution 1

Potassium ferricyanide, $K_3Fe(CN)_6$	10 g
Distilled water.....	100 c.c.

Solution 2

Iron and ammonium citrate (ferric).....	30 g
Water.....	100 c.c.
Gum arabic (gum acacia).....	5 g

Equal parts of the above solutions are mixed just before use. The paper to be sensitized may be floated on the surface or the liquid may be applied with a tuft of absorbent cotton using cross strokes to insure an even coating. The sensitized paper must be dried in the dark and should be used within 36 hours.

ULTRAVIOLET SENSITIZATION

Photographic plates can be made sensitive to short-wave ultra-violet light by immersion in a dilute solution of citric acid in 95 % ethyl alcohol (1 % citric acid). (Sodium salicylate may be substituted for the citric acid.) The plate is immersed in the citric acid solution and immediately withdrawn and dried in less than one minute by waving in the air before putting in the holder. After

PHOTOGRAPHIC FORMULAE (Continued)

exposure the plate can be developed without previous washing and without special precautions. The coating of citric acid adheres to the plate so that a number of plates may be treated and stored away for future use. Citric acid has no detrimental action on the emulsion or the developer. The sharpness of the image is not diminished.

FACTORIAL DEVELOPMENT

If the image first appears after immersion in the developer for a certain time, then this period of time multiplied by the "factor" for the particular developer used will give the total time required for full, normal development. The factor for the degree of development desired may well be determined by experiment; the following are suggested:

Amidol, 2 gr. per oz.....	18
Glycin.....	8-12
Hydroquinone.....	4½-5
Metol.....	30
Metol-hydroquinone.....	14
Ortol.....	10

Pyro, without bromide:

1 gr. per oz.....	18
2 gr. per oz.....	12
3 gr. per oz.....	10
4 gr. per oz.....	8
5 gr. per oz.....	6

With 1 part bromide to 4 parts pyro:

1 gr. pyro per oz.....	9
2 gr. pyro per oz.....	5
3 gr. pyro per oz.....	4½
4 gr. pyro per oz.....	4

DIAPHRAGM OR STOP NUMBERS

<i>F</i> System	<i>f</i> /2	<i>f</i> /3	<i>f</i> /3.5	<i>f</i> /4	<i>f</i> /4.5	<i>f</i> /5.6	<i>f</i> /6.3
Rel. Exp.	1/16	1/7	1/5		1/3		5/8
U. S. No.				1		2	

<i>F</i> System	<i>f</i> /8	<i>f</i> /11.3	<i>f</i> /16	<i>f</i> /22.6	<i>f</i> /32	<i>f</i> /45	<i>f</i> /64
Rel. Exp.	1	2	4	8	16	32	
U. S. No.	4	8	16	32	64	128	256

PLATE AND FILM SPEEDS

Compiled with the collaboration of
Chas. H. Shipman

It is pertinent to state that there is at present no exact way to indicate plate and film speeds. Also since different manufacturers do not use identical methods in their speed determinations the stated speeds vary among the different makes.

In 1900 two English amateurs, Messrs. Hurter and Driffield, proposed a system of plate speeds based on the assumption that, if a plate is given a series of graded exposures, and developed in a pyro developer free from bromide, a density-log exposure curve may be plotted from which a speed value may be determined which is supposed to be inversely proportional to the exposure required to produce average density. The Scheiner system is based upon the assumption that speeds are inversely proportional to the exposure necessary to produce a just visible image. It will be evident that these two systems cannot be compared exactly. Nor is either system correct since the assumptions upon which they are based are not exactly true. Nevertheless the results obtained by these methods are well within the latitude of the emulsions and will serve well as a starting point for all ordinary work. The exposures may be easily altered after a trial to produce the type of result desired.

Kodak Film Speeds are determined by a system of testing in which the exposure on which the speed number is based is taken as the value of exposure for which the slope at the lower part of the characteristic curve is three-tenths the average slope over an exposure range of 30:1 which is found to be the maximum contrast for the average scene.

There can be no simple relationship between speeds obtained in fundamentally different ways and the conversion table given below can be considered only a rough guide.

Comparison of Speed Systems

H & D American	Din	American Scheiner	Weston Numbers	Kodak Speeds	Relative Exposure
35	1/10	8	0.75	4	32
45	2/10	9	1	5	27
56	3/10	10	1.3	6	21
72	4/10	11	1.5	8	16
91	5/10	12	2	10	13
117	6/10	13	2.5	12	11
150	7/10	14	3	16	8
190	8/10	15	4	20	7
240	9/10	16	5	25	5
308	10/10	17	6	32	4
390	11/10	18	8	40	3.3
500	12/10	19	10	50	2.7
636	13/10	20	12	64	2.0
800	14/10	21	16	80	1.7
1050	15/10	22	20	100	1.3
1300	16/10	23	24	125	1.0
1700	17/10	24	32	160	.80
2100	18/10	25	40	200	.67
2700	19/10	26	50	250	.50
3500	20/10	27	64	320	.40
4400	21/10	28	80	400	.33
5600	22/10	29	100	500	.25
7200	23/10	30	125	640	.20
9100	24/10	31	160	800	.17
11600	25/10	32	200	1000	.125
15400	26/10	33	250	1250	.10
20500	27/10	34	320	1600	.08
27300	28/10	35	400	2000	.0625
31400	29/10	36	500	2500	.05
41700	30/10	37	650	3200	.04
54700	31/10	38	800	4000	.03125

PLATE AND FILM SPEEDS (Continued)

Shutter Speeds of Moving Picture Cameras

Ciné Anco Model B.....	1/30 sec.	Keystone (other models)...	1/50 sec.
DeVry.....	1/30	Model B Agfa.....	1/30
Eastman (all models).....	1/30	Paillard Bolex.....	1/30
Filmo all 70's Reg. and 121	1/30	Paragon.....	1/30
Filmo Golf 70, 71's, 75 and		Revere.....	1/30
141.....	1/40	Simplex.....	1/40
Filmo 8 mm. (all).....	1/30	Stewart Warner 8.....	1/50
Keystone Late Models A-3		Stewart Warner Holly-	
and A-7.....	1/40	wood and 532A.....	1/40
Keystone Model K-8.....	1/40	Sept.....	1/90
No. 872650 and above		Univex.....	1/30
Keystone 16B.....	1/50	Victor (all models).....	1/30
		Zeiss Kinamo S-10-16.....	1/30
		Zeiss Movikon.....	1/30*

* When shutter is at 180°.

PLATE AND FILM SPEEDS

The following table presents the most recent figures available at the time of compilation for speed numbers in American Scheiner values and as given for two widely used exposure meters. Values are given for daylight and for tungsten or photoflood illumination.

Speed values given can be considered only as a general guide. Values given by different authorities differ somewhat according to the characteristics of the negatives considered satisfactory. In general the speeds given are for full exposure. The Weston and G. E. figures may be increased by about 50 per cent or the Scheiner values by about two units if a thinner negative is desired.

Many types of material no longer available are included in the table for purposes of comparison.

AMERICAN STANDARDS ASSOCIATION

Exposure Indexes

The American Standards Association (A S A) has adopted certain methods of measuring and indicating speeds of photographic materials and also a scale of corresponding numbers to be used as exposure indexes. Most exposure meters of recent manufacture are using the A S A numbers which are almost identical with the former Weston numbers and differ only slightly from the G. E. index values given in the following Table. For "black and white" materials the differences may be neglected in most cases but for purposes of comparison the relative values of the A S A and G. E. indexes are shown below.

A S A Index	G. E. Index	A S A Index	G. E. Index	A S A Index	G. E. Index
0.6	.6	8	10	100	125
0.8	...	10	12	125	150
1.0	1	12	16	160	200
1.2	1.5	16	20	200	250
1.6	2	20	24	250	300
2.0	...	25	32	320	400
2.5	3	32	40	400	500
3	4	40	48	500	600
4	...	50	64	650	800
5	6	64	80	800	900
6	8	80	100	1000	1000

PLATE AND FILM SPEEDS (Continued)

Maker and kind	American Scheiner		Weston		General Electric	
	Day- light	Tung- sten or Photo- flood	Day- light	Tung- sten or Photo- flood	Day- light	Tung- sten or Photo- flood
CINÉ FILM 8 mm						
Anso						
Hypan Reversible.....	23	21	24	16	32	24
Triple S. Pan.....	29	27	100	64	125	100
Eastman						
Ciné Kodak Pan. Re- versible.....	18	17	8	6	12	8
Super X Pan. Reversible	24	23	32	24	48	32
CINÉ FILM 16 mm						
Anso						
F. G. Plenachromatic Reversible.....	20	...	12	.....	16	.....
Finopan Negative.....	23	21	24	16	32	24
Hypan Reversible.....	24	23	32	24	48	32
Panchromatic Reversible	21	20	16	12	24	16
Superpan Supreme Nega- tive.....	27	25	64	40	100	64
Triple S Pan Reversible..	29	27	100	64	125	100
Dupont						
Regular Pan. Reversible..	20	18	12	8	16	12
Superior Pan. Neg.....	24	22	32	20	48	24
Eastman						
Ciné Kodak Safety.....	20	18	12	8	16	12
Super X Pan Safety.....	24	23	32	24	48	32
Super XX Pan Safety...	29	28	100	80	125	100
Gevaert						
F. G. Pan. Reversible...	20	18	12	8	16	12
Ortho.....	21	17	16	6	24	8
Pan. Super Reversible...	23	21	24	16	32	24
MINIATURE AND 35 mm						
Anso						
F. G. Plenachrome.....	23	21	24	16	32	12
F. G. Reversible Super- pan.....	23	21	24	16	32	24
Finopan.....	23T	21T	24T	16T	32	24
Minipan.....	15*	16*	4*	5*	6*	7*
Superpan.....	26	24	50	32	64	48
Ultra Speed Pan.....	29	27	100	64	125	100
Dupont						
Superior Pan. 2.....	26	24	50	32	64	48
Microcopy.....	...	15*	....	2.5*	....	4*
Eastman						
Direct Positive.....	26	24	50	32	64	48
Microfile.....	15*	13*	4*	2.5*	6*	4*
Panatomic X.....	23	21	24	16	32	24
Plus X.....	26	24	50	32	64	48
Super XX.....	29	27	100	64	125	100
Gevaert						
Express Superchrome...	23	21	24	16	32	24
Panchromosa.....	20	18	12	8	16	12
Panchromosa Micrograin	20	18	12	8	16	12
ROLL FILM AND FILM PACK						
Anso						
Finopan.....	23	21	24	16	32	24
Plenachrome.....	26	24	50	32	64	48
Standard.....	23	18	24	8	32	12
Super Plenachrome.....	26	24	50	32	64	32
Superpan Press.....	29	27	100	64	125	100
Superpan Supreme.....	26	24	50	32	64	48

PLATE AND FILM SPEEDS (Continued)

Maker and kind	American Scheiner		Weston		General Electric	
	Day- light	Tung- sten or Photo- flood	Day- light	Tung- sten or Photo- flood	Day- light	Tung- sten or Photo- flood
ROLL FILM AND FILM PACK (Continued)						
Eastman						
Panatomic X.....	23	21	24	16	32	24
Plus X.....	26	24	50	32	64	48
Super Ortho Press.....	29	24	100	32	125	48
Super XX.....	29	27	100	64	125	100
Verichrome.....	26	24	50	32	64	48
Gevaert						
Superchrome.....	23	18	24	8	32	12
Panchromosa.....	23	21	24	16	32	24
CUT FILM						
Anso						
Commercial.....	20	15	12	4	16	6
Commercial Ortho.....	20	18	12	8	16	12
Commercial Pan.....	20	18	12	8	16	12
Isopan.....	26	24	50	32	64	48
Portrait.....	20	18	12	8	16	12
Process.....	20	15	12	4	16	8
S. S. Plena.....	26	21	50	16	64	24
Super Plenachrome Press	29	24	100	32	125	48
Superpan Portrait.....	26	24	50	32	64	48
Superpan Press.....	29	27	100	64	125	100
Triple S. Pan.....	32	30	200	125	250	200
Triple S. Ortho.....	29	27	100	64	125	100
Defender						
Arrow Pan.....	29	27	100	64	125	100
Commercial.....	20	15	12	4	16	6
F. G. Pan.....	23	21	24	16	32	12
Ortho 7.....	29	27	100	64	125	100
Pentagon.....	23	21	24	16	32	16
Portrait.....	23	18	24	8	32	12
Portrait H. G. S.....	26	21	50	16	48	24
Process.....	20	15	12	4	16	6
Process Pan.....	20	18	12	8	24	12
X. F. Ortho.....	26	21	50	16	64	24
X. F. Ortho Press.....	26	21	50	16	64	24
X. F. Pan.....	26	24	50	32	64	48
X. F. Pan Press.....	26	24	50	32	64	48
Eastman						
Commercial.....	23	15	24	4	32	6
Commercial Matte.....	23	15	24	4	32	6
Commercial Ortho.....	23	18	24	8	48	12
Commercial Pan.....	23	20	24†	12†	40†	20†
Contrast process Ortho..		18		8		12
Ortho X.....	29	27	100	64	125	64
Panatomic X.....	23	21	24	16	32	24
Pan Press.....	25	24	40†	32†	64†	50†
Par Speed Portrait.....	24	19	32†	10†	50†	16†
Portrait Pan.....	26	24	50	32	64	48
Process Pan.....	21	19	16†	10†	24†	16†
S. S. Ortho Portrait.....	26	21	50	16	64	32
S. S. Pan.....	26	24	50	32	64	48
Super Ortho Press.....	29	24	100	32	100	48
Super Pan Press, Type B	29	27	100	64	125	100
Super Panchro Press,						
Sports type.....	32	31	200	160	250	225
Super XX.....	29	27	100	64	125	100
Tri-X Panchromatic....	32	30	200	125	250	200

PLATE AND FILM SPEEDS (Continued)

Maker and kind	American Scheiner		Weston		General Electric	
	Day- light	Tung- sten or Photo- flood	Day- light	Tung- sten or Photo- flood	Day- light	Tung- sten or Photo- flood
CUT FILM (Continued)						
Gevaert						
Commercial.....	20	15	12	4	16	6
Commercial Ortho.....	20	18	12	8	16	12
Studio High Speed.....	23	21	24	16	32	24
Studio Ultra Panchro.....	20	18	12	8	16	12
Superchrome.....	23	18	24	8	32	12
Hammer						
Commercial Pan.....	20	18	12	8	16	12
Medium Commercial....	20	15	12	4	16	6
Medium Commercial Ortho.....	20	18	12	8	16	12
Portrait Ortho.....	26	24	50	32	64	48
Safety.....	17	12	6	2	8	3
Slow.....	14	9	3	1	4	1.5
Slow Ortho.....	14	9	3	1	4	1.5
Special Super Process....	17	12	6	2	8	3
Super Ortho Press.....	32	15	24	4	32	6
True Tone Pan.....	32	18	24	8	32	12
PLATES						
Defender						
Seed L. NH.....	20	18	12	8	16	12
Seed L. Ortho.....	20	18	12	8	16	12
Seed 23.....	17	12	6	2	8	3
Seed 26 X.....	20	18	12	8	16	12
Seed 27.....	23	18	24	8	32	12
Standard Orthonon.....	20	18	12	8	16	12
Stanley Ex. Imp.....	20	18	12	8	16	12
Stanley Reg.....	20	18	12	8	16	12
Eastman						
Commercial.....	20	18	12	8	16	12
D. C. Ortho Plate.....	22	17	20†	6†	32	10
Panatomic X.....	23	21	24	16	32	24
Polychrome.....	23	18	24	8	40†	12
Postcard.....	22	19	12	4	32†	10†
Process.....	17	9	6	1	8	1.5
S. C. Ortho Plate.....	23	18	24	8	40†	12
Super Ortho Press.....	29	27	100	64	125	100
Super Panchro Press....	29	27	100	64	125	100
Tri-X Pan Type B.....	29	27	100	64	125	100
Tri-X Pan Type B, Matte	29	27	100	64	125	100
Universal.....	23	17†	24	6†	40†	10†
Wratten and Wainwright M.....	...	23	....	24	....	32
W & W Metallographic..	...	20	....	12	....	16
Wratten and Wainwright Pan.....	20	18	12	8	20	12
Wratten Process Pan....	...	23	....	24	....	32
W & W Tri Color.....	25	23	40†	24†	64†	40†
"33".....	20	15	12	4	24	6
"33" Matte.....	20	15	12	4	16	6
"40".....	23	18	24	8	32	12
"50".....	23	18	24	8	32	12
Gevaert						
Sensima Ortho.....	20	15	12	4	16	6
Super Chromosa.....	17	15	6	4	8	6
Ultra Panchro.....	32	21	24	16	32	24

PLATE AND FILM SPEEDS (Continued)

Maker and kind	American Scheiner		Weston		General Electric	
	Day-light	Tungsten or Photo-flood	Day-light	Tungsten or Photo-flood	Day-light	Tungsten or Photo-flood
PLATES (Continued)						
Hammer						
Commercial Pan.....	17	15	6	4	8	6
Contrast Pan.....	17	15	6	4	8	6
Extra Fast.....	20	18	24	8	16	12
Medium Commercial....	20	12	12	2	16	3
Medium Commercial Ortho.....	20	15	12	4	16	6
Portrait Ortho.....	...	...	24	16	32	24
Process.....	17	12	6	2	8	3
Process Pan.....	17	12	6	2	8	3
Slow.....	14	9	3	1	4	1.5
Slow Ortho.....	14	9	3	1	4	1.5
Soft Gradation Pan.....	...	...	12	4	16	6
Special Process.....	17	12	6	2	8	3
Specials.....	23	18	24	8	32	12

COLOR FILMS

Speed indexes given below apply when the type of illumination used is that for which the emulsion has been specifically color-balanced. When film is used with illumination other than that for which it is originally intended the recommended filter must be used and the appropriate filter factor employed in computing exposure.

Maker and kind	American Scheiner	Former Weston	Former G. E.	A S A Index
Ansco				
16 mm Daylight.....	18	8	12	10
" Tungsten.....	20	12	18	12
35 mm Daylight.....	18	8	12	12
" Tungsten.....	19	10	15	12
Roll film Daylight.....				12
" " Tungsten.....				12
Sheet film Daylight.....	18	8	12	10
" " Tungsten.....	18	8	12	10
Kodak				
Kodachrome, prof. cut film.....				
Daylight Type.....	17	6	10	8
Type B.....	18	8	12	10
Kodachrome 8.....				
16, 35 mm and Bantam.....				
Daylight.....	18	8	12	10
Type A.....	20	12	20	16
Kodacolor, roll film.....				
Neg. Daylight.....	22	20	32	25
Ektachrome sheet film.....				
Daylight.....	18	8	12	10
Type B.....				10

* Read meter on white surface placed over copy work.

† Value given by manufacturer.

T-Tentative value subject to further test.

WIRE TABLES

COMPARISON OF WIRE GAUGES

DIAMETER OF WIRE IN INCHES

Gauge No.	Brown & Sharpe	Birmingham or Stubs'.	Washburn & Moen	Imperial or Brit. Std.	Stubs' Steel	U. S. Std. plate
00000000						
0000000				.500		
000000				.464		.46875
00000				.432		.4375
0000	.4600	.454	.3938	.400		.40625
000	.4096	.425	.3625	.372		.375
00	.3648	.380	.3310	.348		.34375
0	.3249	.340	.3065	.324		.3125
1	.2893	.300	.2830	.300	.227	.28125
2	.2576	.284	.2625	.276	.219	.265625
3	.2294	.259	.2437	.252	.212	.25
4	.2043	.238	.2253	.232	.207	.234375
5	.1819	.220	.2070	.212	.204	.21875
6	.1620	.203	.1920	.192	.201	.203125
7	.1443	.180	.1770	.176	.199	.1875
8	.1285	.165	.1620	.160	.197	.171875
9	.1144	.148	.1483	.144	.194	.15625
10	.1019	.134	.1350	.128	.191	.140625
11	.09074	.120	.1205	.116	.188	.125
12	.08081	.109	.1055	.104	.185	.109375
13	.07196	.095	.0915	.092	.182	.09375
14	.06408	.083	.0800	.080	.180	.078125
15	.05707	.072	.0720	.072	.178	.0703125
16	.05082	.065	.0625	.064	.175	.0625
17	.04526	.058	.0540	.056	.172	.05625
18	.04030	.049	.0475	.048	.168	.05
19	.03589	.042	.0410	.040	.164	.04375
20	.03196	.035	.0348	.036	.161	.0375
21	.02846	.032	.0318	.032	.157	.034375
22	.02535	.028	.0286	.028	.155	.03125
23	.02257	.025	.0258	.024	.153	.028125
24	.02010	.022	.0230	.022	.151	.025

COMPARISON OF WIRE GAUGES (Continued)

DIAMETER OF WIRE IN INCHES

Gauge No.	Brown & Sharpe	Birmingham or Stubs'.	Washburn & Moen	Imperial or Brit. Std.	Stubs' steel	U. S. Std. plate
25	0.01790	0.020	0.0204	0.020	0.148	0.021875
26	0.01594	0.018	0.0181	0.018	0.146	0.01875
27	0.01419	0.016	0.0173	0.0164	0.143	0.0171875
28	0.01264	0.014	0.0162	0.0149	0.139	0.015625
29	0.01126	0.013	0.0150	0.0136	0.134	0.0140625
30	0.01003	0.012	0.0140	0.0124	0.127	0.0125
31	0.008928	0.010	0.0132	0.0116	0.120	0.0109375
32	0.007950	0.009	0.0128	0.0108	0.115	0.01015625
33	0.007080	0.008	0.0118	0.0100	0.112	0.009375
34	0.006304	0.007	0.0104	0.0092	0.110	0.00859375
35	0.005614	0.005	0.0095	0.0084	0.108	0.0078125
36	0.005000	0.004	0.0090	0.0076	0.106	0.00703125
37	0.004453	.....	0.0085	0.0068	0.103	0.006640625
38	0.003965	.....	0.0080	0.0060	0.101	0.00625
39	0.003531	.....	0.0075	0.0052	0.099	.....
40	0.003145	.....	0.0070	0.0048	0.097	.....
41	.....	.....	0.0066	0.0044	0.095	.....
42	.....	.....	0.0062	0.0040	0.092	.....
43	.....	.....	0.0060	0.0036	0.088	.....
44	.....	.....	0.0058	0.0032	0.085	.....
45	.....	.....	0.0055	0.0028	0.081	.....
46	.....	.....	0.0052	0.0024	0.079	.....
47	.....	.....	0.0050	0.0020	0.077	.....
48	.....	.....	0.0048	0.0016	0.075	.....
49	.....	.....	0.0046	0.0012	0.072	.....
50	.....	.....	0.0044	0.0010	0.069	.....

COMPARISON OF WIRE GAUGES (Continued)

DIAMETER OF WIRE IN CENTIMETERS

Gauge No.	Brown & Sharpe	Birmingham or Stubs.	Washburn & Moen	Imperial or Brit. Std.	Stubs' steel	U. S. Std. plate
00000000	.....	.....	.....	.....	.....	.....
0000000	.....	.....	1.245	1.27	.....	1.27
000000	.....	.....	1.172	1.18	.....	1.191
00000	.....	.....	1.093	1.10	.....	1.111
0000	1.168	1.15	1.000	1.02	.....	1.032
000	1.040	1.08	0.9208	0.945	.....	0.9525
00	0.9266	0.965	0.8407	0.884	.....	0.8731
0	0.8252	0.864	0.7785	0.823	.....	0.7938
1	0.7348	0.762	0.7188	0.762	0.577	0.7144
2	0.6543	0.721	0.6668	0.701	0.556	0.6747
3	0.5827	0.658	0.6190	0.640	0.538	0.6350
4	0.5189	0.605	0.5723	0.589	0.526	0.5953
5	0.4620	0.559	0.5258	0.538	0.518	0.5556
6	0.4115	0.516	0.4877	0.488	0.511	0.5159
7	0.3665	0.457	0.4496	0.447	0.505	0.4763
8	0.3264	0.419	0.4115	0.406	0.500	0.4366
9	0.2906	0.376	0.3767	0.366	0.493	0.3969
10	0.2588	0.340	0.3429	0.325	0.485	0.3572
11	0.2305	0.305	0.3061	0.295	0.478	0.3175
12	0.2053	0.277	0.2680	0.264	0.470	0.2778
13	0.1828	0.241	0.232	0.234	0.462	0.2381
14	0.1628	0.211	0.203	0.203	0.457	0.1984
15	0.1450	0.183	0.183	0.183	0.452	0.1786
16	0.1291	0.165	0.159	0.163	0.445	0.1588
17	0.1150	0.147	0.137	0.142	0.437	0.1429
18	0.1024	0.124	0.121	0.122	0.427	0.1270
19	0.09116	0.107	0.104	0.102	0.417	0.1111
20	0.08118	0.089	0.0884	0.0914	0.409	0.09525
21	0.07229	0.081	0.0808	0.0813	0.399	0.08731
22	0.06439	0.071	0.0726	0.0711	0.394	0.07938
23	0.05733	0.064	0.0655	0.0610	0.389	0.07144
24	0.05105	0.056	0.0584	0.0559	0.384	0.06350

COMPARISON OF WIRE GAUGES (Continued)

DIAMETER OF WIRE IN CENTIMETERS

Gauge No.	Brown & Sharpe	Birmingham or Stubs'.	Washburn & Moen	Imperial or Brit. Std.	Stubs' steel	U. S. Std. plate
25	0.04547	0.051	0.0518	0.0508	0.376	0.05556
26	0.04049	0.046	0.0460	0.0457	0.371	0.04763
27	0.03604	0.041	0.0439	0.0417	0.363	0.04366
28	0.03211	0.036	0.0411	0.0378	0.353	0.03969
29	0.02860	0.033	0.0381	0.0345	0.340	0.03572
30	0.02548	0.030	0.0356	0.0315	0.323	0.03175
31	0.02268	0.025	0.0335	0.0295	0.305	0.02778
32	0.02019	0.023	0.0325	0.0274	0.292	0.02580
33	0.01798	0.020	0.0300	0.0254	0.284	0.02381
34	0.01601	0.018	0.0264	0.0234	0.279	0.02183
35	0.01426	0.013	0.024	0.0213	0.274	0.01984
36	0.01270	0.010	0.023	0.0193	0.269	0.01786
37	0.01131	.....	0.022	0.0173	0.262	0.01687
38	0.01007	.....	0.020	0.0152	0.257	0.01588
39	0.008969	.....	0.019	0.0132	0.251	.....
40	0.007988	.....	0.018	0.0122	0.246	.....
41	.....	.....	0.017	0.0112	0.241	.....
42	.....	.....	0.016	0.0102	0.234	.....
43	.....	.....	0.015	0.0091	0.224	.....
44	.....	.....	0.015	0.0081	0.216	.....
45	.....	.....	0.014	0.0071	0.206	.....
46	.....	.....	0.013	0.0061	0.201	.....
47	.....	.....	0.013	0.0051	0.196	.....
48	.....	.....	0.012	0.0041	0.191	.....
49	.....	.....	0.012	0.0030	0.183	.....
50	.....	.....	0.011	0.0025	0.175	.....

TWIST DRILL AND STEEL WIRE GAUGE

INCHES

No.	Size	No.	Size	No.	Size	No.	Size	No.	Size
1	0.2280	17	0.1730	33	0.1130	49	0.0730	65	0.0350
2	0.2210	18	0.1695	34	0.1110	50	0.0700	66	0.0330
3	0.2130	19	0.1660	35	0.1100	51	0.0670	67	0.0320
4	0.2090	20	0.1610	36	0.1065	52	0.0635	68	0.0310
5	0.2055	21	0.1590	37	0.1040	53	0.0595	69	0.02925
6	0.2040	22	0.1570	38	0.1015	54	0.0550	70	0.0280
7	0.2010	23	0.1540	39	0.0995	55	0.0520	71	0.0260
8	0.1990	24	0.1520	40	0.0980	56	0.0465	72	0.0250
9	0.1960	25	0.1495	41	0.0960	57	0.0430	73	0.0240
10	0.1935	26	0.1470	42	0.0935	58	0.0420	74	0.0225
11	0.1910	27	0.1440	43	0.0890	59	0.0410	75	0.0210
12	0.1890	28	0.1405	44	0.0860	60	0.0400	76	0.0200
13	0.1850	29	0.1360	45	0.0820	61	0.0390	77	0.0180
14	0.1820	30	0.1285	46	0.0810	62	0.0380	78	0.0160
15	0.1800	31	0.1200	47	0.0785	63	0.0370	79	0.0145
16	0.1770	32	0.1160	48	0.0760	64	0.0360	80	0.0135

CENTIMETERS

No.	Size	No.	Size	No.	Size	No.	Size	No.	Size
1	0.5791	17	0.4394	33	0.2870	49	0.1854	65	0.0889
2	0.5612	18	0.4305	34	0.2819	50	0.1778	66	0.0838
3	0.5410	19	0.4216	35	0.2794	51	0.1702	67	0.0813
4	0.5309	20	0.4089	36	0.2705	52	0.1613	68	0.0787
5	0.5220	21	0.4039	37	0.2642	53	0.1511	69	0.0743
6	0.5182	22	0.3988	38	0.2578	54	0.1397	70	0.0711
7	0.5105	23	0.3912	39	0.2527	55	0.1321	71	0.0660
8	0.5055	24	0.3861	40	0.2489	56	0.1181	72	0.0635
9	0.4978	25	0.3797	41	0.2438	57	0.1092	73	0.0610
10	0.4915	26	0.3734	42	0.2375	58	0.1067	74	0.0572
11	0.4851	27	0.3658	43	0.2261	59	0.1041	75	0.0533
12	0.4801	28	0.3569	44	0.2184	60	0.1016	76	0.0508
13	0.4699	29	0.3454	45	0.2083	61	0.0991	77	0.0457
14	0.4623	30	0.3264	46	0.2057	62	0.0965	78	0.0406
15	0.4572	31	0.3048	47	0.1994	63	0.0940	79	0.0368
16	0.4496	32	0.2946	48	0.1930	64	0.0914	80	0.0343

DIMENSIONS OF WIRE

STUBS' GAUGE

Giving the diameter and cross-section in English and metric system
for the Birmingham or Stubs' gauge.

Gauge No.	Diameter in in.	Section in sq. in.	Diameter in cm	Section in sq. cm
0000	0.454	0.16188	1.1532	1.0444
000	.425	.14186	1.0795	0.9152
00	.380	.11341	0.9652	.7317
0	0.340	0.09079	0.8636	0.5858
1	.300	.07069	.7620	.4560
2	.284	.06335	.7214	.4087
3	.259	.05269	.6579	.3399
4	.238	.04449	.6045	.2870
5	0.220	0.03801	0.5588	0.2452
6	.203	.03237	.5156	.20881
7	.180	.02545	.4572	.16147
8	.165	.02138	.4191	.13795
9	.148	.01720	.3759	.11099
10	0.134	0.01410	0.3404	0.09098
11	.120	.011310	.3048	.07297
12	.109	.009331	.2769	.06160
13	.095	.007088	.2413	.04573
14	.083	.005411	.2108	.03491
15	0.072	0.004072	0.1829	0.02627
16	.065	.0033183	.16510	.021409
17	.058	.0026421	.14732	.017046
18	.049	.0018857	.12446	.012166
19	.042	.0013854	.10668	.008938
20	0.035	0.0009621	0.08890	0.006207
21	.032	.0008042	.08128	.005189
22	.028	.0006158	.07112	.003973
23	.025	.0004909	.06350	.003167
24	.022	.0003801	.05588	.002452
25	0.020	0.0003142	0.05080	0.002027
26	.018	.0002545	.04572	.0016417
27	.016	.0002011	.04064	.0012972
28	.014	.0001539	.03556	.0009932
29	.013	.0001327	.03302	.0008563
30	0.012	0.0001181	0.03048	0.0007297
31	.010	.00007854	.02540	.0005067
32	.009	.00006362	.02286	.0004104
33	.008	.00005027	.02032	.0003243
34	.007	.00003848	.01778	.0002483
35	0.005	0.00001963	0.01270	0.0001267
36	.004	.00001257	.01016	.0000811

DIMENSIONS OF WIRE (Continued)

BRITISH STANDARD GAUGE

Giving the diameter and cross-section in English and metric system for the British Standard Gauge.

Gauge No.	Diameter in in.	Section in sq. in.	Diameter in cm.	Section in sq. cm.
0000000	0.500	0.1963	1.2700	1.267
000000	.464	.1691	1.1786	1.091
00000	0.432	0.1466	1.0973	0.9456
0000	.400	.1257	1.0160	.8107
000	.372	.1087	0.9449	.7012
00	.348	.0951	.8839	.6136
0	0.324	0.0825	0.8230	0.5319
1	.300	.07069	.7620	.4560
2	.276	.05983	.7010	.3858
3	.252	.04988	.6401	.3218
4	.232	.04227	.5893	.2727
5	0.212	0.03530	0.5385	0.2277
6	.192	.02895	.4877	.18679
7	.176	.02433	.4470	.15696
8	.160	.02010	.4064	.12973
9	.144	.01629	.3658	.10507
10	0.128	0.01287	0.3251	0.08302
11	.116	.010568	.2946	.06818
12	.104	.008495	.2642	.05480
13	.092	.006648	.2337	.04289
14	.080	.005027	.2032	.03243
15	0.072	0.004071	0.1829	0.02627
16	.064	.003217	.16256	.020755
17	.056	.002463	.14224	.015890
18	.048	.001810	.12192	.011675
19	.040	.001257	.10160	.008107
20	0.036	0.001018	0.09144	0.006567
21	.032	.0008042	.08128	.005189
22	.028	.0006158	.07112	.003973
23	.024	.0004524	.06096	.002922
24	.022	.0003801	.05588	.002452
25	0.020	0.0003142	0.05080	0.002027
26	.0180	.0002545	.04572	.0016417
27	.0164	.0002112	.04166	.0013628
28	.0148	.0001728	.03759	.0011099
29	.0136	.0001453	.03454	.0009363
30	0.0124	0.0001208	0.03150	0.0007791
31	.0116	.00010568	.02946	.0006818
32	.0108	.00009161	.02743	.0005910
33	.0100	.00007854	.02540	.0005067
34	.0092	.00006648	.02337	.0004289
35	0.0084	0.00005542	0.02134	0.0003575
36	.0076	.00004536	.01930	.0002927
37	.0068	.00003632	.01727	.0002343
38	.0060	.00002827	.01524	.0001824
39	.0052	.00002124	.01321	.0001370
40	0.0048	0.00001810	0.01219	0.0001167
41	.0044	.00001521	.01118	.0000982
42	.0040	.00001257	.01016	.0000811
43	.0036	.00001018	.00914	.0000656
44	.0032	.00000804	.00813	.0000519
45	0.0028	0.00000616	0.00711	0.0000397
46	.0024	.00000452	.00610	.0000212
47	.0020	.00000314	.00508	.0000203
48	.0016	.00000201	.00406	.0000129
49	.0012	.00000113	.00305	.0000073
50	0.0010	0.00000079	0.00254	0.0000051

PLATINUM WIRE

MASS IN GRAMS PER FOOT

B. & S. Gauge	Diameter, inches	Mass, g per ft.	B. & S. Gauge	Diameter, inches	Mass, g per ft.
10	.1019	37.5	23	.02257	1.8
11	.09074	28.0	24	.02010	1.4
12	.08081	22.0	25	.01790	1.1
13	.07196	17.5	26	.01594	0.9
14	.06408	14.0	27	.01420	0.7
15	.05707	11.0	28	.01264	0.6
16	.05082	9.0	29	.01126	0.45
17	.04526	7.0	30	.01003	0.35
18	.04030	5.7	31	.008928	0.28
19	.03589	4.4	32	.007950	0.22
20	.03196	3.4	33	.007080	0.17
21	.02846	2.9	34	.006305	0.15
22	.02535	2.3	35	.005615	0.11

ALLOWABLE CARRYING CAPACITIES OF COPPER WIRE

(Regulations of the National Board of Fire Underwriters)

Size, B. & S. Gauge	Diameter, mils	Cross section, circular mils	Amperes	
			Rubber insulation	Other insulation
0000	460.0	211600	225	325
000	409.6	167800	175	275
00	364.8	133100	150	225
0	324.9	105500	125	200
1	289.3	83690	100	150
2	257.6	66370	90	125
4	204.3	41740	70	90
6	162.0	26250	50	70
8	128.5	16510	35	50
10	101.9	10380	25	30
12	80.81	6530	20	25
14	64.08	4107	15	20
16	50.82	2583	6	10
18	40.30	1624	3	5

WIRE TABLE, STANDARD ANNEALED COPPER

American Wire Gauge (B. & S.) English Units

Gauge No.	Diameter in mils at 20°C	Cross section at 20°C		Ohms per 1000 feet*			
		Circular mils	Sq. inches	0°C (32°F)	20°C (68°F)	50°C (122°F)	75°C (167°F)
0000	460.0	211600	0.1662	0.04516	0.04901	0.05479	0.05961
000	409.6	167800	.1318	.05695	.06180	.06909	.07516
00	364.8	133100	.1045	.07181	.07793	.08712	.09478
0	324.9	105500	.08289	.09055	.09827	.1099	.1195
1	289.3	83690	.06573	.1142	.1239	.1385	.1507
2	257.6	66370	.05213	.1440	.1563	.1747	.1900
3	229.4	52640	.04134	.1816	.1970	.2203	.2396
4	204.3	41740	.03278	.2289	.2485	.2778	.3022
5	181.9	33100	.02600	.2887	.3133	.3502	.3810
6	162.0	26250	.02062	.3640	.3951	.4416	.4805
7	144.3	20820	.01635	.4590	.4982	.5569	.6059
8	128.5	16510	.01297	.5788	.6282	.7023	.7640
9	114.4	13090	.01028	.7299	.7921	.8855	.9633
10	101.9	10380	.008155	.9203	.9989	1.117	1.215
11	90.74	8234	.006467	1.161	1.260	1.408	1.532
12	80.81	6530	.005129	1.463	1.588	1.775	1.931
13	71.96	5178	.004067	1.845	2.003	2.239	2.436
14	64.08	4107	.003225	2.327	2.525	2.823	3.071
15	57.07	3257	.002558	2.934	3.184	3.560	3.873
16	50.82	2583	.002028	3.700	4.016	4.489	4.884
17	45.26	2048	.001609	4.666	5.064	5.660	6.158
18	40.30	1624	.001276	5.883	6.385	7.138	7.765
19	35.89	1288	.001012	7.418	8.051	9.001	9.792
20	31.96	1022	.0008023	9.355	10.15	11.35	12.35
21	28.45	810.1	.0006363	11.80	12.80	14.31	15.57
22	25.35	642.4	.0005046	14.87	16.14	18.05	19.63
23	22.57	509.5	.0004002	18.76	20.36	22.76	24.76
24	20.10	404.0	.0003173	23.65	25.67	28.70	31.22
25	17.90	320.4	.0002517	29.82	32.37	36.18	39.36
26	15.94	254.1	.0001996	37.61	40.81	45.63	49.64
27	14.20	201.5	.0001583	47.42	51.47	57.53	62.59
28	12.64	159.8	.0001255	59.80	64.90	72.55	78.93
29	11.26	126.7	.00009953	75.40	81.83	91.48	99.52
30	10.03	100.5	.00007894	95.08	103.2	115.4	125.5
31	8.928	79.70	.00006260	119.9	130.1	145.5	158.2
32	7.950	63.21	.00004964	151.2	164.1	183.4	199.5
33	7.080	50.13	.00003937	190.6	206.9	231.3	251.6
34	6.305	39.75	.00003122	240.4	260.9	291.7	317.3
35	5.615	31.52	.00002476	303.1	329.0	367.8	400.1
36	5.000	25.00	.00001964	382.2	414.8	463.7	504.5
37	4.453	19.83	.00001557	482.0	523.1	584.8	636.2
38	3.965	15.72	.00001235	607.8	659.6	737.4	802.2
39	3.531	12.47	.000009793	766.4	831.8	929.8	1012
40	3.145	9.888	.000007766	966.5	1049	1173	1276

* Resistance at the stated temperatures of a wire whose length is 1000 feet at 20°C.

WIRE TABLE, STANDARD ANNEALED COPPER

(Continued)

American Wire Gauge (B. & S.) English Units (Continued)

Gauge No.	Pounds per 1000 feet	Feet per pound	Feet per ohm*			
			0°C (32°F)	20°C (68°F)	50°C (122°F)	75°C (167°F)
0000	640.5	1.561	22140	20400	18250	16780
000	507.9	1.968	17560	16180	14470	13300
00	402.8	2.482	13930	12830	11480	10550
0	319.5	3.130	11040	10180	9103	8367
1	253.3	3.947	8758	8070	7219	6636
2	200.9	4.977	6946	6400	5725	5262
3	159.3	6.276	5508	5075	4540	4173
4	126.4	7.914	4368	4025	3600	3309
5	100.2	9.980	3464	3192	2855	2625
6	79.46	12.58	2747	2531	2264	2081
7	63.02	15.87	2179	2007	1796	1651
8	49.98	20.01	1728	1592	1424	1309
9	39.63	25.23	1370	1262	1129	1038
10	31.43	31.82	1087	1001	895.6	823.2
11	24.92	40.12	861.7	794.0	710.2	652.8
12	19.77	50.59	683.3	629.6	563.2	517.7
13	15.68	63.80	541.9	499.3	446.7	410.6
14	12.43	80.44	429.8	396.0	354.2	325.6
15	9.858	101.4	340.8	314.0	280.9	258.2
16	7.818	127.9	270.3	249.0	222.8	204.8
17	6.200	161.3	214.3	197.5	176.7	162.4
18	4.917	203.4	170.0	156.6	140.1	128.8
19	3.899	256.5	134.8	124.2	111.1	102.1
20	3.092	323.4	106.9	98.50	88.11	80.99
21	2.452	407.8	84.78	78.11	69.87	64.23
22	1.945	514.2	67.23	61.95	55.41	50.94
23	1.542	648.4	53.32	49.13	43.94	40.39
24	1.223	817.7	42.28	38.96	34.85	32.03
25	0.9699	1031	33.53	30.90	27.64	25.40
26	.7692	1300	26.59	24.50	21.92	20.15
27	.6100	1639	21.09	19.43	17.38	15.98
28	.4837	2067	16.72	15.41	13.78	12.67
29	.3836	2607	13.26	12.22	10.93	10.05
30	.3042	3287	10.52	9.691	8.669	7.968
31	.2413	4145	8.341	7.685	6.875	6.319
32	.1913	5227	6.614	6.095	5.452	5.011
33	.1517	6591	5.245	4.833	4.323	3.974
34	.1203	8310	4.160	3.833	3.429	3.152
35	.09542	10480	3.299	3.040	2.719	2.499
36	.07568	13210	2.616	2.411	2.156	1.982
37	.06001	16660	2.075	1.912	1.710	1.572
38	.04759	21010	1.645	1.516	1.356	1.247
39	.03774	26500	1.305	1.202	1.075	0.9886
40	.02993	33410	1.035	0.9534	0.8529	.7840

*Length at 20°C of a wire whose resistance is 1 ohm at the stated temperatures.

WIRE TABLE, STANDARD ANNEALED COPPER (Continued)

American Wire Gauge (B. & S.) English Units (Continued)

Gauge No.	Diameter in mils at 20°C	Ohms per pound			Lbs. per ohm
		0°C (32°F)	20°C (68°F)	50°C (122°F)	20°C (68°F)
0000	460.0	0.00007051	0.00007652	0.00008554	13070
000	409.6	.0001121	.0001217	.0001360	8219
00	364.8	.0001783	.0001935	.0002163	5169
0	324.9	.0002835	.0003076	.0003439	3251
1	289.3	.0004507	.0004891	.0005468	2044
2	257.6	.0007166	.0007778	.0008695	1286
3	229.4	.001140	.001237	.001383	808.6
4	204.3	.001812	.001966	.002198	508.5
5	181.9	.002881	.003127	.003495	319.8
6	162.0	.004581	.004972	.005558	201.1
7	144.3	.007284	.007905	.008838	126.5
8	128.5	.01158	.01257	.01405	79.55
9	114.4	.01842	.01999	.02234	50.03
10	101.9	.02928	.03178	.03553	31.47
11	90.74	.04656	.05053	.05649	19.79
12	80.81	.07404	.08035	.08983	12.45
13	71.96	.1177	.1278	.1428	7.827
14	64.08	.1872	.2032	.2271	4.922
15	57.07	.2976	.3230	.3611	3.096
16	50.82	.4733	.5136	.5742	1.947
17	45.26	.7525	.8167	.9130	1.224
18	40.30	1.197	1.299	1.452	0.7700
19	35.89	1.903	2.065	2.308	.4843
20	31.96	3.025	3.283	3.670	.3046
21	28.46	4.810	5.221	5.836	.1915
22	25.35	7.649	8.301	9.280	.1205
23	22.57	12.16	13.20	14.76	.07576
24	20.10	19.34	20.99	23.46	.04765
25	17.90	30.75	33.37	37.31	.02997
26	15.94	48.89	53.06	59.32	.01885
27	14.20	77.74	84.37	94.32	.01185
28	12.64	123.6	134.2	150.0	.007454
29	11.26	196.6	213.3	238.5	.004688
30	10.03	312.5	339.2	379.2	.002948
31	8.928	497.0	539.3	602.9	.001854
32	7.950	790.2	857.6	958.7	.001166
33	7.080	1256	1364	1524	.0007333
34	6.305	1998	2168	2424	.0004612
35	5.615	3177	3448	3854	.0002901
36	5.000	5051	5482	6128	.0001824
37	4.453	8032	8717	9744	.0001147
38	3.965	12770	13860	15490	.00007215
39	3.531	20310	22040	24640	.00004538
40	3.145	32290	35040	39170	.00002854

WIRE TABLE, STANDARD ANNEALED COPPER
(Continued)
American Wire Gauge (B. & S.) Metric Units (Continued)

Gauge No.	Diameter in mm at 20°C	Cross section in mm ² at 20°C	Ohms per kilometer*			
			0°C	20°C	50°C	75°C
0000	11.68	107.2	0.1482	0.1608	0.1798	0.1956
000	10.40	85.03	.1868	.2028	.2267	.2466
00	9.266	67.43	.2356	.2557	.2858	.3110
0	8.252	53.48	.2971	.3224	.3604	.3921
1	7.348	42.41	.3746	.4066	.4545	.4944
2	6.544	33.63	.4724	.5127	.5731	.6235
3	5.827	26.67	.5956	.6465	.7227	.7862
4	5.189	21.15	.7511	.8152	.9113	.9914
■	4.621	16.77	.9471	1.028	1.149	1.250
6	4.115	13.30	1.194	1.296	1.449	1.576
7	3.665	10.55	1.506	1.634	1.827	1.988
8	3.264	8.366	1.899	2.061	2.304	2.506
9	2.906	6.634	2.395	2.599	2.905	3.161
10	2.588	5.261	3.020	3.277	3.663	3.985
11	2.305	4.172	3.807	4.132	4.619	5.025
12	2.053	3.309	4.801	5.211	5.825	6.337
13	1.828	2.624	6.054	6.571	7.345	7.991
14	1.628	2.081	7.634	8.285	9.262	10.08
15	1.450	1.650	9.627	10.45	11.68	12.71
16	1.291	1.309	12.14	13.17	14.73	16.02
17	1.150	1.038	15.31	16.61	18.57	20.20
18	1.024	0.8231	19.30	20.95	23.42	25.48
19	0.9116	.6527	24.34	26.42	29.53	32.12
20	.8118	.5176	30.69	33.31	37.24	40.51
21	.7230	.4105	38.70	42.00	46.95	51.08
22	.6438	.3255	48.80	52.96	59.21	64.41
23	.5733	.2582	61.54	66.79	74.66	81.22
24	.5106	.2047	77.60	84.21	94.14	102.4
25	.4547	.1624	97.85	106.2	118.7	129.1
26	.4049	.1288	123.4	133.9	149.7	162.9
27	.3606	.1021	155.6	168.9	188.8	205.4
28	.3211	.08098	196.2	212.9	238.0	258.9
29	.2859	.06422	247.4	268.5	300.1	326.5
30	.2546	.05093	311.9	338.6	378.5	411.7
31	.2268	.04039	393.4	426.9	477.2	519.2
32	.2019	.03203	496.0	538.3	601.8	654.7
33	.1798	.02540	625.5	678.8	758.8	825.5
34	.1601	.02014	788.7	856.0	956.9	1041
35	.1426	.01597	994.5	1079	1207	1313
36	.1270	.01267	1254	1361	1522	1655
37	.1131	.01005	1581	1716	1919	2087
38	.1007	.007967	1994	2164	2419	2632
39	.08969	.006318	2514	2729	3051	3319
40	.07987	.005010	3171	3441	3847	4185

* Resistance at the stated temperatures of a wire whose length is 1 kilometer at 20°C.

WIRE TABLE, STANDARD ANNEALED COPPER (Continued)

American Wire Gauge (B. & S.) Metric Units (Continued)

Gauge No.	Diameter in mm at 20°C	Kilograms per kilo-meter	Meters per gram	Meters per ohm*			
				0°C	20°C	50°C	75°C
0000	11.68	953.2	0.001049	6749	6219	5563	5113
000	10.40	755.9	.001323	5352	4932	4412	4055
00	9.266	599.5	.001668	4245	3911	3499	3216
0	8.252	475.4	.002103	3366	3102	2774	2550
1	7.348	377.0	.002652	2669	2460	2200	2022
2	6.544	299.0	.003345	2117	1951	1745	1604
3	5.827	237.1	.004217	1679	1547	1384	1272
4	5.189	188.0	.005318	1331	1227	1097	1009
5	4.621	149.1	.006706	1056	972.9	870.2	799.9
6	4.115	118.2	.008457	837.3	771.5	690.1	634.4
7	3.665	93.78	.01066	664.0	611.8	547.3	503.1
8	3.264	74.37	.01345	526.6	485.2	434.0	399.0
9	2.906	58.98	.01696	417.6	384.8	344.2	316.4
10	2.588	46.77	.02138	331.2	305.1	273.0	250.9
11	2.305	37.09	.02696	262.6	242.0	216.5	199.0
12	2.053	29.42	.03400	208.3	191.9	171.7	157.8
13	1.828	23.33	.04287	165.2	152.2	136.1	125.1
14	1.628	18.50	.05406	131.0	120.7	108.0	99.24
15	1.450	14.67	.06816	103.9	95.71	85.62	78.70
16	1.291	11.63	.08595	82.38	75.90	67.90	62.41
17	1.150	9.226	.1084	65.33	60.20	53.85	49.50
18	1.024	7.317	.1367	51.81	47.74	42.70	39.25
19	0.9116	5.803	.1723	41.09	37.86	33.86	31.13
20	.8118	4.602	.2173	32.58	30.02	26.86	24.69
21	.7230	3.649	.2740	25.84	23.81	21.30	19.58
22	.6438	2.894	.3455	20.49	18.88	16.89	15.53
23	.5733	2.295	.4357	16.25	14.97	13.39	12.31
24	.5106	1.820	.5494	12.89	11.87	10.62	9.764
25	.4547	1.443	.6928	10.22	9.417	8.424	7.743
26	.4049	1.145	.8736	8.105	7.468	6.680	6.141
27	.3606	0.9078	1.102	6.428	5.922	5.298	4.870
28	.3211	.7199	1.389	5.097	4.697	4.201	3.862
29	.2859	.5709	1.752	4.042	3.725	3.332	3.063
30	.2546	.4527	2.209	3.206	2.954	2.642	2.429
31	.2268	.3590	2.785	2.542	2.342	2.095	1.926
32	.2019	.2847	3.512	2.016	1.858	1.662	1.527
33	.1798	.2258	4.429	1.599	1.473	1.318	1.211
34	.1601	.1791	5.584	1.268	1.168	1.045	0.9606
35	.1426	.1420	7.042	1.006	0.9265	0.8288	.7618
36	.1270	.1126	8.879	0.7974	.7347	.6572	.6041
37	.1131	.08931	11.20	.6324	.5827	.5212	.4791
38	.1007	.07083	14.12	.5015	.4621	.4133	.3799
39	.08969	.05617	17.80	.3977	.3664	.3278	.3013
40	.07987	.04454	22.45	.3154	.2906	.2600	.2390

* Length at 20°C of a wire whose resistance is 1 ohm at the stated temperatures.

WIRE TABLE, STANDARD ANNEALED COPPER
(Continued)
American Wire Gauge (B. & S.) Metric Units (Continued)

Gauge No.	Ohms per kilogram			Grams per ohm
	0°C	20°C	50°C	
0000	0.0001554	0.0001687	0.0001886	5928000
000	.0002472	.0002682	.0002999	3728000
00	.0003930	.0004265	.0004768	2344000
0	.0006249	.0006782	.0007582	1474000
1	.0009936	.001078	.001206	927300
2	.001580	.001715	.001917	583200
3	.002512	.002726	.003048	366800
4	.003995	.004335	.004846	230700
5	.006352	.006893	.007706	145100
6	.01010	.01096	.01225	91230
7	.01606	.01743	.01948	57380
8	.02553	.02771	.03098	36080
9	.04060	.04406	.04926	22690
10	.06456	.07007	.07833	14270
11	.1026	.1114	.1245	8976
12	.1632	.1771	.1980	5645
13	.2595	.2817	.3149	3550
14	.4127	.4479	.5007	2233
15	.6562	.7122	.7961	1404
16	1.043	1.132	1.266	883.1
17	1.659	1.801	2.013	555.4
18	2.638	2.863	3.201	349.3
19	4.194	4.552	5.089	219.7
20	6.670	7.238	8.092	138.2
21	10.60	11.51	12.87	86.88
22	16.86	18.30	20.46	54.64
23	26.81	29.10	32.53	34.36
24	42.63	46.27	51.73	21.61
25	67.79	73.57	82.25	13.59
26	107.8	117.0	130.8	8.548
27	171.4	186.0	207.9	5.376
28	272.5	295.8	330.6	3.381
29	433.3	470.3	525.7	2.126
30	689.0	747.8	836.0	1.337
31	1096	1189	1329	0.8410
32	1742	1891	2114	.5289
33	2770	3006	3361	.3326
34	4404	4780	5344	.2092
35	7003	7601	8497	.1316
36	11140	12090	13510	.08274
37	17710	19220	21480	.05204
38	28150	30560	34160	.03273
39	44770	48590	54310	.02058
40	71180	77260	86360	.01294

ALUMINUM WIRE TABLE
Hard-Drawn Aluminum Wire at 20°C (or, 68°F)
American Wire Gauge (B. & S.) English Units

Gauge No.	Diameter in mils	Cross section		Ohms per 1000 ft.	Pounds per 1000 ft.	Pounds per ohm	Feet per ohm
		Circular mils	Square inches				
0000	460	212000	0.166	0.0804	195	2420	12400
000	410	168000	.132	.101	154	1520	9860
00	365	133000	.105	.128	122	957	7820
0	325	106000	.0829	.161	97.0	602	6200
1	289	83700	.0657	.203	76.9	379	4920
2	258	66400	.0521	.256	61.0	238	3900
3	229	52600	.0413	.323	48.4	150	3090
4	204	41700	.0328	.408	38.4	94.2	2450
5	182	33100	.0260	.514	30.4	59.2	1950
6	162	26300	.0206	.648	24.1	37.2	1540
7	144	20800	.0164	.817	19.1	23.4	1220
8	128	16500	.0130	1.03	15.2	14.7	970
9	114	13100	.0103	1.30	12.0	9.26	770
10	102	10400	.00815	1.64	9.55	5.83	610
11	91	8230	.00647	2.07	7.57	3.66	484
12	81	6530	.00513	2.61	6.00	2.30	384
13	72	5180	.00407	3.29	4.76	1.45	304
14	64	4110	.00323	4.14	3.78	0.911	241
15	57	3260	.00256	5.22	2.99	.573	191
16	51	2580	.00203	6.59	2.37	.360	152
17	45	2050	.00161	8.31	1.88	.227	120
18	40	1620	.00128	10.5	1.49	.143	95.5
19	36	1290	.00101	13.2	1.18	.0897	75.7
20	32	1020	.000802	16.7	0.939	.0564	60.0
21	28.5	810	.000636	21.0	.745	.0355	47.6
22	25.3	642	.000505	26.5	.591	.0223	37.8
23	22.6	509	.000400	33.4	.468	.0140	29.9
24	20.1	404	.000317	42.1	.371	.00882	23.7
25	17.9	320	.000252	53.1	.295	.00555	18.8
26	15.9	254	.000200	67.0	.234	.00349	14.9
27	14.2	202	.000158	84.4	.185	.00219	11.8
28	12.6	160	.000126	106.	.147	.00138	9.39
29	11.3	127	.0000995	134.	.117	.000868	7.45
30	10.0	101	.0000789	169.	.0924	.000546	5.91
31	8.9	79.7	.0000626	213.	.0733	.000343	4.68
32	8.0	63.2	.0000496	269.	.0581	.000216	3.72
33	7.1	50.1	.0000394	339.	.0461	.000136	2.95
34	6.3	39.8	.0000312	428.	.0365	.0000854	2.34
35	5.6	31.5	.0000248	540.	.0290	.0000537	1.85
36	5.0	25.0	.0000196	681.	.0230	.0000338	1.47
37	4.5	19.8	.0000156	858.	.0182	.0000212	1.17
38	4.0	15.7	.0000123	1080.	.0145	.0000134	0.924
39	3.5	12.5	.00000979	1360.	.0115	.00000840	.733
40	3.1	9.9	.00000777	1720.	.0091	.00000528	.581

ALUMINUM WIRE TABLE (Continued)
Hard-Drawn Aluminum Wire at 20°C (or, 68°F)
American Wire Gauge (B. & S.) Metric Units

Gauge No.	Diameter in mm	Cross section in mm ²	Ohms per kilo-meter	Kilo-grams per kilo-meter	Grams per ohm	Meters per ohm
0000	11.7	107	0.264	289	1100000	3790
000	10.4	85.0	.333	230	690000	3010
00	9.3	67.4	.419	182	434000	2380
0	8.3	53.5	.529	144	273000	1890
1	7.3	42.4	.667	114	172000	1500
2	6.5	33.6	.841	90.8	108000	1190
3	5.8	26.7	1.06	72.0	67900	943
4	5.2	21.2	1.34	57.1	42700	748
5	4.6	16.8	1.69	45.3	26900	593
6	4.1	13.3	2.13	35.9	16900	470
7	3.7	10.5	2.68	28.5	10600	373
8	3.3	8.37	3.38	22.6	6680	296
9	2.91	6.63	4.26	17.9	4200	235
10	2.59	5.26	5.38	14.2	2640	186
11	2.30	4.17	6.78	11.3	1660	148
12	2.05	3.31	8.55	8.93	1050	117
13	1.83	2.62	10.8	7.08	657	92.8
14	1.63	2.08	13.6	5.62	413	73.6
15	1.45	1.65	17.1	4.46	260	58.4
16	1.29	1.31	21.6	3.53	164	46.3
17	1.15	1.04	27.3	2.80	103	36.7
18	1.02	0.823	34.4	2.22	64.7	29.1
19	0.91	.653	43.3	1.76	40.7	23.1
20	.81	.518	54.6	1.40	25.6	18.3
21	.72	.411	68.9	1.11	16.1	14.5
22	.64	.326	86.9	0.879	10.1	11.5
23	.57	.258	110	.697	6.36	9.13
24	.51	.205	138	.553	4.00	7.24
25	.45	.162	174	.438	2.52	5.74
26	.40	.129	220	.348	1.58	4.55
27	.36	.102	277	.276	0.995	3.61
28	.32	.0810	349	.219	.626	2.86
29	.29	.0642	440	.173	.394	2.27
30	.25	.0509	555	.138	.248	1.80
31	.227	.0404	700	.109	.156	1.43
32	.202	.0320	883	.0865	.0979	1.13
33	.180	.0254	1110	.0686	.0616	0.899
34	.160	.0201	1400	.0544	.0387	.712
35	.143	.0160	1770	.0431	.0244	.565
36	.127	.0127	2230	.0342	.0153	.448
37	.113	.0100	2820	.0271	.00963	.355
38	.101	.0080	3550	.0215	.00606	.282
39	.090	.0063	4480	.0171	.00381	.223
40	.080	.0050	5640	.0135	.00240	.177

CROSS-SECTION AND MASS OF WIRES

U. S. Measure

Diameters are given in mils (1 mil = .001 in.), and area in square mils (1 sq. mil = .000001 sq. in.). For sections and masses for one-tenth the diameters given, divide by 100 and for sections and masses for ten times the diameter multiply by 100.

Diam. in mils	Cross-sec. in sq. mils	Pounds per foot			
		Copper, density 8.90	Iron, density 7.80	Brass, density 8.56	Aluminum, density 2.67
10	78.54	0.000303	0.0002656	0.0002915	0.0000909
11	95.03	0367	03214	03527	01100
12	113.10	0436	03825	04197	01309
13	132.73	0512	04488	04926	01536
14	153.94	0594	05206	05713	01782
15	176.71	0.000682	0.0005976	0.0006558	0.0002045
16	201.06	0776	06799	07461	02327
17	226.98	0876	07675	08423	02627
18	254.47	0982	08605	09443	02946
19	283.53	1094	09588	10522	03282
20	314.16	0.001212	0.001062	0.001166	0.0003636
21	346.36	1336	1171	1285	04009
22	380.13	1467	1286	1411	04400
23	415.48	1603	1405	1542	04809
24	452.39	1746	1530	1679	05237
25	490.87	0.001894	0.001660	0.001822	0.0005682
26	530.93	2046	1795	1970	06147
27	572.56	2209	1936	2125	06628
28	615.75	2376	2082	2285	07127
29	660.52	2549	2234	2451	07646
30	706.86	0.002727	0.002390	0.002623	0.0008182
31	754.77	2912	2552	2801	08737
32	804.25	3103	2720	2985	09309
33	855.30	3300	2892	3174	09900
34	907.92	3503	3070	3369	10509
35	962.11	0.003712	0.003253	0.003570	0.001114
36	1017.88	3927	3442	3777	1178
37	1075.21	4149	3636	3990	1245
38	1134.11	4376	3844	4218	1316
39	1194.59	4609	4040	4433	1383
40	1256.64	0.004849	0.004249	0.004664	0.001455
41	1320.25	5094	4465	4900	1528
42	1385.44	5346	4685	5141	1604
43	1452.20	5603	4911	5389	1681
44	1520.53	5867	5142	5643	1760
45	1590.43	0.006137	0.005378	0.005902	0.001841
46	1661.90	6412	5620	6167	1924
47	1734.94	6694	5867	6438	2008
48	1809.56	6982	6119	6715	2095
49	1885.74	7276	6377	6998	2183
50	1963.50	0.007576	0.006640	0.007287	0.002273
51	2042.82	7882	6908	7581	2365
52	2123.72	8194	7181	7881	2458
53	2206.18	8512	7460	8187	2554
54	2290.22	8837	7744	8499	2651

CROSS-SECTION AND MASS OF WIRES (Continued)

U. S. Measure (Continued)

Diameters are given in mils (1 mil = .001 in.), and area in square mils (1 sq. mil = .000001 sq. in.). For sections and masses for one-tenth the diameters given, divide by 100 and for sections and masses for ten times the diameter multiply by 100.

Diam. in mils	Cross-sec. in sq. mils	Pounds per foot			
		Copper, density 8.90	Iron, density 7.80	Brass, density 8.56	Aluminum, density 2.67
55	2375.83	0.009167	0.008034	0.008817	0.002750
56	2463.01	09504	08329	09140	2851
57	2551.76	09846	08629	09470	2954
58	2642.08	10195	08934	09805	3058
59	2733.97	10549	09245	10146	3165
60	2827.43	0.01091	0.00956	0.01049	0.003273
61	2922.47	1128	0988	1085	3383
62	3019.07	1165	1021	1120	3495
63	3117.25	1203	1054	1157	3608
64	3216.99	1241	1088	1194	3724
65	3318.31	0.01280	0.01122	0.01231	0.003841
66	3421.19	1320	1157	1270	3960
67	3525.65	1360	1192	1308	4081
68	3631.68	1401	1228	1348	4204
69	3739.28	1443	1264	1388	4328
70	3848.45	0.01485	0.01302	0.01429	0.004456
71	3959.19	1528	1339	1469	4583
72	4071.50	1571	1377	1511	4713
73	4185.39	1615	1415	1553	4845
74	4300.84	1660	1454	1596	4978
75	4417.86	0.01705	0.01494	0.01639	0.005114
76	4536.46	1751	1534	1684	5251
77	4656.63	1797	1575	1728	5390
78	4778.36	1844	1616	1773	5531
79	4901.67	1892	1658	1819	5674
80	5026.55	0.01939	0.01700	0.01865	0.005818
81	5153.00	1988	1743	1912	5965
82	5281.02	2038	1786	1960	6113
83	5410.61	2088	1830	2008	6263
84	5541.77	2138	1874	2057	6415
85	5674.50	0.02189	0.01919	0.02106	0.006568
86	5808.80	2241	1964	2156	6724
87	5944.68	2294	2010	2206	6881
88	6082.12	2347	2057	2257	7040
89	6221.14	2400	2104	2309	7201
90	6361.73	0.02455	0.02151	0.02360	0.007364
91	6503.88	2509	2199	2414	7528
92	6647.61	2565	2248	2467	7695
93	6792.91	2621	2297	2521	7863
94	6939.78	2678	2347	2575	8033
95	7088.22	0.02735	0.02397	0.02630	0.008205
96	7238.23	2793	2448	2686	8378
97	7389.81	2851	2499	2742	8554
98	7542.96	2910	2551	2799	8731
99	7697.69	2970	2603	2857	8910
100	7853.98	0.03030	0.02656	0.02915	0.009091

CROSS-SECTION AND MASS OF WIRES (Continued)

Metric Measure

Diameters are given in thousandths of a centimeter and area of section in square thousandths of a centimeter. $1 \text{ (cm/1000)}^2 = .000001 \text{ sq. cm}$
For sections and masses for diameters 1/10 or 10 times those of the table, divide or multiply by 100.

Diam. in thousandths of a cm	Cross-section in square thousandths of a cm	Grams per meter			
		Copper, density 8.90	Iron, density 7.80	Brass, density 8.56	Aluminum, density 2.67
10	78.54	0.06990	0.06126	0.06723	0.02097
11	95.03	.08458	.07412	.08135	.02537
12	113.10	.10065	.08822	.09681	.03020
13	132.73	.11813	.10353	.11362	.03544
14	153.94	.13701	.12008	.13177	.04110
15	176.71	0.1573	0.1378	0.1513	0.04718
16	201.06	.1789	.1568	.1721	.05368
17	226.98	.2020	.1770	.1943	.06060
18	254.47	.2265	.1985	.2178	.06794
19	283.53	.2523	.2212	.2427	.07570
20	314.16	0.2796	0.2450	0.2689	0.08388
21	346.36	.3083	.2702	.2965	.09248
22	380.13	.3383	.2965	.3254	.10149
23	415.48	.3698	.3241	.3557	.11093
24	452.39	.4026	.3529	.3872	.12079
25	490.87	0.4369	0.3829	0.4202	0.1311
26	530.93	.4725	.4141	.4545	.1418
27	572.56	.5096	.4466	.4901	.1529
28	615.75	.5480	.4803	.5271	.1644
29	660.52	.5879	.5152	.5654	.1764
30	706.86	0.6291	0.5514	0.6051	0.1887
31	754.77	.6717	.5887	.6461	.2015
32	804.25	.7158	.6273	.6884	.2147
33	855.30	.7612	.6671	.7321	.2284
34	907.92	.8081	.7082	.7772	.2424
35	962.11	0.856	0.7504	0.8236	0.2569
36	1017.88	.906	.7939	.8713	.2718
37	1075.21	.957	.8387	.9204	.2871
38	1134.11	1.012	.8866	.9730	.3035
39	1194.59	.063	.9318	1.0230	.3190
40	1256.64	1.118	0.980	1.076	0.3355
41	1320.25	.175	1.030	.130	.3525
42	1385.44	.233	.081	.186	.3699
43	1452.20	.292	.133	.243	.3877
44	1520.53	.353	.186	.302	.4060
45	1590.43	1.415	1.241	1.361	0.4246
46	1661.90	.479	.296	.423	.4437
47	1734.94	.544	.353	.485	.4632
48	1809.56	.611	.411	.549	.4832
49	1885.74	.678	.471	.614	.5035
50	1963.50	1.748	1.532	1.681	.5243
51	2042.82	.818	.593	.753	.5454
52	2123.72	.890	.657	.818	.5670
53	2206.18	.964	.721	.888	.5891
54	2290.22	2.038	.786	.960	.6115

CROSS-SECTION AND MASS OF WIRES (Continued)

Metric Measure (Continued)

Diameters are given in thousandths of a centimeter and area of section in square thousandths of a centimeter. $1 \text{ (cm/1000)}^2 = .000001 \text{ sq. cm.}$ For sections and masses for diameters 1/10 or 10 times those of the table, divide or multiply by 100.

Diam. in. thousandths of a cm	Cross-section in square thousandths of a cm	Grams per meter			
		Copper, density 8.90	Iron, density 7.80	Brass, density 8.56	Aluminum, density 2.67
55	2375.83	2.114	1.853	2.034	0.6343
56	2463.01	.192	.921	.108	.6576
57	2551.76	.271	.990	.184	.6813
58	2642.08	.351	2.061	.262	.7054
59	2733.97	.433	.132	.340	.7300
60	2827.43	2.516	2.205	2.420	0.7549
61	2922.47	.601	.280	.502	.7803
62	3019.07	.687	.355	.584	.8061
63	3117.25	.774	.431	.668	.8323
64	3216.99	.863	.509	.760	.8589
65	3318.31	2.953	2.588	2.840	0.8860
66	3421.19	3.045	.669	.929	.9135
67	3525.65	.138	.750	3.018	.9413
68	3631.68	.232	.833	.109	.9697
69	3739.28	.328	.917	.201	.9984
70	3848.45	3.426	3.003	3.295	1.028
71	3959.19	.524	.088	.389	.057
72	4071.50	.624	.176	.485	.087
73	4185.39	.725	.265	.583	.117
74	4300.84	.828	.355	.682	.148
75	4417.86	3.932	3.446	3.782	1.180
76	4536.46	4.037	.538	.883	.211
77	4656.63	.144	.632	.986	.243
78	4778.36	.253	.727	4.090	.276
79	4901.67	.362	.823	.177	.309
80	5026.55	4.474	3.921	4.303	1.342
81	5153.00	.586	4.019	.411	.376
82	5281.02	.700	.119	.521	.410
83	5410.61	.815	.220	.631	.445
84	5541.77	.932	.323	.744	.480
85	5674.50	5.050	4.426	4.857	1.515
86	5808.80	.170	.531	.972	.551
87	5944.68	.291	.637	5.089	.587
88	6082.12	.413	.744	.206	.624
89	6221.14	.537	.852	.325	.661
90	6361.73	5.662	4.962	5.446	1.699
91	6503.88	.788	5.073	.567	.737
92	6647.61	.916	.185	.690	.775
93	6792.91	6.046	.298	.815	.814
94	6939.78	.176	.413	.940	.853
95	7088.22	6.309	5.529	6.068	1.893
96	7238.23	.442	.646	.196	.933
97	7389.81	.577	.764	.326	.973
98	7542.96	.713	.884	.457	2.014
99	7697.69	.851	6.004	.589	.055
100	7853.98	6.990	6.126	6.723	2.097

RESISTANCE OF WIRES

The following table gives the approximate resistance of various metallic conductors. The values have been computed from the resistivities at 20°C, except as otherwise stated, and for the dimensions of wire indicated. Owing to differences in purity in the case of elements and of composition in alloys, the values can be considered only as approximations.

The following dimensions have been adopted in the computations.

B. & S. gauge	Diameter		B. & S. gauge	Diameter	
	mm	mils 1 mil = .001 in.		mm	mils 1 mil = .001 in.
10	2.588	101.9	26	0.4049	15.94
12	2.053	80.81	27	0.3606	14.20
14	1.628	64.08	28	0.3211	12.64
16	1.291	50.82	30	0.2546	10.03
18	1.024	40.30	32	0.2019	7.950
20	0.8118	31.96	34	0.1601	6.305
22	0.6438	25.35	36	0.1270	5.000
24	0.5106	20.10	40	0.07987	3.145

B. & S. No.	Ohms per cm	Ohms per ft.	B. & S. No.	Ohms per cm	Ohms per ft.
Advance (0°C) $\rho = 48. \times 10^{-6}$ ohm cm			Aluminum $\rho = 2.828 \times 10^{-6}$ ohm cm		
10	.000912	.0278	10	.0000538	.00164
12	.00145	.0442	12	.0000855	.00260
14	.00231	.0703	14	.000136	.00414
16	.00367	.112	16	.000216	.00658
18	.00583	.178	18	.000344	.0105
20	.00927	.283	20	.000546	.0167
22	.0147	.449	22	.000869	.0265
24	.0234	.715	24	.00138	.0421
26	.0373	1.14	26	.00220	.0669
27	.0470	1.43	27	.00277	.0844
28	.0593	1.81	28	.00349	.106
30	.0942	2.87	30	.00555	.169
32	.150	4.57	32	.00883	.269
34	.238	7.26	34	.0140	.428
36	.379	11.5	36	.0223	.680
40	.958	29.2	40	.0564	1.72

RESISTANCE OF WIRES (Continued)

B. & S. No.	Ohms per cm	Ohms per ft.	B. & S. No.	Ohms per cm	Ohms per ft.
Brass $\rho = 7.00 \times 10^{-6}$ ohm cm			Climax $\rho = 87. \times 10^{-6}$ ohm cm		
10	.000133	.00406	10	.00165	.0504
12	.000212	.00645	12	.00263	.0801
14	.000336	.0103	14	.00418	.127
16	.000535	.0163	16	.00665	.203
18	.000850	.0259	18	.0106	.322
20	.00135	.0412	20	.0168	.512
22	.00215	.0655	22	.0267	.815
24	.00342	.104	24	.0425	1.30
26	.00543	.166	26	.0675	2.06
27	.00686	.209	27	.0852	2.60
28	.00864	.263	28	.107	3.27
30	.0137	.419	30	.171	5.21
32	.0219	.666	32	.272	8.28
34	.0348	1.06	34	.432	13.2
36	.0552	1.68	36	.687	20.9
40	.140	4.26	40	1.74	52.9
Constantan (0°C) $\rho = 44.1 \times 10^{-6}$ ohm cm			Copper, annealed $\rho = 1.724 \times 10^{-6}$ ohm cm		
10	.000838	.0255	10	.0000328	.000999
12	.00133	.0406	12	.0000521	.00159
14	.00212	.0646	14	.0000828	.00253
16	.00337	.103	16	.000132	.00401
18	.00536	.163	18	.000209	.00638
20	.00852	.260	20	.000333	.0102
22	.0135	.413	22	.000530	.0161
24	.0215	.657	24	.000842	.0257
26	.0342	1.04	26	.00134	.0408
27	.0432	1.32	27	.00169	.0515
28	.0545	1.66	28	.00213	.0649
30	.0866	2.64	30	.00339	.103
32	.138	4.20	32	.00538	.164
34	.219	6.67	34	.00856	.261
36	.348	10.6	36	.0136	.415
40	.880	26.8	40	.0344	1.05
Eureka (0°C) $\rho = 47. \times 10^{-6}$ ohm cm			Excello $\rho = 92. \times 10^{-6}$ ohm cm		
10	.000893	.0272	10	.00175	.0533
12	.00142	.0433	12	.00278	.0847
14	.00226	.0688	14	.00442	.135
16	.00359	.109	16	.00703	.214
18	.00571	.174	18	.0112	.341
20	.00908	.277	20	.0178	.542
22	.0144	.440	22	.0283	.861
24	.0230	.700	24	.0449	1.37
26	.0365	1.11	26	.0714	2.18
27	.0460	1.40	27	.0901	2.75
28	.0580	1.77	28	.114	3.46
30	.0923	2.81	30	.181	5.51
32	.147	4.47	32	.287	8.75
34	.233	7.11	34	.457	13.9
36	.371	11.3	36	.726	22.1
40	.938	28.6	40	1.84	56.0

RESISTANCE OF WIRES (Continued)

B. & S. No.	Ohms per cm	Ohms per ft.	B. & S. No.	Ohms per cm	Ohms per ft.
German silver $\rho = 33. \times 10^{-6}$ ohm cm			Gold $\rho = 2.44 \times 10^{-6}$ ohm cm		
10	.000627	.0191	10	.0000464	.00141
12	.000997	.0304	12	.0000737	.00225
14	.00159	.0483	14	.000117	.00357
16	.00252	.0768	16	.000186	.00568
18	.00401	.122	18	.000296	.00904
20	.00638	.194	20	.000471	.0144
22	.0101	.309	22	.000750	.0228
24	.0161	.491	24	.00119	.0363
26	.0256	.781	26	.00189	.0577
27	.0323	.985	27	.00239	.0728
28	.0408	1.24	28	.00301	.0918
30	.0648	1.97	30	.00479	.146
32	.103	3.14	32	.00762	.232
34	.164	4.99	34	.0121	.369
36	.260	7.94	36	.0193	.587
40	.659	20.1	40	.0487	1.48
Iron $\rho = 10. \times 10^{-6}$ ohm cm			Lead $\rho = 22. \times 10^{-6}$ ohm cm		
10	.000190	.00579	10	.000418	.0127
12	.000302	.00921	12	.000665	.0203
14	.000481	.0146	14	.00106	.0322
16	.000764	.0233	16	.00168	.0512
18	.00121	.0370	18	.00267	.0815
20	.00193	.0589	20	.00425	.130
22	.00307	.0936	22	.00676	.206
24	.00489	.149	24	.0107	.328
26	.00776	.237	26	.0171	.521
27	.00979	.299	27	.0215	.657
28	.0123	.376	28	.0272	.828
30	.0196	.598	30	.0432	1.32
32	.0312	.952	32	.0687	2.09
34	.0497	1.51	34	.109	3.33
36	.0789	2.41	36	.174	5.29
40	.200	6.08	40	.439	13.4
Magnesium $\rho = 4.6 \times 10^{-6}$ ohm cm			Manganin $\rho = 44. \times 10^{-6}$ ohm cm		
10	.0000874	.00267	10	.000836	.0255
12	.000139	.00424	12	.00133	.0406
14	.000221	.00674	14	.00211	.0644
16	.000351	.0107	16	.00336	.102
18	.000559	.0170	18	.00535	.163
20	.000889	.0271	20	.00850	.259
22	.00141	.0431	22	.0135	.412
24	.00225	.0685	24	.0215	.655
26	.00357	.109	26	.0342	1.04
27	.00451	.137	27	.0431	1.31
28	.00568	.173	28	.0543	1.66
30	.00903	.275	30	.0864	2.63
32	.0144	.438	32	.137	4.19
34	.0228	.696	34	.218	6.66
36	.0363	1.11	36	.347	10.6
40	.0918	2.80	40	.878	26.8

RESISTANCE OF WIRES (Continued)

B. & S. No.	Ohms per cm	Ohms per ft.	B. & S. No.	Ohms per cm	Ohms per ft.
Molybdenum $\rho = 5.7 \times 10^{-6}$ ohm cm			Monel Metal $\rho = 42. \times 10^{-6}$ ohm cm		
10	.000108	.00330	10	.000798	.0243
12	.000172	.00525	12	.00127	.0387
14	.000274	.00835	14	.00202	.0615
16	.000435	.0133	16	.00321	.0978
18	.000693	.0211	18	.00510	.156
20	.00110	.0336	20	.00811	.247
22	.00175	.0534	22	.0129	.393
24	.00278	.0849	24	.0205	.625
26	.00443	.135	26	.0326	.994
27	.00558	.170	27	.0411	1.25
28	.00704	.215	28	.0519	1.58
30	.0112	.341	30	.0825	2.51
32	.0178	.542	32	.131	4.00
34	.0283	.863	34	.209	6.36
36	.0450	1.37	36	.331	10.1
40	.114	3.47	40	.838	25.6
Nichrome $\rho = 100. \times 10^{-6}$ ohm cm			Nickel $\rho = 7.8 \times 10^{-6}$ ohm cm		
10	.00190	.0579	10	.000148	.00452
12	.00302	.0921	12	.000236	.00718
14	.00481	.146	14	.000375	.0114
16	.00764	.233	16	.000596	.0182
18	.0121	.370	18	.000948	.0289
20	.0193	.589	20	.00151	.0459
22	.0307	.936	22	.00240	.0730
24	.0489	1.49	24	.00381	.116
26	.0776	2.37	26	.00606	.185
27	.0979	2.99	27	.00764	.233
28	.123	3.76	28	.00963	.294
30	.196	5.98	30	.0153	.467
32	.312	9.52	32	.0244	.742
34	.497	15.1	34	.0387	1.18
36	.789	24.1	36	.0616	1.88
40	2.00	60.8	40	.156	4.75
Platinum $\rho = 10. \times 10^{-6}$ ohm cm			Silver (18°C) $\rho = 1.629 \times 10^{-6}$ ohm cm		
10	.000190	.00579	10	.0000310	.000944
12	.000302	.00921	12	.0000492	.00150
14	.000481	.0146	14	.0000783	.00239
16	.000764	.0233	16	.000124	.00379
18	.00121	.0370	18	.000198	.00603
20	.00193	.0589	20	.000315	.00959
22	.00307	.0936	22	.000500	.0153
24	.00489	.149	24	.000796	.0243
26	.00776	.237	26	.00126	.0386
27	.00979	.299	27	.00160	.0486
28	.0123	.376	28	.00201	.0613
30	.0196	.598	30	.00320	.0975
32	.0312	.952	32	.00509	.155
34	.0497	1.51	34	.00809	.247
36	.0789	2.41	36	.0129	.392
40	.200	6.08	40	.0325	.991

RESISTANCE OF WIRES (Continued)

B. & S. No.	Ohms per cm	Ohms per ft.	B. & S. No.	Ohms per cm	Ohms per ft.
Steel, piano wire (0°C) $\rho = 11.8 \times 10^{-6}$ ohm cm			Steel, invar (35 % Ni) $\rho = 81. \times 10^{-6}$ ohm cm		
10	.000224	.00684	10	.00154	.0469
12	.000357	.0109	12	.00245	.0746
14	.000567	.0173	14	.00389	.119
16	.000901	.0275	16	.00619	.189
18	.00143	.0437	18	.00984	.300
20	.00228	.0695	20	.0156	.477
22	.00363	.110	22	.0249	.758
24	.00576	.176	24	.0396	1.21
26	.00916	.279	26	.0629	1.92
27	.0116	.352	27	.0793	2.42
28	.0146	.444	28	.100	3.05
30	.0232	.706	30	.159	4.85
32	.0368	1.12	32	.253	7.71
34	.0586	1.79	34	.402	12.3
36	.0931	2.84	36	.639	19.5
40	.236	7.18	40	1.62	49.3
Tantalum $\rho = 15.5 \times 10^{-6}$ ohm cm			Tin $\rho = 11.5 \times 10^{-6}$ ohm cm		
10	.000295	.00898	10	.000219	.00666
12	.000468	.0143	12	.000348	.0106
14	.000745	.0227	14	.000553	.0168
16	.00118	.0361	16	.000879	.0268
18	.00188	.0574	18	.00140	.0426
20	.00299	.0913	20	.00222	.0677
22	.00476	.145	22	.00353	.108
24	.00757	.231	24	.00562	.171
26	.0120	.367	26	.00893	.272
27	.0152	.463	27	.0113	.343
28	.0191	.583	28	.0142	.433
30	.0304	.928	30	.0226	.688
32	.0484	1.47	32	.0359	1.09
34	.0770	2.35	34	.0571	1.74
36	.122	3.73	36	.0908	2.77
40	.309	9.43	40	.230	7.00
Tungsten $\rho = 5.51 \times 10^{-6}$ ohm cm			Zinc (0°C) $\rho = 5.75 \times 10^{-6}$ ohm cm		
10	.000105	.00319	10	.000109	.00333
12	.000167	.00508	12	.000174	.00530
14	.000265	.00807	14	.000276	.00842
16	.000421	.0128	16	.000439	.0134
18	.000669	.0204	18	.000699	.0213
20	.00106	.0324	20	.00111	.0339
22	.00169	.0516	22	.00177	.0538
24	.00269	.0820	24	.00281	.0856
26	.00428	.130	26	.00446	.136
27	.00540	.164	27	.00563	.172
28	.00680	.207	28	.00710	.216
30	.0108	.330	30	.0113	.344
32	.0172	.524	32	.0180	.547
34	.0274	.834	34	.0286	.870
36	.0435	1.33	36	.0454	1.38
40	.110	3.35	40	.115	3.50

FUSING CURRENTS FOR WIRES

Owing to the influence of various factors which control the rate of loss of heat energy the following values can be considered only as approximations.

Gauge No. A.W.G.	Diameter inches	Fusing current in amp.			
		Cu	Al	Fe	Fuse wire
43	0.0021	1	...	...	...
41	.0026	...	1	...	...
39	.0035	2	...	...	...
38	.0040	...	2	...	...
37	.0045	3	...	1	...
35	.0056	4	3	...	...
34	.0063	5	4	...	...
33	.0071	...	...	2	...
32	.0080	...	5	...	...
30	.0100	10	...	3	1.7
28	.0126	15	10	...	...
27	.0142	...	...	5	...
26	.0159	20	15	...	...
25	.0179	25	...	...	...
24	.0201	30	20	10	4.9
23	.0226	35	25	...	...
22	.0253	40	30	...	...
21	.0285	45	35	15	...
20	.032	60	40	...	9.0
19	.036	70	50	20	11.3
18	.040	80	60	25	13.3
17	.045	100	70	30	...
16	.051	120	90	35	19.8
15	.057	140	100	45	...
14	.064	160	120	50	25.4
13	.072	200	160	60	32
12	.081	225	180	70	39.1
11	.091	275	200	90	...
10	.102	...	225	100	54.1
9	.114	...	275	120	63.1
8	.128	...	...	140	81.1
7	.144	...	...	160	90.6
6	.162	...	...	200	110.7
5	.182	...	...	225	132.1
4	.204	...	...	275	154.7

FUNDAMENTAL DATA RELATING TO SIEVES OF THE STANDARD SCREEN SCALE

From "Report of Committee on Standards," A.C.S. Year Book, 1921-1922

DATA FOR SIEVES

Sieve No.	Sieve opening, millimeters	Sieve opening, inches	Wire diameter, millimeters	Wire diameter, inches	Tolerance in average opening, per cent	Tolerance in wire diameter, per cent	Tolerance in maximum opening, per cent	Mesh per cm.	Mesh per inch
2½	8.00	0.315	1.85	0.073	1	5	10	1	2.6
3	6.72	0.265	1.65	0.065	1	5	10	1.2	3.0
3½	5.66	0.223	1.45	0.057	1	5	10	1.4	3.6
4	4.76	0.187	1.27	0.050	1	5	10	1.7	4.2
5	4.00	0.157	1.12	0.044	1	5	10	2	5.0
6	3.35	0.132	1.02	0.040	1	5	10	2.3	5.8
7	2.83	0.111	0.92	0.036	1	5	10	2.7	6.8
8	2.38	0.094	0.84	0.033	2	5	10	3	7.9
10	2.00	0.079	0.76	0.030	2	5	10	3.5	9.2
12	1.68	0.066	0.69	0.027	2	5	10	4	10.8
14	1.41	0.0557	0.61	0.024	2	5	10	5	12.5
16	1.19	0.0468	0.54	0.021	2	5	10	6	14.7
18	1.00	0.0394	0.48	0.0187	2	5	10	7	17.2
20	0.84	0.0331	0.42	0.0165	3	5	25	8	20.2
25	0.71	0.0278	0.37	0.0146	3	5	25	9	23.6
30	0.59	0.0234	0.33	0.0129	3	5	25	11	27.5
35	0.50	0.0197	0.29	0.0113	3	5	25	13	32.3
40	0.42	0.0166	0.25	0.0098	3	5	25	15	37.9
45	0.35	0.0139	0.22	0.0085	3	5	25	18	44.7
50	0.30	0.0117	0.188	0.0074	4	10	40	20	52.4
60	0.25	0.0098	0.162	0.0064	4	10	40	24	61.7
70	0.21	0.0083	0.140	0.0055	4	10	40	29	72.5
80	0.177	0.0070	0.119	0.0047	4	10	40	34	85.5
100	0.149	0.0059	0.102	0.0040	4	10	40	47	120
120	0.125	0.0049	0.086	0.0034	4	10	40	56	143
140	0.105	0.0041	0.074	0.0029	5	15	60	66	167
170	0.088	0.0035	0.063	0.0025	5	15	60	79	200
200	0.074	0.0029	0.053	0.0021	5	15	60	93	233
230	0.062	0.0025	0.046	0.0018	5	15	60	106	270
270	0.053	0.0021	0.041	0.0016	5	15	60	125	323
325	0.044	0.0017	0.036	0.0014	5	15	60		

GRAVITY, LATITUDE, LONGITUDE

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION

Station		Latitude, °	Longitude, °	Elevation, meters	g cm./sec ²
UNITED STATES Alaska	Fort Egbert, Eagle City.....	64	47 4	269	982.183
	Percy Islands, S. E. Alaska....	54	55.8	4	981.524
	Point Young, S. E. Alaska....	58	11.5	7	981.757
	Quiet Harbor, S. E. Alaska....	56	14.1	4	981.624
	St. Michael.....	63	28.5	1	982.192
Arizona	St. Paul Island.....	57	7 3	10	981.726
	Yavapai.....	36	3 9	2179	979.192
	Little Rock.....	34	45.0	89	979.721
	Mount Hamilton.....	37	20.4	1282	979.660
	San Francisco.....	37	47.5	114	979.965
California	Colorado Springs.....	38	50.7	1841	979.490
	Denver.....	39	40.6	1638	979.609
	Hartford.....	41	44.8	37	980.336
Connecticut	Dover.....	39	9 7	12	980.099
	Washington { B.S.....	38	56.3	103	980.095
	Washington { U.S.C. and G.S....	38	53.2	14	980.112
District of Columbia	Apalachicola.....	29	43.5	4	979.322
	Key West.....	24	33.6	1	978.970
	Atlanta.....	33	45.0	324	979.524
Florida	Boise.....	43	37.2	116	980.212
	Sandpoint.....	48	16.4	637	980.680
	Chicago.....	41	47.4	182	980.278
Georgia	Springfield.....	39	47.7	183	980.089
	Indianapolis.....	39	45.9	217	980.090
	Terre Haute.....	39	28.7	151	980.072
Illinois	New Orleans.....	29	57.0	2	979.324
	Calais.....	45	11.2	38	980.631
	Baltimore.....	39	17.8	30	980.097
Indiana	Cambridge.....	42	22.8	14	980.398
	Worcester.....	42	16.5	170	980.324
	Minneapolis.....	44	58.7	256	980.597
Louisiana	Kansas City.....	39	5.8	278	979.990
	St. Louis.....	38	38.0	154	980.001

GRAVITY, LATITUDE, LONGITUDE (Continued)

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Cont.)					
Station		Latitude, °	Longitude, °	Elevation, meters	g cm./sec. ²
UNITED STATES (Continued)					
Montana	Hinsdale.....	48	23.8	661	980.739
Nevada	Goldfield.....	37	42.2	1716	979.456
New Hampshire	Lancaster.....	44	29.5	261	980.486
New Jersey	Hoboken.....	40	44	11	980.269
	Princeton.....	40	21.0	64	980.178
New Mexico	Las Vegas.....	35	35.8	1960	979.204
New York	Albany.....	42	39.1	61	980.344
	Ithaca.....	42	27.1	76	980.300
	New York.....	40	48.5	38	980.267
North Carolina	Potsdam.....	44	40.1	130	980.571
	Asheville.....	35	35.9	82	979.603
North Dakota	Wilmingon.....	34	14.2	77	979.663
	Bismarck.....	46	48.5	100	980.625
Ohio	Pembina.....	48	58.1	97	980.917
	Cincinnati.....	39	8.3	243	980.004
Oregon	Cleveland.....	41	30.4	81	980.241
Pennsylvania	Portland.....	45	31.4	122	980.646
	Philadelphia.....	39	57.1	75	980.196
	Pittsburgh.....	40	27.4	80	980.118
South Carolina	State College.....	40	47.9	77	980.124
South Dakota	Charleston.....	32	47.2	79	979.546
Texas	Pierre.....	44	21.9	100	980.427
	Austin.....	30	17.2	97	979.283
	El Paso.....	31	46.3	106	979.124
	Galveston.....	29	18.2	94	979.272
Utah	Georgetown.....	30	38.0	97	979.298
Virginia	Point Isabel.....	26	4.7	12	979.076
	Salt Lake City.....	40	46.1	111	979.803
Washington	Charlottesville.....	38	2.0	78	979.938
West Virginia	Richmond.....	37	32.2	77	979.960
Wisconsin	Seattle.....	47	39.6	122	980.733
	Charleston.....	38	20.9	81	979.936
Wyoming	Madison.....	43	4.6	89	980.365
	Norris Geyser Basin.....	44	44.2	110	979.950

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Cont.)

Station		Latitude, °	Longitude, °	Elevation, meters	g cm/sec ²
CANADA	Alberta				
British Columbia	Banff.....	51	10.9	1376	980.753
	Calgary.....	51	2.7	1044	980.823
	Chipewyan.....	58	42.7	229	981.723
	Peace River.....	56	14.1	324	981.482
	Liard River.....	59	58.7	160	981.790
	Revelstoke.....	50	59.8	453	980.903
	Vancouver.....	49	16.8	6	980.949
	Winnipeg.....	49	54.4	231	980.990
	St. John.....	45	16.0	33	980.663
	Woodstock.....	46	9.0	56	980.699
Northwest Territory	Arctic Red River.....	67	34.5	41	982.434
	Good Hope.....	66	26.6	41	982.340
	Norman.....	64	15.3	59	982.214
	Providence.....	61	54.0	87	981.955
	Resolution.....	61	21.2	156	981.942
	Simpson.....	61	10.1	152	982.004
	Halifax.....	44	51.6	132	980.574
	Sydney.....	46	40.8	9	980.731
	Kenora.....	49	8.4	12	980.974
	Kingston.....	44	46.0	330	980.530
Prince Edward Island Quebec Saskatchewan	Ottawa.....	45	14.6	79	980.618
	Port Arthur.....	48	23.6	83	980.820
	Sault Ste. Marie.....	46	26.0	189	980.680
	Woodstock.....	43	30.4	186	980.352
	Charlottetown.....	43	47.0	299	980.733
	St. Jérôme.....	46	8.6	8	980.681
	Moose Jaw.....	45	13.9	73	980.943
		45	46.6	107	
		50	23.4	541	

Station		Latitude, °	Longitude, °	Elevation, meters	g cm./sec. ²
CENTRAL AND SOUTH AMERICA					
Argentina	Rahía Blanca.....	38	47.1 S.		980.061
	Buenos Aires.....	34	36.5 S.	2	979.669
Brazil	Rahia.....	12	58.5 S.	4	978.331
Canal Zone	Panama.....	8	54.9	6	978.243
Chile	Valdivia.....	39	53.4 S.	10	979.920
	Valparaiso.....	33	1.8 S.	60	979.609
Peru	Callao.....	12	4.1 S.	1	978.375
Salvador	Acajutla.....	13	34.7	12	978.303
Uruguay	Montevideo.....	34	54.5 S.	4	979.772
EUROPE					
Austria	Vienna.....	48	12.7	183	980.860
Belgium	Brussels.....	50	51.0	102	981.112
Denmark	Copenhagen.....	55	41.2	14	981.559
England	Greenwich.....	51	28.6	0	981.188
Finland	Helsinki.....	60	9.7	29	981.912
France	Paris.....	48	50.2	61	980.943
	Königsberg.....	54	42.8	22	981.477
Germany	Leipzig.....	51	20.1	115	981.180
	Munich.....	48	8.7	525	980.733
Hungary	Budapest.....	47	29.5	108	980.852
Italy	Milan.....	45	28.0	141	980.569
	Rome.....	41	53.5	49	980.367
Netherlands	Amsterdam.....	52	21.9	0	981.288
Norway	Bergen.....	60	23.9	38	981.922
Portugal	Lisbon.....	38	42.5	75	980.088
Roumania	Bucharest.....	44	24.6	83	980.553
Russia and Siberia	Archangel.....	64	34	5	982.278
	Leningrad.....	59	56.5	3	981.929
	Odesa.....	46	26.4	43	980.769
Scotland	Glasgow.....	55	51.5	61	981.605
Spain	Barcelona.....	41	25.0	407	980.240

GRAVITY, LATITUDE, LONGITUDE (Continued)

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Cont.)

Station		Latitude, °	Longitude, °	Elevation, meters	g cm./sec. ²
Europe (Continued)					
Sweden	Stockholm	59	20.6	45	981.843
Switzerland	Geneva	46	12.0	402	980.592
ASIA					
China	Hongkong	22	18.2	33	978.771
India	Madras	13	4.1	6	978.281
Japan	Tokyo	35	42.6	18	979.801
Spain	Bankok	13	43.9	7	978.278
AFRICA					
Algeria	Algiers	36	44.8	213	979.905
Egypt and Anglo-Egyptian	Khartum	15	36.6	383	978.308
Sudan	Monrovia	6	19.0	41	978.165
Liberia	Suez	29	56.0	3	979.307
Red Sea	Cape Town	33	56.18	11	979.657
Union of South Africa	Melbourne	37	49.98	26	979.987
AUSTRALIA					
OCEANIC					
<i>Atlantic Ocean and Mediterranean Sea</i>					
Azores	Ponta Delgada	37	43.8	4	980.143
Bermuda	St. George	32	21	2	979.806
Canary Islands	Las Palmas	28	7.0	8	979.385
Greenland	Karajak Glacier	70	26.9	20	982.534
Iceland	Reykjavik	64	8.5	39	982.273
Jamaica	Kingston	17	57.7	2	978.591
<i>Pacific and Indian Oceans</i>					
Java	Batavia	6	11.08	7	978.178
New Zealand	Auckland	36	50.98	3	979.962
Philippines	Manila	14	34.7	3	978.360
Territory of Hawaii	Honolulu	21	18.1	6	978.946

ACCELERATION DUE TO GRAVITY AND LENGTH OF THE SECONDS PENDULUM

FOR SEA LEVEL AT VARIOUS LATITUDES

Based on the formula of the U. S. Coast and Geodetic Survey. The length of the simple pendulum whose period is two seconds, that is which beats seconds, is computed in each case from the corresponding value of the acceleration.

Latitude °	Acceleration due to gravity		Length of seconds pendulum	
	cm/sec. ²	ft./sec. ²	cm	in.
0	978.039	32.0878	99.0961	39.0141
5	978.078	32.0891	99.1000	39.0157
10	978.195	32.0929	99.1119	39.0204
15	978.384	32.0991	99.1310	39.0279
20	978.641	32.1076	99.1571	39.0382
25	978.960	32.1180	99.1894	39.0509
30	979.329	32.1302	99.2268	39.0656
31	979.407	32.1327		
32	979.487	32.1353		
33	979.569	32.1380		
34	979.652	32.1407		
35	979.737	32.1435	99.2681	39.0819
36	979.822	32.1463		
37	979.908	32.1491		
38	979.995	32.1520		
39	980.083	32.1549		
40	980.171	32.1578	99.3121	39.0992
41	980.261	32.1607		
42	980.350	32.1636		
43	980.440	32.1666		
44	980.531	32.1696		
45	980.621	32.1725	99.3577	39.1171
46	980.711	32.1755		
47	980.802	32.1785		
48	980.892	32.1814		
49	980.981	32.1844		
50	981.071	32.1873	99.4033	39.1351
51	981.159	32.1902		
52	981.247	32.1931		
53	981.336	32.1960		
54	981.422	32.1988		
55	981.507	32.2016	99.4475	39.1525
56	981.592	32.2044		
57	981.675	32.2071		
58	981.757	32.2098		
59	981.839	32.2125		
60	981.918	32.2151	99.4891	39.1689
65	982.288	32.2272	99.5266	39.1836
70	982.608	32.2377	99.5590	39.1964
75	982.868	32.2463	99.5854	39.2068
80	983.059	32.2525	99.6047	39.2144
85	983.178	32.2564	99.6168	39.2191
90	983.217	32.2577	99.6207	39.2207

ACCELERATION DUE TO GRAVITY

FREE AIR CORRECTION FOR ALTITUDE

-0.0003086 cm/sec.²/m for altitude in meters.
 -0.000003086 ft./sec.²/ft. for altitude in feet.

Altitude meters	Correction cm/sec. ²	Altitude feet	Correction ft./sec. ²
200	-0.0617	200	-0.000617
300	.0926	300	.000926
400	.1234	400	.001234
500	.1543	500	.001543
600	.1852	600	.001852
700	.2160	700	.002160
800	.2469	800	.002469
900	.2777	900	.002777

DATA IN REGARD TO THE EARTH

Equatorial radius, 6,378.388 meters, 3,963.34 miles.
 Polar radius, 6,356.911.946 meters, 3,949.99 miles.
 Radius of sphere having same volume, 6,371,221.3 meters, 3,958.89 miles.
 Quadrant of the equator, 10,019,148.4 meters, 6,225.60 miles.
 Quadrant of the meridian, 10,002,288.3 meters, 6,215.12 miles.
 1° latitude at the equator = 68.70 miles.
 1° latitude at the pole = 69.41 miles.
 Mean density of the earth, 5.522 g/cm³, 344.7 lb./ft.³
 Mass of the earth, 5.983×10^{24} kg, 6.595×10^{21} tons.
 Mean surface density of the continents, 2.67 g/cm³, 166.7 lb./ft.³
 Mean linear velocity of the earth in its orbit, 29.77 km/sec., 18.50 mi./sec.
 Mean linear velocity of rotation of the surface at the equator, 0.465 km/sec., 0.289 mi./sec.
 Land area, 148.847×10^6 km², 57.470×10^6 sq. mi.
 Ocean area, 361.254×10^6 km², 139.480×10^6 sq. mi.
 Highest mountain, Everest, 8840 meters, 29,003 ft.
 Greatest sea depth, 10,430 meters, 34,219 ft.
 Thermal gradient of the earth, higher at increasing depths, 30° C per km, 48° C per mi. (uncertain).
 Mean distance to the sun, 149,500,000 km or 92,900,000 mi.
 Mean distance to the moon, 384,393 km or 238,854 mi.

Chemical Composition of the Earth's Crust, Ocean and Atmosphere

Arranged in order of abundance

Element	%	Element	%
O	46.43	P	0.130
Si	27.77	H	.127
Al	8.14	Mn	.096
Fe	5.12	F	.077
Ca	3.63	Cl	.055
Na	2.85	S	.052
K	2.60	Ba	.048
Mg	2.09	C	.027
Ti	0.629	Sr	.018
		Total of all others	.111

Velocity of Seismic Waves

Depth km	Longitudinal or condensational km/sec.	Transverse or distortional km/sec.
0-20	5.4 -5.6	3.2
20-45	6.25-6.75	3.5
1300	12.5	6.9
2400	13.5	7.5

DATA CONCERNING THE SOLAR SYSTEM

Body	Mass Earth = 1	Distance from Sun		Sidereal period, days	Mean specific gravity
		km	miles		
Sun	329390.				1.42
Mercury	0.0549	58×10^6	36.0×10^6	87.97	5.61
Venus	0.8073	108×10^6	67.1×10^6	244.70	5.16
Earth	1.000	149×10^6	92.9×10^6	365.26	5.52
Mars	0.1065	228×10^6	141.7×10^6	686.98	3.95
Jupiter	314.5	778×10^6	483.4×10^6	4332.59	1.34
Saturn	94.07	1426×10^6	886.1×10^6	10759.20	0.69
Uranus	14.40	2869×10^6	1782.7×10^6	30685.93	1.36
Neptune	16.72	4495×10^6	2793.1×10^6	60187.64	1.30
Pluto	.....	5900×10^6	3666.1×10^6	90885.	.....
Moon	0.01228	$*38 \times 10^4$	$*23.9 \times 10^4$	27.32	3.36

Body	Diameter		Acceleration due to gravity at surface		Albedo visual
	km	miles	cm/sec. ²	ft./sec. ²	
Sun	1390600	864100	27440	900.3	.....
Mercury	5140	3194	392	12.9	0.069
Venus	12620	7842	882	28.9	.59
Earth	12756	7926	980	32.2	.....
Mars	6860	4263	392	12.9	.154
Jupiter	143600	89229	2646	86.8	.56
Saturn	120600	74937	1176	38.6	.63
Uranus	53400	33181	980	32.2	.63
Neptune	49700	30882	980	32.2	.73
Moon	3476	2159.9	167	5.47	.073

ATMOSPHERIC AND METEOROLOGICAL DATA

Total mass of the atmosphere, estimated by Ekholm, 5.2×10^{21} g, 11.4×10^{18} pounds, 5.70×10^{15} tons.

Evidence of extent: twilight, 63 km, 39 mi.; meteors, 200 km, 124 mi.; aurora 44-360 km, 27-224 mi.

Height if homogeneous at normal atmospheric pressure, 7991 m, 4.965 mi.

Composition of the atmosphere, mean percentage by volume, at sea level. of the dry air components.

N ₂	78.03	H ₂	0.01
O ₂	20.99	Ne	0.0012
A	0.94	He	0.0004
CO ₂	0.03		

* Distance to Earth.

Variation of Composition of the Atmosphere with Elevation. Percentage Distribution by Volume.

(Humphreys)

Km	Mi.	A	N	H ₂ O	O	CO ₂	H	He
100	62	....	2.95	0.05	0.11	....	95.58	1.31
50	31	0.12	86.78	0.10	10.17	....	2.76	0.07
20	12	0.59	81.24	0.02	18.10	0.01	0.04	....
11	6.8	0.94	78.02	0.01	20.99	0.03	0.01	....

Variation of Temperature, Pressure and Density of the Atmosphere with Altitude

Compiled by Humphreys

Elevation		Summer			Winter		
Km	Mi.	Temp. °C	Pres- sure mm of Hg.	Density, dry air g/cm ³	Temp. °C	Pres- sure mm of Hg.	Density, dry air g/cm ³
20.0	12.4	-51.0	44.1	0.000092	-57.0	39.5	0.000085
19.0	11.8	-51.0	51.5	.000108	-57.0	46.3	.000100
18.0	11.2	-51.0	60.0	.000126	-57.0	54.2	.000117
17.0	10.6	-51.0	70.0	.000146	-57.0	63.5	.000137
16.0	9.9	-51.0	81.7	.000171	-57.0	74.0	.000160
15.0	9.3	-51.0	95.3	.000199	-57.0	87.1	.000187
14.0	8.7	-51.0	111.1	.000232	-57.0	102.1	.000220
13.0	8.1	-51.0	129.6	.000270	-57.0	119.5	.000257
12.0	7.5	-51.0	151.2	.000316	-57.0	140.0	.000301
11.0	6.8	-49.5	176.2	.000366	-57.0	164.0	.000353
10.0	6.2	-45.5	205.1	.000419	-54.5	192.0	.000408
9.0	5.6	-37.8	237.8	.000470	-49.5	224.1	.000466
8.0	5.0	-29.7	274.3	.000524	-43.0	260.6	.000526
7.0	4.3	-22.1	314.9	.000583	-35.4	301.6	.000590
6.0	3.7	-15.1	360.2	.000649	-28.1	347.5	.000659
5.0	3.1	- 8.9	410.6	.000722	-21.2	398.7	.000735
4.0	2.5	- 3.0	466.6	.000803	-15.0	455.9	.000821
3.0	1.9	+ 2.4	528.9	.000892	- 9.3	519.7	.000915
2.5	1.6	+ 5.0	562.5	.000942	- 6.7	554.3	.000967
2.0	1.2	+ 7.5	598.0	.000990	- 4.7	590.8	.001023
1.5	0.9	+10.0	635.4	.001043	- 3.0	629.6	.001083
1.0	0.6	+12.0	674.8	.001100	- 1.3	670.6	.001146
0.5	0.3	+14.5	716.3	.001157	0.0	714.0	.001215
0.0	0.0	+15.7	760.0	.001223	+ 0.7	760.0	.001290

Atmospheric Electricity

Normal potential gradient:

Over land, 67 to 317 volts/m.

Over sea, 128 volts/m.

Potential gradient at Earth's surface beneath thunder cloud, 1×10^4 volts/m.

Quantity discharged by lightning flash, 10-50 coulombs.

Energy of flash, 1×10^{17} ergs.

Potential difference between discharge points, 1×10^9 volts.

Angular Radius of Halos and Rainbows

Coronae due to small water drops..... 1° to 10°

Small halo, due to 60° angles of ice crystals..... 22°

Large halo, due to 90° angles of ice crystals..... 46°

Rainbow, primary..... $41^\circ 20'$

Rainbow, secondary..... $52^\circ 15'$

Solar Constant

The energy falling on one sq. cm area at normal incidence equals 1.92 small calories per minute.

MOLECULAR CONSTANTS

The following gives the arithmetical average velocity, the mean free path, molecular diameter and collision frequency for the temperatures indicated and at standard pressure, 760 mm Hg. except as otherwise stated.

Gas	Average velocity in cm/sec.		Mean free path in cm at 75 cm Hg.		
	0° C	20° C	Boltzmann		Meyer
			0° C	20° C	20° C
Air.....	447×10^2	463×10^2			
Ammonia.....	583	604	5.92×10^{-6}	6.60×10^{-6}	5.83×10^{-6}
Argon.....	381	395	8.98	9.88	8.73
Carbon monoxide.....	454	471	8.46	9.23	8.16
Carbon dioxide.....	362	376	5.56	6.15	5.44
Helium.....	1208	1252	25.25	27.45	33.10
Hydrogen.....	1696	1755	16.00	17.44	15.40
Krypton.....	263	272	9.5		
Mercury.....	170	176		(14.70)	(13.0)
Neon.....	538	557			
Nitrogen.....	454	471	8.50	9.29	8.21
Oxygen.....	425	440	9.05	9.93	8.78
Water vapor.....	566	587			
Xenon.....	210	218	5.6		

Gas	Collision frequency 20° C	Molecular diameter, cm		
		From viscosity	From van der Waal's equation	From heat conductivity
Ammonia.....	9150×10^6	2.97×10^{-8}	3.08×10^{-8}	
Argon.....	4000	2.88	2.94	2.86×10^{-8}
Carbon monoxide.....	5100	3.19	3.12	
Carbon dioxide.....	6120	3.34	3.23	3.40
Helium.....	4540	1.90	2.65	2.30
Hydrogen.....	10060	2.40	2.34	2.32
Krypton.....			(3.69)	3.14
Mercury.....			3.01	
Nitrogen.....	5070	3.15	3.15	3.53
Oxygen.....	4430	2.98	2.92	
Xenon.....			4.02	3.42

EFFECTIVE RADII OF ATOMS

Values given have been computed by Goldschmidt on the basis of empirical assumptions or by Pauling on the basis of wave-mechanics. The latter values are in bold-faced type. Values considered non-typical are in parenthesis.

Condensed from a compilation by Wherry, American Mineralog **14**, 54, 1929.

Element	Charge	Radius Angstrom	Element	Charge	Radius Angstrom
A	0	(1.54)	Cd	0	1.49
Ag	0	1.44		+2	0.97
	+1	1.13			1.03
		1.26	Ce	0	1.82
Al	0	1.43			1.83
	+3	0.50		+3	1.18
		0.57		+4	1.01
As	0	1.16			1.02
	+3	0.69	Cl	0	1.05
	+5	0.47			1.07
	-3	2.22		+7	0.26
Au	0	1.40		-1	1.81
		1.44	Co	0	1.26
	+1	1.37		+2	0.72
B	+3	0.20			0.82
Ba	0	2.10		+3	0.29
	+2	1.35			0.47
		1.43	Cr	0	1.25
Be	0	1.05		+6	0.52
	+2	0.31			0.65
		0.34	Cs	0	2.55
Bi	0	1.46		+1	1.65
	+5	0.74			1.69
Br	0	1.19	Cu	0	1.27
	+7	0.39		+1	0.96
	-1	1.95		+2	0.70
		1.96	Dy	+3	1.07
C	0	0.77	Er	+3	1.04
	+4	0.15	Eu	+3	1.13
	-4	2.60	F	0	0.67
Ca	0	1.97		+7	0.07
	+2	0.99		-1	1.33
		1.06			1.36
Cb	0	1.43	Fe	0	1.26
	+4	0.67		+2	0.75
		0.69			0.83
	+5	0.69		+3	0.67
		0.70			

EFFECTIVE RADII OF ATOMS (Continued)

Element	Charge	Radius Angstrom	Element	Charge	Radius Angstrom
Ga	0	1.33	Mn	0	1.29
	+3	0.62		+2	0.80
Gd	+3	1.11			0.91
Ge	0	1.22		+4	0.50
	+4	0.44			0.52
		0.53		+7	0.46
	-4	2.72	Mc	0	1.36
H	-1	2.08		+4	0.66
He	0	(0.93)		+6	0.62
Hf	0	1.66	N	0	0.71
Hg	0	1.46		+5	0.11
		1.49		-3	1.71
	+2	1.10	Na	0	1.86
		1.12		+1	0.95
Ho	+3	1.05			0.98
I	0	1.36	Nd	+3	1.15
		1.40	Ne	0	(1.12)
	+5	0.94	Ni	0	1.24
	+7	0.50		+2	0.69
	-1	2.16			0.78
		2.20		+3	0.35
In	0	1.45	O	0	0.60
		1.62		+6	0.09
	+3	0.81		-2	1.32
		0.92			1.40
Ir	0	1.35	Os	0	1.30
	+4	0.64			1.34
		0.66		+4	0.65
K	0	2.23			0.67
	+1	1.33	P	0	0.93
Kr	0	(1.69)		+5	0.34
La	+3	1.15		-3	2.12
		1.22	Pb	0	1.74
Li	0	1.56		+2	1.21
	+1	0.60			1.32
		0.78		+4	0.84
				-4	2.15
Mg	0	1.62	Pd	0	1.37
	+2	0.65	Pr	+3	1.16
		0.78		+4	0.92
					1.00

EFFECTIVE RADII OF ATOMS (Continued)

Element	Charge	Radius Angstrom	Element	Charge	Radius Angstrom
Pt	0	1.38	Te	0	1.33
Rb	0	2.36			1.43
	+1	1.48		+4	0.81
		1.49			0.89
Rh	0	1.34		+6	0.56
		1.35		-2	2.03
	+3	0.69			2.21
Ru	0	1.27	Th	0	1.80
		1.34			1.82
	+4	0.63		+4	1.02
		0.65			1.10
S	0	1.02	Ti	0	1.49
		1.04		+4	0.64
	+6	0.29			0.68
		0.34	Tl	0	1.99
	-2	1.74		+1	1.44
		1.84			1.51
Sa, Sm	+3	1.13		+3	0.95
Sb	0	1.34			1.05
	+3	0.90	Tm	+3	1.04
	+5	0.62	U	+4	0.97
	-3	2.45			1.05
Sc	0	1.51	V	0	1.32
	+3	0.81		+4	0.59
		0.83			0.61
Se	0	1.13		+5	0.59
		1.17	W	0	1.37
	+6	0.42		+4	0.66
	-2	1.91			0.68
		1.98		+6	0.88
Si	0	1.18	Xe	0	(1.90)
	+4	0.39	Y	+3	0.93
		0.41			1.06
	-4	2.71	Yb	+3	1.00
Sn	0	1.40	Zn	0	1.31
	+4	0.71			1.34
	-4	2.94		+2	0.74
Sr	0	1.95			0.83
	+2	1.13	Zr	0	1.60
		1.27			1.62
Ta	0	1.42		+4	0.80
		1.44			0.89
Tb	+3	1.09	NH ₄	+1	1.42
					1.59

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS

RAYMOND T. BRIGE, Reviews of Modern Physics **13**, 233, 1941

Table A. Principal Constants and Ratios*

Section	
A	Velocity of light..... $c = (2.99776 \pm 0.00004) \times 10^{10} \text{ cm} \cdot \text{sec}^{-1}$
B	Gravitation constant..... $G = (6.670 \pm 0.005) \times 10^{-8} \text{ dyne} \cdot \text{cm}^2 \cdot \text{g}^{-2}$
C	Liter (= 1000 ml)..... $l = 1000.028 \pm 0.002 \text{ cm}^3$
D	Volume of ideal gas (0°C, A_0)..... $V_0 = (22.4146 \pm 0.0006) \times 10^3 \text{ cm}^3 \cdot \text{atmos} \cdot \text{mole}^{-1}$
	.....$V_0' = 22.4140 \pm 0.0006 \text{ liter} \cdot \text{atmos} \cdot \text{mole}^{-1}$
D	Volume of ideal gas (0°C, A_{13})..... $V_{13} = (22.4157 \pm 0.0006) \times 10^3 \text{ cm}^3 \cdot \text{atmos} \cdot \text{mole}^{-1}$
	.....$V_{13}' = 22.4151 \pm 0.0006 \text{ liter} \cdot \text{atmos} \cdot \text{mole}^{-1}$
E	International ohm (= $p \text{ abs-ohm}$)..... $p = 1.00048 \pm 0.00002$ (U. S. Int. ohm 1948, $p = 1.000495$)
E	International ampere (= $q \text{ abs-amp}$)..... $q = 0.99986 \pm 0.00002$ (U. S. Int. ampere 1948, $q = 0.999835$)
F	Atomic weights (see Table A')
G	Standard atmosphere..... $A_0 = (1.013246 \pm 0.000004) \times 10^6 \text{ dyne} \cdot \text{cm}^{-2} \cdot \text{atmos}^{-1}$
G	45° atmosphere..... $A_{45} = (1.013195 \pm 0.000004) \times 10^6 \text{ dyne} \cdot \text{cm}^{-2} \cdot \text{atmos}^{-1}$
H	Ice-point (absolute scale)..... $T_0 = 273.16 \pm 0.01^\circ \text{K}$
I	Joule equivalent..... $J_{15} = 4.1855 \pm 0.0004 \text{ abs-joule} \cdot \text{cal}_{15}^{-1}$
I	Joule equivalent (electrical)..... $J_{15}' = 4.1847 \pm 0.0003 \text{ int-joule} \cdot \text{cal}_{15}^{-1}$
J	Faraday constant
	(1) Chemical scale
	$F = 96501.2 \pm 10 \text{ int-coul} \cdot \text{g-equiv}^{-1}$
	$F' = 96487.7 \pm 10 \text{ abs-coul} \cdot \text{g-equiv}^{-1}$
	$F'' = 9648.7 \pm 1.0 \text{ abs. e.m.u.} \cdot \text{g-equiv}^{-1}$
	$F' = Fc = (2.89247 \pm 0.00030) \times 10^{14} \text{ abs. e.s.u.} \cdot \text{g-equiv}^{-1}$
K	Avogadro number (chemical scale)..... $N_0 = (6.0228_3 \pm 0.0011) \times 10^{23} \text{ mole}^{-1}$
K	Electronic charge..... $e = F/N_0 = (1.60203_3 \pm 0.00034) \times 10^{-20} \text{ abs. e.m.u.}$
	$e' = ec = (4.80251 \pm 0.0010) \times 10^{-10} \text{ abs. e.s.u.}$
L	Specific electronic charge..... $e/m = (1.7592 \pm 0.0005) \times 10^7 \text{ abs. e.m.u.} \cdot \text{g}^{-1}$
	$e'/m = ec/m = (5.2736_6 \pm 0.0015) \times 10^{17} \text{ abs. e.s.u.} \cdot \text{g}^{-1}$
M	Planck constant..... h (see Table C).

* Unless otherwise specified, all quantities in these tables that involve the mole or the gram equivalent are on the chemical scale of atomic weights.

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Table A'. Atomic Weights

(1) Physical scale ($O^{16} = 16.0000$)	
$H^1 = 1.00813 \pm 0.000017$	
$H = 1.008276 \pm 0.000017$ (from H^1/H^2 abundance = 6900 \pm 100)	$H^2 = 2.01473 \pm 0.000019$
$He^4 = 4.00389 \pm 0.00007$	
$C^{12} = 12.00386 \pm 0.00004$	
$C = 12.01465 \pm 0.00023$ (from C^{12}/C^{13} abundance = 92 \pm 2)	$C^{13} = 13.00761 \pm 0.00015$
$N^{14} = 14.00753 \pm 0.00005$	$N^{15} = 15.0049 \pm 0.0002$
$N = 14.01121 \pm 0.000095$ (from N^{14}/N^{15} abundance = 270 \pm 6)	
$O^{16} = 16.0000$	$O^{18} = 18.0049$
$O = 16.004357 \pm 0.000088$ (from abundance $O^{16}:O^{17} = (506 \pm 10):1$; (0.204 \pm 0.008)	
(2) Chemical scale ($O = 16.0000$)	

Ratio physical to chemical scale
 $r = (16.004357 \pm 0.000086)/16 = 1.000272 \pm 0.000005$

$H^1 = 1.007856 \pm 0.000018$ (from physical scale)	
$H^2 = 2.014183 \pm 0.000021$ (from physical scale)	
$H = 1.008002 \pm 0.000018$ (from physical scale)	
$He^4 = 4.00280 \pm 0.00007$ (from physical scale)	
$C = 12.01139 \pm 0.00024$ (from physical scale)	
$N = 14.00740 \pm 0.00012$ (from physical scale)	
$N = 14.0086 \pm 0.0007$ (direct observation)	
$Na = 22.994 \pm 0.003$	
$Ca = 40.080 \pm 0.005$	$Cl = 35.457 \pm 0.001$
	$Ag = 107.880 \pm 0.002$
	$I = 126.915 \pm 0.004$

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Table C. Partial List of Derived Quantities*

Planck constant	$h = \left\{ \frac{2\pi^2 c^3 F^5}{R_\infty N_0^5 (e/m)} \right\}^{1/3} = (6.624_2 \pm 0.002_4) \times 10^{-27} \text{ erg} \cdot \text{sec}$
	$h/e = \left\{ \frac{2\pi^2 c^3 F^2}{R_\infty N_0^2 (e/m)} \right\}^{1/3} = (4.1349_0 \pm 0.0007_1) \times 10^{-7} \text{ erg} \cdot \text{sec} \cdot \text{e.m.u.}^{-1}$
Atomic weight of electron	$h/e' = h/ec = \left\{ \frac{2\pi^2 F^2}{R_\infty N_0^2 (e/m)} \right\}^{1/3} = (1.3793_3 \pm 0.0002_3) \times 10^{-17} \text{ erg} \cdot \text{sec} \cdot \text{e.s.u.}^{-1}$
	$E = F/(e/m)$ (physical scale) = $(5.4862_4 \pm 0.0017) \times 10^{-4}$ (chemical scale) = $(5.4847_6 \pm 0.0017) \times 10^{-4}$
Band spectra constant connecting wave number and moment of inertia	$h/8\pi^2 c = \left\{ \frac{F^3}{256\pi^4 R_\infty N_0^3 (e/m)} \right\}^{1/3} = (27.986_5 \pm 0.01_0) \times 10^{-40} \text{ g} \cdot \text{cm}$
Boltzmann constant	$k = R_0/N_0 = V_0 A_0/T_0 N_0 = (1.38047_4 \pm 0.00026) \times 10^{-16} \text{ erg} \cdot \text{deg}^{-1}$
Charge in electrolysis of one gram of H	$F/H = 9572.17_3 \pm 1.0 \text{ abs. e.m.u.} \cdot \text{g}^{-1}$
Charge in electrolysis of one gram of H ¹	$e/M_{H^1} = F/H^1 = 9573.5_{80} \pm 1.0 \text{ abs e.m.u. g}^{-1}$
Compton shift at 90°	$h/mc = \left\{ \frac{2\pi^2 F^2 (e/m)^2}{R_\infty N_0^2} \right\}^{1/3} = (0.024265_{14} \pm 0.000005_7) \times 10^{-9} \text{ cm}$
Energy in ergs of one abs-volt-electron	$E_0 = 10^9 e = 10^9 F/N_0 = (1.60203_3 \pm 0.00034) \times 10^{-12} \text{ erg}$
Energy in calories per mole for one abs-volt-electron per molecule	$F' (\text{abs. coul. per gram equiv}) = 23052.8_6 \pm 3.2 \text{ cal}_{18} \cdot \text{mole}^{-1}$
	$J_{1.0} (\text{abs. joules per cal})$

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Fine structure constant..... $\alpha = 2\pi(e')^2/hc = \left\{ \frac{4\pi R_\infty F(e/m)}{N_0} \right\}^{1/3}$	$= (7.2976 \pm 0.0008) \times 10^{-3}$
	$1/\alpha = 137.030_2 \pm 0.016$
	$\alpha^2 = (5.3256 \pm 0.0013) \times 10^{-5}$
Gas constant per mole..... $R_0 = V_0 A_0/T_0 = (8.31436 \pm 0.00038) \times 10^7 \text{ erg} \cdot \text{deg}^{-1} \cdot \text{mole}^{-1}$	
	$R_0' = R_0 \cdot 10^{-7}/J_{15} = 1.986467 \pm 0.00021 \text{ calis} \cdot \text{deg}^{-1} \cdot \text{mole}^{-1}$
	$R_0'' = V_0'/T_0 = (8.205447 \pm 0.00037) \times 10^{-2} \text{ liter} \cdot \text{atmos} \cdot \text{deg}^{-1} \cdot \text{mole}^{-1}$
	$R_0''' = R_0/A_0 = V_0/T_0 = 82.05667 \pm 0.0037 \text{ cm}^3 \cdot \text{atmos} \cdot \text{deg}^{-1} \cdot \text{mole}^{-1}$
also	$R_0 T_0 = V_0 A_0 = (2.27115_0 \pm 0.00006) \times 10^{10} \text{ erg} \cdot \text{mole}^{-1}$
Loschmidt number (0°C , A_0)... $n_0 = N_0/V_0 = (2.6870_{12} \pm 0.0005_0) \times 10^{19} \text{ atoms}^{-1} \cdot \text{cm}^{-3}$	
Magnetic moment of one Bohr magneton..... $\mu_1 = (h/4\pi)(e/m) = \frac{1}{4\pi} \left\{ \frac{2\pi^2 c^3 F^5(e/m)^2}{R_\infty N_0^5} \right\}^{1/3}$	$= (0.9273_{16} \pm 0.0003_7) \times 10^{-20} \text{ erg} \cdot \text{gauss}^{-1}$
Magnetic moment per mole for one Bohr magneton per molecule	
$\mu_1 N_0 = \frac{1}{4\pi} \left\{ \frac{2\pi^2 c^3 F^5(e/m)^2}{R_\infty N_0^5} \right\}^{1/3}$	$= 5585.2_4 \pm 1.6 \text{ erg} \cdot \text{gauss}^{-1} \cdot \text{mole}^{-1}$
Mass of α -particle..... $M_\alpha = (\text{He} - 2E)/N_0 = (6.6442_2 \pm 0.0012) \times 10^{-24} \text{ g}$	
Mass of atom of unit atomic weight..... $M_0 = 1/N_0 = (1.66035 \pm 0.00031) \times 10^{-24} \text{ g}$	
Mass of electron..... $m = e/(e/m) = (F/N_0)/(e/m) = (9.1066_0 \pm 0.0032) \times 10^{-28} \text{ g}$	
Mass of H^1 atom..... $M_{\text{H}^1} = H^1/N_0 = (1.67339_3 \pm 0.00031) \times 10^{-24} \text{ g}$	
Mass of proton..... $M_p = (H^1 - E)/N_0 = (1.67248_2 \pm 0.00031) \times 10^{-24} \text{ g}$	
Radiation density constant..... $a = 8\pi^{5/2} h^{-4}/15c^3 h^3 = \left(\frac{V_0 A_0}{T_0} \right)^4 \frac{4\pi^3 N_0 R_\infty (e/m)}{15c^6 F^5}$	
	$= (7.569_{42} \pm 0.0049) \times 10^{-15} \text{ erg} \cdot \text{cm}^{-3} \cdot \text{deg}^{-4}$
Ratio mass H^1 atom to mass electron..... $M_{\text{H}^1}/m = (e/m)(H^1/F) = 1837.5_{61} \pm 0.5_6$	
Ratio mass proton to mass electron..... $M_p/m = (e/m) \left(\frac{H^1 - E}{F} \right) = 1836.5_{61} \pm 0.5_6$	
Second radiation constant..... $e_2 = hc/k = \frac{c^2 T_0}{V_0 A_0} \left\{ \frac{2\pi^3 F^5}{R_\infty N_0^5 (e/m)} \right\}^{1/3}$	$= 1.4384_8 \pm 0.0003_4 \text{ cm} \cdot \text{deg}$

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Specific charge of α -particle.....	$2e/M_\alpha = \frac{2F}{\text{He} - 2\bar{E}} = 4822.3 \pm 0.51 \text{ abs. e.m.u.} \cdot \text{g}^{-1}$
Specific charge of proton.....	$\frac{F}{H^1 - E} = 9578.77 \pm 1.0 \text{ abs. e.m.u.} \cdot \text{g}^{-1}$
Stefan-Boltzmann constant.....	$\sigma = ac/4 = 2\pi^5 k^4/15c^2 h^3 = \left(\frac{V_0 A_0}{T_0}\right)^4 \frac{\pi^3 N_0 R_\infty (e/m)}{15(Fc)^5}$ $= (5.67283 \pm 0.0037) \times 10^{-5} \text{ erg} \cdot \text{cm}^{-2} \cdot \text{deg}^{-4} \cdot \text{sec}^{-1}$
Wave-length associated with one abs-volt†	$\lambda_0 = 10^{-8} c^2 (h/e')$ $= \frac{c^2}{10^8} \left\{ \frac{2\pi^2 F^2}{R_\infty N_0^2 (e/m)} \right\}^{1/3} = (12395.4 \pm 2.1) \times 10^{-8} \text{ cm} \cdot \text{abs-volt}$
Wave number associated with one abs-volt	$s_0 = 1/\lambda_0 = \frac{10^8}{c^2} \left\{ \frac{R_\infty N_0^2 (e/m)}{2\pi^2 F^2} \right\}^{1/3} = 8067.49 \pm 1.4 \text{ cm}^{-1} \cdot \text{abs-volt}^{-1}$
Wien's displacement law constant‡.....	$A = c_2/4.965114 = 0.289718 \pm 0.00007 \text{ cm} \cdot \text{deg}$
Zeeman displacement per gauss.....	$(e/m)/4\pi c = (4.66991 \pm 0.0013) \times 10^{-5} \text{ cm}^{-1} \cdot \text{gauss}^{-1}$

* In order to be able to calculate, by propagation of errors, the probable error in a derived quantity, it is necessary to express the quantity explicitly in terms of the various fundamental quantities of Table A, or of Table B, and that has been done in each case. Since in this paper e and h are treated as derived quantities, they do not therefore appear in such explicit expressions. But in calculating *numerical* values of derived quantities, the work can often be greatly simplified by using the values of other previously calculated derived quantities—in particular e and h . In order to show how certain derived quantities depend on quantities like e and h , such alternative expressions are given in many cases.

† The factor 10^{-8} was accidentally omitted, in G.C. 1929, in the equation for λ_0 .

‡ The factor 4.965114 is the root of $e^{-\beta} + (\beta/5) - 1 = 0$

ABBREVIATIONS AND SYMBOLS

Abbreviations

The following list of abbreviations is intended to cover those in common use in chemistry and physics. Symbols are presented in a separate list following the abbreviations.

A.	Acre	ca.	Circa, about;	covers	Coversed sine
Å	Ångström unit		approximate-	c.p.	Candle power;
■	Are		ly		circular
a.	Acid	cal.	Calorie (gram)		pitch; center
abs.	Absolute	cc. or c.c.	Cubic centi-		of pressure
abt.	About		meter	cry. or	Crystalline;
a.c.	Alternating cur-	cd.	Cord	cryst.	crystals
	rent	c. cm	Cubic centi-	csc	Cosecant
acet.	Acetone		meter	csc ⁻¹	Arc or angle
acet. a.	Acetic acid	Cent.	Centigrade		whose cose-
al.	Alcohol	centi-	Prefix meaning		cant is...
alk.	Alkali		1/100	csch	Hyperbolic co-
alt.	Altitude	cf.	Confer, compare		secant
amal.	Amalgam;	c.f.m.	Cubic foot per	csch ⁻¹	Inverse hyper-
	amalgamated		minute		bolic cose-
		cgs	Centimeter-		cant
amor. or			gram-second	CTU	Centigrade
amorph.	Amorphous		system of		thermal unit
amp.	Ampere		units	cu.	Cubic
anh.	Anhydrous	cgse	Cgs electro-	cu. cm	Cubic centi-
antilog	Antilogarithm		static system		meter
ap.	Apothecaries'	cgsm	Cgs electromag-	cu. ft.	Cubic foot
appr.	Approximately		netic system	cu. in.	Cubic inch
aq.	Aqua; aqueous;	ch.	Chain	cu. m	Cubic meter
	water	chl.	Chloroform	cu. yd.	Cubic yard
aq. reg.	Aqua regia	cir.	Circular	cwt.	Hundredweight
asym.	Asymmetrical	circum.	Circumference	cyl.	Cylinder
atm. or		cl	Centiliter	d	Derivative; deci-
atmos.	Atmosphere	cm	Centimeter	d.	Decomposes;
	(atmos-	cm ²	Square centi-		day
	pheric)		meter	d.	Dextrorotary
At. No.	Atomic number	cm ³	Cubic centi-	d.c.	Direct current
At. Wt.	Atomic weight		meter	dec.	Decomposes
aux.	Auxiliary	cm.	Circular mil	deci-	Prefix meaning
Av.	Average	coef.	Coefficient		1/10
av. or		colog	Cologarithm	def.	Definition (s)
avoir.	Avoirdupois	colorl.	Colorless	deg	Thermometric
bar.	Barometer	comm'l	Commercial		degree; abso-
bbl.	Barrel	conc.	Concentrated		lute C unless
bd.	Board	cond.	Condensing		contrary is in-
Bé	Beaumé (de-	const.	Constant		dicated
	grees)	cos	Cosine	deka-	Prefix meaning
B.G.	Birmingham	cos ⁻¹	Arc or angle		10
	gauge (hoop		whose cosine	deliq.	Deliquescent
	and sheet)		is...; anti-	den. or	Density
b.h.p.	Brake horse		cosine of; in-	dens.	
	power		verse cosine of		
bl.	Blue	cosec	Cosecant	dg	Decigram
blk.	Black	cosh	Hyperbolic	diam.	Diameter
B.M.	Board measure		cosine	dil.	Dilute
b.p.	Boiling point	cosh ⁻¹	Inverse hyper-	dissd.	Dissolved
br.	Brown		bolic cosine	dk	Deka-
BTU	British thermal	cot	Cotangent	dk.	Dark
	unit	cot ⁻¹	Arc or angle	dkg.	Dekagram
bu.	Bushel		whose cotan-	dkl	Dekaliter
B.W.G.	Birmingham	coth	gent is...	dkm	Dekameter
	wire gauge		Hyperbolic co-	dkm ²	Square deka-
bz.	Benzene		tangent		meter
C	Centigrade	coth ⁻¹	Inverse hyper-	dkm ³	Cubic deka-
c	Carat; centi-		bolic cotan-		meter
c.	Cold		gent	dks	Dekastere
ca	Candle			dl	Deciliter

ABBREVIATIONS AND SYMBOLS (Continued)

Abbreviations (Continued)

dm	Decimeter	fpm	Foot-pound-second elec- tromagnetic system	kg	Kilogram
dm ²	Square deci- meter			kg-cal.	Kilogram-calorie
dm ³	Cubic decimeter	F.S.	Factor of safety	kg-m	Kilogram-meter
d.p.	Diametral pitch; double pole	ft.	Foot	kilo-	Prefix meaning 1,000
dr.	Dram	ft. ²	Square foot	kl	Kiloliter
dr. ap. or 3 ap.	Dram, apothecaries'	ft. ³	Cubic foot	km	Kilometer
dr. av. or 3 av.	Dram, avoirdupois	ft.-lb.	Foot-pound	km ²	Square kilo- meter
dr. fl. or 3 fl.	Dram, fluid	fur.	Furlong	km ³	Cubic kilometer
dr. t. or 3t.	Dram, troy	G	Gravitation constant	kva.	Kilovolt- ampere
ds	Decistere	g	Gram	kw.	Kilowatt
dwt.	Pennyweight	g-cal. or g.-cal.	Gram calorie	kw.-hr.	Kilowatt-hour
efflor.	Efflorescent	gal.	Gallon	l	Liter
e.g.	<i>Exempli gratia</i> , for example	gel.	Gelatinous	l.	Long
e.h.p.	Effective horse power	gill	Gill	l	Laevorotary
E.L.	Elastic limit	glac.	Glacial	lat.	Latitude
em	Cgsm unit of quantity of electricity	glit.	Glittering	lb.	Pound
emf or e.m.f.	Electromotive force	glyc.	Glycerine	lb. ap.	Pound, apothecaries'
es	Electrostatic or cgse unit of quantity of electricity	gm.	Gram	lb. av.	Pound, avoirdupois
etc.	<i>Et. cetera</i> , and so forth	gr.	Gray; grain	lb. t.	Pound, troy
eth.	Ether	grn.	Green	leaf.	Leaflets
eth. acet.	Ethyl acetate	gyr.	Gyrations	lgr.	Ligroin
et. seq.	<i>Et sequentes</i> , and the fol- lowing	h	Hecto-	li.	Link
evap.	Evaporation	ha	Hectare	lin.	Linear
ex.	Excess	hecto-	Prefix meaning 100	liq.	Liquid
exp	Exponential function	hex.	Hexagonal	lim.	Limit
exp.	Explodes	hg	Hectogram	ln	Natural hyper- bolic or Napierian logarithm
exsec	Exterior secant	hhd.	Hogshead	log or log.	Logarithm
F	Fahrenheit	hl	Hectoliter	log.	Logarithm to the base <i>e</i> ; natural, hy- perbolic or Napierian logarithm
f.	Fathom	hm	Hectometer	log ₁₀	Common logarithm; logarithm to the base 10
fath.	Feathery	hm ²	Square hectometer	long.	Longitude
f.h.p.	Friction horse power	hm ³	Cubic hectometer	lng.	Long
fr.	Firkin	hor. or horiz.	Horizontal	l.-p.	Low-pressure
fl.	Fluid	h.-p.	High-Pressure	lt.	Light
fl. dr.	Dram, fluid	HP or h.p.	Horse power	lust.	Lustrous
fl. oz.	Ounce, fluid	h.p.-hr.	Horse power- hour	m	Minim or drop
fluores.	Fluorescent	hr.	Hour	m ²	Meter; milli-
fps	Foot-pound-second sys- tem of units	hyg.	Hygroscopic	m ³	Square meter
fipse	Foot-pound-second elec- trostatic sys- tem	i.	Insoluble	m	Cubic meter
		<i>ibid.</i>	<i>Ibidem</i> , in the same place	m.	Minute
		<i>i.e.</i>	<i>Id est</i> , that is	m.	Meta-
		ign.	Ignites	max.	Maximum
		i.h.p.	Indicated horse power	med.	Medium
		in.	Indigo; inch	meth.	Methyl
		in. ²	Square inch	meth. al.	Methyl alcohol
		in. ³	Cubic inch	m.e.p.	Mean effective pressure
		inc.	Inclusive	met.	Metallic
		in.-lb.	Inch-pound	mg	Milligram
		insol.	Insoluble		
		Int.	International		
		iso.	Isotropic		
		isom.	Isometric		
		isoth.	Isothermal		
		k	Kilo-		

ABBREVIATIONS AND SYMBOLS (Continued)

Abbreviations (Continued)

m.h.c.p.	Mean horizon- tal candle power	perp.	Perpendicular	sol.	Solution;
mi.	Mile	p.f.	Power factor	soln.	soluble
mic.	Microscopic	pk.	Peck	sp.	Solution
micro-	Prefix meaning 1/1,000,000 or 10^{-6}	pl.	Plates	specif.	Specific
micro-	Prefix meaning 10^{-12}	powd.	Powder	sp. gr.	Specific gravity
milli-	Prefix meaning 1/1,000	pr.	Prisms	sq.	Square
milli-	Prefix meaning 10^{-9}	precip. or p'p't'd	Precipitated	sq. ch.	Square chain
min or min.	Minute	p. sol.	Partly soluble	sq. ft.	Square foot
min.	Minim; mini- mum; mineral	pt.	Point; pint	sq. in.	Square inch
ml	Milliliter	purp.	Purple	sq. mi.	Square mile
m.l.h. c.p.	Mean lower hemispherical candle power	pyr.	Pyridine	sq. rd.	Square rod
mm	Millimeter	Q	Quantity	sq. yd.	Square yard
mm ²	Square milli- meter	q	Quintal	std.	Standard
mm ³	Cubic milli- meter	qt.	Quart	subl.	Sublimes
mmf or m.m.f.	Magnetomotive force	q.v.	Quod vide, which see	sym.	Symmetrical
mol.	Molecule	R	Réaumur; radioactive mineral	t	Metric ton
Mol. Wt.	Molecular weight	rac	Racemic	t.	Troy
monocl.	Monoclinic	rad	Radian, meas- ure of angle	tab. or tabl.	Tablets
m.p.	Melting point	rad.	Radius	tan	Tangent
m.s.c.p.	Mean spherical candle power	rd.	Rod	tan ⁻¹	Arc or angle whose tan- gent is . . .
myria-	Prefix meaning 10,000 or 10^4	reg.	Regular	tanh	Hyperbolic tan- gent
mμ	Millimicron; millimicro-	rev.	Revolution	tanh ⁻¹	Inverse hyper- bolic tangent
N	Numeric; num- ber (in math- ematical ta- bles)	rhdr.	Rhomboidal	temp.	Temperature
n.	Normal	rhomb.	Rhombic or or- thorhombic	tetr. or tetrag.	Tetragonal
n	Refractive index	R.M.S.	Square root of mean square	tn.	Ton
need.	Needles	r.p.m.	Revolutions per minute	tr.	Transition
o	Ortho-	s	Stere	tricl.	Triclinic
Obs.	Observer	s.	Scruple; soluble; second	trig.	Trigonal
octahdr.	Octahedral	s. ap. or Θ	Scruple, apothec- aries'	trim.	Trimetric
oil	Oil of turpen- tine	sat. or sat'd	Saturated	T.S.	Tensile strength
or.	Orange	sc.	Scales	turp.	Turpentine
oz.	Ounce	S.E.	Siemens unit	Tw.°	Degrees Twad- dell, hydrom- eter scale
oz. ap. or 3 ap.	Ounce, apothec- aries'	sec or sec.	Second (mean solar unless contrary is stated)	ult.	Ultimate
oz. av. or 3 av.	Ounce, avoird- upois	sec	Secant	uns.	Unsymmetrical
oz. fl. or 3 fl.	Ounce, fluid	sec ⁻¹	Arc or angle whose secant is . . .	U.S.	United States of America;
oz. t. or 3 t.	Ounce, troy	sech	Hyperbolic secant	v.	universal sys- tem of lens apertures
p	Para-	sech ⁻¹	Inverse hyper- bolic secant	vel.	Velocity
pa.	Pale	segm.	Segment	vel. or veloc.	Versed sine
p. et.	Per cent	sh.	Short	vers	Vertical
		sin	Sine	visc.	Viscous
		sin ⁻¹	Arc or angle whose sine is . . .	vol.	Volume
		sinh	Hyperbolic sine	volt.	Volatilizes
		sinh ⁻¹	Inverse hyper- bolic sine	w.	Water
		sl.	Slightly	wh.	White
		sm.	Small	wt.	Weight
				yd.	Yard
				yel.	Yellow
				yr.	Year
				μ	Micron; micro-
				μμ	Micromicron; micromicro-

ABBREVIATIONS AND SYMBOLS (Continued)

Symbols

The following list of symbols is rearranged from a report of the Committee on Letter Symbols and Abbreviations of the American Association of Physics Teachers, H. K. Hughes chairman, published in the American Journal of Physics **8**, 300-315, 1940.

Symbols or definitions in parentheses are those whose use is discouraged by the committee. Symbols or meanings indicated by an asterisk (*) are not recommended by the committee but have been added to the list for the sake of completeness.

English Letter Symbols

A	Magnetic vector potential.
A_n	Normal atmosphere*.
A_{45}	Atmosphere, 45° latitude*.
A	Helmholtz function or maximum isothermal work function or Helmholtz free energy [$= U - TS$]; refracting angle of prism; area; amplitude; strength of simple acoustic source; atomic weight.
A, A_p	Power gain of amplifier; power amplification of amplifier.
A, A_v	Voltage gain of amplifier; voltage amplification of amplifier.
A, b	Richardson equation factors [$I_s = AT^2 \exp(-b/T)$].
a	Linear acceleration.
a	Width of slit, transparent portion; semimajor axis of ellipse; radius of tube, disk or membrane, acous.; coefficient of accommodation; mean absorption coefficient for a room, acous.; absorption coefficient [$I_x = I_0 \exp(-ax)$]; chemical activity; aperture, optics.
a_1	Bohr radius [$= h^2/4\pi^2 me^2$].
a (subscript)	Adsorbed.
a_v (subscript or bar over symbol)	Average value (e.g., \bar{I} , I_{av}).
a, b	Van der Waals constants.
B	Magnetic flux density or induction; magnetic induction density.
B	Density of electric charge of magnetic flux [$d\Phi/dA$]; brightness or luminance [$= dI/dA \cos \theta$].
B, b	Susceptance or reciprocal of reactance.
\mathcal{B}	Steradiancy or steradiance [$= dW/d\omega$].
b	Semiminor axis of ellipse; closest possible distance of approach (in Rutherford scattering formula); first Wien displacement constant [$= \lambda_m T$]; breadth or width.
b_1	Second Wien displacement constant [$= J_m/AT^5$].
(C)	Root-mean square velocity.
C	Molar thermal capacity; normality; (rms speed); capacitance or permittance; compliance.
C_p, C_v	Molecular heat at constant pressure, at constant volume*.
(c)	Most probable velocity.
c	Velocity of light in vacuum; specific heat or thermal capacity; coefficient of induction, or partial capacitance; distance from neutral axis to extreme fiber (beams); velocity of sound or other waves; acoustic conductivity of an opening; concentration of solutions.
c (with suitable subscripts)	Partial capacitance.
(c)	Most probable speed.
c_p	Specific heat or thermal capacity for constant pressure.
c_v	Specific heat or thermal capacity for constant volume.
c_1, c_2	Planck radiation law constants [$J_\lambda = A c_1 \lambda^{-5}/(\exp c_2/\lambda T - 1)$].
e (subscript)	Cathode; critical properties.

ABBREVIATIONS AND SYMBOLS (Continued)

English Letter Symbols (Continued)

D	Displacement; displacement flux density; electric flux density [= $\int \mathbf{D} \cdot d\mathbf{A}$]; electric induction density.
D , D / 4π	Displacement current.
D	Derivative operator.
D	Minimum deviation angle; coefficient of diffusion, fluid; diameter; optical density [= $\log_{10} I_0/I$]; power of lens system or refracting power [= n/f diopters]; relative density; density of electric flux [= $d\psi/dA$]; optical attenuation; angular dispersion [= $d\theta/d\lambda$]; (density [= m/V]).
d	Differential operator.
d	Distance between corresponding points of grating; distance between lens units in an optical system; interplanar distance (Bragg law); spacing of Bragg planes in a crystal.
$d_{t_1}^{t_2}$	Specific gravity at temperature t_2 , with reference to water at temperature t_1^* .
(E)	Electric potential gradient; electric field strength or intensity.
E	Illumination or illuminance [= dF/dA]; total energy, other than work; electromotive force or electromotance or emf; Young's modulus of elasticity; (internal or intrinsic energy, thermodyn).
E_k	Kinetic energy.
E_p	Potential energy.
E_v	Total energy of vibration.
E	Irradiancy or irradiance [= $d\Phi/dA$ or dP/dA , $w\text{ cm}^{-2}$].
(E)	Electric potential gradient; electric field strength or intensity.
e	Eccentricity of ellipse; probable error; base of natural logarithms [= 2.718 . . .]; modulus of electronic charge; coefficient of restitution or resilience.
F	Force.
F	Force in a string or membrane; luminous flux [= dQ/dt], hyperfine quantum number [= $I + J$]; Faraday constant or equivalent; formality; (weight); (Helmholtz function or maximum isothermal work function or Helmholtz free energy [= $U - TS$]).
F, F_g	Gravitational force.
\vec{F}	Magnetomotive force or magnetic scalar potential.
f	Relative humidity; fugacity; frequency (electric circuits, mechanics, sound); focal length of object space; coefficient of friction, if μ designates the Poisson ratio; degrees of freedom, kinetic theory and Gibbs phase rule.
(f₀)	Photoelectric threshold frequency.
f_r	Natural or resonant frequency.
f'	Focal length of image space.
f, F	Function; distribution function.
f (subscript)	Filament.
G	Newtonian gravitational constant; Gibbs free energy, Gibbs function or free enthalpy [= $H - TS$].
g	Landé factor; statistical weight or degeneracy; gyro-magnetic ratio; gravitational acceleration.
g_g	Grid or input conductance.
g_{gp}, (g_m)	Grid-plate transconductance, real part of grid-plate transadmittance.
g_L	Gravitational acceleration, local value.
g_p	Plate or output conductance.
g_s	Gravitational acceleration, standard value [= 980.665 cm sec^{-2}].
g₄₅	Gravitational acceleration 45° value [= 980.616 cm sec^{-2}].

ABBREVIATIONS AND SYMBOLS (Continued)

English Letter Symbols (Continued)

G, g	Reciprocal resistance or conductance; electric conductance.
${}_g$ (subscript)	Reference to gas or vapor.
\mathbf{H}	Magnetic field strength or intensity.
H	Hamiltonian function or operator.
H	Irradiance or irradiance [= $d\Phi/dA$ or dP/dA , $w\text{ cm}^{-2}$]; Hessian function; with suitable subscript, Hermitian function; heat content or enthalpy; Henry law constant; Boltzmann function $\left[= \sum_i n_i \ln n_i \right]$.
\mathcal{H}	Perturbing Hamiltonian function or operator.
h	Head, hydrodyn; radius of lens zone; Planck constant; degree of hydrolysis, electrolytes; depth or height.
\hbar	Dirac \hbar [= $h/2\pi$].
h, k, l	Miller indices.
h_1 [= nh], h_2 [= nk], h_3 [= nl]	Bragg reflection indices.
h (subscript)	Heater.
I	Rectangular areal moment of inertia [= $\int y^2 dA$]; integration constant of Gibbs function equation; luminous intensity or candlepower [= $dF/d\omega$, lu/steradian]; nuclear spin; strength of magnetic shell; acoustic intensity, e.g., $\text{erg cm}^{-2} \text{ sec}^{-1}$; activity at time t , radioactivity; conduction current; steady direct current; rms or effective current; convection current.
I_0	Initial luminous intensity; initial activity, radioactivity.
I_Q	Quiescent current.
I_s	Saturation current; total electron emission or saturation.
I_{xy} , etc.	Product of inertia.
I, I_{xx} , etc.	Moment of inertia.
I, I_{av}	Average current.
$i, (I_{pk})$	Peak current.
$I_m, (I_{\max})$	Maximum current.
\mathbf{i}	Unit vector in X-direction.
i	Mole factor or van't Hoff coefficient; inertia of photographic plate; vapor pressure constant.
$i, (I)$	Instantaneous current.
$J, (J')$	Electric Joule equivalent.
J	Jacobian determinant; mechanical equivalent of heat or Joule equivalent; polar areal moment of inertia [= $\int r^2 dA$]; number of equivalents; total inner quantum number; radiant intensity [= $d\Phi/d\omega = dP/d\omega$]; total emissive power; variable action; (moment of inertia).
J_λ	Spectral radiant intensity [= $dJ/d\lambda$].
J_λ, J_ν	Monochromatic emissive power.
\mathbf{j}	Unit vector in Y-direction.
j	Inner quantum number; inverse Jacobian determinant [$jJ = 1$].
K	Karat*; Kelvin, or absolute C scale of temperature*.
K_λ	Visibility factor or luminosity or monochromatic luminous efficiency [= $F_\lambda/P_\lambda = F_\lambda/\Phi_\lambda \text{ lu } w^{-1}$].
K	Extinction coefficient or index [= $(l/x) \log_{10} I_0/I$]; Kerr constant; luminous efficiency [= $F/P = F/\Phi$]; equilibrium constant, products/reactants; curvature.
K_h	Hydrolysis constant.
\mathbf{k}	Unit vector in Z-direction.
k	Volume modulus of elasticity; molecular gas constant or Boltzmann constant; torque per unit twist or torsion constant; magnetic volume susceptibility [$\mathbf{M} = k\mathbf{H}$]; wave-length constant [= $2\pi/\lambda$]; load per unit

ABBREVIATIONS AND SYMBOLS (Continued)

English Letter Symbols (Continued)

	displacement; magnetic susceptibility; radius of gyration; restoring force per unit displacement; spring constant [= $-F/s$]; force constant [= $-F/s$]; specific reaction velocity, specific reaction rate or reaction velocity constant; velocity coefficient of chemical reaction*; thermal conductivity; coefficient or factor of compressibility; coupling coefficient.
k_g	Grid conductance at zero frequency and constant plate potential [= $(\partial i_g/\partial v_g)_v$].
k_p	Plate conductance at zero frequency and constant grid potential [= $(\partial i_p/\partial v_p)_v$].
L	Torque*.
L	Lagrange function or Lagrangian or kinetic potential [= $E_k - E_p$]; total azimuthal or orbital quantum number; relative heat content; total heat of fusion or vaporization; inductance; with suitable subscript.
	Laguerre function; Lorentz unit [= $Be/4\pi mc^2$]; (standard density, referred to $g_s = 980.665 \text{ cm sec}^{-2}$ at 0°C , $1A_s$).
L_{12}	Mutual inductance.
\bar{L}	Heat of fusion or vaporization, per mole.
L, l	Length of heat flow path.
l	Free path; azimuthal or orbital quantum number; heat of fusion or vaporization per unit mass; length of vibrating string, rod or tube; length.
l_0	Length rest.
l_T	Tait free path.
\bar{l}	Heat of fusion or vaporization per molecule; mean free path.
l (subscript)	Reference to liquid.
M	Intensity of magnetization, magnetization or magnetic polarization.
M	Mutual inductance; total mass; mass per mole; total magnetic quantum number.
M, \bar{M}	Molecular weight.
M_i, \bar{M}_i	Ionic molecular weight, if necessary to distinguish between ions and neutrals.
$M[\alpha]$	Molecular rotatory power*.
$M[\omega]$	Molecular magnetic rotatory power*.
m	Moment of atom, dipole or molecule; magnetic moment, total.
m	Order of spectrum; number of phases, elec. circuits; magnetic quantum number; magnification; mass of molecule; modulation factor; mass of electron; mass*; (strength of magnetic pole).
m_a	Electronic mass, when m is magnetic quantum number.
m_H	Mass of a hydrogen atom*.
m_l	Longitudinal mass [= $m_0/(1 - \beta^2)^{\frac{3}{2}}$].
m_0	Rest mass.
m_t	Transverse mass [= $m_0/(1 - \beta^2)^{\frac{1}{2}}$]
m or max (subscripts)	Maximum.
min (subscript)	Minimum.
N_0	Avogadro's number*.
N	Safety factor; number of turns or of conductors; number of molecules; total number of lines of a grating; number of atoms or nuclei at time t , radioactivity; normalization factor, probability.
N_0	Initial number of atoms or nuclei, radioactivity.
$N_{1,2,\dots}$	Number of atoms or nuclei, if more than one type is considered.
$N^0_{1,2,\dots}$	Initial number of atoms or nuclei, if more than one type is considered, radioactivity.

ABBREVIATIONS AND SYMBOLS (Continued)

English Letter Symbols (Continued)

N, N_0	Number of molecules per gram-molecule, 0°C, 1A, or Avogadro number.
n	Number; number of components, Gibbs phase rule; number of molecules per unit volume or molecular concentration; number of moles; number of revolutions or rotations per unit time; principal quantum number; rotational frequency [rev/time]; rigidity or shear modulus of elasticity; refractive index; (order of spectrum); molecular concentration or molecular density [= no./cm ³]; (angular frequency without damping).
n_g	Group refractive index.
n_0	Number of molecules per cubic centimeter 0°C, 1A, or Loschmidt number.
(n')	Angular frequency of free vibration with damping.
n_a, n_k	Transport number for anion, kation*.
0	Atomic weight of oxygen*.
O	Opacity, reciprocal of absorptance.
P	Electric polarization.
P_s	Surface polarization or strength of double layer, electric.
P'	Probability; active power, elec.; power, used with same system of subscripts as for potential difference except that P unmodified signifies average power; radiant power or flux [= dU/dt]; amplitude of simple harmonic pressure, acous.
P_i	Input power.
$P_{l,m}$	Legendre polynomial.
P_0	Static pressure, acous.; output power.
P_p	Plate power.
P	Generalized momentum; electric moment of atom, molecule or dipole; total electric moment.
p	Heaviside time operator [= d/dt].
P	Vapor pressure; partial potential coefficient; varying pressure, acous.; partial pressure; impact parameter, Rutherford scattering formula; number of pairs of magnetic poles, elec. mach.; distance between a principal plane of a lens system and the appropriate principal plane of a unit; generalized momentum; strength of magnetic pole; pressure; osmotic pressure; potential coefficient; (angular frequency of impressed force).
p_c	Critical pressure.
p (subscript)	Plate.
Q	Figure of merit of reactance [= X/R]; electric quadrupole moment; thermoelectric power; luminous energy [= $\int Fdt$]; quantity of heat; quantity of light or luminous energy; Q-factor, or quality factor, of reactor [= X/R]; moment of area [= $\int ydA$].
q	Generalized coordinate; heat entering system.
q, Q	Electric charge; quantity of electric charge.
R	Gas constant [= pV/nT]; thermal resistance; Rydberg constant; radiation resistance; range, radioactivity; rotational quantum number; acoustic resistance; (radius of tube, disk or membrane, acous.).
R_∞	Rydberg constant at infinite mass.
R	Reluctance; radiance or radiant emittance or radiance or radiant flux density [= $d\Phi/dA = dP/dA$, w/area].
r	Radius vector; position vector.
r	Residual of an observation; radial distance; nuclear radius; radius; relative humidity; specific acoustic resistance [= R/A]; spherical coordinates θ [= colatitude], λ [= latitude], φ [= longitude].
r_p	Plate resistance
$R, (r)$	Electric resistance.
r, θ	Polar coordinates.
$r, \theta, z, (y)$	Cylindrical coordinates.

ABBREVIATIONS AND SYMBOLS (Continued)

English Letter Symbols (Continued)

r (subscript)	Reduced properties.
S	Area; total spin; static sensitivity of photoelectric tube; reciprocal capacitance or elastance; total spin quantum number, strictly speaking, spin is not a quantum number; entropy; action; effective molecular cross section; area of cross section, walls, acous.
s	Linear displacement.
s	Length of arc or path; linear distance; spin quantum number, strictly speaking, spin is not a quantum number; dynamic sensitivity of photoelectric tube; slip; spin; displacement in general; distance between object and corresponding principal plane; object distance, optics; acoustic condensation.
s_p	Transconductance at zero frequency and constant plate potential [= $(\partial i_p / \partial v_g)_{ep}$].
s'	Image distance; distance between image and corresponding principal plane.
S_{2870}, S_{2870}	2870 tungsten sensitivity of photoelectric tube.
s (subscript)	Reference to solid.
T	Torque*.
T	Kelvin temperature; reverberation time; half-life, radioactivity; period of a periodic motion; oscillation period; (kinetic energy; force in a string or membrane).
T_0	Absolute temperature of ice-point; absolute ice-point.
t	Time; length of prism base; transmission coefficient [$t_x = I_x/I_0 = \exp(-ax)$]; ordinary temperature.
t_0	Ordinary ice-point.
t_c, T_c	Critical temperature.
t (subscript)	Transition between polymorphic forms.
U	Radiant energy; potential energy; total energy, other than work; internal or intrinsic energy, thermodyn.
u	Velocity; linear or particle velocity; with suitable subscript, ionic velocity; (component of linear or particle velocity).
u_0	Initial velocity.
$u_{x,y,z}$	Component of linear or particle velocity; rectangular component of velocity.
\hat{u}	Most probable velocity.
\bar{u}	Root-mean-square velocity.
u	Linear or particle speed; speed; density of radiant energy [= dU/dl]; reaction velocity [= $-dc/dt$]; time-independent wave function.
u_0	Initial speed.
\hat{u}	Most probable speed.
u	Rms speed.
u, u_g	Group velocity.
u, u_t	Velocity at time t .
u_w, u_φ	Phase or wave velocity.
\bar{u}, u_{av}	Average velocity.
u, u_t	Speed at time t .
\bar{u}, u_{av}	Average speed.
V	Volume; volume of a cavity or room; rms or effective potential difference; steady d.c. potential difference; molecular volume; shearing force in beam section; electric potential; specific magnetic rotation or Verdet constant; configuration-space volume; atomic volume; (time-dependent variable in Hamilton-Jacobi equation; electromotive force or electromotance or emf; potential energy).
V_c	Critical volume.
V_e	Excitation potential; excitation potential difference.
V_i	Ionization potential.
V_p	Volume of perfect gas, 0°C, A_n .
V_q	Quiescent potential difference.

ABBREVIATIONS AND SYMBOLS (Continued)

English Letter Symbols(Continued)

V_s	Seebeck potential difference.
V_t	Thomson potential difference.
V_c	Contact or Volta potential difference.
V_π	Peltier potential difference.
V_m	Maximum peak potential difference.
v	Velocity; linear or particle velocity; (component of linear or particle velocity).
v_0	Initial velocity.
$v_{x,y,z}$	Component of linear or particle velocity; rectangular component of velocity.
\hat{v}	Most probable velocity.
\bar{v}	Root-mean-square velocity.
v	Specific volume [V/m]; linear or particle speed; speed; velocity of sound or other waves; vibrational quantum number; instantaneous potential difference.
v_0	Initial speed.
v_0	Volume per gram mole of ideal gas at 0°C and A_n^* .
\hat{v}	Most probable speed.
\bar{v}	Rms speed.
V, V_i	Inner potential, metals.
$V_m(V_{max})$	Maximum potential difference.
\bar{V}, V_{av}	Average potential difference.
$\hat{V}, (V_{pk})$	Peak potential difference.
v_g, v_g	Group velocity.
v, v_t	Velocity at time t .
\bar{v}, v_{av}	Average velocity.
v, v_t	Speed at time t .
v_c, \bar{v}_r	Critical volume, reduced volume*.
\bar{v}, v_{av}	Average speed.
H	Radiant emittance or radiant flux density or radiancy or radiance [$= d\Phi/dA = dP/dA, w/area$]; time-dependent variable in Hamilton-Jacobi equation; (weight).
(w)	Phase or wave velocity; component of linear or particle velocity.
w	Weight; mixing ratio or water-vapor content; net work function.
w_g	Gross work function.
$W, (w)$	Work.
X	Volume displacement, acous.; acoustic reactance.
X_C	Capacitive reactance.
X_L	Inductive reactance.
x	Distance between object and principal focus of object space; specific acoustic reactance [$= X/A$].
x'	Distance between image and principal focus of image space.
x, y, z	Rectangular coordinates; variable.
Y	Young's modulus of elasticity; admittance or reciprocal impedance.
$Y_{l,m}$	Associated Legendre polynomial or spherical function [$= P_{l,m}(\theta) \exp im\varphi$].
y	Super-compressibility factor; length of object, optics; variable; (depth or height).
y_g	Grid or input admittance or reciprocal impedance with plate-load [$= g_g - j b_g$].
y_{gp}	Grid-plate transadmittance [$= g_{gp} - j b_{gp}$].
y_p	Plate or output, admittance or reciprocal impedance [$= g_p - j b_p$].
y'	Length of image; image size.
Z	Gram-equivalent weight; radius of image of a point; modulus of section [$= I/c$, where c is distance of neutral axis from extreme fiber]; number of molecular collisions per unit time or collision frequency; coefficient of relative viscosity, referred to water; atomic

ABBREVIATIONS AND SYMBOLS (Continued)

English Letter Symbols (Continued)

z	number; acoustic impedance; radius of circle of least confusion.
Z	Variable; electrochemical equivalent; valence; specific acoustic impedance [= Z/A].

Greek Letter Symbols

α	Angular acceleration.
α	Half-angle subtended by point object at objective of microscope; thermal coefficient of resistance; end correction for a tube, acous.; fine-structure or Sommerfeld constant [= $ch/2\pi e^2$]; specific rotatory power [= θ/lc]; degree of dissociation or ionization, electrolytes; linear expansivity or linear coefficient of expansion; absorption or absorption factor [= F_o/F_i]; absorption coefficient of absorbing material, acous.; angular resolving power of telescope; attenuation constant [$\gamma = \alpha + j\beta$]; temperature coefficient of resistance; coefficient of recombination: (plane angle).
α'	Coefficient of thermal expansion or expansivity of a gas.
α, α_i	Linear coefficient of thermal expansion or linear expansivity.
$\alpha, \alpha', \alpha_V$	Volume expansivity or coefficient of expansion.
β	Phase constant [$\gamma = \alpha + j\beta$]; u/c ; pressure coefficient; $1/kT$; ratio of speed to speed of light [= v/c]; relativity ratio [= v/c]; specific heat constant*; (plane angle).
Γ	Reciprocal inductance [= $1/L$].
γ	Coefficient of surface tension; propagation constant [= $\alpha + j\beta$]; weightivity or specific weight [w/V]; ratio of specific heat or thermal capacity [= c_p/c_v]; adiabatic exponent [$pV^\gamma = \text{const.}$]; angular magnification [= $\tan u'/\tan u$]; contrast of photographic emulsion; electric conductivity [$\mathbf{i} = \gamma \mathbf{E}$].
Δ	Optical length of microscope tube; quadratic discriminant [= $b^2 - 4ac$]; difference in optical path; distance between adjacent principal foci of two lens units; small finite change operator; cubic discriminant [= $(b^2/4) + (a^3/27)$].
δ	Piezoelectric strain constant or modulus; deflection or total elongation; total thermal expansion; frequency deviation [= $\Delta f/f_r$]; galvanometer deflection; variation operator; angle of deviation; beam deflection or sag.
δ_m	Minimum deviation angle.
ϵ	Piezoelectric stress constant; molecular kinetic energy, average [= $\frac{1}{2}m\bar{v}^2$]; base of natural logarithms [= 2.718 . . .]; self-energy [= mc^2]; dielectric coefficient or permittivity or capacitivity; epoch angle.
ϵ_h, ϵ_c	Electrode potential above that of normal hydrogen, of normal calomel, electrode*.
ϵ, ϵ_r	Relative dielectric coefficient or specific inductive capacity.
η	Coefficient of viscosity; efficiency; electric susceptibility [$P = \eta(\mathcal{E})$].
η_l	Current efficiency, electrolysis [= $I_{\text{useful}}/I_{\text{total}}$].
η_V	Voltage efficiency [= $V_{\text{theor}}/V_{\text{actual}}$], electrolysis.
$\eta(\xi, y, w)$	Transverse displacement, acous.
θ	Angular displacement.
θ	Angle of contact; polar coordinate angle; polar angle, colatitude; angle of optical rotation; angular distance; plane angle; angle of diffraction; glancing angle; (Kelvin temperature; ordinary temperature).
κ	Electric conductivity [$\mathbf{i} = \kappa \mathbf{E}$]; volume modulus of elasticity; coefficient or factor of compressibility; susceptibility, magnetic*; absorption index [= $(\lambda/4\pi x) \ln I_o/I$].
Λ	Nuclear dissociation energy; permeance [= L/N^2]; equivalent conductivity, mho/mole; spherical Laplace operator
	$\left[\frac{1}{\sin \theta} \frac{\partial}{\partial \theta} \left(\sin \theta \frac{\partial}{\partial \theta} \right) + \frac{1}{\sin^2 \theta} \frac{\partial^2}{\partial \varphi^2} \right].$
λ	Linear density [= m/l]; mass per unit length; free path; wavelength; latitude, colatitude = ϕ ; disintegration constant [$N = N_o \exp(-\lambda t)$]; linear charge, density; (linear expansivity or linear coefficient of expansion).

ABBREVIATIONS AND SYMBOLS (Continued)

Greek Letter Symbols (Continued)

λ	Wave-length of maximum monochromatic radiance of black-body at stated temperature*.
λ_T	Tait free path.
$\bar{\lambda}$	Mean free path.
μ	Partial molal, or chemical potential Gibbs function [= $\partial G/\partial n$]; Joule-Thomson coefficient [= $\partial T/\partial p_1$]; inductivity or absolute permeability; reduced mass [$1/\mu = (1/m_1) + (1/m_2)$]; molecular conductivity; gas amplification factor, photoelectric tube; amplification factor [= $-(\partial v_p/\partial v_0)i_p$]; chemical potential [$\partial G/\partial n$]; coefficient of friction; grid control ratio, thyratrons; (refractive index; coefficient of diffusion, fluid).
(μ_r)	Group refractive index.
μ_I	Nuclear magneton [= $\mu_0/1838$].
μ_B	Bohr magneton [= $eh/4\pi mc$].
μ_r	Coefficient of rolling friction.
μ_s	Coefficient of starting or static friction.
μ_s (μ_k)	Coefficient of sliding or kinetic friction.
μ, μ_r	Relative magnetic permeability.
ν	Frequency, quantum theory of light; reluctivity [= $1/\mu$]; reciprocal of dispersive power; kinematic viscosity coefficient [= η/ρ].
ν_0	Photoelectric threshold frequency.
ν_∞	Rydberg's fundamental frequency*.
$\tilde{\nu}$	Propagation flux density.
ξ	Longitudinal displacement, acous.
ξ, η, ζ	Displacement components of sound-bearing particle; generalized curvilinear coordinates; moving Cartesian axes coordinates.
Π	Osmotic pressure; Peltier coefficient; Poynting vector; continued product operator; Hertzian vector; reciprocal inductance.
π	Pressure, used for total pressure when p represents vapor pressure; (osmotic pressure).
ρ	Volume density of electric charge; reflectance or reflectivity or reflection factor [= F_r/F_i]; vapor density; resistivity or specific resistance; density [= m/V]; absolute humidity; radius of curvature; (mass per unit length; linear density [= m/l]; surface density [m/A]).
\mathcal{F}	Convection current.
ρ_s	Standard density, referred to $g_s = 980.665 \text{ cm sec}^{-2}$ at 0°C , 1A.
Σ	Exposure [= Et].
σ	Specific magnetization [= M/ρ]; coefficient of surface tension; surface density [m/A]; effective molecular cross section; area; molecular diameter, collision; Poisson ratio; dispersion [= $dn/d\lambda$]; wave number; magnetic leakage coefficient; Stefan-Boltzmann constant [= J/T^4]; Thomson coefficient; electric conductivity [$I = \sigma E$]; surface charge density.
τ	Unit vector tangent to path.
τ	Coupling coefficient; optical transmittance or transmission factor [= F_t/F_i]; mean-life, radioactivity; modulus of decay [$s = A \cos(\omega t + \phi) \exp(-t/\tau)$]; time constant; dew-point temperature; (volume; time, used when t is used for temperature).
Φ	Dyadic in general.
Φ	Magnetic flux of induction [$\int \mathbf{B} \cdot d\mathbf{A}$]; magnetic flux [= $\int \mathbf{B} \cdot d\mathbf{A}$]; radiant power or flux [= dU/dt].
φ	Function; net work function per unit charge or electron affinity [$d\phi = dw/dq$ volts]; electromagnetic scalar potential; longitude; velocity potential, hydrodyn; fluidity, reciprocal of viscosity; angle between ray and normal in first medium; phase angle; (epoch angle).
φ_g	Gross work function per unit charge or gross electron affinity [$d\phi_g = dw_g/dq$ volts].
φ_c	Critical angle.
φ_s'	Angle between ray and normal in second medium.
φ_i	Polarizing angle or principal angle of incidence in dielectrics.
χ	Specific magnetic susceptibility [= k/ρ].

ABBREVIATIONS AND SYMBOLS (Continued)

Greek Letter Symbols (Continued)

Ψ	Planck function [= $-A/T$]; electric flux of induction [= $\int \mathbf{D} \cdot d\mathbf{A}$]; total flux of electric displacement [= $\int \mathbf{D} \cdot d\mathbf{A}$]; total electric flux [= $\int \mathbf{D} \cdot d\mathbf{A}$].
ψ	Time-dependent wave function; azimuth angle, optics.
\bar{l}	Principal azimuth angle.
Ω	Volume of phase space; ohm*.
$[\Omega]$	Relative molecular magnetic rotary power with reference to water*.
ω	Angular velocity.
ω	Pulsatance or periodicity; specific magnetic rotation or Verdet constant; dispersive power [= $(n_F - n_C)/(n_D - 1)$]; angular frequency of impressed force; angular frequency without damping; angular frequency, or periodicity or angular speed [= $2\pi f$]; solid angle.
ω_r	Resonant periodicity.
ω'	Angular frequency of free vibration with damping.

Miscellaneous Symbols

.... (Superscripts)	Time derivatives, dots used over symbol.
$1/k$	Thermal resistivity.
$1/R$	Thermal conductance.

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